Optimal Bankruptcy Laws Across Different Economic Systems

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We model fundamental differences across economic systems and propose optimal bankruptcy laws. We show that creditor-debtor relationships in a given economy are affected by the ability of creditors to obtain information about fundamentals and the managers' ability to strategically use their private information. An optimal bankruptcy law utilizes creditors' information while minimizing managers' use of strategic information. Our proposed laws for a developed bank-based system like Germany include a creditor chapter only, for a developed market-based system like the United States include both a creditor chapter and a debtor chapter, and for an underdeveloped system include both a creditor chapter and a debtor chapter that gives the manager more protection than in a market-based system.

Insofar as debt has traditionally been a major source of outside financing for firms, the structure of the creditor-debtor relationship and the design of bankruptcy laws has received special attention from scholars, lawmakers, and practitioners. When lawmakers design a bankruptcy law that is best for their specific economy, they cannot resort to existing theories in economics, corporate finance, or law because countries differ in their economic environments, and these theories do not capture such cross-country differences. Without an understanding of the sources of these differences, one is in a void when searching for an optimal bankruptcy law for a particular country. In this article, we provide a theory that demonstrates how optimal bankruptcy laws depend on the specific structure of each economy, and propose bankruptcy laws for various economic systems based on their specific characteristics.

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A fundamental relationship common to all economic systems is a principal-agent relationship between entrepreneurs who need to raise funds to establish new firms and outside investors who may provide the funds. The need for outside financing creates two economic inefficiencies. First, with debt outstanding, the debtor may continue to operate the firm when he should liquidate it. This happens because the manager extracts the residual cash flow and his private benefits in continuation, but nothing in liquidation, as the creditor receives the entire proceeds from liquidation. The second source of inefficiency is in the financing stage, where some positive net present value (NPV) projects are not financed. This inefficiency is caused by the inefficient liquidation policy described above, because it limits the amount of cash flow the creditor can recover from the project. Consequently the firm reaches its debt capacity before all positive NPV projects are financed.

The social planner designs a bankruptcy law that aims to minimize the social cost of these inefficiencies. As such, an optimal bankruptcy law has to address the following issues:

- It should facilitate liquidation whenever creditors receive information indicating that liquidation is optimal.
- It should prevent excess liquidation by creditors, when continuation results in the highest total value, but debt value is higher in liquidation.
- It should provide managers with incentives to liquidate the firm voluntarily when creditors fail to discover inefficient continuation.
- It should structure the distribution of the cash flow in liquidation to maximize the debt capacity of the firm.

We consider an uninformed bankruptcy court that cannot observe the actions of the parties and the realized cash flow. The court can only observe payments that have been made between the parties, and which party commenced the bankruptcy proceedings. Therefore the bankruptcy court may condition its strategy only on these elements. Based on this information, we identify two possible bankruptcy chapters: a creditor chapter — the bankruptcy procedures when the creditor commences bankruptcy, and a debtor chapter — the bankruptcy procedures when the manager commences bankruptcy.

An optimal bankruptcy law depends on the information structure in the economy, as this structure is most important to the relationships between creditors and debtors. Specifically, an optimal bankruptcy law always includes a creditor chapter that enables creditors to liquidate the firm and obtain the entire cash flow from liquidation if the manager cannot convince them to continue. This alleviates the inefficiency in the financing stage. In contrast, a debtor chapter is only efficient when the manager does not have an information advantage that enables him to use the debtor chapter strategically, or otherwise when the monitoring technology of the creditor is relatively inefficient. In these cases the optimal debtor chapter prevents

inefficient continuation by giving the manager his value from continuation when he commences bankruptcy, but no more than this value, in order to minimize the inefficiency in the financing stage.[1] In addition, the debtor chapter prevents creditors from forcing inefficient liquidation whenever continuation is more valuable. This is done by a means of threat to impose a penalty on creditors whenever they want to liquidate a firm that is economically viable (in equilibrium, the court never imposes a penalty, because the threat is sufficient to deter creditors from attempting to liquidate a firm with higher value in continuation than in liquidation).

Based on these considerations, our proposed bankruptcy law for various economic systems is as follows:

- An optimal bankruptcy law for developed countries with a bank-based system like Germany, where information acquisition technologies are well developed and most of the financing is done through banks, includes a creditor chapter only.
- An optimal bankruptcy law for developed countries with a market-based system like the United States, where information acquisition technologies are well developed and most of the financing is arm's length, includes both a creditor chapter and a debtor chapter.
- An optimal bankruptcy law for countries with an underdeveloped system with poor information acquisition technologies and concentrated financing includes both a creditor chapter and a debtor chapter. The debtor chapter gives the manager more protection in comparison to that in the market-based system.

While our theory is normative in that it provides policy recommendations rather then empirical predictions, it is interesting to note that it is consistent with observed bankruptcy laws. For example, Rajan and Zingales (1995) report that all countries in their sample have a creditor chapter (like Chapter 7 in the United States), where the debtor loses control and the firm is liquidated by a third party. Moreover, some of the countries with more developed financial markets like Canada, the United Kingdom and the United States, also have a debtor chapter (like Chapter 11 in the United States), where the debtor files for bankruptcy and remains in control.

Our article belongs to the growing body of literature on the design of bankruptcy laws. Bebchuk (1988) and Aghion, Hart, and Moore (1992) consider bankruptcy laws for firms that are already in default. In this case, the main task of the bankruptcy law is to implement efficient liquidation and allocation of the proceeds from liquidation. Bebchuk (1988) and Aghion, Hart, and Moore (1992) show that market solutions where firms are auctioned off and the proceeds are paid according to an absolute priority rule

[1] This is similar to results derived in Berkovitch and Israel (1998), and Kalay and Zender (1998).

(APR) yield efficient liquidation outcomes. While these bankruptcy laws are ex post efficient, they do not necessarily prompt an efficient decision making prior to bankruptcy.

Bebchuk and Picker (1992), Giammarino and Nosal (1996), and Berkovitch, Israel, and Zender (1997, 1998) consider the effects of bankruptcy laws on ex ante decision making. Bebchuk and Picker (1992) consider how the existing bankruptcy law affects the ex ante development of human capital and project choice. Giammarino and Nosal (1996) show how intervention by a bankruptcy court can increase both ex ante and ex post efficiency by altering the bargaining powers of the claimants. Berkovitch, Israel, and Zender (1997, 1998) derive an optimal bankruptcy law that implements both ex post and ex ante efficient decision making. These articles do not consider the effects of the structure of different economies, including the relations between creditors and debtors, on optimal bankruptcy laws.

The article is organized as follows. Section 1 describes the basic model. Section 2 characterizes the first-best outcome and describes two inefficiencies due to rigid outside financing where the claimants must follow the original debt contract. Section 3 characterizes optimal bankruptcy laws for two polar economies; the case where creditors are always fully informed and the case where they are never informed. Section 4 provides the optimal bankruptcy law for a market-based economic system. Section 5 provides the optimal bankruptcy law for a bank-based economic system. Section 6 provides the optimal bankruptcy law for an underdeveloped economic system. Section 7 relates our proposed bankruptcy law to observed bankruptcy laws. In Section 8 we present our conclusions. All proofs are relegated to the Appendix.

1. The Model

Consider a typical economy consisting of entrepreneurs/managers with no personal funds who attempt to establish and manage firms, investors who are considering whether to provide funds to the entrepreneurs, a social planner who designs a bankruptcy law, and a bankruptcy court that implements the bankruptcy law. Managers in the economy maximize the monetary value of their claims and draw nonpecuniary, nontransferable private benefits of control whose equivalent monetary value is B.[2] The assumption that B is nontransferable means that entrepreneurs cannot borrow against it.

The relevant events in the model take place over three dates, 0, 1, and 2, as summarized in Figure 1. On date 0, an entrepreneur attempts to raise

[2] For example, private benefits may include nonpecuniary perquisites or the ability to exercise control over middle management; see Jensen and Meckling (1976), Grossman and Hart (1998), and Harris and Raviv (1988). Private benefits may also represent a cost of losing control. See Hart and Moore (1991) for a theory of debt that is based on the cost of losing inalienable human capital.

