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ABSTRACT

We present a model of a financially distressed firm with outstanding bank debt and public debt. Coordination problems among public debtholders introduce investment inefficiencies in the workout process. In most cases, these inefficiencies are not mitigated by the ability of firms to buy back their public debt with cash and other securities—the only feasible way that firms can restructure their public debt. We show that Chapter 11 reorganization law increases investment, and we characterize the types of corporate financial structures for which this increased investment enhances efficiency.

DURING THE LATE 1980S there was a dramatic increase in the leverage of U.S. corporations, raising concerns about the corporate sector's financial stability.[1] Indeed, by June 1990, 156 (24%) of the 662 companies that issued high-yield bonds between 1977 and 1988 had either defaulted, gone bankrupt, or restructured their public debt. The face value of these distressed bonds amounts to nearly 21 billion dollars.[2]

The central question raised by these distressed firms is easy to put but hard to answer: What is the effect of financial distress on a firm's operating performance? There are two competing views. The first, an application of the

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[1] Bernanke and Campbell (1988) and Bernanke, Campbell, and Whited (1990) document the increases in corporate leverage in the 1980s. The most significant increase occurs in the leverage of the most highly indebted companies.

[2] These numbers were calculated from data made available to us by Paul Asquith. For a more complete analysis of default rates on high-yield bonds, see Asquith, Mullins, and Wolff (1989).

Coase Theorem, holds that there are no real effects of financial distress.[3] Critical to this view is the distinction between financial and economic distress. Admittedly, most firms in financial trouble also suffer from poor operating performance. But, no financial maneuvering can save these economically distressed firms. If, however, a firm's capital structure prevents it from pursuing its value-maximizing operating strategy, creditors will restructure their claims to maximize firm value. We should expect financially distressed firms to do poorly on average, but no worse than if they had no leverage.

The second view—implicit in the leading theory of capital structure—is that financial distress hampers operating performance. In this view, the Coase Theorem fails; financial renegotiation is inefficient and operating distortions are introduced.

Distinguishing between these two views is important for understanding a variety of issues: capital structure decisions; the costs of tax policies which affect the level of corporate debt; the impact of wide-scale financial distress during a recession; and the role and effects of specific provisions of bankruptcy law.

Unfortunately, it is difficult to distinguish empirically between financial and economic distress. Is a financially distressed firm liquidated because renegotiation is inefficient or because the firm is not economically viable? Is a firm's poor operating performance the result of underlying business problems or an inappropriate capital structure? Unfortunately, the empirical attempts to distinguish between financial and economic distress are limited to specific environments in which it is relatively easy to make such a distinction.[4]

The theoretical distinction between financial and economic distress emerges in the important work of Bulow and Shoven (1978) and the follow-up work of White (1980, 1983).[5] These models demonstrate how conflicts among creditors can lead to inefficiencies when a firm is in financial distress. The impediment to efficient renegotiation in these models is the assumption that

[3] This view has been argued by Haugen and Senbet (1978), Roe (1983), Baird (1986), and Jensen (1986).

[4] Cutler and Summers (1988) study the stock price reactions to the events following Pennzoil's successful 10 billion dollar lawsuit against Texaco. Events which should have zero-sum effects resulted in a larger market value loss to Texaco than gain to Pennzoil. They interpret this finding as evidence that Texaco's financial distress was costly; Texaco was in financial but not economic distress. Hoshi, Kashyap, and Scharfstein (1990) show, in a sample of distressed Japanese firms, that those with financial structures that are easier to renegotiate a priori—those which borrow a lot from a single bank—invest more and have higher sales than firms with more complex financial structures.

[5] More recent contributions include Aivazian and Callen (1983), Titman (1984), Brown (1989), Giammarino (1989), Bergman and Callen (1990), and Baird and Picker (1991). With the exception of Titman, which assumes it is impossible to negotiate with customers who rely on the firm for product maintenance and Giammarino which analyzes a signaling model of debt restructuring, these papers assume efficient renegotiation and therefore focus on how value is divided.

the firm cannot renegotiate with public debtholders, although they can renegotiate efficiently with a bank. There are two types of inefficiencies that can result. On the one hand, because public debtholders claim part of the cash flows from new investment, distressed firms can have difficulty issuing equity or debt for new investment. Thus, they may pass up positive net present value investments.[6] On the other hand, a distressed company may actually overinvest because shareholders receive much of the upside benefits of risky investment but bear little of the downside costs. As a result, they may take negative net present value projects which increase the riskiness of the firm's cash flow.[7]

There are two primary contributions of this paper. The first is to show that these investment inefficiencies are still a problem even when firms can renegotiate with public debtholders. We analyze the implicit renegotiation that takes place when firms offer a package of new securities and cash in exchange for the original public debt. Public debt restructurings almost always take this form because the Trust Indenture Act of 1939 requires unanimous debtholder consent before a firm can alter the principal, interest, or maturity of its public debt. Exchange offers effectively alter these features but, since nontendering public debtholders maintain their original claim for payments from the firm, the Trust Indenture Act is not violated.

Despite the frequency with which exchange offers have been made—73 of 156 distressed junk bond issuers have successfully completed exchanges between 1977 and 1990—there is at least one substantial obstacle to successfully completing an exchange.[8] Those debtholders who do not tender can see the value of their bonds rise if the exchange offer is successful since tendering creditors forgive some of the debt and reduce the default risk of the original debt. Although public debtholders as a group would be better off if the exchange offer goes through, those with small stakes have an incentive to hold out. Thus, it can be very difficult to complete an exchange.

This free-rider problem can be, and often is, mitigated by offering a more senior security in exchange for the public debt, one with shorter maturity, or, when it is available, cash. Moreover, in these types of exchanges public debtholders may be willing to tender at below-market prices because they fear that holding out will make them effectively junior to the new securities. But, the important point is that even though these types of offers enable firms to restructure their public debt profitably, they do not, in general, result in efficient investment. The problem is that in deciding whether to tender, public debtholders take the firm's investment policy as given. Thus, individual debtholders—each with small stakes—fail to take into account their effect on the firm's investment decision, despite the fact that their decisions, taken as a whole, affect investment behavior.

[6] This is the effect first analyzed by Myers (1977).

[7] This risk-taking effect is analyzed in detail by Jensen and Meckling (1976).

[8] Of the 73 firms that successfully completed exchange offers 23 have subsequently filed for bankruptcy. Also, many firms have attempted exchange offers which failed.

The second principal contribution is to analyze the effects of reorganization law on investment. We show that key features of the law—the automatic stay, the voting rules for plan approval, and the power of equity holders to retain value for themselves—all act to increase investment both in and out of Chapter 11. Whether this increases efficiency depends on whether the firm would otherwise have underinvested or overinvested as a result of financial distress. We characterize the aspects of the firm's debt structure—the priority of bank debt relative to public debt, the maturity structure, and the existence of covenants restricting senior debt issues—that lead to underinvestment or overinvestment. We are then able to identify the situations in which Chapter 11 increases or decreases investment efficiency.

Our paper is organized as follows. Section I presents our benchmark model of workouts when public debt restructurings are not possible and bankrupt firms are liquidated, not reorganized. We build on the Bulow and Shoven model to analyze the effects of priority and maturity on investment after the onset of financial distress. Section II introduces the possibility of public debt restructurings through exchange offers and compares the results of this model to those of Section I's benchmark model. We show that if there is no restriction on senior debt issues, exchange offers do not affect the costs of financial distress but do place more of the burden of distress on public debtholders. If there are covenants restricting senior debt issues, however, exchange offers can be used to eliminate them and thereby increase investment. In this case, exchange offers may reduce the debt burden so much that they lead to overinvestment and actually exacerbate inefficiencies. We show that it is sometimes efficient to eliminate seniority covenants, but investment efficiency is greater if a firm can only remove them with a vote that is separate from an exchange offer. Section III introduces the possibility of reorganization rather than liquidation upon default. We review some of the key features of Chapter 11 reorganization law and analyze their effects on investment. We conclude in Section IV.

I. A Simple Model of Workouts and Investment

In this section, we consider a simple model of a financially distressed firm with both privately-placed debt and publicly-traded debt. We think of the private debt as bank debt (although it could be held by any large creditor) and the public debt as debentures.[9] We model the idea that it is easier to renegotiate with a bank (or a small syndicate of banks) than with numerous public debtholders by assuming at first that the firm cannot renegotiate with public debtholders. We relax this assumption in Section II where we present a model of exchange offers.

An important issue is how the debt's maturity structure affects the ability of firms to work out of distress. We assume that all of the bank debt, with face value B, is short-term, maturing at date 1. By contrast, fraction q of the

[9] We model public debt as unsecured, so we use the term debentures to distinguish them from bonds, which in the legal literature exclusively refers to secured debt.

face value of the public debt D, is due at date 1, and fraction $1 - q$ is due at a later date 2. This timing reflects the fact that bank debt generally has a shorter maturity than public debt.

The firm has two assets: cash and/or liquid assets of Y; and an investment project which requires an investment of I at date 1 and returns a stochastic cash flow of X at date 2 distributed over the support $[0, \infty)$. We denote the cumulative distribution of X as $F(X)$, the density as $f(X)$, and the mean as $\bar{X}$. For simplicity, we assume the firm has no fixed assets such as plant and equipment. All parties are risk neutral, and the riskless interest rate is zero.

Finally, we assume that the firm is in financial distress at date 1; its assets in place are worth less than the face value of its debt obligations: $Y < B + D$. Thus, if the firm is liquidated, and if absolute priority rules are followed, shareholders receive nothing, and public debtholders and the bank share Y between them. Assuming equal priority of bank and public debt in liquidation, the bank gets $[B/(B + D)]Y$, which we denote L_B and the public debtholders get $[D/(B + D)]Y$, which we denote L_D.[10] If the firm is liquidated, the public debt maturing at date 2 is accelerated to date 1, consistent with the Bankruptcy Code. In this section, we assume that bankruptcy is equivalent to liquidation; reorganization in Chapter 11 is ruled out. In Section III, we analyze how reorganization law affects investment incentives in this model.

