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Security Interests, Misbehavior, and Common Pools

Randal C. Picker

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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. Under the stylized assumptions of the theorem, substituting equity for debt or adding layers of debt to the capital structure of a firm, as occurred during much of the 1980s, has no affect on the firm's value.[1] The theorem applies not only to the mix of debt and equity, but also to the mix of debt itself, such as between secured and unsecured or senior and subordinated debt.[2]

Understanding existing patterns of debt and equity therefore begins with the Modigliani-Miller Theorem. One must identify which of the theorem's assumptions do not hold and explain why relaxing them leads to the patterns of debt and equity that currently exist. Much scholarship has examined the assumption that changes in capital structure do not affect the way in which a firm uses its assets.[3] There is little reason to think that this assumption is true. It is now well-understood that equityholders may choose different projects if debt is present than they would otherwise: equityholders enjoy all of the benefits of successful projects but share the losses from unsuccessful ventures with creditors.

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[1] Franco Modigliani and Merton H. Miller, *The Cost of Capital, Corporation Finance and the Theory of Investment*, 48 Am Econ Rev 261 (1958); Franco Modigliani and Merton H. Miller, *Corporate Income Taxes and the Cost of Capital: A Correction*, 53 Am Econ Rev 433 (1963). For a standard exposition, see Thomas E. Copeland and J. Fred Weston, *Financial Theory and Corporate Policy* 439-44 (Addison-Wesley, 3d ed 1988).

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

[3] For early work, see Michael C. Jensen and William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure*, 3 J Fin Econ 305 (1976).

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 a security interest while others do not. These scholars have focused on the manner in which secured credit might enhance the ability of creditors to monitor debtor misbehavior. The current posture of this literature, however, offers only limited support for the view that secured credit matters in the monitoring of debtor misbehavior.[4]

The focus of this scholarship, limited to the effects of secured credit on debtor misbehavior, 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 single creditor enjoyed priority over another, each creditor might have an incentive to spend resources monitoring both the debtor and the other creditors to ensure that it was paid if the debtor failed. Whether secured credit can be a device that minimizes, or even eliminates, creditor misbehavior is a question that the literature has neglected completely.

In this Article, I set forth a simple game-theoretic model to analyze this question. The formal model exposes weaknesses in the existing literature and suggests that secured credit probably does not respond to debtor misbehavior. More importantly, I suggest that secured credit is a sensible response to the problem of creditor misbehavior. In doing so, I offer a new view of perhaps the central premise of recent bankruptcy scholarship. The same scholars who have not seen a link between secured credit and creditor misbehavior have nevertheless argued that bankruptcy law exists primarily to overcome the problems that arise when too many creditors chase too few assets.[5] By failing to see that secured credit is a re-

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[4] Compare Thomas H. Jackson and Anthony T. Kronman, *Secured Financing and Priorities Among Creditors*, 88 Yale L J 1143, 1149-61 (1979); Saul Levmore, *Monitors and Freeriders in Commercial and Corporate Settings*, 92 Yale L J 49, 55-59 (1982), with Schwartz, 37 Vand L Rev at 1057-59 (cited in note 2). See also Douglas G. Baird, *Property Rights, Priority Rights, and Ostensible Ownership: The Deep Structure of Article 9*, in Peter F. Coogan, et al, 1 *Bender's Uniform Commercial Code Service: Secured Transactions Under the Uniform Commercial Code* § 1.06 (Matthew Bender, 1991).

[5] Thomas H. Jackson, *Bankruptcy, Non-Bankruptcy Entitlements, and the Creditors' Bargain*, 91 Yale L J 857 (1982); Douglas G. Baird and 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* 3 (Harvard, 1986). But compare

sponse to creditor misbehavior, these scholars misunderstand the institution of secured credit and, more importantly, structure their analysis of bankruptcy law upon an unsound premise.[6]

These scholars assume that creditors who face a troubled debtor face a common pool problem, and that bankruptcy law exists to overcome it. The common pool problem, however, is typically within the domain of property law. It arises among strangers who have had no established relationships with each other or with any common third party. The setting is an English pasture in the fifteenth century,[7] a Texas oil field at the turn of the century[8] or a fishery in Malaysia today.[9] The common pool problem arises in these situations from an overlapping distribution of rights where acquisition or capture means 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 others, the dominant strategy for each person is to graze, drill, or fish, without regard to the common interest 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 among them. 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.

James W. Bowers, *Whither What Hits the Fan?: Murphy's Law, Bankruptcy Law and the Elementary Economics of Loss Distribution,* 26 Ga L Rev 27 (1991) (noting possible relationship between secured transactions and bankruptcy theory).

[6] This scholarship also suffers from a more basic defect. 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 I expect to pursue in further research is whether first accepting state law baselines and then asking how to best respect those baselines in a collective bankruptcy proceeding fundamentally misconceives the appropriate nature of the inquiry. 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. By looking only at bankruptcy law with debt-collection rules as a given, we have ignored these fundamental questions.

[7] See J.A. Yelling, *Common Field and Enclosure in England 1450-1850* (Macmillan, 1977).

[8] See Gary D. Libecap and Steven N. Wiggins, *Contractual Responses to the Common Pool: Prorationing of Crude Oil Production,* 74 Am Econ Rev 87 (1984).

[9] See E.N. Anderson, Jr., *A Malaysian Tragedy of the Commons,* in Bonnie J. McCay and James M. Acheson, eds, *The Question of the Commons: The Culture and Ecology of Communal Resources* 327 (Arizona, 1987).

Many firms have both secured and unsecured creditors; others grant no secured debt but still have senior and subordinated unsecured creditors. By the initial allocation of priority rights, many firms can avoid the common pool problem altogether. For example, if the firm would owe a single secured creditor more than the firm would be worth if it failed, no common pool problem would arise.