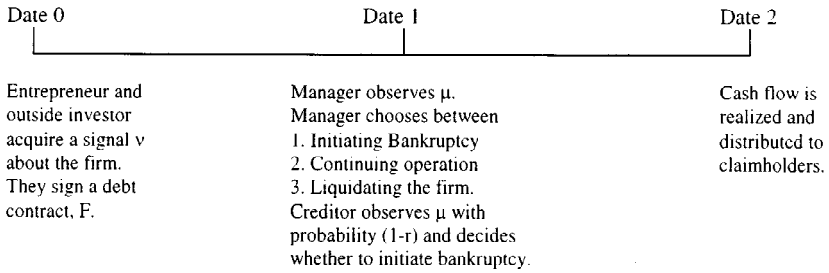

Figure 1
Sequence of events and decisions

$I to start a firm. The firm consists of an investment project that is either liquidated at date 1 for a known liquidation value L, or is continued and generates a single cash flow on date 2. As of date 0, before the project is financed, the entrepreneur, potential investors, and the social planner view this cash flow as the sum of three independent random variables, given by

$$\tilde{R}_a = \tilde{\nu} + \tilde{\mu} + \tilde{\varepsilon}. \tag{1}$$

The random variables ν and μ represent the quality of the project, which may depend on managerial effort and ability. Potential investors and the entrepreneur observe the realization of ν before they sign a financial contract on date 0. As such, ν represents the identifiable quality of the project on date 0. It has a cumulative distribution function $Q(\nu)$ over the support $[\nu_{\min}, \nu_{\max}]$. The random variable μ represents the identifiable quality of the project on date 1. It has a cumulative distribution function $G(\mu)$ over the support $[0, \mu_{\max}]$, with expected value $\bar{\mu}$. The random variable ε is white noise, with mean zero and a cumulative distribution function $H(\varepsilon)$ over the support $[\varepsilon_{\min}, \varepsilon_{\max}]$, representing residual uncertainty that is resolved on date 2. We assume that $\nu_{\max} + \bar{\mu} > I > \nu_{\min} + \bar{\mu} + \int_0^{L-\nu_{\min}} (L - \nu_{\min} - \mu)\, dG(\mu)$, so that in the financing stage some projects have a positive NPV, while others have a negative NPV.

On date 0, based on the realization of ν and the expectations regarding μ and ε, an investor decides whether to commit funds to the project. To focus on bankruptcy, we assume that to raise I, the entrepreneur issues debt with face value F to be paid on date 2.[3] At this date, after the project has been financed, the creditor and the entrepreneur forecast the date 2 cash flow to be

$$\tilde{R}_b = \nu + \tilde{\mu} + \tilde{\varepsilon}. \tag{2}$$

[3] Debt contracts may be optimal when there are costs for verifying ε on date 2, as in Townsend (1979).

We now describe the information acquisition process and the relationship between the manager and the creditor, which we view as the most important aspect of debt contracts and resolution of financial distress. On date 1 the manager and the creditor engage in information acquisition. The information structure is two- dimensional:

(1) **Information about fundamentals** — the information the parties may learn about the realization of the quality parameter μ. To capture the notion that the manager is better informed than the creditor, we assume that the manager first discovers the realization of μ, and the creditor may then discover it with probability $(1 - r)$. If the creditor fails to learn the information, he continues to hold the prior beliefs $G(\mu)$.

The probability that the creditor will discover the information, $(1 - r)$ depends on the effectiveness of different information transmission technologies, as follows. First, the more efficient capital markets are, the more informative are securities' prices. This increases the likelihood that creditors will learn the true information, that is, $(1 - r)$ increases as capital markets become more developed. Second, the availability of more efficient information acquisition technologies, such as accounting systems, credit-rating agencies, and financial analysts who follow companies, is associated with higher $(1 - r)$.

(2) **Strategic information** — the information the manager has about the creditor's information acquisition technology. Specifically this depends on the manager's ability to predict the outcome of the creditor's investigation. We identify two distinct information structures:

(a) *Soft information.* The manager cannot predict the outcome of the creditor's investigation. That is, he believes that the creditor will learn the true value of μ with probability $(1 - r)$ and that he will not learn μ with probability r.[4]

(b) *Hard information.* The manager can perfectly predict the outcome of the creditor's investigation. That is, while the probability that the creditor will learn the value of μ is still $(1 - r)$, now the manager knows the fate of the creditor's investigation beforehand.

The following example demonstrates our information structure. Consider the relationships between a firm, a debt rating agency, and investors in the capital market. Suppose that the rating agency investigates the firm and provides a report to investors. The investigation is imperfect; it reveals the true state of the firm with probability $(1 - r)$ and fails to provide any new information with probability r. This represents information about fundamentals. To demonstrate the difference between soft and hard information, consider the following two scenarios. First, the agency provides its report to

[4] We consider the cases where the manager continues to hold his prior beliefs regarding the success of the creditor's investigation. Nothing will change if we allow for the manager to receive additional information and update his belief about the probability of successful investigation.

investors *without* first revealing it to the manager. In this case, the manager cannot predict whether or not investors will learn the true state of the firm. This is the case of *soft information*. Second, the agency discusses the report with the manager *prior* to releasing it to the public. In this case, since the manager reads the report before the investors, he perfectly predicts whether or not they will learn the true state of the firm. This is the case of *hard information*.

To relate the information structure of our model to economic systems, we adopt the classification of economic systems for developed economies suggested by Allen and Gale (1995) and define the economic system of underdeveloped economies as follows:

A market-based system — most corporate financing is done through the capital market. Therefore, the relationship between creditors and firms is arm's length, so creditors obtain most of their information from the financial markets and their own independent investigations of the firm's affairs. Managers cannot see and do not have control over the information processed by creditors. Therefore, managers do not have a strategic advantage, so the information is soft. Regarding the information about fundamentals, as markets become more efficient, creditors are more likely to learn the information, so $(1-r)$ is higher. Allen and Gale (1995) focused on the "U.S. model" to analyze a market-based system. In their U.S. model, creditors are likely to learn the information, because U.S. capital markets are highly efficient and the disclosure rules in the United States are strict.

A bank-based system — most corporate financing is done through banks and other financial institutions. In this case, banks take an active interest in firms, usually by having representatives on the board of directors and maintaining veto power over certain activities; thus $(1-r)$ is high. Managers are likely to have a good idea of the information creditors are processing at any time; thus the information is hard. Allen and Gale (1995) focused on the "German model" to analyze a bank-based system. In their German model, the information about fundamentals is of high quality, but not as high as in the U.S. model, because the accounting information German firms are required to reveal is much less than U.S. firms are required to give.

An underdeveloped system — financial markets, financial institutions, and accounting systems are not yet developed, and there are no reliable information collection entities, like rating agencies and financial analysts to provide information. Similarly to a bank-based system, most corporate financing is done by banks and other financial institutions. The main difference between underdeveloped and bank-based systems is that information transmission in the economy is poor, so creditors are unlikely to learn the information $(1-r)$ is low. Taken together, this explains why an underdeveloped system is characterized by hard information and a low probability that creditors will learn the information.

Having described the economic systems based on their information struc-

tures, we now continue to present the sequence of events and decisions. After the manager acquires information, but before the creditor completes his investigation, the manager makes two simultaneous decisions. He decides whether he wants to disclose the information to the creditor and what action to take: commence bankruptcy, liquidate the firm, or continue operations.[5] If the manager decides to disclose the information to the creditor, the creditor becomes fully informed about the true state of the firm. We assume that mandatory disclosure cannot be implemented and that voluntary disclosure is costless.[6] This assumption implies that the manager does not disclose the information when he continues. He discloses the information only in bankruptcy when it increases his payoff.

If the manager commences bankruptcy, the court implements the rules set by the social planner, as described in the next section. We assume that when the firm is liquidated, its assets will be ultimately managed by another manager, and that the new manager will extract the private benefits B.[7] Since managers do not have personal wealth and cannot borrow against B, they cannot bid more than L for the firm. We assume that in the financing stage the option to liquidate the firm on date 1 is never trivial, that is, $\nu_{\min} + \bar{\mu} \geq L \geq \nu_{\max}$.[8]

If the manager chooses to continue, the creditor, after completing his investigation, decides whether he wants to commence bankruptcy or let the firm continue operations. If the creditor commences bankruptcy, the outcome will be according to the bankruptcy law, as described in the next section. If he lets the firm continue operations, the manager estimates the date 2 cash flow to be

$$\tilde{R} = \nu + \mu + \tilde{\varepsilon}. \tag{3}$$

The creditor's estimation of the cash flow is as follows. If either the manager discloses the value of μ to the creditor, or the creditor's investigation succeeds, the creditor estimates the cash flow to be $\tilde{R}$, given by Equation (3). Otherwise the creditor updates his estimation of the cash flow, conditional on the manager not disclosing the information.

Figures 2 and 3 describe the extensive game form for the case of soft information and hard information, respectively. In both games nature moves first by selecting the realizations of ν and μ, and the creditor's investiga-

[5] Note that at this juncture the parties may also renogotiate the debt contract. In an earlier version (available from the authors upon request) we have shown that the renegotiation option is dominated by our proposed bankruptcy law. We therefore did not incorporate workout negotiations into the model.

[6] This assumption is made to emphasize the importance of the manager's private informatin. With disclosure costs, the design problem for the social planner has an additional layer of complexity, because he has to minimize the expected disclosure costs. To simplify the analysis, we chose not to incorporate these costs.

[7] This assumption is made to emphasize the agency problem in the economy. See discussion in note 9.

[8] If instead $\nu_{\max} > L$, the liquidation decision is trivial for all $\nu_{\max} \geq \nu > L$, because it is always optimal to continue operations. Similarly, if $L > \nu_{\min} + \bar{\mu}$, the liquidation decision is trivial for all $L - \bar{\mu} > \nu \geq \nu_{\min}$ because, in this range, it is always optimal to liquidate.

