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The Financing and Redeployment of Specific Assets

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ABSTRACT

We model the role various forms of nonrecourse secured debt play in efficiently redeploying assets whose value is state-specific. Ex ante, an entrepreneur and an asset redeployer make noncontractible state-specific investments in the primary and next-best uses of an asset, respectively. The redeployer provides a secured nonrecourse loan equal to the value of the asset in the critical state that separates the good and bad states. In the event of a bad state, this contract averts ex post bargaining over the asset's quasi-rents on redeployment and leaves the parties' ex ante investments undistorted.

IT IS FAIRLY EASY TO FIND examples of assets that were intended for one use and later redeployed to an alternative use. 1950s-era gasoline filling stations are routinely converted into restaurants, convenience stores, and trendy coffee shops. With the decline in worldwide passenger travel during the late 1980s, many older Boeing 747 passenger aircraft were reconfigured for use as air freighters. And with the decline in downtown business occupancies in many American cities during the early 1990s, a large number of older office buildings have been found to make charming and inexpensive hotel conversions. In each of these cases, a substantial portion of the asset's capital cost was devoted specifically to serving its intended use and yet turned out to be worthless. That is, when put in place the assets were *specific* assets. Moreover, in each case the assets were effectively redeployed to an alternative use after failing in their intended use.

This paper examines the role nonrecourse secured debt plays in ensuring the optimal allocation of ownership over specific assets. Early work by Williamson (1975) and Klein, Crawford, and Alchian (1978) on the role of economic organization in avoiding the threat of postcontractual opportunism

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laid the foundation for what has come to be called the bargaining literature (see Grossman and Hart (1986) and Hart and Moore (1990a)). In light of the bargaining literature, we argue that the problem posed by asset specificity is much more general than it appeared in its early conception (Alchian and Woodward (1988) and Johnsen (1995)). Whenever ex ante investments are noncontractible, asset specificity can plague both parties to an exchange and can arise due to a variety of events that can change the state of the world and affect investment returns. By establishing state-contingent control over the asset, financial contracting can ameliorate the problem, allowing the parties to increase their joint wealth (Zender (1991), Aghion and Bolton (1992)).

We examine the case of a general asset that can be devoted to one of two specific uses whose values vary differently with the state of the world. In anticipation of the good states, a wealthy entrepreneur endowed with specialized skill at using the asset in the good states considers making an investment that is specific to the primary use of the asset. Because he is a specialist at maximizing the value of the asset in its primary use, he recognizes that he lacks the skill to use it efficiently if any of the bad states prevail, in which case the asset should be redeployed to an alternative use. Indeed, it is reasonable to assume that he lacks the skill even to identify the asset's next best use or to recognize clearly the occurrence of the bad states, in which case he risks maintaining it in a suboptimal use. Knowing this, the entrepreneur contracts with an asset redeployer who has specialized skill at redeploying the general asset in the bad states. Efficient redeployment, however, requires the redeployer to make an ex ante specific investment, which for him involves identifying the character and net value of the asset's next best use.

If the parties rely on negotiated spot exchange to transfer ownership of the asset in the bad states, any rents arising from redeployment are split between them in some way. Ex post bargaining allows the entrepreneur to capture some of the bad-state rents, leaving the redeployer with less than the entire surplus from redeployment.[1] This distorts both parties' ex ante investments. Anticipating his ability to capture some of the bad-state rents from redeployment, for example, the entrepreneur's investment is less specific to the good states than is optimal given his specialized skill. This allows him to increase the value he can derive from continuing to use the asset in the bad states and thereby increases his bargaining power in negotiating for a share of the redeployment rents. Similarly, the redeployer reduces his investment in identifying the asset's next best use because he recognizes that some of the rents from skilled redeployment otherwise go to the entrepreneur. Since the asset should not be used by the entrepreneur in the bad states, these adjustments serve only to dissipate the parties' joint wealth.

A nonrecourse secured loan issued by the redeployer to the entrepreneur equal to the value of the asset in the critical state that separates the good and bad states solves the investment distortion problem caused by ex post

[1] Post-contractual opportunism represents the special case in which the state of the world changes purely due to one party's opportunistic whim.

bargaining. If a good state prevails, the entrepreneur retains ownership over the asset and repays the loan as agreed. If a bad state prevails, he gladly allows the redeployer to repossess the asset because its value to him is less than the face value of the loan. Because there is no bargaining over the ex post transfer price of the asset, the entrepreneur captures the entire good-state surplus, the redeployer captures the entire bad-state surplus, and their respective ex ante investments are optimal.

In the critical state the value of the asset in its primary use is just equal to its general value; that is, the contribution of the general asset to the primary use is identical to its contribution (net of redeployment costs) to the next best use. Because the redeployer is a specialist at identifying alternative uses of the general asset, his willingness to lend this amount, with recourse to the asset only on default, serves to bond the zealous performance of his specialty by making him a residual claimant to his proficiency in carrying it out. Presumably, he is easily capable of identifying a fairly low-order alternative use of the asset, say, as scrap. But both parties gain from secured debt's ability to motivate the redeployer to identify a higher-order alternative use, which we define as the asset's next best use. Similarly, secured debt makes the entrepreneur's equity stake a residual claim to the zealous performance of his specialty up to the amount he truly vests in the primary use of the asset.

Our model of nonrecourse secured debt follows Williamson (1988) in recognizing a close relationship between debt finance and the redeployment value of a specific asset. It extends and generalizes the work of Zender (1991) and Aghion and Bolton (1992) on the role of debt as an asset-transfer mechanism. In contrast to these authors, the benefits of secured finance in our model arise even if the entrepreneur has sufficient wealth to finance the entire investment. Unlike Zender and Aghion and Bolton, our model requires no intermediate signal correlated with the state and contractible ex ante. It requires only that the parties' ex ante specific investments are wealth increasing and otherwise noncontractible. As with other models of financial contracting, it is worth noting that the arrangement will be adopted even by parties who are risk neutral.

Our model sheds considerable light on the choice between bank financing and financing by specialized redeployers. It also sheds light on various financial arrangements, including financial leasing, real options, vendor financing, the choice between secured and unsecured debt, project finance, and the general pattern of debt priorities and their disposition in bankruptcy. A number of papers have examined these financial arrangements.[2] Our work is perhaps closest to that of Welch (1997) and Berkovitch, Israel, and Zender (1995). We share Welch's desire to minimize bargaining costs but

[2] See Myers, Dill, and Bautista (1976), Sharpe and Nguyen (1995), and Smith and Wakeman (1985) for leasing; Stulz and Johnson (1985) and Rajan and Winton (1995) for secured debt; Kensinger and Martin (1988) and Chemmanur and John (1996) for project finance; Brennan, Maksimovic, and Zechner (1988) and Smith (1987) for vendor financing; Hart and Moore (1990b), Bolton and Scharfstein (1996), Diamond (1993), Winton (1995), and Welch (1997) for the various levels of seniority of debt.

emphasize the mutual gains from specialized investment. Like Berkovitch et al., we recognize that the bargaining power of creditors should be limited in bankruptcy. In their view, such limitations induce managers to invest in firm-specific human capital, whereas in our view they induce creditors to invest in specialized redeployment skills. An attractive feature of our model is its ability to provide a unified explanation for a variety of financial arrangements.

We proceed as follows. In Section I, we illustrate the importance of asset redeployment in the context of aircraft financing. We then demonstrate the superiority of nonrecourse secured debt over negotiated spot exchange and illustrate its use in financial leasing, real options, and vendor financing. In Section II, we explain the choice between secured and unsecured debt by introducing two assets that have complementary primary uses in the good states but different next best uses in the bad states, with project finance representing a special case. We then introduce the case where a single asset has multiple next best uses over different ranges of states to explain the existence and pattern of debt priorities. In Section III, we present a few empirical implications and additional anecdotal evidence to demonstrate the richness and generality of the redeployment hypothesis. We conclude with a few remarks about the nature of investment and its importance to asset values and by noting where future research is likely to prove fruitful.

I. The Basic Model

A. Aircraft Financing and Redeployment—An Illustration

Aircraft finance industry firms employ a rich variety of financial contracts, including both secured and prioritized debt, financial and operating leases, real options, project finance, and vendor finance, in serving the commercial passenger and air freight industries. There is little doubt that commercial aircraft are often specific to given uses, that the commercial passenger and air freight industries have been subject to repeated exogenous shocks affecting the state of the world, and that finance industry firms such as Guiness Peat Aviation (GPA) and General Aviation Transport Corporation (GATX) are actively engaged in reconfiguring and redeploying aircraft in response to such shocks. A limited examination of industry reports provides ample evidence to illustrate the power and generality of our model.[3]

[3] General background for our discussion of aircraft finance can be found in "Deals Roundup," *Airfinance Journal* 25 (3), 14–20 (July 1993); "GATX set to Bounce Back," *Asset Finance & Leasing Digest* 7 (2), 115–118 (April 1993); "GATX/Airlog Issues Major Contract for Conversion of 74 Passenger Aircraft to Freighters," *Business Wire*, p. 5B (Oct. 15, 1991); "Small Market Open for Conversion of Widebody Craft," *Journal of Commerce*, p. 9B (Feb. 26, 1988); "Flagship Express Services Launches Nightly Air Freighter Service; Company Leases Three DC-8-71 Aircraft," *PR Newswire* (June 13, 1993); "Braniff Places Aircraft Order for Boeing 737-300s," *PR Newswire* (Sept. 6, 1989); *Searls v. GATX Corp.*, et al., Case No. 91 C 6796, U.S. District Court for the Northern District of Illinois, Eastern Div., Sept. 21, 1994. For an analysis of aircraft sales that is largely consistent with our analysis of aircraft finance, see Pulvino (1998).