The central question is whether the financially distressed firm invests in the project at date 1. If $Y > I + B + qD$, the firm has enough cash to invest in the project and pay off both the bank debt and the public debt maturing at date 1. In this case, the firm invests regardless of whether the project has positive or negative net present value: if the firm does not invest, equity gets nothing; if the firm does invest, there is some chance that equity's payoff would be positive. We assume instead that $Y < I + B + qD$ so that the firm needs an additional $I + B + qD - Y$ to meet its date-1 obligations and invest in the project.

The firm has several options in meeting its cash shortfall. It can try to raise new funds by issuing debt or equity, or it can try to restructure its existing bank debt or public debt. We focus here on debt restructurings—first on bank debt restructurings and, in Section II, on public debt restructurings. We show later that the firm prefers to restructure than to issue new debt or equity.

A. Bank Debt Restructurings

We consider bank debt restructurings first because they are substantially easier to organize than public debt restructurings.[11] Indeed, the Trust Indenture Act of 1939 *prohibits* public debtholders from changing the principal,

[10] In bankruptcy, creditors do not have a claim for unmatured interest. So, for simplicity, we assume that the contractual interest rate on the public debt is zero.

[11] Gilson, John, and Lang (1990) show empirically that the existence of public debt is the most significant determinant of whether a financially distressed firm restructures successfully out of court or files for Chapter 11 reorganization.

interest, or maturity of public debt without public debtholders' unanimous consent. Even without the Trust Indenture Act, free rider problems can impede successful renegotiation. For example, if some public debtholders forgive part of their debt, the value of the remaining debt rises. If each public debtholder is small, and thus has no effect on the outcome of the negotiations, then each will refuse to restructure his portion of the debt. We discuss these issues in detail in Section II.

In a bank debt restructuring the firm effectively rolls over its initial loan of B and borrows an additional $I + qD - Y$ for the investment and to pay off the public debt due at date 1. Our analysis is simplified if we assume that the interest on this loan has lower priority than all outstanding debt while the principal has equal priority. This assumption is not realistic since bankruptcy law does not distinguish between principal and matured interest. But, any other assumption complicates the analysis because the fraction of the firm that the public debtholders get depends on the interest rate on the new loan. On the other hand, if we assume the new interest has lower priority, the combined return to the bank and the firm is independent of the interest rate. This permits us to complete the analysis without determining the interest rate on the bank debt. The issue this raises for the ability to renegotiate with the bank is interesting, but it is an unnecessary complication for the basic analysis.

If the firm invests, and $X < I + B + D - Y$, the bank receives

$$\frac{I + B + qD - Y}{I + B + D - Y} X.$$

If $X > I + B + D - Y$, the shareholders and the bank together get to split $X - (1 - q)D$. The bank agrees to finance the firm provided:

$$\int_0^Z \frac{I + B + qD - Y}{I + B + D - Y} Xf(X)\, dX + \int_Z^\infty [X - (1 - q)D] f(X)\, dX - (I + qD - Y) \geq L_B, \quad (1)$$

where $Z \equiv I + B + D - Y$.

The right-hand side of inequality (1) is what the bank receives in liquidation. There are two important assumptions implicit in this formulation. First, the firm liquidates and cannot invest in bankruptcy. In Section III, we introduce the possibility of investment in Chapter 11 bankruptcy proceedings. Second, we assume that if the bank does not lend money, the firm goes bankrupt; the firm cannot raise the necessary cash from an outside source. We will see below that, although it may be possible to raise outside funds, the bank has a greater incentive to provide funds than any outsider. Since we wish to derive conditions under which investment occurs, not how the gains from the investment are split, our analysis is unaffected by this assumption.

Inequality (1) is equivalent to:

$$\overline{X} - I \geq qD + \int_0^Z \frac{(1-q)D}{Z} Xf(X)\, dX + \int_Z^\infty (1-q)Df(X)\, dX + L_B - Y. \quad (2)$$

The first three terms on the right-hand side sum to the market value of the public debt conditional on bank lending and investment. Thus, we write (2) as:

$$\overline{X} - I \geq V_D - L_D, \quad (3)$$

where V_D is the market value of the public debt in this case.

Inequality (3) captures a simple but important idea. V_D is the value of the public debt conditional on investment while L_D is its value if no investment occurs. So the difference of the two measures the transfer from the bank and equity holders to public debtholders if the firm invests. If the net present value of the project, $\overline{X} - I$, is greater than this transfer, then the firm restructures its bank debt and invests.

Interestingly, this transfer can be positive or negative. If it is positive, the firm will tend to forego positive NPV projects, those with NPV between zero and $V_D - L_D$; the debt obligations act as a tax on the project, discouraging investment. If it is negative, the firm may adopt negative NPV projects, those with NPV between $V_D - L_D$ and zero; creditors effectively subsidize the project, encouraging investment. So, inefficiencies can involve either underinvestment or overinvestment.

This wedge is introduced because the value of the public debt conditional on investment can be greater or less than its liquidation value. If, for example, Y is close to zero, public debt is worth almost nothing in a liquidation, so public debtholders benefit from investment. In this case, the existence of public debt discourages investment. By contrast, if Y is close to $B + D$, public debtholders would get paid off nearly in full if the firm is liquidated. But, if it is not liquidated, public debtholders own a risky claim, the value of which could well be below D. Here, public debt promotes investment, though it may be inefficient.

The discussion suggests that there are two effects at work. On the one hand, the debt obligations tend to make investment look unattractive because existing creditors can siphon off cash flow from the project. This is Myers' (1977) well-known argument; the existence of a "debt overhang" discourages investment. On the other hand, debt obligations can lead the firm to take excessive risks: equity receives nothing if the firm is liquidated but has some value if the firm invests, even if it is in a negative NPV investment, a point made clear by Jensen and Meckling (1976).

The maturity structure of the debt has important effects on the efficiency of investment. As the maturity of the public debt shortens (q increases), its value increases because the date-1 portion is safe and the date-2 portion is risky: $dV_D/dq > 0$. This increases the transfer to public debtholders and reduces the firm's incentive to invest. In the limit as all the public debt becomes due at date 1, the transfer approaches $D - L_D > 0$. In this case, the firm may pass up positive NPV investments but will never choose negative NPV investments. The efficiency effect of shortening the public debt's maturity is ambiguous. The increase in q may force the firm to pass up positive NPV projects, but it also may deter investment in negative NPV projects.

An increase in bank debt, holding fixed the total amount of indebtedness, $B + D$, has an unambiguously positive effect on efficiency. The increase in B decreases the right-hand side of expression (3) if it is positive and increases it if it is negative. So, the shift toward bank debt away from public debt can either induce the firm to take positive NPV projects it would not have taken or turn down negative NPV projects it would have taken. Clearly, if all debt were held by the bank, investment would always be efficient; bank renegotiation is assumed to be costless so the conditions of the Coase Theorem are satisfied.

B. New Capital Infusions

Instead of restructuring its bank debt, the firm could try to raise new money from another bank or by issuing equity. Neither of these alternatives is as attractive as a restructuring. Like a restructuring, the new bank lends $I + B + qD - Y$ and receives the same date-2 payoffs. But, unlike a restructuring, some of the new money goes to pay off the existing bank debt of B at face value. One can show that the firm will be able to raise new debt financing provided

$$\bar{X} - I \geq V_D - L_D + B - L_B, \tag{4}$$

or, in words, if the net present value of the investment exceeds the sum of the transfer to the public debtholders, $V_D - L_D$, and the transfer to the bank, $B - L_B$. The condition differs from a bank debt restructuring because in a restructuring the bank takes into account the fact that its debt is worth only $L_B < B$ in a liquidation. With a new loan the bank receives a transfer of $B - L_B > 0$. This subsidy means that the set of investment projects that can be financed without outside debt is a strict subset of those which can be financed with a bank debt restructuring.

Investment is even less attractive if the firm issues equity rather than debt. The bank continues to receive a subsidy of $B - L_B$, but the transfer to the public debtholders rises. The public debt conditional on investment is worth more because the date-2 portion of the debt is paid off before equity is paid anything. By contrast, when the firm issues debt, the public debtholders and the new debtholders are on equal footing at date 2. So, the condition for

investment takes the same form as inequality (4) except that V_D is greater when the firm issues equity.

The analysis implies that the firm never issues equity since an equity issue transfers value to public debtholders not transferred by a debt issue. The prediction is less clear about the choice between debt issues and a bank loan restructuring. Clearly, when inequality (3) is satisfied but inequality (4) is not, the firm will restructure its bank debt. But, if both inequalities are satisfied the model has no prediction. The bank knows that if there is no restructuring, the firm will issue new debt and the bank will receive B. So, in a debt restructuring, the bank will settle for nothing less than B. As a result, equity holders are indifferent between a debt issue and a bank debt restructuring because they must transfer B to the bank in both situations.

C. Effects of Priority

So far, we have assumed that all debt has equal priority in bankruptcy. However, firms can explicitly contract for certain debts to be paid before others in bankruptcy. There are two ways in which priority can affect the ability of distressed firms to raise capital in our model. First, the seniority of the existing bank debt affects what the bank would get in bankruptcy liquidation if it did not lend new money, thereby determining the value of the bank's next best alternative. The more junior the existing bank debt, the worse off the bank is in liquidation, so the more willing it is to lend. Second, the seniority of the new bank debt affects what the bank can get if it lends new money. In general, the more senior the new bank debt, the better off the bank is at any chosen interest rate. Thus, if they could, the firm and the bank would like to issue debt that is senior to the existing public debt. Of course, there are often constraints on their ability to do so; the public debt may contain covenants restricting the issuance of any debt senior to the public debt. These covenants may prohibit such issuance altogether, may limit the amount, or may allow it if certain cash flow and net worth conditions are satisfied.

