

Corporate Bankruptcy: A U.S.-European Comparison

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Both Britain and France have adopted new bankruptcy laws since 1985 and a new bankruptcy law has also been proposed in Germany, although not yet adopted. In all three countries, a major purpose of the new law is to shift away from exclusively focusing on protection of creditors' interests in bankruptcy and toward a balance between protecting creditors versus saving distressed firms. However, the features of bankruptcy law differ widely in all three countries and in the U.S. In this paper I compare basic features of bankruptcy law in the four countries. A framework is proposed for analyzing the efficiency effects of bankruptcy law and it is used to analyze basic tradeoffs in bankruptcy law. Two main tradeoffs in bankruptcy emerge. The first is between *ex ante* and *ex post* bankruptcy costs: if a bankruptcy policy treats managers harshly, then the probability of firms suffering financial distress will be low, but once firms become distressed then managers have a strong incentive to waste resources in attempts to avoid bankruptcy. A lenient bankruptcy policy has the opposite effect. The second tradeoff occurs once firms are already in bankruptcy and results from the difficulty of identifying which firms, if any, are economically efficient and therefore worth saving. A harsh bankruptcy policy that provides only for liquidation of bankrupt firms generates high type II error costs, because the going concern value of distressed but economically efficient firms is lost. But it has low type I error costs, because no resources are wasted in saving economically inefficient distressed firms. Another conclusion of the analysis is that the traditional European emphasis on protecting creditors' interests in bankruptcy is no longer warranted given creditors' ability to reduce risk by diversifying.

The framework is used to analyze bankruptcy costs under several different bankruptcy policies, including Chapter 7/Chapter 11 in the U.S., the German policy of liquidation only, the newer French and British policy of permitting reorganization but appointing a bankruptcy official to decide which firms get reorganized, and a bankruptcy reform proposal.

1. Corporate Bankruptcy Laws Compared

In this section, I discuss and compare basic features of bankruptcy law in the four countries. Before turning to bankruptcy law itself, however, it is worthwhile to note the difference between unsecured versus secured creditors. Unsecured creditors have the right to be repaid according to the terms of their contracts with the firm, but do not have the right to claim any particular assets of the firm. If the firm defaults on some provision of the contract, unsecured creditors must take legal action and obtain a court order against the firm to be repaid. In contrast, secured creditors both have the right to be repaid according to the terms of their contracts and the right to claim specified assets of the firm if it defaults. They can claim these assets directly, as long as doing so does not cause a breach of the peace. The collateral for secured claims can range from buildings and real estate to machinery, inventory or accounts receivable.

When firms become financially distressed, they typically stop paying some of their debts. If they stop paying secured creditors, then these creditors will quickly reclaim their collateral, so that the firm must continue to pay secured debts if the collateral is critical to the firm's operations. In contrast, there is more breathing space vis-à-vis unsecured creditors, since it is time-consuming for them to sue the firm and win. Creditors whose claims are unsecured typically include trade creditors, involuntary creditors such as tort claimants, claims for unpaid taxes and, for large firms, holders of long-term unsecured debt (subordinated debentures). Creditors such as banks and other working capital lenders typically hold secured claims.

Now turn to bankruptcy law in the four countries. Table 1 highlights important similarities and differences between bankruptcy law in the U.S. versus in the three European countries. One major set of differences between the U.S. and the three European countries concerns how and when a bankruptcy begins. Consider first how bankruptcies are initiated. Bankruptcy filings may be initiated either voluntarily by managers or involuntarily by other parties, usually creditors. U.S. bankruptcy law discourages involuntary bankruptcy filings by creditors, since it requires that three or more creditors together initiate an involuntary bankruptcy petition. Creditors bear the burden of proving that the

firm is not paying its bills generally and managers may dispute their claims and file countersuits for damages. As a result, only about 2-3% of Chapter 11 bankruptcy filings and well under 1% of Chapter 7 bankruptcy filings in the U.S. were involuntary during the period 1980-1982.¹ Instead, nearly all bankruptcy filings in the U.S. are voluntary filings by managers, although in practice managers often file for bankruptcy one step ahead of a creditor who would otherwise shut the firm down. In contrast, European bankruptcy laws encourage any involved party—including creditors, managers, members of boards of directors, workers' representatives, and the bankruptcy court itself—to initiate involuntary bankruptcy filings. When an outside party initiates bankruptcy, the onus is on managers to show that the firm should not be in bankruptcy, rather than on creditors to show that it should.² Whether these provisions are effective is unclear, however. Recent data from Germany show that nearly half of all bankruptcy filings are initiated by other parties than the debtor. However, the figures do not distinguish between corporate and individual filings.³

Now consider the timing of bankruptcy. In the three European countries, bankruptcy law provides for sanctions against managers and others if they delay filing for bankruptcy past a certain point. In France, managers are obliged to file for bankruptcy within 15 days after the firm finds it impossible to meet liabilities which are due with available assets. Managers who delay past this point face the possibility of both criminal penalties and being held personally liable for the firm's debts.⁴ Germany requires that managers file for bankruptcy within three weeks of the time when the firm becomes insolvent. The manager faces potential civil or criminal liability for delay in filing and the firm's bank lender also faces potential liability if it attempts to hide the situation.⁵ In Britain, directors who know

¹ In 1981, 170 of 7,310 Chapter 11 bankruptcy filings were involuntary, or .2%. See Administrative Office of the U.S. Courts, *Federal Judicial Workload Statistics, 1981*, tables F2A and F2B. (More recent data is not available.)

² For example, a firm that has not paid a particular creditor because of a dispute over a bill may end up having to defend itself from the creditor's attempt to initiate bankruptcy on the grounds that the firm is not paying its bills generally. See (ref.) for discussion in the English context.

³ See Drukarczyk (1987), table 2.1.

⁴ See Beardsley (1985).

⁵ See Klasmeyer and Kubler (1991) and Ihle (1989).

that a company is insolvent can be held liable for the extra losses sustained by creditors until the firm enters insolvency proceedings.⁶ In contrast, the U.S. has no explicit policy toward delay in filing for bankruptcy.