The debtor will also seek ways to minimize the harms of the common pool. The creditors can anticipate the common pool problem and will therefore charge interest rates to cover the anticipated losses that will result. Because the debtor bears these interest costs directly, it will internalize the cost of the common pool and will therefore search for mechanisms to minimize the costs. 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.[10] Actions that are in the self-interest of the individual shepherd, oil driller, fisher, or prisoner run contrary to the interests of the group. If one's focus is too narrow, however, one may identify a situation as a prisoner's dilemma when it is instead a small decisionmaking problem embedded in a much larger one. Although the self-interested acts of the individual in such a situation may appear harmful to the group when seen in the context of the smaller problem, they may actually correspond to the interests of the group when seen in the context of the larger problem.[11] The legal literature reflects this insight in the particular case of repeated play of the prisoner's dilemma, where it is well-known that socially efficient results may be obtained even while allowing for independent decisionmaking.[12] However, the broader range of ways in which embedding can occur has

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[10] Jackson, *Logic* at 10 (cited in note 5). For a recent history of the Prisoner's Dilemma, see William Poundstone, *Prisoner's Dilemma* (Doubleday, 1992).

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

[12] See, for example, Alan O. Sykes, *Constructive Unilateral Threats in International Commercial Relations: The Limited Law of § 301* (forthcoming Law and Public Policy in International Business, 1992); 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 Georgetown L J 1495, 1542-44 (1990); John K. Setear, *The Barrister and the Bomb: The Dynamics of Cooperation, Nuclear Deterrence, and Discovery Abuse*, 69 BU L Rev 569, 594-601 (1989); Henry N. Butler and Jonathan R. Macey, *The Myth of Competition in the Dual Banking System*, 73 Cornell L Rev 677, 692 n 65 (1988); Roberta Romano, *Metapolitics and Corporate Law Reform*, 36 Stan L Rev 923, 928 n 12 (1984). This literature draws upon the experimental work in Robert Axelrod, *The Evolution of Cooperation* (Basic/Harper Collins, 1984), and the theoretical work in Drew Fudenberg and Eric Maskin, *The Folk Theorem in Repeated Games with Discounting or with Incomplete Information*, 54 Econometrica 533 (1986).

yet to receive substantial attention. This Article examines a particular version of an embedded game, while leaving to another day a more general discussion of embedded games and legal rules.

This Article 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 rights serve many purposes; I focus on situations in which the value of the assets in a firm depends on how the firm exercises control over them. Section II explores the extent to which contracts can address problems of misbehavior and argues that we need more powerful devices to control misbehavior effectively. Creditors must often monitor debtor misbehavior; with creditor misbehavior on the other hand, we need devices that stop monitoring. In each case, we must address the important consequences of monitoring externalities. 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 Article.

I. The World of Secured and Prioritized Credit

Before I focus specifically 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 may range from a $10 loan at the local pawnshop secured by a pledge of a ring, to the mortgage on my house, to multi-billion dollar loans secured by all of a company's assets. In the United States, real property lending constitutes the largest part of the secured transactions market. At the end of 1990, there was approximately $8.6 trillion outstanding in non-governmental debt.[13] Real property mortgage debt constituted approximately $3.85 trillion of that amount, or more than forty-five percent of the non-governmental debt. No other single category of debt looms so large in the private economy.[14]

Although secured lending on real estate dwarfs other forms of secured or prioritized lending, these other forms of lending are far

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[13] See *Summary of Credit Market Debt Outstanding*, 77 Federal Reserve Bulletin A43, Table 1.59 (Oct 1991).

[14] Id.

from insubstantial. In the United States, for instance, automobile financing in 1990 represented another $285 billion of debt, most of which was secured.[15] The asset-based finance industry lent another $96 billion.[16] This category covers privately-held loans to businesses by banks, financing companies and others for which the primary collateral is the personal property assets of the business. Corporate bonds and notes, in contrast, are often publicly-held. These instruments are generally unsecured, though some categories, such as utility bonds and equipment trust certificates, routinely involve security. These issues are sufficiently common that approximately eighteen percent of the new corporate issues over the three-year period 1988-1990 involved secured credit.[17] During that same period, another fifteen percent of the new corporate issues created prioritized credit. Senior debentures, senior notes, and even senior subordinated notes were common.[18]

Given such a diverse factual pattern, we would be surprised 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, security interests can minimize the costs of making and collecting loans. Second, they can reduce the need to monitor in situations where the property's value is largely independent of how it is managed. Third, security interests can make assets available to creditors on default that debtors would otherwise shield from them. Fourth, through a security interest, a debtor can commit to a creditor that the debtor will not later create debt—consensually or nonconsensually—that is superior to or on par with preexisting debt. Finally, security interests—and priority devices more broadly—can significantly affect the manner in which parties exercise control over the monitoring of assets. I will consider this fifth role of security interests in detail in Section II. Before turning to the monitoring and control functions of security interests, however, I consider the first four roles in turn.

Pawnbroking is among the most common of secured transactions. More than thirty-five million such loans are made each year.[19] The pawnbroker usually lends less than $100, often sub-

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[15] See *Consumer Installment Credit*, 77 Federal Reserve Bulletin A38, Table 1.55 (Oct 1991).

[16] See Frank J. Donahue, *Getting Back to Basics*, 48 The Secured Lender 36, 39 (Jan/Feb 1992).

[17] Compiled from issues of *Corporate Financing Week*.

[18] Id.

[19] Ellen Braitman, *As Pawnshops Thrive, Banks Steer Clear*, Am Banker 1 (Nov 15, 1991).

stantially 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 a borrower can give of his or her ability to pay is to deliver to the pawnbroker an asset with a value that exceeds the size of the loan. This security interest is not foolproof, as there could be a thief in the borrower's chain of title. However, 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 would loom large relative to the amount lent. In short, the security interest minimizes the costs of making and collecting these small loans.

Real estate mortgages are different. 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. Although drafting and recording the mortgage may decrease the costs of collecting in the event of a default, 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 reduction in collection costs they produce, real estate mortgages cannot readily be understood as devices for minimizing 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 accounts for many "Chapter 20" bankruptcies[20]—almost all of the variation affects the real estate 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. They also lack any good means of risking the value of the house in exchange for some large potential upside.

