Matching Bankruptcy Laws to Legal Environments

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Abstract

We study a model of optimal bankruptcy law in an environment where legal quality can vary along two dimensions: the quality of contract enforcement, and the ability of judges. We show that a judicially-influenced bankruptcy process can enhance the efficiency of incomplete contracts by conditioning the liquidation/reorganization decision on ex-post information about firm quality. We consider the optimal balance of debtor and creditor interests as a function of the legal environment, and show that the optimal degree of "creditor-friendliness" in the bankruptcy law increases as the quality of enforcement of contracts deteriorates and as judicial ability to recognize firm quality falls. We also explore the optimal scope of bankruptcy law and find that it may be optimal to "target" the law to a smaller subset of firms for which judicial discretion is most valuable, particularly when judges are less experienced. Our model contributes to the existing law and finance literature in demonstrating that optimal bankruptcy laws, in particular the degree of optimal creditor protection, depends heavily on the existing legal environment. The model also explains some cross-sectional patterns in bankruptcy laws adopted around the world.

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1 Introduction

Bankruptcy and debt collection laws are increasingly being recognized as fundamental institutions, necessary for the growth of credit markets and entrepreneurship in developing economies. In practice, the design of these laws varies substantially across countries, along dimensions such as the allocation of control rights, priority rules, protection of secured creditors, and the discretion given to bankruptcy judges and administrators. Similarly, the scope of these laws and their relative use varies greatly across countries (Claessens and Klapper, 2002).

Empirical evidence from the law and finance literature, most notably that of La Porta, et. al. (1997, 1998) find positive relationships between the degree of creditor-friendliness of reorganization laws and desirable outcomes such as the size of debt markets. This empirical finding raises two important questions. First, what does reorganization law contribute to the efficient implementation of contracts between firms and their lenders that could not be achieved without it? Given that workouts are often arranged outside the scope of reorganization procedures, what factors lead some firms to use the legal reorganization procedure and others to avoid it? Second, why have many developed countries, such as France and Japan, recently introduced reorganization laws that resemble U.S. Chapter 11, which scores among the lowest in the world on these creditor protection indices? The fact that the degree of creditor protection in reorganization law varies widely across countries suggests that the appropriate law, and the appropriate balance of debtor and creditor interests, may depend on extant characteristics of the economy. Indeed, as Hart (2000) notes:

> *It is unlikely that "one size fits all."...Which procedure a country chooses or should choose may then depend on other factors, e.g., the country's institutional structure and legal tradition. One can also imagine a country choosing a menu of procedures and allowing firms to select among them. It is important to recognize that bankruptcy reform should not be seen in isolation: it may be necessary to combine it with legal and other reforms, e.g., the training of judges, improvements in corporate governance and the strengthening of investor rights, and possibly even changes in the international financial system.*

This paper takes a first step toward formally integrating the design of appropriate bankruptcy procedures into the larger framework of legal institutions and private contractual mechanisms that govern interactions between borrowers and lenders. Recent contributions in the empirical law and finance literature make distinctions between the quality of the legal code and the quality of enforcement, finding that both are important for development. Our paper focuses on the appropriate matching of the legal code to the quality of enforcement, taking as given that the former is more flexible than the latter. Empirical evidence suggests that legal code is often responsive to exactly these concerns. For example, Pistor, Raiser, and Gelfer (2000) reports significant improvement in shareholder and the creditor rights in transition economies during the 1992-1998 period, which they attribute to lawmakers' response to weak shareholder/creditor protection in those countries during the privatization process[1].

We consider the role of bankruptcy laws as part of an optimal contracting problem between firms and their creditors when contracts are incomplete and laws are imperfectly enforced. While there are many common characteristics that define reorganization laws, we focus on the role of judicial discretion in affecting the ownership and control of assets. We demonstrate two main points related to the impact of reorganization laws on contractual efficiency. First, judicial discretion over the reorganization/liquidation decision can be desired by contracting parties ex-ante, even when judges are less informed ex-post than the contracting parties and prone to making errors. When managers are biased toward reorganization and creditors are biased toward liquidation ex-post, reorganization law can be used to enhance contracts by conditioning the survival of the firm on the available ex-post information when this is difficult to describe in a contract. These ex-post biases are in part driven by the quality of investor protection and the legal environment: the less able are firms to pledge their future cash flows to creditors, the more creditors prefer to seize the assets and sell them even if existing management is efficient. In this sense, the value of reorganization law is directly influenced by other legal institutions such as debt collection law, disclosure rules, and the quality of their enforcement.

Second, our model shows that the optimal balance between firms and creditors depends not only on firm characteristics, such as the profitability and risk of the firm's assets, but also on the quality of the legal environment. In particular, the model shows that as the enforcement of debt contracts deteriorates (as the verifiability of cash flows decreases), firms prefer a more creditor-friendly reorganization law: ex-post efficient firms should face higher barriers to reorganization in order to protect creditors' willingness to lend ex-ante. As enforcement of debt contracts improves, contracts are enhanced by more lenient rules which allow the most viable firms to survive over the objections of creditors.

We find also that implementation of a debtor-friendly policy requires sufficient capability on the part of judges to identify viable firms. When judges' ability to separate out viable from

[1] Pistor (2000) reports 16 countries in transition economies to establish registers for security interests, which used EBRD model or US law, during the late 1990s.

non-viable firms is poor, firms prefer a more creditor-friendly law. As judges' discernment capabilities increase, the efficiency of contracts are enhanced more by debtor-friendly laws. This theoretical result illustrates a second mechanism by which the quality of institutions affects not only the effectiveness of the law, but also affects the characteristics of the optimal law itself.

The results in the model explain some of the cross-sectional variation in bankruptcy laws around the world, in particular the negative relationship between the creditor-friendliness of bankruptcy and per-capita GDP, as reported by La Porta, et. al. (1998). The model also generates predictions about usage rates of reorganization laws, as studied by Claessens and Klapper (2002). Our model predicts that usage rates of reorganization procedures should be lowest when the bankruptcy law is a poor match for the legal environment, particularly when countries with less-developed legal systems do not allow for sufficient creditor protection in reorganization. In such situations, firms are more likely to use contractual mechanisms that avoid the law and result in out-of-court resolution of financial distress.

2 Related Literature

In a world with complete contracts and costless bargaining, bankruptcy, at best, provide a default rule that replicates private contracting. At worst, bankruptcy laws place restrictions on contracts that lead to inefficiencies. For this reason, seminal works in the legal literature, including Baird (1986) and Jackson (1986) advocate market-based mechanisms such as auctions in place of judicially-administered bargaining, as in Chapter 11. Previous work that justifies a role for reorganization laws do so on the basis of costly bargaining, incomplete contracts, or both. Early works on the subject focus on the ability of bankruptcy law to resolve common pool problems caused by multiple dispersed creditors. Gertner and Scharfstein (1991) focus on rules of Chapter 11 such as the automatic stay and debtor-in-possession financing and their impacts on investment.

Among the class of models of bankruptcy that address issues similar to ours, the most relevant are Berkovitch and Israel (1999) and Povel (1999). Berkovitch and Israel (1999) consider the dependence of optimal bankruptcy laws on the extant environment. In their paper, the difference between systems is modeled by the information structure of lenders rather than the quality of investor protection and enforcement, as we consider here. Povel (1999), similar to our model, addresses trade-offs between tough (pro-creditor) and soft (pro-debtor) bankruptcy laws, where the timing of bankruptcy is the critical decision variable, rather than ownership of assets.

Two other works that adopt similar modeling approaches are Berglof, Roland, von Thadden (2000), and Giammarino and Nosal (1996). The work by Berglof, Roland, and von Thadden (2000) similarly examines the role of bankruptcy in a model of nonverifiable cash flows. In their model, bankruptcy is identified by states in which conflicting claims among multiple creditors are resolved. Unlike our model, they do not consider the role of judicial influence over outcomes, and the optimal bankruptcy procedure would arise from a multilateral private contract without a role for courts. An early exposition of the effect of judicial discretion in bankruptcy procedure on social welfare has been made by Giammarino and Nosal (1996). In their model, the role of the bankruptcy judge is to identify and punish strategic default by managers. Similar to our model, they consider bankruptcy law as an option rather than an unavoidable procedure, and conclude that the additional option of bankruptcy can be valuable. Our model differs from theirs in that we solve for optimal laws and examine their dependence on the legal environment.

Another novel feature of our paper is the explicit modeling of the effects of judicial expertise on ex-ante contracts and ex-post outcomes. Although it has been recognized in the legal literature (for example, see Miceli, 1990), the role of judicial error has not been widely recognized in the bankruptcy literature. We adopt an exogenous setting of judicial error similar to that of Ayotte and Robinson (2003), who study the role of two-sided error in a general principal-agent problem with a wealth-constrained agent. Giammarino and Nosal (1996) briefly analyze one-sided error (the failure to recognize strategic default), finding that it reduces the use of bankruptcy law. Chen and Sundaresan (2003) introduces an imperfect signal regarding firm's viability in a continuous time model of bankruptcy, upon which the judge decides when to reorganize or to liquidate via Bayesian updating. The result of their model show that debt contracting may take form of Chapter 11, private workouts or liquidation depending on the parameters of the model.

Our model also relates to the growing empirical literature on law and finance. La Porta, et. al. (1997, 1998) were the first to proxy for the strength of creditor protection by using indices based on reorganization laws. Although they find a significant positive relationship between "creditor friendly" features of reorganization law and the size of debt markets, the statistical significance of this result disappears when legal origin is included. Pistor (2000) and Pistor, Raiser, and Gelfer (2000) find evidence that, in addition to the form of laws, the quality of legal enforcement is strongly related to similar outcome measures. Claessens and Klapper (2002) find that the use of the bankruptcy law is positively correlated with judicial efficiency. We believe our model is valuable in that it is the first, to our knowledge, to model the way in which bankruptcy rules and their enforcement are interrelated. To the extent that existing laws (at least partially) reflect country-specific characteristics in an optimal way, our model can explain some of the observed cross-sectional patterns in bankruptcy laws around the world. To the extent that laws are occasionally poorly suited to the legal environment, our model can explain when usage rates are likely to be low due to a poorly-matched procedure.

3 The Benchmark Model: Out-of-Court Distress Resolution

3.1 Model Setup

We consider an economy similar to Bolton and Scharfstein (1996) (hereafter BS (1996)), in which cash flows from investment projects can be (partially) diverted by borrowers, making the threat of liquidation necessary to enforce repayment. The risk-neutral manager of each firm owns a two-period investment project, which requires an outlay of K at an initial date 0 for the purchase of a physical asset. The firm is wealthless and must borrow K from a lender/lenders operating in a competitive credit market.[2] At date 1, the project produces a random cash flow of x with probability θ or zero with probability $1-\theta$.

As in BS (1996), we assume that both the first period and the second period cash flows are observable to both parties but are (partially) nonverifiable to the third party. This can result from managerial perquisite consumption or direct expropriation of cash flows. In either case, we expect that the amount of cash flows that can be pledged to creditors will depend, at least in part, on the quality of legal enforcement; this will be modeled explicitly in Section 4. In this setting, contracts can not be based on realized cash flows but are instead based on payments made by the firm. The general contract specifies that if the firm makes a payment R_x, the creditor has the right to liquidate the project with probability β_x, and likewise, if the firm makes a payment R_0, the creditor has right to liquidate the project with probability

[2] In this paper, we do not consider issues of coordination among multiple creditors as a motivation for bankruptcy law. In our model, the law can be valuable apart from resolving creditor runs, so we abstract from this problem here. For a thorough analysis of these issues from an ex-ante perspective, see Berglof, Roland and Von Thadden (2000). The ex-ante choice of the number of creditors could matter in this model, however, in affecting the bargaining power between the manager and creditor(s) following a default. We adopt a reduced form approach to this problem in allowing the contracting parties to set the bargaining power in the ex-ante contract.

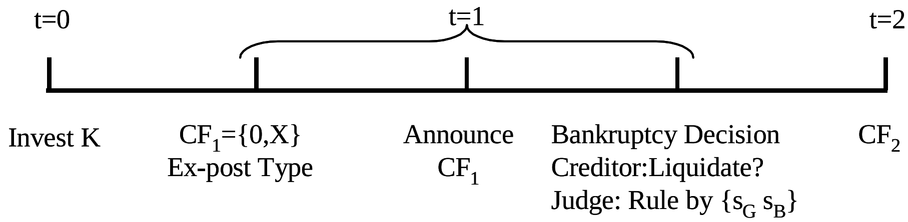

Figure 1: Timing of the Game

β_0.[3] Since the creditor acts competitively, the manager makes a take-it-or-leave-it offer of a contract $\{R_x,\beta_x,R_0,\beta_0\}$ to the creditor in exchange for K dollars at date zero.

Since cash flows are not verifiable, the firm can choose whether or not to repay R_x when cash flow is $x > R_x$. If cash flow is zero, of course, the firm must default on its debt. Following BS (1996), we use the term *strategic default* to refer to the situation in which the firm has cash but chooses not to repay, and *liquidity default* to refer to the situation in which the firm cannot repay because cash flow is low.

To model the role of bankruptcy, we depart from BS (1996) in adding uncertainty about the going-concern value of the firm at date 1. The continuation and liquidation values of the firm after date 1 depends on a random state of nature which is not realized until after the first period cash flow is realized. With probability φ, the firm's assets are worth more in the hands of its existing manager, who can generate gross value y by running the firm through date 2. When the existing manager is efficient, creditors can not generate any value from the assets, but can sell to an outside buyer who can generate γy, where $0 < \gamma < 1$. Conversely, with probability $1-\varphi$, the existing manager is inefficient and can generate only γy, while the outside buyer can generate y if he is able to buy the firm.[4]After period two, no fixed assets remain in the firm and the game ends.

We assume that efficient bargaining takes place between the contractual owner of the assets and the buyer. The outside buyer is not wealth constrained; thus, when the outsider is efficient, he will always buy the firm. Ex-post inefficiency may occur, however, if the existing manager is efficient but wealth-constrained and $\beta_0 > 0$. If this is the case, the creditor will prefer to sell to the inefficient outside buyer who can offer the largest price for the assets.

[3]We describe this as probabilistic liquidation rather than partial liquidation, but if the production technology is constant returns to scale the two are equivalent here.

[4]Our results are not sensitive to the specification of uncertainty, and the outside buyer can be interpreted as a break-up liquidation value rather than continuation under a new manager.

This occurs because second period cash flows are also nonverifiable; thus the creditor cannot induce the manager to make positive payments at date 2.

The key assumption in the model is that this state (the ex-post firm type) is observable at date 1, but is sufficiently complex that it cannot be described it in a contract written at date 0. This contractual incompleteness, combined with the potential ex-post inefficient liquidation of the firm's assets, can give rise to a role for courts. For now, we consider out-of-court distress resolution, which does not involve intervention by third-parties in contracts.

3.2 Optimal Contract

As a special case of the general contract described in the previous section, the debt contract can be expressed as $\beta_t = 1$ if $x \geq R_t$, and $\beta_t = 0$ if $x < R_t$. This contract, however, is not optimal and leads to excess liquidation if the firm does not make the payment R_t. Instead, the optimal contract would be one that liquidates the project with probability less than one upon payment less than R_t, as will be shown below. After the firm's announcement of the first period cash flow, the creditor receives the contractually-specified payment and liquidates the project with the ex-ante contracted probability. Before proceeding further into the detailed analysis, it is worth noting that liquidation of the project with positive probability upon receiving cash flow R_x, and payment from the creditor to the manager upon realizing zero cash flow is suboptimal, as in BS (1996).