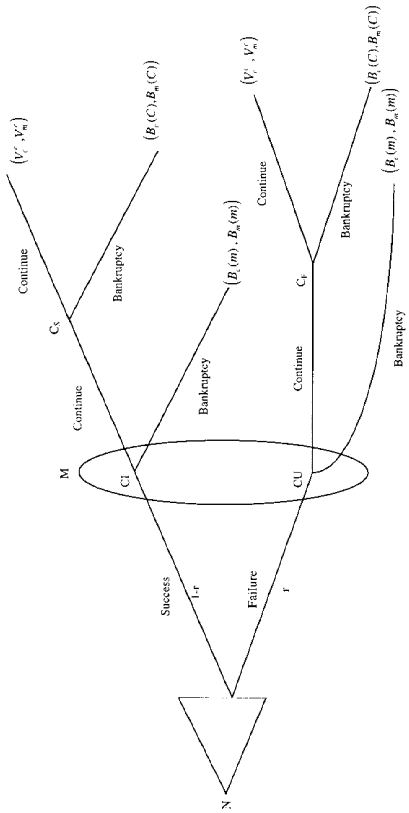

Figure 2
The bankruptcy game — soft information case
The game: Nature moves first by selecting the realization of ν and μ_s and success/failure of the investigation. The manager then moves from his information set M, and chooses to continue or commence bankruptcy. If he chooses to continue, the creditor now moves from his nodes (C_S and C_F) and chooses between continuation and bankruptcy.

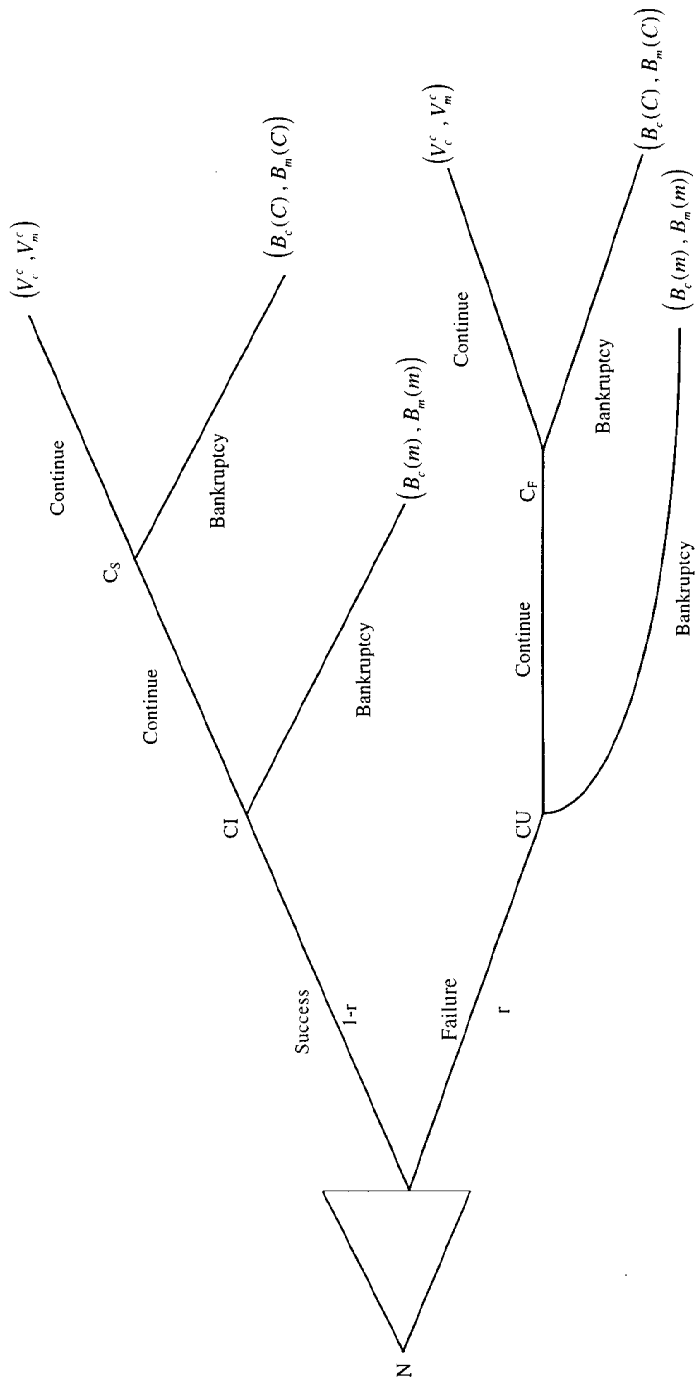

Figure 3
The bankruptcy game — hard information case
The hard information game is very similar to the soft information game of Figure 2 with one change: now the manager moves from the nodes CI or CU, and not from the information set M, because he can predict the outcome of the creditor's investigation.

tion outcome, failure or success. Then the manager moves; in the case of soft information, described by Figure 2, the manager moves from his information set M. In the case of hard information, described by Figure 3, the manager moves from either node CI or node CU. If the manager chooses to continue, the creditor makes his move next by choosing between continuation and bankruptcy. On date 2, the cash flow is realized and distributed to claimholders. We assume that the lowest possible cash flow on date 2 and the liquidation value L are less than the initial investment I. Consequently the debt is risky at the time contracts are written, so $F > I > L$.

2. The First-Best Outcome and the Distortion of Rigid Debt Financing

The definition of efficiency under incomplete information must depend on the information structure and incentives in the economy. We assume that the social planner knows the ex ante distribution of $\tilde{\nu}$, $\tilde{\mu}$, and $\tilde{\varepsilon}$, but not their realizations. He also knows the structure of the game and the incentives of the players. The social planner's objective is to choose a bankruptcy law that will maximize the social value of the firm, SV, given by

$$\begin{aligned} SV \;=\; & \int_{N_R} (I + B)\, dQ(\nu) \\ & + \int_{N_A} \Big[\int_{M_L(\nu,\mu)} (L + B)\, dG(\mu) \\ & \qquad + \int_{M_C(\nu,\mu)} (\nu + \mu + B)\, dG(\mu) \Big] dQ(\nu) \end{aligned} \tag{4}$$

where

$N_R = \{\nu \mid \text{the project is not financed}\}$
$N_A = \{\nu \mid \text{ the project is financed}\}$
$M_L(\nu, \mu) = \{(\nu, \mu) \mid \text{the project is liquidated}\}$
$M_C(\nu, \mu) = \{(\nu, \mu) \mid \text{the project is continued}\}$

When the project is not financed, the alternative use of the investment I is a zero NPV project that will generate private benefits, B. Thus, from the social planner's perspective, rejecting the project results in a social value of $I + B$. This explains the first integral in Equation (4). When the project is financed, the social value depends on the liquidation decision. When the firm is liquidated, the monetary value is L and, since the benefits are realized in the alternative use of the assets, the social value is $L + B$.[9] This

[9] We assume that B accrues to an alternative manager. Technically, our assumption regarding B is that it appears in the social value function, SV, in all possible states of the world, and therefore can be factored out as a constant in Equation (4). Our proposed bankruptcy law is also optimal under the other extreme modeling where the social planner always ignores the private benefits, because the only modification to our analysis would be to reduce the social value function by the constant B. Our proposed bankruptcy law is not necessarily optimal for the case where the social planner accounts for B in some states of the world

is represented by the first integral in the square brackets in Equation (4). When the firm continues, the expected cash flow is $\nu + \mu$, resulting in a social value of $\nu + \mu + B$, as given by the second integral in the square brackets in Equation (4).

The sets N_R, N_A, $M_L(\nu, \mu)$, and $M_C(\nu, \mu)$ are determined by the incentives and information structure in the economy. In general, the social planner's choice of bankruptcy law affects the social value function SV through its effects on the sets N_R, N_A, $M_L(\nu, \mu)$, and $M_C(\nu, \mu)$. Therefore the optimal bankruptcy law will depend on the information structure and the degree of incentive distortions in the economy. Before we turn to characterizing optimal bankruptcy laws for different information structures and incentives, we show the distortion that outside debt financing creates. To do this, we start by characterizing the first-best outcome, where the social planner can choose the sets N_R, N_A, $M_L(\nu, \mu)$, and $M_C(\nu, \mu)$ free of any constraint.

Free of incentives and information constraints, the social planner can choose directly the sets N_R, N_A, $M_L(\nu, \mu)$, and $M_C(\nu, \mu)$ to maximize the social value function SV given by Equation (4). The first-best outcome is obtained when the firm follows the optimal liquidation policy and finances all positive NPV projects. For a given realization of ν and μ, the first-best liquidation policy is to liquidate the firm if the social value in liquidation exceeds the social value under continuation, $L + B > \nu + \mu + B$, and to continue to operate the firm otherwise. Proposition 1 characterizes the first-best liquidation policy.

