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Abstract

In a market-based financial system, credit is held by dispersed creditors, and out-of-court renegotiation of debt is more likely to fail because of hold-out problems; in a bank-based system, out-of-court renegotiation stands good chances to succeed. Since out-of-court renegotiation is a substitute for court-supervised reorganization, the design of a reorganization law cannot abstract from the financial system. Chapter 11-style renegotiation is shown to benefit public debt firms and to be harmful for private debt firms; the overall effect depends on the financial system, but is likely to be positive only in a market-based system. The case for a reorganization law is weakened if dilution threats like exit consents are taken into account: such a law is then in most cases undesirable. Legislation, however, which jointly introduces a reorganization law while facilitating the use of dilution threats will improve welfare in a market-based system, but reduce welfare in a bank-based system. Thus, the paper identifies a new determinant in the debate over optimal bankruptcy codes, which is how easily dilution threats can be deployed.

Keywords : Workouts, reorganization law, Chapter 11, financial systems, dilution threats, exit consents, hold-in effect.

JEL Classification : G21, G32, G33, G34.

1. Introduction

In many European countries, there is an ongoing process and debate about bankruptcy law reform, stimulated by what is perceived as the success of Chapter 11 of the US Bankruptcy Code of 1978. The French bankruptcy laws of 1985 and 1995 and the new German insolvency code enacted in 1999 have accordingly weakened creditor rights and facilitated court-supervised reorganization.[1] In Britain, where the Insolvency Code gives a clear advantage to senior creditors, there is an active debate about reforming the bankruptcy legislation,[2] as for example in the Netherlands and Italy. The discussion is not confined to Western Europe: Transition economies in East and Central Europe have faced the need for a massive and parallel financial restructuring of firms, and recent financial crises in debt-laden emerging markets have underscored the potentially high cost of insufficient bankruptcy laws and lacking reorganization procedures. In a historical perspective, there is a striking coincidence between major reforms of bankruptcy laws and of banking laws in the US and in Germany (Hauswald (1996)).

The economic debate on the optimal reorganization law[3] has long recognized that the efficiency of such a law should be gauged in light of the presumed performance of the market solutions talking hold in the absence of a law, respectively the market for distressed asset sales and out-of-court debt restructurings or workouts.[4] There is substantial empirical evidence that the credit structure of a distressed firm matters for the performance of the market solutions, by showing that workouts are likely to fail when the firm's creditor base is dispersed.[5] This suggests that the optimal structure of a bankruptcy code depends on the financial system as the determinant of the typical degree of creditor dispersion.

If holdout problems among multiple creditors, together with imperfect markets for distressed assets, are the principal reason why market solutions may fail, then the analysis should naturally investigate the mechanisms that could overcome the resistance of dispersed creditors to make concessions. To have concessions decided upon by court order or majority vote, typical features of a reorganization laws, is one obvious alternative. Another is to

[1] See e.g. Kaiser (1996) and White (1996).

[2] See Franks and Nyborg (1996).

[3] Recent contributions include Bebchuk (1988), Aghion, Hart and Moore (1992), Berkovitch, Israel and Zender (1998) and Cornelli and Felli (1997).

[4] The preeminent objection against a reorganization law, raised by Haugen and Senbet (1978) and others, argues that workouts (out-of-court renegotiation) should be a perfect substitute for court-supervised reorganization. The opposing view, dominant in the Law and Economics literature (see e.g. Jackson (1986)), argues that court-supervised reorganization is needed to overcome inefficiencies in out-of-court debt renegotiation, which would be due to free-rider or hold-out problems.

[5] For US evidence, see for instance Gilson, John and Lang (1990), Gilson (1997), Franks and Torous (1989), (1994), Asquith, Gertner and Scharfstein (1991), James (1996), and Brown, James and Mooradian (1995).

give the debtor the means to force concessions by diluting the value of the claims of holdouts. Vehicles to engineer such dilution threats are e.g. exit consents, cash tender offers and asset spin-offs, and these devices are frequently adopted in distressed out-of-court debt reschedulings.[6]

The purpose of the paper is to analyze the interdependence of bankruptcy law and financial system while explicitly *(i)* addressing the choice between court-supervised reorganization and workouts, and *(ii)* taking into account that a distressed debtor can resort to dilution threats like exit consents, potentially a powerful alternative to court-supervised reorganization.

In the paper, workouts are analyzed in a situation of asymmetric information about the true value of the firm. In the first step of the analysis, only *pari passu* exchange offers are considered in workouts, i.e. offers where creditors are proposed new debt claims of equal seniority. A dispersed creditor structure will then lead to a renegotiation breakdown, while debt renegotiation with a single lender is (second best) efficient. The paper proposes a simple signaling explanation of the choice between private and public debt: Managers of riskier firms will use bank loans because flexible renegotiation of loans is more important to them, but bank credit has higher interest rates. High-quality firms will issue public debt as a credible signal of their quality, and get access to more attractive borrowing rates.

In this model, introducing a reorganization law is not necessarily efficient and the efficiency varies across financial systems. A reorganization law is more likely to be beneficial in a market-based system. It will speed up disintermediation, and increase the number of bankruptcy filings - both of these predictions were observed in the United States after 1978 (reform of the Bankruptcy Code). Frequently cited shortcomings of the Chapter 11 procedures are less harmful than commonly perceived, and they will typically even improve the efficiency of the reorganization procedure, as they increase the incentives to choose bank debt and to renegotiate out of court. This is true for delays in the procedure, violations of the absolute priority rule and management bias in the procedure.

In the second step, the assumption of *pari passu* renegotiation offers is abandoned and renegotiation offers for more senior claims (dilution threats) are taken into account. The question is then how these dilution threats affect the relationship between bankruptcy code and financial system. Dilution threats will always significantly improve the chances for a successful workout with diffusely held debt. Should dilution threats therefore be welcomed, as often suggested in the Law and Economics literature? And if so, should they be viewed as a substitute or rather a complement of court-supervised reorganization? The analysis reveals the following. Suppose dilution threats are possible, and the introduction of a reorganization law is considered. The renegotiation efficiency of public debt firms will actually go down in

[6]See Hege and Mella-Barral (2000) for a discussion of dilution threats and empirical references.

this case, making the introduction of a reorganization law in most cases an undesirable move. Conversely, suppose the question is whether the planned introduction of a reorganization law should be accompanied by supporting financial securities legislation permitting dilution threats. The answer is affirmative in a market-based system, where such a coordinated legislative is a welfare improvement. By contrast, in a bank-based system, it would reduce welfare. Overall, the case for a reorganization law is weakened if dilution threats are taken into account, but the optimal law design will again depend on the financial system.

The present paper is a companion paper to Hege (2000), where an extensive and more general account of the analysis with *pari passu* exchange offers is given. Hege (2000), however, does not address dilution threats. A few other papers combine a choice between workouts and court-supervised reorganization but they omit the debt structure choice and are of more limited scope. Hold-out effects if there are many creditors are demonstrated in a few other papers, notably Bolton and Scharfstein (1996). White (1994) conceives of Chapter 11 as a filtering device which makes the emergence of inefficient pooling equilibria less likely. Two earlier papers, Berkovitch and Israel (1999) and Detragiache (1994), discuss that the optimal bankruptcy design may depend on the dominant debt source of firms, or on the financial system. Both papers, however, ignore the decision between workout and court-supervised reorganization, and the alternative of dilution threats, and they do not consider that the design of the reorganization procedure interacts with the composition of the financial system.

