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THE LAW SCHOOL

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The Modigliani-Miller Theorem on the irrelevance of corporate capital structure is perhaps the best-known result in modern finance. Simply put, the theorem states that, under certain assumptions, the market value of a firm is independent of its capital structure. Substituting equity for debt or, as occurred during much of the 1980s, adding layers of debt to the capital structure of a firm, would, under the stylized assumptions of the theorem, have no effect on its value.¹ The theorem applies to the mix of debt and equity and more generally to the mix of debt-as between secured and unsecured or senior and subordinated-as well.² Understanding existing patterns of debt and equity begins therefore with the Modigliani-Miller Theorem. One must identify which of its assumptions do not hold and explain why relaxing them leads to the patterns of debt and equity that currently exist. Much scholarship has focused on the assumption that changes in capital structure do not affect how a firm's assets are used. There is little reason to think that this assumption is true. As is now well-understood, equity-

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¹ Franco Modigliani & Merton H. Miller, The Cost of Capital, Corporation Finance, and the Theory of Investment, 48 Amer. Econ. Rev. 261 (1958); Franco Modigliani & Merton H. Miller, Corporate Income Taxes and the Cost of Capital: A Correction, 53 Amer. Econ. Rev. 433 (1963). For a standard exposition, see Thomas E. Copeland & J. Fred Weston, Financial Theory and Corporate Policy 439 (3d edition 1988).

² See Alan Schwartz, The Continuing Puzzle of Secured Debt, 37 Vand. L. Rev. 1051 (1984).

holders may choose different projects if debt is present from what they would choose otherwise. Equityholders enjoy all of the benefits of successful projects but share the losses from unsuccessful ventures with creditors.

Over the last decade, a number of scholars have tried to extend this analysis to the institution of secured credit. They have asked whether the desirability of giving decisionmaking power to the equityholders and the resulting need of creditors to ensure that the equityholders do not abuse this power explains why some creditors take security and others do not. These scholars have focused on the way secured credit might enhance the ability of creditors to monitor debtor misbehavior. The current posture of this literature offers only some support for the view that secured credit matters for monitoring debtor misbehavior.³

In addressing only debtor misbehavior, the focus of this scholarship has been too narrow. Just as the debtor is capable of misbehaving, so too are the creditors. A creditor may seize assets and sell them piecemeal even if a sole owner would keep the assets together. If no creditor enjoyed priority over another, each creditor might have an incentive to spend resources monitoring both the debtor and other creditors to ensure that it was not left unpaid if the debtor failed. Whether secured credit may be a device that minimizes, or even eliminates, creditor misbehavior is a question that has been completely neglected in the literature.

In this paper, I set forth a simple game-theoretic model to analyze these questions. The formal model exposes weaknesses in the existing literature and suggests that it is unlikely that secured credit responds to debtor misbehavior. More importantly, I suggest that secured credit is a sensible response to the problem of creditor misbehavior. As a corollary, I offer a new view of perhaps the central premise of recent bankruptcy scholarship. The same scholars who have not seen any link between secured credit and the problem of

³ Compare Thomas H. Jackson & Anthony T. Kronman, Secured Financing and Priorities Among Creditors, 88 Yale L. J. 1143 (1979); Saul Levmore, Monitors and Freeriders in Commercial and Corporate Settings, 92 Yale L.J. 49 (1982) with Schwartz, *supra* note 2, at 1057-59. See also Douglas G. Baird, Property Rights, Priority Rights, and Ostensible Ownership: The Deep Structure of Article 9 in P. Coogan, W. Hogan, D. Vagts & J. McDonnell, Secured Transactions Under the Uniform Commercial Code (1988).

creditor misbehavior have nevertheless advanced the notion that bankruptcy law exists in the main to overcome the problems that arise when too many creditors chase too few **assets**.⁴ By failing to see that secured credit is itself a response to the problem of creditor misbehavior, these scholars have misunderstood the institution of secured credit and, more importantly, they have structured their analysis of bankruptcy law upon an unsound **premise**.⁵

These scholars assume that creditors who face a troubled debtor confront a common pool problem and they then assert that bankruptcy law exists to overcome it, just as laws exist to overcome common pool problems elsewhere. The common pool problem, however, is typically the domain of property law. It arises among strangers who have had no established relationship with each other or **any** common third party. The setting is an English pasture in the

⁴ Thomas H. Jackson, Bankruptcy, Non-Bankruptcy Entitlements, and the Creditors' Bargain, **91** Yale L.J. 857 (1982); Douglas G. Baird & Thomas H. Jackson, Corporate Reorganizations and the Treatment of Diverse **Ownership** Interests: A Comment on Adequate Protection of Secured Creditors in Bankruptcy, **51** U. Chi. L. Rev. 97 (1984); Thomas H. Jackson, The Logic and Limits of Bankruptcy Law (1986) (hereinafter cited as "Logic,."). But compare James W. Bowers, Whither What Hits the Fan: Murphy's Law, Bankruptcy Law and the Elementary Economics of Loss Distribution (forthcoming, Georgia Law Review) (noting possible relationship between secured transactions and bankruptcy theory).

⁵ This work also suffers from a more basic defect, as it begins the inquiry in the wrong place. It starts with the notion that the underlying debt-collection rules are fixed and that bankruptcy law should be designed around them. An issue for further research is whether first accepting state law baselines and then asking how those baselines can best be respected in the context of a collective bankruptcy proceeding fundamentally misconceives the nature of the inquiry that should be made. We might be better served by focusing directly on the form of a **set** of optimal insolvency rules. In particular, the current bankruptcy law is now designed to solve the common pool problem, but that problem arises only because levying on assets and establishing priority to those assets are treated as one. If they were separated-if seizing assets left unchanged the unsecured creditor's right to only a pro rata share of the assets if the debtor were insolvent at the time of seizure-the traditional common pool problems would be minimized, if not completely eliminated. We need to weigh carefully the advantages and disadvantages of linking seizure and priority, but, by looking only at bankruptcy law with debt-collection rules as a given, we have ignored these fundamental questions.

fifteenth century,⁶ a Texas oil field at the turn of the century,⁷ or a fishery in Malaysia today.⁸ The common pool problem itself arises from an overlapping distribution of rights defined by equating acquisition or capture with an absolute priority in ownership. When each person has the same right to graze, drill or fish and no one has the right to exclude, the dominant strategy for each person is to graze, drill or fish, without regard to the interest all have in assuring that the resource is put to its best use.

Those who enjoy these rights to a common resource acquire them independently. There are no prior dealings. By contrast, the relationships among the debtor and its creditors are largely contractual. The parties themselves can structure their relationships with each other to minimize the common pool problem. Firms commonly have both secured and unsecured creditors; still others grant no secured debt but have senior and subordinated unsecured creditors. By the initial allocation of priority rights, many firms can avoid the common pool problem altogether. Such a case would exist, for example, if the parties could ensure that the firm would owe a single secured creditor more than it would be worth anytime it failed.

There are substantial reasons to think that the debtor will seek ways to minimize the resulting harms of the common pool. The creditors can anticipate the common pool and its consequences. They will therefore charge interest rates to cover the anticipated losses from the common pool. Because the debtor bears these costs directly, the debtor will internalize the cost of the common pool and will therefore search for mechanisms to minimize this cost. Security interests and other priority devices play this role.

To put the point in different terms, the common pool problem is a multi-party version of the Prisoner's Dilemma.⁹ Actions that are in the self-interest of the individual fisher, shepherd, oil driller or

⁶ See J A Yelling, *Common Field and Enclosure in England 1450-1850* (MacMillan Press Ltd. 1977).

⁷ See Gary D. Libecap & Steven N. Wiggins, Contractual Responses to the Common Pool: Prorationing of Crude Oil Production, 74 *Amer. Econ. Rev.* 87 (1984).

⁸ See E.N. Anderson, Jr., A Malaysian Tragedy of the Commons, in *The Question of the Commons: The Culture and Ecology of Communal Resources* (Bonnie M. McCay and James M. Acheson, eds. 1987)

⁹ Jackson, *Logic*, *supra* note 4, at 10.

prisoner run contrary to the interests of the group. If one's focus is too narrow, however, one may identify something as a Prisoner's Dilemma when it in fact is a small decisionmaking problem embedded in a much larger one. The self-interested acts of individuals, which may appear harmful to the group when seen in the context of the small problem, may in fact correspond to the interests of the group when seen in the large problem.¹⁰ The legal literature does reflect this insight in the particular case of repeated play of Prisoner's Dilemma games where it is well-known that socially efficient results may be obtained even while allowing for independent decisionmaking.¹¹ The broader range of ways in which embedding can occur has yet to receive substantial attention. This paper examines a particular version of an embedded game, while leaving to another day a more general discussion of embedded games and legal rules.