Consequently, a mortgage lender need only worry that the borrower will try to make off with the value of the house by selling it, pocketing the cash, and disappearing. A security interest on the

[20] The "Chapter 20" bankruptcy—a Chapter 7 petition followed quickly by a Chapter 13 petition—is a recent phenomenon. A relatively straightforward example of these cases can be found in *Johnson v Home State Bank*, 111 S Ct 2150 (1991).

house effectively prevents this. The security interest follows the house into the new owner's hands. Note the difference in the positions of the unsecured creditor and the secured creditor. If the borrower sells the house for its market value, the unsecured creditor has no right against the house in the new owner's hands.[21] The secured creditor's rights, however, continue in full as if the borrower still owned the house.

The third role played by security interests relates to state and federal exemption laws for the assets of individuals. Although most people understand that security interests affect the relative rights of the creditors, many overlook the fact that security interests also directly affect rights between the debtor and the creditor. Section 522 of the Bankruptcy Code, for instance, sets forth a set of federal exemptions. A state can supplement this scheme if it so chooses or can displace it entirely. Most states have chosen to create their own exemptions, some of which are extremely favorable to debtors.[22] Federal law draws the rather mysterious line of preventing the debtor from simply waiving these exemptions as against unsecured creditors,[23] but allowing the debtor to 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.[24]

The legal rules surrounding a mechanism will, in part, determine the role it plays. In the context of security interests, the legal regime allows a debtor to assure a creditor that it will not later create debt that is superior to or on par with preexisting debt. To put the point differently, the current legal system will not generally enforce simple negative pledge clauses or promises of priority. Without more, an unsecured creditor would suffer the risk that subsequent debt will 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

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[21] 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, reprinted in 7A *Uniform Laws Annotated* 577-78 (West, 1985); Uniform Fraudulent Transfer Act § 8, reprinted in id at 662-63.

[22] Florida and Texas are well-known in this regard.

[23] See 11 USC § 522(e) (1988 & Supp 1990); FTC Credit Practices, 16 CFR 444.2(2) (1984).

[24] 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 CFR § 444.2. See also Robert E. Scott, *Rethinking the Regulation of Coercive Creditor Remedies*, 89 Colum L Rev 730, 747 (1989).

forecast. Prior unsecured lenders would also face the risk of dilution through subsequent 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 lies in part with the role assigned to secured credit under current law. As we have seen, current law attaches attributes to the security interest, such as its special status as against third-party purchasers, its use as a means of receiving rights against otherwise exempt assets, and its use as a commitment device. But another role for secured credit remains: secured credit, as well as prioritized credit more generally, can affect the manner in which parties exercise control over the monitoring of assets. In the balance of this Article, I consider situations in which the value of the firm's assets depends on how the firm exercises control over them.

II. Monitoring and Contracts

How assets are managed and their resulting value reflects the returns that accrue to the group exercising control over the assets. One sees this most often in firms that have both debt and equity. The interests of shareholders as a group diverge from those of creditors as a group. When shareholders have creditors, they embrace investment policies that they would reject if they did not have creditors. Four types of such possible misbehavior by shareholders are commonly identified:[25] (i) flat-out withdrawals of assets by shareholders; (ii) increased risk with internal funds (or asset substitutions);[26] (iii) increased risk through new funds and new projects;[27] and (iv) foregoing valuable investment opportunities.[28]

A. Monitoring, Solvency, and the Limits of Contracts

Creditors can reduce the risk of debtor misbehavior either by monitoring the debtor's behavior or by acquiring certain rights

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[25] George G. Triantis, *Secured Debt Under Conditions of Imperfect Information*, 21 J Legal Stud 225, 234 (1992).

[26] See, for example, Clifford W. Smith, Jr. and Jerold B. Warner, *Bankruptcy, Secured Debt, and Optimal Capital Structure: Comment*, 34 J Fin 247, 250 (1979); Jackson and Kronman, 88 Yale L J at 1149-50 (cited in note 4); Levmore, 92 Yale L J at 51-52 (cited in note 4).

[27] See, for example, Eugene F. Fama and Merton H. Miller, *The Theory of Finance* 150-52 (Holt, Rinehart and Winston, 1972); Alan Schwartz, *A Theory of Loan Priorities*, 18 J Legal Stud 209, 228-30 (1989).

[28] See Triantis, 21 J Legal Stud at 230 (cited in note 25).

against the debtor 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,[29] the related automatic first priority position[30] and secured credit itself can be understood as attempts to reduce debtor misbehavior through contracts. These approaches work best when the debtor must 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 legally barred from granting a superior or equal interest in those existing assets to a second lender.

Contracts alone will prove inadequate, however, given the means by which shareholders can transfer wealth. Monitoring may also 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 the applicable legal regime surely bars shareholder theft, the contract and the laws are not self-enforcing. If the debtor can proceed unilaterally once it receives the loan, the creditors will need to monitor the debtor in order to protect their own interests.[31]

A few examples will illustrate the difficulty of trying to eliminate debtor misbehavior solely through contractual terms. Consider an example that will occupy much of this Article. A debtor has a choice between two investment projects. Each project requires the debtor to borrow $100.[32] Project 1 is certain to yield $115. Project 2 is a high-risk project: ninety percent of the time it yields $40, and the remaining ten percent of the time it yields $635. Note that the expected payoff for Project 2 is $99.50, less than the $100 (in expected value) the debtor would have to pay risk-neutral creditors to finance the project.[33]

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[29] See Fama and Miller, *The Theory of Finance* at 151-52 (cited in note 27); James S. Ang and Jess H. Chua, *Coalitions, the Me-First Rule, and the Liquidation Decision*, 11 Bell J Econ 355 (1980); Michelle J. White, *Public Policy Toward Bankruptcy: Me-First and Other Priority Rules*, 11 Bell J Econ 550 (1980).

[30] See Schwartz, 18 J Legal Stud 209 (cited in note 27).