Proposition 1. *The first-best liquidation policy is given by the following sets:*

$$M_L(\nu, \mu) = \{(\nu, \mu) \mid \nu + \mu \leq L\} \text{ and } M_C(\nu, \mu) = \{(\nu, \mu) \mid \nu + \mu > L\}.$$

Having characterized the first-best liquidation policy, the social planner's optimization problem described by Equation (4) is reduced to

$$\begin{aligned} \max_{\{N_R, N_A\}} SV = & \int_{N_R} (I + B)\, dQ(\nu) \\ & + \int_{N_A} \Big[\int_0^{L-\nu} (L + B)\, dG(\mu) \\ & \qquad + \int_{L-\nu}^{\mu_{\max}} (\nu + \mu + B)\, dG(\mu) \Big] dQ(\nu). \quad (5) \end{aligned}$$

and ignores them in others. For example, if we assumed instead that the benefits were not transferable to an alternative manager in liquidation, then they would be lost in liquidation from a social value perspective too. This alternative assumption would result in additional underinvestment in the financing stage because the creditor cannot recover the nonpecuniary benefits B and thus would not internalize it. For the sake of simplicity, we have chosen to abstract away from these considerations. We believe that in many situations, our assumptions reflect the true situation. In others, especially in piecemeal liquidation, it is likely that some or all of the benefits will be lost.

The first-best financing policy on date 0 is to finance all projects with positive NPV and reject all projects with negative NPV. Proposition 2 establishes that this financing policy can be represented by a critical value ν^u such that the firm finances all projects with $\nu \geq \nu^u$ and rejects all other projects.

Proposition 2. *The first-best financing policy can be represented by a critical value ν^u such that $N_R = [\nu_{\min}, \nu^u)$ and $N_A = [\nu^u, \nu_{\max}]$. The critical value ν^u is given by*

$$\nu^u + \bar{\mu} + \int_0^{L-\nu^u} (L - \nu^u - \mu)\, dG(\mu) = I. \tag{6}$$

The intuition behind Proposition 2 is as follows. Equation (6) defines the critical value of ν such that the monetary value from accepting the project is equal to the monetary value from rejecting it.[10] Therefore the social planner is indifferent between accepting the "marginal project" ν^u and rejecting it. Since Equation (5) is strictly increasing with ν, the social planner increases the SV function by accepting all projects with $\nu \geq \nu^u$ and rejecting all projects with $\nu < \nu^u$.

To demonstrate how debt financing distorts value, we now compare the first-best outcome to the outcome when the claimants must follow the original debt contract. In this case, the manager always continues to operate the firm when the firm should be liquidated. To see why, note that, since $F > L$, the manager's payoff in liquidation is zero. In contrast, in continuation the manager obtains the private benefits B and a nonnegative monetary value S from his stake in the firm, defined by

$$S = \int_{F-\nu-\mu}^{\varepsilon_{\max}} (\nu + \mu + \varepsilon - F)\, dH(\varepsilon). \tag{7}$$

Taken together, the manager always continues because his total value from continuation, $S + B$, is positive and exceeds his zero payoff in liquidation.

This excessive continuation policy adversely affects the ability of the manager to raise funds on date 0. The creditor is willing to provide funds if he and the entrepreneur can agree on a debt contract with face value F and expected value I. The lowest quality (or the marginal) project for which a debt contract with expected value I can be written is $\hat{\nu} = I - \bar{\mu}$. This project has an expected cash flow of $\hat{\nu} + \bar{\mu} = I$. The creditor will finance this project if he receives the entire cash flow from it. This occurs when the face value of debt is higher than or equal to the highest possible realization of the cash flow, $F \geq \nu + \mu_{\max} + \varepsilon_{\max}$. Therefore, when the entrepreneur needs outside financing and the claimants must follow the original debt contract,

[10] Note that B enters Equation (5) as a constant, so the relation between monetary value and social value is unaffected by B.

the project will be financed whenever the realized value of v exceeds $\hat{v}$. Proposition 3 compares projects that will be financed when the claimants must follow the original debt contract to projects that will be financed under the first-best outcome.

Proposition 3. *Debt financing results in underinvestment; $\hat{v} > v^u$ and all positive NPV projects with $v \in (v^u, \hat{v}]$ are rejected.*

When the claimants must follow the original debt contract, the need for outside financing results in two inefficiencies. First, the firm follows an inefficient liquidation policy on date 1. As a result, all projects have a lower expected value. This leads to the second inefficiency, where projects with a small positive NPV under the first-best financing policy are now being rejected. In what follows we characterize a bankruptcy law that alleviates these inefficiencies.

3. Optimal Bankruptcy Law for Informed and Uninformed Creditors Economies

In general, the social planner cannot implement the first-best outcome because the liquidation and financing decisions are made by managers and creditors in the economy. Unlike the first-best case, where the social planner is able to choose the sets N_R, N_A, $M_L(v, \mu)$, and $M_C(v, \mu)$ directly, here he can only affect these sets indirectly through the design of bankruptcy law. We require that the bankruptcy law be implementable by an uninformed bankruptcy court that does not know the realized values of $\tilde{v}$, $\tilde{\mu}$, or $\tilde{\varepsilon}$. We assume that the bankruptcy court is much less informed than the claimants, and has no expertise in evaluating a specific firm. Therefore the claimants cannot disclose their information to the bankruptcy court. The only information observable to the court is who commenced the bankruptcy proceedings. This information structure implies that implementable bankruptcy procedures may only be based on which party commenced bankruptcy and on the monetary transfers between the claimants.

Before we turn to characterizing an optimal bankruptcy law for different economic systems in subsequent sections, we first characterize in this section an optimal bankruptcy law for two polar economies for which the nature of information — soft or hard — is less important: (1) *informed creditors economy* — an economy where creditors always learn the value of μ, $r = 0$; and (2) *uninformed creditors economy* — an economy where creditors never learn the value of μ, $r = 1$. This analysis is useful in developing intuition and in solving for optimal bankruptcy laws for the different economic systems.

In the *informed creditors economy* ($r = 0$) the game is fully described by the upper branch in Figures 2 and 3. In this case the social planner's problem is to maximize the social value function SV by choosing the acceptance

set, rejection set, continuation set, and liquidation set, subject to feasibility constraints and the incentive compatibility constraint for the creditor. Since it is unnecessary to write the complete optimization problem to see that the *creditor mechanism* of Proposition 4 implements the first-best outcome for this economy, we defer the formal presentation of the social planner's problem to the case of the *uninformed creditors economy*.

Proposition 4 (The Creditor Mechanism). *Consider an informed creditors economy* ($r = 0$). *The following creditor mechanism implements the first-best outcome. When the creditor commences bankruptcy:*[11]

(1) The court allows the manager to make a take-it-or-leave-it offer to the creditor.

(2) If the creditor rejects the offer, the court liquidates the firm and pays the proceeds from liquidation, L, to the creditor.

(3) If the creditor accepts the offer, it becomes the new debt contract.

The intuition behind Proposition 4 is that the creditor mechanism, by forcing liquidation whenever the creditor rejects an offer from the manager, guarantees that the creditor will receive the entire liquidation value when the firm is liquidated. By allowing the manager to submit a take-it-or-leave-it offer, the creditor mechanism prevents the creditor from profiting by strategically commencing bankruptcy when he learns that the firm is about to continue efficiently. Thus this mechanism enables an uninformed court to implement the first-best outcome by simultaneously giving the creditor the highest cash flow possible when the firm is liquidated and giving the manager just enough power to prevent any attempt by the creditor to strategically use the creditor mechanism. This creditor mechanism provides the creditor with the highest possible payout in bankruptcy, thereby implying that all positive NPV projects that are financed under the first-best investment rule are financed under the creditor mechanism.

Consider now the *uninformed creditors economy* ($r = 1$). In this case, only the manager knows if the firm should be liquidated. The manager will disclose to the creditor the information that the firm should be liquidated only if he gets in liquidation at least what he can obtain when the firm continues. This information rent to the manager distorts the financing and liquidation decisions. Thus the first-best outcome cannot be obtained.

The second-best outcome for the uninformed creditors economy is obtained by maximizing the social value function SV of Equation (4) subject to feasibility and information constraints as follows:

$$\max_{\{N_A, N_R, M_L(\nu,\mu), M_C(\nu,\mu), B_C(m), B_m(m)\}} SV \tag{8}$$

[11] The creditor mechanism does not specify what happens if the manager commences bankruptcy. In an informed creditors economy this mechanism is also optimal when the manager commences bankruptcy.

subject to

$$B_m(m) \geq B + S \qquad \text{for every } (\nu, \mu) \in M_L \tag{9}$$

$$V_C^L + V_m^L \leq L \tag{10}$$

$$V_C^C + V_m^C \leq \nu + \mu + B \tag{11}$$

$$\int_{M_L} V_C^L \, dG(\mu) + \int_{M_C} V_C^C \, dG(\mu) \geq I \qquad \text{for every } \nu \in N_A \tag{12}$$

where

$B_m(m)$ = the payoff assigned to the manager in bankruptcy when the manager commences bankruptcy,
V_m^L = the payoff to the manager if the firm is liquidated,
V_m^C = the payoff to the manager if the firm continues,
V_C^L = the payoff to the creditor if the firm is liquidated, and
V_C^C = the payoff to the creditor if the firm continues.