Lemma 1 *(Bolton and Scharfstein, 1996) In an optimal contract,* $\beta_x = 0$ *and* $R_0 = 0$*.*

In order to induce the manager to make payments in the first period upon realizing cash flow x, the manager's incentive-compatibility constraint must be satisfied. Given that the manager sees his type before deciding whether or not to repay, there are two relevant constraints. For the ex-post efficient manager (denoted as the *good type*), we need

$$x - R_x + (1 - \beta_x)y + \beta_x(1 - \eta)y \geq x - R_0 + (1 - \beta_0)y + \beta_0(1 - \eta)y$$

where η is the bargaining power of the agent who has the right to sell the physical asset. Using the results from *Lemma 1* above, the good type's incentive constraint can be simplified to

$$R_x \leq \beta_0 \eta y$$

Similarly, for the ex-post inefficient manager (denoted as the *bad type*), we need

$$x - R_x + (1-\beta_x)Y + \beta_x 0 \geq x - R_0 + (1-\beta_0)Y + \beta_0 0$$

where $Y = \gamma y + \eta(1-\gamma)y$ is the ex-post inefficient manager's profit from the sale of the physical asset to the efficient outside buyer. The first term of Y, γy, is the inefficient manager's profit by holding on to the physical asset, and the second term of Y, $\eta(1-\gamma)y$, is the inefficient manager's bargaining share of the efficiency improvement by selling the physical asset to the efficient outside buyer. Using *Lemma 1* as in the good IC's case, the bad IC reduces to

$$R_x \leq \beta_0 Y$$

There are two possible contracts depending on which incentive constraint is satisfied by the contract. When the good IC is satisfied, the bad IC is automatically satisfied because $\eta y \leq Y$. Hence, the creditor can collect at most $\beta_0 \eta y$ from both the good and the bad types when the first period cash flow is x. On the other hand, when only the bad IC is satisfied, i.e. $\beta_0 \eta y \leq R_x \leq \beta_0 Y$, then the creditor can collect at most $\beta_0 Y$ from the bad types when the first period cash flow is x. As shown in the following lemma, however, in this model , it is always (weakly) better to allow the good types to strategically default in order to collect more from the bad types.

Lemma 2 *(Optimality of Strategic Default) Given the model and assumptions states above, if $\eta < 1$, then the optimal contract chosen by a profit maximizing firm allows strategic default, and the creditors will make zero expected profit under this contract. If $\eta = 1$, no strategic default is allowed.*

The optimality of allowing strategic default results from our assumption that the physical asset will end up in the hands of the efficient agent when the first period cash flow is x. So, by allowing the good types to strategically default, the creditor can collect more from the bad types, and can collect the same expected amount from the good types that would have been collected if induced to repay[5]. The firm's ex-ante expected profit under the contract with strategic default is given by

$$\Pi_F = \theta\{\varphi[x + (1-\beta_0)y + \beta_0(1-\eta)y] + (1-\varphi)(x - \beta_0 Y + Y)\} + (1-\theta)(1-\beta_0)\{\varphi y + (1-\varphi)Y\}$$

[5] Also, note that the bad IC must be binding, otherwise the manager can offer a contract that has lower liquidation probability, β_0, and make the bad IC bind. Such contract will weakly dominate the previous contract because the manager faces lower liquidation probability while the bad IC is unaffected.

the creditor's ex-ante expected profit is

$$\Pi_C = \theta\varphi\beta_0\eta y + \theta(1-\varphi)\beta_0 Y + (1-\theta)\beta_0\{\varphi\eta\gamma y + (1-\varphi)\eta y\} - K$$

and the outside buyer's ex-ante expected profit is

$$\Pi_B = \theta(1-\varphi)(1-\eta)(1-\gamma)y + (1-\theta)\{(1-\beta_0)(1-\varphi)(1-\eta)(1-\gamma)y + \beta_0[\varphi(1-\eta)\gamma y + (1-\varphi)(1-\eta)y]\}$$

The optimal contract is the one which maximizes the firm's profit subject to the creditor's participation constraint (denoted as *creditor IR*), which is $\Pi_C \geq 0$[6]. The resulting optimal contract is summarized in the following proposition.

Proposition 3 *(Optimal Contract without Bankruptcy Court) The optimal contract* $\{R_x, \beta_x, R_0, \beta_0\}$ *are given as,* $R_x = \beta_0 Y$, $\beta_x = 0$, $R_0 = 0$, *and* $\beta_0 = \frac{K}{\eta y\{\theta[\varphi + (1-\varphi)(\gamma+\eta-\eta\gamma)/\eta] + (1-\theta)[\varphi\gamma + (1-\varphi)]\}}$.

The numerator of β_0 is the initial investment made by the creditors, and the denominator is the expected return to the creditor from the project. For future reference in the following sections, the social surplus can be evaluated by summing the firm's, the creditor's, and the outside buyer's profit, which is given by

$$\Pi_S = \Pi_F + \Pi_C + \Pi_B = \theta x + y - K - \beta_0(1-\theta)\varphi(1-\gamma)y$$

The first three terms represent the net present value of the project, and the last term represents the efficiency loss when the physical asset goes to the inefficient outside buyer upon liquidity default. Social surplus, as well as the firm's equilibrium profit, is strictly decreasing with the liquidation probability β_0. Finally, and most importantly, notice that the creditor and the debtor cannot reach an agreement to continue the firm with the incumbent manager upon liquidity default, which is summarized in the following proposition.

Proposition 4 *(Liquidation Bias) Following a liquidity default, the creditor strictly prefers liquidation to continuation.*

As stated above, the creditor will not let the manager to continue the project upon liquidity default, even though the creditor knows that the incumbent manager is the efficient type. This ex-post debtor/creditor conflict stems from the nonverifiability of the second period cash flow,

[6] The creditor IR is binding at optimum, because if it were slack, then the manager can offer a contract with lower liquidation probability that still satisfies the creditor IR and gives higher profit to the manager.

in that the second period cash flow cannot be pledged by the financially distressed manager in return for the continuation of the project. Upon letting the efficient manager continue the project, the creditor will receive zero payment at date 1, and also zero payment at date 2. On the other hand, if the creditor liquidates the project, he can receive positive amount from the sale of the physical asset, even though the asset ends up in the hand of the inefficient outside buyer.

We now proceed to analyze the role of bankruptcy courts, which can condition liquidation probabilities on (noisy) ex-post information about the manager's quality. The goal of the court is to increase the efficiency of contracts by liquidating inefficient firms while preventing liquidation of efficient managers who are liquidity constrained. As we will see, however, this may exacerbate the tendency of managers to strategically default and can damage lending markets when the law is poorly matched to the firm's characteristics.

4 Reorganization with a Bankruptcy Court

4.1 Model Setup and Optimal Reorganization Law

In our model, the fundamental difference between reorganization law and out-of-court distress resolution is the presence of a third-party (a judge or administrator) who is given the power to condition outcomes on information available when the firm defaults. This additional flexibility relative to out-of-court distress resolution can result in benefits to using reorganization law.[7]

We assume that at date 1, the judge receives a signal regarding the manager's ex-post type, but not the first period cash flow. The court can condition the survival of the firm on his signal of the firm's type and on the manager's report of the first period cash flow realization. In terms of notation, this implies that the choice of reorganization law is a choice over five variables. The four liquidation probabilities $\{\beta_G^0, \beta_B^0, \beta_G^x, \beta_B^x\}$ depend on the judge's signal about the firm's type $\{G, B\}$ and the firm's reported cash flow $\{x, 0\}$. We also allow the law to allocate the bargaining power η allocated to the ex-post owner of the assets.[8] In this section we assume that the firm writes contracts with the creditor specifying the terms

[7] We should emphasize that our model does not seek to address whether the reorganization procedure should be administered by the state or run privately. Instead, we take as given that the distinction between the reorganization procedure and the out-of-court workout alternative is the presence or absence of third-party discretion, since this is usually the case in practice.

[8] We expect that the law will be able to influence bargaining power through rules such as exclusivity periods and stays on collection. Though in reality this ability is at best partial, we consider the extreme case in which the court sets this value to understand how bargaining power affects outcomes.

of the reorganization law to maximize its profit subject to the participation of the creditor and outside buyer.[9] For simplicity, we assume that bankruptcy is costless, but the manager prefers to avoid court when he is indifferent.[10]

Given that the ex-post firm type is observable to the creditor and firm at date 1, but both parties have an incentive to mislead the court, we expect that an information revelation process would produce imperfect information about the firm's viability. To model the potential fallibility of the judge, we assume he receives an imperfect signal regarding the manager's type, where the signal of manager being a good type, s_G, is more likely when the manager is efficient, and the signal of manager being a bad type, s_B, is more likely when the manager is inefficient[11].

$$\Pr(s_G|Good) = 1 - \alpha$$

$$\Pr(s_B|Good) = \alpha$$

$$\Pr(s_G|Bad) = \beta$$

$$\Pr(s_B|Bad) = 1 - \beta$$

The error of mistakenly identifying the good type as a bad type is referred as *type I error*, and the error of mistakenly identifying the bad type as a good type is referred as *type II error*.[12] We assume that the judge's signal is always partially informative; i.e. $0 < \alpha < \frac{1}{2}$ and $0 < \beta < \frac{1}{2}$. Before stating the optimal contract, we state the following lemma, which shows that courts are unnecessary when the firm repays its debt at date 1:

[9] Though we frame the problem as firm profit maximization subject only to the creditor's participation constraint, the optimal reorganization law from the firm's perspective is equivalent to the optimal law in a social planner's problem where the outside buyer's utility is also included. The optimal contract in that problem gives the outside buyer zero surplus making the two problems equivalent.

[10] Adding a fixed cost of bankruptcy affects the results in a predictable way: contracting parties are more likely to avoid the court, and conditional on court use, liquidation probabilities are higher in the optimal policy. We abstract from these issues to simplify the analysis.

[11] We provide motivation for this exogenous judicial error assumption in the Appendix. It can be shown that the judicial error can be endogenously derived from particular choice of bankruptcy procedure. In the static two-period model, however, we take the judicial error as given.

[12] It is without loss of generality that we assume one judge type $\{\alpha, \beta\}$. One can show that dispersion among judges does not affect our results about the optimal design of the code. Thus, the α, β can be interpreted as average error probabilities across varying judge types.

Lemma 5 *(No court when firm repays) In an optimal contract,* $\beta_G^x = \beta_B^x = 0$; *judicial discretion is unnecessary when the firm repays* R_x

Lemma 5 demonstrates that court involvement can only be beneficial when ex-post conflicts between debtors and creditors cannot be resolved by bargaining. When the firm succeeds and is not liquidity constrained, the firm and the creditor can bargain toward an efficient outcome which allows the efficient owner to run the firm. Given that this is the case, a court becomes unnecessary, as any division of surplus that could be achieved by setting the liquidation probabilities $\{\beta_G^x, \beta_B^x\}$ could also be achieved by raising or lowering R_x.

Using the result of *Lemma 5*, the general contract written between the manager and the creditor is to let the manager continue if R_x is paid in the first period, and to file for bankruptcy if $R_0 = 0$ is paid.[13] The optimal contract is determined by the maximization of firm profit subject to the creditor IR, i.e. $\Pi_C = 0$, and the manager's incentive compatibility constraint. As in the case without the bankruptcy court, there are two possible cases regarding which manager's incentive constraints are satisfied. The efficient manager's incentive constraint (*good IC*) is given by

$$x - R_x + y \geq x - R_0 + (1-\alpha)\{(1-\beta_G)y + \beta_G(1-\eta)y\} + \alpha\{(1-\beta_B)y + \beta_B(1-\eta)y\}$$

which reduces to

$$R_x \leq \overline{\beta_\alpha}\eta y$$

where $\overline{\beta_\alpha} = (1-\alpha)\beta_G + \alpha\beta_B$ is the probability of liquidation of the ex-post efficient manager. Similarly, the incentive constraint for the ex-post inefficient manager (*bad IC*) is given by

$$x - R_x + Y \geq x - R_0 + \beta\{(1-\beta_G)Y + \beta_G(1-\eta)0\} + (1-\beta)\{(1-\beta_B)Y + \beta_B(1-\eta)0\}$$

which reduces to

$$R_x \leq \overline{\beta_\beta}Y$$

where $\overline{\beta_\beta} = \beta\beta_G + (1-\beta)\beta_B$ is the probability of liquidation of the ex-post inefficient manager. For the argument in the following paragraphs, it is useful to compare the liquidation

[13] When the firm announces the first period cash flow to be x, then mixed strategy of involving and avoiding court is weakly dominated by purely avoiding the bankruptcy court. The dominance is strict is the involvement of the bankruptcy court incurs positive amount of cost.

probabilities for the case that involves and the case that avoids the bankruptcy court, which is shown in the following lemma.

Lemma 6 *(Ordering of the Liquidation Probabilities) In any optimal contract,* $\beta_G < \overline{\beta_\alpha} < \beta_0 < \overline{\beta_\beta} < \beta_B$

The lemma helps us understand the valuable role of judicial discretion and the cost of judicial error. In allowing courts to condition outcomes on new information, the firm would like to minimize $\overline{\beta_\alpha}$, the true liquidation probability when the manager is efficient, since this is directly related to ex-post efficiency. This is accomplished by setting the signal-based liquidation probability β_G lower than the unconditional liquidation probability β_0. This is costly, however, because a lower liquidation probability encourages strategic default and limits the firm's willingness to repay the creditor. The firm compensates for this expected loss to creditors by offering them a higher liquidation payoff when the manager is inefficient, hence $\beta_B > \beta_0 > \beta_G$.

When judges make errors, however, the good managers are occasionally seen as bad and vice versa. This narrows the gap in the "true type" liquidation probabilities and makes discrimination between types more difficult, hence $\beta_G < \overline{\beta_\alpha}$ and $\beta_B > \overline{\beta_\beta}$. As we will see, the reduced flexibility of the contract caused by judical error will result in efficiency losses relative to a perfectly informed court.

Returning to the analysis of the optimal court-based contract, it can be shown that the optimal reorganization rule allows strategic default for the ex-post efficient manager, which is stated formally in *Lemma 7.*

Lemma 7 *(Optimality of Strategic Default) For all* $0 \leq \eta \leq 1$*, good types strategically default, and bad types repay in the optimal contract. Creditors make zero expected profit.*

Notice that in contrast to *Lemma 2*, strategic default always occurs when the bankruptcy court is involved, even if $\eta = 1$. Intuitively, the good manager's incentive to behave opportunistically is larger relative to the non-court case where the liquidation decision is not conditioned on manager quality. Using *Lemma 7*, we know that the bad IC is binding, which implies $R_x = \overline{\beta_\beta} Y$, and the ex-ante expected profit from the project of the firm, the creditor, and the outside buyer can be found as,

$$\begin{aligned} \Pi_F &= \theta\{\varphi[x + (1 - \overline{\beta_\alpha})y + \overline{\beta_\alpha}(1-\eta)y] + (1-\varphi)(x - R_x + Y)\} \\ &\quad + (1-\theta)\{\varphi(1-\overline{\beta_\alpha})y + (1-\varphi)(1-\overline{\beta_\beta})Y\} \end{aligned}$$

$$\Pi_C = \theta\{\varphi\overline{\beta_\alpha}\eta y + (1-\varphi)R_x\} + (1-\theta)\{\varphi\gamma\overline{\beta_\alpha} + (1-\varphi)\overline{\beta_\beta}\}\eta y - K$$

$$\begin{aligned}\Pi_B &= \theta(1-\varphi)(1-\eta)(1-\gamma)y + (1-\theta)\{\varphi\overline{\beta_\alpha}(1-\eta)\gamma y \\ &\quad +(1-\varphi)[(1-\overline{\beta_\beta})(1-\eta)(1-\gamma)y + \overline{\beta_\beta}(1-\eta)y]\}\end{aligned}$$

The total social surplus can be obtained by summing the firm's, the creditor's, and the outside buyer's expected profit, which reduces to

$$\Pi_S = \theta x + y - K - \overline{\beta_\alpha}(1-\theta)\varphi(1-\gamma)y$$

The next proposition concerns the optimal balance of bargaining power between the ex-post owner of the assets and the outside buyer, a topic that has received considerable attention in the bankruptcy literature. Empirical evidence suggests that the liquidation of assets by distressed firms can occur at "fire sale" prices (Pulvino, 1998); in other words, outside buyers are able to purchase distressed assets at prices below fundamental values. Yet, the prevailing view is that the inefficiency of fire sales depend on the ex-post efficiency of the outcome, not the division of the bargaining surplus. Rhodes-Kropf and Viswanathan (2001) argue that auctions may be inefficient because the assets may be sold to an ex-post inefficient user. Shleifer and Vishny (1992) find similar ex-post social losses from fire sales and an ex-ante cost through lower debt capacity. Baird (1993), however, suggests that a fire-sale auction to an efficient buyer may be preferred to a delayed bankruptcy sale at a higher price because the latter involves deadweight bankruptcy costs. The following result finds a different justification for the suboptimality of fire sales, which does not rely on liquidity constrained outside buyers or information asymmetries:

Proposition 8 *(Sub-optimality of fire sale) In an optimal contract,* $\eta = 1$; *reorganization laws that benefit the outside buyer are inefficient.*

The result in *Proposition 8* is straightforward given that the contract is written between the firm and the creditor; setting η higher simply serves to limit the surplus of the outside buyer, who is not part of the contract at time zero. This proposition also holds, however, if a social planner chooses the parameters of the reorganization law and takes the outside buyer's ex-post surplus into account.[14] If the creditor and the manager know ex-ante that a fraction of the project's profit will go to an outside buyer, the creditor must liquidate projects with a higher probability in order to be willing to lend. Because judges always make errors with some probability, this will result in greater liquidation of good managers. Since liquidation of good firms is inefficient, the optimal contract makes this liquidation probability as small as possible.