[31] Note that I focus on monitoring after the debtor receives the money. Monitoring, or screening, surely takes place before the creditor lends the money as well. See, for example, Barry E. Adler, *A New Perspective on the Bankruptcy Priority Puzzle*, 22 J Legal Stud (forthcoming 1993). Prescreening, however, does not prevent misbehavior after the fact.

[32] Fixing the level of outside investment required puts to one side interactive effects between contract design and investment. For a discussion of credit contract design, see Douglas Gale and Martin Hellwig, *Incentive-Compatible Debt Contracts: The One-Period Problem*, 52 Rev Econ Stud 647 (1985).

[33] For simplicity, I assume throughout a risk-free rate of interest of zero percent.

In a world of full information and complete enforcement of contracts, the problem of debtor misbehavior is readily solvable through contracts. If the creditors think that the debtor will undertake Project 1, financing will be readily forthcoming, because the sure return of $115 more than covers the required debt payments of $100. In contrast, lenders will not finance Project 2, because its expected payout is not enough to repay the $100 loan.

Problems arise, however, if the creditors cannot control which project the debtor chooses to undertake. 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, the firm will fail ninety percent of the time and leave the debtor with nothing. But ten percent of the time, the debtor will net $535. Adopting Project 2 therefore yields the debtor, on average, $53.50. Project 2 is therefore attractive to the debtor because the debtor will net 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.[34] 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." I will call this a "forcing contract."[35] Given the assumption of full information—meaning here that the information is both immediately known to both parties[36] and is immediately communicable to any third party[37]—the creditors will know immediately if the debtor chooses Project 2. Given the assumption of complete enforcement of contracts, the creditors can then enforce the debtor's promise to turn over all of the revenues from the project.

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[34] This example assumes that the investment project is the borrower's only asset, so that the creditor cannot recover against other assets.

[35] See Eric Rasmusen, *Games and Information: An Introduction to Game Theory* 138 (Basil Blackwell, 1989).

[36] That is, in the standard language of the theory of contracts, the information is "observable." See Oliver Hart and Bengt Holmstrom, *The Theory of Contracts*, in Truman F. Bewley, ed, *Advances in Economic Theory: Fifth World Congress* 71, 134 (Cambridge, 1987).

[37] That is, the information is "verifiable." See id.

As a result, the debtor will always 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 has the effect of making the debtor's overall wealth lower when it chooses Project 2 over Project 1 will bring about the same result.

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, therefore, disappears in a more realistic setting. Enforcement of the forcing contract requires that the creditors actually know which project the debtor chose; in practice, however, they typically will not know. From the creditor's perspective, everything depends on taking from the debtor any incentive to choose Project 2; but the debtor will have an incentive to choose Project 2 as long as the creditors cannot monitor what the debtor is doing because monitoring is too costly.

Consider again the forcing contract. The debtor promises to pay all of Project 2's revenues to the creditor if the debtor chooses Project 2, but only $100 if it chooses Project 1. If the creditors spent nothing on verifying project choice, the debtor would lose its incentive to choose Project 1. Following its economic interests, 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. The decision to choose Project 2 would violate the contract, but without additional investigation, the creditors will not know whether the debtor in fact has chosen 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 debtor's superior expertise in knowing which project it should choose and even what project it has 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. Ultimately, however, 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 the debtor's 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 narrowed (though at a cost), there is no assurance that the creditor can communicate this information 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, there is the additional problem of ensuring that creditors do not duplicate each other's monitoring efforts. Introducing more than one creditor also creates monitoring problems *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—then the right level of monitoring may occur without the need for any effort to induce that outcome. Although some forms of monitoring are private goods, more often than not monitoring involves externalities. Monitoring may confer positive externalities on fellow creditors—for example, when one creditor's monitoring results in the debtor remaining solvent. Or monitoring may inflict negative externalities, as when one creditor's monitoring of the debtor allows it to detect failure more quickly and thereby grab the available assets first. In both of 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, positive monitoring externalities do not alone lead the creditors collectively 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.[38] The right of the trustee to recover eve-of-bankruptcy transfers, however, undercuts the possibility of inducing the unsecured creditor to monitor.[39] 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 of 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 literature on the problem of the misbehaving debtor and secured credit is to look to the monitoring assumptions made by various scholars. The critical point over which they disagree is the extent to which the secured creditor can tailor its monitoring to a particular situation.

On one view, the secured lender specializes and takes a security interest only in 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 subject to the security interest. Despite the monitoring, however, the debtor may still misbehave with the unliened assets. This vision of monitoring is seen in work by Jackson and Kronman,[40] and by Baird.[41]

The second view of monitoring assumes that spillovers are inevitable. For example, the debtor loses absolute discretion over inventory when a secured creditor monitors receivables. Other credi-

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

[39] See 11 USC § 547 (1988).

[40] See Jackson and Kronman, 88 Yale L J at 1154 n 44 (cited in note 4).

[41] See Baird, *The Deep Structure of Article 9* at § 1.03 (cited in note 4).

tors anticipate the spillover and adjust their monitoring accordingly. In the extreme, monitoring by one creditor prevents all misbehavior, leaving only the issue of allocating the burden of monitoring. This view captures the essence of the public good aspect present in the enforcement of group rights. It also reflects the idea that tailoring is costly and we often live in a one-size-fits-all world. Many lenders have standard procedures for their auditors to follow for each particular kind of debtor they service. It is a means of economizing on their internal decisionmaking and controlling their internal principal-agent problems. Tailoring also may be irrelevant if the paradigm secured transaction is the all-assets lender taking a security interest in everything 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 Levmore.[42]

My analysis builds on the latter work. 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. I make a similar assumption 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 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 misbehavior, and each creditor benefits when misbehavior is prevented. Because of the assumption that monitoring costs are fixed, the monitor cannot individuate its monitoring decisions. The model therefore does not account for the possibility that the amount of monitoring a creditor chooses 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. Public goods and free riding go hand in hand. As a group, creditors face the question of how to coordinate their individual decisionmaking so as to reach the outcome that is best for

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[42] See Levmore, 92 Yale L J at 53-59 (cited in note 4); Schwartz, 37 Vand L Rev at 1056-57 (cited in note 2), also uses this monitoring approach in discussing Levmore's work, though it is not clear that he embraces it.