Equation (9) is the incentive compatibility constraint for the manager to commence bankruptcy and liquidate the firm. It states that when the manager commences bankruptcy, his payoff, $B_m(m)$, is at least as high as his payoff if he chooses to continue, $B + S$. Note that we use here the result that the manager liquidates only in bankruptcy. Equations (10) and (11) are feasibility constraints; they state that the total values for the creditor and the manager in liquidation and continuation are feasible. Finally, Equation (12) is the individual rationality constraint for the creditor to finance the project up front. It states that for a project to be financed, the expected payoff to the creditor is not less than the initial investment.

Equations (9)–(12) were derived from the game described in Figures 2 and 3. The uninformed creditors economy is the game described in these figures, where the probability of failure $r = 1$. Equation (9) implies that, in equilibrium, the manager commences bankruptcy in the states where liquidation is optimal. Equations (10) and (11) are feasibility constraints on the total payoffs. Equation (12) implies that, for the acceptance region, it is an equilibrium action for the creditor to finance the projects.

Having described the constrained maximization problem, Lemma 1 characterizes the second-best outcome for the uninformed creditors economy.

Lemma 1. *Consider an uninformed creditors economy* ($r = 1$). *The second-best outcome is as follows:*

(a) There exists $X^* \in (L - B, L)$ *such that the liquidation set is* $M_L(\nu, \mu) = \{(\nu, \mu) \mid \nu + \mu < X^*\}$ *and the continuation set is* $M_C(\nu, \mu) = \{(\nu, \mu) \mid \nu + \mu \geq X^*\}$.

(b) The financing policy can be represented by a critical value ν^* *such that* $N_R = [\nu_{\min}, \nu^*)$ *and* $N_A = [\nu^*, \nu_{\max}]$. *The critical value* ν^* *is given by*

$$\nu^* + \bar{\mu} + \int_0^{X^*-\nu^*} (L - B - \nu^* - \mu)\, dG(\mu) = I. \tag{13}$$

A bankruptcy law implements the second-best outcome if it can induce managers, at a minimum cost, to commence bankruptcy whenever the firm should be liquidated. Proposition 5 describes a bankruptcy mechanism — *the debtor mechanism* — that implements the second-best outcome of Lemma 1 for the case of an uninformed creditors economy.

Proposition 5 (The Debtor Mechanism). *Consider an uninformed creditors economy* ($r = 1$). *The following debtor mechanism implements the second-best outcome of Lemma 1. When the manager commences bankruptcy:*

(1) The court allows the creditor to make a take-it-or-leave-it offer to the manager.

(2) If the manager accepts the offer, it becomes the new debt contract.

(3) If the manager rejects the offer, the firm continues under the original debt contract and the creditor has to pay to court a penalty of $P^* = X^* + B - L$.

The intuition behind Proposition 5 is that the mechanism, by forcing continuation under the original debt contract whenever the manager rejects an offer made by the creditor, guarantees that the manager will get his value from continuation when he discloses that the firm is about to continue inefficiently. This gives the manager an incentive to prevent inefficient continuation. The mechanism maximizes the debt capacity by allowing the creditor to submit a take-it-or-leave-it offer, thereby giving him the highest payoff possible. Allowing this also prevents the manager from strategically commencing bankruptcy when he knows that the firm is about to continue efficiently. Finally, the penalty that the court imposes on the creditor whenever the manager rejects his offer gives the creditor an incentive to submit an acceptable liquidation offer to the manager whenever the firm should be liquidated. It is necessary to assess a penalty because whenever $L - B < \nu + \mu < X^*$, the creditor prefers continuing inefficiently to bribing the manager in liquidation. With the penalty it does not pay for the creditor to make an unacceptable offer to the manager. Note that, in equilibrium, the penalty is never imposed because the threat of the penalty induces the creditor to submit an acceptable offer in this region.

The debtor mechanism and the creditor mechanism are optimal in the two polar economies discussed above. In the next three sections we show that these mechanisms are also part of optimal bankruptcy laws for all other economies.

4. Optimal Bankruptcy Law for a Market-Based System: The Randomized Dual Chapter Code

In this section we characterize an optimal bankruptcy law for a market-based system, which is characterized by soft information. Figure 2 describes the game for this case. As can be seen from the manager's information set M in Figure 2, the manager has to decide whether he wants to continue or commence bankruptcy before he knows the outcome of the creditor's investigation. The maximization problem for the social planner is similar to the one described in Equations (8)–(12). The main difference is that now the manager moves from an information set which is not a singleton. This affects the incentive compatibility constraint for the manager, Equation (9).

To see the effects on Equation (9), note that the manager commences bankruptcy whenever his payoff in bankruptcy exceeds his expected payoff from continuation. The manager's expected payoff from continuation consists of his continuation value when the creditor's investigation fails, with probability r, and his continuation value when the investigation succeeds, with probability $1 - r$. When the manager continues and the creditor's investigation fails, it is optimal for the creditor to let the firm continue, and the payoffs are determined by the original debt contract. When the manager continues and the creditor's investigation succeeds, the game proceeds in the same manner as the informed creditors economy. Following the same reasoning as in the case of the informed creditors economy, it is optimal to assign the entire cash flow to the creditor and nothing to the manager in the liquidation set. Therefore the second-best outcome is characterized by maximizing SV given in Equation (8) subject to Equations (10)–(12) and Equation (14):

$$B_m(m) \geq r(B + S) \qquad \text{for every } (\nu, \mu) \in M_L. \tag{14}$$

Note that Equation (14) is the new incentive compatibility constraint for the manager; it replaces Equation (9). Lemma 2 characterizes the second-best outcome for the case of soft information.

Lemma 2. *The second-best outcome for the case of soft information is as follows:*

(a) There exists $X_s \in (L - rB, L)$ *such that the liquidation set is* $M_L(\nu, \mu) = \{(\nu, \mu) \mid \nu + \mu < X_s\}$ *and the continuation set is* $M_C(\nu, \mu) = \{(\nu, \mu) \mid \nu + \mu \geq X_s\}$.

(b) The financing policy can be represented by a critical value ν^* *such that* $N_R = [\nu_{\min}, \nu^*)$ *and* $N_A = [\nu^*, \nu_{\max}]$. *The critical value* ν^* *is given by*

$$\nu^* + \bar{\mu} + \int_0^{X_s - \nu^*} (L - rB - \nu^* - \mu)\, dG(\mu) = I. \tag{15}$$

Note that the only difference between Lemma 2 and Lemma 1 is that rB in Lemma 2 replaces B in Lemma 1. This is so because Equation (14) results in a lower information rent of rB for the manager, while Equation (9) provides for a minimum of B for the manager.

Since soft information is related to a market-based system, we now use Lemma 2 to present a bankruptcy law — the randomized dual chapter code — that implements the second-best outcome in a market-based system.

Proposition 6 (Optimal Bankruptcy Law for a Market-Based System). *The following randomized dual chapter code implements the second-best outcome for a market-based system. It consists of both a creditor chapter and a debtor chapter as follows:*

> **A creditor chapter**. *If the creditor commences bankruptcy, the court uses the creditor mechanism of Proposition 4.*
> **A debtor chapter**. *If the manager commences bankruptcy, the court uses the following randomized mechanism:*
> *(1) It implements the creditor mechanism of Proposition 4 with probability* $(1 - r)$.
> *(2) It implements the debtor mechanism of Proposition 5 with probability* r*, where the penalty to the creditor if the manager rejects his offer is* $P_s = X_s + rB - L$.

The randomized dual chapter code is optimal because it selectively utilizes the creditor's information, yet it provides the manager with the appropriate incentives to liquidate the firm efficiently when the creditor does not discover the information. Specifically the creditor chapter of the proposed law provides the creditor with the most efficient way to utilize his information without abusing it. The debtor chapter of the proposed law induces the manager to commence bankruptcy when he has the incentive to continue inefficiently, by giving him his expected value from continuation.

5. Optimal Bankruptcy Law for a Bank-Based System: The Single Chapter Code

A bank-based system is characterized by hard information and a high probability that the creditor investigation succeeds. When information is hard, the randomized dual chapter code is inefficient because the ability of the manager to predict the outcome of the creditor's investigation gives him a very important strategic advantage. Under the randomized dual chapter code, when the manager learns that the creditor's investigation will fail, he does not commence bankruptcy, and continues to operate the firm inefficiently. When the manager learns that the investigation will succeed, he commences bankruptcy and receives a higher payoff than he would receive if he waited for the creditor to commence bankruptcy.