The intuition behind this result differs from the ex-ante cost described in Shleifer and Vishny (1992). In their model, excessively low prices in fire sales lead firms to choose less debt in their capital structure, to allow existing management to retain control in low states. The cost of outside equity is the inability to prevent inefficient investment in good states. In our model, outside equity finance is not feasible because only a liquidation threat can ensure repayment. The ex-ante inefficiency occurs because the firm must issue greater liquidation rights to the creditor to counteract the lost surplus to the outside buyer. In this sense, our model predicts that leverage will increase in anticipation of fire sales rather than decrease.

The fact that the outside buyer and creditor always receive an expected payment of zero in the optimal contract implies that firm profit and social surplus are equivalent. The firm's profit with the bankruptcy court resembles that of the benchmark case without the bankruptcy court. The only difference is the liquidation probability, which has been replaced to $\overline{\beta_\alpha}$, i.e. the liquidation probability of the good type subject to the judicial error. The resulting optimal reorganization law is summarized in the following proposition.

Proposition 9 *(Optimal Reorganization Law) The optimal contract sets $\eta = 1$ and the liquidation probabilities upon receiving a good and a bad signal as follows.*

a) (High-NPV project) When $K/(\eta y) < \Delta_\alpha$, $\beta_G = 0$ and $\beta_B = \frac{K/(\eta y)}{\Delta_\alpha}$.

b)(Low-NPV project) When $K/(\eta y) > \Delta_\alpha$, $\beta_G = \frac{K/(\eta y) - \Delta_\alpha}{\Delta_{1-\alpha}}$ and $\beta_B = 1$.

where the coefficients Δ_α and $\Delta_{1-\alpha}$ are given by $\Delta_\alpha = \theta(1-\varphi)\frac{\gamma+\eta-\gamma\eta}{\eta}(1-\beta) + \theta\varphi\alpha + (1-\theta)\varphi\gamma\alpha + (1-\theta)(1-\varphi)(1-\beta)$, and $\Delta_{1-\alpha} = \theta(1-\varphi)\frac{\gamma+\eta-\gamma\eta}{\eta}\beta + \theta\varphi(1-\alpha) + (1-\theta)\varphi\gamma(1-\alpha) + (1-\theta)(1-\varphi)\beta$.

Intuitively, when the project has high NPV (specifically, low K), it is easy to make the creditor's participation constraint bind, which requires less liquidation of good firms. Hence, in this case, the judge saves all firms receiving the good signal and liquidates with positive

[14] If the outside buyer were part of the bargain at date 0, then $\eta = 1$ is not uniquely optimal since the outside buyer could contribute part of the up-front investment cost K in exchange for his ex-post expected surplus. The argument in Baird (1993) implicitly rests on this assumption, which would not be realistic in most cases.

probability upon receiving the bad signal. However, for low-NPV projects, it is difficult to satisfy the creditor's participation constraint, so the optimal law becomes more pro-creditor: all firms receiving a bad signal are liquidated and good signal firms are continued only probabilistically.

Using *Lemma 6*, and comparing the firm profit/social surplus for both the court and the non-court cases, the following conclusion can be made.

Proposition 10 *If access to the court is costless, then* $(\Pi_F)^C > (\Pi_F)^{NC}$*,where* $(\Pi_F)^C$ *is the firm's profit under the optimal reorganization law and* $(\Pi_F)^{NC}$ *is the firm's profit under the optimal private liquidation law; i.e. the firm's optimal reorganization policy generates greater profit than the optimal private liquidation policy.*

This result follows from the fact that the court-based procedure allows for greater flexibility regarding ex-post decisions that the private solution does not provide. It should be noted that this result holds despite the fact that the bankruptcy judge has inferior information regarding the cash flow and the ex-post type of the manager. It assumes, however, that the firm tailors the characteristics of the reorganization law to optimally suit its characteristics. In the following section we will consider the more realistic case in which the law sets a single policy and firms choose between a privately-contracted liquidation law and a legally imposed reorganization law that involves judicial discretion but is invariant to firm characteristics. For now, we consider these firm-specific characteristics to understand how the optimal reorganization law can vary across firms.

Proposition 11 *When reorganization laws are set optimally,* $\frac{\partial \overline{\beta}_\alpha}{\partial \theta} < 0$ *and* $\frac{\partial \overline{\beta}_\alpha}{\partial K} > 0$*; the optimal law for a given firm is more creditor-friendly when*

a) the NPV is lower (higher K*), and*

b) cash flows are riskier (lower θ*, holding* θx *constant).*

Intuitively, part (a) of the proposition is straightforward. For higher NPV projects (when K is lower), the creditor requires a smaller repayment to satisfy his participation constraint. Since judicial error always results in liquidation of some efficient types, the liquidation probability in the optimal contract is set as small as possible such that the creditor is willing to extend funds at date 0. A lower K thus implies lower liquidation probabilities for the firm.

Part (b) of the proposition can be understood as follows. Keeping the net present value $\theta x + y - K$ constant, a riskier firm implies larger x and smaller θ. The incentive for strategic default is greater for the high-risk, high-return firm because the default decision is made after the return is realized. Holding θx constant, the high-risk firm realizes a greater cash flow than the low-risk firm when it succeeds. The manager's incentive to repay, however, is driven only by the threat to seize his *future* expected cash flow, which is the same for both firms. The increased difficulty of enforcing repayment for riskier projects implies that the creditor must have a stronger liquidation threat to enforce greater repayment.

4.2 Matching Bankruptcy Laws to Legal Environments

The growing empirical literature on investor protection around the world, starting with La Porta, Lopez-de-Silanez, Shleifer, and Vishny (1997, 1998), find that the degree of legal protection of investors, in particular, the pro-creditor features of bankruptcy laws, have a significant positive impact on the development of capital markets. As we will show, however, the optimal degree of creditor protection in a country's reorganization law should also adapt itself endogenously to other characteristics of the legal environment. It is this adaptation to the legal environment that may be creating the wide difference in the level of pro-creditor/pro-debtor policies reflected in the reorganization law among different countries as reported by Claessens and Klapper (2002).

We first examine the impact of judicial error on the optimal reorganization policy. Many developing countries have recently passed bankruptcy laws that require judical expertise to implement; for example, Japan introduced only recently a reorganization law (Civil Rehabilitation Law) for medium and small sized businesses which requires significant judicial discretion, including the ability to dismiss management and lift a stay on debt collection (Wagatsuma, 2001). We would expect that the inexperience of judges would have an important impact on the efficiency of outcomes. Less obvious, however, is the way the characteristics of the law should optimally adjust to account for judicial fallibility. The following proposition shows how the judicial error impacts reorganization law.

Proposition 12 *(The Effect of Judicial Efficiency)* $\frac{\partial \overline{\beta}_\alpha}{\partial \alpha} > 0$ *and* $\frac{\partial \overline{\beta}_\alpha}{\partial \beta} > 0$*; as the court becomes more effective (less effective), the optimal law becomes more debtor-friendly (creditor friendly).*

Intuitively, the decision to allow good firms to survive over creditor objection brings an ex-post efficiency benefit and a cost, namely that the creditor's participation constraint is more difficult to satisfy. Judicial error, both in favor of debtors and in favor of creditors, increases the cost of attempting to save the efficient but unlucky manager. As error of either type increases, keeping $\overline{\beta}_{\alpha}$ (the true liquidation probability of the good types) constant necessarily requires a lower $\overline{\beta}_{\beta}$: a greater fraction of bad managers will also retain control. This is not feasible, however, since the creditor's participation constraint would no longer be satisfied. This implies that $\overline{\beta}_{\alpha}$ must rise in order to preserve the creditor's willingness to lend in equilibrium when judicial error of either type is higher.

This brings up a related corollary:

Corollary 13 *Social surplus decreases with judicial errors α and β.*

As we discussed earlier, social surplus is directly proportional to the true probability of liquidating good managers, $\overline{\beta}_{\alpha}$. Hence, social surplus decreases with both types of error.

We should point out that the idea behind this proposition has had a large impact on the development of bankruptcy law in practice. In U.S. law, the interpretation of the new value exception, which allows absolute priority to be violated when equity owners contribute new value, has depended in large part on the perceived (in)ability of judges to quantify the efficiency gains of leaving existing management in place. Baird (1986) notes that in a Supreme Court case in 1939, Justice William Douglas ruled that the expertise of an owner-manager did not constitute new value because of the inherent difficulty in estimating the expected value of the owner-manager's contributions. The current state of U.S. bankruptcy law, however, takes more of an intermediate approach which, in essence, gives owner-managers an option to retain equity in their ongoing firms in exchange for new value.[15]

Now, we turn our attention to the effect of legal enforcement of debt contracts on the reorganization law. In order to model the quality of legal enforcement, assume that a small fraction[16], ρ, of the second period cash flow is verifiable. Figuratively, ρ reflects each country's quality of contractual enforcement. As enforcement improves, the creditor can claim a larger portion of the manager's future cash flows as payment in lieu of liquidating the project. This, in turn, allows for a lower probability of liquidation, which is proportional to the efficiency loss of the contract.

[15] For a more thorough discussion of this issue, see Skeel (2001). The new value exception currently appears to be ill-defined, but is geared toward allowing owner-managers to retain an interest in their firms.

[16] We assume small ρ to focus on the impact of verifiability on the period-zero participation constraint of the lender. For small ρ, this is the only relevant effect. As ρ increases, however, the creditors' liquidation bias also vanishes; for $\rho = 1$, the optimal policy is to liquidate all firms since ex-post efficiency is guaranteed. We choose not to emphasize this effect because a liquidation bias can occur for other reasons previously emphasized in the literature, such as a race among dispersed creditors (Jackson, 1986), private benefits of control (Aghion and Bolton, 1992), or moral hazard combined with limited liability (Ayotte, 2003).

Following similar arguments as in the previous section, the incentive compatibility condition for the good type becomes $R_x \leq \rho y + (\eta - \rho)\overline{\beta_\alpha} y$, and the incentive compatibility condition for the bad type becomes $R_x \leq \rho Y + (1 - \rho)\overline{\beta_\beta} Y$. It is optimal to allow strategic default for the good types and collect more from the bad types. The ex-ante expected profit of the firm, the creditor, and the outside buyer are given by,

$$\begin{aligned}\Pi_F &= \theta\{\varphi[x + (1 - \overline{\beta_\alpha})(1 - \rho)y + \overline{\beta_\alpha}(1 - \eta)y] + (1 - \varphi)[x - R_x + Y]\} \\ &\quad +(1 - \theta)\{\varphi(1 - \overline{\beta_\alpha})(1 - \rho)y + (1 - \varphi)(1 - \overline{\beta_\beta})(1 - \rho)Y\}\end{aligned}$$

$$\begin{aligned}\Pi_C &= \theta\{\varphi[(1 - \overline{\beta_\alpha})\rho y + \overline{\beta_\alpha}\eta y] + (1 - \varphi)R_x\} + (1 - \theta)\{\varphi[(1 - \overline{\beta_\alpha})\rho y + \overline{\beta_\alpha}\eta\gamma y] \\ &\quad +(1 - \varphi)[(1 - \overline{\beta_\beta})\rho Y + \overline{\beta_\beta}\eta y]\} - K\end{aligned}$$

$$\begin{aligned}\Pi_B &= \theta\{(1 - \varphi)(1 - \eta)(1 - \gamma)y\} + (1 - \theta)\{\varphi\overline{\beta_\alpha}(1 - \eta)\gamma y \\ &\quad +(1 - \varphi)[(1 - \overline{\beta_\beta})(1 - \eta)(1 - \gamma)y + \overline{\beta_\beta}(1 - \eta)y]\}\end{aligned}$$

The total social surplus, which is again equal to the firm's profit, reduces to

$$\Pi_S = \theta x + y - K - \overline{\beta_\alpha}(1 - \theta)\varphi(1 - \gamma)y$$

As can be seen from above, the mathematical form of social surplus is unchanged by the introduction of a small fraction of verifiable second period cash flow, and the social loss is incurred when the judge rules to liquidate the good manager upon liquidity default. The optimal value of $\overline{\beta_\alpha}$, however, is smaller as ρ increases, because the increased transfer from the firm to the creditor by the verifiable second period cash flow reduces the need to liquidate. This results in the following proposition:

Proposition 14 *(The Effect of Legal Enforcement) For sufficiently small ρ, $\frac{\partial \overline{\beta_\alpha}}{\partial \rho} < 0$; the optimal "debtor-friendliness" of the bankruptcy law depends positively on the degree of enforcement (ρ).*

As mentioned earlier, better enforcement implies that creditor protection can be satisfied without converting the assets to cash in bankruptcy. Thus, the optimal policy can focus more on ex-post efficiency, which a more pro-debtor policy allows.

4.3 Reorganization Laws With Heterogeneous Types

In the previous sections, we have implicitly taken the approach that firms and creditors could specify the terms of the reorganization law, namely the liquidation probabilities β_G and β_B, to maximize the efficiency of the contract given the firm's characteristics (K, θ, x, y) and the exogenous characteristics of the environment (ρ and the error probabilities α and β). In doing so, we are able to understand the characteristics that drive optimal reorganization laws. In practice, of course, firms are restricted in their ability to tailor their own insolvency procedure. Since the optimal liquidation probabilities are dependent on firm characteristics, it may be the case that a given procedure is better suited for some firms than others. The firms for which the reorganization law is poorly suited may instead opt for private solutions to distress, as we modeled in Section 2, rather than submit to an inappropriate legal procedure. We assume the firm makes this decision at date zero. In practice, this can be achieved several ways. First, a firm can choose to finance with equity-based contracts, as is commonly seen in venture capital. Doing so can create cash flow rights similar to debt securities without the possibility of bankruptcy (Ayotte (2003), Smith and Stromberg, (2004)). In the U.K., judicial discretion can be avoided by contract through granting a floating charge to a creditor: this will allow the firm to use the receivership procedure, which transfers control over the firm's assets to the floating charge holder in default. The absence of a floating charge can trigger the administration procedure, which transfers control to a court-appointed administrator.