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, such as subordination agreements, among some creditors, we rarely see fully specified contracts among all the creditors.

Alternatively, following the public goods literature,[43] 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.[44] For the purposes of this Article, I ignore the possibilities of interposing an aggregation mechanism between the creditors and the debtor, or 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 situations give rise to the public good problem in monitoring on which I focus.

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. To analyze this relationship, I will use the common setting of an entrepreneur seeking investment capital for a project from two creditors. I consider three cases: a simple debtor-misbehavior model, a simple common pool model, and a combined debtor-misbehavior/common pool model. Before looking at the cases, I will sketch the current state of the literature and how my results compare.

The debate over the effects of secured credit has taken a series of turns, focusing exclusively on the effects of security interests on debtor misbehavior. In their early work, Jackson and Kronman focused on the need to monitor possible debtor misbehavior, arguing that high-cost monitors should obtain security interests to reduce their need to monitor. Levmore criticized this work, because it rested on the unlikely premise that secured creditors would be less

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

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

efficient monitors than unsecured creditors.[45] Levmore instead pursued the debtor-misbehavior model and argued that secured credit responded to the problems of (1) free riding on monitoring and (2) duplication in monitoring among unsecured creditors.[46] Schwartz, in turn, criticized Levmore's description of the debtor-misbehavior model, arguing that an equilibrium in which only one creditor monitors will result without any capital structure design.[47] Schwartz noted that in a multiple creditor model, having only one unsecured creditor monitor forms an equilibrium, given the assumptions about monitoring. Duplicate monitoring or no monitoring at all are then disequilibrium phenomena. From this Schwartz concluded that "the stable, pervasive existence of personal property security is quite unlikely to be a response to the disequilibrium phenomenon of duplicate monitoring."[48]

My analysis revisits this analysis for the question of debtor misbehavior and breaks new ground by confronting the creditor misbehavior problems of the common pool. Under the simple debtor-misbehavior model, Schwartz's conclusion regarding the absence of a need for secured credit seems right, but his analysis remains incomplete. The monitoring game played among the creditors is characterized by multiple equilibria.[49] Schwartz understood that multiple equilibria would exist, but did not 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.[50]

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[45] See Levmore, 92 Yale L J at 52-53 (cited in note 4).

[46] Id at 53-55.

[47] See Schwartz, 37 Vand L Rev at 1055-59 (cited in note 2).

[48] Id at 1057.

[49] The problems associated with multiple equilibria—or, to put it differently, situations in which the applicable solution concept cannot distinguish among a number of "reasonable" outcomes and identify a single outcome as "the" solution—are increasingly a focus of research. For representative examples, see Paul Krugman, *History versus Expectations*, 106 Q J Econ 651 (1991); Eric B. Rasmusen, J. Mark Ramseyer and John S. Wiley, Jr., *Naked Exclusion*, 81 Am Econ Rev 1137 (1991); Kevin Murphy, Andrei Shleifer and Robert Vishny, *Industrialization and the Big Push*, 97 J Pol Econ 1003 (1989). See also Alan Schwartz, *Bankruptcy, Workout, and Debt Contrast*, (unpublished manuscripts, April 1992, (on file with U Chi L Rev)).

[50] The Battle of the Sexes takes its name from the following situation. A man and a woman have tickets for a prize fight and a ballet on the same evening. They cannot communicate with each other and must choose independently which event to attend. One person prefers the boxing, the other the ballet—you can guess the assumed match between sex and entertainment tastes—and hence the name of the game. The couple would like to be together, and, in fact, each person gets more pleasure from attending either event with the other than from attending that person's preferred event alone. This last fact creates the multiple equilibria: game theory predicts that they will attend together—they will coordi-

However, unlike the typical Battle of the Sexes game in which the players seek to coordinate on playing the same strategy, creditors seek to coordinate on playing different strategies. 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. However, security interests are unnecessary to create a monitoring game with a single solution.[51]

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 take the form of the Prisoner's Dilemma. Unlike the Battle of the Sexes with its multiple equilibria, here a unique solution exists, but it is a poor one. We need capital structure design to get to a different solution; security interests can serve as the mechanism for reaching that superior solution.

A. General Statement of the Model

As Section II suggests, a full-blown model of contracting in multiple creditor contexts would be dauntingly complex. The model that I offer 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 for its investment project. D is assumed here to be $100. I also 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 one, 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 simply be an interest rate, but it may also include contingent charges, such as reimbursement for legal fees, monitoring costs and the like. The assumption of two creditors could be justified in a more general setting,[52] but operationally, the firm will be required to choose d_i, the face amount of

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nate their strategies—but it cannot tell us whether they will go to the fight or the ballet. See Rasmusen, *Games and Information* at 34-35 (cited in note 35).

[51] Though there are caveats. See note 60.

[52] The assumption that a debtor borrows from more than one creditor is common. See, for example, Jackson and Kronman, 88 Yale L J at 1158 n 55 (cited in note 4), 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 common wisdom that it is prudent for a firm to have relationships with more

the debt owed to creditor i, from the range $0 < d_i < D$ for all i, such that $d_1 + d_2 = D$. I assume that the lending market is competitive and has a risk-free rate of return set at 0%.

The central question explored in stage one is whether security interests have any role to play in the presence of other standard contractual terms. I assume contracts 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 decisions as to whether to monitor the debtor. This monitoring is assumed to gather information covering possible debtor misbehavior and possible creditor misbehavior in the models where both are possible. This assumes economies of scale in monitoring. Monitoring is costly, and I will assume 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. Furthermore 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. The debtor will choose Project 2 if neither creditor monitors and if Project 2 is preferred by the debtor to Project 1. The debtor will choose Project 1 if either creditor monitors the debtor. In stage four, 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 deals with the debtor. Allowing either of these would undercut the central assumption that the debtor has two creditors acting noncooperatively. I also assume that the creditors' monitoring decisions are fully revealed only after the fact, so that there are no strategic issues raised with regard to reimbursing monitoring costs and the like.