Why have a policy favoring early initiation of bankruptcy? In general, the earlier firms enter bankruptcy, the less distressed is their financial condition. From an efficiency standpoint, early bankruptcy for distressed firms is therefore desirable, both because it minimizes losses to creditors if the firm is liquidated and because it maximizes the likelihood of actually saving the firm if an attempt is made to reorganize it. However, managers often prefer to delay filing for bankruptcy, particularly if they lose their jobs once the filing occurs. In their attempts to avoid bankruptcy, they have an incentive to act in ways that waste the firm's resources. The approach in the three European countries is to encourage early bankruptcy filings by penalizing managers and banks for delay in filing and by making it easier for creditors and others to initiate involuntary bankruptcies. As will be seen, the approach in the U.S. is to encourage early bankruptcy filings by treating managers more leniently in bankruptcy. However, it is doubtful whether either approach is effective. Sanctions for delay in filing for bankruptcy are only effective if they are used frequently and are severe, but there is no evidence that this is the case. Also, creditors have little incentive to initiate involuntary bankruptcy filings. Secured creditors would prefer to reclaim their collateral and have little to gain from initiating bankruptcy since it may prevent or delay them from doing so. Unsecured creditors could potentially gain from initiating bankruptcy, but have relatively small claims so they usually do not find it worthwhile individually to incur the expense. Further, the free rider problem prevents them from getting together even though as a group they might benefit from forcing the firm into bankruptcy. Another reason that creditors are unlikely to initiate involuntary bankruptcies is that they may benefit more from negotiating individually with managers to resolve their claims than from initiating bankruptcy, which—as a collective procedure—mainly benefits others.⁷

⁶ See Cuthbertson and Hudson (1991).

⁷ See Bulow and Shoven (1978), White (1980) and Gertner and Scharfstein (1990) for models and

Once a bankruptcy filing has occurred, the next issues are whether an outside official is appointed by the bankruptcy court to take charge of the firm and who makes the initial decision whether the firm will be liquidated or remain in operation while a reorganization plan is formulated. In the three European countries, the bankruptcy judge appoints always appoints an outside official when a firm enters bankruptcy and the outside official either replaces existing managers or has authority over them in operating the business.⁸ The outside official decides whether the firm will be shut down and its assets liquidated or whether it will continue to operate while an attempt is made to reorganize it.⁹ In contrast in the U.S., existing managers have the right to choose between filing for bankruptcy under Chapter 7 or Chapter 11 of the U.S. Bankruptcy Code. (They are allowed this choice even if the bankruptcy filing is involuntary.) Since Chapter 7 is the U.S. bankruptcy liquidation procedure and Chapter 11 the bankruptcy reorganization procedure, this in effect means that managers make the initial decision concerning whether the firm will be liquidated or reorganized. If the bankruptcy filing is under Chapter 7, then a trustee is appointed who liquidates the firm's assets. But if managers choose Chapter 11, then they remain in control as "debtor-in-possession," unless creditors can convince the bankruptcy judge to appoint a trustee. Judges appoint trustees only for causes such as fraud or incompetence, and such appointments occur only rarely.¹⁰ Assuming that managers file remain in control under Chapter 11, the bankruptcy court provides some loose surveillance over their actions, since judges must approve new loans to the firm and sales of assets, but less than would occur under an outside bankruptcy official.

Jackson (1986) for discussion.

⁸ Outside bankruptcy officials in the European countries are normally accountants who specialize in insolvency practice.

⁹ In Germany, the bankruptcy court rather than the outside bankruptcy official decides whether the firm will be shut down or not. Under the proposed new German bankruptcy law, the outside bankruptcy official would make the decision. See Ihle (1989). In both Germany and France, the bankruptcy official (or judge) receives advice from representatives of both creditors and workers.

¹⁰ In separate samples of small and very large firms in Chapter 11, LoPucki (1983) and LoPucki/Whitford (1990) found that the probability of a trustee being appointed was only 6% and 5%, respectively. For small firms, the 6% figure includes some cases in which the manager had abandoned the business by the time of the bankruptcy filing, so that the appointment of a trustee was unopposed.

These differences between U.S. and European bankruptcy procedures are related, since whether creditors find it worthwhile to initiate involuntary bankruptcies depends on what happens to the firm after the bankruptcy is initiated. Creditors in the U.S. are unlikely to incur the expense of initiating an involuntary bankruptcy filing because, even if they succeed, managers will choose to reorganize under Chapter 11 and will remain in control of the firm. In contrast, creditors in Europe face lower costs in initiating involuntary bankruptcies and stand to gain more since an outside official takes over the firm. This does not necessarily imply that initiating an involuntary bankruptcy is worthwhile for creditors in the three European countries, but it does suggest that the cost-benefit analysis looks more favorable to them than to creditors in the U.S.

Now suppose that the firm has filed for bankruptcy and is to be liquidated. The value of its assets is less than creditors' claims. How are the firm's assets divided among creditors? Secured creditors claim their collateral. In contrast, once a bankruptcy filing occurs, unsecured creditors are subject to the "automatic stay," which prevents them from pursuing individual legal actions against the firm. Instead they are compensated through the collective bankruptcy procedure. The justification for the automatic stay is that in the absence of bankruptcy, individual unsecured creditors have an incentive to race to be first to sue the firm for repayment of their claims. As in a bank run, those creditors who were first to succeed in their legal actions against the firm would be paid in full while others would receive nothing. But the race is costly, both because creditors engage in duplicative efforts to monitor the firm and because the firm may be shut down prematurely and the value of its assets reduced by creditors claiming assets piecemeal. Bankruptcy instead substitutes a fixed procedure and a predetermined priority ordering, which is similar in the U.S. and the three European countries.¹¹

The bankruptcy official liquidates all assets of the firm not subject to secured creditors' liens, and the proceeds are then used to settle unsecured claims.¹² The ordering of claims

¹¹ Secured creditors also have an incentive to race to be first to reclaim their collateral if liens on assets are not publicly registered, because multiple creditors may have liens on the same asset. See Webb (1987) for a discussion of the race to be first as a prisoner's dilemma model.