To see this more formally, suppose there is no covenant prohibiting a senior debt issue. Then the interest rate on the new bank debt can be set so high that the firm always defaults at date 2 and the senior debt gets all of the date-2 cash flow X. This means that the value of the public debt conditional on new senior lending is just qD and public debtholders only receive their date-1 payment. The value of the public debt if the firm is liquidated is L_D, assuming, as before, that the existing bank debt and public debt have equal priority. Based on the previous section we know that the project's net present value must exceed the net subsidy to public debtholders from investment. So the bank will be willing to lend provided

$$\overline{X} - I \geq qD - L_D. \tag{5}$$

The right-hand side of (5) is strictly less than the right-hand side of expression (3) since $qD < V_D$; the firm is more prone to invest when there is no

covenant restricting senior debt issuance.[12] It can have positive or negative efficiency effects by reducing the underinvestment problem or exacerbating the overinvestment problem.

This analysis can tell us something about the interaction between maturity structure and seniority covenants. If the public debt has a relatively short maturity (q near 1), the firm is likely to underinvest. In this case, a seniority covenant tends to worsen the problem, making it more difficult for the firm to raise capital. If the firm leaves out the covenant, we would expect to see the bank lend new money that is senior to the old debentures. The ability to issue such debt can counteract the inefficiency created by the short maturity of the public debt. In contrast, if the debt has a relatively long maturity, the firm is more prone to overinvest. In this case, a seniority covenant makes it more difficult to raise capital and could eliminate the tendency toward overinvestment. Thus, if capital structure is chosen partly to minimize the costs of financial distress, we would expect long-term public debt to contain seniority covenants in the indentures and short-term public debt to omit such covenants.

This framework can also tell us something about the interaction between public debt maturity and the priority of the existing debt. Suppose that there is no seniority covenant. Then if the original public debt is pari passu (equal priority) with the bank debt, the investment condition is given by expression (5). But, if the initial bank debt is senior to the public debt, the condition becomes

$$\bar{X} - I \geq qD - \max(Y - B, 0) \tag{6}$$

because the value of the junior public debt in liquidation is now $\max(Y - B, 0)$. Since this is less than $L_D \equiv [D/(B + D)]Y$, the value of the public debt if it is pari passu with the old bank debt, the firm is now less prone to invest; the bank does better in liquidation, so financing new investment is less attractive.

The shorter the maturity of the public debt, the more likely the firm is to underinvest. Thus, the model suggests that when the public debt is relatively short term, existing senior bank debt is likely to worsen the underinvestment problem. But, when the public debt is long term, the seniority of bank debt can be a useful way of curbing the overinvestment problem. If the costs of financial distress drive capital structure choices, our model predicts that the bank debt will be senior if the public debt is long term and junior if it is short term.

[12] Stulz and Johnson (1985) develop this point in a model where the ability to use secured debt for new borrowing mitigates the Myers (1977) underinvestment problem. Berkovitch and Kim (1990) analyze how priority structure affects investment efficiency under both symmetric and asymmetric information.

Although the model predicts that the bank debt will be junior if the public debt is short term, in a more realistic formulation, it is difficult to make short-term bank debt effectively junior. To see this, suppose that if the firm does not invest and is not liquidated at date 1, it nevertheless has positive, stochastic cash flows at date 2. Thus, unlike the model above, if the firm pays off its debts at date 1, the value of equity is positive even if the firm does not invest. The firm has three alternatives: invest, continue without investing, or be liquidated.

Now suppose that $Y \geq qD + B$ so that it is feasible for the firm to meet its date-1 debt obligations and continue in operation without investing. The value of the bank debt is B, which is what it is worth in liquidation if the bank debt is senior. The bank refuses to provide new funds for investment, but demands payment of B in period 1. This is more than $\max(Y - D, 0)$, the bank's payoff if the firm is liquidated and the bank is junior to the public debt. Thus, even though the bank debt is contractually junior to the public debt, the bank acts as if it is senior. This makes the bank reluctant to lend new money, a more efficient outcome. So, in this model, if q is small enough so that $Y > qD + B$, the bank acts as a senior lender. But, if q is very close to one, it is possible to induce the bank to act as if it was junior to the public debt.

II. Distressed Exchange Offers for Public Debt

So far, we have assumed that it is impossible to renegotiate with public debtholders. This assumption is not too far off the mark; the Trust Indenture Act's prohibitions on changes in the timing or amount of public debt payments forces public debt restructurings to take the form of exchange offers.[13] Firms offer cash and/or a package of debt and equity securities, with the offer typically contingent on the acceptance of a specified fraction of the debt.[14]

In this section, we analyze the extent to which this limited form of renegotiation affects the inefficiencies discussed in the previous section. The key assumption of the model is that each debtholder's stake is small enough that he ignores the effect of his tender decision on both the firm's investment decision and the value of the firm's securities. This assumption is unrealistically strong for firms with a large portion of their debt held by just a few institutional investors, an admittedly common situation. We make this assumption to highlight the problems that arise when creditors cannot fully

[13] There are some similarities between corporate debt exchange offers and buybacks of developing country debt. See Froot (1989) and Bulow and Rogoff (1989) for analyses of developing country debt exchanges.

[14] For example, in early 1990, AP Industries offered \$50 in cash, one share of common stock, and \$340.91 principal amount of new zero-coupon senior subordinated notes due in 1997 in exchange for each \$1000 principal amount of its 12 $^{3}/_{8}$% subordinated debentures due in 2001. The offer was conditioned on 95% of the outstanding principal amount being tendered.

coordinate their actions. We believe that similar effects would be present in a model in which debtholders have substantial stakes.[15]

We proceed in two stages. First, we analyze the profitability of exchanges assuming that the firm has ample cash to finance the investment even without a debt restructuring. We will show that an exchange is profitable only if the debt is exchanged for cash or for debt that has higher priority than the original debt. Although this analysis has no efficiency implications—the firm invests even without an exchange—it is helpful in answering the second more interesting question: when can an exchange reduce cash obligations and enable the firm to invest? We will show that the bank is generally better off if the firm can exchange its debentures, that investment incentives are unaffected by the ability to exchange debt in most circumstances, and that the ability to exchange is not equivalent to efficient renegotiation of the public debt.

A. Exchanges Assuming No Cash Shortage

In this subsection we assume that, while the firm is in financial distress, it does not need an exchange or a bank concession in order to invest and meet its date-1 debt obligations: $Y > I + B + qD$. We first consider an exchange for debt due at date 2 with a face value of p for each dollar in face value of the existing debt. Let X_b be the breakeven value of X, so the firm defaults at date 2 for all $X < X_b$. Shareholders receive nothing if $X < X_b$ and receive $X - X_b$ otherwise. Thus, an exchange is profitable if and only if it lowers X_b.

Let β denote the fraction of public debt the firm exchanges. Without an exchange, $X_b = I + D + B - Y$. By contrast, if the firm exchanges, it owes the nontendering debtholders $(1 - \beta)D$ and the tendering debtholders βpD, so $X_b = I + (1 - \beta)D + \beta pD + B - Y$. Here, X_b is decreasing in β if and only if $p < 1$, i.e., the firm can exchange a dollar of old debt for less than a dollar of new debt. So if $p < 1$ an exchange is profitable and if $p > 1$ an exchange is unprofitable.

Proposition 1: *It is unprofitable to offer an exchange for new debt with equal priority to the old public debt.*

Proof: See Appendix.

The exchange is unprofitable because of a classic holdout problem.[16] If other debtholders tender, the value of the existing debt rises, creating an incentive to hold out. To see this, consider the decision facing the holder of \$1 of debt who is offered \$1 of the new debenture ($p = 1$) due at date 2.[17] Will the holdout have an incentive to tender, assuming that all the other

[15] Gertner (1990) analyzes a bargaining model in which one party needs to reach agreement with two others under asymmetric information. Holdout problems similar to those analyzed here are also present. In addition, he shows that it may not be in the private interest of bargaining parties to form coalitions, even though the coalitions improve overall bargaining efficiency.

[16] Roe (1987) contains the first discussion of this holdout problem.

[17] We assume that \$1 is a negligible portion of the overall public debt.

debtholders tender? If so, then it is an equilibrium for all debtholders to exchange.

The answer depends on the payoffs of the two debentures when the firm is in default at date 2. If the firm does not default, the debtholder is just as happy with the new debentures as with the old debentures. But if the firm does default at date 2, the payoffs are quite different. Those who tender receive their pro rata share of the firm at date 2, $(X + Y - I - B)/D$, but the holdout receives q at date 1 and receives a pro rata share of the firm at date 2, $(1 - q)(X + Y - I - B)/D$. Since $(X + Y - I - B)/D < 1$, the debtholder is better off holding out.

The holdout is better off because the earlier payment on the old debenture is effectively senior to the new debenture. Tendering debtholders share ratably in a risky date-2 claim. But, by holding out, the debtholder receives a safe date-1 payment while still sharing pro rata in the date-2 portion of payoffs.

This logic rests crucially on the assumption that the debtholders do not act collectively. Suppose they could. Then the question becomes: are we all better off if we all tender than if we all hold out? This is quite different from the individual question: am I better off if I tender than if I hold out assuming everyone else tenders? In the collective case, if everyone tenders then the payoff is again $(X + Y - I - B)/D$ when the firm defaults. But, if no one tenders then the payoff is q at date 1 and $(X + Y - I - B - qD)/D$ at date 2. This is equal to the payoff from tendering, so debtholders as a group are indifferent between the two options when $p = 1$.

The holdout problem is even more pronounced if the firm offers to exchange junior debt or equity for the old debentures. There are now two reasons why debtholders want to hold out. As before, holdouts are senior in that some of their claim is paid at date 1 before the uncertainty is realized and tendering debtholders are paid. In addition, holdouts also have seniority at date 2 since the new security is junior debt or equity. If all debtholders tender, a holdout's claim would be riskless since the holdout gets q at date 1, and the $1 - q$ that is owed at date 2 is senior to the claims of all tendering debtholders, making it riskless as well. Thus, a corollary of Proposition 1 is that exchange offers for junior debt or equity are also unprofitable.

