

Leasing, Ability to Repossess, and Debt Capacity*[†]

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Abstract

This paper studies the role of leasing of productive assets. When capital is leased (or rented), it is more easily repossessed and hence leasing has higher debt capacity than secured lending and relaxes financing constraints. However, leasing gives rise to an agency problem with regard to the care with which the leased asset is used or maintained. We show that this implies that more credit constrained firms lease capital, while less credit constrained firms buy capital. Our theory is consistent with the explanation of leasing provided by leasing firms, namely that leasing “preserves capital,” which is generally considered a fallacy in the academic literature. We provide empirical evidence that small and credit constrained firms lease a considerably larger fraction of their capital than larger and less constrained firms.

JEL Classification: D23; D92; E22; G31; G32; G33.

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1 Introduction

The ability of the lessor to repossess an asset is a major benefit of leasing. This ability to repossess allows a lessor to implicitly extend more credit than a lender whose claim is secured by the same asset. The debt capacity of leasing thus exceeds the debt capacity of secured lending. This makes leasing valuable to credit constrained firms.

When an asset is leased, however, the asset is under the control of a user who is not the owner. Leasing hence involves a separation of ownership and control, which is costly due to agency problems. The benefit of leasing in terms of the ease with which an owner can repossess the asset has to be weighed against the cost due to the agency problem. The benefit will outweigh the cost for firms which are more credit constrained, while firms which are less credit constrained or unconstrained prefer to own assets.

In the U.S. bankruptcy code, leasing and secured lending are treated quite differently. In Chapter 11, the lessee has the choice between either assuming the lease, which means keeping control of the asset and continuing to make the specified payments, or rejecting the lease and returning the asset. In contrast, the collateral which secures the claim of a secured lender is subject to automatic stay in Chapter 11, which prohibits recovery of or foreclosure on the property. Thus, in bankruptcy it is much easier for a lessor to regain control of an asset than it is for a secured lender to repossess it. The ease with which a lessor and a lender can repossess an asset in bankruptcy moreover affects their bargaining power outside of bankruptcy and hence affects what they can reasonably expect to be repaid outside of bankruptcy.

Thus, U.S. statutes clearly make repossession easier for a lessor than for a secured lender. More generally, and in most legal environments, one might expect that it is typically easier for the owner of an asset to regain control of it, than it is for a lender who takes a security interest in an asset to repossess it. Allocating ownership to the agent providing financing strengthens the financier's claim by facilitating repossession. This in turn allows the financier to extend more credit. Allocating ownership to the user of the capital, in contrast, is efficient since it minimizes the agency costs due to the separation of ownership and control. It is this basic tradeoff which we think determines to a large extent whether it is advantageous to lease, which means that the financier retains ownership, or buy, which means that the financier merely takes a security interest in the asset.

Interestingly, the main argument for leasing typically given by leasing firms is that

it “conserves cash,” provides “100 percent financing,” or “preserves credit lines.” This is indeed the advantage of leasing as argued above, since the debt capacity of leasing exceeds the debt capacity of secured lending. In contrast, this argument is generally considered a fallacy in the academic literature.¹ For example, Brealey, Myers, and Allen (2005), list “leasing preserves capital” as one of the dubious reasons for leasing and argue as follows (p. 702):²

Leasing companies provide “100 percent financing;” they advance the full cost of the leased asset. Consequently, they often claim that leasing preserves capital, allowing the firm to save its cash for other things.

But the firm can also “preserve capital” by borrowing money. If Greymare Bus Lines leases a \$100,000 bus rather than buying it, it does conserve \$100,000 cash. It could also (1) buy the bus for cash and (2) borrow \$100,000, using the bus as security. Its bank balance ends up the same whether it leases or buys and borrows. It has the bus in either case, and it incurs a \$100,000 liability in either case. What’s so special about leasing?

Schallheim (1994) argues similarly and notes that (p. 7) “... 100 percent financing remains a popular advertising approach, especially to small lessee firms or for venture leases.”

We argue that what is special about leasing is the relative ease with which the leased asset can be repossessed. Given this, it is not the case that the firm could borrow the same amount from a lender. The higher debt capacity of leasing is a particularly important reason to lease for small firms and new ventures, which are likely severely credit constrained.