This paper is divided into four sections. Section I sets out a brief road map to the worlds of secured and prioritized credit. Security interests and priority serve many purposes; my story is about situations in which the value of the assets in a firm depends on how control over them is exercised and as such occupies a well-defined spot on the map. Section II explores the extent to which problems of misbehavior can be addressed through contract and argues that more powerful devices are required to control misbehavior. For debtor misbehavior, monitoring often will be required; for creditor misbehavior, devices to stop monitoring will be needed. In each case,

¹⁰ A similar point is made in George Tsebelis, *Nested Games: Rational Choice in Comparative Politics*, 7 (1990).

¹¹ See, e.g., Alan Sykes, *Optimal Threat Strategies in International Commercial Relations: A Strategic Analysis of Section 301* (Unpublished Manuscript); Larry Kramer, *Rethinking Choice of Law*, 90 *Colum. L. Rev.* 277, 341-43 (1990); John C. Coffee, Jr., *Unstable Coalitions: Corporate Governance as a Multi-Player Game*, 78 *Geo. L.J.* 1495, 1542-44 (1990); John K. Setear, *The Barrister and the Bomb: The Dynamics of Cooperation, Nuclear Deterrence and Discovery Abuse*, 69 *B.U.L. Rev.* 569 (1989); Henry N. Butler 8c Jonathan R. Macey, *The Myth of Competition in the Dual Banking System*, 73 *Cornell L. Rev.* 677, 692 (1988); Roberta Romano, *Metapolitics and Corporate Law Reform*, 36 *Stan. L. Rev.* 923, 928 (1984). This literature draws upon the experimental work in Robert Axelrod, *The Evolution of Cooperation* (1984) and the theoretical work in Drew Fudenberg & Eric Maskin, *The Folk Theorem in Repeated Games with Discounting or with Incomplete Information*, 54 *Econometrica* 532 (1986).

the important consequences of monitoring externalities must be addressed. Section III considers three formal models of these situations: a debtor-misbehavior model; a common pool (or creditor misbehavior) model; and a combined debtor and creditor misbehavior model. In each of the three cases, I set out a simple two-person model and apply a standard game-theoretic solution concept to suggest how individual decisionmaking can be coordinated without writing full-blown contracts among the various parties. Section IV concludes the paper.

I. THE WORLD OF SECURED AND PRIORITIZED CREDIT

Security interests arise for a variety of different reasons. Before I focus on security interests in personal property of the limited-liability firm, I briefly examine the role that security interests play in the economy generally. Secured transactions range from a \$10 loan at the local pawnshop secured by a pledge of a ring, to the mortgage on my house, to multibillion dollar loans secured by all of a company's assets. In the United States, the largest part of the secured transaction market is real property lending. At the end of 1990, there were approximately \$8.5 trillion outstanding in nongovernmental debt. Of that, \$3.86 trillion, or more than 45% of the total, consisted of real property mortgage debt. No other single category of debt looms so large in the private economy.¹³

Secured lending on real estate dwarfs other secured or prioritized lending, but the balance is far from insubstantial. Another \$285 billion in debt is represented by automobile financing, most of which is secured.¹⁴ Another \$96 billion is lent by the asset-based finance industry.¹⁵ This category covers loans to businesses by banks, financing companies and others for which the primary collateral is the personal property assets of the business. This debt is privately held. Corporate bonds and notes, in contrast, are often publicly held.

¹² See table 1 59 Summary of Credit Market Debt Outstanding in 77 Federal Reserve Bulletin, No. 10 (October, 1991).

¹³ Id

¹⁴ See table 1 55 Consumer Installment Credit in 77 Federal Reserve Bulletin, No. 10 (October, 1991).

¹⁵ See Frank J Donahue Getting back to basics, 48 The Secured Lender 36,39 (January/February, 1992).

As a general matter, these instruments are unsecured, though some categories, such as utility bonds and equipment trust certificates, routinely involve security. These issues are sufficiently common that secured credit was used in approximately **18%** of the new corporate issues over the three-year period 1988-1990.¹⁶ During that same period, another 15% of the new corporate issues created prioritized credit. Senior debentures and senior notes-even senior subordinated notes-were commonly issued.

Given this factual pattern, it would be surprising if secured credit played the same role in all transactions. It almost surely does not. There are at least five different roles security interests can play. First, they minimize the costs of making and collecting loans. Second, they reduce the need to monitor in situations where the property's value is largely independent of how it is managed. Third, they make assets available to creditors on default that would otherwise be shielded from them. Fourth, through a security interest, a debtor can commit to a creditor that the debtor will not after-the-fact create debt-consensually or nonconsensually-that is superior to or on par with preexisting debt. Fifth and finally, security interests-and priority devices more broadly-control monitoring of assets in situations in which the way control over them is exercised matters. This fifth role needs to be fleshed-out, but before doing so in detail, consider the first four roles one by one.

Pawnbroking is among the most common of secured transactions. More than 35 million such loans are made each year.¹⁷ The amount lent is usually less than \$100, often substantially less. Security interests help minimize transactions costs for these loans. Detailed investigations into the borrower's net worth would cost more than the amount borrowed. The best evidence I can give of my ability to pay is to deliver to the pawnbroker an asset with a value that exceeds the size of the loan. Even that is not foolproof, as there could be a thief in my chain of title, but for most personal property, possession is still the best evidence of ownership. The pledge in pawnbroking also minimizes collection costs. The pawnbroker need not chase down the defaulting borrower, but instead can pay off the loan by selling the asset. Again, without security, collection costs

¹⁶ Compiled from issues of *Corporate Financing Week*.

¹⁷ *American Banker*, November 15, 1991, p.1.

would loom large relative to the amount lent. The security interest minimizes the costs of making and collecting these small loans.

A different story must be told for real estate mortgages. Detailed investigations of financial responsibility are standard. The costs of drafting and recording a mortgage increase rather than decrease the costs of making the loan. They may decrease the costs of collecting in the event of a default, but these costs are small relative to the size of the loan itself. Given the increased expense in creating real estate mortgages and the relatively modest reductions in collecting them, real estate mortgages cannot readily be understood as devices for minimizing direct transaction costs. Instead, security interests in real estate reduce needless monitoring of the debtor's behavior. My mortgage lender has yet to appear at my house to see if I have fixed the leaky faucet in the kitchen. Indeed, if all goes well, my lender does little more than collect checks and remind me occasionally of my duty to keep my house insured. While there is little doubt that real estate values change dramatically over time-this fact has driven the recent surge in "Chapter 20" bankruptcies-almost all of the variation affects the market as a whole and little of it is idiosyncratic. Homeowners could reduce value by destroying their homes, but almost surely will not do so, and they lack any good means of risking the value of the house in exchange for some large potential upside.

Consequently, my mortgage lender need only worry that I will try to make off with the value of the house by selling it, pocketing the cash and disappearing. A security interest on the house effectively prevents this. The security interest follows the house into the new owner's hands. Note well the difference in the positions of the unsecured creditor and the secured creditor. If I sell the house for its market value, the unsecured creditor has no right to go against the house in the new owner's hands.¹⁸ The secured creditor's rights continue in full as if I still owned the house.

Another factor at work relates to state and federal exemption laws for the assets of individuals. It is a commonplace that security interests affect the relative rights of the creditors; it is easy to over-

¹⁸ Under the uniform fraudulent conveyance laws, payment of fair consideration is an absolute defense, so long as the purchaser is without knowledge of the fraud. See Uniform Fraudulent Conveyance Act § 9; Uniform Fraudulent Transfer Act § 8.

look that security interests also directly affect the rights between the debtor and the creditor. Section 522 of the Bankruptcy Code sets forth a set of federal exemptions. A state can supplement this scheme if it so chooses or displace it entirely (and many states have chosen the latter), but most states have their own exemptions and some are extremely favorable to debtors. (Florida and Texas are well-known in this regard.) The rather mysterious line drawn is that while the debtor cannot simply waive these exemptions as against unsecured creditors,¹⁹ the debtor can grant an enforceable security interest in many of the otherwise exempt assets. Security interests make property available to creditors on default that would otherwise be denied to them.²⁰

The role played by a mechanism is in part determined by what role the legal rules assign to it. For example, the security interest is how the legal regime allows a debtor to commit to a creditor that it will not after-the-fact create debt that is superior to or on par with preexisting debt. To put the point differently, the legal system currently will not generally enforce simple negative pledge clauses or promises of priority and therefore, without more, an unsecured creditor would suffer the risk that later-appearing debt would dilute the value of earlier debt. In the absence of such a commitment, unsecured creditors would have to forecast the extent of later debt and charge interest based on that forecast. Prior unsecured lenders would also be at risk of dilution through later-appearing nonconsensual debt. Like limited liability, security interests play an important role in limiting the extent to which later nonconsensual creditors can share in assets intended to be set aside for particular creditors.

The answer to the question “Why secured credit here?” thus is at least in part answered by the role assigned to secured credit under current law. The attributes attached to the security interest by the legal regime—its special status as against third-party purchasers, or as

¹⁹ See 11 U.S.C. § 522(e) and FTC Credit Practices Rule, 16 C.F.R.