In this section, we take two different but complementary perspectives on the bankruptcy design problem when the law cannot be conditioned on individual firm characteristics. We first consider the firm's choice over whether or not to use a reorganization law with a given set of characteristics. We then consider the problem of a social planner who sets the terms of the law to maximize social surplus. This will shed light on the optimal scope of the bankruptcy law: should a court-based reorganization procedure be aimed at all firms, or only a subset for which the law is most valuable?

4.4 Screening under Exogenous (Suboptimal) Reorganization Law

In this subsection, we turn our focus to the firm's side of the problem: given a law with fixed liquidation probabilities β_G and β_B, which firms will choose to "contract in" to the reorganization law and which firms will "contract out" and resolve their distress privately? To examine this question, we allow firms to differ along the dimension K, the startup investment cost required of the creditor. We assume a continuum of NPV projects, $K \in [\underline{K}, \overline{K}]$. For a firm with a given project NPV, i.e. given K, the reorganization law, e.g. $\widetilde{\beta_G}$ and $\widetilde{\beta_B}$, may not be optimal[17]. Given the additional benefit of conditioning the outcome on the judge's signal, however, it may still be the case that resolving distress according to the (suboptimal) court-based procedure is more beneficial than resolving distress outside court. However, as the discrepancy between the ideal optimal bankruptcy law and the actual suboptimal bankruptcy law increases, the firm will benefit more by avoiding the bankruptcy court. While it is difficult to completely characterize the court/no court decision for any given β_G and β_B pair, it is straightforward to characterize the firms that will not use a given law, because it does not protect creditors adequately. In what follows, we assume that bargaining power is set optimally at $\eta = 1$.

Lemma 15 *Let $\widetilde{\beta_G}(\widetilde{K})$ and $\widetilde{\beta_B}(\widetilde{K})$ be an optimal reorganization law for a firm with startup cost $\widetilde{K}$. Then a necessary condition for firms to choose the court-based reorganization law to resolve distress under the policy $\{\widetilde{\beta_G}(\widetilde{K}),\widetilde{\beta_B}(\widetilde{K})\}$ is given by $K \leq \widetilde{K}$.*

Lemma 15 tells us that, for a fixed reorganization law, the lower NPV firms (high-K firms) will choose private distress resolution. For these firms, the law is too debtor-friendly to be sustainable; i.e. the creditor must be given more protection in the form of a higher liquidation probability in order to be willing to extend credit at date 0. In essence, the prospect of date 1 forgiveness of the firm's debts must be "bought" with the promise of higher date one cash flows when the firm succeeds. When this purchase price is not feasible, due to the strategic default motive, the firm must provide for greater protection of creditors through liquidation rights in default. Since we are interested in world-wide variation of reorganization laws, it would be of interest how this infeasible region changes across countries with different judicial efficiency, α and β, and degree of enforcement, ρ, which is stated in the following proposition.

Proposition 16 *The infeasible region of the reorganization law is expanding with increasing type II error, β, and is contracting with increasing type I error, α, and increasing level of enforcement, ρ.*

It is straightforward to see that as the signal error in favor of firms β rises, it is more difficult to sustain funding with court resolution of distress, since this implies less efficient identification of the good firms and less protection for creditors. With respect to the error in favor of creditors, α, *Lemma 15* shows that when the reorganization law is written optimally,

[17] We assume that this reorganization law is optimal for some type of firm, which requires initial investment $\widetilde{K}$.

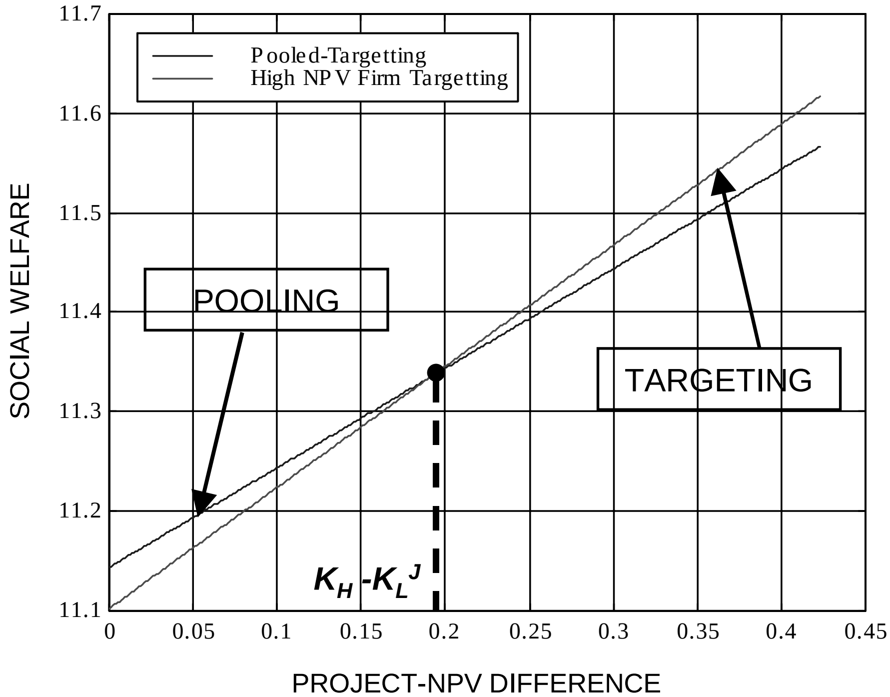

Figure 2: Optimal Scope of the Bankruptcy Law: Pooling vs. Targeting

both types of error are welfare-destroying. When the law is set suboptimally, however, a judicial bias in favor of creditors can compensate for an excessively debtor-friendly policy, thus making the law available for a greater subset of firms. Our predictions are consistent with the empirical findings by Claessens and Klapper (2002) in that bankruptcy usage rates are greater for countries with better enforcement capability.

4.5 The Optimal Scope of Bankruptcy

In this subsection, we consider a social planner's problem of choosing a single reorganization law to maximize social surplus, given that firms can choose whether to contract in or out of the procedure at date 0. To model the problem in a simple fashion, suppose there are two types of firms which differ only on the required startup cost K. A fraction λ of the firms are high NPV projects that require initial investment of K_L, and the remaining $1-\lambda$ fraction have low NPV projects that require an initial investment of K_H, where $K_H > K_L$. We assume that the social planner who designs the law knows λ, but the bankruptcy judge cannot observe each individual firm's startup cost.

In this scenario, the social planner can try to optimize the reorganization law such that both NPV types will choose to use the law, which we term *pooling*, or he can *target* the law to a subset of firms, letting the rest of the firms resolve distress outside of bankruptcy. It can be shown that to induce both K_L- and K_H-firms to choose bankruptcy court, the judge needs to set the rules as if he is targeting for the low NPV firm (i.e. K_H-firm)[18]. Thus, the effective choice is between pooling and targeting only the high-NPV types. Then the social planner will choose pooling if

$$(1-\lambda)\Pi_S^{Pool}(K_H) + \lambda\Pi_S^{Pool}(K_L) > (1-\lambda)\Pi_S^{NC}(K_H) + \lambda\Pi_S^{T_L}(K_L)$$

and high-NPV targeting if

$$(1-\lambda)\Pi_S^{Pool}(K_H) + \lambda\Pi_S^{Pool}(K_L) < (1-\lambda)\Pi_S^{NC}(K_H) + \lambda\Pi_S^{T_L}(K_L)$$

where $\Pi_S^{Pool}(K_H)$ is the social surplus of the K_H-firm under pooling, $\Pi_S^{Pool}(K_L)$ is the social surplus of the K_L-firm under pooling, $\Pi_S^{NC}(K_H)$ is the social surplus of K_H-firm under no-court, and $\Pi_S^{T_L}(K_L)$ is the social surplus of the K_L-firm under K_L-firm targeting. Figure 2 shows an example of the social planner's choice between pooling and targeting. As can be seen in the figure, the social planner prefers pooling when the NPV of K_L- and K_H-firms are small, but prefers targeting high NPV firm when the NPV difference is large. For convenience, let us denote the value of K_L, while keeping K_H fixed, that makes the judge indifferent between pooling and targeting as K_L^J[19]. i.e.

$$(1-\lambda)\Pi_S^{Pool}(K_H) + \lambda\Pi_S^{Pool}(K_L^J) = (1-\lambda)\Pi_S^{NC}(K_H) + \lambda\Pi_S^{T_L}(K_L^J)$$

So, the judge prefers pooling for those industries where $K_L > K_L^J$ (for fixed K_H), and prefers targeting when $K_L < K_L^J$ (for fixed K_H). Figure 2 is a special case for a given degree of judicial error ($\alpha = \beta = 0.05$). Figure 3 shows a plot of K_L^Js for range of feasible values of judicial

[18] This results because the firm's profit and Good IC and Bad IC take the same funtional form for both high- and low-NPV firms. The only difference between these two types of firms lies in the creditor's profit, where for high-NPV firm we need to subtract K_L from creditor's expected revenue, and K_H for the low NPV firm. If the judge sets the liquidation probabilites, β_G and β_B, to satisfy high NPV creditor's IR, but not enough for low NPV creditor's IR, then pooling will not be achieved, because the creditor of the low NPV firm will not lend money at date 0 for the contract that commits to involve the bankruptcy court. Hence, pooling implies targeting for the low-NPV firm. Extending this model to continuum of NPV-projects, say $K \in [\underline{K}, \overline{K}]$, then pooling implies targeting to the lowest NPV firm (i.e. $\overline{K}$-firm).

[19] The existence of the point K_L^J is a straightforward result from *Proposition 10* and *Proposition 11*, and the proof is available from the authors upon request.

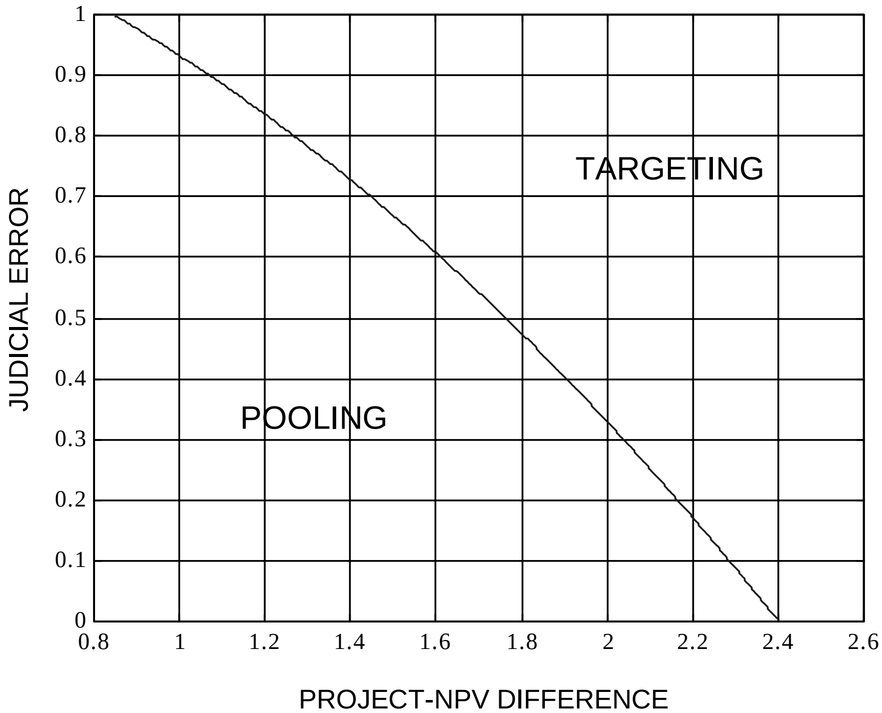

Figure 3: Targeting Map: Judicial Efficiency vs. Industry Characteristics

error, where the x-axis is the NPV difference between two types of firms (i.e. high NPV and low NPV firms), and the y-axis is the total amount of judicial error, i.e. $\alpha + \beta$. The amount of judicial error can be considered as a country specific variable, where the small judicial error may represent countries with more experienced judges and bankruptcy professionals, such as United States, and large judicial error may represent countries with a shorter history of case law and less experienced professionals, such as Japan under its new civil rehabilitation law. From Figure 3, we can see that for a given NPV difference, pooling is optimal when judicial error is small, and targeting is optimal when judicial error is large. Thus, in countries adopting new laws, we find that contracts are optimally enhanced by a reorganization law that has more limited scope; in other words, we should expect that a smaller fraction of firms will use the law to resolve distress, and these firms will be the most profitable from an ex-ante standpoint.

5 Conclusions

The goal of this paper is to examine the ways in which optimal bankruptcy laws depend on the legal environment, specifically on the quality of contract enforcement and the experience and abililty of the judicial system. Empirical literature in law and finance increasingly recognizes a distinction between the quality of the legal code and the quality of enforcement, both of which have beneficial effects on development. Our model takes this issue a step further in demonstrating that these factors are not independent. Simply stated, "one size does not fit all" with respect to the optimal bankruptcy law. The creditor protection features of bankruptcy laws are more important when enforcement quality and judicial experience are low. As these factors improve, the law can take a more debtor-friendly approach in allowing "honest but unlucky" managers to remain in control of their firms, preventing inefficient liquidations that would otherwise occur.

In a more general sense, our model explains why a court-based bankruptcy procedure can add value to contracts when private liquidation procedures are also available. Contracting parties anticipate that creditors will have an ex-post liquidation bias, which occurs in our model because future cash flows are difficult to verify. The creditor, if given control, would prefer to sell the assets to a less efficient manager who is not wealth constrained. If a third party, such as a judge, can verify the manager's quality with some regularity, the court can "complete an incomplete contract" by allowing managers to keep the firm's assets when they are identified as efficient. Doing so, of course, can be costly. Allowing managers to retain control of assets weakens creditors' desire to fund new projects. If the bankruptcy law is too debtor-friendly; i.e. creditors are not given sufficient liquidation rights, our model finds that more firms will write contracts that avoid the law and rely on less flexible private mechanisms. Thus, we expect that debtor-friendly laws will be counterproductive in countries where investor protection is poor, but can be effective in countries with better investor protection and more effective courts. We also find that from a legal design perspective, the number of firms using the court-based procedure depends on judicial efficiency. For a less-experienced judicial system, court-based bankruptcy should target a smaller subset of distressed firms for which ex-post discretion is most valuable. As court experience improves, the law can take a broader role relative to private liquidations.

For future research, one important issue we have not examined in depth is the forces that affect the choice of bankruptcy laws. While we expect that the laws in place will reflect efficiency concerns to some degree, there are obviously more factors at work, including interest group politics, the effect of competition among competing states, and potentially the country's legal origin. An interesting question in this regard is whether common law systems, which rely heavily on judicial interpretation and precedent, are more effective at producing convergence toward optimality compared to civil law systems which rely more heavily on legal code. We also leave open a thorough examination of the industry-level variation in the uses of bankruptcy vs. private distress resolution. In high-tech startups, for example, venture capital is a common form of finance which resolves distress through contingent control rights–most of the recent high-tech failures did not use bankruptcy to wind up their operations or attempt reorganization under court supervision. Our model predicts that such outcomes are more likely for firms with riskier cash flows when the law is too debtor-friendly. A more complete empirical test of this prediction would be an interesting application of this model.

6 Appendix

6.1 Motivation for Judicial Error: Dynamic Complete Contracts

In this section, we motivate the need for judicial error in modeling bankruptcy procedures. Although, there have been a large number of papers that studied bankruptcy, and more specifically, Chapter 11, very rarely, did those papers considered the possibility of judicial error in bankruptcy court's decision making process[20]. However, as we will show in this section, judicial error is an inevitable feature, when there is informational asymmetry between the bankruptcy court and the insolvent borrower. i.e. the judge of the bankruptcy court cannot completely eliminate the judicial error, and always faces a trade-off between punishing an innocent victim (i.e. liquidating the profitable project) and failing to punish a guilty agent (i.e. saving worthless project). Hence, it is unlikely that these judicial errors will disappear by smart choices of bankruptcy procedures. Rather, the choice of bankruptcy procedure will often be a trade-off between type I and type II errors.