¹² The bankruptcy official also plays a role concerning assets subject to creditors' liens. In the U.S., the official decides whether the asset is worth more than the secured creditor's claim, in which case the trustee

is called the “absolute priority rule” (APR) in the U.S. The APR calls for paying creditors in full in order until assets are exhausted. Administrative expenses—including the costs of lawyers, the outside bankruptcy official’s compensation, and post-bankruptcy loans to the firm—are paid first. Priority claims—including claims for unpaid taxes, social insurance payments, and wages—are paid second, and unsecured creditors’ claims are paid third.¹³ In the three European countries, the priority ordering in liquidation is similar to the APR, although some details differ.¹⁴

Now suppose that the firm has filed for bankruptcy and an initial decision has been made to reorganize it. There is a conflict between secured creditors’ right to claim their collateral versus the goal of reorganizing the firm. In order for the firm to reorganize successfully, it must retain assets which are crucial to its operations, but often secured creditors wish to claim these assets, since delay or wear-and-tear make them less valuable. In the U.S., this conflict is resolved in the firm’s favor by applying the automatic stay to secured creditors in Chapter 11, which prevents them from removing their collateral. France also applies the automatic stay to secured creditors in reorganization, but Germany does not. Britain stays secured creditors under the administration order procedure, but not under receivership (see below).

Now consider the reorganization process itself—who formulates the reorganization plan, how it is adopted and what, if any, provisions aid failing firms to reorganize. Here procedures in the four countries differ widely. Consider the U.S. first. In U.S. bankruptcy law, there is a strong presumption that the manager will formulate the reorganization plan.

sells the asset, pays the secured creditor, and uses the residual to pay unsecured creditors. In countries such as Germany, liens other than on real estate are not registered. Therefore multiple creditors may have liens on the same asset and the bankruptcy official must decide which creditors get which assets. The three European countries also override secured claims in some situations. In France and Germany, claims by workers for unpaid wages and benefits take priority over certain secured claims. See Spear (1989) and Beardsley (1985). Britain has rules which prevent enforcement of some secured liens if they were given to secure an old loan being renewed rather than a new loan. See Pennington (1988).

¹³ The absolute priority rule treats claims of equal priority equally regardless of when they are due. Debts due in the future are accelerated to the present at full face value. Among unsecured claims, subordination agreements made outside of bankruptcy are followed in bankruptcy.

¹⁴ There are variations among the countries in the types of claims which have priority status. For example, the U.S. allows priority for rent claims and consumer deposits, but Germany does not. See Klasmeier and Kubler (1991), p. 17-52.

Managers have an exclusive right for the first 120 days after the bankruptcy filing to propose a plan, plus an additional 60 days for it to be adopted. Further, managers normally petition the bankruptcy judge to extend the exclusivity period and extensions are usually granted, so that managers often remain in control for a prolonged period before offering their plan. Since managers control the flow of information about the firm to creditors, creditors have little information about the firm's true state. The exclusivity period encourages continuation of the firm's operations, since managers generally favor saving the firm and creditors must either accept managers' plan or wait until the exclusivity period is over to propose their own plan. Even after the exclusivity period has ended, for free rider reasons creditors rarely propose their own reorganization plans.¹⁵

The reorganization plan proposes a settlement of all pre-bankruptcy creditors' claims against the firm, usually with payments made over several years. A typical reorganization plan in the U.S. might provide for unsecured creditors to receive repayment of 25 to 50% over 5 years, with large firms usually paying more than small firms.¹⁶ Creditors vote on the plan by class and each class of creditors must adopt it by a majority in number of claims and a two-thirds majority by value. A majority of old equity must also vote in favor of the plan. The fact that old equity must vote in favor of the plan encourages continuation of the firm's operations. This is because if the firm were liquidated, the sale price would inevitably be less than the firm's liabilities, so that equity would receive nothing and would be "deemed" to have voted against the plan. But if the firm continues to operate, then no sale occurs, no sale price is established, a fiction is maintained that the firm is solvent and old equity is left in place. If a reorganization plan is not agreed on, then either the plan may be adopted anyway under a procedure known as "cramdown" or the bankruptcy judge may order the firm's bankruptcy filing transferred to Chapter 7.¹⁷

¹⁵ In 34 of 43 large bankruptcies studied by Lopucki/Whitford (1990), managers' exclusivity period was extended until a reorganization plan was adopted, so that creditors never had a chance to present a plan. In Weiss' (1992) study of large firms in bankruptcy, of 35 firms that adopted Chapter 11 plans, only one plan was proposed by creditors. When creditors propose a plan, they—unlike managers—must back it up with expensive outside appraisals.

¹⁶ See White (1993) for a summary of the evidence.

¹⁷ Cramdown is used when some classes of creditors have not accepted the plan by the required majority vote. Under it, if any class of creditors receives less than full payment, creditors in lower ranking classes

Several additional provisions of U.S. law encourage reorganization of failing firms. Once a firm has filed under Chapter 11, it stops paying interest on pre-bankruptcy debts, both secured and unsecured, until a reorganization plan is approved.¹⁸ Managers also have the right to reject or assume any pre-bankruptcy contracts with suppliers or customers. This allows them to reject unprofitable contracts while continuing profitable ones. Also once the firm has filed under Chapter 11, new loans are given highest priority as administrative claims, so that they leapfrog pre-bankruptcy creditors in the priority ordering if the firm later liquidates. This makes it easier for the firm to obtain new loans. Finally, firms in Chapter 11 also benefit from two government subsidies: the right to keep their tax loss carryforwards if they reorganize in bankruptcy and the ability to transfer their pension plans—which are normally underfunded—to the Pension Benefit Guaranty Corporation, a public agency. These provisions obviously make reorganizing under Chapter 11 more attractive for failing firms. But despite these favorable provisions, several studies have found that only about one-quarter to one-third of firms that file under Chapter 11 actually adopt reorganization plans that provide for the firm to continue operating. (For the largest firms, however, the probability is much higher.)¹⁹

Turn now to the three European countries, all of which have recently either proposed or adopted reforms intended to encourage failing firms to reorganize in bankruptcy. The new French bankruptcy law goes furthest in attempting to rescue failing firms: the primary objectives of the French law are “safeguarding the business” and “maintaining the firm’s operations,” while “discharging liabilities” ranks only third.²⁰ When a firm initially files for bankruptcy, the bankruptcy judge appoints an outside official who represents the interests

cannot receive anything. Thus the payoff pattern under cramdown is similar to that under the absolute priority rule in liquidation. However, courts have in recent cases adopted plans that violated absolute priority, such as when equityholders make a new investment in the reorganized firm. (This is the “new value doctrine.”) Cramdown is used infrequently since it requires a valuation of the firm’s assets, which is expensive. But is useful to managers as a threat in bargaining with creditors.

¹⁸ Only secured creditors whose collateral is worth more than the value of their claims have the right to receive interest during the period of reorganization.