²⁰ There are limits on the extent to which this can occur. Section 522(f)(2) of the Bankruptcy Code allows the debtor to avoid a broad category of nonpossessory, nonpurchase money liens. Also, the taking of such a lien constitutes an unfair practice under 16 C.F.R. 444.2. See, e.g. Robert Scott, Rethinking the Regulation of Coercive Creditor Remedies, 89 Colum. L. Rev. 730, 747 (1989).

a means of receiving rights against otherwise exempt assets, or as a commitment device-explain its uses. But there are other situations in which creating prioritized credit may be useful and secured credit is a sufficient way to do that. In the balance of the paper, I consider situations in which the value of the assets in a firm depends on how control over them is exercised.

II. MONITORING AND CONTRACTS

How the assets are managed and their resulting value will reflect the returns that accrue to the group exercising control over the assets. This is seen most often in firms that have both debt and equity. The interests of shareholders, as a group, and those of creditors, as a group, diverge. Shareholders embrace investment policies when they have creditors that they would reject if they did not. Four types of possible misbehavior are commonly identified? (i) flat-out withdrawals of assets by shareholders; (ii) increased risk with internal funds (or asset substitutions)²²; (iii) increased risk through new funds and new projects²³; and (iv) forgoing valuable investment opportunities.²⁴

A. Monitoring, Solvency and *the Limits of Contracts*

Creditors can reduce the risk of misbehavior either by monitoring or by acquiring certain rights at the outset. These are distinct approaches. Indeed, given sufficient rights in the debt contract, the amount of costly monitoring that takes place may go down. “Me-first” covenants,²⁵ the related automatic first priority position²⁶ and

²¹ George G. Triantis, Secured Debt under Conditions of Imperfect Information (forthcoming, J. Legal Stud.) (1992).

²² See, e.g., Clifford W. Smith, Jr. & Jerold B. Warner, Bankruptcy, Secured Debt, and Optimal Capital Structure: Comment, 34 J. Fin. 247, 250 (1979); Jackson & Kronman, *supra* note 3, at 1149-50; Levmore, *supra* note 3, at 51-52.

²³ See, e.g., Eugene F. Fama & Merton H. Miller, The Theory of Finance, 150-52 (1972); Alan Schwartz, A Theory of Loan Priorities, 18 J. Legal Stud. 209 (1989).

²⁴ See Triantis, *supra* note 21.

²⁵ See Fama & Miller, *supra* note 23, at 151-52; James S. Ang & Jess H. Chua, Coalitions, the me-first rule, and the liquidation decision, 11 Bell J.

secured credit itself can be understood as attempts at reducing misbehavior through contracts alone. These clearly work best when the debtor has to go outside the firm to raise new funds for a risky and undesirable project. If the first lender takes a security interest in all of the assets of the debtor, the debtor is simply legally barred from granting a superior or equal interest in existing assets to a second lender.

Contracts alone will prove inadequate, however, given all the means by which shareholders can transfer wealth. Monitoring may be necessary to prevent asset substitutions, shareholder theft or diversion of profitable opportunities. Even though the contract between the debtor and the lender may bar asset substitution and even though the applicable legal regime surely bars shareholder theft, the contract and the laws are not self-enforcing. If the debtor can proceed unilaterally, the creditors will need to monitor the debtor in order to protect themselves from misbehavior after they have handed over the money to the debtor.²⁷

The difficult problem of getting the debtor to behave appropriately through contract terms alone without additional monitoring can be made more concrete. Consider an example that will occupy much of the paper. A debtor has a choice between two investment projects. Each project requires the debtor to borrow \$100.²⁸ Project 1 is certain to yield \$115. Project 2 is a high-risk project: 90% of the time it yields \$40, and the remaining 10% of the time it yields \$635. Note that the expected payoff for Project 2 is \$99.50 and is therefore

Econ. 355 (1980); Michelle J. White, Public policy toward bankruptcy: me-first and other priority rules, 11 *Bell J. Econ.* 550 (1980).

²⁶ Schwartz, *supra* note 23.

²⁷ Note that I focus on monitoring after the debtor receives the money. Monitoring, or screening, surely takes place before money is lent, see, e.g., Barry E. Adler, A New Perspective on the Bankruptcy Priority Puzzle (forthcoming, *Journal of Legal Studies*), but that screening does not prevent misbehavior after-the-fact.

²⁸ Fixing the level of outside investment required puts to one side interactive effects between contract design and investment seen in, for example, Douglas Gale & Martin Hellwig, Incentive-Compatible Debt Contracts: The One-Period Problem, 52 *Rev. Econ. Stud.* 647 (1985).

less than the \$100 (in expected value) the debtor would have to pay risk-neutral creditors to finance the project.²⁹

In a world of full information and complete enforcement of contracts, the problem of misbehavior is readily solvable through contracts. If the creditors thought that the debtor would undertake Project 1, financing would be readily forthcoming, because the sure return of \$115 more than covers the required debt payments of \$100. In contrast, Project 2 would not be financed. Its expected payout is not enough to repay the \$100 loan. Problems arise, however, if the creditors cannot control which project the debtor undertakes. As long as the debtor cannot credibly commit to undertaking Project 1, it will be tempted to undertake Project 2, regardless of what it tells the creditors at the time of the loan. If the debtor chooses Project 2, 90% of the time, the firm fails and the debtor gets nothing, but 10% of the time, the debtor nets \$535. Adopting Project 2 therefore yields the debtor, on average, \$53.50. Project 2 is therefore attractive to the debtor because the debtor nets only \$15 from Project 1. The creditors, by contrast, enjoy none of the gain if Project 2 succeeds and suffer the costs if it fails, as it likely will. If the debtor invests in Project 2, the creditors recover, on average, only \$46 of the \$100 they are owed, while they are sure to be paid in full if the debtor chooses Project 1. Given the debtor's incentives, the creditors will not lend to the debtor if they cannot ensure that it will invest in Project 1 rather than Project 2.

The debtor and the creditors therefore will want to alter the debtor's incentives in choosing between the two projects. The debtor may make the following promise: "If Project 2 is chosen, I promise to give you all of the revenues; otherwise, I will pay you \$100." Given the assumption of full information—meaning here that the information is both immediately known to both parties³⁰ and is immediately communicable to any third party³¹—the creditors would know immediately if the debtor chose Project 2. Given the

²⁹ For simplicity, I assume throughout a risk-free rate of interest of 0%.

³⁰ That is, in the standard language of the theory of contracts, that the information is observable. See Oliver Hart & Bengt Holmstrom, *The Theory of Contracts*, 134 in *Advances in Economic Theory—Fifth World Congress* (Truman F. Bewley ed. 1987).

³¹ That is, that the information is verifiable. See *id.*

assumption of complete enforcement of contracts, the creditors could then enforce the debtor's promise to turn over all of the revenues from the project given its selection. As a result, the debtor would never select Project 2 and would instead select Project 1. If the debtor makes this commitment, debt financing for Project 1 will be readily forthcoming. Note, of course, that many other contracts bring about the same result in a world of full information and complete enforcement. Any promise that had the effect of making the debtor's overall wealth lower when Project 2 was selected over Project 1 would have the same effect.

But information is never perfect and courts limit the range of contracts that they will enforce. The self-enforcing commitment that is almost tautologically available with full information and complete enforcement is therefore lost in a more realistic setting. Enforcement of the forcing contract requires that the creditors know which project was chosen. Without more, they typically will not know. Everything depends on taking from the debtor any incentive to choose Project 2, but the debtor will have this incentive as long as the creditors cannot monitor what the debtor is doing and monitoring is costly.

Consider again the forcing contract. The debtor promises to pay over all of Project 2's revenues if Project 2 is chosen, but only \$100 if Project 1 is chosen. If the creditors spent nothing on verifying project choice, the debtor would lose its incentive to choose Project 1. The debtor could choose Project 2. If the project failed, the debtor might turn over the \$40 as per the contract, but if the project succeeded, it would turn over only \$100. That would violate the contract, but without additional investigation, the creditors will not know whether the debtor in fact chose Project 2. Two different events—choice of Project 1 or choice of Project 2 and success—are consistent with the payment of the \$100, even though only the former complies with the contract. To distinguish these two situations the creditors would have to make costly after-the-fact inquiries. Part of what may separate creditors from debtors is precisely the expertise that is required to know which project should be chosen or even what project has been chosen.

One might address this problem by expanding the scope of the contract. Contracts could depend on the debtor's choice of project, the realized state of the world, the payments actually made by the

debtor, and the information investment (or monitoring) decisions made by the creditors, but ultimately the creditors must confront the difficulty of drafting a contract sophisticated enough to give the debtor the right incentives and simple enough to allow them to monitor its performance cheaply. Even if the creditors are able to surmount these barriers, they still face the burden of persuading a third party that the debtor has in fact broken its promises. Even if the gap between creditor and debtor information regarding project choice can be lowered at will (though at a cost), there is no assurance that this information can be communicated effectively to a judge or jury.