With the elimination of the U.S. Civil Aeronautics Board in 1978 and the deregulation of commercial air transport that followed, several major airlines began a protracted departure from the industry. Whether through bankruptcy or voluntary reorganization, this led secured lenders and lessors to repossess, reconfigure, and redeploy many of the aircraft the airlines had pledged as collateral. For example, in response to competitive fares, many passenger aircraft designed for full-service use under regulated fares were taken off lease from defaulting airlines and then reconfigured and redeployed for use specifically in low-frills service on high-traffic routes. Similarly, in response to reduced world demand for passenger travel, many Boeing 747s were taken off lease from defaulting airlines and then reconfigured and redeployed for use specifically in air freight transport.

Anticipating the effects of deregulation, aircraft industry finance firms appear to have invested substantial resources throughout the 1980s and early 1990s to establish general knowledge of secondary market redeployment opportunities for used aircraft. They also appear to have invested, ex ante, to establish specific knowledge of redeployment opportunities for particular used aircraft. This no doubt involved the identification of higher-order alternative uses for specific classes, categories, and types of aircraft as well as the relatively narrow submarkets into which they could be efficiently redeployed. We believe secured debt was and is instrumental in allowing aircraft and other asset redeployers to capture the returns to their ex ante investments in redeployment.

The ex ante investments we have in mind need not be marginal to each new aircraft financed. Our hypothesis applies even where the ex ante investment is entirely fixed, although as the investment is directed to identifying successively higher-order alternative uses and narrower submarkets it applies to a smaller category of aircraft, in the limit applying as a marginal investment to a single specialized aircraft.[4] Competition between finance firms requires them to invest, ex ante, in identifying successively higher-order alternative uses and narrower redeployment submarkets until the costs and benefits are equal at the margin. This leads to a higher level of debt finance than if lenders refused to specialize in redeployment.[5]

[4] Our model views the initial configuration of the asset as exogenous. An equally plausible view, which we choose not to model, is that the redeployer's ex ante investment consists of the extra amount it lends against an asset configured in such a way that it has a higher redeployment value than it otherwise would. In this view, the lender merely finances the added investment rather than making it directly.

[5] Perhaps Tony Ryan, founder of GPA, put it best in describing the early years of aircraft financing: "I remember when I first went to the City of London, I talked to 10 or so banks. We were mainly in Boeing 737s then, and they would ask me two questions. One was how much can you buy a 737 for, which in those days was \$3 or \$4 million new. And the next question was, what is the scrap value of a 737, and I'd say, well, \$25,000. They didn't understand that it was a mobile asset that could generate revenues anywhere." "Why Ryan is Floating on Air; Tony Ryan of GPA Group Ltd," *Management Today* (June 1992, p.44).

B. Redeployment of a Single Asset

An asset redeployer must identify an asset's next best use and be prepared to repossess and resell it to a member of the class of next best users. We hypothesize that in some cases there is a real trade-off between the costs identifying the asset's next best use, ex ante, and the ex post costs of repossession and resale, so that some level of ex ante investment is efficient. Where ex ante investments are noncontractible, nonrecourse secured debt avoids ex post bargaining and appropriately bonds the redeployer's performance by making him a residual claimant to the asset's highest feasible bad-state value.[6]

This analysis applies to the activities of other intermediaries as well. Implicit in the lender's identification of the asset's next best use is an assessment of its value in the critical state that separates the good and bad states.[7] This value establishes the face amount of the loan. As with the full scope of redeployment activities, accurate valuation looked at in isolation may be noncontractible and subject to gains from ex ante investment. If valuation is left until the bad state occurs, for example, a sales agent will have too little incentive to search for a better price (Garbade and Silber (1982)) because he captures only a share of the gains. And the entrepreneur benefits from an ex ante valuation of the primary use of the asset to better determine his optimal level of investment.

Where valuation alone poses a contractibility problem, the remaining redeployment functions can be vertically disintegrated and performed ex post by an entirely separate firm, leaving the lender to perform the valuation function. It is clear that many lenders, especially commercial banks, have little interest or expertise in redeploying the assets that serve as collateral for the loans they issue. They appear to be engaged almost exclusively in valuing the revenues from the asset's current use, relying on conventional rules of thumb (Alchian (1950)) to determine the prudent loan-to-value ratio, which at the margin equals the expected redeployment value of the asset. Other lenders, such as aircraft finance firms, are actively engaged in fully integrated redeployment, including valuation, repossession, and resale. The distinction between pure valuation and fully integrated redeployment allows us to provide tentative explanations for many of the observed patterns of commercial lending described in the remainder of the paper.

[6] Bargaining may also occur between the redeployer and the next best user and give rise to the need for ex ante arrangements between these parties. There is no need for such arrangements if the alternative user makes no ex ante investment and if all bargaining power belongs to the redeployer. Both conditions are likely to hold in practice.

[7] Efficient asset monitoring or its inverse, asset substitution and underinvestment, may also be noncontractible and subject to gains from ex ante investment. Although the monitoring function is clearly affected by financial contracting (see, among others, Jensen and Meckling (1976), Smith and Warner (1979), and Jensen (1986)), for the sake of tractability we assume throughout the paper that the agency costs of debt held are constant.

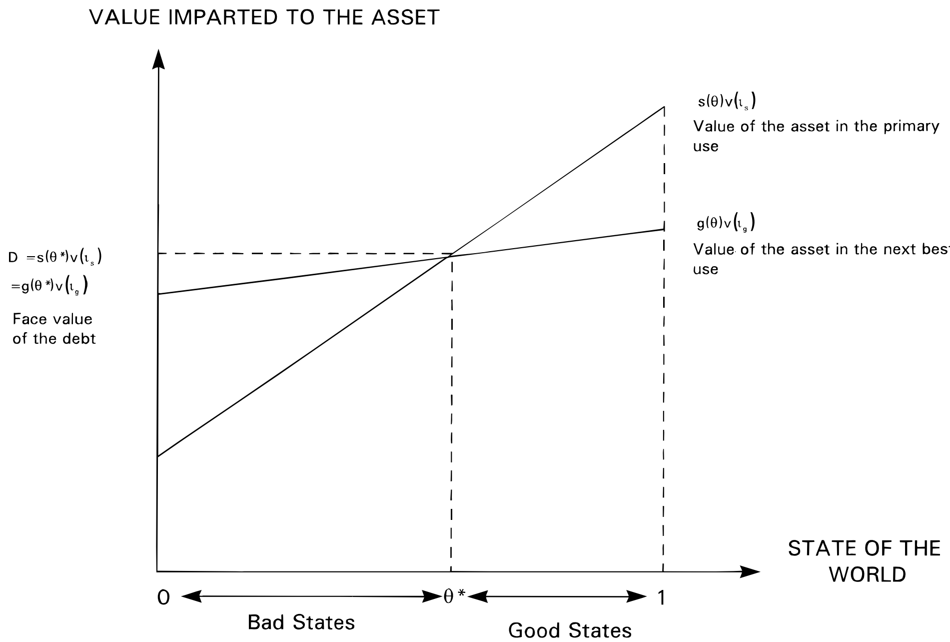

Figure 1. Case of two uses and one asset. The graph represents the value of the asset in its primary use ($s(\theta)v(\iota_s)$) and its next best use ($g(\theta)v(\iota_g)$) as a function of the state of the world θ and the investment made toward that use (ι_s and ι_g, respectively). The face value of the debt D is chosen to equal the value of the asset in the state θ^* in which the two uses have the same value.

B.1. The Inefficiency of Ex Post Bargaining

Our entrepreneur is endowed with specialized skills, s, that allow him to impart value to the aircraft by making a noncontractible ex ante investment that is specific to the asset's primary use, such as full-service passenger travel prior to deregulation. An investment of ι_s at time $t = 1$ allows the entrepreneur to realize value $sv(\iota_s)$ at time $t = 2$. Here, s can be thought of as an index of specialization reflecting the efficiency with which he can make use of his specific investment. The function $v(.)$ is increasing and concave.

Assume that the value of the entrepreneur's skills varies with the state of the world, θ, that prevails at time $t = 2$. The entrepreneur's skills, as well his investment, are specific to the good states of the world. θ is uniformly distributed over the interval [0,1] and the index of specialization, s, is an increasing function of θ. State 1 constitutes the best state of the world (see Figure 1), in which the asset is most efficiently retained in its primary use. In contrast, state zero constitutes the worst state of the world, in which the entrepreneur's skills are practically worthless and the investment he made at time $t = 1$ turns out to have been made in vain. The aircraft should be redeployed to another user in that state.