Figure 3 implies that when the social planner designs the bankruptcy law, he has to consider the incentives of the manager for each of the manager's two decision nodes, CI and CU. If the manager is at node CU, he commences bankruptcy whenever his bankruptcy payoff exceeds his payoff from continuation under the original debt contract. Therefore the incentive compatibility constraint for the manager to commence bankruptcy at node CU is

$$B_m(m) \geq B + S \qquad \text{for every } (\nu, \mu) \in M_L. \tag{16}$$

If the manager is at node CI, he commences bankruptcy whenever his bankruptcy payoff exceeds his payoff from continuing. As we saw in the case of the informed creditors economy, efficient liquidation by an informed creditor is obtained by giving L to the creditor and zero to the manager whenever the creditor files for bankruptcy. Therefore the incentive compatibility constraint for the manager to commence bankruptcy at node CI is

$$B_m(m) \geq 0 \qquad \text{for every } (\nu, \mu) \in M_L. \tag{17}$$

When the social planner designs the bankruptcy law, he does not know whether the manager will end up at node CI or CU. Thus the social planner has to choose between imposing Equation (16) in both nodes, thereby paying the manager too much at node CI, or imposing Equation (17) in both nodes, resulting in excessive continuation in node CI. The choice of the social planner depends on r and B, because they determine the costs and benefits of each alternative. Lemma 3 formalizes this discussion.

Lemma 3. *The second-best outcome of the hard information case is as follows:*

(a) There exists a B^* such that, for all $B > B^*$, the liquidation and continuation sets are the first-best sets when the creditor's investigation succeeds, and no liquidation occurs when the creditor's investigation fails. The resulting financing rule is given by

$$\nu^* + \bar{\mu} + (1 - r) \int_0^{L-\nu^*} (L - \nu^* - \mu)\, dG(\mu) = I. \tag{18}$$

(b) For every $B \in [0, B^*)$, there exists $r^*(B)$ such that, whenever $r > r^*(B)$, the liquidation and continuation sets and the financing rule are the same as in the uninformed creditors economy, described in Lemma 1.

(c) If $r < r^*(B)$, the continuation and liquidation sets and the financing rule are as in part (a) of this lemma.

(d) $r^*(B)$ increases with B, and $r^*(B) \to 1$ as $B \to B^*$.

A bank-based system is characterized by hard information and a high probability that the creditor discovers the information, consistent with part

(c) of Lemma 3. We now present a bankruptcy law — the single chapter code — that implements this second-best outcome for a bank-based system.

Proposition 7 (Optimal Bankruptcy Law for a Bank-Based System). *The second-best outcome for a bank-based system [characterized by hard information and $r < r^*(B)$] is implemented by a single chapter code consisting of the creditor mechanism of Proposition 4.*

The single chapter code is optimal because, given the high likelihood that the creditor learns the information, it is not worthwhile paying the manager information rents to make him reveal his information.

6. Optimal Bankruptcy Law for an Underdeveloped System: The Deterministic Dual Chapter Code

An underdeveloped economy is characterized by hard information and a low probability that the creditor learns the information. In this case the second-best outcome is given by part (b) of Lemma 3. We now present a bankruptcy law — the deterministic dual chapter code — that implements the second-best outcome in an underdeveloped system.

Proposition 8 (Optimal Bankruptcy Law for an Underdeveloped System). *The following deterministic dual chapter code implements the second-best outcome for an underdeveloped system [characterized by hard information and $r > r^*(B)$]. It consists of both a creditor chapter and a debtor chapter as follows:*

> **A creditor chapter**. *If the creditor commences bankruptcy, the court uses the creditor mechanism of Proposition 4.*
> **A debtor chapter**. *If the manager commences bankruptcy, the court uses the debtor mechanism of Proposition 5 .*

Unlike a bank-based system where creditors discover the information with high probability, in an underdeveloped system creditors are less likely to learn the information and therefore the information possessed by managers is more valuable. Thus it pays to enable the manager to take advantage of his information by allowing him an access to a debtor chapter. This is so as the cost of the manager's strategic advantage, in cases where the creditors have learned the information, is low compared with the advantage of using the manager's information. Recall also that unlike the case of a market-based economy, randomization is not efficient here, because the manager has a strategic advantage.

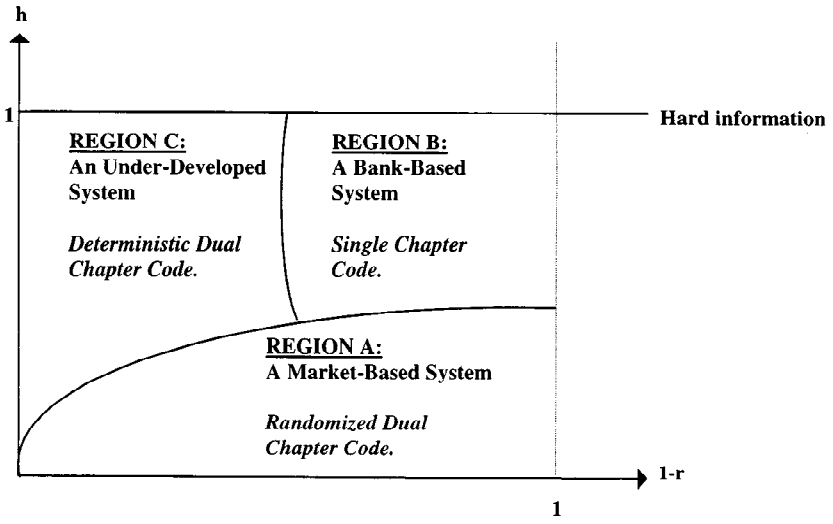

Figure 4
Information structure, economic systems, and optimal bankruptcy laws
This figure describes the relations between information structure and economic systems. The variable h represents the degree of hard information in the economy. Hard information corresponds to $h = 1$, and soft information is represented by $h = 0$. The variable $(1 - r)$ represents the quality of information in the economy. Region A contains countries with a market-based system, characterized by soft information. The optimal bankruptcy code is the *randomized dual bankruptcy code*. Region B contains countries with a bank-based system, characterized by hard information and high quality of information [a high h and a high $(1 - r)$]. The optimal bankruptcy code is the *single bankruptcy code*. Finally, Region C contains countries with an underdeveloped system, characterized by hard information and a poor quality of information [a high h and a low $(1 - r)$]. The optimal bankruptcy code is the *deterministic dual bankruptcy code*.

7. How Our Proposed Bankruptcy Laws Relate to Observed Laws

We have characterized optimal bankruptcy laws for three extreme economic systems, a market-based system, a bank-based system, and an underdeveloped system. The systems of most countries, however, fall in between these extremes. For example, developed countries like Japan, France, Canada, and the United Kingdom combine elements of both bank-based and market-based systems. This implies that the information structure in most countries is a mixture of hard and soft information. We incorporate these possibilities by assuming that the information is hard with probability h and soft with probability $1 - h$. The probability h may be determined by the relative weights of bank financing and arm's length financing in the economy. The analysis so far has been a special case of this structure, where soft information corresponds to $h = 0$ and hard information corresponds to $h = 1$. As h increases from 0 to 1, the economy moves from soft information toward hard information. Figure 4 describes the optimal bankruptcy law as a function of h and $(1 - r)$.

Developed countries that are market-based oriented are positioned in region A of Figure 4. Likewise, developed countries that are bank-based oriented are positioned in region B of Figure 4. As their economic system changes over time, developed countries may move between these two regions. For example, Japan and France traditionally had bank-based systems, but the importance of their rapidly developing financial markets is increasing [see Allen and Gale (1995)]. Therefore our model predicts that the optimal bankruptcy law for these countries should eventually change from the single chapter code to the randomized dual chapter code.

Underdeveloped countries are located in region C of Figure 4; they have inefficient information acquisition technologies [low $(1 - r)$] and the information tends to be hard. An imminent outcome of their future economic development will be an improvement of their information acquisition technologies, resulting in a higher $(1 - r)$. Therefore their economic transition will lead them to either region A or region B, according to their development path. If they develop toward a bank-based system, as in Germany, their optimal bankruptcy law will eventually be the single chapter code. If they develop toward a market-based economy, their optimal bankruptcy law will be the randomized dual chapter code.

It seems natural to assess the validity of our theory by matching its recommendations to the observed bankruptcy laws in various countries. Before we attempt to do so, we should note two things. First, unlike the case of for-profit corporations, where it is reasonable to expect that on average optimal actions will be followed, it is less obvious that political systems that are subject to constant pressures from different interest groups will be quick to take actions that maximize social welfare. Second, in this article we suggest specific mechanisms that implement the optimal bankruptcy outcome, though it is possible that there are others. For example, in a market-based system, any bankruptcy procedure that gives the debtor a payoff in the debtor chapter that is equal to his expected payoff from continuation can be part of a bankruptcy law that implements the second-best outcome. Therefore it is useful to compare only the general aspects of existing bankruptcy laws to the recommendations of our theory, including who is entitled to commence bankruptcy, who maintains control in bankruptcy, and whether there is any violation of APR in bankruptcy.[12]

Rajan and Zingales (1995) provide a summary of various aspects of different bankruptcy laws of the G-7 countries. It is interesting to note that, consistent with our theory, virtually all of the G-7 countries have a creditor chapter whereby the creditor can file for bankruptcy, the debtor loses control, the firm is liquidated by a third party, and the proceeds are

[12] In the context of our article, the stated purpose of the bankruptcy law, liquidation or reorganization, is bound to be less informative because our theory is not concerned with this issue.

paid to claimants according to APR. The bankruptcy code of some of the G-7 countries, such as France and Italy, as well as that of non-G-7 countries, such as Israel and Sweden, consists of a creditor chapter only. Other G-7 countries with more developed financial markets, such as Canada, Japan, the United Kingdom, and the United States, also have a debtor chapter whereby the debtor files for bankruptcy and remains in control during the bankruptcy proceedings.[13] The empirical regularities in the United States, that APR is maintained in Chapter 7 and is violated in Chapter 11, appear to be consistent with our theory, provided that Chapter 7 and Chapter 11 represent our creditor chapter and debtor chapter, respectively. Lawmakers in a number of countries, including Israel and the United Kingdom, are either currently debating adding a debtor chapter to their single chapter bankruptcy codes or have done so recently.[14] To the extent that their capital markets have been developing in recent years, this is consistent with our theory.