There is an extensive literature on leasing in finance, but its focus is almost exclusively on the tax-incentives for leasing, following, e.g., Miller and Upton (1976) and Myers, Dill, and Bautista (1976).³ In contrast, agency problems have received far less

¹Practitioners in turn argue that the academic literature has gotten the answer wrong. For example, Andrew and Gilstad (2005) write that “business schools typically teach that leasing is a zero-sum game. However, the economic assumptions that lead to this belief often are not true. These incorrect assumptions have caused serious confusion and bias in lease evaluation for more than a generation.” In particular, they argue that there is a “failure to seriously consider the differences that exist between the financial characteristics of the lessor and the lessee beyond tax rates.”

²See also Ross, Westerfield, and Jaffe (2002), p. 604, who include “one hundred-percent financing” on a similar list.

³A more extensive review of the literature is provided in Section 5 below.

attention. That leasing involves agency costs due to the separation of ownership and control has been recognized for example by Alchian and Demsetz (1972). However, the fact that leasing is associated with a repossession advantage relative to secured lending has not been modeled to the best of our knowledge. Nor has the literature argued that the greater ability to repossess means that the debt capacity of leasing is higher. The repossession advantage has been discussed informally in the literature (see, e.g., Smith and Wakeman (1985), Krishnan and Moyer (1994), and Sharpe and Nguyen (1995)). Most notably, Smith and Wakeman (1985) provide a discussion of both tax and nontax determinants of the lease vs. buy decision and argue that (p. 899) “it is simpler for a lessor to regain physical possession of a leased asset either prior to or after the declaration of bankruptcy than for a secured debtholder to acquire the pledged asset.” Their list of eight nontax reasons to lease in the conclusions of their paper however does not include the “leasing preserves capital” explanation due to the greater ability of the lessor to repossess the asset.

We provide empirical evidence that small firms and firms which appear more credit constrained lease a considerably larger fraction of their capital using micro data from the U.S. Census of Manufactures and Compustat. We find that the fraction of capital that firms lease is significantly related to firm size, decreasing from 46% for small firms to 11% for large firms. We find furthermore that firms which pay lower dividends (relative to assets), have lower cash flow (relative to assets), and have higher Tobin’s q lease a significantly larger fraction of their capital. Moreover, as a mode of financing leasing is of comparable importance to long-term debt even for relatively large firms: the fraction of capital that firms lease in our merged Census-Compustat data is 16% which is similar to the long-term debt to assets ratio of 19%.⁴ Our data hence seems to suggest that for small firms leasing likely is the most important source of external finance. Related empirical evidence is provided by Krishnan and Moyer (1994) and Sharpe and Nguyen (1995). Both these papers provide evidence consistent with our prediction that more credit constrained firms lease more. Finally, Slovin, Sushka, and Poloncheck (1990) and Ezzell and Vora (2001) provide evidence which suggests that sale-and-leaseback transactions are associated with positive abnormal returns and the latter in addition provides evidence that these returns are positively related to the extent of a firm’s financial constraints. These papers assume that such transactions keep the net amount of financing constant, whereas our theory suggests

⁴See also Graham, Lemmon, and Schallheim (1998) who report that operating leases, capital leases, and debt are 42%, 6%, and 52% of fixed claims, respectively, in 1981-1992 Compustat data.

that sale-and-leaseback transactions free up capital and thus provides an alternative interpretation of their results.⁵

Our focus is on the specific relative advantage of leasing over secured lending in the U.S. The extent of this relative advantage varies across different countries. For example, in the U.K., recovery or foreclosure by a secured lender is much easier than in the U.S., and hence the relative advantage of leasing may be reduced. This suggests interesting testable implications regarding the prevalence of leasing vs. secured lending in different legal environments.⁶ We discuss several additional implications of the effect of financial constraints on leasing for corporate finance and macroeconomics in the conclusions.