Concerning dilution threats, Roe (1987) argues that they may be desirable by increasing the chances that out-of-court restructurings succeed. By contrast, Gertner and Scharfstein (1991) and similarly Kahan and Tuckman (1993) argue that debtors can abuse them to obtain excessive debt concessions, which may lead to additional sources of inefficiencies like overinvestment. Hege and Mella-Barral (2000) show that this problem goes all but away if subsequent rounds of dilution threats are taken into account as well as the willingness of the debtor to commit, via the design of the debt contract, to an ex post efficient renegotiation strategy.

The paper is organized as follows: the model is set up in Section 2. The following two Sections summarize results which have been developed and proved in Hege (2000): Section 3 reviews debt renegotiation and the market equilibrium, and Section 4, the impact of a court-supervised reorganization procedure and of presumed deficiencies in the US Bankruptcy Code. Section 5 analyzes the model if the issue of more senior claims (dilution threats) are taken into account. Section 6 concludes.

2. The Model

The model portrays a levered firm run by a risk-neutral owner-manager. In t_0, the owner-manager of the firm chooses between public debt (bonds) or bank debt, and in t_1, the owner-manager has access to an uncertain investment opportunity. All financial variables are expressed in t_0 present values. The investment opportunity in t_1 necessitates costs of I which are unknown in t_0. The common prior belief is that I is uniformly distributed over a unit interval, $I \sim U[\underline{I}, \overline{I}]$, where $\overline{I} = \underline{I} + 1$. In t_1, the owner-manager learns privately the realization of I, but investors remain uninformed about I. The project yields a sure incremental cash flow of R. It is assumed that $R - \overline{I} > 1$, i.e. even the most costly project is profitable and yields an expected surplus, $R - \overline{I}$, in excess of the interval of uncertainty about the investment costs.[7]

From the assets already in place in t_0, the firm derives an uncertain cash flow Y in t_2. Y determines whether the firm will have abundant or little internal funds available. As of t_0, Y is projected to be low, $Y = \underline{Y}$, with probability θ and high, $Y = \overline{Y}$, with probability $1-\theta$. Y is publicly observable in t_1, and it determines the *state* at the time the investment decision is made: In the good state $\overline{Y}$ the firm is rich in internal funds Y, while in the bad state $\underline{Y}$ the firm is poor in internally generated cash and is likely to need outside funds to invest. The probability θ can be directly interpreted as the *business risk* of the firm, as will be seen. In t_0, the value θ is private information of the firm's owner. For simplicity, it is assumed that θ is uniformly distributed with a minimum of $\underline{\theta}$ and a maximum of $\overline{\theta}$, $\theta \sim U[\underline{\theta}, \overline{\theta}]$. The timing of the model is summarized in *Figure 1*.

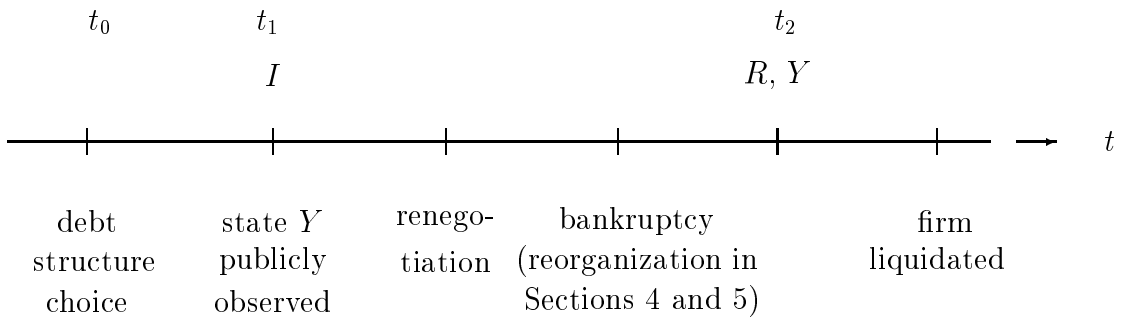

Figure 1: Time Line

As of t_0, the firm has debt outstanding with a face value D, maturing in t_2. We assume that the owner-manager does not consider to reduce the leverage D by adding equity or

[7] This assumption is not essential for the results, but simplifies the algebra. Also, we would obtain the same result if we assumed that R is uncertain and I is known.

another form of financial security. The capital strcture choice of the owner-manager is only whether to finance this debt with *private debt*, that is bank debt, or with *publicly traded debt*. D is exogenously fixed in spite of the cost of financial distress which will be analyzed below. This assumption should be interpreted as follows: There are advantages to debt financing which outweigh the financial distress costs as of t_0, though this dominance may be reversed in t_1 when the bad state $\underline{Y}$ is realized.[8]

Moreover, we assume that the debt level D is so high that:

$$\overline{Y} + R - \overline{I} > D > \underline{Y} + R - \underline{I} \tag{1}$$

We briefly discuss the implication of Assumption (1) on the investment decision in t_1, when the state Y is known. We start with the first inequality, $\overline{Y}+R-\overline{I} > D$, which addresses the good state $\overline{Y}$. In the good state, the owner-manager can pledge a total deterministic revenue of $\overline{Y}+R$ towards financiers, of which D is already pledged away. Thus, the owner-manager can raise in t_1 incremental financing of at most $\overline{Y}+R-D$. She needs to finance I. The first inequality assures that the incremental financing constraint $\overline{Y}+R-D$ is always *larger* than $\overline{I}$, the highest possible investment need, so investment is always possible.

The second inequality, $D > \underline{Y}+R-\underline{I}$ addresses the bad state $\underline{Y}$. The owner-manager can then only raise $\underline{Y}+R-D$ in incremental financing. The second inequality assures that this is always *lower* than $\underline{I}$, the minimal investment need. Thus, condition (1) implies that the investment project can always be financed in the good state, but never in the bad state.

Therefore, since undertaking the project would be desirable in all circumstances, a classic *debt overhang problem*[9] arises if and only if the bad state is realized. This overhang problem creates a rationale for a state-contingent debt claim, i.e. the possibility to adjust D to a level low enough so that the project can be financed even in the bad state $\underline{Y}$. State-contingent debt can be obtained through *debt renegotiation*.

The timing in t_1 is as follows. After Y is publicly revealed, debt can be renegotiated. Renegotiation is modelled as a one stage take-it-or-leave offer. In case of public debt, the owner-manager is making the offer. In case of bank debt, the bank makes the offer.[10] There is no cost associated with debt renegotiation.

The renegotiation game captures debt renegotiation out-of-court. After debt renegotiation, any of the creditors can file for bankruptcy if the firm is not able to meet the payments due in t_1 or t_2. Bankruptcy is tantamount to liquidation, as in Chapter 7 of the US Code.