8. Discussion and Conclusions

We have characterized economic systems by a two-dimensional information structure: information about fundamentals and strategic information. The information about fundamentals is the key aspect of the difference between developed countries and underdeveloped countries. Creditors in underdeveloped countries have little or no information about fundamentals, whereas creditors in developed countries may have a considerable amount of information at their disposal. Strategic information is the key aspect of the difference between the two types of economic systems in developed countries; a market-based system has soft information and a bank-based system has hard information.

We have identified three optimal bankruptcy laws for the three economic systems. All three use the creditor mechanism, whereby the firm is liquidated and the APR is maintained. Two of the three also use the debtor mechanism, which favors managers and results in violations of the APR. Violating the APR is designed to motivate managers to reveal their private information when the firm is economically not viable, and may be viewed as "information rent" that is paid to managers for their information. Our explicit modeling of strategic information enables us to identify the conditions under which having a bankruptcy chapter that biases the outcome toward the debtor is justified.

We have focused on debt financing because our goal was to propose optimal bankruptcy laws. Nevertheless, the problem that we tackled here

[13] The case of Germany is less obvious. In Germany, both creditors and debtors can file for liquidation and only the debtor can file for reorganization. However, in both cases a receiver is appointed to manage the firm. Thus it is unclear how effective is the debtor chapter in protecting the debtor's interests.

[14] See Franks and Nyborg (1996) for a discussion of recent changes in UK bankruptcy law.

is considerably more general in nature, and relates to optimal monitoring, incentives, and securities design. Debt contract is optimal under costly state verification of the residual uncertainty parameter ε, as in Townsend (1979). It is possible that with different assumptions regarding observability and contractibility, other financing contracts will do the same or better than debt contract. It is also possible that the type of mechanisms that are optimal for a creditor-debtor relationship are also useful in a general monitoring problem of managers by outside owners. These are very important, and perhaps more fundamental issues, that we leave for future research.

Our theory recommends different bankruptcy laws for different economic systems, based on their information structures. Nevertheless, the theoretical constructs of this article can also be used to differentiate between different firms. Under this interpretation, our analysis may suggest that it would be optimal to enact different bankruptcy laws for different firms. For example, one can think of start-up firms as being relatively difficult to monitor, because it is not simple to understand the nature of nontangible assets and business potential, especially if it involves intensive R&D, and as having hard information, since they tend to have close relationships with their providers of venture capital. Consequently start-up firms are likely to belong to region C of Figure 4, for which the deterministic dual chapter code is optimal. Similarly, more mature firms in a market-based system are easier to monitor and are likely to belong to region A of Figure 4, for which the randomized dual chapter code is optimal.

Our bankruptcy mechanism does not require external "triggering" such as default on debt payments or violation of bond covenants. It implements the optimal outcome unconditionally. In this respect, our proposed bankruptcy laws seem to have an advantage over existing laws, where bankruptcy is conditioned on some triggering clauses. It is reasonable to conjecture that with added frictions, like disclosure costs, direct bankruptcy costs, and monitoring costs, triggering mechanisms such as default on debt payments or violations of bond covenants will contribute to efficiency and will be part of optimal contracts or optimal bankruptcy law. For example, if either the creditor's investigation or bankruptcy procedures are costly, it is likely that conditioning bankruptcy filing on default will be optimal, as in Harris and Raviv (1990).

Our model simplifies the complicated problem of designing bankruptcy laws and cannot possibly address all the issues of creditor-debtor relationships or capture all aspects of differences between economic systems. For example, we took the information structures of different economic systems as given and then derived optimal bankruptcy laws for these systems. In doing so we did not consider the determinants of economic systems and how different bankruptcy laws will in turn affect future behavior of agents in these economies. We recognize both the limitations of this approach and the difficulties in resolving these issues. Allen and Gale (1995) discuss the

difficulties associated with trying to understand how economic systems are formed: "It is not clear what circumstances explain the adoption of such different financial systems in different countries. Perhaps this is a case where history matters." We think that history matters, but the structure of economic systems is also reacting to economic motives, perhaps very slowly. Therefore we believe that it is important to study existing economic systems to gain additional insights that will lead us to a more coherent theory that explains financial markets, financial structure, and corporate control issues across different countries and cultures. This article is just such an effort.

Appendix

Proof of Proposition 1. Suppose $\nu + \mu \leq L$. In this case, the social value in liquidation, $L + B$, exceeds the continuation value $\nu + \mu + B$, so liquidation is optimal. Similarly, when $\nu + \mu > L$, it is optimal to continue. ■

Proof of Proposition 2. The first two terms on the left-hand side of Equation (6) represent the expected cash flow when the firm always continues, and the integral is the additional value from following the first-best liquidation policy. Equation (6) states that the full-information NPV of the project when $\nu = \nu^u$ is zero. Because the NPV is monotonically increasing in ν, the project has a positive NPV whenever $\nu > \nu^u$ and a negative NPV whenever $\nu^u > \nu$. ■

Proof of Proposition 3. Suppose on the contrary that $\hat{\nu} \leq \nu^u$. Substituting $\hat{\nu} + \bar{\mu}$ for I in the right-hand side of Equation (6) and rearranging terms we get

$$\int_0^{L-\nu^u} (L - \nu^u - \mu)\, dG(\mu) = \hat{\nu} - \nu^u. \tag{A1}$$

The left-hand side of Equation (A1) is strictly positive. By our supposition, the right-hand side of Equation (A1) is less than or equal to zero, a contradiction. Thus, $\hat{\nu} > \nu^u$. By the definition of ν^u, all projects with $\nu > \nu^u$ have a positive NPV, but by the definition of $\hat{\nu}$, those with $\nu < \hat{\nu}$ cannot be financed. ■

Proof of Proposition 4. Suppose $r = 0$. If $\nu + \mu < L$, the manager cannot make an acceptable offer to the creditor such that the firm will continue and the manager will obtain a positive payoff. Therefore the creditor commences bankruptcy, the firm is liquidated, and the creditor receives the entire proceeds from liquidation.

If $\nu + \mu > L$ and the creditor commences bankruptcy, the manager offers a new debt contract with expected value L. The creditor accepts the offer because he cannot obtain more by rejecting it and receiving the proceeds from liquidation. Thus the firm continues. If the creditor does not commence bankruptcy, the firm also continues. Taken together, the liquidation and continuation sets are identical to the sets in the first-best outcome, $M_L(\nu, \mu) = \{(\nu, \mu) \mid \nu + \mu \leq L\}$ and $M_C(\nu, \mu) = \{(\nu, \mu) \mid \nu + \mu > L\}$.

The highest expected cash flow the creditor can obtain from the project is when $F = \nu + \mu_{\max} + \varepsilon_{\max}$, in which case he gets the entire cash flow. Because the firm follows the first-best liquidation policy, the highest expected cash flow the creditor can

obtain is

$$\nu + \bar{\mu} + \int_0^{L-\nu} (L - \nu - \mu)\, dG(\mu). \tag{A2}$$

Equating the expression in Equation (A2) to I defines the marginal project that will be financed. A comparison to Equation (6) reveals that the marginal project is ν^u, as in the first-best outcome. ■

Proof of Lemma 1.

(a) To show that there exists $X^* \in (L - B, L)$ such that liquidation is optimal if $\nu + \mu < X^*$ and continuation is optimal otherwise, the following two observations are useful.

(1) Continuation is optimal for all ν and μ such that $\nu + \mu > L$, because social value in continuation is larger and the creditor can get more in continuation than the maximum he can get in liquidation.

(2) Liquidation is optimal for all ν and μ such that $\nu + \mu < L - B$, because in this region liquidation yields a higher social value and the maximum payoff that the creditor can get in liquidation, $L - B - S$, exceeds his payoff in continuation, $\nu + \mu - S$.

For all other values of ν and μ such that $\nu + \mu \in (L - B, L)$, the following trade-off exists: liquidation increases social value ex post, $L > \nu + \mu$, but decreases the payoff to the creditor, $\nu + \mu - S > L - B - S$. This reduces the debt capacity ex ante. This trade-off determines X^*, as we show below.