¹⁹ For data on small firms in Chapter 11, see LoPucki (1983) and Flynn (1989). For large firms, Weiss (1990) found a probability of .86 that a reorganization plan was adopted.

²⁰ See Simeon *et al* (1987), p. 18A-19.

of the state rather than of creditors. There is a mandatory 18 month “observation period,” during which the firm cannot be shut down. After this period has passed, the outside official decides whether or not the firm can be saved.²¹ If not, then a different outside official is appointed who represents only creditors and acts as the firm’s liquidator. If so, then the outside bankruptcy official frequently arranges to bring in a “lease-manager” to run the firm. The lease-manager must operate the firm rather than shutting it down and generally must purchase it after two years. At this time, the proceeds are distributed to creditors as if the firm had been liquidated.²² Thus there is frequently no reorganization plan and creditors play little or no role in the reorganization process.

In Britain, there are two separate bankruptcy procedures. The older procedure is known as receivership. In Britain, a creditor may hold a general secured interest in the firm’s assets, known as a “floating charge,” and have the right to appoint a receiver if the firm defaults. The receiver represents only the interest of the floating charge creditor and may sell any assets of the firm not subject to another creditor’s lien in order to repay the debt owed to the floating charge creditor. There is an obvious problem that receivers searching for easily liquidated assets may harm the firm by selling off assets essential to its continued operation, even when the firm is more valuable as a going concern. The newer British bankruptcy procedure, known as an administration order, was intended to address this problem and to encourage reorganization of failing firms. Under it, an outside bankruptcy official is appointed who represents creditors generally. The outside official proposes a reorganization plan, which must be approved by a vote of the creditors’ committee. However, managers of failing firms cannot use the administration order procedure to block receivership. If the floating charge creditor has already appointed a receiver, then an administration order can only be issued if the floating charge creditor consents. Thus unlike in the U.S., managers of failing firms cannot defeat creditors’ attempts to claim collateral by filing for bankruptcy reorganization.²³

²¹ There is a simpler procedure for firms with under 50 employees. See Martin (1989).

²² See Beardsley (1985) and Martin (1989).

²³ See Cork Gully (1986) and Webb (1990) for discussion of the two British bankruptcy procedures.

Turn now to Germany.²⁴ Unlike most countries, German bankruptcy law does not provide for discharge of debts. Therefore even if a firm files for bankruptcy and turns its assets over to the bankruptcy court, it only obtains a discharge of debts if individual creditors voluntarily agree. As a result, there is less incentive to file for bankruptcy in Germany than in other countries and more incentive for distressed firms to attempt voluntary restructurings.²⁵ Debt renegotiations are relatively easy for large firms in Germany, since major bank lenders tend to be represented on firms' boards of directors and there is less reliance on publicly traded debt. As a result, the number of parties that must agree on a voluntary restructuring is fairly small. Small firms often shut down without filing for bankruptcy at all, since filing for bankruptcy is costly and has little benefit.²⁶

Current German law does provide a reorganization procedure, although it is rarely used. Because there is no automatic stay for secured creditors in bankruptcy, secured creditors' claims must remain intact in reorganization unless they agree to a reduction voluntarily and only unsecured creditors can be forced to accept a reduction in their claims. But most German firms have relatively little unsecured debt, so that the benefit of a formal reorganization is relatively small. The bankruptcy official proposes the reorganization plan. Unsecured creditors must be paid at least 35% of their claims or 40% if payment is delayed for more than a year. They vote on the plan and to be accepted it must receive votes representing at least a majority of unsecured creditors and at least 50% of the value of unsecured claims. If the plan is not adopted, the firm is liquidated. Currently about 1% of bankruptcy filings are reorganizations. The proposed new German bankruptcy law is

²⁴ Germany has two separate bankruptcy laws, one adopted in 1877 which provides for liquidation and another adopted in 1935 which provides for reorganization. There is no distinction between bankruptcy procedures for individuals versus corporations. See Drukarczyk (1987).

²⁵ For corporations, the lack of a discharge in bankruptcy is unimportant since once the firm liquidates, creditors cannot pursue it for debt repayment. But for small corporations, the lack of a discharge matters since manager-shareholders may have personally guaranteed corporate debt.

²⁶ Recent data show that there were only 16,760 bankruptcy filings in Germany in 1984, including both corporate and individual filings. This compares with ... bankruptcy filings for the U.S. in the same year, of which ... were personal and ... were by corporations. See Drukarczyk (1987), table 2.2, for German data and ... for U.S. data. See Gilson, John and Lang (1990) for a study of non-bankruptcy workouts of large firms in the U.S. Their results suggest that workouts are more likely to succeed without a formal bankruptcy filing when the firm's capital structure is less complicated and when it involves relatively more bank (secured) debt and less publicly-traded (unsecured) debt.

intended to make bankruptcy reorganization more attractive to failing firms. It institutes an automatic stay in bankruptcy against secured creditors, so that reorganization plans will be able to reduce the claims of both secured and unsecured creditors. It also provides for discharge of debt covered by the plan after 7 years and it drops the minimum payoff requirement for unsecured debt.²⁷

Finally, turn to the costs of the bankruptcy procedure. In all three European countries, an outside bankruptcy official is always appointed and the firm must pay the official's compensation. This means that bankruptcy costs have a high fixed component. In contrast in the U.S., bankruptcy officials are only appointed in Chapter 7 cases and their compensation is in the form of a percentage of the value of the assets they locate and sell. Therefore the fixed component of bankruptcy costs is low. This implies that bankruptcy costs for small firms are higher in Europe than in the U.S. The high fixed cost of bankruptcy in Europe means that many small firms cannot afford to go bankrupt. In Germany, for example, bankruptcy courts only accept about one-fourth of all petitions, with the rest denied on the grounds that the firm lacks sufficient assets to pay for the procedure.²⁸ This does not occur in the U.S., where the minimum cost of a bankruptcy filing under Chapter 7 is only a nominal filing fee.

To summarize, this discussion of bankruptcy law suggests that there are important differences among the U.S. and the three European countries in their approaches to bankruptcy. In the U.S., managers of failing firms are encouraged to file for bankruptcy earlier by the "carrot" of Chapter 11, which allows managers to remain in control and gives them bargaining power over creditors in determining the reorganization plan and various other subsidies. The European countries, in contrast, use a "stick" approach, with managers facing penalties for delay in filing for bankruptcy. Another important difference is that in the three European countries, an outside official is always appointed to take over the firm when it files for bankruptcy; while in the U.S., the manager usually remains

²⁷ The reform proposal has gone through a number of changes over the years. See Ihle (1989) and Schiessel (1988) for discussion of early versions.