2 Leasing versus Secured Lending

The main difference between leasing and secured lending from our vantage point is its treatment in bankruptcy. We start by discussing the main difference between the treatment of a true lease and a claim with a security interest in bankruptcy. That is, we start by discussing the differences from a legal perspective. We then provide a more detailed discussion of the differences from the taxation and accounting perspective as well. An overview of the classifications for legal, tax and accounting purposes is provided in Table 1. Broadly speaking, the picture is as follows: While there are differences between the three classifications, they are actually highly correlated. Moreover, the differences across different types of leases and secured debt are a matter of degree since the classification of a specific transaction depends on a variety of characteristics. In particular, the ability to repossess gradually decreases

⁵For example, Women’s Wear Daily (April 20, 2005) reports that “A&G has sold Asprey’s Bond Street store to Quinlan Private, the Irish property group, ... A&G Group said it planned to use the proceeds to fund its international expansion program. ... the current building has been handed back to A&G Group on a long-term lease that will last for at least 25 years.” Similarly, the Wall Street Journal (September 13, 2004) reports that “Krispy Kreme also gave details of a sale-leaseback deal ... saying it had sold six stores for \$17.3 million and agreed to lease them back for 20 years. The company had previously confirmed that some proceeds of the deal were used to fund continuing operations ... Some accounting experts said the sale-leaseback might be an indication of a cash crunch.”

⁶The difference between the treatment of leasing and secured lending in the U.S. provides firms who need financing with a choice regarding the ability of a financier to repossess assets which may be valuable. Firms which are more constrained then choose to lease, which means they choose to issue tougher claims, while firms which prefer to issue weaker claims issue secured debt.

as a lease starts to look more like secured debt, and hence as more of the property rights are allocated to the user.⁷ There seems to be an important link between the retention of property rights and the ability to repossess.

Bankruptcy law and commercial law distinguish between a “true lease” and a lease intended as security, which means that the lease merely establishes a “security interest” in the asset.⁸ A true lease is an executory contract. This means that the obligations of both parties to the contract remain largely to be performed. In a true lease, the lessor retains effective ownership. In Chapter 11, the lessee faces a choice between assuming the lease and rejecting the lease. If the lessee assumes the lease, he has to continue to make the scheduled payments and, if there has been a default, it has to be cured to assume the lease. In addition, the lease becomes a post-petition liability and the lessor has hence effectively a first priority claim. If the lessee rejects the lease, he has to return the asset to the lessor. Any additional claims that the lessor has are then unsecured claims in bankruptcy.

If the lease is intended as security, or recharacterized by the bankruptcy judge as such, the lessor is effectively treated like any other secured lender. That is, the lessee acquires effective ownership. Most importantly the collateral is then subject to automatic stay, which prohibits recovery of or foreclosure on the collateral. The debtor is typically allowed to continue to use the asset. A secured lender may be entitled to protection against a decline in collateral value over the course of a bankruptcy case, but the inconvenience of automatic stay is not sufficient to obtain adequate protection. In short, while the secured lender is not completely unprotected, he is clearly in a much weaker position than the lessor in a true lease.

Whether or not the lease is a true lease, or merely establishes a security interest, depends on the duration of the lease (relative to the economic life of the asset), the extent to which the lessee is bound to renew the lease for the remaining life or bound to become the owner, the extent to which the lessee has options to renew or become the owner for no additional (or nominal) payments, among other factors (see Table 1

⁷Ayotte and Goan (2005) provide an interesting related argument regarding the role of asset backed securities, leases, and secured debt given differences in “bankruptcy remoteness.” In their analysis, tougher claims limit inefficient continuation. For an analysis of secured debt, see Stulz and Johnson (1985), who argue that secured debt limits the underinvestment problem. This is an interesting, but different explanation for secured lending from the explanation in our model. Moreover, Stulz and Johnson do not distinguish between secured debt and leasing.

⁸See Ayer and Bernstein (2002) and Ayer, Bernstein, and Friedland (2003, 2004a,b) for a clear discussion of the issues analyzed in this section, which is addressed to Chapter 11 professionals.

for details). The more the lease seems to allocate control to the lessee and the more the lessee seems to be expected to end up as the residual claimant of the asset, the more likely the lessee is to be treated as effective owner.

The classification criteria from the perspective of taxation and accounting have a similar spirit (see again Table 1 for details). The tax law distinguishes between a “true lease” and a “conditional sales contract.” To qualify as a true lease, a lower bound on the extent to which the lessor is the residual claimant has to be met. In addition, an upper bound on the extent of control of the asset by the lessee cannot be exceeded. The accounting rules in turn distinguish between an “operating lease” and a “capital lease.” The criteria for classification are however quite similar to the criteria for tax purposes.