Consider an asset redeployer who is endowed with specialized skills, $g(\theta)$, in redeploying assets like those used by the entrepreneur. A noncontractible investment of ι_g at time $t = 1$ allows the redeployer to realize value $g(\theta)v(\iota_g)$ at time $t = 2$ and state θ. Because his skills are specialized to the general asset, which can be devoted to either the asset's primary use or its next best use, their value varies much less with the state of the world than the entrepreneur's. In the post-deregulation airline industry, the general asset can be seen as the core attributes of, say, Boeing 747s that are suitable for both passenger and airfreight service. Thus, $g(\theta)$ is an increasing function of the state of the world, but it increases at a slower rate than $s(\theta)$; it is smaller in the good states but larger in the bad states (see Figure 1). More formally, we assume for all relevant ι_s and ι_g

$$s(0)v(\iota_s) < g(0)v(\iota_g); \tag{1}$$

$$s(1)v(\iota_s) > g(1)v(\iota_g); \tag{2}$$

$$s'(.) > 0; \tag{3}$$

$$g'(.) > 0; \tag{4}$$

$$g'(\theta)v(\iota_g) < s'(\theta)v(\iota_s) \qquad \forall\theta \in [0,1]. \tag{5}$$

Joint maximization implies that the asset should be owned by the entrepreneur in the good states and by the redeployer in the bad states. The maximum value that can be imparted to the asset is[8]

$$\operatorname*{Max}_{\iota_s,\iota_g,\theta^*} \int_{\theta^*}^{1} s(\theta)v(\iota_s)\,d\theta + \int_{0}^{\theta^*} g(\theta)v(\iota_g)\,d\theta - r(\iota_s + \iota_g), \tag{6}$$

where θ^* is the critical state that separates the good states $[\theta^*,1]$ from the bad states $[0,\theta^*]$ and r is the riskless rate of return. ι_s, ι_g, and θ^* are the solutions to

$$\int_{\theta^*}^{1} s(\theta)v'(\iota_s)\,d\theta - r = 0, \tag{7}$$

$$\int_{0}^{\theta^*} g(\theta)v'(\iota_g)\,d\theta - r = 0, \tag{8}$$

and

$$s(\theta^*)v(\iota_s) = g(\theta^*)v(\iota_g). \tag{9}$$

They represent the first-best allocation and levels of investments.

[8] We assume joint concavity in ι_s, ι_g, and θ^*.

To see the inefficiency of ex post bargaining, let the parties bargain over the transfer price of the asset following realization of a bad state at time $t = 2$. The surplus over which bargaining takes place is $g(\theta)v(\iota_g) - s(\theta)v(\iota_s)$. It equals the difference between the value of the asset when owned by the redeployer, $g(\theta)v(\iota_g)$, and the value of the asset when owned by the entrepreneur, $s(\theta)v(\iota_s)$. Assuming the Nash bargaining solution (Rubinstein (1982) and Grossman and Hart (1986)) for simplicity, the entrepreneur's problem at time $t = 1$ becomes

$$\begin{aligned}\operatorname*{Max}_{\iota_s^0} \int_0^{\theta^0} &\left(s(\theta)v(\iota_s^0) + \left(\frac{g(\theta)v(\iota_g^0) - s(\theta)v(\iota_s^0)}{2} \right) \right) d\theta \\ &+ \int_{\theta^0}^1 s(\theta)v(\iota_s^0)\,d\theta - r\iota_s^0, \end{aligned} \tag{10}$$

where θ^0 is the solution to

$$s(\theta^0)v(\iota_s^0) = g(\theta^0)v(\iota_g^0). \tag{11}$$

It has the following first-order condition[9]

$$\begin{aligned} &\int_0^{\theta^0} \left(\frac{s(\theta)v'(\iota_s^0)}{2} \right) d\theta + \frac{s(\theta^0)v(\iota_s^0) + g(\theta^0)v(\iota_g^0)}{2} \frac{\partial \theta^0}{\partial \iota_s^0} \\ &\quad + \int_{\theta^0}^1 s(\theta)v'(\iota_s^0)\,d\theta - s(\theta^0)v(\iota_s^0)\frac{\partial \theta^0}{\partial \iota_s^0} - r = 0 \\ &\Leftrightarrow \int_0^{\theta^0} \left(\frac{s(\theta)v'(\iota_s^0)}{2} \right) d\theta + \int_{\theta^0}^1 s(\theta)v'(\iota_s^0)\,d\theta - r = 0, \end{aligned} \tag{12}$$

using equation (11).

A comparison of first-order conditions (12) and (7) reveals that the entrepreneur's investment incentives have been changed by the expectation of bargaining at time $t = 1$. This is surely true if $\theta^0 \neq \theta^*$, but it is also true if $\theta^0 = \theta^*$, since the first-order condition (12) then implies that $\iota_s^0 > \iota_s$.

A similar result can be shown for the redeployer's investment incentives. We have thus proved the following proposition.

PROPOSITION 1: *Joint maximization with noncontractible state-specific investment cannot be attained when bargaining over the transfer price of the asset occurs on realization of the state.*

[9] Note that both the entrepreneur and the redeployer recognize their ability to alter the state, θ^0, that separates good states from bad states.

This result holds for all distributions of bargaining power between the parties, even those in which one party has no bargaining power. The transfer price of the asset in all such cases depends on the ex ante investment made by at least one party, which therefore is distorted by the dependence.[10]

B.2. The Optimality of Nonrecourse Secured Debt

As in MacLeod and Malcomson (1993), it is fairly easy to demonstrate the efficiency of a financial contract that transfers ownership to the redeployer contingent on the observed realization of θ^* and on his payment of a fixed price established at time $t = 0$, prior to the realization of the state and to any ex ante investment by the parties (see the Appendix). This requires that θ^* be contractible, however, which in some settings is infeasible. In such settings, nonrecourse secured debt issued by the redeployer to the entrepreneur achieves the necessary state-contingent transfer of control with no need for a contractible state, or for a contractible signal that is correlated with the state.

PROPOSITION 2: *Joint maximization under state-contingent ownership is attained through the issuance of nonrecourse debt of face value* $D \equiv s(\theta^*)\nu(\iota_s) = g(\theta^*)\nu(\iota_g)$ *secured by a lien against the asset.*

All proofs are relegated to the Appendix.

This solution presents the entrepreneur with a choice of either repaying the loan and keeping the asset or defaulting on the loan and relinquishing the asset, in which case the redeployer's recourse is limited to the bad-state value of the asset. The entrepreneur then chooses to default only when the value he can impart to the asset is smaller than the face value of the loan. Because the face value of the loan has been chosen to equal the value of the asset in the critical state, θ^*, the entrepreneur relinquishes the asset to the redeployer in all the bad states, $[0,\theta^*]$ (see Figure 1). The parties thereby avoid ex post bargaining that would otherwise distort their ex ante investments.[11] These results hold without respect to any wealth constraint faced by the entrepreneur.[12]

[10] Note that perfect competition among redeployers fails to solve the problem of ex post bargaining. Indeed, foreseeing that they will obtain no fraction of the redeployment surplus, redeployers will fail to make any ex ante investment.

[11] The debt contract described in Proposition 2 has two effects: it defines a default option requiring that the asset either be kept by the entrepreneur on repayment of the loan or be ceded to the redeployer, and it gives all bargaining power to the entrepreneur, who can choose whether to honor the debt contract or to default. These two effects combine to make joint maximization possible, as in Chung (1991), Aghion, Dewatripont, and Rey (1994), and Noldeke and Schmidt (1995). Note that repayment of the debt by the entrepreneur in the good states denies the redeployer any claim to the asset.

[12] Prior to the Gulf War, Kuwait Airlines was widely criticized throughout the industry for its inexperience after having paid cash for aircraft (*Airfinance Journal*, July 1993). One plausible explanation for the criticism is that by self-financing Kuwait Airlines gave up the wealth enhancing incentives provided by secured debt.

The model's results fit nicely with the events following airline deregulation. Many aircraft loans met with default by failing carriers, and many carriers voluntarily relinquished aircraft. Although several carriers sought protection under Chapter 11 of the Bankruptcy Code, secured lenders often succeeded in repossessing and redeploying the aircraft that served as collateral. It is interesting to note that Section 1110 of the Bankruptcy Code now specifically exempts aircraft and vessels from Chapter 11's stay of a secured creditor's lien under certain circumstances.[13] Whatever the motivation for Section 1110, it surely has the effects of reducing the costs of redeployment by aircraft finance firms and, all else equal, increasing the amount they are willing to lend by increasing the aircrafts' critical state value.

B.3. Alternative Financial Contracts—Options and Leasing

Many aircraft are financed through so-called financial leases, which are virtually equivalent to secured debt except for special tax treatment in the United States and the United Kingdom that allows the lessor, as the nominal owner of the asset, to claim the depreciation deductions. Although financial leasing may have received its impetus from these tax advantages, it now prospers irrespective of them. Indeed, it is nearly as popular in Continental Europe where depreciation allowances are claimed by the user of the asset.[14] Early on in the study of financial contracting, Black and Scholes (1973) and Merton (1977) noted the similarity between debt and options. Put and call options are both methods of establishing state-contingent ownership and can easily be shown to produce the same outcome as nonrecourse secured debt (see the Appendix).

Aircraft finance industry reports demonstrate that leases often include options. Call options are found explicitly in leases that offer the lessee (the entrepreneur) the option to acquire the asset from the lessor (the redeployer) at a previously determined price midway through the lease or when the lease term expires. Roughly the same pattern exists outside the aircraft finance industry (McConnell and Schallheim (1983) and Schall (1992)). As a general matter, call options are implicit in the very nature of all leases, which can be viewed as compound call options (McConnell and Schallheim (1983)); each successive lease payment purchases the use of the asset for an additional period as well as the option to renew at the end of that period. Lease payments are either specified when the lease is negotiated or tied to market interest rates or a price index (Schall (1992)) in a way that precludes ex post bargaining.

The prevalence of options in aircraft leasing is no doubt a reflection of the active redeployment market for used aircraft. We speculate that leasing is preferred to secured lending by active redeployers because, among other rea-

[13] See 11 USCS 1110 (1997). Section 1110 allows both aircraft lenders and lessors with a security interest to obtain relief from the automatic stay unless the borrower agrees to perform all obligations and cure any monetary defaults before 60 days after the date of the bankruptcy filing (Shrank and Strauss (1995), at Vol. 2, p. 374).