In order to link the length of the exclusivity period and the judicial error, we introduce a dynamic valuation model that is similar to that by Francois and Morellec (2002), where they modeled the exclusivity period of the automatic stay procedure as a Parisian option. i.e. the judge rules to liquidate the firm if the value of firm's asset stays below the default boundary consecutively for pre-specified exclusivity period. Their model, however, considers homogeneous firms, and therefore the automatic stay does not contribute to providing additional

[20]Notable exception is Chen and Sundaresan (2003).

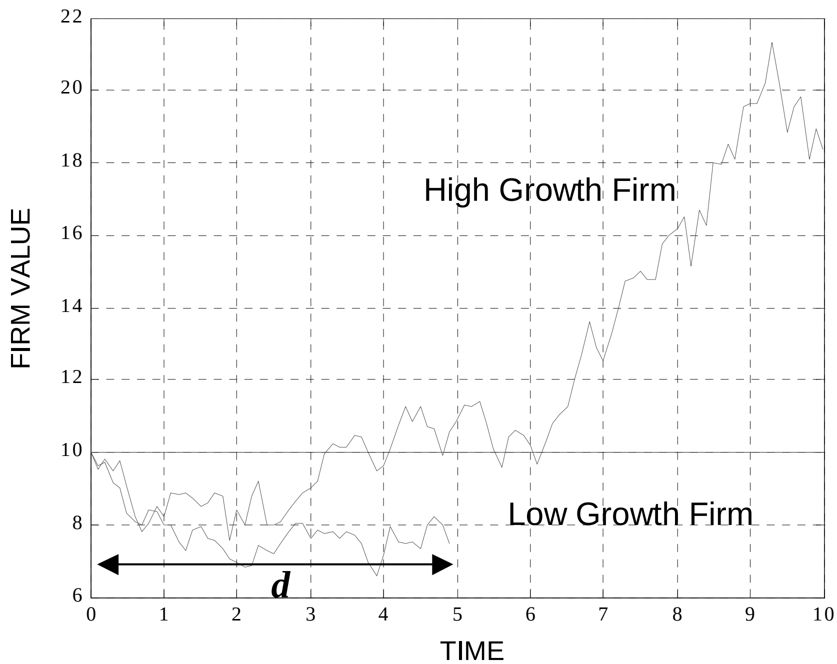

Figure 4: Passive Filtering of Heterogeneous Projects by Automatic Stay

information regarding the firm's characteristics, rather this procedure provides a grace period for the firm and let it give more chance to escape the default region by luck. One of the reason why the court is willing to provide an automatic stay procedure is to learn more about the firm's financial viability during this automatic stay period, before making the liquidation decision. In this section, we generalize Francois and Morellec (2002)'s model by introducing firms that have heterogeneous projects, and thereby, providing motivation for the existence of automatic stay period from a social surplus maximizer point of view. To minimize the complexity of analysis and address the point of interest, we allow each firm to be either good or bad, depending on their asset and cash flow generating characteristics. Under real measure, both the good and the bad firms' asset value follow a geometric Brownian motion with identical diffusion coefficient, σ, but have different drift coefficient, μ_G for good firm and μ_B for bad firm, where $\mu_G > \mu_B$[21]. Assuming that the bad firm's growth is too small, and is not worth to keep running, the judge of the bankruptcy court, who is a social surplus maximizer, wants to liquidate bad firms but wants to keep the good firm. However, the judge of the

[21] i.e. good project's asset follows $dV_t = \mu_G V_t dt + \sigma V_t dW_t$, whereas bad project's asset follows $dV_t = \mu_G V_t dt + \sigma V_t dW_t$.

bankruptcy court cannot observe the firm's type, and therefore, needs to devise a mechanism that allows the judge to identify each firm's type from the signal generated by the mechanism. One such mechanism is the automatic stay, where, upon default, the bankruptcy court mandates the firm's asset to stay within the firm for a pre-specified exclusivity period. If the firm cannot rise above the default boundary during this exclusivity period, the judge rules to liquidate the firm, and if the firm rises above the default boundary, the judge rules to resume normal operation and save the firm. Since the good firm has higher drift coefficient than the bad firm, it is more likely to rise above the default boundary upon reaching the default boundary. Figure 4 shows an example of such procedure. The upper path is the asset value of the good firm, and the lower path is that of the bad firm. Upon hitting the default boundary, the good firm eventually rises above the default boundary, but the bad firm never makes it over the default boundary and is shutdown at the expiration of the exclusivity period. Hence, by observing whether the firm reaches over the default boundary or stays below the default boundary consecutively during the exclusivity period can provide a signal for the judge regarding the firm's type. This signal is, however, imperfect, and the judge can make errors by making inferences regarding the firm's type using this signal. Specifically, for given exclusivity period, d, the judge falsely liquidates good firms (type I error) with probability

$$\alpha = e^{2ab_G} \frac{\Phi(-b_G\sqrt{d})}{\Phi(b_G\sqrt{d})}$$

and fails to liquidate the bad firm (type II error) with probability

$$\beta = 1 - e^{2ab_B} \frac{\Phi(-b_B\sqrt{d})}{\Phi(b_B\sqrt{d})}$$

where $a = \frac{\ln(V/V_B)}{\sigma}$, $b_G = \frac{\mu_G - \delta - \sigma^2/2}{\sigma}$, $b_B = \frac{\mu_B - \delta - \sigma^2/2}{\sigma}$, $\Phi(x) = 1 + \sqrt{2\pi} e^{x^2/2} N(x)$, and N(x) is the cumulative distribution function of the standard normal distribution[22]. Since $\Phi(\cdot)$ is an increasing function in its argument, α decreases for increasing exclusivity period, d, and β increases with increasing exclusivity period, which is shown in Figure 5. As can be seen in the figure, the total amount of judicial error cannot be arbitrarily reduced, and is a trade-off between the type I and the type II errors. The optimal length of the exclusivity period can

[22] This result is an adaptation from Francois and Morellec (2002)'s Parisian option model of automatic stay for an economy with homogeneous projects. In their paper, they find the probability of liquidation of a firm with value process, $dV_t = (r - \delta)V_t dt + \sigma V_t dW_t^Q$, to be $P_L(d, \mu) = e^{2ab} \frac{\Phi(-b\sqrt{d})}{b\sqrt{d}}$, where $b = \frac{\mu - \delta - \sigma^2/2}{\sigma}$. In our model, we have two possible projects with drifts μ_G and μ_B, and the type I error is the probability of liquidating the good project, $\alpha = P_L(d, \mu_G)$, and the type II error is the probability of not liquidating the bad project, $\beta = 1 - P_L(d, \mu_B)$.

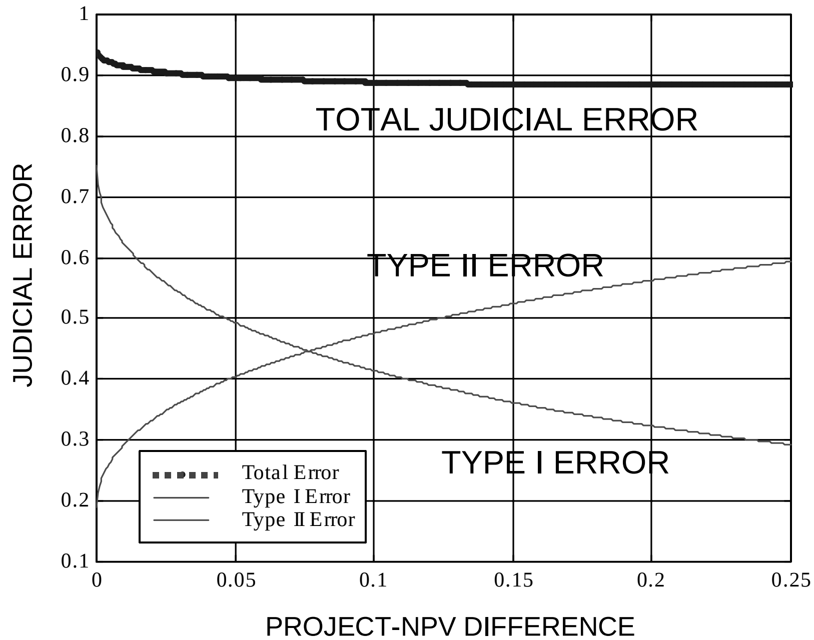

Figure 5: Judicial Error vs. Length of the Automatic Stay

be found by minimizing the expected welfare loss incurred by type I error, and that of the type II error. i.e. the social surplus maximizing judge of the bankruptcy court ex-ante sets the length of the exclusivity period as,

$$d = \arg\min\{c_G\alpha + c_B\beta\}$$

where c_G is the welfare loss incurred by liquidating a good firm, and c_B is the welfare loss incurred by saving a bad firm[23].

Using the dynamic model, one can proceed to find the value of the firm and the value of the debt and the equity for each type of firm. However, it is often the case that the dynamic feature, although useful, is not essential in the main economic reasoning, and it would be possible to reduce the complexity of the analysis, while maintaining the economic intuition by using a static model instead of a dynamic model, which is done in the main text of this paper.

[23]In this paper, we are not focusing on specific attributes of the welfare loss. Hence, we exogenously denoted the cost as c_G and c_B, but it is straightforward to endogenize these costs using firm's cashflow characteristics. For example, the cost of liquidating a good firm, c_G, can be the discounted present value of future cashflow stream, and the cost of saving the bad firm, c_B, can be the discounted future cashflow stream of the bad project less the cost of financial distress.

As an example of how such conversion from dynamic to static model can be done, we take the case of converting dynamic complete contract to a static complete contract[24]. The cash flow in a dynamic model is modeled as a geometric Brownian motion, $dV_t = (r - \delta)V_t dt + \sigma V_t dW_t$, while in a static model it can be modeled as discrete output, $\widetilde{y} \in \{y_H, y_L\}$, where $y_H > y_L$. The heterogeneous profitability of the projects are modeled as different drift coefficient in a dynamic model, i.e. $\mu \in \{\mu_G, \mu_B\}$, whereas it is modeled as different probability of high outcome, i.e. $Pr(\widetilde{y} = y_H) = \theta_G$ for the good project and $Pr(\widetilde{y} = y_H) = \theta_B$ for the bad project, in a static version. Finally, the judicial error is expressed in terms of the liquidation probability in a dynamic setting, i.e. $\alpha = e^{2ab_G} \frac{\Phi(-b_G\sqrt{d})}{\Phi(b_G\sqrt{d})}$ and $\beta = 1 - e^{2ab_B} \frac{\Phi(-b_B\sqrt{d})}{\Phi(b_B\sqrt{d})}$, while it is exogenously given as type I and type II error, i.e. $Pr(s_G|\theta_G) = 1 - \alpha$, $Pr(s_B|\theta_G) = \alpha$, $Pr(s_G|\theta_B) = \beta$, $Pr(s_B|\theta_B) = 1 - \beta$, in a static setting. Based on the results of the dynamic model of this section, however, we know that the type I and the type II errors are linked with the length of the exclusivity period, d, and one type of error cannot be reduced arbitrarily small without increasing the other. In the discrete model, we assume that the total amount of judicial error, $\alpha + \beta$, is constant for a given ex-ante market distribution of firm types.

6.2 Proofs of Lemmas and Propositions

Lemma 1 *(Bolton and Scharfstein, 1996) In an optimal contract,* $\beta_x = 0$ *and* $R_0 = 0$.

Proof. Although, the model in this paper is slightly different, the main argument of this proof follows the same logic as in that of Bolton and Scharfstein (1996). First, β_x is zero, because if it were strictly positive, then the firm can offer an alternative contract with smaller β_x and larger R_x that makes creditor IR unchanged, but makes firm strictly better off. Specifically, if β_x is not zero, then the firm can offer an alternative contract that decreases β_x by a small amount ϵ, and increases R_x, by $\epsilon\eta y$. Such contract will still satisfy the creditor IR, i.e. $\Pi_C \geq 0$, while making the firm strictly better off, i.e. $\Pi_F = \epsilon\gamma(1-\eta)y > 0$. We can continue this logic till β_x becomes zero. Hence, in an optimal contract, β_x is zero. Similar argument can be applied to show $R_0 = 0$ at optimum. If it were not, then the firm can offer an alternative contract that has lower β_0 and larger R_0, while keeping the creditor IR unchanged. As β_0 decreases, the fraction of the outside buyer's profit from the total amount of social surplus decreases, and the total amount of social surplus itself increases. Hence, the firm's profit increases by offering such alternative contract, while leaving the creditor

[24] Note that in the main text, the model was a static incomplete contract, which is different from what we discuss in this section. The dynamic version of incomplete contract with geometric Brownian motion cashflow requires much more involve analysis, and is delegated as a future work.

indifferent. Again, we can continue this logic till R_0 becomes zero. Therefore, in an optimal contract, $R_0 = 0$. ■

Lemma 2 *(Optimality of Strategic Default) Given the model and assumptions states above, if $\eta < 1$, then the optimal contract chosen by a profit maximizing firm allows strategic default, and the creditors will make zero expected profit under this contract. If $\eta = 1$, no strategic default is allowed.*

Proof. Remind that the good IC and the bad IC are

$$R_x^g \leq (\beta_0 - \beta_x)\eta y$$

$$R_x^b \leq (\beta_0 - \beta_x)Y$$

Also notice that if $\eta < 1$, the upper bound of the good IC, $(\beta_0 - \beta_x)\eta y$, is smaller than that of the bad IC, $(\beta_0 - \beta_x)Y$, because $(\beta_0 - \beta_x)\eta y - (\beta_0 - \beta_x)Y = (\beta_0 - \beta_x)\gamma(1-\eta)y > 0$. Hence, if the good IC is binding, the bad IC is automatically satisfied with a slack, whereas if the bad IC is binding, the good IC is not satisfied. As a result, when the good IC binds, the firm's, the creditor's, and the outside buyer's profit becomes

$$\begin{aligned}\Pi_F &= \theta\{\varphi[x - R_x^g + (1-\beta_x)y + \beta_x(1-\eta)y] + (1-\varphi)[x - R_x^g + (1-\beta_x)Y \\ &\quad +\beta_x(1-\eta)0]\} + (1-\theta)\{\varphi[(1-\beta_0)y + \beta_0 0] + (1-\varphi)[(1-\beta_0)Y + \beta_0 0]\}\end{aligned}$$

$$\begin{aligned}\Pi_C &= \theta\{\varphi[R_x^g + (1-\beta_x)0 + \beta_x\eta y] + (1-\varphi)[R_x^g + (1-\beta_x)0 + \beta_x\eta y]\} \\ &\quad +(1-\theta)\{\varphi[(1-\beta_0)0 + \beta_0\eta\gamma y] + (1-\varphi)[(1-\beta_0)0 + \beta_0\eta y]\} - K\end{aligned}$$

$$\begin{aligned}\Pi_B &= \theta\{\varphi[(1-\beta_x)0 + \beta_x 0] + (1-\varphi)[(1-\beta_x)(1-\eta)(1-\gamma)y + \beta_x(1-\eta)y]\} \\ &\quad +(1-\theta)\{\varphi[(1-\beta_0)0 + \beta_0(1-\eta)\gamma y] + (1-\varphi)[(1-\beta_0)(1-\eta)(1-\gamma)y \\ &\quad +\beta_0(1-\eta)y]\}\end{aligned}$$