The tax and accounting classification of course affect who treats the asset as a capital asset and depreciates it for tax and accounting purposes, respectively. There is however a connection between the various classifications. Operating leases are usually true leases for tax and legal purposes. Capital leases are often considered conditional sales contracts for tax purposes with two important caveats: First, a lease with a term exceeding 75% of the asset’s economic life but not exceeding 80% will be a capital lease for accounting purposes but a true lease for tax purposes. Second, by making different assumptions about economic life, residual value, and so on for accounting and tax purposes, a lessee has some additional leeway to have a capital lease treated as a true lease for tax purposes. Importantly, whether a lease is considered a true lease for tax purposes and an operating lease for accounting purposes may affect how it will be characterized for legal purposes and hence may affect its treatment in bankruptcy.

To sum up, the ability to repossess is an advantage of true leases from the legal perspective. From the accounting perspective, this advantage is hence primarily enjoyed by operating leases, although some capital leases may enjoy the same advantage. This is important in interpreting empirical work which uses accounting data or census data which is based on accounting classifications as we discuss below.

3 A Model of Leasing

In this section we consider a model of the choice between buying capital and leasing capital. We study an environment where leased capital can be repossessed by the lessor at a lower cost, since he retains ownership, but depreciates faster due to the

separation of the ownership and control of the capital. The interest rate at which agents can borrow and lend is determined in equilibrium. Agents who are sufficiently credit constrained lease capital whereas agents who are less constrained or unconstrained own all their capital.

3.1 Environment

The economy has two dates, 0 and 1. There is a continuum of agents of measure one. Agents have identical preferences and access to the same projects, but differ in the idiosyncratic endowment that they are born with, i.e., in the amount of internal funds that they have. The preferences of agents are

$$d_0 + \sum_{s \in \mathcal{S}} \pi(s) d_1(s)$$

where d_0 and $d_1(s)$ are the (non-negative) dividends at time 0 and in state s at time 1, where the state s is idiosyncratic and there are two states, high (H) and low (L), i.e., $\mathcal{S} = \{H, L\}$.⁹ At time 0, each agent observes his idiosyncratic endowment (which we will also refer to as “internal funds”) $e \in \mathcal{E} \subset \mathbb{R}_+$, which is distributed independently and identically across agents with density $p(e)$ on \mathcal{E} . Except for the differences in internal funds, agents are ex ante identical and face the same probabilities of the two states at time 1, which are independent across agents.

Each agent has access to a concave production technology which produces a cash flow at time 1 of $a(s)k^\alpha$, where k is the amount of capital deployed by the agent, $a(s)$ is the stochastic productivity which depends on the state s , and $\alpha \in (0, 1)$. We assume that $a(H) = 1$ and $a(L) = 0$, so cash flow is only generated in state H .¹⁰ Agents can buy capital (i_b) and/or lease (or rent, which is equivalent) capital (i_l). Bought (or owned) capital and leased capital are assumed to be perfect substitutes in production, i.e., $k = i_b + i_l$.

Capital can be bought at a price of 1 at time 0, depreciates at a rate of $\delta \in (0, 1)$, and the (depreciated) owned capital can be sold at a price of 1 per unit of capital

⁹For simplicity, we have assumed risk neutrality and no discounting. Neither of these assumptions is necessary. In fact, a previous version of this paper featured a model with risk averse agents and discounting.

¹⁰This assumption simplifies the analysis, but is not critical. Notice also that no cash flow uncertainty is a special case of this formulation where $\pi(H) = 1$. Our main results carry over to this case.

at time 1.¹¹ Purchases of capital can be partially financed by borrowing in a state contingent way.¹² A promise to repay $Rb(s)$ in state s at time 1 gives the agent funds of $\pi(s)b(s)$ at time 0, where R is the gross interest rate which will be determined in equilibrium.