[14] We are indebted to Piet Sercu for this observation.

sons, it provides to the lessor a marginal transaction cost advantage in repossessing the collateral on default by maintaining its full ownership of the asset. This reduces redeployment costs and raises the asset's critical-state value along with the face value of the loan.

B.4. Vendor Financing

As we use the term, "vendor finance" applies to those situations in which a manufacturer finances the purchases of its product by one or more users in the vertical chain of production and distribution. Raw materials financing, finished and unfinished goods inventory financing, and durable goods financing are all examples of vendor financing. In many, but not all, cases the manufacturer takes a security interest in the newly provided goods. According to the Uniform Commercial Code's "purchase money mortgage" provision, the manufacturer generally can establish a priority claim to identifiable assets over the borrower's prior secured creditors as long as the assets can be adequately traced (UCC § 9-107 (1995) and Schwartz (1989)). In practice, this provision limits the vendor's recourse to assets provided by other secured lenders unless those lenders are dramatically oversecured.

Vendor financing represents the case in which the manufacturer of a given product has the highest index of specialization relative to other redeployers of that same product. The manufacturer's tendency to take a security interest exclusively in its own products results at least in part from its superior skill in redeploying those, but not others', products. As recognized by Schwartz (1989), Mian and Smith (1992), and Petersen and Rajan (1997), this explanation for vendor financing is especially compelling where the goods in question are somewhat specialized. In such a setting, the manufacturer, who either has an established distribution system that includes other vendees or is regularly involved in marketing negotiations with other vendees, has a natural informational advantage over outside lenders in redeploying its own products. This advantage is not necessarily absolute, however, and secured debt therefore avoids the rent dissipation that would occur if the parties negotiated ex post over the repurchase price paid by the manufacturer in the bad state.

A manufacturer's natural informational advantage in redeploying specialized assets may explain why Boeing sometimes finances its own aircraft sales. Boeing, along with GATX, is one of the few firms licensed by the FAA to reconfigure certain aircraft, so that once having tailored an aircraft to its primary use Boeing has a comparative advantage in identifying the asset's next best use, estimating the likely reconfiguration costs, and actually performing the reconfiguration and resale in the event of a bad state.

II. Multiple Assets and Multiple States

The driving force behind the UCC's purchase money mortgage provision is to confine a lender's claim to the single asset for which it provided financing, leaving prior lenders' claims unaffected by the borrower's added indebtedness. No doubt vendor financing often occurs in the context of multiple assets, but the multiple asset case arises in many other settings and raises the issue of when secured debt is superior to unsecured debt.

A. Multiple Assets—Secured versus Unsecured Debt

As in the case of vendor finance, for any given asset we can rank order its competing redeployers, and in a world of specialized redeployers it would not be surprising to find that this ordering differs for different assets with different next best uses. Where the entrepreneur seeks to use different assets in conjunction in the good states, it is efficient for him to borrow or lease from two different finance firms and to secure each loan with a lien against a single asset. We consider the case of two assets for simplicity. Let the entrepreneur be the best user of assets 1 and 2 jointly in the good states because the assets are strictly complementary in these states.[15] Let redeployer 1 have specialized skill at redeploying asset 1 to its next best use and redeployer 2 have specialized skill at redeploying asset 2 to its next best use. For now, assume that the bad states are identical for both assets. The maximum value that can be imparted to the two assets is

$$\begin{aligned}\operatorname*{Max}_{\iota_s,\iota_{g1},\iota_{g2},\theta^*} &\int_{\theta^*}^{1} s(\theta)v(\iota_s)\,d\theta + \int_0^{\theta^*} g_1(\theta)v(\iota_{g1})\,d\theta \\ &+ \int_0^{\theta^*} g_2(\theta)v(\iota_{g2})\,d\theta - r(\iota_s + \iota_{g1} + \iota_{g2}),\end{aligned} \tag{13}$$

where $g_1(\cdot)$ and $g_2(\cdot)$ denote the indices of specialization of redeployers 1 and 2, and ι_{g1} and ι_{g2} denote their ex ante specific investments. Note that θ^* is the solution to

$$s(\theta^*)v(\iota_s) = g_1(\theta^*)v(\iota_{g1}) + g_2(\theta^*)v(\iota_{g2}). \tag{14}$$

We can now show

PROPOSITION 3: *Where two assets are best used jointly by the entrepreneur in the good states but have different next best uses and different specialized redeployers in the bad states, and where good and bad states are identical across assets, joint maximization under state-contingent ownership is attained through the issuance of debt of face value*

$$D \equiv s(\theta^*)v(\iota_s) = g_1(\theta^*)v(\iota_{g1}) + g_2(\theta^*)v(\iota_{g2}). \tag{15}$$

[15] Hart and Moore (1990a) define assets as being strictly complementary if unproductive unless used together.

It consists of two loans: a loan of face value D_1 obtained from redeployer 1 and secured by a lien against asset 1 and a loan of face value D_2 obtained from redeployer 2 and secured by a lien against asset 2.

Note that Proposition 3 does not require D_1 and D_2 to be specified; it requires only that D_1 and D_2 sum to D. Because the two assets are used strictly in combination by the entrepreneur, the good and bad states are identical across assets, thus imposing a constraint only on the face value of the total debt.

Proposition 3 is similar to Proposition 2 in using debt to achieve the efficient transfer of assets. It differs from Proposition 2 in requiring that a lien be established by each redeployer over the asset for which he is the best user in the bad states. As a general rule, a secured creditor's lien allows it either to reclaim the collateral or to receive full value in the event of bankruptcy (White (1980)), and the UCC's purchase money mortgage provision tends to confine each lender's recourse to its own collateral, at least as against other secured lenders. Where all assets are fully secured, separate liens therefore guarantee that each secured creditor's bankruptcy payoff depends largely on the value of its collateral, thereby ensuring that each secured creditor makes the optimal ex ante investment in redeployment.

Secured loans often give the lender recourse to the borrower's remaining assets. Such full-recourse rights pose a difficult problem for the redeployment hypothesis because they fail to confine the lender's claim solely to the asset to be redeployed. If strictly enforced, we would therefore expect them to weaken the lender's incentive to invest, ex ante, in redeployment by obscuring its residual claim. If the borrower's remaining assets are subject to security interests held by other lenders, however, a lender's recourse rights are strictly subordinated to their rights and are treated as unsecured claims in bankruptcy subject to pro rata sharing with unsecured creditors. We therefore have reason to believe that recourse rights are fairly weak in practice and, where they exist at all, have little effect on the lender's incentives to invest specifically in redeploying a given asset.[16] Unfortunately, there appears to be very little systematic evidence on the relative frequency of recourse and nonrecourse secured debt and even less on the extent to which secured lenders can realistically expect to assert their recourse rights.

In the aircraft finance industry, virtually all equipment loans (and, implicitly, leases) are secured. Outside the industry, unsecured lending is common, in which case pro rata sharing often governs the disposition of a borrower's bankruptcy estate between creditors. This has an effect on the parties' ex ante investment incentives and raises the issue of why secured lending does not dominate globally. In many cases, multiple lenders neglect to take security because their loans are not used by the borrower to pur-

[16] We thank Julian Franks for the observation that the payoff to secured lenders in bankruptcy is essentially limited to the value of the security, even if this value should be lower than the face value of the loan.

chase identifiable assets. In such cases, the loan proceeds may be used to create an intangible asset that in some states is redeployed as a going concern rather than as separate assets.

We have thus far treated leasing and secured debt as nearly perfect substitutes. If this were true, however, there would be little reason for the user of an asset ever to prefer ownership financed by secured nonrecourse debt over leasing. And yet secured debt persists. Aircraft finance industry reports indicate that even as major airlines have dramatically increased their reliance on operating leases, arguably in order to improve the appearance of their balance sheets in the face of lingering concerns over financial distress following deregulation (Gritta, Lippman, and Chow (1994)), most airlines persist in owning many aircraft and financing them with secured nonrecourse debt. In our view, this is a reflection of the marginal advantage ownership provides borrowers in preventing opportunistic repossession. Mann (1997) reports a longstanding concern among commercial law scholars and practitioners that finance firms may use a technical default to threaten repossession of an essential asset and to extract the quasi-rents of an otherwise thriving business. By giving the borrower relatively strong ownership rights, secured debt ensures that he captures the rents necessary to induce the optimal ex ante investment. We hypothesize that this is especially important where the assets in question are part of the core of the borrower's business. In the airline industry, for example, we expect the aircraft that are specialized to marginal or peripheral routes or functions to be financed with leases, whereas the aircraft that are specialized to trunk routes and essential functions are financed with secured debt. Our explanation supplements those that view secured debt as serving to induce monitoring by lenders and to avoid Myers's (1977) underinvestment problem. The former explanation is presented by Rajan and Winton (1995) and others, the latter by Stulz and Johnson (1985), who show how to price secured debt in the case of a firm that has two assets and both secured and unsecured debt.

B. Project Finance

Project finance has come to be a popular method of financing certain types of assets and invariably involves the use of nonrecourse secured debt. The assets, or ventures, for which project finance is most often used are "capable of standing alone as an independent entity" (Kensinger and Martin (1988)). The stand-alone nature of an asset financed by project finance implies that its good and bad states and its redeployer differ from those of the entrepreneur's other assets and gives rise to the requirement that no recourse from one asset to another should be possible. Indeed, failure to impose the nonrecourse constraint would allow one redeployer to threaten the entrepreneur and the other redeployers with repossession over the range of states where the entrepreneur should cede one asset but remain the owner of the other assets. Ex post bargaining would ensue, in which the first redeployer would capture part of the surplus made possible by having the entrepreneur remain the owner of the other assets, thus distorting the parties' ex ante investment incentives.