B. Externalities in Monitoring and the Optimal Level of Monitoring

Given the inability of contractual terms alone, to ensure appropriate behavior by the debtor, creditors commonly monitor their debtors. As already noted, creditors fear that their debtors will take inappropriate risks, or simply steal, and will thereby dissipate the assets otherwise available to satisfy their claims. When there are many creditors, we face the additional problem of ensuring that creditors do not duplicate the efforts of one another. Introducing more than one creditor also creates monitoring problems as among the creditors. Creditors fear their fellow creditors. When the going gets tough, the tough creditor gets going: aggressive creditors seek payment of their claims in full from the failing debtor with the hope of avoiding the pro rata payment regime that would otherwise apply in bankruptcy. Given that seizure of property determines priority to that property, each unsecured creditor needs to worry that other creditors will exercise their right to withdraw assets from the debtor in the wake of a default. Creditors will monitor their debtor both to decide when to withdraw assets and to prevent asset withdrawals by their fellow creditors.

In these situations, it is possible to identify an optimal level of monitoring. Whether that level of monitoring will result without any effort to induce that outcome depends critically on the extent to which monitoring externalities exist. If monitoring is a private good-if monitoring by one creditor has no effect on a second creditor-the right level of monitoring may occur without the need for any effort to induce that outcome. Although some forms of monitoring may follow that pattern, more often than not monitor-

ing involves externalities. These may be positive, as they are when my monitoring of the debtor means the debtor remains solvent, conferring benefits on my fellow creditors. Or they may be negative, as when my monitoring of the debtor allows me to detect failure more quickly and thereby grab the available assets first. In these situations, it will take some work to get the right level of monitoring.

The way in which these externalities work themselves out is complex. For example, that monitoring confers benefits on the other creditors does not alone lead to less than optimal monitoring. If monitoring conferred special benefits to the monitor that were not available to the rest of the group, for example, monitoring might be set at the socially optimal amount notwithstanding the externality. Indeed, beating the pro rata rule might be the compensation required to induce an unsecured creditor to monitor the debtor.³² This possibility is of course undercut today by the right of the trustee to recover eve-of-bankruptcy transfers.³³ Identifying this benefit to the monitoring creditor, however, does not tell us how coordination is to be achieved among the potential monitors. An equilibrium would seem to require that each creditor have fairly detailed knowledge of the benefits and costs of monitoring to the other creditors.

Again, the full extent of the externalities depends critically on assumptions made about monitoring. In fact, one rough way of organizing much of the preexisting literature on the problem of the misbehaving debtor and secured credit is keyed to the monitoring assumptions. The critical point is the extent to which the secured creditor can tailor its monitoring to the particular situation. On one view, the secured lender specializes and takes a security interest only on a well-defined category of assets, such as equipment, inventory or receivables. The secured creditor's monitoring of how the debtor treats its equipment does not spill over to monitoring the debtor's other assets. The only comfort that the unsecured creditors can take from the secured creditor's monitoring is that it reduces the chance that the secured creditor will later seek to share in the assets not

³² This is precisely the explanation given for allowing bank depositors to withdraw on demand in Charles W. Calomiris & Charles M. Kahn, *The Role of Demandable Debt in Structuring Optimal Banking Arrangements*, 81 *Amer. Econ. Rev.* 497 (1991).

³³ 11 U.S.C. § 547.

subject to the security interest. It gives them no comfort that the debtor is not misbehaving with the unliened assets. This vision of monitoring is seen in work by Jackson and Kronman³⁴ and by Baird.³⁵

The second view of monitoring assumes that spillovers are inevitable. **F**or example, the debtor loses absolute discretion over inventory when a secured creditor monitors receivables. Other creditors anticipate the spillover and adjust their monitoring accordingly. In the extreme, monitoring by one creditor prevents all misbehavior, and the only issue is allocating the burden of monitoring. This view captures the essence of the public-good aspect present in the enforcement of group rights. **I**t also reflects the idea that tailoring is costly and we often live in a one-size-fits-all world. Many lenders have a standard drill for their auditors to follow, for each kind of debtor. It is a means of economizing on their internal decisionmaking and controlling their internal principal-agent problems. Tailoring may be irrelevant also, if the paradigm secured transaction is the all-assets lender taking a security interest in all that Article 9, applicable real estate law and the remaining common law that fills the gaps between the two allows. This vision of monitoring is seen in the work of Levmore³⁶ and Schwartz.³⁷

My analysis builds on this second view of monitoring. To highlight the problem of coordinating the actions of creditors, I make several simplifying assumptions. I take the cost of monitoring needed to curb misbehavior as a given, fixed cost. Moreover, if any creditor monitors the debtor, all debtor misbehavior is prevented. Monitoring by additional creditors adds nothing. A similar assumption will be made for creditor withdrawals. If one (and only one) creditor monitors, that creditor will be able to withdraw assets successfully in the event of a pending debtor failure, and that creditor will thereby avoid the pro rata payment regime. If more than one creditor monitors, all withdrawals are prevented, and if the debtor fails, pro rata payments are made. Note that under these assumptions monitoring is a public good. Monitoring by one creditor prevents all

³⁴ See Jackson & Kronman, *supra* note 3, at 1154 n.4.

³⁵ See Baird, *supra* note 3.

³⁶ See Levmore, *supra* note 3.

³⁷ See Schwartz, *supra* note 22, at 1056-57.

misbehavior, and each creditor benefits when misbehavior is prevented. Note, though, as already suggested, the assumption that monitoring costs are a given, fixed cost prevents the monitor from individuating its monitoring decisions. The model therefore does not account for the possibility that the amount of monitoring a creditor chooses to do might be optimal for that creditor but suboptimal for the creditors as a whole.

As noted, the assumption that monitoring by one creditor is sufficient to prevent all debtor misbehavior captures the public-good problem in monitoring. Public goods and free riding go hand-in-hand. As a group, the creditors face the question of how to coordinate their individual decisionmaking so as to reach the outcome that is best for the group as a whole. The creditors could coordinate through direct contracts among themselves to allocate monitoring responsibility and cost-sharing. This would require a complex web of contracts among the creditors and would almost surely be costly to implement. Although we do see bilateral contracts among some creditors-subordination agreements being the prime example—we rarely see fully specified contracts among all the creditors.

Alternatively, following the public goods literature,³⁸ some sort of intermediate device could be interposed between the debtor and the creditors. Indeed, banks and other financial intermediaries play such a role in aggregating the otherwise separate actions and information of their depositors.³⁹ For the purposes of this paper, I ignore the possibility of interposing an aggregation mechanism between the creditors and the debtor, or equivalently, of allowing the creditors to enter into contracts among themselves regarding monitoring. Although some creditors can coordinate their actions, situations arise in which they cannot. These give rise to the public good problem in monitoring and are the situations on which I want to focus.

³⁸ See, e.g., Christopher Bliss & Barry Nalebuff, *Dragon-Slaying and Ballroom Dancing: The Private Supply of a Public Good*, 25 J. Pub. Econ. 1 (1984); Glenn W. Harrison & Jack Hirshleifer, *An Experimental Evaluation of Weakest Link/Best Shot Models of Public Goods*, 97 J. Polit. Econ. 201 (1989).

³⁹ See Douglas W. Diamond, *Financial Intermediation and Delegated Monitoring*, 51 Rev. Econ. Stud. 393 (1984).

III. A MODEL OF EFFICIENT MONITORING OF DEBTORS AND CREDITORS

In this section, I examine the relationship between monitoring efficiency and the debtor's capital structure. A common setting involving an entrepreneur with an investment project and two creditors is set out. Three cases are considered: a simple debtor-misbehavior model, a simple common pool model and a combined debtor misbehavior/common pool model. Before looking at the cases, let me sketch the current state of the literature and how my results compare.

In their early work, Jackson and Kronman focused on the need to monitor possible debtor misbehavior, and argued that security interests should be granted to high-cost monitors to reduce the amount of monitoring they needed to do. Levmore⁴⁰ criticized this work, because it rested on the unlikely premise that secured creditors would have higher costs of monitoring than unsecured creditors. Levmore instead pursued the debtor-misbehavior model and argued that secured credit responded to problems of freeriding on monitoring and duplication in monitoring among unsecured creditors. Schwartz, in turn, criticized Levmore's description of the debtor-misbehavior model, arguing that an equilibrium in which only one creditor monitors will be reached without any capital structure design.⁴¹ Schwartz notes that in a multiple creditor model, having one unsecured creditor monitor and no other unsecured creditor monitor forms an equilibrium, given the assumptions about monitoring. Duplicate monitoring or no monitoring at all are then disequilibrium phenomena, and from this Schwartz concludes that "the stable, pervasive existence of personal property security is quite unlikely to be a response to the disequilibrium phenomenon of duplicate monitoring."⁴²

My analysis revisits this analysis for the question of debtor misbehavior and, I believe, breaks new ground by confronting the creditor misbehavior problems of the common pool. As to the simple debtor-misbehavior model, Schwartz's conclusion regarding the absence of

⁴⁰ See Levmore, *supra* note 3.