Quite the opposite result holds if the firm can offer a more senior debenture in exchange for the old debt. These types of exchanges are quite common. In a sample of 169 exchange offers by 67 companies, we discovered at least 48 instances in which a firm offered a debenture that is senior to the old debentures.[18]

[18] These 67 companies are a subsample of the 73 original issue high-yield debt companies that completed exchange offers between 1977 and June 1990. We found information on the exchange offers from two sources: *First Boston High Yield Handbook*, 1988 and 1989, and the S&P Called Bond Record, 1977–1990. We could not find detailed information on the exchange offers of the remaining 6 companies. This may be an underestimate of the frequency of exchanges for senior securities because classification is based on a security's title. In some case cases, the new security may have the same title but be senior.

Proposition 2: *It is profitable to offer an exchange for new debt which is senior to the old public debt.*

Proof: See Appendix.

There are two competing effects at work. Again, the difference in the payoffs from tendering and holding out depends on the payoffs of the old and new debentures when the firm is in default at date 2. As before, consider the decision facing the holder of \$1 of debt, assuming that all others tender when $p = 1$. On the one hand, the holdout's date-2 claim is worthless when the firm defaults. Since the new debt is senior, each new debenture holder is paid $(X + Y - I - B)/D$ and there are insufficient funds to pay the old junior debenture holder. On the other hand, the portion q of the holdout's claim is paid at date 1, making it effectively senior to the new debentures. On the whole, given our assumptions that $X > 0$ and $Y > I + B + qD$, the increased seniority at date 2 is worth more than the earlier maturity of the q portion of the claim. Instead of a holdout problem there is a *hold-in* problem; debt holders would tender for $p < 1$ despite the fact that they are made worse off as a group.

The hold-in problem is more severe when the public debt is relatively long term. Very short maturity debt is paid off almost in full at date 1. So only a small portion of the debt can be leapfrogged in the capital structure. The short maturity of the debt effectively gives it a degree of seniority that cannot be erased by a senior debt issue. Indeed, one can show that as the debt becomes shorter-term, p increases and exchanges become less attractive to the firm.[19]

We have shown that the firm prefers exchanges for senior debt to exchanges for pari passu or junior debt. But in many cases there are seniority covenants in the public debt prohibiting senior debt issues. Yet firms with such covenants do issue more senior debt in exchanges.[20] How is this possible? The indenture for the debt issue typically specifies that covenants can be changed or eliminated by either a simple or super majority vote of the

[19] The property of longer maturity debt that makes the hold-in problem relevant is that a greater fraction of promised payments come after the resolution of uncertain cash flows. Extending maturity from date 1 to date 1.5 would have no effect if there were no chance of insolvency before date 2.

[20] For example, in March 1987, Michigan General offered \$500 principal amount of 6% Increasing Rate Senior Subordinated Notes due in 1992, \$200 principal amount of Zero Coupon Delayed Convertible Senior Subordinated Notes due in 1997, and 12 shares of \$2 Delayed Convertible Preferred Stock in exchange for each \$1000 principal amount of 10 $^{3}/_{4}$% Senior Subordinated Debentures due in 1998. Both new Senior Subordinated Notes were made senior to the old debentures even though there was a covenant in its indenture stating, "the Company will not incur, create, issue, assume or guarantee any full recourse indebtedness which is both senior in right of payment to the Debentures and subordinate or junior in right of payment to any other Senior Indebtedness." This covenant protects the public debtholders from being leapfrogged by new public debt but does not, by itself, restrict issuing new senior bank debt. The bank loan agreement or other covenants in the public debt indenture may restrict the amount of new senior bank debt.

face value of the debt.[21] The exchange is then made contingent on a so-called *exit consent* in which the required fraction of the debt votes to strip the old debenture of the seniority and perhaps other covenants. The act of tendering consists of two actions: first, a vote to strip the debt of its covenant protection, and second, an acceptance of the exchange for the now legally-issued senior debt.[22] In Section II.B below, we discuss the efficiency consequences of tying the covenant waiver to the exchange offer via an exit consent.

There are at least two other ways firms commonly structure an exchange. One is to offer cash instead of a security such as debt or equity. Another is to offer debt with a shorter maturity than the existing debt. It turns out that in our two-period model these alternatives are equivalent. Debt due at date 1 is paid off with certainty, so exchanges for short-term debt are equivalent to cash exchanges.[23]

Proposition 3: *It is profitable to offer an exchange for cash.*

Proof: See Appendix.

Exchange offers for cash are profitable for similar reasons that senior debt exchanges are profitable. As more debtholders tender, more cash is paid out at date 1, reducing the value of the old debt at date 2. Tendering debtholders are paid cash for the $1 - q$ portion of their claim at date 1. Since this is paid before a holdout receives payment on the $1 - q$ portion of his claim, the tendering debtholders are effectively senior to the nontendering debtholders. As a result, the date-2 portion of the old debt claim is less valuable. Faced with this hold-in problem, old debtholders are willing to tender at a low price.

Recall that throughout the analysis we have assumed that the firm does not have a cash shortage. If the firm does not have sufficient cash, it will use all of its cash in excess of $B + I$ to buy back debt. It is important to note that the firm would not find it profitable to issue outside equity or debt (with equal or junior priority to the old debt) in order to buy back the public debt. The outside capital would not be senior to the untendered debt, so the required interest rate on the outside capital would more than make up for the savings on the exchange offer.

In this model, the ability to exchange for cash does not lead to any added inefficiencies since the firm will always invest in the single project. However, in a model in which there are either several projects or the level of investment is a choice variable, significant inefficiencies can result. The firm may choose to use cash which could be invested in positive net present value

[21] Since the vote does not change the timing or amount of payments it is not prohibited by the Trust Indenture Act. See Roe (1987).

[22] The legal status of exit consents is quite uncertain. Although an exit consent was upheld in Katz versus Oak Industries Inc. 508 A.2d 873 (Del. Ch. 1986), several potential legal arguments against them have not been tried. See Coffee and Klein (1990).

[23] Both alternatives are quite common. In our sample of 169 exchange offers, 39 involved some cash. Of the 101 cases in which a debt security was offered, 74 offered debt with a shorter maturity than the old debt.

projects to buy back public debt if the reduction in payments to creditors exceeds the NPV of a project. But, this inefficiency is limited in scope; financially distressed firms tend not to have a great deal of excess cash available for this type of activity.

As we discussed above, there is no difference between an exchange for cash and an exchange for shorter maturity debt of any priority in this model. In a model with more than two periods, there may be a difference because the firm may not have enough cash to exchange all the debt for cash immediately but may be able to achieve a similar effect with an exchange for shorter maturity debt. Our analysis suggests that an exchange for shorter maturity debt is profitable when the firm can make the debtholders who tender effectively senior to those who do not tender. This is possible if the realization of the risky project occurs after the new debt matures, but there are some relatively certain cash flows before the new debt matures. This allows the new debt to have low default risk and be paid off before the old debt matures.

B. Exchanges When There Is a Cash Shortage

The above analysis assumes that the firm does not need to restructure its debt in order to invest at date 1. Exchanges have no effect on efficiency; they just redistribute value from public debtholders to shareholders. We now suppose the firm needs a concession from either the bank or public debtholders to invest at date 1. We start by assuming that $I + B < Y < I + B + qD$; the firm needs some concession to invest but has enough cash to pay off the bank and invest.

We explicitly model bank renegotiation and public debt exchanges. The firm first approaches the bank seeking a concession. It makes a take-it-or-leave-it offer to postpone some or all of B until date 2, perhaps along with some debt forgiveness. The firm then has the option of offering an exchange for the public debt. This timing captures the idea that a firm is unable to commit to the bank not to pursue a profitable exchange offer.

Suppose the bank refuses to give the firm a concession. At this point, the firm can propose to exchange the public debt for a more senior debenture. (As we saw in the previous section this is preferred to offering a debenture that is pari passu with the old debt.) We assume for the moment that there is no seniority covenant. Because the new debt is senior to the old, the firm can set p, the face value of the new debenture, so that it is paid all of the date-2 cash flows. Thus, the maximum value of a unit of the new debenture is $(\overline{X} - Y - I - B)/D$, provided the firm buys back all of the debt.[24] If a debtholder does not tender, he receives only the date-1 payment q. So, if $(\overline{X} + Y - I - B)/D > q$ or, equivalently, if

$$\overline{X} - I \geq B + qD - Y \tag{7}$$

[24] The proof that the firm will wish to buy back all of the debt applies in this case as well.

an exchange offer for senior debt is feasible. In this case, the firm will want to buy back its public debt because the alternative is liquidation in which case shareholders get nothing.

Now consider the first stage of the model in which the firm approaches the bank to receive a concession. The bank knows that if it turns down the firm's offer, the firm will be able to exchange its debentures provided expression (7) is met. In this case, the bank receives B. So, the bank will turn down any offer which has an expected value less than B.

It is possible that the firm might prefer to renegotiate with the bank to receive some date-1 debt relief rather than restructure its public debt. As long as it can defer enough of its bank debt to pay off the date-1 portion of the public debt, this strategy is feasible. So, suppose the bank extends the maturity of its loan but requires the firm to pay B' at date 2. Assume for the moment that there is no public debt covenant prohibiting the issuance of senior debt; B' can be senior to the date-2 payments on the public debt. In addition, if $Y < I + qD$ the bank has to provide a cash infusion of $I + qD - Y$. If $Y > I + qD$, the remaining cash of $Y - I - qD$ is available to pay off the bank at date 1. Since the new bank debt is senior, the minimum B' that the bank would accept satisfies

$$\int_0^{B'} Xf(X)\,\mathrm{d}X + \int_{B'}^{\infty} B' f(X)\,\mathrm{d}X + Y - I - qD = B. \tag{8}$$

The question is whether the firm prefers renegotiating with the bank or renegotiating with the public debtholders via an exchange offer. Proposition 4 establishes that, when feasible, the firm prefers a public debt restructuring to a bank debt restructuring.