However, borrowing is constrained in the following ways: First, promises have to be collateralized, and when capital is repossessed, there is a deadweight cost to repossession of fraction $1 - \theta$ of the depreciated capital, so that the lender can repossess only a fraction θ of the resale value of capital, i.e., the *collateral constraint* is, $\forall s \in \mathcal{S}$,

$$Rb(s) \leq \theta i_b(1 - \delta).$$

We assume, similar to Hart and Moore (1994) and Kiyotaki and Moore (1997), that the agent has all the bargaining power ex post, except that the lender can threaten to repossess the capital underlying the loan. The borrower will make a take it or leave it offer equal to the value of the repossessed capital and the lender will accept this offer. Thus, the agent cannot promise to pay more than the resale value of repossessed capital and we have the stated collateral constraint.

Second, repayments have to be made either with cash flows or with repossessed capital, i.e., there is the following *repayment constraint*, $\forall s \in \mathcal{S}$:

$$Rb(s) \leq a(s)k^\alpha + \theta i_b^r(s)(1 - \delta).$$

where $i_b^r(s)$ is the amount of capital repossessed in equilibrium in state s .¹³ Since $a(L) = 0$, promises to borrow against the low state will have to be repaid by having capital repossessed. Moreover, we assume that $a(H)k^\alpha > \theta k(1 - \delta)$ in the relevant range, which implies that the repayment in the high state can be made entirely out of cash flow.

Third, the lender cannot repossess more capital than the agent owns, i.e., there is a *repossession constraint* that $i_b^r(s) \leq i_b$, $\forall s \in \mathcal{S}$.

Finally, we assume that cash flows are private information, and so it has to be incentive compatible for agents to announce the state s truthfully. In particular the agent with the high cash flow has to prefer to announce that the cash flow is

¹¹Notice that we assume here that the price on new and used capital is the same, in contrast to Eisfeldt and Rampini (2005), in order to focus on the lease vs. buy decision.

¹²Similar results can be obtained if borrowing is exogenously restricted to be non-state contingent.

¹³For related models of collateralized lending in which agents who default incur deadweight costs in equilibrium see, e.g., Diamond (1984), Lacker (2001), and Rampini (2005).

high and make the appropriate repayment $Rb(H)$ and incur the deadweight cost of repossession $i_b^r(H)(1 - \delta)(1 - \theta)$, rather than pretending to have low cash flow and make the corresponding repayment and incur the corresponding deadweight cost, i.e., we have the *incentive compatibility constraint*

$$Rb(H) + i_b^r(H)(1 - \delta)(1 - \theta) \leq Rb(L) + i_b^r(L)(1 - \delta)(1 - \theta).$$

Since $a(L) = 0$, agents who are borrowing and have a low cash flow realization cannot pretend to have high cash flow since they cannot make cash payments.

To give agents who have high internal funds and are thus saving part of their internal funds and lending them to constrained agents incentives to announce the state truthfully, we need to also impose that $Rb(L) \leq Rb(H)$. The last two constraints together will simply imply that when an agent is saving, he saves in an uncontingent way ($b(H) = b(L)$), whereas when an agent is borrowing, this last constraint is redundant.

Capital can also be leased. The benefit of leasing is that the leasing company can costlessly repossess the (depreciated) leased capital at time 1 and thus its repossession technology is better than the repossession technology of the lenders (who can only repossess a fraction θ of capital).¹⁴ The cost of leasing is that leased capital is subject to an agency problem with regard to the care with which the leased capital is used or maintained and hence depreciates at a rate $\delta_l \in (0, 1)$, where $\delta_l > \delta$. We do not model the specifics of the agency problem here, but we discuss the economic nature of the agency problem in more detail below. The leasing contract is as follows: An agent who leases i_l units of capital pays a leasing fee of $u_l i_l$ at time 0 (where u_l is the leasing rate per unit of capital which will turn out to be the user cost of leased capital) and nothing at time 1. We can assume without loss of generality that the depreciated leased capital will simply be returned to the lessor at time 1 and no other payments to the lessor are required (in fact, no additional payments could be enforced). This implies a leasing rate per unit of capital of $u_l = 1 - R^{-1}(1 - \delta_l)$, as we show below. Assume furthermore that $1 - \delta_l > \theta(1 - \delta)$. This assumption ensures that the agency problem is not so severe that the leased capital depreciates so much that less remains after depreciation than the amount of depreciated owned capital that a secured lender could repossess.