²⁸ See Verbrugg (1986) and Ihle (1989).

in control. The replacement of managers in bankruptcy in the three European countries them a strong incentive to avoid or delay bankruptcy as long as possible. Reorganization procedures also differ widely among the four countries. Secured creditors are prevented from claiming collateral assets while firms are attempting to reorganize in the U.S. and in France, but not in Germany and not in the U.K. under the receivership procedure.

2. Bankruptcy Costs

In this section, I examine the costs of bankruptcy, *i.e.*, the deadweight costs generated by the bankruptcy process. Bankruptcy costs at three different points in time are considered: (1) before it is known whether the firm will be financially distressed or not, (2) after the firm has become financially distressed but before it files for bankruptcy, and (3) after the bankruptcy filing, if one occurs. In the first period, the issue is how the treatment of firms in bankruptcy affects the incentives of managers to expend effort in maximizing the value of the firm. In the second period, the issue is how the treatment of managers in bankruptcy affects their incentives both to delay filing for bankruptcy and to undertake excessively risky investments in order to avoid bankruptcy. Finally after the bankruptcy filing, it is difficult to determine which firms, if any, are worth saving. Therefore bankruptcy costs may occur both because firms are reorganized which should be shut down and because firms are liquidated which should be saved. The framework is used to point out important tradeoffs in bankruptcy.

2.1 *Ex ante* bankruptcy costs: The punishment effect

Ex ante bankruptcy costs are incurred before it is known whether the firm will be financially distressed or not. Suppose we think of the firm as a contract between shareholders and a manager. The value of the firm in the future, denoted V , is assumed to depend on managers' level of effort or ability, e , where $V_e \geq 0$. Managers are assumed to expend effort according to how they are paid. If managers are risk neutral, then the optimal compensation contract is one in which they pay a fixed fee to shareholders in return for the right to run the firm and receive all of its value net of the fee. In this case managers expend effort up to the point where a marginal increase in effort has a payoff

equal to managers' opportunity cost of time. More generally, this line of argument implies that managers of high value firms should receive high pay and managers of low value firms should receive low or negative pay or be dismissed. If a firm is in financial distress or in bankruptcy, it suggests that managers should be punished, *i.e.*, they should be replaced. An argument along these lines has been made recently by Aghion, Hart and Moore (1992) who argue that Chapter 11 in the U.S., which presumes that existing managers will be retained during bankruptcy reorganization, treats managers too leniently.

On the other hand, it can be argued that managers prefer to have some smoothing of their incomes, either because they are risk averse or because they recognize that their firms' performance depends on other factors as well as their own effort. Suppose V depends both on the manager's effort and on industry-wide or economy-wide factors beyond the manager's control. If a firm is unsuccessful, it could either be because the manager's effort/ability level was low or because factors beyond managers' control were unfavorable. Suppose shareholders cannot distinguish between low managerial effort and other factors. Then managers prefer a pay structure which builds in some income smoothing.²⁹ Empirical evidence supports the view that managers prefer some smoothing of income. In an examination of the pay structure of Chief Executive Officers (CEO's) of large U.S. corporations, Jensen and Murphy (1990) find only a quantitatively small relationship between changes in the value of the firm and changes in CEO pay.³⁰ But if executives prefer to have relatively smooth incomes outside of bankruptcy, then they presumably would also prefer income smoothing in bankruptcy. This suggests that managers would choose *ex ante* to give up some income when the firm is successful in return for favorable treatment in bankruptcy when the firm is unsuccessful.

Suppose we accept the optimal compensation argument. Then suppose $\Delta V(e)$ represents the reduction in the value of the average firm due to managers' reduced effort if bankruptcy policy does not automatically replace them when their firms enter bankruptcy.

²⁹ Managers' pay might also be structured to depend partly on factors such as the performance of the firm relative to the industry. See Hölmstrom (1982).

³⁰ Jensen and Murphy argue that smoothing of CEO pay reflects not executives' preferences, but external pressure which prevents corporations from paying successful CEO's very highly and therefore forces them to smooth the entire pay structure.

$\Delta V(e)$ equals zero under a bankruptcy policy of liquidation-only or under a policy of replacing all managers of firms in bankruptcy with outside bankruptcy officials, but it is positive for bankruptcy policies such as Chapter 11 that treat managers favorably. Suppose N is the total number of firms in the economy. Then the *ex ante* deadweight cost of a lenient bankruptcy policy is $\Delta V(e)N$, or the average loss of value per firm due to managers' reduced effort level times the number of firms in the economy. I refer to this as the punishment effect.³¹

Now consider whether the same issues apply to creditors. We can think of creditors as bargaining with shareholders or managers over a contract in which they are paid a fixed amount regardless of the firm's financial condition. Being a secured rather than an unsecured creditor reduces risk, since if the firm defaults, creditors can reclaim their collateral. However, when firms enter bankruptcy, bankruptcy law may override the terms of creditors' contract with the firm, which affects the riskiness of their claims. U.S. law stays secured creditors from reclaiming collateral during bankruptcy reorganization, while German law does not. This makes secured creditors' claims less risky in Germany than in the U.S. Unsecured creditors receive little or nothing in bankruptcy liquidation in all countries, but in the U.S. they tend to be treated better when firms reorganize in bankruptcy than when they liquidate. Are there any efficiency consequences of structuring bankruptcy law to make creditors' return in bankruptcy more or less risky? Financial theory suggests not, since creditors—unlike managers—can diversify their portfolios by buying and selling claims, so that if they are risk averse they end up holding small amounts of many different types of claims issued by many different firms. Given the ability of creditors to diversify, the traditional emphasis in bankruptcy law on protecting creditors' claims seems no longer warranted. In what follows, I ignore the riskiness of creditors' claims as a factor in bankruptcy costs.

³¹ In 19th century England, an even harsher policy was routinely used to punish debtors for bankruptcy—they were put in prison. As noted above, the European countries still provide for criminal penalties for managers who delay filing for bankruptcy, but they appear to be rarely used. Gilson (1990) argues that the turnover of managers is relatively high in Chapter 11, but the correct comparison, which would be to managerial turnover rates in reorganization in one of the European countries, is not available.