Proposition 4: *If $I + B < Y < I + B + qD$ and there are no contractual restrictions on issuing senior debt, the firm prefers a public debt exchange to a bank debt restructuring.*

Proof: See Appendix.

In both an exchange offer and a bank debt restructuring, the bank ends up with a claim worth B. However, the exchange is less costly because the firm can take advantage of the hold-in problem; by exchanging for senior debt and leaving holdouts with a junior security, the firm induces public debtholders to tender for a claim that the bank would not accept.

Now suppose instead that $\overline{X} - I < B + qD - Y$, so expression (7) is violated. In this case, an exchange offer is not feasible without a bank concession. Thus, if the bank turns down the firm's take-it-or-leave-it offer, the firm is liquidated and the bank gets L_B. This means that the firm can offer the bank a claim worth L_B, and the bank will accept the offer. Note also that when $Y < I + B$ the bank would also accept an offer of L_B because without such a writedown the firm would be unable to invest at date 1.

Given an offer worth L_B and the bank's acceptance, the firm may be able to exchange its public debt. In an exchange, the maximum value of each new

senior debenture is $(\overline{X} + Y - I - L_B)/D$, while each untendered debenture is worth q because there will no funds available at date 2 to pay off the untendered junior debt. Thus, the firm can complete an exchange provided

$$\overline{X} - I \geq qD - L_D. \tag{9}$$

Note that if the exchange is successful, the firm will be able to make its date-1 bank payment of L_B and invest I since we have assumed that $Y > I + B > I + L_B$. If (9) is violated, however, the firm does not offer to exchange and thus is liquidated at date 1.

There will tend to be underinvestment if the current portion of the public debt qD exceeds its liquidation value L_D and overinvestment if the current portion is less than its liquidation value. The minimum transfer to the public debtholders from investment is the least that they can be given with investment qD minus what they get in liquidation L_D. If the transfer is positive, there is underinvestment, and if the net subsidy is negative, there is overinvestment.

The condition for investment is exactly the same as in the model of Section I in which exchange offers were ruled out, but it is possible for the firm to issue senior bank debt. In both cases, investment occurs if the net present value of the project exceeds $qD - L_D$. Although investment behavior is no different, the parties who pay for the investment are different. If (9) is a strict inequality, the public debtholders are worse off with an exchange than with a bank debt restructuring. In the bank debt restructuring, they keep their old securities, while in an exchange the hold-in problem leads public debtholders to accept a lower value security. Since, in both cases, the bank gets a claim worth L_B, equity is the beneficiary of the exchange offer.

Thus, exchange offers can be profitable for the firm if it is able to exchange the debt for more senior securities or has excess cash it can use to exchange the debt for cash. But note the ability to exchange does nothing to improve the efficiency of investment decisions of financially distressed firms if there is no seniority covenant in the public debt; it just affects who bears the costs of financial distress.[25] The reason is that public debtholders take the success of the exchange as given in making their tender decision. Therefore, they do not consider how a change in operating policy made possible by the exchange, affects their claim.

We summarize these results in the following proposition.

Proposition 5: *If the firm has insufficient cash to invest, there are three possible outcomes. If the NPV of the investment $\overline{X} - I$ is sufficiently large, the bank is paid in full, the public debtholders accept an exchange, and the firm invests. For intermediate NPVs, the bank debt is forgiven to L_B, the public debtholders accept an exchange, and the firm invests. If the NPV is suffi-*

[25] Although the basic idea that exchange offers give limited possibilities to increase investment incentives is quite robust, the strong result of no effect is somewhat model-specific. For example, if management were only willing to invest if equity value exceeded some threshold level, the concessions from public debtholders would increase the ability to invest.

ciently small, the firm is liquidated and does not invest. The possibility of a public debt exchange does not alter investment when there are no covenants prohibiting senior debt issues.

The analysis assumes that there is no covenant in the public debt prohibiting a senior debt issue. As discussed in Section II.A, however, firms can get around this covenant through an exit consent in which debtholders simultaneously tender their debentures for more senior ones and, as a condition of the exchange, vote to remove the seniority covenant on the original debt issue. The condition for investment continues to be given by inequality (9).

Thus, exchange offers combined with exit consents can be used to strip seniority covenants that would otherwise prevent a public debt restructuring and constrain investment; in this case, exchange offers have real investment effects. But, the firm can go too far; exit consents and exchange offers can reduce the value of the public debt so much that the firm actually overinvests. Coffee and Klein (1990) have argued that the "coercive" character of exit consents leads to inefficiencies and have called for a ban on exit consents. As a result of a ban, debtholders would still be able to vote to remove covenants, but the vote would not be a condition for tendering in an exchange.

Such a ban on exit consents is efficient in our model. To see this, suppose there is a seniority covenant in the public debt. The interesting case is where the firm cannot raise new bank financing that is pari passu with the existing debt: $\overline{X} - I < V_D - L_D$ and $V_D - L_D > 0$, so that the firm potentially underinvests. If the firm could renegotiate directly with public debtholders they would be willing to reduce the value of their debt conditional on investment to L_D through a reduction of principal or interest. Of course, the Trust Indenture Act does not permit public debtholders to reduce V_D in this way. But, they can effectively reduce V_D by voting to waive the seniority covenant. At the same time, the bank lends new money senior to the public debt, and the interest rate is chosen so that the value of the public debt V_D' is anywhere from a minimum of qD to a maximum of V_D. (Note that V_D' cannot be below qD because if the firm invests the payment of qD is required.)

Public debtholders will accept a covenant waiver only if they know they will receive at least L_D as a result of the restructuring. If $qD < L_D$, the firm can offer L_D, and the public debtholders will accept; if $qD > L_D$, the value of the debt cannot be reduced all the way to L_D, and the offer will be qD. So $V_D' = \max\{qD, L_D\}$. Thus, the condition for investment with a covenant waiver is

$$\overline{X} - I \geq \max\{qD, L_D\} - L_D = \max\{qD - L_D, 0\}. \tag{10}$$

Contrast this condition to inequality (9) which determines investment when exit consents are possible. The two conditions are the same when $qD > L_D$. In both cases underinvestment may result because there are limits on how much debt reduction is feasible via exit consents or covenant waivers. But, when $qD < L_D$, exit consents allow some negative NPV projects to be

taken while covenant waivers do not. The firm can reduce the value of the public debt to below its liquidation value when exit consents are possible but cannot do this when debtholders vote separately on the covenant waiver. Thus, in some situations, exit consents go too far in lowering the debt burden. We have only focused on the case where $\bar{X} - I < V_D - L_D$ and $V_D - L_D > 0$, but in the other cases covenant waivers also lead to weakly more efficient investment outcomes than exit consents.[26]

The conclusion is that exchange offers only alter investment behavior when there is a covenant in the public debt prohibiting senior debt issues. In these cases, firms can use exit consents to remove covenants, issue senior debt, and increase investment. But, exit consents can result in excessive investment. By contrast, if the firm is prohibited from using exit consents and instead must ask for a separate vote to waive a seniority covenant, investment decisions are improved.

The results of this section indicate that the firm would never propose an exchange for more junior securities. This is difficult to reconcile with empirical observations. There are two promising explanations. First, if the firm has private information, it may signal its information by the type of security offered in an exchange. As Myers and Majluf (1984) show, equity issues can signal that the firm's value is low. The firm may then offer an exchange for equity so that debtholders lower the value of the claim they require in exchange.[27] This may offset the losses the firm incurs from the holdout problem created by an exchange for a more junior security.

A second reason why firms may offer junior securities is that public creditors are not really atomistic. In this case, the firm may be able to convince a sufficient number of large debtholders that their acceptance of equity is necessary for a successful restructuring. Equity may be preferred because it reduces the cash drainage from the firm.

Finally, we note two recent developments that have made exchanges less attractive. In the LTV bankruptcy, Judge Lifland disallowed a portion of the claims of public debtholders who participated in a previously completed exchange. He ruled that the admissible claim was the market value of the debentures at the time of the exchange, not its face value. Thus, there may be some reluctance to exchange for fear that the firm would file for Chapter 11 in the future. In addition, the tax treatment of exchanges was changed as part of the Revenue Reconciliation Act of 1990, requiring the firm to recognize cancellation of debt income based on the market value of new securities, not their face value. Firms may be able to avoid this tax liability in Chapter 11.

[26] For completeness, consider the case where $\bar{X} - I < V_D - L_D < 0$. In this case the public debtholders would never agree to lower the value of their debt further below its liquidation value. In contrast, an exit consent could allow negative NPV projects to be taken. Also consider the case where $\bar{X} - I > V_D - L_D$. Neither covenant waivers nor exit consents change investment behavior. Public debtholders reject any covenant waiver, but an exit consent can be used to extract value from public bondholders.

[27] See Gertner (1990) and Brown, James, and Mooradian (1991). The latter paper provides empirical evidence consistent with the signaling view.

III. Reorganization Law and Investment

In the U.S., financially distressed companies often seek court protection under the provisions of Chapter 11 of the Bankruptcy Code. These provisions in the Code are intended to promote reorganization of economically viable firms as going-concerns and thereby avoid inefficient liquidation of distressed firms. When a firm files for bankruptcy, all of its debts become due, but an *automatic stay* is invoked stopping all principal and interest payments, and secured creditors lose the right to take possession of their collateral.

In Chapter 11, control of a firm, known as the *debtor in possession*, typically remains with the current management and board of directors. This contrasts with Chapter 7 bankruptcy proceedings in which a trustee takes control and manages the company while organizing a piecemeal liquidation or sale of the firm as a going concern. Creditors are paid in accordance with the absolute priority rule, so equity gets nothing unless all creditors are paid in full. In Chapter 11, management is permitted to continue operating the firm, but all significant decisions are subject to court review and legal motions by creditors to disallow the proposed policy.[28] In reviewing the debtor's policies, the court's objective is to approve policies which maximize the value of the estate. The court has the charge of promoting "equitable" resolutions. This gives the court significant latitude in overseeing the debtor's operations. In addition, the fiduciary responsibility of management is to maximize the value of the estate, not the value of equity.