Aircraft industry reports indicate that project finance is occasionally used to finance airlines as opposed to individual aircraft. We hypothesize that this occurs where the next best use of the fleet of aircraft is as a going concern rather than in piecemeal liquidation. As with banks and other commercial lenders, including unsecured creditors, project finance lenders appear to be involved in valuing the net income of the "asset" in its current use and lending based on a conventional ratio of this projected value, which we assert approximates the asset's redeployment value.

C. Debt Priorities

Our initial discussion of the aircraft finance industry illustrates two sets of events—deregulation and the late 1980s decline in passenger travel—that led to the systematic reconfiguration and redeployment of aircraft. The latter event identified a very general asset common to use in both passenger and air freight service. Deregulation identified a more specialized general asset common to use in both pre- and postderegulation passenger service. Consider a hypothetical case in which both events stand to affect a given aircraft and that the possibility of the events and their implications for the asset's best use can be anticipated by various specialized redeployers. As with our treatment of vendor finance, we hypothesize that the aircraft in question is subject to a variety of alternative uses that can be ranked, ex ante, in order of the range of states over which each of those uses has the highest value. For each alternative use, the redeployers capable of maximizing the asset's value can also be ranked. This leads to the unique matching of redeployers to alternative uses, and we would not be surprised to find that the most efficient redeployer differs across alternative uses.

For simplicity, we examine the case of a single asset with three distinct alternative uses over three distinct states of the world—primary, intermediate, and bad. We introduce a second redeployer, whom we refer to as the specialized redeployer. For clarity, we label as the generalized redeployer the party previously identified as the redeployer. The entrepreneur, whose index of specialization is $s(.)$, is the most efficient owner of the asset in its primary use over the good states. The specialized redeployer, whose index of specialization is $ls(.)$, is the most efficient owner of the asset over intermediate states while he arranges redeployment to the intermediate use. And the generalized redeployer, whose index of specialization is $g(.)$, is the most efficient owner of the asset in the bad states while he arranges redeployment to the third-best use. As with the other parties, the specialized redeployer's index of specialization increases in θ but at a rate intermediate to those of the entrepreneur and the generalized redeployer (see Fig-

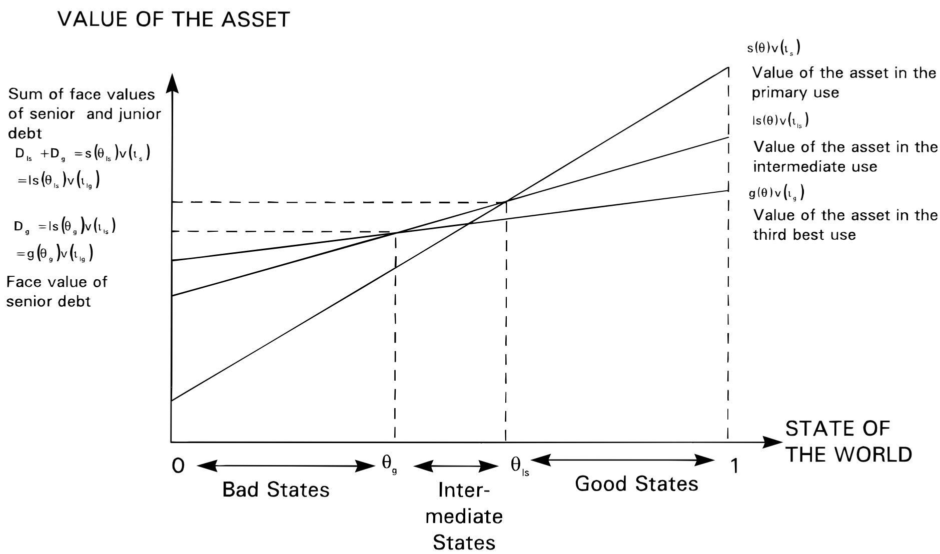

Figure 2. Case of three uses and one asset. The graph represents the value of the asset in its primary use ($s(\theta)v(\iota_s)$), its intermediate use ($ls(\theta)v(\iota_{ls})$), and its third best use ($g(\theta)v(\iota_g)$) as a function of the state of the world θ and of the investment made toward that use (ι_s, ι_{ls}, and ι_g, respectively). The face value of the senior debt D_g is chosen to equal the value of the asset in the state θ_g in which the intermediate use and the third best use have the same value. The face value of the junior debt D_{ls} is chosen to be such that the total debt equals the value of the asset in the state θ_{ls} in which the primary use and the intermediate use have the same value.

ure 2). The specialized redeployer makes an ex ante specific investment of ι_{ls} at time $t = 1$. $g(.)$, $ls(.)$, and $g(.)$ are such that, for all relevant ι_s, ι_{ls}, and ι_g,

$$s(0)v(\iota_s) < ls(0)v(\iota_{ls}) < g(0)v(\iota_g); \tag{16}$$

$$s(1)v(\iota_s) > ls(1)v(\iota_{ls}) > g(1)v(\iota_g); \tag{17}$$

$$s'(.) > 0; \tag{18}$$

$$ls'(.) > 0; \tag{19}$$

$$g'(.) > 0; \tag{20}$$

$$g'(\theta)v(\iota_g) < ls'(\theta)v(\iota_{ls}) < s'(\theta)v(\iota_s) \qquad \forall\theta \in [0,1]. \tag{21}$$

The maximum value that can be imparted to the asset is

$$\begin{aligned}\operatorname*{Max}_{\iota_s,\iota_{ls},\iota_g,\theta_{ls},\theta_g} \int_{\theta_{ls}}^{1} s(\theta)v(\iota_s)\,d\theta + \int_{\theta_g}^{\theta_{ls}} ls(\theta)v(\iota_{ls})\,d\theta \\ + \int_0^{\theta_g} g(\theta)v(\iota_g)\,d\theta - r(\iota_s+\iota_{ls}+\iota_g),\end{aligned} \tag{22}$$

where θ_{ls} separates the good states from the intermediate states and θ_g separates the intermediate states from the bad states. ι_s, ι_{ls}, ι_g, θ_{ls}, and θ_g are the solutions to the first-order conditions

$$\int_{\theta_{ls}}^{1} s(\theta)v'(\iota_s)\,d\theta - r = 0, \tag{23}$$

$$\int_{\theta_g}^{\theta_{ls}} ls(\theta)v'(\iota_{ls})\,d\theta - r = 0, \tag{24}$$

$$\int_0^{\theta_g} g(\theta)v'(\iota_g)\,d\theta - r = 0, \tag{25}$$

$$s(\theta_{ls})v(\iota_s) = ls(\theta_{ls})v(\iota_{ls}), \tag{26}$$

and

$$ls(\theta_g)v(\iota_{ls}) = g(\theta_g)v(\iota_g), \tag{27}$$

respectively.

We can now show Proposition 4.

PROPOSITION 4: *Where one asset has three possible uses over different ranges of states, and where bankruptcy procedures deny creditors the right to veto reorganization plans that leave them unimpaired, joint maximization under state-contingent ownership is attained through the issuance of debt of total face value*

$$D \equiv s(\theta_{ls})v(\iota_s) = ls(\theta_{ls})v(\iota_{ls}). \tag{28}$$

It consists of two loans: a senior loan of face value $D_g \equiv g(\theta_g)v(\iota_g) = ls(\theta_g)v(\iota_{ls})$ obtained from the generalized redeployer and a junior loan of face value $D_{ls} \equiv D - D_g$ obtained from the specialized redeployer, with priority of the former over the latter.

Proposition 4 is similar to Proposition 2 in that the total debt issued by the entrepreneur discourages him from keeping the asset in all but the good states. It is also similar to Proposition 2 in that, should a good state fail to obtain, prioritized debt allows the specialized redeployer to take ownership of the asset only in the intermediate states, in which case he assumes the debt owed to the generalized redeployer.[17]

The priority of the loan made by the generalized redeployer over that made by the specialized redeployer, together with compulsory acceptance of proposed reorganization plans by unimpaired creditors and courts' ability to stay the liens of unimpaired secured lenders (11 USCS 1124 (1997)) is essential to preclude ex post bargaining. The importance of compulsory acceptance is relatively easy to see. Where an intermediate state prevails, compulsory acceptance precludes bargaining between the specialized redeployer and the generalized redeployer, to whom the specialized redeployer offers repayment of the loan of face value D_g that the generalized redeployer had made to the entrepreneur.

The importance of debt priorities can be made clear by considering the case where the loan made by the specialized redeployer is senior to that made by the generalized redeployer, a bad state prevails, and the value that can be imparted to the asset by the generalized redeployer is smaller than the face value of the debt, D_{ls}, owed to the specialized redeployer. Here, any value that the generalized redeployer could impart to the asset would accrue to the specialized redeployer, who would therefore have to bargain to induce the generalized redeployer to redeploy the asset efficiently by offering him part of the surplus made possible by having the generalized redeployer rather than the specialized redeployer use the asset.

Junior and senior secured debt are common in the aircraft finance industry. In fact, mirroring the recognized equivalence of debt and leasing, aircraft industry reports often refer to junior and senior leases. One of the more remarkable features of aircraft leasing is that the lessor often receives secured financing from a commercial bank or other commercial investor and in turn leases the aircraft to the ultimate user. Through these so-called leveraged leases, the lessor acts as a financial intermediary, and the question becomes why the ultimate user does not simply contract directly with the lender. As we have already noted, commercial banks and other lenders appear to be focused primarily on valuing the asset's ability to generate net income in its current use and lending based on a conventional ratio that approximates a fairly low-order redeployment value. Recognizing this ex ante, the parties may find it prudent to arrange for the services of a motivated redeployer with specialized skill in identifying higher-order alternative uses. The lender thus makes an ex ante investment interposing the lessor into the transaction as a residual claimant to its proficiency in redeploying the asset. It does this by lending up to 85 percent of the purchase price of the asset, retaining a senior security interest, and leaving the lessor to provide the remaining "equity" (Shrank and Strauss (1995)), or what in fact amounts to a junior security interest.