2.2 Bankruptcy costs after firms are in financial distress

Now suppose some firms have become financially distressed, but have not filed for bankruptcy. Two types of bankruptcy costs that may be incurred by managers of failing firms who are attempting to avoid or delay filing for bankruptcy are the gambling effect and the delay effect, discussed here.

(a) *The gambling effect.* The gambling effect refers to the fact that managers of firms in financial distress have an incentive to undertake excessively risky investments—at an extreme to stake the firm’s cash at the gambling tables—as a means of avoiding bankruptcy. If the risky investment succeeds, its high return enables the firm to avoid bankruptcy at least temporarily and, if it fails, the firm goes bankrupt but managers are no worse off since it would have done so anyway without the investment. Equityholders also favor risky investments in this situation, since their equity is likely to be worthless otherwise. Losses on risky investments are borne by creditors in the form of a lower payoff in bankruptcy.

As an example, suppose a firm owes \$100 to a creditor next period. The firm has only \$20 in cash on hand and no lender is willing to loan the firm the remaining \$80. An investment project is available which costs \$20 and pays \$100 with 15% probability before next period. The project is attractive to managers since it gives the firm a 15% probability of being able to avoid bankruptcy next period, when otherwise it would fail with certainty. But the project’s expected return of \$15 is less than its cost of \$20, so that undertaking it has an economic cost of \$5. The cost of the gambling effect is the economic loss on the project, \$5 in the example, times the probability of managers undertaking it.³²

Suppose G denotes the expected cost per failing firm of resources wasted in inefficiently risky projects. Suppose ρ is the probability that a firm is financially distressed, so that ρN is the total number of distressed firms. ρ is negatively related to the level of effort e by managers, since with higher effort the value of the firm increases and it is less likely to be financially distressed. The aggregate gambling effect is $\rho(e)NG$. Note that the gambling

³² The gambling effect was pointed out by Stiglitz (1972) and Jensen and Meckling (1976). White (1980) showed that the gambling effect also applies to managers’ decision whether to continue operating failing firms for one more period.

effect applies only to financial distressed firms, whereas the punishment effect applies to all firms.³³

There is an important tradeoff in bankruptcy between the punishment effect and the gambling effect. Consider a harsh bankruptcy policy under which all bankrupt firms are liquidated. *Ex ante*, this policy gives managers an incentive to work hard, so that firms' average value is high and the punishment effect is small. Also the high average value of firms implies that relatively few are financially distressed, so that ρN is small. However, once firms are in financial distress, the policy gives managers strong incentives to gamble to avoid bankruptcy, so that losses per failing firm, G , are high. In contrast, a bankruptcy policy which treated managers more leniently would cause the punishment effect to be higher and the number of failing firms to be higher, but the loss due to the gambling effect per failing firm would be lower.

(b) *The delay effect.* The delay effect refers to the fact that managers of financially distressed firms have an incentive to delay filing for bankruptcy, particularly if managers are automatically replaced in bankruptcy. But if the firm is economically inefficient, then delay is economically costly. Figure 1 shows the situation of a firm which is both economically inefficient and financially distressed. $R(t)$ represents the firm's revenues at time t , *i.e.*, revenues generated by the firm's capital in its current use. Revenues are declining over time, perhaps because the firm's products are becoming technologically outmoded or are going out of style. $A(t)$ represents the revenues that the firm's capital would generate if it were shifted to its best alternate use, net of the cost of conversion. $E(t)$ is the firm's expenses at time t , including principle and interest payments due at t on all types of debt, and obligations to pay for inputs, wages and taxes. For simplicity, expenses are assumed to be constant over time and are also assumed to be the same under both the actual and the best alternate use of the firm's capital. From time t_2 onward, the firm makes losses.³⁴

³³ Strictly speaking, the gambling effect also applies to managers of non-failing firms, but it is much stronger for managers of failing firms since their probability of bankruptcy if no risky investment occurs is much higher.

³⁴ $R(t) - E(t)$ does not correspond exactly to profit, because expenses may include repayment of principle and depreciation is excluded.

From time t_1 onward, it is economically efficient for managers to reinvest the firm's capital in its best alternate use. If managers do not invest, there will be an efficiency gain from shutting the firm down and liquidating its assets, which will free them to move to the new use.³⁵ Suppose the firm files for bankruptcy at time t_3 , after it has been making losses for several periods. Then the deadweight costs of delay in filing for bankruptcy per economically inefficient failing firm, D , are $D = \int_{t_1}^{t_3} [A(t) - R(t)] dt$. The total number of financially distressed firms was assumed to be $\rho(\epsilon)N$ and the proportion of distressed firms that are economically inefficient is assumed to be δ . Therefore the total number of economically inefficient and financially distressed firms is $\delta\rho N$ and the aggregate costs of delay in filing for bankruptcy are $\delta\rho ND$.

As with gambling costs, there is a tradeoff between the treatment of managers in bankruptcy and the extent of delay in filing for bankruptcy. Under a harsh bankruptcy policy managers have an incentive to work hard, so that few firms become financially distressed. In addition, when managers work hard, the probability of the firm being economically inefficient, δ , is likely to be low even if factors outside of managers' control (such as a recession) cause their firms to be unprofitable. Therefore the punishment effect will be small and the number of unprofitable inefficient firms will also be small. However, once firms are in financial distress, a harsh bankruptcy policy gives managers a strong incentive to delay filing for bankruptcy, so that the delay effect per firm rises. In contrast, a more lenient bankruptcy policy would be associated with a higher punishment effect but a lower delay effect.

Engaging in delay versus gambling are to some extent substitute strategies for managers of financially distressed firms who are attempting to avoid bankruptcy. Gambles, assuming they do not pay off, use up the firm's cash and thereby reduce the resources managers have available to delay bankruptcy. Greater delay is possible if managers conserve cash instead of gambling.

³⁵ In most cases, we expect that the investment will be undertaken by existing managers, since it is profitable. There are various reasons why managers might fail to do so, however. One possibility is that no lender will finance the investment, since the new loan may be risky and the firm has no free assets that can be used to provide collateral. Another possibility is that managers' human capital is specialized to the old use of capital.