⁴¹ See Schwartz, *supra* note 2.

⁴² *Id.* at 1057.

a need for secured credit seems right, but his analysis seems incomplete. The monitoring game played among the creditors is characterized by multiple equilibria. Schwartz clearly understood that multiple equilibria would exist, but didn't view that as problematic. Multiple equilibria, though, usually pose thorny coordination problems. Indeed, the debtor monitoring game played by the creditors is similar to the well-known Battle of the Sexes game, except that the creditors seek to coordinate on playing different strategies rather than the same strategies as they usually do. Because of the multiplicity of equilibria, there can be no assurance that the creditors will appropriately coordinate their decisions. I suggest that eliminating multiple equilibria is a critical component of capital structure design. Notwithstanding that, security interests are unnecessary to create a monitoring game with a single solution.⁴³

More importantly, I argue that responding to the problem of creditor misbehavior is of substantial importance in the design of capital structures. Creditor misbehavior can have the form of the Prisoner's Dilemma. Unlike the Battle of the Sexes and its multiple equilibria, here a unique solution exists, but it's a poor solution. Capital structure design is needed to get to a different solution and security interests can serve as the mechanism for reaching that superior solution.

I. General Statement of the Model

As the analysis in Section II should suggest, a full-blown model of contracting in multiple creditor contexts would be dauntingly complex. The model of this paper sidesteps this problem by focusing on particular, well-known contractual forms for debt. The model proceeds in four stages. In the first stage, the debtor enters the lending market and signs two contracts providing total financing of D , assumed here to be \$100. I assume that the firm will have two creditors, because secured and unsecured creditors are indistinguishable if the debtor has only a single creditor. Label the lending creditors C_1 and C_2 . At stage 1, C_1 lends an amount d_1 at a fee schedule f_1 and C_2 does the same for d_2 at schedule f_2 . A fee schedule may just be an interest rate, but it may also include contingent charges, such as reimbursement for legal fees, monitoring costs or the like. The as-

⁴³ Though there are caveats. See *infra* at n. 49.

sumption of two creditors could be justified in a more general setting⁴⁴ but operationally the firm will be required to choose d_i , the face amount of the debt owed to creditor i , from the range $0 < d_i < D$ for all i , $d_1 + d_2 = D$. I assume that the lending market is competitive and has a risk-free rate of return set at 0%.

The central question explored here is whether security interests have any role to play in the presence of other standard terms. Contracts are assumed to be standard debt contracts, meaning a fixed amount is to be repaid, subject to solvency constraints. Three choices are allowed. First, debt may be secured or unsecured, but, of course, in the two-creditor model, only one creditor can be secured. Second, the contract may (or may not) specify partial or full reimbursement of creditor monitoring costs. Third, the debtor can distribute the debt D between C_1 and C_2 arbitrarily, subject to the debt floor required to ensure a model with two creditors in equilibrium.

In stage two, after lending, the creditors simultaneously make their individual monitoring decisions. That is, each creditor chooses whether to monitor the debtor. This monitoring is assumed to convey information covering possible debtor misbehavior and possible creditor misbehavior in the models where both are possible. This assumes economies of scope in monitoring. Monitoring is costly, and it will be assumed that there is a fixed cost of monitoring at stage two, call it k_1 for creditor C_1 and k_2 for creditor C_2 . Assume that k_1 is \$5 and k_2 is \$8. In stage three, in light of the monitoring decisions, the debtor chooses between Projects 1 and 2. Project 2 will be implemented if neither creditor monitors and if Project 2 is preferred by the debtor to Project 1. Project 1 is carried out if either creditor monitors the debtor. In stage 4, nature moves and determines the project's outcome.

I ignore the possibility of direct contracts between the creditors or between the creditors and an intermediary that in turn deals with

⁴⁴ The assumption that debtor borrows from more than one creditor is common, see, e.g., Jackson & Kronman, *supra* note 3, at 1158-60, but it would be better to have that result appear endogenously in a more general model. The result itself might be justified on the risks of instability associated with having a single supplier of any good. It is surely common wisdom that it is prudent for a firm to have relationships with more than one vendor to prevent dislocations that might arise if the vendor failed or switched supply policies.

the debtor. Allowing either of these would undercut the central assumption that the debtor has two creditors acting noncooperatively. I also assume that the creditor monitoring decisions are fully revealed after the fact, so that there are no strategic issues raised with regard to reimbursing monitoring costs and the like.

2. *The Debtor-Misbehavior Model*

The first model explores whether a security interest is required to induce efficient monitoring. Return to the case in which the debtor has two projects available to it. Each project requires debt financing totalling \$100. Project 1 is certain to yield \$115. Project 2 is a high-risk project: 90% of the time it yields \$40, and the remaining 10% of the time it yields \$635. As noted, the expected payoff for Project 2 is \$99.50, which, of course, is less than the \$100 (in expected value) the debtor would have to pay risk-neutral creditors to finance the project. The debtor has an incentive to substitute Project 2 for Project 1, because it receives most of the benefits of the high-risk/high-gain project and bears few of its costs. In contrast, creditors expect to lose money if the debtor is left unchecked and pursues Project 2. Hence, the creditors will not invest unless the debtor can be monitored. Recall that monitoring is assumed to be indivisible and that monitoring by one creditor suffices to prevent misbehavior.

At the first stage, competition among potential lenders to the firm naturally limits the fee schedules that can be charged to the debtor. Therefore, at the time of making the loan, each creditor should expect to earn just a competitive rate of return. The payoffs occur only after the second-stage monitoring game is complete. For this reason, the creditors and the debtor need to anticipate the monitoring decisions that will be made in the monitoring subgame. Creditors must expect to earn at least a competitive rate of return given the monitoring costs they will face. If the two proposed fee schedules in the first stage would lead either creditor to anticipate a subcompetitive or supracompetitive rate of return because of the monitoring decisions those fee schedules would generate, new fee schedules are needed.

The lenders have two decisions to make. First, each lender has to set a fee schedule for lending. Assume initially that the \$100 risk-free debt is split evenly between C_1 and C_2 . Second, each lender must decide whether to monitor the debtor. Suppose that both

lenders make their first-stage decisions on the assumption that C_1 will monitor and C_2 will not. Given the underlying monitoring technology and the certainty of debtor misbehavior without monitoring, the only possible equilibrium has one (and only one) creditor monitoring.⁴⁵ Now consider the fee schedules of the creditors. C_2 will seek payment of the amount lent plus interest at the risk-free rate, or \$50. Suppose that C_1 simply builds the monitoring charge into the interest rate and therefore seeks payment of \$55.

This arrangement forms a Nash equilibrium. That is, neither the debtor nor C_1 or C_2 can improve their positions by deviating from their courses of action, given the actions of the others. C_2 will plan not to monitor, given that C_1 will plan to do so, and given that C_1 will plan to monitor, the debtor will not be able to misbehave, therefore the loans will be paid in full, and thus C_2 must just offer the competitive rate on its loan. For C_1 , given that C_2 will not plan to monitor, C_1 will plan to monitor, therefore the debtor will not misbehave; C_1 charges an interest rate set to just cover its \$5 monitoring costs. Note that the debtor gains nothing by redistributing its borrowing between the two creditors. Given the assumptions used by the creditors in setting their lending fees, each charges just the risk-free rate and C_1 builds the monitoring charge into the interest rate.

The interest rate and monitoring decisions are made in sequence, however, and we need to take this feature into account. When the second-stage monitoring decisions are made—that is, when the monitoring subgame occurs—the creditors will face the following payoff matrix:

⁴⁵ As has been noted before. See Schwartz, *supra* note 2, at 1057.

		C ₂	
		Not Monitor	Monitor
C ₁	Not Monitor	[24, 22]	[55, 42]
	Monitor	[50, 50]	[50, 42]

Figure 1.i: Payoffs without Contingent Reimbursement

That is, if neither creditor monitors, the debtor misbehaves. The alternative project succeeds 10% of the time and the creditors are paid in full but 90% of the time the project fails, and \$40 is available to be divided pro rata on C₁'s claim of \$55 and C₂'s claim of \$50. Taken together, this results in an expected payoff of \$24 to C₁ and of \$22 to C₂. If C₁ monitors and C₂ does not, the debtor will not misbehave; both creditors are paid in full and C₁ nets \$50 (\$55 - \$5 monitoring cost). Note that both creditors earn the risk-free rate when monitoring occurs as contemplated when the interest rates were set. If C₂ monitors and C₁ does not, again the debtor behaves and both creditors are paid in full, but C₁ earns a supracompetitive return. C₁ set its interest rate to reflect the cost of monitoring, but did not do so. C₂'s monitoring saved it from the costs of debtor's misbehavior. In contrast, C₂ earns less than the risk-free rate because it paid \$50 but spent \$8 in monitoring cost. C₂ bears the cost of monitoring without charging for it. In the final cell, both creditors monitor, C₁ earns a competitive rate and C₂ again loses out.