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than one vendor to prevent dislocations that might arise if the vendor failed or switched supply policies.

B. 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 may invest in one of two projects. Each project requires debt financing totalling $100. Project 1 is certain to yield $115. Project 2 is a high-risk project: ninety percent of the time it yields $40, and the remaining ten percent 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 they can effectively monitor the debtor.[53]

At the first stage, competition among potential lenders naturally limits the fee schedules that they can charge to the debtor. Therefore, at the time it makes the loan, each creditor should expect to earn just a competitive rate of return. The payoffs occur only after the second stage of the monitoring game is complete. For this reason, the creditors and the debtor need to anticipate the monitoring decisions that each party will make 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.

Assume initially that the $100 risk-free debt is split evenly between C_1 and C_2. The lenders have two decisions to make. First, each creditor must set a fee schedule for lending. Second, each creditor must decide whether to monitor the debtor. Suppose that both creditors 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.[54] Now consider the fee schedules of the creditors. C_2 will seek payment of the amount lent plus interest at the

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[53] Recall that monitoring is assumed to be indivisible and that monitoring by one creditor suffices to prevent misbehavior.

[54] As has been noted before. See Schwartz, 37 Vand L Rev at 1057 (cited in note 2).

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, given the actions of the others, neither the debtor nor C_1 or C_2 can improve its position by deviating from its courses of action. C_2 will plan not to monitor, given that C_1 will plan to do so. Furthermore, 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 C_2 must offer the competitive rate on its loan. Given that C_2 will not plan to monitor, C_1 will plan to monitor, thereby preventing the debtor from misbehaving. C_1 will charge an interest rate set to cover just 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.

Up to this point however, we have failed to take into account that creditors make interest rate and monitoring decisions in sequence. When the creditors make their second-stage monitoring decisions, they face the following payoff matrix:

		C_2	
		Not Monitor	*Monitor*
C_1	*Not Monitor*	[24,22]	[55,42]
	Monitor	[50,50]	[50,42]

FIGURE 1.1: PAYOFFS WITHOUT CONTINGENT REIMBURSEMENT

That is, if neither creditor monitors, the debtor misbehaves. The alternative project succeeds ten percent of the time and the creditors are paid in full. But ninety percent of the time the project fails, and $40 is available to be divided pro rata on C_1's claim of $55 and C_2's claim of $50. Taken together, this results in an expected payoff of $24 to C_1 and of $22 to C_2. If C_1 monitors and C_2 does not, the debtor will not misbehave; both creditors are paid in full and C_1 nets $50 ($55 less $5 monitoring cost). Note that both creditors earn the risk-free rate when monitoring occurs as contemplated when the interest rates were set. If C_2 monitors and C_1 does not, again the debtor behaves and both creditors are paid in full, but C_1 earns a supracompetitive return. C_1 set its interest rate to reflect the cost of monitoring, but did not actually monitor. C_2's monitoring saved C_1 from the costs of the debtor's misbehav-

ior. In contrast, C_2 earns less than the risk-free rate because it paid $50 but spent $8 in monitoring costs. C_2 bears the cost of monitoring without charging for it. In the final cell, both creditors monitor, C_1 earns a competitive rate and C_2 again loses out.

Note that both of the cells in which one creditor monitors are Nash equilibria. If C_1 monitors, C_2 will not, and if C_2 does not, C_1 will. Similarly, if C_2 monitors, C_1 will not, and if C_1 does not, then C_2 will, notwithstanding that the creditors contemplated a different result when they originally set the lending charges. The second-stage monitoring game exhibits two pure strategy Nash equilibria.

This game has the form of the Battle of the Sexes game, except that the players seek to play different strategies rather than the same strategy. The multiple equilibria give rise to a coordination problem, and the Nash conception alone provides no way to select between them. 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 nothing that makes one solution the obvious choice. We would not think the outcome obvious if we simply began with the monitoring subgame. 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,[55] but this is not one of those times. The creditors here 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. In the stage one model, the creditors premised the interest rates 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

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[55] See, for example, Elon Kohlberg and Jean-Francois Mertens, *On the Strategic Stability of Equilibria*, 54 Econometrica 1003 (1986).

resulting monitoring subgame is dominance solvable[56] and (2) given the anticipated outcome in the subgame, the creditors earn only a competitive rate of return given the design of the first-stage structure.

To put the point another way, the central problems facing the debtor and its creditors include assigning the role of monitor, ensuring that the monitor actually does monitor, and creating a mechanism that properly compensates the monitor for assuming 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 covering the monitoring costs through the interest rate, the debtor should agree to pay a separate monitoring charge to, say C_1, if monitoring costs are incurred. That would give the following payoff matrix in the monitoring subgame:[57]

		C_2	
		Not Monitor	*Monitor*
C_1	*Not Monitor*	[23,23]	[50,42]
	Monitor	[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_1, monitoring weakly dominates not-monitoring. Although C_1 will always net $50 if it monitors, 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. As a result, C_2 should recognize that C_1 will monitor, and therefore C_2 need not monitor. In effect, we can remove the weakly-dominated strategies[58] from consideration and instead focus on the new payoff matrix:

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[56] A general discussion of dominance solvability may be found in David M. Kreps, *A Course in Microeconomic Theory* 417-21 (Princeton, 1990).

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

[58] Strategy A is weakly dominated by strategy B if B always results in as large a payoff to the player as A and sometimes results in a larger payoff. Weakly-dominated strategies are discussed in Kreps, *A Course in Microeconomic Theory* at 417-21 (cited in note 56).