¹⁴We assume that the lessor can repossess the entire (depreciated) leased capital for simplicity, but there would be a benefit to leasing as long as the fraction that the lessor can repossess exceeds θ .

The idea that separating ownership and control results in greater depreciation of capital goes back to at least Alchian and Demsetz (1972). They argue as follows (p. 792): “But suppose the hammer were destructible and that careless (which is easier than careful) use is more abusive and causes greater depreciation of the hammer. Suppose in addition the abuse is easier to detect by observing the way it is used than by observing only the hammer after its use ... If the hammer were rented and used in the absence of the owner, the depreciation would be greater than if the use were observed by the owner and the user charged in accord with the imposed depreciation. (Careless use is more likely than careful use – if one does not pay for the greater depreciation.) An absentee owner would therefore ask for a higher rental price because of the higher *expected* user cost than if the item were used by the owner. ... Renting is therefore in this case more costly than owner use.” In our model this is captured by the assumption that $\delta_l > \delta$ and will indeed be reflected in the user cost of leased capital.

One might expect that the hold-up problem induced by leasing could be easily solved by giving the lessee an option to buy (see, e.g., Nöldeke and Schmidt (1998)). However, purchase options can lead the bankruptcy court to recharacterize the lease as intended as security interest only, thereby eliminating the repossession advantage. We might hence expect purchase options to be used less frequently when the lessee values the tougher lease claims as a way to relax credit constraints.

3.2 Agent’s Problem

Consider the problem of an agent with an idiosyncratic endowment, or internal funds, $e \in \mathcal{E}$. Taking the interest rate R , the leasing fee u_l , and his internal funds e as given, the agent’s problem is one of maximizing utility by choosing dividends $\{d_0, d_1(s)\}$, the amount of capital to lease i_l , purchases of capital i_b , the amount of capital that is allowed to be repossessed in each state $i_b^r(s)$, and the amount to borrow against each state $b(s)$, i.e.,

$$\max_{\{d_0, d_1(s), i_l, i_b, i_b^r(s), b(s)\}_{s \in \mathcal{S}} \in \mathbb{R}_+^7 \times \mathbb{R}^2} d_0 + \sum_{s \in \mathcal{S}} \pi(s) d_1(s) \quad (1)$$

subject to budget constraints at time 0 and in state s at time 1

$$d_0 + u_l i_l + i_b \leq e + \sum_{s \in \mathcal{S}} \pi(s) b(s) \quad (2)$$

$$d_1(s) + Rb(s) \leq a(s)k^\alpha + i_b(1 - \delta) - i_b^r(s)(1 - \delta)(1 - \theta), \quad \forall s \in \mathcal{S}, \quad (3)$$

where $k \equiv i_l + i_b$, and, $\forall s \in \mathcal{S}$, the collateral constraints,

$$Rb(s) \leq \theta i_b(1 - \delta), \quad (4)$$

the repayment constraints,

$$Rb(s) \leq a(s)k^\alpha + \theta i_b^r(s)(1 - \delta), \quad (5)$$

the repossession constraints

$$i_b^r(s) \leq i_b, \quad (6)$$

as well as the incentive compatibility constraints

$$Rb(H) + i_b^r(H)(1 - \delta)(1 - \theta) \leq Rb(L) + i_b^r(L)(1 - \delta)(1 - \theta), \quad (7)$$

$$Rb(L) \leq Rb(H). \quad (8)$$

Before characterizing the solution to the agent's problem, we discuss the problem of a leasing firm and define an equilibrium.

3.3 Lessor's Problem

Consider the problem of a competitive lessor, which maximizes profits, taking the leasing charge u_l as given. To provide an amount of capital i_l to the lessee, the lessor needs to purchase that amount of capital at time 0. Since there is no deadweight cost when the lessor repossesses the capital, we can assume that all leased capital is repossessed without loss of generality and the lessor will be able to sell the amount of capital $i_l(1 - \delta_l)$ at a price of 1 at time 1. Discounting cash flows at time 1 at rate R the lessor's problem is

$$\max_{i_l} u_l i_l - i_l + R^{-1} i_l (1 - \delta_l).$$

The first order condition of the lessor's problem implies that

$$u_l = 1 - R^{-1}(1 - \delta_l)$$

and the lessor makes zero profits in equilibrium. Thus, we can assume that the unconstrained agents own the leasing firms and hence leasing firms do not face credit constraints and discount cash flows at rate R .