It is important to note that both of the cells in which one creditor monitors are Nash equilibria. If C₁ monitors, C₂ will not, and if C₂ does not, C₁ will. Similarly, if C₂ monitors, C₁ will not, and if C₁ does not, C₂ will, notwithstanding that a different result was contemplated when the lending charges were set originally. The second stage monitoring game exhibits two pure strategy Nash equilibria. This game has the form of the well-known Battle of the Sexes game, except that the players seek to play different strategies rather than the same strategies. The multiple equilibria give rise to a coordination problem, and the Nash conception alone provides no way to select among the various equilibria. To be sure, the parties anticipated one of these subgame results, but given the essential simultaneity of the monitoring decisions by each creditor, there is noth-

ing that makes this outcome the obvious one. We would not think the outcome obvious if we simply began with the monitoring subgame, and it is hard to see why one outcome becomes more likely merely because we have embedded the monitoring subgame into the larger fee-setting and monitoring game. Sometimes embedding may help achieve a solution,⁴⁶ but this is not one of those times. The creditors are not indifferent among the equilibria. Each would prefer to freeride on the monitoring efforts of the other, and receive full (or more than full) payment without incurring the monitoring costs.

One should note that the outcome in which C_2 monitors and C_1 does not should not be an equilibrium in the original game. The interest rates were premised on C_1 monitoring and C_2 not monitoring. In this outcome, C_1 earns a supracompetitive return and C_2 a subcompetitive one. Because the debtor ultimately bears the cost of monitoring, it will seek an arrangement that has a unique equilibrium in the original game and all subgames. The debtor and its creditors will try to create a payoff structure at the first stage such that there will be a single equilibrium at the second stage. To put the point formally, the first-stage structure should be considered a possible solution if (1) the resulting monitoring subgame is dominance solvable and (2) given the anticipated outcome in the subgame, the creditors just earn a competitive rate of return given the design of the first-stage structure.

To put the point another way, the central problems for the debtor and the creditors are assigning the role of monitor, ensuring that the monitor actually does monitor, and creating a mechanism that compensates (but does not overcompensate) the monitor for this burden. The firm's capital structure at the outset should be designed to eliminate the indeterminacy associated with multiple Nash equilibria in the monitoring subgame. One way of doing this is to ensure that the resulting monitoring subgame is dominance solvable.

Consider these ideas in the context of the simple misbehavior model. Rather than having the monitoring costs covered through the interest rate, the debtor should agree to pay a separate monitor-

⁴⁶ See, e.g., Elon Kohlberg & Jean-Francois Mertens, On the Strategic Stability of Equilibria, 54 *Econometrica* 1003 (1986).

ing charge to, say C_1 , if monitoring costs are incurred. That would give the following payoff matrix in the monitoring subgame⁴⁷:

		C_2	
		<i>Not Monitor</i>	<i>Monitor</i>
C_1	<i>Not Monitor</i>	[23, 23]	[50, 42]
	<i>Monitor</i>	[50, 50]	[50, 42]

Figure 1.2: Payoffs with Contingent Reimbursement

The revised game has the same two pure-strategy Nash equilibria, but there is an important difference between this game and the original subgame. For C_2 , monitoring weakly dominates not-monitoring. C_1 always nets \$50 if it monitors but it may net only \$23 if it does not. That is, C_1 will never do worse by monitoring, and may do better, and therefore C_1 should monitor. C_2 should recognize that C_1 will in fact monitor and therefore decide not to monitor. In effect, we can remove the weakly-dominated strategies from consideration and instead focus on the new payoff matrix:

		C_2	
		<i>Not Monitor</i>	<i>Monitor</i>
C_1	<i>Monitor</i>	[50, 50]	[50, 42]

Figure 1.3: Payoffs after Elimination of C_1 's Weakly Dominated Strategy

Given this, C_2 will choose not to monitor.⁴⁸

⁴⁷ As before, here and subsequently, payoffs in figures are the expected payoffs calculated using the probability distributions given for a particular project.

⁴⁸ A general discussion of dominance solvability and elimination of weakly-dominated strategies may be found in David M. Kreps, *A Course in Microeconomic Theory* 417-21 (1990). There are, of course, criticisms that can be leveled against this approach. In particular, Nozick and others have set forth examples of games in which playing a dominant strategy leads to what might be considered unreasonable results. See Robert Nozick, *Newcomb's Problem and Two Principles of Choice*, reprinted in *Paradoxes of Rationality and Cooperation: Prisoner's Dilemma and Newcomb's Problem* (Richmond Campbell and Lanning Sowden eds.). From that, they have argued that a different decisionmaking rule is needed, since the dominance rule does a poor job on fringe cases. In this paper, however, I use the concept of dominance solvability in the

This is a general result, so long as the monitoring creditor knows that it will be paid in full if the debtor behaves. When the monitoring creditor is unsecured, however, it will be paid in full only if all unsecured creditors (and any senior creditors) are paid in full as well. Given the assumptions that neither player will be paid in full if the debtor misbehaves and that the monitoring costs of C_1 are fully repaid, C_1 never does worse by monitoring and often does better. As before, C_1 should monitor, and C_2 should not. Note that the creditors need to have very little specific information to reach these conclusions. Indeed, C_1 needs to know only that it will receive less than full payment if the debtor misbehaves, and C_2 needs to know only that fact and that C_1 's monitoring costs will be fully reimbursed. The game with contingent payment of monitoring costs is dominance solvable, and this suggests that the indeterminacy of multiple Nash equilibria in the monitoring subgame can be avoided through the device of contingent full-payment of monitoring costs. It is quite common for a loan contract to include provisions for reimbursement of the expenses involved in monitoring collateral, including expenses associated with using attorneys and the like.

What this means then is that we cannot justify security interests, even after we have addressed the problem of multiple Nash equilibria.⁴⁹ Fortunately, debtor misbehavior is only half of the story; the

context of simple subgames that present none of the fringe cases. No one suggests that a richer decisionmaking rule that could replace the dominance rule would lead to different results in those cases that we now consider readily solved under the dominance rule. Indeed, we would probably consider the new rule seriously flawed if it did. Other objections to the use of dominance arguments can be made. See, e.g., Roger B. Myerson, *Game Theory* 192-95 (1991).

⁴⁹ A more complex story can be told and security interests may be useful there. The examples in the text assume that monitoring the debtor results in success. In reality, a project may fail even if the debtor is monitored. Project *success* depends on more than just the debtor making the right decisions. Full reimbursement of monitoring costs no longer suffices to make the monitoring subgame dominance solvable, but it does if coupled with a security interest in favor of the monitor. More precisely, contingent full-payment of monitoring costs coupled with a security interest will result in a dominance solvable monitoring subgame if two conditions are satisfied: (1) if the debtor misbehaves, there is a chance that the secured creditor will receive only partial payment; and (2) if the debtor is monitored and behaves, the secured creditor is sure to be paid in full, even if the other creditor is not.

second half is creditor misbehavior, and it is the subject of the next section.

3. *Creditor Misbehavior*

The possibility that a creditor will monitor its debtor's solvency follows directly from introducing even a single debt into an all-equity firm. Introducing more than one unsecured creditor creates a richer set of monitoring possibilities and needs. These are the problems of the common pool. Coordination of decisionmaking in the all-equity firm is very simple. Collective action by shareholders is the norm. The shareholders as a group decide on the hiring and firing of managers, investment strategies and indeed the firm's continued existence. Individual shareholders cannot unilaterally withdraw assets from the firm. They must act in concert with the others.

Debt changes decisionmaking about the firm's assets. No longer are decisions about the firm's assets made only jointly. Certain entities-debtholders-are typically given the right to withdraw assets from the firm without the consent of fellow creditors or of equity-holders. For unsecured creditors, withdrawal of the assets also establishes priority to the assets. Each withdrawal harms creditors in as many as three ways.

Both of these conditions may be plausible. Although for purposes of exposition I have modeled the debtor's misbehavior as choosing a particular alternative investment project, in reality there is probably almost no-limit on the extent to which a debtor can misbehave. For any particular secured obligation, we can probably imagine misbehavior that would result in only partial payment (or perhaps even no payment) being made to the secured creditor. The second condition is also plausible, especially if we recognize that the division of the debt among the creditors is not set exogenously but instead can be selected to ensure that the second condition for dominance solvability is satisfied. Operationally, the amount of the debt owed to the secured creditor must be capped by the bottom of the distribution of returns on the debtor's project, and, in a world of perfect information about that distribution, as assumed here, that can be done easily. Secured lending is often done based on a percentage of asset value, and coupling this with careful monitoring makes the second condition plausible as well. This condition also matches the common wisdom that secured creditors usually are paid in full in bankruptcies.

Note, though, that all I have suggested is that full-cost reimbursement with a security interest is sufficient for dominance solvability; other devices such as more than full-cost reimbursement or rapid repayment of monitoring costs might have the same effect.