Operations proceed with court oversight until a reorganization plan is approved through a voting procedure of creditors or the firm is liquidated (piecemeal or as a going concern) either in Chapter 11 or after a conversion to Chapter 7. A reorganization plan specifies a new capital structure for the firm, delineating how creditors are paid in terms of cash or securities of the reorganized firm.

In this section, we focus on three aspects of Chapter 11 that we believe are fundamental for understanding its effect on operating and investment decisions: the automatic stay, the voting rules that determine whether a reorganization plan is approved, and the maintenance of equity value despite the fact that creditors are not paid in full. In general, Chapter 11 has ambiguous effects on efficiency, but the analysis characterizes the situations in which efficiency is enhanced or diminished.

A. The Automatic Stay

The automatic stay increases the firm's incentive to invest. To see this suppose the firm files for Chapter 11 and that the automatic stay is the only feature of Chapter 11. The public debtholders' claims are delayed until date 2, at which time they are either paid in full or share the firm's assets with the bank if the firm is unable to make its debt payment.

[28] Control of the corporation can be given to a trustee if creditors can show that current management has acted fraudulently.

Effectively, the automatic stay extends the maturity of the public debt from $q > 0$ to $q = 0$. As we have seen, the firm has a greater incentive to invest when the debt has longer maturity. There are two separate effects. First, the firm may now have the cash needed for investment, so it may not have to borrow funds at date 1: Y may be less than $I + B + qD$ but greater than $I + B$. And even if the firm must borrow ($Y < I + B$), investment is more attractive because the automatic stay forces public debtholders to bear more risk.

The firm may be more willing to invest, but it is not necessarily efficient for it to do so. Public debtholders may be forced to bear too much risk, leading the firm to overinvest. The oversight of the court and the ability of public debtholders to object to the firm's investment plans may prevent large abuses of this type.

This analysis assumes that the new money comes from the bank and is pari passu with the outstanding public debt. But, the debtor will generally try to get the court to approve financing senior to all existing debt. Such financing—known as *debtor in possession* (*DIP*) *financing*—is considered an administrative cost which is paid ahead of all other creditors. The court can even make post-petition debt senior to other administrative costs. In addition, the court can approve a *cash collateral* agreement, allowing the debtor to use liquid assets to finance its operations even if these assets are pledged as collateral to a creditor. Thus, the court can effectively strip seniority covenants and security from existing debt. This leads to even greater investment incentives, although the junior creditors who are potentially hurt by the new senior investment can try to petition the court to reject the new financing.

The automatic stay also affects the incentives of the bank to lend outside of bankruptcy. Since the subsidy to the public debtholders from investment is reduced by the automatic stay, the bank and the firm have an incentive to restructure inside bankruptcy rather than outside bankruptcy. If the deadweight losses associated with bankruptcy are less than the reduction in the net subsidy to debtholders, firms will file for bankruptcy even though they could have successfully restructured outside of bankruptcy. In this case, the Chapter 11 option can reduce efficiency. Investment is unchanged by the filing, but the firm is willing to incur a deadweight cost to extract value from public debtholders.[29]

B. Chapter 11 Voting

Investment inefficiencies arise in our model because of the inability to negotiate directly with public debtholders. Exchange offers do little to improve investment efficiency. The underlying problem is that unlike the bank,

[29] This implicitly assumes that a firm which defaults must file for bankruptcy. However, in this situation, if bankruptcy proceedings are costly, public bondholders may choose not to force the firm into bankruptcy despite default. They know that bankruptcy results in imposition of the automatic stay which may delay payment as much as default. In this case, the automatic stay can effectively be achieved without an actual filing.

public debtholders do not take into account their effect on the firm's investment policy.

Chapter 11 voting rules can get around this problem. Reorganization plans must be approved by all classes of creditors and the court. Classes are determined by grouping creditors with essentially equivalent claims. So, for example, secured and unsecured creditors are always assigned to different classes. A class approves a plan if two-thirds of the allowed monetary interests and a majority in number within the class accepts the plan. A dissenting member of a class can object to a plan if he gets a claim worth less than his claim in liquidation.

To see how the voting procedure affects restructuring and investment, suppose that the firm files for Chapter 11 reorganization and immediately proposes a reorganization plan that gives public debtholders a claim on the reorganized company which, conditional on investment, is worth $L_D + \varepsilon$, a little more than the return to public debtholders under liquidation. Furthermore, suppose that this is a take-it-or-leave-it offer and that if the plan is rejected the firm is liquidated.In deciding how to vote, a public debtholder compares his return if the plan is successful with his return if it is not. If the plan is successful, all public debtholders share $L_D + \varepsilon$. If the plan is unsuccessful, all public debtholders share L_D in liquidation. Thus, they all vote for the plan. The debtor can offer the holders of the public debt a claim just above its liquidation value, so there is no subsidy to or from public debtholders. The result is efficient investment.

Why does this voting mechanism work while an exchange offer does not? The answer is that the voting procedure does not allow public debtholders to be treated differently depending on their vote, whereas tendering and nontendering public debtholders are treated differently. In an exchange offer, a public debtholder compares the value of the new claim with the value of the old claim *conditional on success* of the exchange offer because it is possible for the debtholder to keep his old claim even if the tender offer is successful. But if the conditions for acceptance under the voting procedure are met, those who do not vote for the plan are compelled to accept the offer.[30] Thus, the voting procedure can be used to internalize the effects of the investment decision and get around the holdout and hold-in problems, thereby improving investment efficiency.[31]

The voting procedure is unlikely to work as smoothly as we have modeled it. In practice, the debtor does not have all the bargaining power. The threat to liquidate the firm if the plan is rejected may not be credible; the debtor may choose to continue operating the firm in Chapter 11. Asymmetric

[30] A dissenting member of an approving class who gets less than the liquidation value of its claim can object to the plan. If successful, this will cause the plan to be defeated. This does not accomplish the same thing as holding out in a successful exchange offer. In that situation, other creditors make concessions while the holdout's claim is unchanged.

[31] A similar problem arises in the context of takeovers. Shareholders that do not tender may be able to free-ride on the acquirer's value gains. One way around this problem has been proposed by Bebchuk (1985): let the shareholders vote whether to accept the offer and make a successful vote binding on all shareholders. This reduces inefficiency for the same reason it does here.

information may lead to inefficiencies through strategic behavior and delay. Nevertheless, an important feature of voting is its capacity to overcome the holdout and hold-in problems.

This analysis raises a natural question: if Chapter 11 voting procedures enhance efficiency, why can the firm not include in its debt covenants a provision that mimics the Chapter 11 voting procedures for exchange offers by the firm. The answer is that, as discussed above, the Trust Indenture Act of 1939 prohibits it.[32]

This voting rule can help the firm to obtain concessions from public debtholders. Even if the bank is willing to lend outside Chapter 11, the firm may be better off filing for bankruptcy and taking advantage of the voting procedure to obtain a transfer from public debtholders. This is more likely to be the best strategy when these concessions are large. Thus, if the public debt is relatively short term, senior, or protected by seniority covenants, the public debt is generally more valuable outside Chapter 11 than inside. In these cases, we would expect firms to file.

C. Maintenance of Equity Value

One of the most salient features of Chapter 11 reorganizations is that shareholders typically retain a stake in the firm, even though debtholders are not paid in full. Franks and Torous (1989) find that, in a sample of 28 Chapter 11 filings, equity holders retain some equity in the reorganized firm in 21 cases.

The debtor's bargaining power in Chapter 11 is derived from a number of procedural rules on the formation and acceptance of a reorganization plan. The *debtor in possession* has the exclusive right to propose a plan for the first 120 days after filing the bankruptcy petition. This exclusivity period can be, and often is, extended by the judge for long periods. Only once exclusivity is lifted can creditors propose a plan.

The debtor's threat to delay a plan is often credible; the debtor wishes to protract bankruptcy proceedings on the chance that the debtor will turn solvent and that shareholders will receive a larger payoff in the liquidation or reorganization. These debtor bargaining powers help explain why shareholders typically retain a stake in the reorganized firm even though creditors are not paid in full.

[32]The Act was initially promoted to protect public debtholders from being exploited by the firm. The fear was that a large shareholder would have an incentive to secretly buy up the bonds and vote to eliminate principal and interest payments. Roe (1987) argues that this provision of the Trust Indenture Act no longer serves any useful purpose and is inconsistent with the voting procedures used in Chapter 11 reorganizations. Fraud statutes can be used to avoid manipulation by large shareholders. The Act may force firms to file for bankruptcy with all its other baggage in order to restructure its public debt. Currently, "pre-packaged" or "1126b" plans, in which reorganization plans are already approved when the firm files for bankruptcy, are becoming popular. They are used mainly to compel holdouts to go along with other members of their creditor class. Republic Health used a pre-package plan successfully.

This threat is damaging to creditors because they usually want the proceedings to end as soon as possible in order to receive principal and interest payments on their debt. In addition, all creditors face the risk that the estate's value will decline dramatically during bankruptcy. Secured creditors also face the risk that the secured assets will depreciate during Chapter 11.

Clearly, the decision to accept or reject a plan depends on what happens if the plan is not approved, i.e., on the threat points in this game.[33] One threat point of a plan's sponsor is that the plan will be approved by the court even in the presence of a dissenting class of creditors. The procedure is referred to as *cramdown*. Section 1129 of the Bankruptcy Code provides for cramdown if a class receives a claim with value equivalent to full payment or if every class junior to the dissenting class receives nothing.[34]

Creditors also have threats. They can propose a plan of their own which can be crammed down on the equity holders. Perhaps, even more important, secured creditors can try to lift the automatic stay.[35] They can also file for dismissal of the case or conversion to Chapter 7 liquidation.[36] Creditors can fight management's operating and investment decisions. They can refuse to lend new money, and they can try to block asset sales.