[8] Hege (2000) rigorously derives the optimal capital structure in the same framework.

[9] See Myers (1977) for the origin of this concept.

[10] This bargaining model was chosen to capture two real world features: *(i)* Exchange offers are almost always initiated by managers and decided upon by investors. *(ii)* Banks wield considerable bargaining power in debt restructurings. The results are robust with respect to the renegotiation procedure.

Then the investment opportunity I is lost and remaining assets are distributed respecting priority. In the basic model, there is no court-supervised reorganization procedure. This is introduced in Section 4.

In principle, neither the equityholder nor the owner-manager should retain any value when the firm is in financial distress. However, only the manager knows the true value of I and how much debt reduction is precisely needed in order to realize the project value $R-I$. He tries to solicit excessive debt reductions from the creditors so as to retain a positive value when the firm emerges from debt renegotiation. The owner-manager may raise as much fresh money as investors are willing to lend to him. Unless the firm is declared bankrupt, he can keep, and ultimately consume, any amount raised in excess of I.

The workout is successful if and only if the debt level after renegotiation D does not exceed $R-I$. If this condition is satisfied, $D \leq R-I$, then the owner-manager could obtain funds from any of the following three sources: *(i)* The initial lender(s) how hold debt claims worth D; *(ii)* the owner of the firm, provided she has a sufficiently deep pocket; *(iii)* new investors. The reason that all three would make the same financing decision, is that any earlier investment is sunk and makes no difference. Also, competition on the capital markets ensures the financier of the project receives a zero profit on the funds I. Therefore, whether old or new investors provide the funds in t_1, makes no difference in the old investors' renegotiation behavior.

The equilibrium concept applied throughout is Perfect Bayesian Equilibrium.

3. No Reorganization Law

A. Renegotiating Private and Public Debt

We will solve the model backwards in the usual fashion, starting with the decisions after the state is known. Renegotiation will only be undertaken if the bad state $\underline{Y}$ has been realized. Only *pari passu* offers, offering debt claims of equal or lower priority, are considered in this and the next Section.

In the case of *private debt*, the bank's take-it-or-leave-it offer will start renegotiation, and the owner-manager will accept any offer that gives him more than zero. The bank has all the bargaining power. Like a monopolist who takes demand effects into account when fixing prices, the bank solves for its optimal debt forgiveness by taking into account that more concessions will increase the success probability of the workout. This success probability of this offer will depend on the distribution of I which the bank has to guess. The analysis is straightforward. Recall that the value of the good project $R-I$, is always larger than 1, the interval of uncertainty about the true costs I. Therefore, the bank finds it optimal to make a relatively large concession such that the remaining debt is just $\underline{Y}+R-\overline{I}$: The good project

will always be possible, regardless of the true value of I. Making a less generous concession reduces the success probability and gives the bank a smaller revenue.

Turning to the case of *public debt*, we assume that *exchange offers are not made conditional on unanimous consent.* [11] It is useful to sketch some elements of the analysis since we will use them again in Section 5; a full account can be found in Hege (2000). Suppose $n-1$ investors do exchange, and consider the problem of the n-th investor. The optimal exchange offer, which is *conditional on success*, will offer to exchange each debt contract with face value D/n for a new contract with lower face value of $\frac{\underline{Y}+\underline{Y}+x}{n}$, where x denotes the aggregate debt level that is offered to the bondholders in excess of the face value that a bank would keep. $x \in [0,1]$ is chosen from the range of uncertainty about I, and captures at the same time the bankruptcy probability. We can then analyze the n-th bondholder's incentives:

- If the n-th bondholder approves the exchange, then the success probability is $1-x$. The n-th investor would then earn a profit of π^e:

$$\pi^e = (1-x)\,\frac{\underline{Y}+R-\overline{I}\,+\,x}{n} + x\,\frac{\underline{Y}}{n}\,.$$

- If the n-th bondholder holds out, then this decision reduces the success probability for the exchange offer overall by an amount of $\mu^n(x)$, n's probability of being *pivotal* for the success. The n-th bondholder's expected payoff π^h in this case is:

$$\pi^h = x\frac{\underline{Y}}{n} + (1-x)\begin{cases} D/n & \text{with probability} 1-\mu^n(x) \\ \underline{Y}/n & \text{with probability } \mu^n(x) \end{cases}$$

The n-th bondholder will accept the exchange offer if $\pi^h \leq \pi^e$, or if (after simplifications):

$$(1-\mu^n(x))\,D + \mu^n(x)\underline{Y} \;\leq\; x + \underline{Y} + R - \overline{I} \tag{2}$$

Under the "best" exchange offer from the owner-manager's point of view, this incentive constraint is just binding. For inequality (2) to be satisfied, $\mu^n(x)$ must be strictly larger than zero, since $D > x + \underline{Y} + R - \overline{I} > \underline{Y}$. But then $x \to 1$ is necessary for $\mu^n(x)$ to be bounded away from zero. As the share of a single investor in the total debt gets smaller and smaller, the probability of her being pivotal for the success of reorganization out of court must vanish. This in turn implies that the ex ante probability of successful renegotiation

[11] Empirically, exchange offers are frequently made conditional on a certain *threshold* of approval, but *never on everyone's approval.* A manager, when making an exchange offer simultaneously to many dispersed bondholders, will not rely on all bondholders actually responding, let alone all bondholders responding rationally. The assumption does not exclude that exchange offers are made conditional on success.

goes to zero as the number of bondholders increases. We can summarize our insights as follows:[12]

OBSERVATION 1: *(i) If the firm uses private debt, then renegotiation is successful with probability one.*

(ii) If the firm issues public debt, then the probability of renegotiation being successful goes to zero as n, the number of investors, goes to infinity.

Incomplete information is a necessary ingredient for this result. If there was perfect information about I then the owner-manager would submit an offer that is just sufficient to achieve efficiency, but needs every single investor's approval. This is tantamount to conditioning on unanimous approval.

B. The Market Equilibrium

Since θ is private information of the owner-manager, the market equilibrium is a signaling equilibrium where owner-managers self-select in their choice of debt instrument that will truthfully disclose its according to their θ-type. The costly signal is the expected costs of financial distress which vary according to the type θ and the debt instrument: The higher the failure risk, the more beneficial is it to have renegotiable private debt. Private debt is efficient in the bad state, and moreover it offers a direct benefit to the owner-manager in form of a fraction of the renegotiation surplus. Owners who attach a low probability to financial distress prefer inefficient renegotiation. In turn, they will receive a more favorable interest rate.

We guess that all types θ higher than some cutoff type θ^C choose private debt, and all types below θ^C use public debt. When issuing private debt, debt with a face value of D will be priced at an initial value of $B_0 < D$, which discounts for the bankruptcy risk such that a bank who does not know the type θ excepts just a zero profit. Similarly, if the owner-manager issues public debt with face value D, the issue value will be $D_0 < D$.[13] In addition,

[12]Formal proofs for this and the three following Observations in Section 4 are contained in Hege (2000).