The social value function depends on X^* in the following way:

$$\begin{aligned} SV \;=\; & \int_{\nu_{\min}}^{\nu^*} (I + B)\, dQ(\nu) \\ & + \int_{\nu^*}^{\nu_{\max}} \Big[\int_0^{X^*-\nu} (L + B)\, dG(\mu) \\ & \qquad + \int_{X^*-\nu}^{\mu_{\max}} (\nu + \mu + B)\, dG(\mu) \Big]\, dQ(\nu), \end{aligned} \tag{A3}$$

where ν^* is defined by

$$\nu^* + \bar{\mu} + \int_0^{X^*-\nu^*} (L - B - \nu^* - \mu)\, dG(\mu) = I. \tag{A4}$$

The derivative of Equation (A3) with respect to X^* is

$$\begin{aligned} \frac{\partial SV}{\partial X^*} \;=\; & \int_{\nu^*}^{\nu_{\max}} (L - X^*) g(X^* - \nu)\, dQ(\nu) \\ & + \nu^{*\prime} q(\nu^*) \Big(I - \Big[\int_0^{X^*-\nu^*} (L + B)\, dG(\mu) \\ & \qquad + \int_{X^*-\nu^*}^{\mu_{\max}} (\nu^* + \mu + B)\, dG(\mu) \Big] \Big) \end{aligned} \tag{A5}$$

where

$$\nu^{*\prime} = \frac{\partial \nu^*}{\partial X^*} = -\frac{(L - B - X^*)g(X^* - \nu^*)}{1 - G(X^* - \nu^*) - (L - B - X^*)}. \tag{A6}$$

At the point $X^* = L$, the first integral in Equation (A5) is zero. From Equation (A6), at $X^* = L$, $\nu^{*\prime}$ is positive. Thus the term in the brackets in Equation (A5) is reduced to

$$-B - \int_0^{L-\nu^*} B\, dG(\mu) < 0. \tag{A7}$$

Therefore, at the point $X^* = L$, SV decreases with X^*.

Similarly Equation (A6) implies that, at the point $X^* = L - B$, $\nu^{*\prime} = 0$. Consequently Equation (A5) is reduced to the first integral, which is positive, implying that SV increases with X^* at $L - B$. By continuity and monotonicity, there exists X^* that satisfies the lemma.

(b) To obtain Equation (13), equate in Equation (A3) the project's expected cash flow under the liquidation rule X^* to I. ■

Proof of Proposition 5. First note that the manager discloses the information if he commences bankruptcy. This is because if the manager does not disclose the value of μ, the creditor believes that $\mu = \mu_{\max}$, offers zero to the manager, and the manager rejects the offer and continues. Therefore, since disclosure is costless, it is optimal for the manager to disclose the information to the creditor if he commences bankruptcy.

The following strategies constitute a Nash equilibrium in the uninformed creditors economy, given the debtor mechanism of Proposition 5:

(i) The manager commences bankruptcy whenever $\nu + \mu < X^*$ and continues otherwise. If he commences bankruptcy, he accepts any offer made by the creditor that liquidates the firm and gives the manager at least $B + S$.

(ii) The creditor submits a liquidation offer with payoff $B + S$ to the manager in bankruptcy if $\nu + \mu < X^*$. Otherwise, he submits an unacceptable offer to the manager.

To show that the above strategies constitute a Nash equilibrium, note that the manager cannot do better by deviating to another strategy, because he gets his continuation value in bankruptcy only when $\nu + \mu < X^*$. The creditor cannot benefit by deviating either. If he makes an unacceptable offer to the manager, the manager continues, and the creditor receives $\nu + \mu - S - P^* = \nu + \mu - S - (X^* + B - L)$. This payoff is smaller than the creditor's payoff from liquidation, L - B - S, for the region $\nu + \mu < X^*$.

Finally, these strategies implement the second-best outcome. The liquidation and continuation regions are the same as in Lemma 1, and the payoff in liquidation yields the minimum payoff to the manager, so that debt capacity is as described by Equation (13). ■

Proof of Lemma 2. Note that when $B_m(m) > rB$, it is optimal for the manager to commence bankruptcy and liquidate the firm in the liquidation states. Thus the proof is identical to the proof of Lemma 1 where rB replaces B. ■

Proof of Proposition 6. The following strategies constitute a Nash equilibrium under the proposed bankruptcy law:

(i) The manager commences bankruptcy from his information set whenever $\nu + \mu < X_s$, and continues otherwise. If in bankruptcy the creditor mechanism is played, he uses

the strategies as in the creditor mechanism. If the debtor mechanism is played, he uses the strategies as in the debtor mechanism, where rB replaces B.

(ii) When the manager commences bankruptcy, the creditor uses his strategies as in the creditor and the debtor mechanisms, respectively, according to the mechanism being selected, where rB replaces B. If the manager does not commence bankruptcy and the creditor learns that liquidation is optimal, that is, $v + \mu < L$ (this is an off-equilibrium outcome), he commences bankruptcy, and the game evolves according to the creditor mechanism.

These strategies constitute an equilibrium because the manager cannot improve his payoff by continuing in the liquidation region. His continuation value is $r(B + S)$, and this is his expected value from bankruptcy under the proposed mechanism. The off-equilibrium action of the creditor to commence bankruptcy is optimal.

The above equilibrium implements the second-best liquidation policy while giving the manager the minimum payoff in liquidation. This implements the second-best financing, in a similar fashion to Proposition 5. ■

Proof of Lemma 3. Suppose the social planner imposes Equation (16). Then the manager commences bankruptcy from both nodes CI and CU and the outcome is as in the uninformed creditors economy. Thus the social value function is given by

$$\begin{aligned} SV \;=\; & \int_{v_{\min}}^{v^*} (I + B)\, dQ(v) \\ & + \int_{v^*}^{v_{\max}} \Big[\int_0^{X^* - v} (L + B)\, dG(\mu) \\ & \qquad + \int_{X^* - v}^{\mu_{\max}} (v + \mu + B)\, dG(\mu) \Big] dQ(v), \end{aligned} \tag{A8}$$

where

$$v^* + \bar{\mu} + \int_0^{X^* - v^*} (L - B - v^* - \mu)\, dG(\mu) = I. \tag{A9}$$

Suppose the social planner imposes Equation (17). Then the manager continues and the outcome of the game is the same as that when the manager continues in the soft information case; with probability r the creditor is uninformed and the firm continues, and with probability $1 - r$, liquidation is according to the first-best rule. The resulting financing rule is given by

$$v^* + \bar{\mu} + (1 - r) \int_0^{L - v^*} (L - v^* - \mu)\, dG(\mu) = I. \tag{A10}$$

The social value function is now

$$\begin{aligned} SV \;=\; & \int_{v_{\min}}^{v^*} (I + B)\, dQ(v) \\ & + \int_{v^*}^{v_{\max}} \Big[(1 - r) \Big(\int_0^{L - v} (L + B)\, dG(\mu) \end{aligned}$$

$$+\int_{L-\nu}^{\mu_{\max}}(\nu+\mu+B)\,dG(\mu)\Big)$$

$$+r\,(\nu+\bar{\mu}+B)\Big]\,dQ(\nu). \qquad \text{(A11)}$$

From Equation (A9) it can be seen that, for large enough B, the liquidation option when the manager reveals the information is negative, and for $B = 0$ it is positive (the first-best liquidation policy). Thus there exists $B^* > 0$ such that for every $B > B^*$, inducing the manager to reveal information reduces SV, and Equation (A11) dominates Equation (A8). This proves part (a). Now, suppose $B < B^*$. At $r = 0$, Equations (A10) and Equation (A11) imply that imposing Equation (17) implements the first-best outcome. Thus, the social value in Equation (A11) is higher than Equation (A8). When $r = 1$, imposing Equation (17) reduces the second integral in Equation (A11) to $\nu + \bar{\mu}$, without the added value from optimally exercising the liquidation option. Thus it is smaller than Equation (A8). Since Equation (A11) decreases with r while Equation (A8) is independent of r, there exists r^* such that, implementing Equation (16) is optimal for $r > r^*$, and imposing Equation (17) is optimal for $r < r^*$. Finally, since B can be factored out as a constant in both Equation (A8) and Equation (A11), the only effect of B on SV is through its effect on the financing rules given in Equations (A9) and (A10). Noting that Equation (A10) is independent of B, we obtain that ν^* does not affect SV in Equation (A11). In contrast, ν^* reduces SV in Equation (A8) since, from Equation (A9), it increases with B (this is because increases in B reduce the ability to finance positive NPV projects). Thus r^* increases with B. By definition of B^*, $r^*(B^*) \to 1$, as $B \to B^*$. ■

Proof of Propositions 7 and 8. The propositions follow from Lemma 3 and the result that Equation (16) is associated with the debtor mechanism of Proposition 5, and Equation (17) is associated with the creditor mechanism of Proposition 4. ■

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