[17] Proposition 4 presents some similarities to the suggestions made by Bebchuk (1988) regarding corporate reorganizations. It should be noted, however, that whereas Bebchuk takes the structure of prioritized debt as given, the focus of Proposition 4 is what that structure should be.

With leveraged leasing, valuation over an extremely bad state is vertically disintegrated from redeployment (valuation integrated with repossession and resale) over an intermediate state. The lessor "owns" the asset and bears the appropriate intermediate-state residual. The lessor in turn receives financing from the outside lender, who bears the residual from the occurrence of an extremely bad state. In a leveraged lease, a financial lessor can obtain relief from the automatic stay under Section 362 (d)(2) only where the debtor has no equity in the asset and the asset is unnecessary to an effective plan of reorganization (Shrank and Strauss (1995)). These are exactly the circumstances under which the lessor would be unable to use its control of the asset to engage in ex post bargaining.

An even more remarkable feature of aircraft leasing is that a single firm sometimes provides both junior and senior financing. On at least one leveraged lease, Boeing financed the secured loan and provided the junior debt as the lessor. Why would the parties take the time to create two different financial claims to be held by a single redeployer? Our response is that Boeing wanted to preserve its option to transfer either the loan or the lease separately and that formalizing the two critical-state values with two layers of debt was designed to prevent ex post bargaining.

III. Conclusion

Based on the National Survey of Small Business Finance conducted in 1988–89, Petersen and Rajan (1997) provide evidence that is consistent with the redeployment hypothesis. They explicitly test the hypothesis that suppliers have an advantage in lending to finance their customers' inventory where they can repossess and resell the goods to other buyers. The evidence from their sample fails to reject this implication. They also find that the use of trade credit is significantly higher in urban areas than in rural areas, a finding we believe can be explained by the lower redeployment costs faced by firms closer to a central market. This should give firms that specialize in redeployment a relative advantage over those that engage in pure valuation of lower-order alternative uses.

In their insightful analysis of accounts receivable management, Mian and Smith (1992) focus on the economies and diseconomies of scale and scope from vertically integrating various accounts receivable functions into a single firm. The spirit of their analysis is largely consistent with ours. They explicitly recognize that due to its specialized customer or product knowledge a manufacturer may have an advantage over outside lenders in repossessing and reselling its own merchandise. This is a narrow example of the redeployment hypothesis, and there is no reason why it cannot be extended to an entirely separate financial firm under the proper circumstances.

Thus, according to the redeployment hypothesis, banks and other commercial lenders specialize in plain vanilla financing of relatively low-order alternative uses of fairly general assets. These lenders' expertise is in pure valuation (and perhaps asset monitoring). In contrast, equipment lenders, lessors, and others specialize in fully integrated redeployment—asset valuation, monitoring, repossession, and resale—as in the aircraft finance industry. All else equal, we would expect pure valuation specialists to lend less than the redeployment specialist against a given asset because they are willing to bear the default risk on only the very lowest-order alternative uses arising from only the very worst states. Because they lend against a very general asset amenable to a variety of alternative uses, the market into which the asset is redeployed is likely to be fairly thick, perhaps being characterized by something close to perfect competition. Repossession and resale in such a market are fairly routine and can therefore be vertically disintegrated from valuation and performed ex post.

Firms specializing in redeployment tolerate much higher "default" rates (including either forced or voluntary repossession) given that the cost to them of realizing the more specialized general asset's next best value is relatively low. For them, valuation must be vertically integrated with repossession and resale because the market into which they redeploy the general asset is likely to be much thinner, with successful redeployment depending on effective ex ante investment. Interestingly, Carey, Post, and Sharpe (1998) find clear evidence in support of the redeployment hypothesis: There appears to be specialization among lenders, with finance companies financing riskier borrowers.

Our analysis has important implications for follow-up research on corporate financial structure. As long as a lender is fully secured, for example, it should be virtually indifferent to ex post changes in the riskiness of the primary use of the asset that have no effect on the asset's redeployment value. Thus, as firm value (value in primary use) falls to zero, the value of lenders' claims (based on next best use) may remain relatively stable. In a refinement to Smith and Warner (1979), bond covenants designed to prevent asset substitution should therefore tend to focus on those ex post increases in risk that threaten the value of the asset's next best use, ignoring those that pose no threat to the value of this use. The redeployment value of a firm's assets should therefore have an important influence, all else equal, on its optimal capital structure. This can help explain why some firms have virtually no debt, while others are highly levered. Although the redeployment value of a firm's assets is surely only one of several determinants of capital structure, we believe it holds substantial promise for future research.

Appendix

A Contractible Signal: Let P denote the transfer price and consider both parties' problems. The entrepreneur's problem at time $t = 1$ is

$$\operatorname*{Max}_{\iota_s} \int_{\theta^*}^{1} s(\theta) v(\iota_s)\, d\theta + \int_{0}^{\theta^*} P\, d\theta - r\iota_s, \tag{A1}$$

and the redeployer's is

$$\underset{\iota_g}{\text{Max}} \int_0^{\theta^*} (g(\theta)v(\iota_g) - P)\, d\theta - r\iota_g. \tag{A2}$$

Since P is fixed and θ^* has been previously determined and is contractible, the first-order conditions of the above problems are identical to those of problem (6).

Proof of Proposition 2: Since the face value of the debt is $D \equiv s(\theta^*)v(\iota_s) = g(\theta^*)v(\iota_g)$, the entrepreneur chooses to default on the loan, or threatens to do so, in the states, θ, such that $s(\theta)v(\iota_s^0) < D \equiv s(\theta^*)v(\iota_s)$, where ι_s^0 denotes the investment made by the entrepreneur. These are the states $\theta < \theta^0$, where θ^0 is such that $s(\theta^0)v(\iota_s^0) = D$.

Note that the realization of a state $\theta < \theta^0$ does not necessarily imply that the entrepreneur should relinquish the asset to the redeployer, because the entrepreneur might still be the best user of the asset. That would be the case if ι_s^0 and ι_g^0 were such that there exist some states $\theta < \theta^0$ at which

$$g(\theta)v(\iota_g^0) < s(\theta)v(\iota_s^0) < D, \tag{A3}$$

where ι_g^0 denotes the specific investment made by the redeployer. The entrepreneur and the redeployer would then bargain over the associated surplus, and the entrepreneur's problem at time $t = 1$ would become

$$\underset{\iota_s^0}{\text{Max}} \int_{\theta^0}^{1} (s(\theta)v(\iota_s^0) - D)\, d\theta + \int_{\theta^{00}}^{\theta^0} \frac{s(\theta)v(\iota_s^0) - g(\theta)v(\iota_g^0)}{2}\, d\theta - r\iota_s^0, \tag{A4}$$

where θ^{00} is such that $s(\theta^{00})v(\iota_s^0) = g(\theta^{00})v(\iota_g^0)$.

It has first-order condition

$$\begin{aligned}
&\int_{\theta^0}^{1} s(\theta)v'(\iota_s^0)\, d\theta - (s(\theta^0)v(\iota_s^0) - D)\frac{\partial\theta^0}{\partial\iota_s^0} + \int_{\theta^{00}}^{\theta^0} \frac{s(\theta)v'(\iota_s^0)}{2}\, d\theta \\
&\quad + \frac{s(\theta^0)v(\iota_s^0) - g(\theta^0)v(\iota_g^0)}{2}\frac{\partial\theta^0}{\partial\iota_s^0} \\
&\quad - \frac{s(\theta^{00})v(\iota_s^0) - g(\theta^{00})v(\iota_g^0)}{2}\frac{\partial\theta^{00}}{\partial\iota_s^0} - r = 0 \\
&\Leftrightarrow \int_{\theta^0}^{1} s(\theta)v'(\iota_s^0)\, d\theta + \int_{\theta^{00}}^{\theta^0} \frac{s(\theta)v'(\iota_s^0)}{2}\, d\theta \\
&\quad + \frac{s(\theta^0)v(\iota_s^0) - g(\theta^0)v(\iota_g^0)}{2}\frac{\partial\theta^0}{\partial\iota_s^0} - r = 0,
\end{aligned} \tag{A5}$$

using the definitions of θ^0 and θ^{00}. The redeployer's problem becomes

$$\begin{aligned}&\underset{\iota_g^0}{\text{Max}} \int_{\theta^0}^{1} D d\theta + \int_{\theta^{00}}^{\theta^0}\left(g(\theta)v(\iota_g^0) + \frac{s(\theta)v(\iota_s^0) - g(\theta)v(\iota_g^0)}{2}\right)d\theta \\ &\qquad + \int_0^{\theta^{00}} g(\theta)v(\iota_g^0)\,d\theta - r\iota_g^0 \\ &\Leftrightarrow \underset{\iota_g^0}{\text{Max}} \int_{\theta^0}^{1} D d\theta + \int_0^{\theta^0} g(\theta)v(\iota_g^0)\,d\theta + \int_{\theta^{00}}^{\theta^0} \frac{s(\theta)v(\iota_s^0) - g(\theta)v(\iota_g^0)}{2}\,d\theta - r\iota_g^0.\end{aligned} \tag{A6}$$

It has first-order condition

$$\begin{aligned}&-D\frac{\partial\theta^0}{\partial\iota_g^0} + \int_0^{\theta^0} g(\theta)v'(\iota_g^0)d\theta + g(\theta^0)v(\iota_g^0)\frac{\partial\theta^0}{\partial\iota_g^0} - \int_{\theta^{00}}^{\theta^0}\frac{g(\theta)v'(\iota_g^0)}{2}\,d\theta \\ &\qquad + \frac{s(\theta^0)v(\iota_s^0) - g(\theta^0)v(\iota_g^0)}{2}\frac{\partial\theta^0}{\partial\iota_g^0} \\ &\qquad - \frac{s(\theta^{00})v(\iota_s^0) - g(\theta^{00})v(\iota_g^0)}{2}\frac{\partial\theta^{00}}{\partial\iota_g^0} - r = 0 \\ &\Leftrightarrow \int_0^{\theta^0} g(\theta)v'(\iota_g^0)\,d\theta - \int_{\theta^{00}}^{\theta^0}\frac{g(\theta)v'(\iota_g^0)}{2}\,d\theta - r = 0,\end{aligned} \tag{A7}$$

using the definitions of θ^0 and θ^{00}. The former, in particular, indicates that $\partial\theta^0/\partial\iota_g^0 = 0$.