		C_2	
		Not Monitor	*Monitor*
C_1	*Monitor*	[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.[59]

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 the debtor pays all unsecured creditors (and any senior creditors) in full as well. Given the assumptions that neither creditor 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 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 the debtor will fully reimburse C_1's monitoring costs. The game with contingent payment of monitoring costs is dominance solvable, which suggests that we can avoid the indeterminacy of multiple Nash equilibria in the monitoring subgame through the device of contingent full-payment of monitoring costs. It is quite common for a loan contract to

[59] 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*, in Richmond Campbell and Lanning Sowden, eds, *Paradoxes of Rationality and Cooperation: Prisoner's Dilemma and Newcomb's Problem* 107-29 (British Columbia, 1985). From that, these critics have argued that a different decisionmaking rule is needed, since the dominance rule does a poor job on fringe cases. In this Article, however, I use the concept of dominance solvability in the context of simple subgames that present none of the problematic 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 scholars have objected to the use of dominance arguments on different grounds. See, for example, Roger B. Myerson, *Game Theory: Analysis of Conflict* 192-95 (Harvard, 1991).

include provisions for reimbursement of the expenses involved in monitoring collateral, through the use of attorneys or the like.

What this means then is that we cannot justify the use of security interests, even after we have addressed the problem of multiple Nash equilibria.[60] Fortunately, debtor misbehavior is only half of the story; the second half is creditor misbehavior.

C. 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. It is very simple for the all-equity firm to coordinate its decisionmaking. Collective action by shareholders is the norm. The shareholders, as a group, decide on the hiring and firing of managers, investment strategies and indeed on the firm's continued existence. Individual shareholders cannot

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[60] It may be possible to resurrect security interests even for debtor misbehavior. The examples in the text assume that monitoring the debtor results in success of the project. In reality, a project may fail even if a creditor monitors the debtor. 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.

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, there is 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) 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. In a world of perfect information about that distribution that can be done easily. Secured lending is often done based on a percentage of asset value; 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. (For once, the common wisdom also seems to be right. See, for example, Lawrence A. Weiss, *Bankruptcy Resolution: Direct Costs and Violation of Priority of Claims*, 27 J Fin Econ 285, 295 (1990).)

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

unilaterally withdraw assets from the firm. They must act in concert with the other shareholders.

Debt changes decisionmaking about the firm's assets. Joint decisionmaking by shareholders is supplemented by individual decisionmaking by creditors. Debt typically gives certain creditors the right to withdraw assets from the firm without the consent of fellow creditors or of equityholders. For unsecured creditors, withdrawal of the assets also establishes priority to the assets.

Each withdrawal harms creditors in as many as three ways. 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, though they are typically procedural and not substantive.[61] But it may do so without necessarily receiving full price for the good sold. Such sales occur because the withdrawing creditor bears none of the loss in value from the inefficient sale.

Second, withdrawal of assets may break up efficient combinations of assets. The printing press may be worth $100 standing alone, the dyes for the press worth $25 standing alone, and the press and the dyes 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. Each creditor 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 debtor's spiteful refusal to pay. Because these features seem fixed, I consider only

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[61] See, for example, the commercial reasonableness standard applicable to secured sellers under UCC § 9-504, and note the safe harbor of UCC § 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.").

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 that the debtor cannot misbehave. Here we have a new role for monitoring and its consequences. If one creditor monitors, and the other does not, the monitoring creditor will be able to detect debtor failure and will withdraw assets from the debtor. 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 them. 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 secure credit. 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 a low-risk debtor wishing to invest in a project with an eighty percent chance of success. Furthermore, assume that if it succeeds, the project results in total assets of $122.75, but if it fails, the project's assets are 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. Now consider the resulting payoff matrix 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.[62] C_1 will not monitor, regardless of what C_2 does, and C_2 will not monitor either. The costs of mon-

[62] Dominance solvable signifies here that the best course of action for each player is independent of what the other player does. When C_2 does not monitor, C_1 earns $50 instead of $47 if it does not monitor; when C_2 monitors, C_1 earns $48 instead of $45 if it does not. Similarly, when C_1 does not monitor, C_2 earns $50 instead of $44 if it does not monitor; when C_1 does monitor, C_2 earns $48 instead of $42 by not monitoring. Both are better off not monitoring, regardless of what the other does.

itoring exceed the benefits to be gained from avoiding the pro rata rule, given the debtor firm's high probability of success.

Now suppose that the probability of success is only fifty percent instead of eighty percent. The project now yields $146 if it succeeds and $84 if it fails, giving once again an expected value of $115. Assume, as in the prior example, that the creditors make their first-stage fee schedule decisions based on the assumption that neither player will monitor in the monitoring subgame. Now 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. C_1 will monitor, regardless of what C_2 does, and C_2 will therefore earn a subcompetitive rate of return. That means that C_2 will reject the proposed fee-schedule pair, and the parties will have to create a second set. Assume instead that the creditors set their proposed fee schedules on the assumption that both players will monitor in the monitoring subgame. The following payoff matrix will result:

		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. C_1 will monitor regardless of what C_2 does, and the same is true for C_2. 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 moni-

toring pattern. Creditors will not monitor low-risk debtors—a no-monitoring equilibrium—because the cost of monitoring exceeds the benefits gained from monitoring.[63] Both creditors, however, will monitor high-risk debtors—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 two.[64] 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. As a result, monitoring will lower the value of the 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. The security interest will be socially efficient if its cost 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 a security interest. One creditor, however, will take a security interest 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. Assume that the debtor grants a security interest in all of the firm's assets to C_1. The creditors face the following payoff matrix in the monitoring subgame:[65]

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[63] The benefits of monitoring are either grabbing more than a pro rata share of the assets or ensuring that one receives such a share.

[64] Having both creditors monitor will be the unique pure-strategy Nash equilibrium in the second-stage monitoring game. The bank run literature reflects the idea that withdrawal is the dominant strategy if the bad state is known to have occurred. See, for example, James S. Coleman, *Foundations of Social Theory* 215-18 (Belknap, 1990). Compare Andrew Postlewaite and Xavier Vives, *Bank Runs as an Equilibrium Phenomenon*, 95 J Pol Econ 485 (1987).