[13]Straightforward calculations yield:

$$B_0 \;=\; \left(1 - \frac{\overline{\theta} + \theta^C}{2}\right) D \;+\; \left(\frac{\overline{\theta} + \theta^C}{2}\right) \left(\underline{Y} \;+\; R - \overline{I}\right) , \tag{3}$$

and

$$D_0 \;=\; \left(1 - \frac{\underline{\theta} + \theta^C}{2}\right) D \;+\; \left(\frac{\underline{\theta} + \theta^C}{2}\right) \underline{Y} . \tag{4}$$

the owner-manager of a bank-financed expects to keep some surplus in the event of successful renegotiation, which is equal to $\frac{1}{2}$.[14]

Comparison of the respective payoffs charecterizes the cutoff type θ^C, the type just indifferent between bank debt and public debt, via the condition $B_0 - D_0 + \theta^C \frac{1}{2} = 0$. This condition can be written as:

$$\theta^C \left(1 + R - \overline{I}\right) = (\overline{\theta} - \underline{\theta})\,(D - \underline{Y}) - \overline{\theta}(R - \overline{I})\,. \tag{5}$$

Equation (5) characterizes the *separating market equilibrium*, which expresses the following trade-off: Because there is a continuum of types θ, but only a single discrete signal (the choice between bank or public debt), firms self-select into two pools: Firms at the good end of the quality interval, $\theta \in [\underline{\theta}, \theta^C)$, will signal their high quality by using public debt. This is cheaper, but implies higher costs in the event of financial distress. Firms at the poor end of the quality interval, $\theta \in (\theta^C, \overline{\theta}]$, find giving up debt renegotiation too costly. They prefer to be pooled with all the firms at the risky end and to pay a higher risk premium. Either such a separating equilibrium exists, or all firm types issue bank debt.[15]

4. Introducing a Reorganization Law

In this Section, court-supervised reorganization is introduced. In the extensive-form game, court-supervised reorganization will be introduced as an alternative to straight bankruptcy: *after* the workout, if the firm is still insolvent (i.e. cannot meet its obligations at t_1 or t_2) there is now a choice between filing for straight liquidation as before or filing for court-supervised reorganization. Creditors *and* the owner-manager have a right to file for court-supervised reorganization if out-of-court renegotiation fails, as under Chapter 11 of the US Bankruptcy Code of 1978.

The reorganization procedure modelled here is inspired by Chapter 11 of the US Bankruptcy Code of 1978. We begin by analyzing a *"perfect"* procedure, where we assume efficient decision-making about continuation and liquidation, no delay, and respect for the priority of claims. We will first revisit the model under such a perfect procedure, and then briefly discuss how the outcome changes if imperfections in the Bankruptcy Code are taken into account.

[14] Renegotiation succeeds with probability 1, the bank reduces its claim to $D = R - \overline{I}$, and the owner keeps the remainder, which is $R - EI - D = \frac{1}{2}$.

[15] The separating equilibrium will only exist if the cutoff point θ^C is strictly interior in the interval $(\underline{\theta}, \overline{\theta})$. Hege (2000) discusses the necessary and sufficient conditions.

A. Perfect Court-Supervised Reorganization

The reorganization procedure here is "perfect" or frictionless: The court decides without any delay, and the court always takes the efficient decision concerning the continuation of the firm, by imposing the minimum debt reduction needed to get the profitable project going. This implies that the court collects and publicly reveals the private information about the investment cost I.[16] Finally, the old creditors are given all the transferable surplus. Court-supervised reorganization procedure, however, is costly: There is a flat bankruptcy cost of $b < R - \overline{I}$ having priority over creditors.[17]

With perfect court-supervised reorganization as an option, if renegotiation is not successful, then creditors will file for court-supervised reorganization since bankruptcy costs are below the expected value of the profitable project, $b < R - EI$. The interesting part of the results (Observation 2) refers to the case where $b < 1$, i.e. where b is smaller than the range of values of I. Then even for a private debt firm, the workout will fail if investment costs I are high, and the firm will end up in court-supervised reorganization with a positive probability. The reason is that the owner-manager will only truthfully reveal that $I < \underline{I} + b$ if renegotiation were to fail otherwise. By contrast, the prospects of working out public debt (in the limit where the number of creditors n approaches infinity) remain as slim as before. The impact of introducing Chapter 11-style reorganization procedures can be summarized as follows:

OBSERVATION 2: *(i) With private debt, renegotiation will be successful with probability* $min\{1, b\}$.

(ii) With public debt, the probability of successful renegotiation goes to zero as the number of creditors goes to infinity.

(iii) The proportion of public debt firms and the number of bankruptcy filings (including court-supervised reorganization) will increase after court-supervised reorganization is introduced.

To see the intuition, consider part *(iii)* first. In the separating market equilibrium, the decision of the marginal firm using public debt is important, and it depends on two effects: First, court-supervised reorganization mitigates the cost of financial distress of this firm, since only the bankruptcy cost b, but not the investment opportunity is lost if a workout fails. The distress cost for high-quality firms is in fact reduced from $R - I$ to b. Therefore,

[16]The latter assumption is probably quite realistic: Under Chapter 11, the manager is required to reveal under oath all relevant information about the present financial standing of the firm. Reorganization plans are usually quite detailed and contain information not readily available to outside investors.

[17]The restriction $b < R - \overline{I}$ is obvious. Otherwise there is no gain from using court-supervised reorganization.

since distress costs are lower, the marginal credit risk quality of a firm finding public debt attractive will also be lower. Second, banks take court-supervised reorganization into account and make less generous offers in the renegotiation stage. This will reduce the probability of avoiding bankruptcy to b from 1. In other words, deadweight losses now also arise for firms using bank debt, even though they are smaller one than under public debt. Both effects make private debt look less attractive than before. As for the increase in the number of bankruptcy filings, there are two reasons: First, less firms will have bank debt which can be renegotiated out-of-court. Second, of those, a greater proportion will not succeed in a workout.

Importantly, court-supervised reorganization exerts *countervailing* effects on the debt restructuring capacity of private and of public debt firms: It improves efficiency for public debt firms, but it affects private debt firms adversely. Moreover, there will be a third effect: The proportion of public debt firms will grow due to the introduction of a reorganization. But overall efficiency is smaller for public debt firms than for private debt firms, implying a negative welfare impact of the third effect.

The overall efficiency impact of introducing a reorganization law is therefore ambiguous, and it depends on the *financial system*. Since the debt structure, which represents different financial systems, is endogenous in this model, the comparative statics of the underlying financial system requires to vary the exogenous parameter which drives the debt structure. The adequate efficiency criterion in the present model is comparing the total expected deadweight loss under financial distress incurred under any of the bankruptcy law regimes. The following result obtains:

OBSERVATION 3: *The financial system determines whether a perfect reorganization law is efficient or not:*

(i) In a bank-based system (in a system where the proportion of public debt firms is small), introducing a perfect reorganization law is inefficient.

(ii) In a market-based system (in a system where the proportion of public debt firms is large), introducing a perfect reorganization law is efficient.