The fact that equity retains value in many reorganizations even if creditors are not paid in full can have important implications for behavior outside of Chapter 11, in particular for incentive to lend new money outside of bankruptcy. In our model, the firm has only two alternatives: to obtain new funds and invest, or to go bankrupt and liquidate the firm. In practice, however, there is generally a third option: to file for Chapter 11 protection, invoke the automatic stay, and maintain control, continuing in operation without new funds for investment. This threat is often both harmful to creditors and perfectly credible: in liquidation equity value is almost certain to be wiped out, while in Chapter 11 equity value is positive if there is any possibility of solvency. Faced with this threat, the creditors' best alternative may be to extend further funds for investment. Thus, reorganization law provides a distressed firm with a credible threat that increases the creditors' incentives to provide new funds. In essence, the law affects the bargaining

[33] See Brown (1989) and Baird and Picker (1991) for analyses of how various bankruptcy rules affect the way in which firm value is divided between shareholders and creditors.

[34] Some jurisdictions have allowed equity to maintain value in cramdown even if all creditors are not paid in full. This rule, known as the *new value exception*, permits old equity holders to maintain control as long as it pays creditors the liquidation value of the assets and the old equity holders contribute new capital equal to the value of the equity of the reorganized company. The existence of the new value exception under the Bankruptcy Code is a controversial and unsettled legal issue. See Norwest Bank Worthington versus Ahlers 485 U.S. 197 (1988) and the discussion in Baird and Jackson (1990).

[35] Causes to lift the automatic stay include lack of adequate protection, or a showing that the creditor is undersecured and the collateral is not necessary for an effective reorganization.

[36] The court can convert a Chapter 11 case to Chapter 7 if it is in the best interest of the creditors and the estate as long as certain conditions are met. These conditions, listed in Section 1112 of the Code, include continuing losses with "no reasonable likelihood of rehabilitation," unreasonable delay by the debtor, and failure to consummate a plan.

process outside of bankruptcy, changing not just how surplus is split but the efficiency of outcomes as well.

To develop this idea in more detail, we consider the following simple extension of our model in Section I. Suppose that if the firm continues in operation without investing, it receives a stochastic date-2 payoff of X_c (with mean $\bar{x}_c$) in addition to the date-1 liquidation value of Y. In order to focus on continuation as a threat rather than a value-maximizing strategy, we assume that continuation is inefficient; total value is higher if the firm liquidates than if it continues without investment, $\overline{X}_c < 0$. The value of the public debt if the firm follows the continuation strategy is V_D^c. The bank and the firm together get $\overline{X}_c + Y - V_D^c$ if the firm continues without investing. If the firm invests, their combined payoff, as before, is $\overline{X} - I + Y - V_D$. Finally, if the firm is liquidated, their combined payoff is L_B, with equity getting nothing.

Suppose that among these three alternatives liquidation is the most attractive to the bank and equity combined, so that

$$L_B > \max\left(\overline{X} - I + Y - V_D, \overline{X}_c + Y - V_D^c\right) \tag{11}$$

Then, absent Chapter 11 reorganization, the firm will be liquidated.

But, now suppose the firm can file in Chapter 11, invoke the automatic stay, defer debt payments until date 2, and stay in control of the firm. This is collectively inefficient for the bank and shareholders since $L_B > \overline{X}_c + Y - V_D^c$. The bank would like to pay the firm to liquidate instead of continue, but it cannot. Any payment from the bank to the firm cannot go to shareholders before it goes to the firm's other creditors; this would be a fraudulent conveyance and declared illegal. Given this restriction, the firm's threat is credible; shareholders are better off continuing in operation in the hope that X_c is sufficient to pay creditors at date 2, thereby giving equity a positive return, which exceeds equity's zero return in liquidation.

So the bank has two options. It can let the firm file Chapter 11 or it can provide new money for investment. If the joint returns from investing are larger than those from continuation in Chapter 11, i.e.,

$$\overline{X} - I - V_D \geq \overline{X}_c - V_D^c, \tag{12}$$

the bank will lend money for investment. If not, the firm will file for Chapter 11 protection.

The option to file for Chapter 11 protection can increase efficiency. If (12) is satisfied, the firm will be more prone to invest. This is efficient if $V_D - L_B > 0$, the case in which the firm underinvests without Chapter 11. If, however, $V_D - L_D < 0$, the firm would otherwise overinvest, and Chapter 11 merely exacerbates the inefficiency. By contrast, if (12) is violated, Chapter 11 always reduces efficiency since the firm continues rather than liquidates, and $\overline{X}_c < 0 < Y$.

The overall efficiency effects of this aspect of Chapter 11 are ambiguous, but we can identify the situations in which it is likely to be helpful or harmful. First, when the public debt is short term, the bank debt is senior,

and the public debt is protected by seniority covenants, underinvestment is likely to be a problem, and Chapter 11 can be helpful. Second, when investment is risky relative to continuation, investment tends to be more attractive to the bank and equity because the public debt is worth less. In this case, the likely effect of Chapter 11 is to promote investment rather than to give the firm an easy way of avoiding efficient liquidation.

Another out-of-bankruptcy effect of the maintenance of equity value in Chapter 11 is to reduce the incentives to take risk. In a Chapter 7 liquidation, shareholders generally receive nothing, making Chapter 7 very unattractive to shareholders and management. So, as the firm's financial position gradually deteriorates, management has a strong incentive to take risk-increasing investments and to pay out as much firm value as possible to themselves. This incentive is obviously diminished the higher the return to equity and management in Chapter 11. Of course, if public debtholders are aware of the law, they must be promised a higher interest rate to compensate them for their lower return when the firm is in distress. If the investment decisions of a financially distressed firm are more efficient, there will be more than enough increased value to pay the higher interest rates and yet increase equity value.

IV. Concluding Remarks

This paper outlines some of the characteristics of corporate financial structure that can make financial distress more or less costly. We focus on coordination problems among numerous public debtholders as the main source of inefficiency. This problem can lead to underinvestment when bank debt is senior, when public debt is short term, or when it is protected by seniority covenants. Overinvestment tends to be a problem with junior bank debt, long-term public debt, and when a firm can strip seniority covenants with exit consents.

Exchange offers can be used to restructure public debt, but they do not, in general, lead to efficient investment. So, financial distress may result in inefficient operating policy even though banks are perfectly informed and exchanges are possible with public creditors. If there are no seniority covenants in the public debt, exchange offers do not change the firm's investment behavior but simply force public debtholders to bear more of the burden of financial distress. If there is a seniority covenant, however, investment can be increased through an exchange offer that strips public debt of its covenant and enables a firm to issue senior debt to finance investment. However, such exchange offers can go too far, resulting in overinvestment in some cases. Efficiency is increased if exit consents are not allowed, and, instead, debtholders vote separately to eliminate seniority covenants.

The Trust Indenture Act gives rise to investment inefficiencies because it forces firms to make exchange offers rather than bargain directly with public debtholders. In our model, all investment inefficiencies would be eliminated if the Trust Indenture Act was repealed. Of course, this result follows from

our assumption of complete information in which case bargaining is efficient in the absence of transaction costs. In a more realistic model with asymmetric information and other transaction costs, investment inefficiencies are likely to result.

There are a number of empirical implications of our model. First, the model predicts that, conditional on an out-of-court workout, distressed firms with senior bank debt, short-term public debt, and effective seniority covenants will invest less. Second, the model predicts that exchanges are more likely when the public debt is relatively long term. And, when possible, exchanges should shorten the maturity of public debt, strip existing covenants, and offer more senior securities.

Our model is also a useful starting point to think about the tradeoffs firms face in deciding whether to file for Chapter 11 rather than seek an out-of-court restructuring. We have outlined how debt structure affects the payoffs from an out-of-court restructuring. To complete the theory, we need a model of the reorganization process, one that tells us how debt structure affects investment behavior and the division of firm value in Chapter 11.

We conclude by noting that while we have analyzed the effects of Chapter 11 on distressed firms, we have sidestepped an important point made by legal scholars. Roe (1983), Baird (1986), and Jackson (1986) have all argued that the manipulation that is possible in Chapter 11 can be avoided by eliminating Chapter 11 reorganization altogether and relying on Chapter 7.

The basic thrust of the argument is as follows. Consider a firm in financial distress much like the firm we have modeled. Suppose the firm goes into Chapter 7 and the trustee sells the firm in its entirety, either through an auction or through negotiations with investors and other firms. The proceeds from the sale are then used to pay off creditors using the same priority rules that apply if the assets are sold piecemeal. Any funds that are left after paying off all the creditors in full go to the original shareholders. The newly created firm has none of its previous debts and should be able to invest efficiently. If the original managers of the firm are essential for the investment project, the new owners can hire them to run the company, or the old managers could buy the firm themselves, borrowing against the firm's now unencumbered assets. In effect, the Chapter 7 effects a swap of all the outstanding debt for a package of new securities.

Our analysis suggests that the issues are more complex than these authors suggest. The important point is that the maintenance of equity value in Chapter 11 affects both investment and bargaining outside of bankruptcy. It makes creditors more willing to lend, and it can reduce managerial moral hazard outside of bankruptcy. Moreover, if the market for the sale of distressed firms is thin and inefficient, the buyer will get some rents. This will inefficiently increase the firm's ex ante cost of capital since neither original shareholders nor creditors receive these rents. And, the forced sale envisioned by these authors can lead to different operating and investment policies. So, the normative question of whether a forced sales regime is more

or less efficient than some form of reorganization law is an empirical one, given the potential allocative distortions of both systems.