[65] 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 the debtor will repay C_1 in full. Now consider C_2's monitoring decision. In C_2's case as well, not monitoring dominates monitoring. Hence, neither creditor will monitor.[66]

This model predicts that creditors will take security interests only in high-risk firms. Creditors will not monitor low-risk firms even if the debtor issues only unsecured credit. Taking a security interest will introduce a cost without an offsetting benefit. For high-risk firms, the debtor increases the value of its equity 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 one will not alter these outcomes. Although raising the interest rate cannot decrease the amount of monitoring, it may serve to increase the amount of monitoring at stage two; conversely, lowering the interest rate may decrease the amount of monitoring at stage two.

The central difference between this view of monitoring and that of prior models is that here monitoring—at best—simply redistributes 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 reduces the amount of value available for distribution. In contrast, direct monitoring of the project decisions of the debtor enhances value for

[66] 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.

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 creditor monitors the debtor; such a prediction surely is counter-factual. Therefore a third model is required, one that combines debtor and creditor misbehavior.

D. 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 because it prevents debtor misbehavior and ensures investment in the best projects. But monitoring is destructive in that it is the mechanism that permits creditor misbehavior.

To reset the stage, the debtor will misbehave (by selecting Project 2) if neither creditor monitors it. Project 2 fails ninety percent of the time and is worth $40 and succeeds ten percent of the time and is worth $635. For low-risk debtors, Project 1 succeeds eighty percent of the time and is worth $122.75 and fails twenty percent of the time and is worth $84. For high-risk debtors, Project 1 succeeds only fifty percent of the time and is worth $146 and fails fifty percent 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. If the parties set the first stage fee schedules on the assumption that C_1 will monitor and C_2 will not, and that C_1 will be reimbursed for its monitoring costs only if it in fact monitors, the following payoff matrix in the monitoring subgame will result:

		C_2	
		Not Monitor	*Monitor*
C_1	*Not Monitor*	[22,24]	[46,47]
	Monitor	[50,50]	[47,45]

FIGURE 3.1: PAYOFFS IN COMBINED MODEL: THE UNSECURED CASE, LOW-RISK DEBTOR

This game is again dominance solvable. C_1 will monitor, regardless of what C_2 does, and therefore C_2 will not monitor. As in the pure misbehavior model, monitoring is essential to prevent debtor misbehavior. But given that C_1 will be paid in full if it monitors, there is no need for a security interest to reach this result. Moreover, C_2 will not monitor for possible creditor misbehavior by C_1 given the high probability that the debtor's project will succeed. As in the common pool model, the high probability of success means that C_2 will not monitor in an attempt to stop C_1 from deviating from the pro rata distribution rules. Security interests are again irrelevant.

Now consider the high-risk debtor. Again if the parties set the first-stage fee schedules on the assumption that C_1 will monitor and C_2 will not, we get the following payoff matrix in the subgame:

		C_2	
		Not Monitor	*Monitor*
C_1	*Not Monitor*	[20,28]	[31,63]
	Monitor	[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 will monitor. This is not an equilibrium result in the game as a whole, since neither creditor earns the competitive rate of return (C_1 earns less and C_2 more); furthermore, the debtor, while needing one creditor to monitor, needs only that one.

If each of the creditors instead assumes that they both will monitor the debtor's behavior 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 with the debtor needlessly lowering the value of equity as it bears the costs of two monitors.

Suppose instead that C_1 receives a security interest. If the creditors set their first-stage fee schedules on the assumption that C_1 monitors and C_2 does not, we get the following payoff matrix:

		C_2	
		Not Monitor	*Monitor*
C_1	*Not Monitor*	[41,7]	[50,45]
	Monitor	[50,50]	[50,42]

FIGURE 3.4: PAYOFFS IN COMBINED MODEL: THE SECURED CASE

This is dominance solvable, with C_1 monitoring and C_2 not monitoring. Each creditor earns a competitive rate of return, and the value of the 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. This is the behavior pattern thought to be present in most secured lending.[67]

Note, however, 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

[67] But compare Adler, 21 J Legal Stud (cited in note 31) (arguing that unsecured creditor monitoring is critical for policing conflicts between managers and dispersed equityholders).

some, perhaps vanishingly small, pool of unencumbered assets in the firm when it fails. One might therefore argue that security interests shrink the size of the common pool, but do not otherwise eliminate the pool of assets 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. Therefore, the importance of security interests in mitigating the harms of the common pool will still hold.

CONCLUSION

During the 1980s, two separate strands of academic work in commercial law attempted to explain the pervasive existence of secured credit and to provide 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, bankruptcy law scholarship was premised on the idea that bankruptcy law solved 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 in an attempt to defeat the pro rata distribution scheme of bankruptcy. The possible relationship between security interests and common pools was ignored.

This Article presents an integrated treatment of these issues in a standard game-theoretic context. The monitoring of debtor misbehavior takes the form of the Battle of the Sexes game, except that the players seek to coordinate on playing different strategies rather than the same strategy. 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 approach. Creditor misbehavior can take the form of the Prisoner's Dilemma. Unlike the Battle of the Sexes and its multiple equilibria, here a unique solution exists. The difficulty is that 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 play an important role in the efficient allocation of capital; most of their benefits derive from

eliminating the duplicative monitoring of possible creditor misbehavior that defines the common pool. Moreover, we must reconsider the common pool construct that currently forms the basis for our understanding of the bankruptcy laws. 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 therefore reconsider the mission of the bankruptcy laws since the parties themselves can and do keep this problem from arising in the first place.

There may also be a broader principle at work. I started by noting the analogy between the failing firm and the Prisoner's Dilemma. I have argued that one way out of the dilemma is to embed it into a larger decisionmaking problem. The particular payoffs in the new subgame—the old, free-standing Prisoner's Dilemma—emerge as results of the decisions in the larger game. 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 larger game may have substantial implications for legal analysis more generally. It may be insufficient simply to recognize a Prisoner's Dilemma or some other game with multiple or suboptimal equilibria. Knowing when the dilemma stands alone and when it does not becomes critical if we are to use game-theoretic models to decide, as we have with regard to the Bankruptcy Code, what problems the legal system should address.