A good intuition for Observation 3 is gained by first considering only those firms that *do not* change their creditor structure. Among these, firms with public debt gain, firms with bank debt lose from introducing a perfect reorganization law. The efficiency effect of court-supervised reorganization must clearly be positive if a vast majority of firms have dispersed public debt, and vice versa. It remains to consider the third effect, the shift in the creditor structure leading to, on average, more public debt. This effect is dominated by the direct effect if either private or public debt dominates over the range of firm types.

In intermediate cases where both public and private debt are well-represented across the range of firm types, this shift effect could be responsible for turning the total welfare impact negative. Finally, if b is small, then the loss of using public debt instead of bank debt is small, and a reorganization law is always efficient.

To summarize, the efficiency of a reorganization law depends crucially on the dominant source of borrowing, banks or bond markets. The more firms rely on market-based debt instruments, the more likely will there be a benefit from introducing a reorganization law. Moreover, consider an economy with a *massive bankruptcy problem*, i.e. a country where a large number of financial distress case occur concomitantly, as it happened recently in emerging market hit by financial crises or in transition economies. The massive bankruptcy problem is *not in itself a sufficient reason* to recommend the introduction of a court-based reorganization procedure: This inevitably lowers the incentives to successfully manage debt renegotiation out-of-court, an effect which is likely to dominate in a bank-oriented financial system.

Therefore, the model has clear implications concerning the relationship between bankruptcy costs and financial system. The fact that a lean and fast reorganization procedure (where b is small) is always efficient is by itself not surprising. Less expected, however, is the opposite case: A bank-based financial system may be better off having an "expensive" reorganization procedure rather than a "cheap" one. An intuition can be gained from rehearsing the implication of "perfect" court-supervised reorganization: Less costly bankruptcy procedures weaken at the same time the ex post incentives for banks to renegotiate out-of-court and the ex ante incentives for managers to choose private debt, and both effects have a negative impact on the efficiency of the law.

B. Imperfections in the Reorganization Procedure

The way Chapter 11 works in practice has attracted a great deal of criticism in recent years.[18] Attention has primarily focused on concerns that Chapter 11 *(i)* involves a long and extremely costly procedure; that *(ii)* it leads to violations of the Absolute Priority Rule; and that *(iii)* outcomes are inefficient, with typically a management bias leading systematically to inefficient continuation of firm that should be liquidated. We will briefly review how these concerns would impact the performance and desirability of Chapter 11 in the present model.

(i) Cost and delays in the court-supervised reorganization procedure. We investigate the comparative statics of a change in b, by assuming for simplicity that $b < 1$. A workout for a bank-financed firm will then fail with probability $1 - b$, causing a loss of b. For a public debt firm, the workout will always fail, meaning that the bankruptcy cost b accrues always.

[18]See e.g. White (1989), Bradley and Rosenzweig (1992), Franks and Torous (1989)(1994), Aghion, Hart and Moore (1992) and Bebchuk and Chang (1992).

Therefore, the expected deadweight loss due to bankruptcy is $(1 - F(b))b + F(b)b(1 - b)$, where $F(b)$ is the proportion of bank-financed firms, $F(b) = (\underline{\theta} - \theta^C)/(\underline{\theta} - \overline{\theta})$.

We find that the expected deadweight loss due to bankruptcy may be increasing or decreasing as a function of bankruptcy costs b. The reason for this ambiguity lies in the interaction between court-supervised and out-of-court debt restructuring. Only if bankruptcy costs are already low is a reduction b unambiguously a good thing. Otherwise, it may make things worse. This is more likely to be the case if bankruptcy costs are relatively high (close to or larger than 1). Moreover, the higher the proportion of public debt firms, the larger the benefit from a reduction in b.

This observation has a clear implication for a market-oriented financial system like the United States. The critiques that bankruptcy costs are excessive may well have a point since US firms rely predominantly on the bond market for their debt financing. However, making the Chapter 11 procedure leaner and faster - this was the intention of the 1994 reform, and could be the result if the incentives for reaching pre-packaged bankruptcy agreements are further improved - could still have a negative effect overall. In the model, this is precisely the case if b is high ! This can be interpreted as implying that a veritable *trap for bankruptcy reform* may arise in a system where *(i)* public debt markets dominate and *(ii)* the costs of legal procedures are high.

(ii) Violations of the Absolute Priority Rule. In practice, the absolute priority rule (APR), the principle that junior claimants should not receive anything before all senior claims have been served in full, is routinely violated[19]. Chapter 11 is often blamed for this, in particular since incumbent management retains substantial control rights under Chapter 11: Management has the exclusive initial right to submit a reorganization plan within 120 days, and this deadline is frequently extended. After the reorganization plan has been submitted, a vote will be held requiring the consent of at least two third of the claims and the claimants in each class of claims (where classes are organized according to seniority). This implies that the consent of the shareholders is needed.[20] The requirement to win approval of the shareholders is seen as a likely source for violations of APR. To incorporate these ideas, we assume that the manager retains a positive benefit $f > 0$ when the firm emerges from the court procedure. The owner-manager's retention f is a convenient measure of the severity of the violation of the Absolute Priority Rule (equity deviations).

Intuitively, one would expect that equity deviations should make public debt more attractive - after all, the owner-manager receives a positive payoff if the firm emerges from

[19]see e.g. Eberhart, Moore and Roenfeldt (1990), Franks and Torous (1989)(1994) and White (1989).

[20]If the reorganization plan fails to win approval, the court can move on to a *"cram-down"*: roughly, a cram-down amounts to setting up and enacting a reorganization plan without the claimholders' consent. As the court is bound by rules, cram-down is generally a time-consuming and very costly procedure; it is hardly used at all.

bankruptcy, and this happens more frequently with public debt. This is, however, only one side of the effects. The other side is that the bank will adjust its renegotiation strategies endogenously to allow for equity deviations. The bank knows that its offer will not be accepted unless the owner-manager can retain at least f, and the bank offers accordingly. It turns out that the two effects are exactly offsetting: The increment in the owner-manager's expected payoff in the financial distress case, if using public debt relative to bank debt, does not depend on f, and neither does the market equilibrium, i.e. the fractions of firms financed by private or by public debt. The present model, by strictly focusing on the incentive structure of debt renegotiation, offers the following explanation why equity deviations are so systematic in practice: Equity deviations in court may be a good thing, or at least be neutral, because they make it less attractive to opt for court-supervised procedures instead of a workout.

(iii) Management bias of court-supervised reorganization. In the discussion surrounding Chapter 11, the "management bias" of the procedure is frequently cited, which may be taken as an indication that inefficient decision-making is more likely to suffer from a distortion in the opposite direction: In this view, courts tend to rule in favor of *too much* continuation when liquidation would be efficient. The following is a typical story told in order to understand how inefficient outcomes may come about: A coalition of manager and bankruptcy judge can play a dominant role during reorganization. Managers have a straightforward interest in the continuation of the firm, and they might find support from a judge who is afraid of liquidating an ailing enterprise prematurely. Together, they can easily keep the firm afloat for a very long time, at the expense of creditors who see a drop in the liquidation value in the meantime.