Are gambling by managers and delay in filing for bankruptcy important in practice? Both phenomena imply that when firms liquidate in bankruptcy, unsecured creditors receive little. This is because managers “use up” the firm’s assets before filing for bankruptcy, obtaining cash by giving creditors liens on the firm’s free assets. The cash is then used either for gambles or to finance the firm’s continued operation by, say, paying for new deliveries of materials. When these firms file for bankruptcy, secured creditors claim their collateral and few assets are left to repay unsecured claims. Evidence from both the U.S. and Germany suggests that when firms liquidate in bankruptcy, unsecured creditors receive a payoff rate of only 2-3%.³⁶ The fact that the payoff rates to unsecured creditors are very low in both Germany and the U.S. suggests that bankruptcy-avoiding behavior by managers—either delaying or gambling or both—are important in both countries. The low payoff rate in Germany also suggests that the policy of encouraging creditors to initiate (early) involuntary bankruptcy filings is not effective.

2.3 Bankruptcy costs after firms have filed for bankruptcy

We have already noted that only some firms in financial distress are economically inefficient. Figure 2 shows a firm that is financially distressed but is nonetheless economically efficient. Its revenues $R(t)$ fluctuate over time, but they exceed its alternate net revenues $A(t)$ over the long run, so that the best use of its capital is the current use, *i.e.*, the firm is economically efficient. However, from time t_2 to t_3 , the firm makes losses. It may or may not enter bankruptcy, depending on how long and severe its losses are. I assume for simplicity that all firms in financial distress are either economically inefficient and fall into the situation depicted in figure 1 or are economically efficient and fall into the situation depicted in figure 2.³⁷

When an economically inefficient firm enters bankruptcy, the best outcome is for its assets to be liquidated, thereby releasing its capital to move to higher value uses. However

³⁶ Drukarczyk (1987) finds a payoff rate in Germany of 2.4% for a sample of firms. White (1990) finds a similar rate in the U.S.

³⁷ Firms in financial distress could also fall in between the two cases. Also, the $A(t)$ and $D(t)$ curves could be reversed in figures 1 and/or 2 or the $R(t)$ curves could be constant while the $E(t)$ curves are rising or fluctuating. None of these possibilities would change the basic analysis.

when an economically efficient firm enters bankruptcy, the best outcome is for it to continue operating, since its capital has no higher value use. The economic justification for having a reorganization procedure in bankruptcy is to save firms that are economically efficient but financially distressed, *i.e.*, figure 2 firms. However, when failing firms enter bankruptcy, it is difficult to tell with certainty which type they are. As of time t_2 in figures 1 and 2, both types of firms have revenues which are falling over time and both are beginning to make losses. Thus they look essentially alike. The differences between them depend on alternate net revenues, $A(t)$, and on future revenues, $R(t)$, which are unobservable. Because of the uncertainty about which firms in bankruptcy are which type, any bankruptcy system that incorporates a reorganization procedure is likely to make errors. The errors may be random, or may reflect efforts by managers to deceive outsiders concerning their firms' true state, or may reflect efforts by outside officials to save the jobs of bankrupt firms.³⁸

The fact that there are two different types of distressed firms that should be treated differently in bankruptcy gives rise to type I and type II error in bankruptcy. Suppose economically efficient firms are liquidated in bankruptcy, either because no reorganization procedure exists or because a procedure exists but it mistakenly categorizes some efficient firms as inefficient. Since from an efficiency standpoint these firms should have been reorganized, deadweight costs of filtering failure in bankruptcy (type I error) are incurred. Conversely, if a bankruptcy reorganization policy exists, then some economically inefficient failing firms may be mistakenly categorized as efficient and allowed to reorganize. Since from an efficiency standpoint these firms should have been liquidated, deadweight costs of filtering failure in bankruptcy (type II error) are incurred.

(a) *Costs of type I error in bankruptcy.* Consider first the cost of failing to identify economically inefficient firms in bankruptcy, so that these firms go through the reorganization procedure. I assume that the reorganization procedure fails to save these firms on any long-term basis, but does allow them to operate longer than they would have otherwise. If there were no reorganization procedure, we previously assumed that economically inefficient firms would file for bankruptcy and liquidate at time t_3 in figure 1. But if there

³⁸ See White (1992) for a game-theoretic model of type I and type II error in bankruptcy.

is a reorganization procedure, suppose these firms continue operating until some later time t'_3 , including the time spent in reorganization. The cost of type I error per firm is $C_I = \int_{t_3}^{t'_3} [R(t) - A(t)] dt$. Note that the cost of type I error in bankruptcy equals the increase in the delay effect per firm when firms reorganize rather than liquidate in bankruptcy. The cost of type I error, like the cost of delay, is economic stagnation since resources move more slowly from less efficient to more efficient uses. Suppose the probability of inefficient firms reorganizing in bankruptcy is r . Since there are $\delta\rho N$ inefficient failing firms in total, the total cost of type I error in bankruptcy is $r\delta\rho N C_I$. The more attractive the reorganization procedure is to managers, the more inefficient firms will file under it and the higher type I error costs in bankruptcy will be. On the other hand, the more successful bankruptcy policy is in identifying inefficient firms in bankruptcy and liquidating them, the smaller is r and the lower are the costs of type I error.³⁹

(b) *Costs of type II error in bankruptcy.* Now consider the costs of failing to save firms of the type shown in figure 2 that are economically efficient despite being in bankruptcy. The cost of failing to save economically efficient but distressed firms is the loss of their going concern value, or the difference between the present value of the area under the $R(t)$ curve and the present value of the area under the $A(t)$ curve. This amount, $C_{II} = [PV(R(t)) - PV(A(t))]$, is positive over the long run by assumption. How high the costs of type II error in bankruptcy C_{II} tend to be is ambiguous. If an economically efficient firm shuts down in bankruptcy and is liquidated, one view is that its going concern value is not lost since a new owner is likely to buy the firm's assets from the bankruptcy trustee and reopen it quickly. Thus costs C_{II} may be low on average, since shutdowns of economically efficient distressed firms are temporary. On the other hand, when firms file for bankruptcy, secured creditors may quickly claim assets that are essential to its operations, which prevents the bankruptcy trustee from selling the firm as a viable concern. Also, workers with specific human capital may find other jobs and the nexus of relationships between the firm, its suppliers and its customers—once disrupted—may be difficult to re-establish. Thus costs

³⁹ If firms in bankruptcy reorganization receive subsidies from the government, then the cost of type I error also rises. This cost is ignored, however, since it is a transfer.

C_{II} may be high on average. Which story is correct is probably different for different types of firms.