Appendix

Proof of Proposition 1: For a given p and β, the value of the firm in default is: $X + Y - I - B - (1 - \beta)qD$. Total outstanding claims at date 2 are $(1 - \beta)(1 - q)D + \beta pD$ of which tendering debtholders collectively receive a fraction $\beta pD/[(1 - \beta)(1 - q)D + \beta pD]$. Thus, the value of each of the βD tendered debentures is:

$$\int_0^{X_b} \frac{p}{(1-\beta)(1-q)D + \beta pD} \left[X + Y - I - B - (1-\beta)qD \right] f(X)\, dX + \int_{X_b}^{\infty} pf(X)\, dX. \quad \text{(A1)}$$

Each nontendering debtholder receives a certain payment of q at date 1 and a risky claim at date 2 comprised of his share of the insolvent firm if $X < X_b$ and full payment of $(1 - q)$ if $X > X_b$:

$$q + \int_0^{X_b} (1-q) \frac{X + Y - I - B - (1-\beta)qD}{(1-\beta)(1-q)D + \beta pD} f(X)\, dX + \int_{X_b}^{\infty} (1-q) f(X)\, dX. \quad \text{(A2)}$$

Equating (A1) and (A2) determines, for any given β, the p at which debtholders are just indifferent between tendering and not tendering. This equation can be rewritten as:

$$\int_0^{X_b} \frac{(X + Y - I - B)(1 - q - p) + pqD}{(1-\beta)(1-q)D + \beta pD} f(X)\, dX + \int_{X_b}^{\infty} (1-p) f(X)\, dX = 0. \quad \text{(A3)}$$

At $p = 1$, the left-hand side is

$$\int_0^{X_b} \frac{q[D - (X + Y - I - B)]}{(1-\beta)(1-q)D + \beta pD} f(X)\, dX. \quad \text{(A4)}$$

The integrand is 0 at $X = X_b$ and positive for $X < X_b$, so (A4) is positive at $p = 1$. Since the left-hand side of (A3) is decreasing in p, the p that solves (A3) is greater than one. Q.E.D.

Proof of Proposition 2: The value of the old debentures given β and p when the firm exchanges for senior debt is given by:

$$q + \int_{X_1}^{X_b} \frac{X + Y - I - B - (1 - \beta)qD - \beta pD}{(1 - \beta)D} f(X)\,dX + \int_{X_b}^{\infty} (1 - q) f(X)\,dX, \quad \text{(A5)}$$

where $X_1 \equiv I + B + (1 - \beta)qD + \beta pD - Y$ is the cutoff value of X above which the new debentures are paid in full and $X_b \equiv I + B + (1 - \beta)D + \beta pD - Y$ is the cutoff value of X above which the old debt is paid in full and the firm is solvent; $X_1 \leq X_b$, with equality if and only if $\beta = 1$. Since the new debt is senior to the old debt, for X between X_1 and X_b holdouts share $X + Y - I - B - (1 - \beta)qD - \beta pD$, the cash left after date-1 payments and date-2 payments of βpD to the new senior debt.

Tendering debtholders do not receive q at date 1 but do receive a senior claim at date 2. The value of their debt is

$$\int_0^{X_1} \frac{X + Y - I - B - (1 - \beta)qD}{\beta D} f(X)\,dX + \int_{X_1}^{\infty} pf(X)\,dX. \quad \text{(A6)}$$

We now show that the value to the firm of an exchange is increasing in β. Equating (A5) and (A6) and combining terms gives,

$$\int_0^{X_1} \frac{X + Y - I - B - qD}{\beta D} f(X)\,dX - \int_{X_1}^{X_b} \frac{X + Y - I - B - pD}{(1 - \beta)D} f(X)\,dX - \int_{X_b}^{\infty} (1 - p) f(X)\,dX = 0. \quad \text{(A7)}$$

Since $X_b = I + B - Y + (1 - \beta)D + p\beta D$,

$$\frac{dX_b}{d\beta} = D\left[\beta \frac{\partial p}{\partial \beta} - (1 - p)\right]. \quad \text{(A8)}$$

Differentiating (A7),

$$\frac{\partial p}{\partial \beta} = \frac{\displaystyle\int_0^{X_1} \frac{X + Y - I - B - qD}{\beta^2 D} f(X)\,dX + \int_{X_1}^{X_b} \frac{X + Y - I - B - pD}{(1 - \beta)^2 D} f(X)\,dX}{\displaystyle\int_{X_1}^{X_b} \frac{1}{1 - \beta} f(X)\,dX + \int_{X_b}^{\infty} f(X)\,dX}. \quad \text{(A9)}$$

Multiplying by β and substituting from (A7),

$$\beta \frac{\partial p}{\partial \beta} = \frac{\frac{1}{1-\beta}\int_{X_1}^{X_b} \frac{X + Y - I - B - pD}{(1-\beta)D} f(X)\,dX + \int_{X_b}^{\infty} (1-p) f(X)\,dX}{\int_{X_1}^{X_b} \frac{1}{1-\beta} f(X)\,dX + \int_{X_b}^{\infty} f(X)\,dX}, \tag{A10}$$

and

$$\beta \frac{\partial p}{\partial \beta} - (1-p) = \frac{\frac{1}{1-\beta}\int_{X_1}^{X_b} \frac{X + Y - I - B - pD}{(1-\beta)D} f(X)\,dX - \int_{X_1}^{X_b} \frac{1-p}{1-\beta} f(X)\,dX}{\int_{X_1}^{X_b} \frac{1}{1-\beta} f(X)\,dX + \int_{X_b}^{\infty} f(X)\,dX}. \tag{A11}$$

The denominator is clearly positive. The numerator is equal to

$$\frac{1}{(1-\beta)^2 D}\int_{X_1}^{X_b} \left[X + Y - I - B - D(1 - \beta + \beta p)\right] f(X)\,dX.$$

At X_1 the integrand is $(1-\beta)(q-1)D$, which is negative. Since the integrand is increasing in X, the numerator is negative, and X_b is decreasing in β. Thus, one can determine whether an exchange offer is profitable by checking to see whether p is greater or less than one at $\beta = 1$.

If we set $\beta = 1$, $X_1 = X_b$ and we can rewrite (A7) as

$$\int_0^{X_b} \frac{X + Y - I - B - qD}{D} f(X)\,dX - \int_{X_b}^{\infty} (1-p) f(X)\,dX = 0. \tag{A13}$$

Since $Y > I + B + qD$ by assumption, the first term in (A13) is positive. Thus, to satisfy (A13), p must be less than one. Q.E.D.

Proof of Proposition 3: Suppose the firm offers to exchange each dollar of old debt for V dollars of cash or new short-term debt. Debtholders will be indifferent between tendering and not for any V and β provided,

$$q + \int_0^{X_b} \frac{X + Y - I - B - (1-\beta)qD - V\beta D}{(1-\beta)D} f(X)\,dX + \int_{X_b}^{\infty} (1-q) f(X)\,dX = V, \tag{A14}$$

where $X_b \equiv I + B + (1 - \beta)qD + V\beta D - Y$. We can rewrite (A14) as

$$\int_0^{X_b} \frac{X + Y - I - B - VD}{(1 - \beta)D} f(X)\,dX + \int_{X_b}^{\infty} (1 - V) f(X)\,dX = 0. \quad \text{(A15)}$$

Totally differentiating (A15) yields,

$$\frac{dV}{d\beta} = \frac{\int_0^{X_b} \frac{X + Y - I - B - VD}{(1 - \beta)^2 D} f(X)\,dX}{F(X_b) + (1 - \beta)[1 - F(X_b)]} \quad \text{(A16)}$$

$$= \frac{-(1 - V)[1 - F(X_b)]}{\beta\{F(X_b) + (1 - \beta)[1 - F(X_b)]\}}, \quad \text{(A17)}$$

where the second equality follows from substituting (A15) into (A16). From (A14), $V < 1$, so (A17) implies that $V'(\beta) < 0$. The cost to the firm of the exchange is $\beta DV(\beta)$. Since debtholders are indifferent between tendering and not, the expected payments to the nontendering debtholders must be $(1 - \beta)DV(\beta)$. Adding, the expected payments to all public debtholders is $V(\beta)D$. So, the firm maximizes profits by choosing β to minimize $V(\beta)$. Since $V'(\beta) < 0$, an exchange for cash is profitable. Q.E.D.

Proof of Proposition 4: From (A13), the exchange offer terms for senior debt are determined by

$$\int_0^{X_b} (X + Y - I - B - qD) f(X)\,dX - \int_{X_b}^{\infty} (1 - p) D f(X)\,dX = 0, \quad \text{(A18)}$$

where $X_b = X + Y - I - B - pD$.

In an exchange, the shareholders receive $X - X_b$ if it is positive and zero otherwise. In a bank renegotiation, shareholders receive $X - B' - (1 - q)D$ if it is positive and zero otherwise. So an exchange is more profitable provided $X_b < B' + (1 - q)D$.

To show that this is indeed the case, we assume, to the contrary, that $X_b \geq B' + (1 - q)D$. Thus, let $B' \equiv X_b - (1 - q)D - \varepsilon$, $\varepsilon \geq 0$. Then equation (8) can be rewritten as

$$\int_0^{X_b - (1-q)D - \varepsilon} X f(X)\,dX + \int_{X_b - (1-q)D - \varepsilon}^{\infty} [X_b - (1 - q)D - \varepsilon] f(X)\,dX + Y - I - qD - B = 0. \quad \text{(A19)}$$

Using the definition of X_b and rearranging, (A19) becomes

$$\int_0^{X_b - (1-q)D - \varepsilon} (X + Y - I - qD - B) f(X)\,dX - \int_{X_b - (1-q)D - \varepsilon}^{\infty} (1 - p) D = 0. \quad \text{(A20)}$$

Now compare (A20) and (A18). The only difference is the limits of integration. Note that the left-hand side of (A18) is increasing in X_b and since $X_b - (1 - q)D - \varepsilon < X_b$, the left-hand side of (A20) is less than that of (A18). Thus, if (A18) is satisfied with equality, (A20) must be violated. Thus, B' must be greater than $X_b + (1 - q)D$. Q.E.D.

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