To introduce management bias in a certainly sketchy, and rather informal, manner, suppose there is uncertainty about the quality of the project (i.e. about R), and suppose the owner-manager has private information about the quality of the project. The private information arrives after debt contracts are signed, but prior to the debt renegotiation stage at the end of period 1. Suppose the owner-manager is willing to undertake the project even if it is bad, because he draws a private benefit from continuation. In our model, such a private benefit emerges endogenously, since the firm keeps some revenues whenever a successful workout is engineered. We can then consider a comparison between two bankruptcy procedures: In the perfect procedure, the court always gets informed about the project and decides efficiently. In the procedure with management bias, there are systematic errors in the court's decision-making, of the sort that firms with bad projects are frequently continued even though they should not. Following the by now familiar logic, the effective bankruptcy costs are higher in the second case. Therefore, we find that having a management bias in the court-supervised reorganization procedure will, as compared to the perfect procedure, always increase the share of bank debt, but have ambiguous welfare effects.

5. Exchange Offers with Higher Seniority

A. Dilution Threats and Exit Consents

In this Section, we drop the assumption that only *pari passu* exchange offers, exchange offers proposing new claims of lower or equal seniority, are possible. In the practice of corporate bond workouts in the US, exchange offers proposing debt of higher seniority or tender offer offering cash in exchange for surrendering the bonds are very common.[21] A popular tool are so-called *exit consents*: In an exit consent, the bondholders' approval of more senior debt issues is *tied* to the opportunity to participate in the exchange offer, creating a powerful tool to force dispersed creditors into accepting unfavorable exchange terms. More specifically, an exit consent is used if the corporate bond contains a seniority covenant, i.e. a covenant prohibiting the issue of higher seniority debt without the consent of the bondholders. The seniority covenant, which is not a core item protected by the unanimity clause of the Trust Indenture Act, can be waived by the approval of a majority or super-majority of bondholders. An exit consent ties the two provisions: Only those bondholders which agreeing to the waiver of the seniority covenant may participate in the exchange for new bonds of higher seniority.

Hege and Mella-Barral (2000) argue that besides exit consents, there are other ways and means with a similar flavor of exploiting the non-cohesiveness of dispersed creditors. Consider the two essential value components of a debt claim with credit risk: Income rights (coupons and repayments of principal) and liquidation rights in the case of bankruptcy. Any vehicle which asks dispersed creditors for concessions in their income rights by offering more or privileged liquidation rights uses the same economic mechanism of *dilution* which is behind an exit consent: The improvement in liquidation rights must come at the expense of other creditors, since in the case of bankruptcy, the remaining firm value belongs to the creditors (Absolute Priority Rule). Hege and Mella-Barral (2000) call all vehicles relying on this mechanism *dilution threats*; popular examples are cash offers, assets sales and asset spin-offs.

In the legal literature, exit consents are typically seen in a favorable light, in spite of the potential abuse of creditors' right which they may entail. The argument, elaborated e.g. by Roe (1987), is that by forcing debtholders to make concessions, they are an effective means of keeping hold-out problems among many dispersed debtholders in check. Hege and Mella-Barral (2000) find similarly that it is in the shareholders interest to design the debt contract in a way which commits them to use exit consents in an efficient way. They may then be the only means of introducing a renegotiation option into widely dispersed debt.

[21] Gertner and Scharfstein (1991), Brown et.al. (1993), Chatterjee et.al. (1995) all document this in their distressed firms samples.

Shareholders, however, may not limit the use of exit consents to such efficient purposes, they may also deploy them in a purely opportunistic fashion to increase equity value at the expense of debt values. This aspect is highlighted in the analysis of Gertner and Scharfstein (1991): They show that shareholders may abuse exit consents to obtain inefficient debt concessions, causing firms to overinvest and thus destroy value. The authors call this the "hold-in" effect. For similar reasons, Coffee and Klein (1991) argue in favor of abolishing exit consent. Kahan and Tuckman (1993), however, find in their empirical analysis no indication that hold-ins are a concern in reality.

This is the backdrop of our analysis here, which investigates the following question: How does the interdependence of financial system and reorganization law change if dilution threats are possible?

B. No Reorganization Law

In analogy to Section 2, we assume first that there is no reorganization law. We analyze again the n-th bondholder's incentives:

- If the bondholder approves the exchange, then she is offered *senior* debt claims with face value $\frac{\underline{Y}+R-\overline{I}+x^S}{n}$ in exchange for surrendering each bond with a face value of D/n, so she is asked for a concession of $\hat{D}/n = D/n - \frac{\underline{Y}+R-\overline{I}+x}{n}$. As before, $x^S \in [0,1]$ is chosen from the range of values of I for which information is incomplete, and x^S is at the same time the probability that the workout fails whereas the success probability is $1-x^S$. When accepting, The n-th investor would then earn a profit of π^e:

$$\pi^e = x^S \frac{\underline{Y}}{n} \; + \; (1-x^S)\frac{\underline{Y}+R-\overline{I}+x^S}{n}\,.$$

- If the n-th bondholder holds out, then this decision reduces the success probability for the exchange offer overall by an amount of $\mu^S(x)$, n's probability of being pivotal for the success, where $\mu^S(x^S) \; = \; \frac{\hat{D}}{(1-x^S)n}$. The optimal strategy for the owner-manager in this case is to make an *unconditional* offer, guaranteeing that tendering bondholders are senior to all holdouts if the offer fails (not enough capital can be raised to finance I).[22] A holdout bondholder will then anticipate that she will be junior to all bondholders who accept the exchange offer. We anticipate that in equilibrium, all bondholders will have the right incentives to accept the offer, so when calculating her profits as a holdout, the bondholder needs to take into account that all $n-1$ other bondholders accept and become senior to her. Therefore, the n-th bondholder's expected payoff π^h in this case

[22]Moreover, the owner-mamanger will set the minimum acceptance rate sufficiently low to guarantee that all bondholders expect the offer to be accepted.

is:

$$\pi^h = \begin{cases} D_1/n & \text{with probability} \quad (1-x^S)(1-\mu^S(x^S)) \\ \max(0, \underline{Y} - \frac{n-1}{n}(\underline{Y} + R - \overline{I} + x^S)) & \text{with probability} \quad x^S + (1-x^S)\mu^S(x^S) \end{cases} .$$

When the number of shareholders n becomes larger and larger, obviously $\max(0, \underline{Y} - \frac{n-1}{n}(\underline{Y} + R - \overline{I} + x^S)) = 0$ at some point. Assuming that the incentive condition for the n-th bondholder accepting the exchange offer (if all other bondholders tendering), $\pi^h \leq \pi^e$, holds with equality, it can be written as:

$$(1-x^S)(1-\mu^S(x))D_1 = \underline{Y} + (R - \overline{I} + x^S)(1-x^S) \,. \tag{6}$$

This is a quadratic equation in x^S:

$$x^{S^2} - x^S(D_1 - R - \overline{I} + 1) + D_1 - \underline{Y} - R - \overline{I} = 0 \,. \tag{7}$$

But the latter equation can be true even if $1 - \mu^S(x^S) \to 1$, as long as x^S, i.e. the chance of a failure of the exchange offer, is large enough. Investigation of the properties of this quadratic expression gives us the following result:

PROPOSITION 1: *Suppose there is no court-supervised reorganization procedure and exchange offers attaching dilution threats are possible. Suppose the number of investors n goes to infinity.*

(i) Out-of-court renegotiation of public debt fails with a probability x^S which is positive but strictly less than one.