When the bad IC binds, however, the good type (managers) will strategically default, and the profit of each agent becomes,

$$\begin{aligned}\Pi_F &= \theta\{\varphi[x - R_0 + (1-\beta_0)y + \beta_0(1-\eta)y] + (1-\varphi)[x - R_x^b + (1-\beta_x)Y \\ &\quad +\beta_x(1-\eta)0]\} + (1-\theta)\{\varphi[(1-\beta_0)y + \beta_0 0] + (1-\varphi)[(1-\beta_0)Y + \beta_0 0]\}\end{aligned}$$

$$\begin{aligned}\Pi_C &= \theta\{\varphi[R_0 + (1-\beta_0)0 + \beta_0\eta y] + (1-\varphi)[R_x^b + (1-\beta_x)0 + \beta_x\eta y]\} \\ &\quad +(1-\theta)\{\varphi[(1-\beta_0)0 + \beta_0\eta\gamma y] + (1-\varphi)[(1-\beta_0)0 + \beta_0\eta y]\} - K\end{aligned}$$

$$\begin{aligned}\Pi_B &= \theta\{\varphi[(1-\beta_x)0+\beta_x 0]+(1-\varphi)[(1-\beta_x)(1-\eta)(1-\gamma)y+\beta_x(1-\eta)y]\} \\ &\quad +(1-\theta)\{\varphi[(1-\beta_0)0+\beta_0(1-\eta)\gamma y]+(1-\varphi)[(1-\beta_0)(1-\eta)(1-\gamma)y \\ &\quad +\beta_0(1-\eta)y]\}\end{aligned}$$

Straightforward calculation show that $\Pi_C^{BadIC} - \Pi_C^{GoodIC} = \theta(1-\varphi)(\beta_0-\beta_x)(Y-\eta y) > 0$, for a fixed β_0. i.e. the creditor IR is easier to satisfy when bad IC binds. Since the creditor acts competitively, the firm offers a take-it-or-leave-it offer that makes creditor to break even. So, under the bad IC binding, the liquidation probability, β_0, is lower. Then, two effects make firm to prefer a contract that involves strategic default for the good type, i.e. bad IC binds. First, the social surplus, $\Pi_S = \theta x + y - K - \beta_0(1-\theta)\varphi(1-\gamma)y$, increases as β_0 decreases. Second, outside buyer's profit decreases, which in turn increases firm's profit for given total social surplus, as β_0 decreases. Therefore, in equilibrium, the bad IC binds, and the good types strategically default upon seeing first period cash flow x. If $\eta = 1$, then good IC and bad IC coincides, and both types' pay R_x upon seeing first period cash flow x. Hence, no strategic default occurs in this case. ■

Proposition 3 *(Optimal Contract without Bankruptcy Court) The optimal contract* $\{R_x,\beta_x,R_0,\beta_0\}$ *are given as,* $R_x = \beta_0 Y$, $\beta_x = 0$, $R_0 = 0$, *and* $\beta_0 = \frac{K}{\eta y\{\theta[\varphi+(1-\varphi)(\gamma+\eta-\eta\gamma)/\eta]+(1-\theta)[\varphi\gamma+(1-\varphi)]\}}$.

Proof. First notice that at optimum, the creditor IR and bad IC is binding. To see this, if creditor IR were not binding, then the firm, who makes a take-it-or-leave-it offer of a contract, will be strictly better off by offering an alternative contract that has lower β_0, and still satisfies creditor IR. i.e. $\Pi_C \geq 0$. As shown in the proof of *Lemma 1*, a contract with lower β_0 makes firm strictly better off and still induces creditors to participate. Hence, at optimum, the firm will push β_0 to the lowest limit, which is when creditor IR binds. Similar logic applies in showing that if bad IC were not binding, then the firm can offer an alternative contract with lower $\beta_0 - \beta_x$[25], which, as before, will make the firm strictly better off while still satisfying creditor IR. Continuing this logic, the bad IC is binding at optimum. Once we showed that the creditor IR and the bad IC is binding, it is straightforward to get the claimed result. i.e. $\beta_0 = \frac{K}{\eta y\{\theta[\varphi+(1-\varphi)(\gamma+\eta-\eta\gamma)/\eta]+(1-\theta)[\varphi\gamma+(1-\varphi)]\}}$ can be derived from $\Pi_C = 0$, and $R_x = \beta_0 Y$ is the bad IC when it is binding. ■

Proposition 4 *(Liquidation Bias) Following a liquidity default, the creditor strictly prefers liquidation to continuation.*

Proof. The liquidation bias comes from the fact that the second period cash flow is not verifiable, and therefore, the incumbent manager of the firm cannot pledge this cash flow

[25] Since $\beta_x = 0$, smaller $\beta_0 - \beta_x$ implies smaller β_0.

to the creditor in return for continuing the project. In such case, the creditor face two choices upon liquidity default. Let the incumbent manager, either efficient or inefficient, continue the project, or liquidate the project and sell it to the outside buyer, who may or may not be efficient. The creditor's profit from the former case is zero, whereas it is $\eta\gamma y$ when the outside buyer is inefficient and it is ηy if the outside buyer is efficient. Hence, the self-interested creditor prefers to liquidate the project, even if the creditor knows that the incumbent manager is efficient and truly has no cash to payout (i.e. the creditor knows the firm is in liquidity default and not strategic default). ■

Lemma 5 *(No court when firm repays) In an optimal contract,* $\beta_G^x = \beta_B^x = 0$; *judicial discretion is unnecessary when the firm repays* R_x*.*

Proof. There are two things to notice to derive the claimed result. First, when the manager has cash, i.e. the realized first period cash flow is x, the allocation of the physical asset between the manager and the creditor does not affect the social surplus. Because, if the incumbent manager has the asset and is efficient, he will keep it, while if he is inefficient the he will sell the project to the efficient outside buyer. Hence, no matter what type the manager is, the project will end up in the hands of the efficient agent. As will be shown in *Lemma 7*, at optimum the bad IC is binding, and R_x is set to the maximum value that the inefficient (bad type) manager is willing to pay than strategically default when the first period cash flow x. So, the bankruptcy court cannot increase R_x, and can only reduce or leave it unchanged. If the court reduce R_x, the creditor, who marginally breaks even at the optimum[26], gets worse off and demand higher liquidation probability, $\overline{\beta_\alpha}$, to break even under the reduced R_x. This reduces the social surplus because $\Pi_S = \theta x + y - K - \overline{\beta_\alpha}(1-\theta)\varphi(1-\gamma)y$. Therefore, the social surplus maximizing court leaves R_x unchanged. i.e. i.e. court chooses no action upon receiving case from a solvent firm. Then the creditor and manager weakly prefer not to take the case to the bankruptcy court when the firm admits high cash flow in the first period. If there is a positive cost by taking the case to the court, the preference is strict. ■

Lemma 6 *(Ordering of the Liquidation Probabilities) In any optimal contract,* $\beta_G < \overline{\beta_\alpha} < \beta_0 < \overline{\beta_\beta} < \beta_B$

Proof. There are two possible cases to consider. One, when both the good and the bad IC holds, and the other, when only the bad IC holds[27]. When both good IC and bad IC are

[26] Also to be shown in Proposition 8.

[27] In the next lemma, we will show that in an optimal reorganization law, the case where both the good and the bad IC binds is not optimal, and therefore, is ruled out.

satisfied[28],

$$\Pi_C^{Court} = \theta\overline{\beta_\alpha}\eta y + (1-\theta)\{\varphi\overline{\beta_\alpha}\gamma\eta y + (1-\varphi)\overline{\beta_\beta}\eta y\} - K = 0$$

$$\Pi_C^{NoCourt} = \theta\beta_0\eta y + (1-\theta)\{\varphi\beta_0\gamma\eta y + (1-\varphi)\beta_0\eta y\} - K = 0$$

Subtracting Π_C^{Court} from $\Pi_C^{NoCourt}$ should also be zero. Rearranging terms gives

$$\overline{\beta_\alpha} - \beta_0 = -\frac{(1-\theta)(1-\varphi)}{\theta + (1-\theta)\varphi\gamma}(\overline{\beta_\beta} - \beta_0)$$

Hence, when $\overline{\beta_\alpha} > \beta_0$, then $\overline{\beta_\beta} < \beta_0$, and vice versa. Since the social surplus maximizing judge prefers to save the good type and prefers to liquidate the bad type, $\beta_G < \beta_B$[29]. Since we assumed the errors are small, i.e. $\alpha < \frac{1}{2}$ and $\beta < \frac{1}{2}$, we have $\beta_G < \overline{\beta_\alpha} < \overline{\beta_\beta} < \beta_B$. From above equation, therefore, we can conclude that $\beta_G < \overline{\beta_\alpha} < \beta_0 < \overline{\beta_\beta} < \beta_B$.

When only the bad IC holds,

$$\Pi_C^{Court} = \theta\varphi\overline{\beta_\alpha}\eta y + \theta(1-\varphi)\overline{\beta_\beta}Y + (1-\theta)\{\varphi\overline{\beta_\alpha}\gamma\eta y + (1-\varphi)\overline{\beta_\beta}\eta y\} - K = 0$$

$$\Pi_C^{NoCourt} = \theta\varphi\beta_0\eta y + \theta(1-\varphi)\beta_0 Y + (1-\theta)\{\varphi\beta_0\gamma\eta y + (1-\varphi)\beta_0\eta y\} - K = 0$$

Again, subtracting Π_C^{Court} from $\Pi_C^{NoCourt}$ should also be zero. Rearranging terms gives

$$\overline{\beta_\alpha} - \beta_0 = -\frac{\{\theta(\eta+\gamma-\eta\gamma)/\eta + 1 - \theta\}(1-\varphi)}{\varphi\{\theta + (1-\theta)\gamma\}}(\overline{\beta_\beta} - \beta_0)$$

Following the same logic as before, we get $\beta_G < \overline{\beta_\alpha} < \beta_0 < \overline{\beta_\beta} < \beta_B$. ■

Lemma 7 *(Optimality of Strategic Default) For all* $0 \leq \eta \leq 1$*, good types strategically default, and bad types repay in the optimal contract. Creditors make zero expected profit.*

Proof. Following similar algebra as in *Lemma 2*, we can show the upper bound of the good IC is smaller than that of the bad IC, even if $\eta = 1$. i.e. $\overline{\beta_\beta}Y - \overline{\beta_\alpha}\eta y = (\overline{\beta_\beta} - \overline{\beta_\alpha})\eta y + \gamma(1-\eta)\overline{\beta_\beta}y > 0$. Hence, if the good IC is binding, the bad IC is automatically satisfied with a slack, whereas if the bad IC is binding, the good IC is not satisfied. As a result, when the good IC binds, the firm's, the creditor's, and the outside buyer's profit becomes

$$\begin{aligned}\Pi_F \;\; = \;\; & \theta\{\varphi[x - R_x + y] + (1-\varphi)[x - R_x + Y]\} \\ & +(1-\theta)\{0 - R_0 + \varphi[(1-\alpha)((1-\beta_G)y + \beta_G 0) + \alpha((1-\beta_B)y + \beta_B 0)] \\ & +(1-\varphi)[\beta((1-\beta_G)Y + \beta_G 0) + (1-\beta)((1-\beta_B)Y + \beta_B 0)]\}\end{aligned}$$

[28] It is straightforward to show that the smaller one, i.e. the good IC, is binding at optimum.

[29] This can be formally shown, but will be skipped, because in Proposition 8 we will show this result for a similar case where only bad IC holds.

$$
\begin{aligned}
\Pi_C &= \theta R_x + (1-\theta)\{\varphi[R_0 + (1-\alpha)\beta_G\eta\gamma y + \alpha\beta_B\eta\gamma y] \\
&\quad +(1-\varphi)[R_0 + \beta\beta_G\eta y + (1-\beta)\beta_B\eta y]\} - K
\end{aligned}
$$

$$
\begin{aligned}
\Pi_B &= \theta\{\varphi[(1-\alpha)0 + \alpha 0] + (1-\varphi)(1-\eta)(1-\gamma)y\} \\
&\quad +(1-\theta)\{\varphi[(1-\alpha)\beta_G(1-\eta)\gamma y + \alpha\beta_B(1-\eta)\gamma y] \\
&\quad +(1-\varphi)[\beta((1-\beta_G)(1-\eta)(1-\gamma)y + \beta_G(1-\eta)y) \\
&\quad +(1-\beta)((1-\beta_B)(1-\eta)(1-\gamma)y + \beta_B(1-\eta)y)]\}
\end{aligned}
$$

When the bad IC binds, however, the good type (managers) will strategically default, and the profit of each agents become,

$$
\begin{aligned}
\Pi_F &= \theta\{\varphi[x - R_0 + (1-\alpha)((1-\beta_G)y + \beta_G(1-\eta)y) + \alpha((1-\beta_B)y \\
&\quad +\beta_B(1-\eta)y)] + (1-\varphi)[x - R_x + Y]\} + (1-\theta)\{0 - R_0 \\
&\quad +\varphi[(1-\alpha)((1-\beta_G)y + \beta_G 0) + \alpha((1-\beta_B)y + \beta_B 0)] \\
&\quad +(1-\varphi)[\beta((1-\beta_G)Y + \beta_G 0) + (1-\beta)((1-\beta_B)Y + \beta_B 0)]\}
\end{aligned}
$$

$$
\begin{aligned}
\Pi_C &= \theta\{\varphi[R_0 + (1-\alpha)\beta_G\eta y + \alpha\beta_B\eta y] + (1-\varphi)R_x\} \\
&\quad +(1-\theta)\{\varphi[R_0 + (1-\alpha)\beta_G\eta\gamma y + \alpha\beta_B\eta\gamma y] \\
&\quad +(1-\varphi)[R_0 + \beta\beta_G\eta y + (1-\beta)\beta_B\eta y]\} - K
\end{aligned}
$$

$$
\begin{aligned}
\Pi_B &= \theta\{\varphi[(1-\alpha)0 + \alpha 0] + (1-\varphi)(1-\eta)(1-\gamma)y\} \\
&\quad +(1-\theta)\{\varphi[(1-\alpha)\beta_G(1-\eta)\gamma y + \alpha\beta_B(1-\eta)\gamma y] \\
&\quad +(1-\varphi)[\beta((1-\beta_G)(1-\eta)(1-\gamma)y + \beta_G(1-\eta)y) \\
&\quad +(1-\beta)((1-\beta_B)(1-\eta)(1-\gamma)y + \beta_B(1-\eta)y)]\}
\end{aligned}
$$

Straightforward calculation show that $\Pi_C^{BadIC} - \Pi_C^{GoodIC} = \theta(1-\varphi)(\overline{\beta_\beta}Y - \overline{\beta_\alpha}\eta y) > 0$, for fixed β_G and β_B. i.e. the creditor IR is easier to satisfy when bad IC binds. Since the creditor acts competitively, the firm offers a take-it-or-leave-it offer that makes creditor to break even. So, under bad IC binding, the liquidation probability, $\overline{\beta_\alpha}$, is lower. Then, two effects make firm to prefer a contract that involves strategic default for the good type, i.e. bad IC binds. First, the social surplus, $\Pi_S = \theta x + y - K - \overline{\beta_\alpha}(1-\theta)\varphi(1-\gamma)y$, increases as $\overline{\beta_\alpha}$ decreases. Second, outside buyer's profit decreases, which in turn increases firm's profit for given total social surplus, as $\overline{\beta_\alpha}$ decreases. Therefore, in equilibrium, the bad IC binds, and the good types strategically default upon seeing first period cash flow x. Notice that unlike *Lemma 2*, even if $\eta = 1$, the bad IC is larger than the good IC. Therefore, no strategic default always occurs in this case. ■

Proposition 8 *(Sub-optimality of fire sale) In an optimal contract,* $\eta = 1$; *reorganization schemes that benefit the outside buyer are inefficient*[30].