First, assets may be withdrawn from the firm and sold for too little. This is the risk of inefficient sales. The holder of a \$100 debt removes the firm's printing press and sells it for \$100, notwithstanding that a more diligent seller would have received \$150 for the press. To be sure, the seller has to satisfy certain norms, typically procedural and not substantive,⁵⁰ but it may do so without necessarily receiving full price for the good sold. The withdrawing creditor bears none of the loss in value from the inefficient sale, and therefore such sales occur. Second, withdrawal of assets may break up efficient combinations of assets. The printing press may be worth \$100 standing alone, the dies for the press worth \$25 standing alone, and the press and the dies worth \$150 if sold together. The creditor owed \$100 may withdraw the press alone and inflict a \$25 loss on the remaining creditors. Again, the creditor bears none of the losses associated with the sale. Third, and finally, even if there are no asset synergies and withdrawn assets are sold for full value, any withdrawal reduces the pool of assets otherwise available. Creditors will monitor other creditors in an effort to police the pro rata distribution rules of bankruptcy. All of this follows from the three initial premises of unilateral withdrawal rights, the link between withdrawal and priority, and an undifferentiated debt structure. In actuality, unilateral withdrawal rights are common and may even define the debt contract. Although one can imagine debt without the right to seize assets, such debt puts the creditor at the risk of a spiteful refusal to pay. Because these features seem so fixed, I consider only the issues raised by creditor monitoring of withdrawals to prevent deviations from the pro rata distribution rules.

Consider the debtor again and its investment project. Assume (for now) that the debtor cannot misbehave. What is new here is the role of monitoring and its consequences. If one creditor monitors, and the other does not, the monitoring creditor will be able to detect the failure and will withdraw assets from the debtor.

⁵⁰ See, e.g., the commercial reasonableness standard applicable to secured sellers under U.C.C. § 9-504 and note the safe harbor of U.C.C. § 9-507(2) ("The fact that a better price could have been obtained by a sale at a different time or in a different method from that selected by the secured party is not of itself sufficient to establish that the sale was not made in a commercially reasonable manner.")

Through monitoring, the creditor will completely defeat the otherwise applicable pro rata distribution rule. Note that, for the creditors as a group, monitoring adds nothing. It simply redistributes value among the creditors. In the prior misbehavior model, monitoring reallocated value between the debtor and the creditors as a group. The debtor desired monitoring because only with monitoring could it borrow at all. In the common pool, monitoring confers no benefit on the debtor. Indeed, monitoring imposes a cost on the debtor, because the creditors will set their fee schedules to reflect the outcome of the monitoring subgame.

Consider an example in which the probability of success for the project is .8; assume that if Successful, the project results in total assets of \$122.75, but if it fails, it is worth \$84. (This gives the project an expected value of \$115 as before.) Assume that the creditors make their first-stage fee schedule decisions on the assumption that neither player will monitor in the subgame, and consider the resulting payoff matrix faced when the monitoring subgame is played:

		C ₂	
		Not Monitor	Monitor
C ₁	Not Monitor	[50, 50]	[48, 44]
	Monitor	[47, 48]	[45, 42]

Figure 2.1: Payoffs in Pure Common Pool Model: The Unsecured Case, Low-Risk Debtor

This game is dominance solvable.⁵¹ C₁ will not monitor, regardless of what C₂ does, and C₂ will not monitor either. The costs of monitoring exceed the benefits to be gained from avoiding the pro rata rule, given the firm’s high probability of success.

Now suppose that the probability of success is only .5; the project yields \$146 if successful and \$84 if it fails, giving again an expected value of \$115. Assume, as in the prior example, that the creditors

⁵¹ The best course of action for each player is independent of what the other player does. When C₂ does not monitor, C₁ earns \$50 instead of \$47 if it does not monitor; when C₂ monitors, C₁ earns \$48 instead of \$45 if it does not. Similarly, when C₁ does not monitor, C₂ earns \$50 instead of \$48 if it does not monitor; when C₁ does monitor, C₂ earns \$48 instead of \$47 by not monitoring. Both are better off not monitoring, regardless of what the other does.

make their first-stage fee schedule decisions on the assumption that neither player will monitor in the monitoring subgame, and consider the resulting payoff matrix in the subgame:

		C ₂	
		Not Monitor	Monitor
C ₁	Not Monitor	[50, 50]	[42, 50]
	Monitor	[53, 42]	[45, 42]

Figure 2.2: Payoffs in Pure Common Pool Model: The Unsecured Case, High-Risk Debtor, No Monitoring Expected

If the game played out as the creditors contemplated it would when they set their fee schedules, each player would receive \$50, the appropriate competitive rate of return. But the game will not play out that way. C₁ will monitor, regardless of what C₂ does, and C₂ will therefore earn a subcompetitive rate of return. That means that C₂ will reject the proposed fee-schedule pair, and a second set will have to be considered. Assume instead, therefore, that the creditors set their proposed fee schedules on the assumption that both players will monitor in the monitoring subgame, which would give the following payoff matrix:

		C ₂	
		Not Monitor	Monitor
C ₁	Not Monitor	[55, 58]	[40, 65]
	Monitor	[64, 44]	[50, 50]

Figure 2.3: Payoffs in Pure Common Pool Model: The Unsecured Case, High-Risk Debtor, Monitoring Expected

This is once again dominance solvable: C₁ will monitor regardless of what C₂ does, and the same is true for C₂. Both creditors monitor and earn competitive rates of return.

Under plausible circumstances, in a world of unsecured credit, the problem of the common pool will result in the following monitoring pattern. Low-risk debtors will not be monitored at all—a no-monitoring equilibrium—because the cost of monitoring exceeds the benefits gained from monitoring. (The benefits of monitoring are either grabbing more than a pro rata share of the assets or ensuring

that one receives such a share.) High-risk debtors will be monitored by both creditors—a dual monitoring equilibrium. That is, in a world of unsecured credit, it will be a dominant strategy for each creditor to monitor a high-risk debtor at stage 2.⁵² Each creditor will therefore set first-period interest rates on the assumption that both creditors will monitor the solvency of the high-risk firm. Because monitoring is costly, interest rates will have to be higher to generate competitive returns, and that will lower the value of equity. In this model, monitoring creates no efficiencies and simply allocates value between the creditors. In equilibrium, the creditors enjoy a competitive rate of return and the debtor bears the cost of monitoring.

Introducing the possibility of secured credit changes the analysis. Issuing secured credit to one of the creditors may eliminate the incentives for either creditor to monitor, and security will be socially efficient if the cost of security is less than the total monitoring costs of the two creditors. In the case of a low-risk debtor, neither creditor will monitor. In the absence of the risk of such inefficient monitoring, neither creditor will take security. One creditor, however, will take security when the debtor is high-risk in order to ensure that neither has the incentive to monitor the debtor's insolvency. In short, this model predicts a pattern of secured credit in which low-risk firms do not use secured credit, while high-risk firms do. One can illustrate this point formally by returning to the model and assuming that the debtor grants a security interest in all of the assets of the firm to C_1 . The creditors face the following payoff matrix in the monitoring subgame?

⁵² That is, having both creditors monitor will be the unique pure-strategy Nash equilibrium in the second stage monitoring game. The idea that withdrawal is the dominant strategy if the bad state is known to have occurred appears in the bank run literature. See, e.g., James S. Coleman, *Foundations of Social Theory* 215–218 (1990); and compare Andrew Postlewaite & Xavier Vives, *Bank Runs as Equilibrium Phenomenon*, 95 *J. Polit. Econ.* 485 (1987).

⁵³ The example sets the cost of issuing secured credit at \$0, but this simplification does not affect the results, because the cost of secured credit is sunk, once issued.

		C ₂	
		Not Monitor	Monitor
C ₁	Not Monitor	[50, 50]	[50, 42]
	Monitor	[45, 50]	[45, 42]

Figure 2.4: Payoffs in Pure Common Pool Model: The Secured Case, High-Risk Debtor

As before in the debtor-misbehavior model, given the assumption that the total amount owed to C_1 is less than the lowest possible value for the project, C_1 always collects in full, and not-monitoring dominates monitoring. C_1 need not seek to deviate from the pro rata rules or protect against a deviation. Instead, the upfront priority structure ensures that C_1 will be paid in full. Now consider C_2 's monitoring decision. In C_2 's case as well, not monitoring dominates monitoring. Hence, neither player will monitor.⁵⁴

This model predicts that creditors will take security interests in high-risk firms. Low-risk firms will not be monitored even if only unsecured credit is issued. Taking a security interest will introduce a cost without an off-setting benefit. For high-risk firms, the value of equity is increased through the use of secured credit as long as the costs associated with creating secured credit are less than the total monitoring costs of the individual creditors. Simply raising the interest rate at stage I will not alter these outcomes. Raising the interest rate cannot decrease and may increase the amount of monitoring at stage 2; conversely, lowering the interest rate may decrease the amount of monitoring at stage 2.