(ii) The smaller the return R and the larger the creditors' minimum concession $D - (R - \overline{I}) - \underline{Y}$, the larger is the probability x^S of renegotiation failure.

Proof: See the Appendix. □

In the proof, we also show that no other equilibrium exists. Part *(i)* of Proposition 1 needs to be contrasted with Observation 1. There, it was shown that exchange offers will always fail when senior offers were excluded. Now, there is always a positive probability for an exchange offer to succeed, even if debt is maximally dispersed. The reason for this difference is the effect of the dilution threat: The essential mechanism of offering senior debt is to *dilute* the value of bondholders attempting to hold out. That means that if the number of tendering bondholders is large enough, not only will the minimum acceptance rate of the exchange offer be met, but all of the remaining asset values will be distributed among those

debtholders that have tendered, leaving nothing to the holdouts. As a consequence, the position of a potential holdout is weakened, explaining the result.

Part *(ii)* of Proposition 1 discusses the comparative statics which are easy to understand: the more bondholders collectively stand to loose by accepting the offer compared to their nominal claim, captured by the minimum concession $D-(R-\overline{I})-\underline{Y}$, the higher must be the stakes for a bondholder attampting to hold out in order to guarantee the incentive condition $\pi^e \geq \pi^h$, i.e. the larger must be the probability that the workout attempt fails and that consequently, the holdouts receive nothing.

C. Perfect Reorganization Law

Next, we turn to the case where a perfect reorganization law is introduced. We consider two questions: *(i)* If the existing financial securities laws give debt issuers a wide margin of exercising dilution threats against debtholders, for example via exit consents, how would this affect our analysis concerning the effects of introducing a reorganization law? *(ii)* When introducing a reorganization law, should it be accompanied by an amendment of the financial securities legislation facilitating the use of dilution threats?

(i) Redoing the analysis to answer the first question, we find that π^h, the payoff of a holdout bondholder, is unchanged, at least as long n is large (that is, so large that under an unconditional offer, holdouts receive nothing in case the exchange offer fails.) However, the payoff of tendering bondholders is different: if the exchange offer fails, the firm will then go into court-supervised reorganization, implying an aggregate loss of only b to the investors. The payoff π^e can be rewritten as:

$$\pi^e = \begin{cases} \underline{Y} + R - \overline{I} + x^R & \text{with probability } 1 - x^R \\ \underline{Y} + R - \overline{I} + \frac{1}{2}x^R - b & \text{with probability } x^R \end{cases} .$$

Now if the incentive constraint $\pi^h \leq \pi^e$ is just binding , we get the quadratic equation:

$$\frac{1}{2}{x^R}^2 - x^R(D + 1 - b) + (D - \underline{Y} - R - \overline{I}) \; = \; 0 \; . \tag{8}$$

The comparison of the two quadratic expressions allows us to analyze the effects of introducing a reorganization law, under the assumption that exchange offers for more senior claims are possible. We find:

PROPOSITION 2: *Suppose exchange offers offering more senior debt are possible. Consider public debt as n goes to infinity.*

(i) The failure probability of out-of-court renegotiation with public debt is strictly larger than in the absence of a reorganization law.

(ii) The welfare effect of introducing a perfect reorganization law is always negative in a bank-based financial system, and more often negative in a market-based financial system than it was with pari-passu offers.

Proof: See the Appendix. □

Thus, the answer to the first question is markedly different from what was the case without dilution threats (Observation 3): If they have access to the use of dilution threats, public debt firms work out more efficiently *without* a reorganization law.

Proposition 2 demonstrates that if the possibility to attach dilution threats is already established, the welfare analysis of a reorganization law is dramatically different. Since it will increase the financial distress cost for public debt firms and leave then unchanged for bank debt firms, the average financial distress costs in most cases will go up. Only the third and indirect effect making firms migrate from public to bank debt is now positive, but this effect is likely to be dominated by the direct effects.

(ii) What does this then imply for the welfare impact of introducing a *joint regime* of a perfect reorganization law together with legislation facilitating the use of dilution threats like exit consents? Recall that public debt firms will work out more efficiently with dilution threats than without (Proposition 1), but less efficiently in the joint regime than if dilution threats stand alone without a reorganization law (Proposition 2). This is the backdrop for this analysis, for which we the following effects:

PROPOSITION 3: *(i) In a market-based financial system, if a joint regime (reorganization law plus possibility to attach dilution threats) is introduced, the welfare impact is positive.*

(ii) In a bank-based system, if a joint regime is introduced, the welfare impact is negative.

Proof: See the Appendix. □

The intuition for this finding is not far them the reason behind Observation 3: Public debt firms benefit, bank debt firms suffer from the introduction of the joint regime, and finally there is a indirect third effect making marginal bank debt firms switch to public debt. The overall welfare effect depends on which of the segments was dominating prior to the introduction of the joint regime.

D. Comparative Statics of Bankruptcy Costs

Finally, we explore the following question how the cost efficiency of the reorganization procedure impacts the design of the reorganization law. Here, we take up the first step of our analysis of imperfections in the reorganization law, the comparative statics with respect

to the bankruptcy costs b. Recall that we found in Section 3 that an increase in b has an ambiguous effect: It makes reorganization more costly, but improves the incentives to use bank debt, and to work out more efficiently.

How is this analysis changed if we allow for exchange offer proposing more senior claims does a decrease in bankruptcy costs b change the efficiency of public debt firms? We find the following rather surprising answer:

PROPOSITION 4:

(i) The failure probability of out-of-court renegotiation is strictly increasing in b for public debt, but strictly decreasing in b for bank debt.

(ii) For bankruptcy costs b being low enough, public debt firms have a higher probability of successful out-of-court renegotiation than bank-financed firms.

Proof: See the Appendix. □

Proposition 4 shows that the lower are total bankruptcy costs b, the more effective is a reorganization law in giving incentives for successful debt renegotiation *out-of-court*. The reason is that the smaller is b, the less stand tendering bondholders to lose form a failure of reorganization, therefore the less often is breakdown needed to deter holdouts.

This is in remarkable contrast to the effect which a reorganization law has on bank-financed firms: The smaller is b, the *less* likely is a bank-financed firm to successfully work out. As a result, for rather low values of b, it is actually possible that the efficiency properties of both types of firms *cross over*, i.e. public debt firms are becomig the more efficient ones, as far as the financial distress costs are concerned.

What does this imply for the market equilibrium? With public debt suddenly the more efficient debt form for firms in financial distress, it is clear that issuing public debt cannot work any longer as a signal for a low expected risk of getting into financial distress. This role will now be taken over by bank debt, since it carries the higher bankruptcy costs; issuing bank debt can therefore credibly convey the signal that the owner-manager anticipates a low risk of distress. The separating equilibrium flips over: High risk firms will issue public debt, and low risk firms will use the less renegotiation-friendly bank debt, but get a more favorable lending rate in return.[23]

[23]This is true if the parameter constellation supports a separating equilibrium; the conditions for that are analogous to those conditions (??) and (??). If this is not the case, then all firms issue public debt.