There are $(1 - \delta)\rho N$ efficient but distressed firms in total. If there is no bankruptcy reorganization policy, then none of them are saved in bankruptcy and the total cost of type II error is maximized at $(1 - \delta)\rho N C_{II}$. If there is a bankruptcy reorganization policy, then the cost of type II error is likely to be lower. Suppose the probability of successfully reorganizing efficient firms in bankruptcy is denoted s . s depends on two factors: (1) how effective bankruptcy policy is in identifying which bankrupt firms are economically efficient and should be saved and (2) how effective bankruptcy policy is in actually saving the targeted firms. The total costs of type II error in bankruptcy given the existence of a reorganization policy are $(1 - s)(1 - \delta)\rho N C_{II}$. s approaches one and the costs of type II error fall as the bankruptcy reorganization procedure becomes more effective either in identifying efficient firms in bankruptcy and/or in saving these firms once they are identified. Type II error costs also depend on how attractive the reorganization procedure is to managers. If managers are treated leniently in reorganization, then they are likely to file for bankruptcy earlier, which increases s and therefore reduces type II error costs.

The discussion suggests that there are two main tradeoffs in bankruptcy. The first is between bankruptcy costs incurred before firms' financial situation is known and bankruptcy costs incurred after the firm has become financially distressed but before it files for bankruptcy. A bankruptcy policy that treats managers harshly causes the punishment effect to fall, but may cause the gambling effect and the delay effect to rise. A lenient bankruptcy policy has the opposite effect. The second tradeoff occurs after firms have filed for bankruptcy and results from the difficulty of identifying which if any firms in bankruptcy are worth attempting to save. A harsh bankruptcy policy that provides only for liquidation of bankrupt firms causes the cost of type II error to rise, because the going concern value of distressed but economically efficient firms is lost. But such a policy reduces the cost of type I error since no economically inefficient firms are saved. A lenient bankruptcy policy has the opposite effect on type I and II error costs.

The discussion also suggests that the traditional goal of bankruptcy policy in the European countries—that of protecting the interests of creditors—is no longer worthwhile

given the ability of creditors to diversify by holding claims of many different types against many different firms.

3. Bankruptcy Cost Tradeoffs

In this section, I briefly analyze bankruptcy costs under four different bankruptcy policies. The first loosely represents the U.S. bankruptcy system, where managers are allowed to choose between liquidation and reorganization in bankruptcy and they remain in control during reorganization. The second represents the *de facto* German bankruptcy system, under which all firms in bankruptcy shut down and their assets are liquidated. The third represents the French system and the British administration order system, under which an outside bankruptcy official is appointed when firms file for bankruptcy and the official decides whether the firm should be liquidated or reorganized. This “expert judgment” system represents what European bankruptcy systems appear to be moving toward. Finally, the fourth system represents a proposed reform of bankruptcy procedures. Table 2 summarizes bankruptcy costs under the various policies.

The U.S. Chapter 7/Chapter 11 procedure allows managers to choose between liquidation and reorganization in bankruptcy and to control the reorganization process at least initially. It therefore treats managers relatively leniently. As a result, the punishment effect is high, but the gambling effect and the delay effect per firm are low. Many failing firms of both types file under Chapter 11, so that the “right” firms are saved and the costs of type II error are relatively low, but the “wrong” firms are also saved so the costs of type I error are relatively high. The U.S.-style system works best if a high proportion of financially distressed firms are economically efficient and therefore worth saving.

The U.S. bankruptcy system is clearly attractive to policymakers, since they see it as saving the jobs provided by financially distressed firms. Saving these firms saves money for the government, since the immediate costs are borne by creditors while workers who would otherwise lose their jobs would be eligible for publicly financed unemployment compensation and retraining programs. Thus the benefits of a bankruptcy policy which encourages reorganization and is favorable to managers are immediate and obvious to policymakers. The costs of such a policy are easy for policymakers to disregard, since the punishment effect and the cost of high type I error are long-term and hidden.

Now consider the alternate system of liquidating all firms in bankruptcy, the next line of table 2. Under a policy of liquidation-only, the punishment effect is low and the costs of type I filtering error are zero, since no distressed firms are saved. However, there are high costs of type II filtering error, since all economically efficient but distressed firms shut down. There are also high per firm costs of delay and gambling, since managers have a strong incentive to do whatever they can to postpone or avoid bankruptcy. This system works best if most or all failing firms are economically inefficient, since in that case the costs of type II filtering error is zero. But it works less well if many distressed firms are worth saving.

Now consider the system that the various European countries appear to be moving toward: establishment of a reorganization procedure in bankruptcy, but use of an outside bankruptcy official to decide which firms will be reorganized. Because managers are still treated harshly, this system also has the advantage of a low punishment effect. Also, substituting an expert's judgment about whether to reorganize the firm for the U.S. system of allowing managers to decide or the German system of automatic liquidation in bankruptcy is likely to reduce the costs of filtering error in bankruptcy. If experts had infallible judgment, then there would be zero costs of both type I or type II error. More realistically, the two error rates should be roughly equal if errors are random and both should be fairly low if officials' judgments do not become politicized. On the other hand, managers are treated harshly in this system, since they are likely to be replaced even if the outside expert decides that the firm should be reorganized. Therefore the costs of delay and gambling will be high. In addition, the probability of successfully reorganizing those firms chosen by bankruptcy officials may be low, because by the time managers file for bankruptcy, it may be too late to save their firms.

Finally, consider a reform proposal which has been popular with academic economists. It calls for selling all firms in bankruptcy on the open market as quickly as possible after the bankruptcy filing. Firms would be sold as going concerns whenever possible. New owners would make the decisions concerning whether to shut the firms down or keep them operating and, if the latter, would also decide whether to retain the old managers. The proceeds

of selling the firm would be used to pay creditors under the absolute priority rule.⁴⁰ This proposal is attractive since new owners—having their own money at stake—have a strong incentive to make accurate decisions about whether to liquidate or reorganize failing firms. Thus the costs of type I and type II filtering error should be close to zero. However, the costs of delay and gambling would still be high, since managers would probably assume that new owners would replace them and would therefore avoid bankruptcy as long as possible.

Summarizing table 2, perhaps the most surprising result is that the analysis seems to have no clear results. A clear choice of one bankruptcy system over the others would require estimating numerical values for the various bankruptcy cost elements in table 2.

⁴⁰ Various versions of this proposal include Baird (1986), Jackson (1986), Bebchuk (1988) and Bradley and Rosenzweig (1992).

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