The substitution of $\iota_s^0 = \iota_s$ and $\iota_g^0 = \iota_g$ into equations (A5) and (A7) and equalities $s(\theta^0)v(\iota_s^0) = D \equiv s(\theta^*)v(\iota_s) = g(\theta^*)v(\iota_g)$ and $s(\theta^{00})v(\iota_s^0) = g(\theta^{00})v(\iota_g^0)$ reveals that $\theta^0 = \theta^{00} = \theta^*$ and reduces equations (A5) and (A7) to equations (7) and (8), indicating that ι_s and ι_g constitute a solution to equations (A5) and (A7) as well as to equations (7) and (8). Joint maximization is therefore achieved.

Where there exists no state $\theta < \theta^0$ in which inequalities (A3) hold, but there exist some states $\theta > \theta^0$ in which $D < s(\theta)v(\iota_s^0) < g(\theta)v(\iota_g^0)$, the entrepreneur relinquishes the asset to the redeployer in these states. The problems solved by the entrepreneur and the redeployer can be shown to retain the same formulation. Joint maximization under state-contingent ownership is therefore achieved in this case as well. Q.E.D.

Put and Call Options: Consider a put option on the asset, written by the redeployer to the entrepreneur, with strike price $D \equiv s(\theta^*)v(\iota_s) = g(\theta^*)v(\iota_g)$. It presents the entrepreneur with the choice between keeping the asset and exercising the option. The entrepreneur chooses to keep the asset only in the states wherein the value he can impart to it is larger than the exercise price of the option. He chooses to exercise the option only in the states wherein the value he can impart to the asset is smaller than the exercise price of the option. Because this price equals the value of the asset in the state, θ^*, that separates good states from bad states, the entrepreneur is induced to cede the asset to the redeployer in all the bad states, $[0,\theta^*)$. This efficient outcome involves no bargaining following realization of the state of the world. It therefore introduces no distortion in either party's ex ante asset-specific investment and achieves joint maximization under state-contingent ownership. It is easy to see that the same is true of a call option of exercise price D on the asset initially acquired by the redeployer rather than by the entrepreneur, written by the former to the latter.

Proof of Proposition 3: The problem solved by redeployer 1 is

$$\operatorname*{Max}_{\iota_{gl}^0} \int_{\theta^0}^{1} D_1\, d\theta + \int_0^{\theta^0} g_1(\theta)v(\iota_{g1}^0)\, d\theta + \int_{\theta^{00}}^{\theta^0} \frac{s(\theta)v(\iota_s^0) - (g_1(\theta)v(\iota_{g1}^0) + g_2(\theta)v(\iota_{g2}^0))}{3}\, d\theta - r\iota_{g1}^0, \tag{A8}$$

where θ^0 and θ^{00} are the solutions to

$$s(\theta^0)v(\iota_s^0) = D \equiv s(\theta^*)v(\iota_s) = g_1(\theta^*)v(\iota_{g1}) + g_2(\theta^*)v(\iota_{g2}) \tag{A9}$$

and

$$s(\theta^{00})v(\iota_s^0) = g_1(\theta^{00})v(\iota_{g1}^0) + g_2(\theta^{00})v(\iota_{g2}^0), \tag{A10}$$

respectively. We assume the surplus obtained by allocating ownership of each asset to its best user over the range of states θ^{00} to θ^0 is divided equally between all three parties.

The preceding problem has first-order condition

$$\int_0^{\theta^0} g_1(\theta)v'(\iota_{g1}^0)\, d\theta - \int_{\theta^{00}}^{\theta^0} \frac{g_1(\theta^0)v'(\iota_{g1}^0)}{3}\, d\theta - r = 0, \tag{A11}$$

using the definitions of θ^0 and θ^{00}. Substituting $\iota_s^0 = \iota_s$, $\iota_{g1}^0 = \iota_{g1}$, and $\iota_{g2}^0 = \iota_{g2}$ into equations (A9), (A10), and (A11) reveals that $\theta^0 = \theta^{00} = \theta^*$ and reduces equation (A11) to

$$\int_0^{\theta^*} g_1(\theta)v'(\iota_{g1})\, d\theta - r = 0, \tag{A12}$$

which is the first-order condition with respect to ι_{gl} from problem (13). The same result can be shown to hold for the problems solved by redeployer 2 and the entrepreneur. Q.E.D.

Proof of Proposition 4: By analogy to θ^0 and θ^{00}, define θ_{ls}^0, θ_{ls}^{00}, θ_g^0, and θ_g^{00} to be such that

$$s(\theta_{ls}^0)v(\iota_s^0) = D; \tag{A13}$$

$$s(\theta_{ls}^{00})v(\iota_s^0) = ls(\theta_{ls}^{00})v(\iota_{ls}^0); \tag{A14}$$

$$ls(\theta_g^0)v(\iota_{ls}^0) = D_g; \tag{A15}$$

and

$$ls(\theta_g^{00})v(\iota_{ls}^0) = g(\theta_g^{00})v(\iota_g^0), \tag{A16}$$

where ι_s^0, ι_{ls}^0, and ι_g^0 are the specific investments made by the entrepreneur, the specialized redeployer, and the generalized redeployer, respectively. The problem solved by the entrepreneur is

$$\underset{\iota_s^0}{\text{Max}} \int_{\theta_{ls}^0}^1 (s(\theta)v(\iota_s^0) - D)\,d\theta + \int_{\theta_{ls}^{00}}^{\theta_{ls}^0} \frac{s(\theta)v(\iota_s^0) - ls(\theta)v(\iota_{ls}^0)}{2}\,d\theta - r\iota_s^0. \tag{A17}$$

It has first-order condition

$$\int_{\theta_{ls}^0}^1 s(\theta)v'(\iota_s^0)\,d\theta + \int_{\theta_{ls}^{00}}^{\theta_{ls}^0} \frac{s(\theta)v'(\iota_s^0)}{2}\,d\theta + \frac{s(\theta_{ls}^0)v(\iota_s^0) - ls(\theta_{ls}^0)v(\iota_{ls}^0)}{2}\frac{\partial\theta_{ls}^0}{\partial\iota_s^0} - r = 0, \tag{A18}$$

using the definitions of θ_{ls}^0 and θ_{ls}^{00}. The problem solved by the generalized redeployer is

$$\begin{aligned}
&\underset{\iota_g^0}{\text{Max}} \int_{\theta_g^0}^1 D_g\,d\theta + \int_0^{\theta_g^{00}} g(\theta)v(\iota_g^0)\,d\theta \\
&\quad + \int_{\theta_g^{00}}^{\theta_g^0}\left(g(\theta)v(\iota_g^0) + \frac{ls(\theta)v(\iota_{ls}^0) - g(\theta)v(\iota_g^0)}{2}\right)d\theta - r\iota_g^0 \\
&\Leftrightarrow \underset{\iota_g^0}{\text{Max}} \int_{\theta_g^0}^1 D_g\,d\theta + \int_0^{\theta_g^0} g(\theta)v(\iota_g^0)\,d\theta + \int_{\theta_g^{00}}^{\theta_g^0} \frac{ls(\theta)v(\iota_{ls}^0) - g(\theta)v(\iota_g^0)}{2}\,d\theta - r\iota_g^0.
\end{aligned} \tag{A19}$$

It has first-order condition

$$\int_0^{\theta_g^0} g(\theta)v'(\iota_g^0)\,d\theta - \int_{\theta_g^{00}}^{\theta_g^0} \frac{g(\theta)v'(\iota_g^0)}{2}\,d\theta - r = 0, \tag{A20}$$

using the definitions of θ_g^0 and θ_g^{00}.