6. Conclusion

This paper discusses how the introduction of a reorganization law depends on the financial system. In a bank-based system, debtors tend to have credit from a single or a few lenders, while in a market-based system, tradeable debt instruents are preferred and creditors of a company tend to be more dispersed. A reorganization law like the US Bankruptcy Code of 1978 will only be beneficial if the typical creditor structure is sufficiently dispersed so as to create serious hold-out problems; otherwise it will do more harm than good, since it diminishes incentives to find privately negotiated solutions. The policy debate on the bankruptcy law needs to take these general equilibrium effects into account.

This paper specifically addresses the role of a reorganization law if the debtor can take recourse to dilution threats as an alternative tool to overcome holdout problems. Dilution thrats are the possibility to offer senior claims to creditors willing to exchange, while eroding the value of potential holdouts. The paper confirms that dilution threats can go a long way to establish the efficiency of out-of-court renegotiation even with a dispersed creditor base. They substantially diminish the benefits from a reorganization law even in a market-based system, while leaving the negative judgment about reorganization laws in bank-based systems unchanged. Thus, on balance, dilution threats further weaken the case for a reorganization law.

Starting from a situation where neither dilution threats nor a reorganization law are available, passing legislation which at the same time introduces a reorganization law and makes dilution threats feasible has a positive welfare impact in a market-basd system, but a negative impact in a bank-based system.

In a wider perspective, this analysis shows that legislation regulating how debtors can use dilution threats is an essential *complement* to the optimal bankruptcy legislation. This important link, which has not been emphasized previously, is certainly worthy of further analysis.

Appendix

Proof of Proposition 1: First, one can verify that there is no mixed strategy separating equilibrium. This is for the same reason as in the absence of senior offers: For a mixed strategy equilibrium, $\pi^h = \pi^e$ would have to hold. But x under the condition $\pi^h = \pi^e$ is independent of $R - I$. So the exchange offer cannot release information about the true value of the firm when it has simultaneously to satisfy the equilibrium constraint. Then there is a pooling equilibrium where all types of I will pool for a common offer, and some types will propose offers that will be unsuccessful even if accepted.

We are left with the proof of the properties of x^S as implicitly defined by (7). First, setting $x^S = 0$ in (7) yields:

$$D - \underline{Y} - R - \overline{I} > 0\,. \tag{A.1}$$

Second, setting $x^S = 1$ in (7) yields:

$$-\underline{Y} < 0\,. \tag{A.2}$$

Differentiating (7) yields:

$$2x^S - (D - \underline{Y} - R - \overline{I}) < 0\,. \tag{A.3}$$

Note that the LHS of (A.3) is negative $\forall x^S \in (0,1)$ since $D - \underline{Y} - R - \overline{I} > 1$ from the parameter assumption (1). Since (7) is continuous and continuously differentiable, this proves the claim that there is a unique solution of (7) $x^S \in (0,1)$.

Next, note that $\sqrt{(D - R - \overline{I} + 1)^2 - 4(D - R - \overline{I} - \underline{Y})} = \sqrt{(D - R - \overline{I} - 1)^2 + 4\underline{Y}}$. The solution to the quadratic expression (7) can therefore be written as:

$$x^S = \frac{1}{2}(D - R - \overline{I} + 1) - \sqrt{(D - R - \overline{I} - 1)^2 + 4\underline{Y}}\,. \tag{A.4}$$

Differentiating (7) with respect to D gives:

$$\frac{\partial x}{\partial D} = \frac{1}{2}\left(1 - (D - R - \overline{I} - 1)((D - R - \overline{I} - 1)^2 + 4\underline{Y})^{-1/2}\right) > 0\,. \tag{A.5}$$

Moreover, $\frac{\partial x^S}{\partial D} = \frac{\partial x^S}{\partial \overline{I}}$. Finally, $\frac{\partial x^S}{\partial R} < 0$ follows directly from inspecting (A.4). □

Proof of Proposition 2: π^h can be written analogously to Proposition 1, π^e and the quadratic expression (8) for x^R guaranteeing the incentive condition $\pi^e \geq \pi^h$ are stated in the text.

We need to show that $x^R > x^S$. Equating (7) and (8) shows that x^S and x^R will satisfy:

$$x^{S\,2} - x^S(D - R - \overline{I} + 1) = \frac{1}{2}x^{R\,2} - x^R(D - b + 1)\,. \tag{A.6}$$

Moreover, both sides in (A.6) are equal to $= -(D - R - R - \overline{I}) < 0$. Draw the curve of $x^{S\,2} - x^S(D - R - \overline{I} + 1)$ and of $\frac{1}{2}x^{R\,2} - x^R(D - b + 1)$. Since $R - \overline{I} > b$ and both brackets in (A.6) are positive, $x^{S\,2} - x^S(D - R - \overline{I} + 1)$ will always have a higher value than $\frac{1}{2}x^{R\,2} - x^R(D - b + 1)$, for all $x^S = x^R \in [0, 1]$. It follows that to satisfy equality at a negative value, $-(D - R - R - \overline{I})$, $x^R > x^S$. □

Proof of Proposition 3: Recall that there are three effects to be taken into account: the welfare effect on public debt firms (positive), on bank debt firms (negative if $b < 1$) and on firms switching from private to public debt (negative).

Suppose almost all firms are financed by public debt. Then the effect on public debt firms will be dominant, since the mass of bank-debt firms and the mass of bank debt firms switching to public debt are negligible. The overall effect must be positive.

Suppose almost all firms are bank financed and $b < 1$. Then the effect on bank firms is negative and the effect on firms switching from bank debt to public debt is also negative, while the positive effect on public debt firms is negligible. □

Proof of Proposition 4: To show *(i)*, differentiate (8) implicitly with respect to b:

$$\frac{\partial x^R}{\partial b}\Big(x^R - (D - b + 1)\Big) + x^R = 0\,.$$

Since $x^R \leq 1$ and $D > b$, the expression in brackets is negative, showing that $\frac{\partial x^R}{\partial b} > 0$. The claim concerning private debt firms is proven in Hege (2000). *(ii)* Notice first that the probabilities for both types for of firms are continuous in b. Consider then the case of $b \to 0$. Following Observation 2*(i)*, this implies that renegotiation with bank debt will always fail. (See Hege (2000) for a proof). On the other hand, with public debt we know that this probability $x^R \in (0, 1)$. Notably, for $b \to 0$, the probability x^R is given by (from expression (8)),

$$\frac{1}{2}x^{R\,2} - x^R(D + 1) + (D - \underline{Y} - R - \overline{I}) = 0\,. \tag{A.7}$$

Now suppose that $x^R \to 1$. Then consider (A.7) for $x^R = 1$:

$$\frac{1}{2} - (D + 1) + (D - \underline{Y} - R - \overline{I}) < 0\,. \tag{A.8}$$

which gives a contradiction, showing the claim. □

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