Proof. We need to show that $\Pi_B = 0$ at optimum. The outside buyer's ex-ante expected profit, Π_B, is positive when $\eta < 1$, and is zero when $\eta = 1$. Since the optimal solution of η of the judge's social surplus maximization problem is $\eta = 1$, outside buyer's ex-ante expected profit, Π_B, is zero at optimum, which was to be shown. ■

Proposition 9 *(Optimal Reorganization Law) The optimal contract sets* $\eta = 1$ *and the liquidation probabilities upon receiving a good and a bad signal as follows.*

a) (High-NPV project) When $K/(\eta y) < \Delta_\alpha$, $\beta_G = 0$ and $\beta_B = \frac{K/(\eta y)}{\Delta_\alpha}$.

b)(Low-NPV project) When $K/(\eta y) > \Delta_\alpha$, $\beta_G = \frac{K/(\eta y) - \Delta_\alpha}{\Delta_{1-\alpha}}$ and $\beta_B = 1$.

where the coefficients Δ_α and $\Delta_{1-\alpha}$ are given by $\Delta_\alpha = \theta(1-\varphi)\frac{\gamma+\eta-\gamma\eta}{\eta}(1-\beta) + \theta\varphi\alpha + (1-\theta)\varphi\gamma\alpha + (1-\theta)(1-\varphi)(1-\beta)$, and $\Delta_{1-\alpha} = \theta(1-\varphi)\frac{\gamma+\eta-\gamma\eta}{\eta}\beta + \theta\varphi(1-\alpha) + (1-\theta)\varphi\gamma(1-\alpha) + (1-\theta)(1-\varphi)\beta$.

Proof. Similar to *Proposition 3*, at optimum, the creditor IR and bad IC is binding. To see this, if creditor IR were not binding, then the firm, who makes a take-it-or-leave-it offer of a contract, will be strictly better off by offering an alternative contract that has lower $\overline{\beta_\alpha}$, and still satisfies creditor IR. i.e. $\Pi_C \geq 0$. As shown in the proof of *Lemma 1*, a contract with lower $\overline{\beta_\alpha}$ makes firm strictly better off and still induces creditors to participate. Hence, at optimum, the firm will push $\overline{\beta_\alpha}$ to the lowest limit, which is when creditor IR binds. Similar logic applies in showing that if bad IC were not binding, then the firm can offer an alternative contract with lower $\overline{\beta_\alpha}$, which, as before, will make the firm strictly better off while still satisfying creditor IR. Continuing this logic, the bad IC is binding at optimum. The judge's problem is to maximize the social surplus, $\Pi_S = \theta x + y - K - \overline{\beta_\alpha}(1-\theta)\varphi(1-\gamma)y$, subject to the creditor IR, $\Pi_C = 0$, and bad IC, $R_x = \overline{\beta_\beta} Y$. A brief investigation on the first order condition shows that the objective function is maximized by increasing β_G and η, and decreasing β_B subject to the creditor IR and bad IC. For convenience, let us rearrange the creditor IR in terms of β_G and β_B as follows. $\Pi_C = \Delta_{1-\alpha}\beta_G + \Delta_\alpha\beta_B$, where $\Delta_\alpha = \theta(1-\varphi)\frac{\gamma+\eta-\gamma\eta}{\eta}(1-\beta) + \theta\varphi\alpha + (1-\theta)\varphi\gamma\alpha + (1-\theta)(1-\varphi)(1-\beta)$, and $\Delta_{1-\alpha} = \theta(1-\varphi)\frac{\gamma+\eta-\gamma\eta}{\eta}\beta + \theta\varphi(1-\alpha) + (1-\theta)\varphi\gamma(1-\alpha) + (1-\theta)(1-\varphi)\beta$. Depending on whether the

[30] Technically, we mean $\eta = 1$, in which case the outside buyer's ex-ante expected profit is zero, i.e. $\Pi_B = 0$.

β_G reaches 0 first or β_B reaches one first, the optimal reorganization law can be divided into two cases. When $\frac{K}{\eta y} < \Delta_\alpha$[31], then $\beta_G = 0$ and $\beta_B = \frac{K/(\eta y)}{\Delta_\alpha}$. When $\frac{K}{\eta y} > \Delta_\alpha$[32], then $\beta_B = 1$ and $\beta_G = \frac{K/(\eta y) - \Delta_\alpha}{\Delta_{1-\alpha}}$. Finally, since larger η gives larger social surplus, the judge, if he can[33], sets η to the maximum feasible value one. ■

Proposition 10 *If access to the court is costless, then* $(\Pi_F)^C > (\Pi_F)^{NC}$*,where* $(\Pi_F)^C$ *is the firm's profit under the optimal reorganization law and* $(\Pi_F)^{NC}$ *is the firm's profit under the optimal private liquidation law; i.e. the firm's optimal reorganization policy generates greater profit than the optimal private liquidation policy.*

Proof. From *Lemma 6*, we showed $\overline{\beta_\alpha} < \beta_0$. Since the social surplus of the court and the non-court cases are $\Pi_S^{Court} = \theta x + y - K - \overline{\beta_\alpha}(1-\theta)\varphi(1-\gamma)y$ and $\Pi_S^{NoCourt} = \theta x + y - K - \beta_0(1-\theta)\varphi(1-\gamma)y$ respectively, we get $\Pi_S^{Court} - \Pi_S^{NoCourt} = (\beta_0 - \overline{\beta_\alpha})(1-\theta)\varphi(1-\gamma)y > 0$. ■

Proposition 11 *When reorganization laws are set optimally,* $\frac{\partial \overline{\beta_\alpha}}{\partial \theta} < 0$ *and* $\frac{\partial \overline{\beta_\alpha}}{\partial K} > 0$*; the optimal law for a given firm is more creditor-friendly when*

a) the NPV is lower (higher K), and

b) cash flows are riskier (lower θ*, holding* θx *constant).*

Proof. Rather than to take the derivative directly, it is more intuitive to have an intermediate step and use the chain rule. First, let us show $\frac{\partial \overline{\beta_\alpha}}{\partial \theta} < 0$. for a small increase in θ, say $\delta\theta$, the creditor's profit increases by $\delta\Pi_C = \delta\theta\{\varphi(1-\gamma)\overline{\beta_\alpha}\eta y + (1-\varphi)\overline{\beta_\beta}(Y - \eta y)\} > 0$. i.e. by increasing θ, the creditor's profit also increases. Since at optimum, the creditor IR is binding at zero, $\overline{\beta_\alpha}$ needs to be adjusted to bring Π_C back to zero. Since $\frac{\partial(\delta\Pi_C)}{\partial \overline{\beta_\alpha}} = \varphi(1-\gamma)\eta y > 0$, $\overline{\beta_\alpha}$ needs to be decreased to decrease Π_C. As a result, as θ increases, $\overline{\beta_\alpha}$ decreases. i.e. $\frac{\partial \overline{\beta_\alpha}}{\partial \theta} < 0$, which was to be shown.

To show $\frac{\partial \overline{\beta_\alpha}}{\partial K} > 0$, we follow similar steps. Since $\delta\Pi_C < 0$ when $\delta K > 0$, we need to adjust $\overline{\beta_\alpha}$ to increase Π_C and make the creditor IR to bind at optimum. Since we already know $\frac{\partial(\delta\Pi_C)}{\partial \overline{\beta_\alpha}} = \varphi(1-\gamma)\eta y > 0$, $\overline{\beta_\alpha}$ needs to be increased to increase Π_C. As a result $\overline{\beta_\alpha}$ increases when K increases. .i.e. $\frac{\partial \overline{\beta_\alpha}}{\partial K} > 0$, which was to be shown. ■

[31] We denote this case as "high-NPV" project, because compared to the other case discussed below, the initial investment in this case is relatively low and the liquidation probabilites, β_G and β_B, do not need to be large to make the creditor break even. Hence, as shown in the following result, the judge saves all firms upon receiving good signal, s_G, and liquidates with some probability, β_B, upon receiving bad signal, s_B.

[32] In contrast to the previous case, we denote this case as "low-NPV" project. In this case it is more difficult to satisfy the creditor IR than in the "high-NPV" project case. Hence, the judge liquidates all projects upon receiving a bad signal, s_B, and saves some firms with positive probability, β_G, upon receiving good signal, s_G.

[33] For cases where the judge is unable to set the bargaining power, we can take η as an exogenously given parameter.

Proposition 12 *(The Effect of Judicial Efficiency)* $\frac{\partial \overline{\beta_\alpha}}{\partial \alpha} > 0$ *and* $\frac{\partial \overline{\beta_\alpha}}{\partial \beta} > 0$*; as the court becomes more effective (less effective), the optimal law becomes more debtor-friendly (creditor friendly).*

Proof. All we need to show is $\frac{\partial \overline{\beta_\alpha}}{\partial \alpha} > 0$ and $\frac{\partial \overline{\beta_\alpha}}{\partial \beta} > 0$. There are two cases, the "high-NPV" and the "low-NPV" case. For "high-NPV" project, i.e. $\frac{K}{\eta y} < \Delta_\alpha$,

$$\frac{\partial \overline{\beta_\alpha}}{\partial \alpha} = \frac{K/(\eta y)}{\Delta_{1-\alpha}^2}\{\theta(1-\varphi)\frac{\gamma+\eta-\gamma\eta}{\eta}(1-\beta)+(1-\theta)(1-\varphi)(1-\beta)\} > 0$$

$$\frac{\partial \overline{\beta_\alpha}}{\partial \beta} = -\frac{\alpha K/(\eta y)}{\Delta_{1-\alpha}^2}\{-\theta(1-\varphi)\frac{\gamma+\eta-\gamma\eta}{\eta} - (1-\theta)(1-\varphi)\} > 0$$

For the "low-NPV" project, i.e. $\frac{K}{\eta y} > \Delta_\alpha$,

$$\frac{\partial \overline{\beta_\alpha}}{\partial \alpha} = \frac{1}{\Delta_{1-\alpha}^2}\{\theta(1-\varphi)\frac{\gamma+\eta-\gamma\eta}{\eta}\beta+(1-\theta)(1-\varphi)\beta\}\{\Delta_\alpha+\Delta_{1-\alpha}-K/(\eta y)\} > 0$$

where $\Delta_\alpha+\Delta_{1-\alpha}-K/(\eta y) > 0$ for feasible projects, because this is the creditor IR with the highest liquidation probability, i.e. $\beta_G = 1$ and $\beta_B = 1$. If $\Delta_\alpha+\Delta_{1-\alpha}-K/(\eta y) < 0$, the the project will not be funded by the creditor because no feasible liquidation probability will make the creditor to break even.

$$\frac{\partial \overline{\beta_\alpha}}{\partial \beta} = \frac{1-\alpha}{\Delta_{1-\alpha}^2}\{\theta(1-\varphi)\frac{\gamma+\eta-\gamma\eta}{\eta}+(1-\theta)(1-\varphi)\}\{\Delta_\alpha+\Delta_{1-\alpha}-K/(\eta y)\} > 0$$

■

Corollary 13 *Social surplus decreases with judicial errors* α *and* β*.*

Proof. To see this, the result of *Lemma 6* implies that as the judicial error increases, the difference between $\overline{\beta_\alpha}$ and β_G also increases. Hence, for a given minimum value of β_G, the social surplus decreases because $\overline{\beta_\alpha}$ increases. In other words, for limited range[34] of β_G and β_B, the judicial errors α and β further restricts the range of $\overline{\beta_\alpha}$, which directly affects the social surplus. ■

Proposition 14 *(The Effect of Legal Enforcement)* $\frac{\partial \overline{\beta}_\alpha}{\partial \rho} < 0$; *the optimal "debtor-friendliness" of the bankruptcy law depends positively on the degree of enforcement* (ρ)[35].

Proof. Rather than taking the derivative directly, we follow an indirect approach as in Proposition 11. First consider the "high-NPV" case. When ρ increases to $\rho+\delta\rho$, R_x increases

[34] Since β_G and β_B are probabilites, they are restricted to lie between zero and one. Furthermore, the creditor IR, $\Pi_C = 0$, may further restrict possible values of β_G and β_B.

[35] Technically, we mean $\frac{\partial \overline{\beta}_\alpha}{\partial \rho} < 0$.

by $\delta R_x = \delta\rho\{1-\overline{\beta_\beta}\}Y > 0$, and Π_C increases by $\delta\Pi_C = \theta\{\varphi[(1-\alpha)(1-\beta_G)\delta\rho y + \alpha(1-\beta_B)\delta\rho y] + (1-\varphi)\delta R_x\} + (1-\theta)\{\varphi[(1-\alpha)(1-\beta_G)\delta\rho y + \alpha(1-\beta_B)\delta\rho y] + (1-\varphi)[\beta(1-\beta_G)\delta\rho Y + (1-\beta)(1-\beta_B)\delta\rho Y]\} - K > 0$ i.e. as ρ increases, Π_C increases too. Since at optimum, creditor IR should bind to zero, we need to adjust $\overline{\beta_\alpha}$ to decrease Π_C and make it $\Pi_C = 0$. Since $\frac{\partial\Pi_C}{\partial\beta_B} = \theta\{\varphi[(1-\alpha)0 + \alpha(-\rho y + \eta y)] + (1-\varphi)(1-\rho)\alpha Y\} + (1-\theta)\{\varphi[(1-\alpha)0 + \alpha(-\rho y + \eta\gamma y)] + (1-\varphi)[\beta 0 + (1-\beta)(-\rho Y + \eta y)]\} > 0$[36], β_B needs to be decreased to decrease Π_C. i.e. $\frac{\partial\overline{\beta_\alpha}}{\partial\rho} < 0$. Next, consider the "low-NPV" case. We already know $\frac{\partial\Pi_C}{\partial\rho} < 0$. In order to make $\Pi_C = 0$, we need to decrease Π_C. Since, $\frac{\partial R_x}{\partial\beta_G} = (1-\rho)\beta Y > 0$ and $\frac{\partial\Pi_C}{\partial\beta_G} = \theta(1-\varphi)(1-\rho)\beta Y + \theta\varphi\alpha\eta y + (1-\theta)(\varphi\gamma\alpha + (1-\varphi)\beta)\eta y > 0$, β_G, and consequently $\overline{\beta_\alpha}$[37], must be decreased to bring Π_C back to zero. i.e. $\frac{\partial\overline{\beta_\alpha}}{\partial\rho} < 0$. ■

Lemma 15 *Let $\widetilde{\beta_G}(\widetilde{K})$ and $\widetilde{\beta_B}(\widetilde{K})$ be an optimal reorganization law for a firm with startup cost $\widetilde{K}$. Then a necessary condition for firms to choose the court-based reorganization law to resolve distress under the policy $\{\widetilde{\beta_G}(\widetilde{K}), \widetilde{\beta_B}(\widetilde{K})\}$ is given by $K \leq \widetilde{K}$.*

Proof. Before starting the proof, let us describe each agent's ex-ante expected profit from the project, when the liquidation probabilities are exogenously set as $\widehat{\beta_G}$ and $\widehat{\beta_B}$, the initial investment is $\widehat{K}$, and the payment in good state that makes creditor to break even is $\widehat{R_x}$[38]. For convenience, let's define the probability of liquidation of the efficient manager (good type) and the probability of liquidation of the inefficient manager (bad type) as $\widehat{\beta_\alpha} = (1-\alpha)\widehat{\beta_G} + \alpha\widehat{\beta_B}$ and $\widehat{\beta_\beta} = \beta\widehat{\beta_G} + (1-\beta)\widehat{\beta_B}$. Then the firm's, the creditor's, and the outside buyer's ex-ante expected profit from the project are

$$\begin{aligned}\Pi_F &= \theta\{x + \varphi[(1-\widehat{\beta_\alpha})(1-\rho)y + \widehat{\beta_\alpha}(1-\eta)y] + (1-\varphi)[x - \widehat{R_x} + Y \\ &\quad +(1-\widehat{\beta_\beta})0 + \widehat{\beta_\beta}0]\} + (1-\theta)\{\varphi[(1-\widehat{\beta_\alpha})(1-\rho)y + \widehat{\beta_\alpha}0] \\ &\quad +(1-\varphi)[(1-\widehat{\beta_\beta})(1-\rho)Y + \widehat{\beta_\beta}0]\}\end{aligned}$$

$$\begin{aligned}\Pi_C &= \theta\{\varphi[(1-\widehat{\beta_\alpha})\rho y + \widehat{\beta_\alpha}\eta y] + (1-\varphi)[\widehat{R_x} + (1-\widehat{\beta_\beta})0 + \widehat{\beta_\beta}0]\} \\ &\quad +(1-\theta)\{\varphi[(1-\widehat{\beta_\alpha})\rho y + \widehat{\beta_\alpha}\eta\gamma y] + (1-\varphi)[(1-\widehat{\beta_\beta})\rho Y + \widehat{\beta_\beta}\eta y]\} - \widehat{K}\end{aligned}$$

[36] Two things are worth noticing. First, since $\beta_G = 0$ is fixed, changing $\overline{\beta_\alpha}$ implies changing β_B. Second, since we assumed ρ to be small, $\rho y < \eta y$, $\rho\gamma y < \eta y$ and $\rho Y < \eta y$.