Finally, the problem solved by the specialized redeployer is

$$\begin{aligned}
&\operatorname*{Max}_{\iota_{ls}^0} \int_{\theta_g^{00}}^{\theta_g^0} \frac{ls(\theta)v(\iota_{ls}^0) - g(\theta)v(\iota_g^0)}{2}\,d\theta + \int_{\theta_g^0}^{\theta_{ls}^{00}} (ls(\theta)v(\iota_{ls}^0) - D_g)\,d\theta \\
&\quad + \int_{\theta_{ls}^{00}}^{\theta_{ls}^0} \left(ls(\theta)v(\iota_{ls}^0) - D_g + \frac{s(\theta)v(\iota_s^0) - ls(\theta)v(\iota_{ls}^0)}{2} \right) d\theta + \int_{\theta_{ls}^0}^{1} D_{ls}\,d\theta - r\iota_{ls}^0 \\
&\Leftrightarrow \operatorname*{Max}_{\iota_{ls}^0} \int_{\theta_g^{00}}^{\theta_g^0} \frac{ls(\theta)v(\iota_{ls}^0) - g(\theta)v(\iota_g^0)}{2}\,d\theta + \int_{\theta_g^0}^{\theta_{ls}^0} (ls(\theta)v(\iota_{ls}^0) - D_g)\,d\theta \\
&\quad + \int_{\theta_{ls}^{00}}^{\theta_{ls}^0} \frac{s(\theta)v(\iota_s^0) - ls(\theta)v(\iota_{ls}^0)}{2}\,d\theta + \int_{\theta_{ls}^0}^{1} D_{ls}\,d\theta - r\iota_{ls}^0.
\end{aligned} \tag{A21}$$

It has first-order condition

$$\begin{aligned}
&\int_{\theta_g^{00}}^{\theta_g^0} \frac{ls(\theta)v'(\iota_{ls}^0)}{2}\,d\theta + \int_{\theta_g^0}^{\theta_{ls}^0} ls(\theta)v'(\iota_{ls}^0)\,d\theta \\
&\quad - \int_{\theta_{ls}^{00}}^{\theta_{ls}^0} \frac{ls(\theta)v'(\iota_{ls}^0)K}{2}\,d\theta + \frac{ls(\theta_g^0)v(\iota_g^0) - g(\theta_g^0)v(\iota_g^0)}{2}\frac{\partial\theta_g^0}{\partial\iota_{ls}^0} - r = 0,
\end{aligned} \tag{A22}$$

using the definitions of θ_{ls}^0, θ_{ls}^{00}, θ_g^0, and θ_g^{00}.

Substituting $\iota_s^0 = \iota_s$, $\iota_{ls}^0 = \iota_{ls}$, and $\iota_g^0 = \iota_g$ into equations (A18), (A20), and (A22) and the definitions of θ_{ls}^0, θ_{ls}^{00}, θ_g^0, and θ_g^{00} reveals that $\theta_{ls}^0 = \theta_{ls}^{00} = \theta_{ls}$ and $\theta_g^0 = \theta_g^{00} = \theta_g$ and reduces equations (A18), (A22), and (A22) to equations (23), (25), and (24), respectively. Q.E.D.

REFERENCES

Aghion, Philippe, and Patrick Bolton, 1992, An incomplete contracts approach to financial contracting, *Review of Economic Studies* 59, 473–494.

Aghion, Philippe, Mathias Dewatripont, and Patrick Rey, 1994, Renegotiation design with unverifiable information, *Econometrica* 62, 257–282.

Alchian, Armen, 1950, Uncertainty, evolution, and economic theory, *Journal of Political Economy* 58, 211–221.

Alchian, Armen, and Susan Woodward, 1988, The firm is dead; Long live the firm: A review of Oliver E. Williamson's "The Economic Institutions of Capitalism," *Journal of Economic Literature* 26, 65–79.

Bebchuk, Lucian, 1988, A new approach to corporate reorganizations, *Harvard Law Review* 101, 775–804.

Berkovitch, Elazar, Ronen Israel, and Jaime Zender, 1995, The design of bankruptcy law: A case for management bias in reorganizations, Working paper, University of Michigan.

Black, Fischer, and Myron Scholes, 1973, The pricing of options and corporate liabilities, *Journal of Political Economy* 81, 637–654.

Bolton, Patrick, and David Scharfstein, 1996, Optimal debt structure and the number of creditors, *Journal of Political Economy* 104, 1–25.

Brennan, Michael, Vojislav Maksimovic, and Josef Zechner, 1988, Vendor financing, *Journal of Finance* 43, 1127–1141.

Carey, Mark, Mitch Post, and Steven A. Sharpe, 1998, Does corporate lending by banks and finance companies differ? Evidence on specialization in private debt contracting, *Journal of Finance* 53, 845–878.

Chemmanur, Thomas, and Kose John, 1996, Optimal incorporation, structure of debt contracts, and limited-recourse project financing, *Journal of Financial Intermediation* 5, 372–408.

Chung, Tai-Yeong, 1991, Incomplete contracts, specific investment, and risk sharing, *Review of Economic Studies* 58, 1031–1042.

Diamond, Douglas, 1993, Seniority and maturity of debt contracts, *Journal of Financial Economics* 33, 341–368.

Garbade, Kenneth D., and William L. Silber, 1982, Best execution in securities markets: An application of signaling and agency theory, *Journal of Finance* 37, 493–504.

Gritta, Richard D., Ellen Lippman, and Garland Chow, 1994, Lease capitalization and the effect on the debt ratios of the major U.S. airlines, *Transportation Law Journal* 22, 1–14.

Grossman, Sanford, and Oliver Hart, 1986, The costs and benefits of ownership: A theory of vertical and lateral integration, *Journal of Political Economy* 94, 691–719.

Hart, Oliver, and John Moore, 1990a, Property rights and the nature of the firm, *Journal of Political Economy* 98, 1119–1158.

Hart, Oliver, and John Moore, 1990b, A theory of corporate financial structure based on the seniority of claims, mimeo, London School of Economics.

Jensen, Michael, 1986, Agency costs of free cash flow, corporate finance, and takeovers, *American Economic Review* 76, 323–329.

Jensen, Michael, and William Meckling, 1976, Theory of the firm: Managerial behaviour, agency costs, and ownership structure, *Journal of Financial Economics* 3, 305–360.

Johnsen, D. Bruce, 1995, The quasi-rent structure of corporate enterprise: A transaction cost theory, *Emory Law Journal* 44, 1277–1356.

Kensinger, John, and John Martin, 1988, Project finance: Raising money the old-fashioned way, *Journal of Applied Corporate Finance* 1, 69–81.

Klein, Benjamin, Robert Crawford, and Armen Alchian, 1978, Vertical integration, appropriable rents, and the competitive contracting process, *Journal of Law and Economics* 21, 297–326.

MacLeod, Bentley, and James Malcomson, 1993, Investments, holdup, and the form of market contract, *American Economic Review* 83, 811–837.

Mann, Ronald J., 1997, Strategy and force in the liquidation of secured debt, *Michigan Law Review* 96, forthcoming.

McConnell, John, and James Schallheim, 1983, Valuation of asset leasing contracts, *Journal of Financial Economics* 12, 237–261.

Merton, Robert, 1977, On the pricing of contingent claims and the Modigliani-Miller theorem, *Journal of Financial Economics* 5, 241–249.

Mian, Shehzad, and Clifford Smith, 1992, Accounts receivable management policy: Theory and evidence, *Journal of Finance* 47, 169–200.

Myers, Stewart, 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147–175.

Myers, Stewart, David Dill, and Alberto Bautista, 1976, Valuation of financial lease contracts, *Journal of Finance* 31, 247–251.

Noldeke, Georg, and Klaus Schmidt, 1995, Option contract and renegotiation: A solution to the hold-up problem, *Rand Journal of Economics* 26, 163–179.

Petersen, Mitchell A., and Raghuram G. Rajan, 1997, Trade credit: Theories and evidence, *Review of Financial Studies* 10, 661–691.

Pulvino, Todd C., 1998, Do asset fire-sales exist? An empirical investigation of commercial aircraft transactions, *Journal of Finance* 53, 939–978.

Rajan, Raghuram, and Andrew Winton, 1995, Covenants and collateral as incentives to monitor, *Journal of Finance* 50, 1113–1146.

Rubinstein, Ariel, 1982, Perfect equilibrium in a bargaining model, *Econometrica* 50, 97–109.

Schall, Lawrence, 1992, Leasing; in John Eatwell, Murray Milgate, and Peter Newman, eds.: *The New Palgrave Dictionary of Money and Finance* (McMillan Press, London).

Schwartz, Alan, 1989, A theory of loan priorities, *Journal of Legal Studies* 18, 209–261.

Sharpe, Steven, and Hien Nguyen, 1995, Capital markets imperfections and the incentive to lease, *Journal of Financial Economics* 39, 271–294.

Shrank, Ian, and Elise Strauss, 1995, *Equipment Leasing 1995*, Vol. 2 (Practising Law Institute, New York, N.Y.).

Smith, Clifford, and L. MacDonald Wakeman, 1985, Determinants of corporate leasing policy, *Journal of Finance* 40, 895–910.

Smith, Clifford, and Jerold Warner, 1979, On financial contracting: An analysis of bond covenants, *Journal of Financial Economics* 7, 117–161.

Smith, Janet Kiholm, 1987, Trade credit and informational asymmetry, *Journal of Finance* 42, 863–872.

Stulz, René, and Herb Johnson, 1985, An analysis of secured debt, *Journal of Financial Economics* 14, 501–521.

Welch, Ivo, 1997, Why is bank debt senior? A theory of asymmetry and claim priority based on influence costs, *Review of Financial Studies* 10, 1203–1236.

White, Michelle, 1980, Public policy toward bankruptcy: Me-first and other priority rules, *Bell Journal of Economics* 11, 550–564.

Williamson, Oliver E., 1975, *Markets and Hierarchies: Analysis and Antitrust Implications* (Free Press, New York, N.Y.).

Williamson, Oliver E., 1988, Corporate finance and corporate governance, *Journal of Finance* 43, 567–591.

Winton, Andrew, 1995, Costly state verification and multiple investors: The role of seniority, *Review of Financial Studies* 8, 91–123.

Zender, Jaime, 1991, Optimal financial instruments, *Journal of Finance* 46, 1645–1663.