The central difference between the view of monitoring here and that in prior models is that here monitoring-at best—simply re-

⁵⁴ This model assumes that there are no undetected withdrawals of assets by creditors, or, to put it another way, that recovering withdrawn assets is costless. That could be seen as in tension with the usual perception that recovering debtor withdrawals is costly—therefore justifying monitoring to nip fraudulent dividends in the bud. The key difference between the two situations is that recovery from the defaulting debtor is much harder than recovery from the typical creditor. The debtor is insolvent or disappears to Rio, but the creditor generally is solvent and stays at home.

distributes value among the creditors. Although not modeled here, a more realistic assumption—and one more in tune with the common pool analogy—is that monitoring by creditors actually reduces the amount of value available for distribution. In contrast, direct monitoring of the project decisions of the debtor enhances value for creditors by preventing unilateral transfers of value to the debtor through the adoption of high-risk projects.

This model suggests a plausible role for security interests. The upfront priority a security interest creates minimizes the opportunities for the end-of-game efforts to subvert the pro rata rule that define the common pool problem. Second, and as important, the model suggests that the common pool problem is not an immutable feature of the relationship between a debtor and its multiple creditors. Whether a common pool problem even exists depends on the capital structure of the debtor. Note, though, that this model predicts that no one monitors the debtor, which almost surely is counterfactual. A third model is required, one that combines debtor and creditor misbehavior.

4. *Debtor and Creditor Misbehavior*

In the combined misbehavior model, the unmonitored debtor will misbehave by switching to the high-risk project and a monitoring unsecured creditor will seek to defeat the pro rata distribution rule. Monitoring has a dual character: it is useful in that it prevents debtor misbehavior and ensures investment in the best projects, but it is destructive in that it is the mechanism that permits creditor misbehavior.

To reset the stage, the debtor will misbehave if neither creditor monitors and will then select Project 2. Project 2 fails 90% of the time and is worth \$40 and succeeds 10% of the time and is worth \$635. For low-risk debtors, Project 1 succeeds 80% of the time and is worth \$122.75 and fails 20% of the time and is worth \$84. For high-risk debtors, Project 1 succeeds only 50% of the time and is worth \$146 and fails 50% of the time and is worth \$84. If a creditor monitors, the debtor cannot misbehave, but the creditor will seek to cheat on the pro-rata rule.

Start with low-risk debtors and assume that the first-stage fee schedules are set on the assumption that C_1 will monitor and C_2 will not and that C_1 is reimbursed for its monitoring costs only if they

are in fact incurred. That gives rise to the following payoff matrix in the monitoring subgame:

		C ₂	
		<i>Not Monitor</i>	<i>Monitor</i>
C ₁	<i>Not Monitor</i>	[22, 24]	[46, 47]
	<i>Monitor</i>	[50, 50]	[47, 45]

Figure 3.1: Payoffs in Combined Model: The Unsecured Case, Low-Risk Debtor

This game is again dominance solvable. C₁ will monitor, regardless of what C₂ does, and therefore C₂ should not monitor. As in the pure misbehavior model, monitoring is essential to prevent debtor misbehavior, but, given that C₁ will be paid in full if it monitors, there is no need for a security interest to reach this result. Moreover, the unsecured creditor will not monitor for possible creditor misbehavior given the high probability that the debtor’s project will succeed. As in the common pool model, the high-probability of success means that the unsecured creditor would not monitor to try to deviate from the pro rata distribution rules. Security interests are again irrelevant.

Now consider the high-risk debtor. Again assume that the first-stage fee schedules are set on the assumption that C₁ will monitor and C₂ will not. We get the following payoff matrix in the subgame:

		C ₂	
		<i>Not Monitor</i>	<i>Monitor</i>
C ₁	<i>Not Monitor</i>	[20, 28]	[31, 63]
	<i>Monitor</i>	[50, 50]	[41, 51]

Figure 3.2: Payoffs in Combined Model: The Unsecured Case, High-Risk Debtor, No Monitoring Expected

This subgame, too, is dominance solvable, but the result is that both creditors monitor. This is not an equilibrium result in the game as a whole, since neither creditor earns the competitive rate of return (C₁ earns less and C₂ more), and the debtor, while needing one creditor to monitor, needs only one.

If the creditors instead assume that both creditors will monitor in the subgame, we get the following payoff matrix:

		C ₂	
		Not Monitor	Monitor
C ₁	Not Monitor	(23, 26)	(38, 65)
	Monitor	(64, 44)	(50, 50)

Figure 3.3: Payoffs in Combined Model: The Unsecured Case, **High-Risk** Debtor, Monitoring Expected

This is dominance solvable, with both creditors monitoring and earning competitive returns, but the debtor needlessly lowers the value of equity as it bears the costs of two monitors.

Suppose instead that C₁ receives a security interest. If the creditors set their first-stage fee schedules on the assumption that C₁ monitors and C₂ does not, we get the following payoff matrix:

		C ₂	
		Not Monitor	Monitor
C ₁	Not Monitor	(50.4, 7)	45
	Monitor	(50.2, 50)	42

Figure 3.4: Payoffs in Combined Model: The Secured Case

This is dominance solvable, with C₁ monitoring and C₂ not monitoring. Each creditor earns a competitive rate of return, and the value of equity is maximized, given the constraints.

A clear result emerges. High-risk debtors should issue secured credit to minimize common pool problems. Doing so reduces the total monitoring costs if the cost of issuing secured credit is less than the monitoring cost of the non-monitoring creditor. This model predicts a pattern of low-risk debtors with unsecured credit, and high-risk debtors with secured credit. The secured creditor does the monitoring, which is the behavior pattern thought to be present in most secured lending.⁵⁵

⁵⁵ But compare Adler, *supra* note 27 (arguing that unsecured creditor monitoring is critical for policing conflicts between managers and dispersed equityholders).

One should, however, note the limits of this model. The key condition that gives rise to dominance solvability in the combined model is that the secured creditor is assured of payment in full, even when the debtor fails. The flipside of that result is that there must be some, perhaps vanishingly small, pool of unencumbered assets in the firm when it fails. It might therefore be argued that security interests shrink the size of the common pool but do not otherwise eliminate the pool available for unsecured creditors. Understanding that situation will require models with more than two creditors. However it still seems likely that the potential size of the common pool will affect the monitoring decisions of the unsecured creditors, and therefore the importance of security interests in mitigating the harms of the common pool will still carry through.

IV. CONCLUSION

During the **1980s**, two separate strands of academic work in commercial law focused on, respectively, explaining the pervasive existence of secured credit and providing a theoretical basis for the bankruptcy laws. This work tried to explain secured credit by focusing narrowly on the problem of the misbehaving debtor. At the same time, much of bankruptcy law scholarship was premised on the idea that bankruptcy law served to solve a common pool problem. The common pool problem arises from an overlapping distribution of rights among the unsecured creditors of the failing firm. No creditor has the right to exclude another, and therefore the dominant strategy for each creditor may be to monitor the debtor to seek to defeat the pro rata distribution scheme of bankruptcy. Almost no attention was paid to the relationship between security interests and common pools.

This paper presents an integrated treatment of these issues in a standard game-theoretic context. The monitoring of debtor misbehavior has the form of the Battle of the Sexes game, except that the players seek to coordinate on playing different strategies rather than the same strategies as they usually do. Because of the multiplicity of Nash equilibria, there can be no assurance that the creditors will appropriately coordinate their decisions. I suggest that eliminating multiple equilibria is a critical component of capital structure design. In the simple debtor-misbehavior model, this amounts to no more

than providing for payments that are contingent upon the amount of monitoring performed. Responding to the problem of creditor misbehavior requires a different design approach. Creditor misbehavior can have the form of the Prisoner's Dilemma. Unlike the Battle of the Sexes and its multiple equilibria, here a unique solution exists, but it is a poor solution. Capital structure design is needed to reach a different solution and security interests can serve as the mechanism for reaching the superior solution.

Consequently, security interests do have an important role in the efficient allocation of capital, but most of their benefits derive from eliminating the duplicative monitoring of possible creditor misbehavior that defines the common pool. Moreover, the common pool construct that currently forms the basis for our understanding of the bankruptcy laws must be reconsidered. The existence or nonexistence of the unsecured common pool at the end of the firm's life depends on the design of the firm's capital structure at its inception. The common pool need not arise, and we must reconsider what the bankruptcy laws should accomplish once we have recognized that the parties themselves can and in fact do much to keep this problem from arising in the first place.

There may also be a broader principle at work here. I started by noting the analogy made between the failing firm and the Prisoner's Dilemma. I have argued that one way out of the dilemma is to embed the dilemma into a larger decisionmaking problem. The particular payoffs in the new subgame- the old, freestanding Prisoner's Dilemma-then emerge as results of the decisions in the larger game, and the resulting payoffs should not have the structure that leads to the devastating results of the original Prisoner's Dilemma. Recognizing that a small game is embedded in a large game may have substantial implications for legal analysis more generally. Simply recognizing a Prisoner's Dilemma or some other game with multiple or suboptimal equilibria may be insufficient. Knowing when the dilemma stands alone (and when it does not) becomes critical if we are to use these game-theoretic models to decide, as we have with regard to the Bankruptcy Code, what problems the legal system should address.