[37] Since $\beta_B = 1$ is fixed, changing $\overline{\beta_\alpha}$ implies changing β_G.

[38] Since creditor behave competitively, the firm makes a take-it-or-leave-it offer that makes the creditor to break even.

$$\begin{aligned}\Pi_B &= \theta\{\varphi[(1-\widehat{\beta_\alpha})0+\widehat{\beta_\alpha}0]+(1-\varphi)[(1-\gamma)(1-\eta)y+(1-\widehat{\beta_\beta})0+\widehat{\beta_\beta}0]\} \\ &\quad +(1-\theta)\{\varphi[(1-\widehat{\beta_\alpha})0+\widehat{\beta_\alpha}(1-\eta)\gamma y]+(1-\varphi)[(1-\widehat{\beta_\beta})(1-\gamma)(1-\eta)y \\ &\quad +\widehat{\beta_\beta}(1-\eta)y]\}\end{aligned}$$

The social surplus can be obtained by summing each agent's ex-ante expected profit from the project, which becomes

$$\Pi_S = \Pi_F + \Pi_C + \Pi_B = \theta x + y - \widehat{K} - \widehat{\beta_\alpha}(1-\theta)(1-\varphi)(1-\gamma)y$$

Now consider when the firm will choose not to participate in the reorganization law. There are three possible situations, i.e. when firm's profit by pursuing court is negative, when bad IC is violated, and when firm's profit by avoiding court is larger than that by pursuing the court. Since, we assume $\eta = 1$, which implies outside buyer's profit is zero, firm's profit equals social surplus, $\Pi_F = \Pi_S$. Hence, the first case, $\Pi_F < 0$, implies a trivial case where the project itself is not profitable enough. The second case implies that both the good and the bad type will strategically default, in which case the creditor make not enough profit to break even. Finally, the third case is technically most involved, and the result may depend on specific choice of parameters, and hence will not be considered in detail in this paper. So, by *the infeasible region of the reorganization law*, we mean the violation of the second case, where bad IC is not satisfied. To simplify notation let us denote

$$\begin{aligned}\Pi_C(\widehat{\beta_\alpha},\widehat{\beta_\beta},\widehat{K},\widehat{R_x}) &= \theta\{\varphi[(1-\widehat{\beta_\alpha})\rho y+\widehat{\beta_\alpha}\eta y]+(1-\varphi)[\widehat{R_x}+(1-\widehat{\beta_\beta})0 \\ &\quad +\widehat{\beta_\beta}0]\}+(1-\theta)\{\varphi[(1-\widehat{\beta_\alpha})\rho y+\widehat{\beta_\alpha}\eta\gamma y] \\ &\quad +(1-\varphi)[(1-\widehat{\beta_\beta})\rho Y+\widehat{\beta_\beta}\eta y]\}-\widehat{K}\end{aligned}$$

For $K > \widetilde{K}$, $\Pi_C(\overline{\beta_\alpha},\overline{\beta_\beta},K,R_x)=0$ by the definition of the optimal reorganization law for K-firm, and $\Pi_C(\widetilde{\beta_\alpha},\widetilde{\beta_\beta},K,R_x)<0$, because $\widetilde{\beta_\alpha}<\overline{\beta_\alpha}$ and $\widetilde{\beta_\beta}<\overline{\beta_\beta}$[39]. Hence to satisfy creditor IR under $\widetilde{\beta_\alpha}$ and $\widetilde{\beta_\beta}$, R_x need to be raised to R_x', where $R_x' > R_x$, i.e. $\Pi_C(\widetilde{\beta_\alpha},\widetilde{\beta_\beta},K,R_x')=0$. Notice that bad IC is binding at optimum. i.e. $x - R_x + Y = x - R_0 + (1-\overline{\beta_\beta})Y$. Hence $x - R_x' + Y < x - R_0 + (1-\widetilde{\beta_\beta})Y$, because $R_x' > R_x$ and $\widetilde{\beta_\beta} < \overline{\beta_\beta}$. Therefore bad IC is violated when $K > \widetilde{K}$. For $K < \widetilde{K}$, $\Pi_C(\overline{\beta_\alpha},\overline{\beta_\beta},K,R_x) = 0$ by the definition of the optimal reorganization law for K-firm, and $\Pi_C(\widetilde{\beta_\alpha},\widetilde{\beta_\beta},K,R_x) > 0$, because $\widetilde{\beta_\alpha} > \overline{\beta_\alpha}$ and $\widetilde{\beta_\beta} > \overline{\beta_\beta}$[40]. Hence to satisfy creditor IR under $\widetilde{\beta_\alpha}$ and $\widetilde{\beta_\beta}$, R_x need to be lowered to R_x',

[39] Since $\widetilde{\beta_\alpha},\widetilde{\beta_\beta}$ and $\overline{\beta_\alpha},\overline{\beta_\beta}$ are optimal reorganization law for $\widetilde{K}$-firm and K-firm respectively, and $\frac{\partial\overline{\beta_\alpha}}{\partial K}>0$ and $\frac{\partial\overline{\beta_\beta}}{\partial K}>0$, $\widetilde{K}<K$ implies $\widetilde{\beta_\alpha}<\overline{\beta_\alpha}$ and $\widetilde{\beta_\beta}<\overline{\beta_\beta}$.

[40] Since $\widetilde{\beta_\alpha},\widetilde{\beta_\beta}$ and $\overline{\beta_\alpha},\overline{\beta_\beta}$ are optimal reorganization law for $\widetilde{K}$-firm and K-firm respectively, and $\frac{\partial\overline{\beta_\alpha}}{\partial K}>0$ and $\frac{\partial\overline{\beta_\beta}}{\partial K}>0$, $\widetilde{K}>K$ implies $\widetilde{\beta_\alpha}>\overline{\beta_\alpha}$ and $\widetilde{\beta_\beta}>\overline{\beta_\beta}$.

where $R_x^{'} < R_x$, i.e. $\Pi_C(\widetilde{\beta_\alpha}, \widetilde{\beta_\beta}, K, R_x^{'}) = 0$. Notice that bad IC is binding at optimum. i.e. $x - R_x + Y = x - R_0 + (1 - \overline{\beta_\beta})Y$. Hence $x - R_x^{'} + Y > x - R_0 + (1 - \widetilde{\beta_\beta})Y$, because $R_x^{'} < R_x$ and $\widetilde{\beta_\beta} > \overline{\beta_\beta}$. Therefore bad IC is satisfied when $K < \widetilde{K}$. As a result, firms with $K > \widetilde{K}$ will not participate the reorganization law, and firms with $K < \widetilde{K}$ may participate the reorganization law. In the latter case, the firm will choose to pursue the court if $\Pi_F^{Court} > \Pi_F^{NoCourt}$ and will not pursue if $\Pi_F^{Court} > \Pi_F^{NoCourt}$. ■

Proposition 16 *The infeasible region of the reorganization law is expanding with increasing type II error, β, and is contracting with increasing type I error, α, and increasing level of enforcement, ρ.*

Proof. Let us first prove the effect of type I error, α. As the type I error, α, increases, $\widetilde{\beta_\alpha} = (1 - \alpha)\widetilde{\beta_G} + \alpha\widetilde{\beta_B}$ increases as well, because $\beta_G < \beta_B$, and larger weight is given to β_B relative to β_G, whereas $\widetilde{\beta_\beta}$ remains unchanged. Inspection of Π_C indicates that as $\widetilde{\beta_\alpha}$ increases, Π_C also increases[41] for fixed $\widetilde{\beta_\beta}$. Since $\widetilde{K}$ is the initial investment level that makes $\widetilde{\beta_\alpha}$ and $\widetilde{\beta_\beta}$ an optimal reorganization law, $\widetilde{K}$ must be adjusted to make $\Pi_C = 0$. Since $\frac{\partial \Pi_C}{\partial \widetilde{K}} < 0$, $\widetilde{K}$ must be increased to decrease Π_C and bring it back to zero. i.e. increase in α causes increase in $\widetilde{K}$, or formally $\frac{\partial \widetilde{K}}{\partial \alpha} > 0$. Since the upper boundary of infeasible region is fixed to $\overline{K}$, increase in the lower boundary, $\widetilde{K}$, implies contraction of the infeasible region of the reorganization law.

Next, let us prove the effect of type II error, β. As the type II error, β, increases, $\widetilde{\beta_\beta} = \beta\widetilde{\beta_G} + (1 - \beta)\widetilde{\beta_B}$ decreases, because $\beta_G < \beta_B$, and larger weight is given to β_G relative to β_B, whereas $\widetilde{\beta_\alpha}$ remains unchanged. Inspection of Π_C indicates that as $\widetilde{\beta_\beta}$ decreases, Π_C decreases[42] for fixed $\widetilde{\beta_\alpha}$. Since $\widetilde{K}$ is the initial investment level that makes $\widetilde{\beta_\alpha}$ and $\widetilde{\beta_\beta}$ an optimal reorganization law, $\widetilde{K}$ must be adjusted to make $\Pi_C = 0$. Since $\frac{\partial \Pi_C}{\partial \widetilde{K}} < 0$, $\widetilde{K}$ must be decreased to increase Π_C and bring it back to zero. i.e. increase in β causes decrease in $\widetilde{K}$, or formally $\frac{\partial \widetilde{K}}{\partial \beta} < 0$. Since the upper boundary of infeasible region is fixed to $\overline{K}$, decrease in the lower boundary, $\widetilde{K}$, implies expansion of the infeasible region of the reorganization law.

Finally, let's prove the effect of the degree of enforcement, ρ. As the degree of enforcement, ρ, increases creditor's profit, Π_C, increases as well, because $\frac{\partial \Pi_C}{\partial \rho} > 0$. Since $\widetilde{K}$ is the initial investment level that makes $\widetilde{\beta_\alpha}$ and $\widetilde{\beta_\beta}$ an optimal reorganization law, $\widetilde{K}$ must be adjusted to make $\Pi_C = 0$. Since $\frac{\partial \Pi_C}{\partial \widetilde{K}} < 0$, $\widetilde{K}$ must be increased to decrease Π_C and bring it back to

[41] Formally, one can show that $\frac{\partial \Pi_C}{\partial \widetilde{\beta_\alpha}} > 0$. Also, intuitively, as the probability of liquidation increases, the creditor's profit increases because creditor get positive payment only by liquidation upon default.

[42] Formally, one can show that $\frac{\partial \Pi_C}{\partial \widetilde{\beta_\beta}} > 0$. Also, intuitively, as the probability of liquidation decreases, the creditor's profit decreases because creditor get positive payment only by liquidation upon default.

zero. i.e. increase in ρ causes increase in $\widetilde{K}$, or formally $\frac{\partial \widetilde{K}}{\partial \rho} > 0$. Since the upper boundary of infeasible region is fixed to $\overline{K}$, increase in the lower boundary, $\widetilde{K}$, implies contraction of the infeasible region of the reorganization law. ■

7 References

Aghion, P. and Bolton, P. "An Incomplete Contracts Approach to Financial Contracting", *Review of Economic Studies* 59, 473-494.

Ayotte, K.M., 2003, "Bankruptcy and Entrepreneurship: The Value of a Fresh Start." *Working Paper,* Columbia University.

Ayotte, K. M., and D. T. Robinson, 2004, "Optimal Contracting in the Presence of Judicial Error", *Working Paper*, Columbia University and Duke University.

Baird, D. G., 1986, "The Uneasy Case for Corporate Reorganizations", *Journal of Legal Studies* 15, 127-147.

Baird, D. G., 1993. "Revisiting Auctions in Chapter 11", *Journal of Law and Economics* 36, 633-669.

Berglof, E., G. Roland, and E.-L. von Thadden, 2000, "An Incomplete-Contracts Approach to Corporate Bankruptcy", *Working Paper*, Universite de Lausanne.

Berkovitch, E., and R. Israel 1999, "Optimal Bankruptcy Laws across Different Economic Systems", *Review of Financial Studies* 12, 347-377.

Bolton, P., and D. S. Scharfstein, 1996, "Optimal Debt Structure and the Number of Creditors", *Journal of Political Economy* 104, 1-25.

Chen, N., and S. M. Sundaresan, 2003, "Decisions under Bankruptcy and Their Implications for Recontracting Debt", *Working Paper*, Columbia University.

Claessens, S., and L. F. Klapper, 2002, "Bankruptcy Around the World: Explanation of Its Relative Use", *Working Paper*, University of Amsterdam.

Francois, P., and E. Morellec, 2002, "Capital Structure and Asset Prices: Some Effects of Bankruptcy Procedures", *Journal of Business*, forthcoming.

Giammarino, R. M., and E. Nosal, 1996, "The Efficiency of Judicial Discretion in Bankruptcy Law", *Working Paper*, University of British Columbia.

Hart, O., 2000, "Different Approaches to Bankruptcy", *NBER Working Paper* 7921, Cambridge, MA.

Jackson, T. H., 1986, *The Logic and Limits of Bankruptcy Law*, Harvard University Press, Cambridge, MA.

La Porta, R., F. Lopez-de-Silanez, A. Shleifer, and R. W. Vishny, 1997, "Legal Determinants of External Finance", *Journal of Finance* 52, 1131-1150.

La Porta, R., F. Lopez-de-Silanez, A. Shleifer, and R. W. Vishny, 1998, "Law and Finance", *Journal of Political Economy* 106, 1113-1155.

Miceli, T. J., 1990, "Optimal Prosecution of Defendants Whose Guilt is Uncertain", *Journal of Law, Economics, and Organization* 6, 189-201.

Pistor, K., 2000, "Patterns of Legal Change: Shareholder and Creditor Rights in Transition Economies", Forthcoming in *European Business Organization Law Review* 1.

Pistor, K., M. Raiser, and S. Gelfer, 2000, "Law and Finance in Transition Economies", *Economics of Transition* 8, 325.368.

Povel, P., 1999, "Optimal Soft or Tough Bankruptcy Procedures", *Journal of Law, Economics, and Organization* 15, 659-684.

Pulvino, T., 1998. "Do Asset Fire Sales Exist? An Empirical Investigation of Commercial Aircraft Transactions" *Journal of Finance* 53, 939-978.

Rhodes-Kropf, M., and S. Viswanathan, 2000, "Corporate Reorganizations and Non-Cash Auctions", *Journal of Finance* 55, 1807-1849.

Shleifer, A. and R. Vishny, 1992. "Liquidation Values and Debt Capacity: A Market Equilibrium Approach" *Journal of Finance* 47, 1343-1365.

Skeel, D., 2001, Debt's Dominion: A History of Bankruptcy Law in America. Princeton University Press, Princeton NJ.

Smith, D. C., and P. Stromberg, 2004, "Maximizing the Value of Distressed Assets: Bankruptcy Law and the Efficient Reorganization of Firms," Working paper, Board of Governors of the Federal Reserve and University of Chicago.

Wagatsuma, M., 2001, "Recent Developments in Insolvency Reform in Asia: summary of Recent Developments in Insolvency Reform in Japan", *Forum for Asian Insolvency Reform*, Bali, Indonesia, 7-8 February, 2001.