Notice that the leasing charge u_l is paid up front. This is due to the fact that the agent cannot commit to make extra payments at time 1, since all the lessor can do is

recover $i_l(1 - \delta_l)$. Moreover, leasing can be interpreted as involving an implicit loan $R^{-1}i_l(1 - \delta_l)$. This implicit loan exceeds the amount that a secured lender would be willing to lend per unit of capital (which is $R^{-1}\theta(1 - \delta)$) given our assumption. This additional debt capacity is the benefit of leasing and it is in this sense that leasing “preserves capital.” Leasing provides “100 percent financing” since the lessee needs internal funds in the amount of the one period user cost only. Since the user cost is paid up front, this is not quite 100 percent financing, but it is rather close.

3.4 Equilibrium

An equilibrium in this economy is an interest rate R , a leasing rate u_l , and an allocation, such that agents maximize, taking the interest rate and leasing rate as given, and the capital market clears. The capital market clears if the total aggregate direct net borrowing plus the total amount of financing required by the leasing firms equals zero, i.e.,

$$\sum_{e \in \mathcal{E}} p(e) \sum_{s \in \mathcal{S}} \pi(s) b(s; e) + \sum_{e \in \mathcal{E}} p(e) R^{-1} i_l(e) (1 - \delta_l) = 0$$

The first term is the aggregate explicit net debt and the second term is the aggregate implicit leasing debt. Moreover, in equilibrium the leasing rate has to satisfy $u_l = 1 - R^{-1}(1 - \delta_l)$.

3.5 Characterization

First, it can be easily shown that an agent who is not financially constrained (i.e., whose collateral and repayment constraint are not binding) and hence discounts cash flows at the market interest rate R , owns all his capital, starts the optimal size firm, and therefore invests a constant amount. The user cost of owned capital to an unconstrained agent is

$$u_b \equiv 1 - R^{-1}(1 - \delta)$$

while the user cost of leased capital, as derived above, is $u_l \equiv 1 - R^{-1}(1 - \delta_l)$. Hence, $u_b < u_l$, and a financially unconstrained firm thus prefers to buy capital. Leasing capital would separate ownership and control and imply a higher rate of depreciation without any benefit to an unconstrained agent.

The simplest way to characterize the extent to which an agent is credit constrained is by considering the agent's multiplier on his time 0 budget constraint, μ_0 .¹⁵ The multiplier μ_0 can be interpreted as the value of or return on internal funds. For unconstrained agents $\mu_0 = R$, since unconstrained agents simply save additional internal funds at the market interest rate, while for constrained agents $\mu_0 > R$, that is, the return on internal funds exceeds the market interest rate. Since buying capital involves a larger payment up front, while leaving the agent with more funds at time 1, agents who have a higher μ_0 and therefore discount the additional funds at time 1 more heavily, may prefer leasing to buying.

We discuss the agents' lease vs. buy decision depending on their initial endowment or the amount of internal funds, beginning with the agents with the lowest endowments. An explicit analytical characterization is in the appendix. Here we will provide an intuitive discussion. Moreover, for simplicity we will focus on the case where leasing is relatively costly in terms of depreciation, that is, δ_l is relatively high (see the appendix for exact conditions).

Agents who are financially constrained may lease some or all of their capital. Agents with the lowest endowments lease all their capital. Agents with slightly higher endowments substitute bought capital for leased capital, holding investment constant. In the case where δ_l is relatively high, agents who substitute owned capital for leased capital are still quite constrained and borrow as much as they can against the low state. This means that capital is fully repossessed in the low state. This also means that an agent with high cash flow strictly prefers to announce truthfully and make his repayment out of cash flow, that is, the incentive compatibility constraint is slack.

Agents with higher internal funds fully substitute toward owned capital, and increase their investment while continuing to borrow the maximum amount against both states. Once the return on internal funds has dropped sufficiently, agents reduce the borrowing against the low state, since such borrowing is costly due to the deadweight cost of repossession. In this range agents again keep the amount they invest constant.

When the amount borrowed against the low state becomes low enough, the incentive compatibility constraint starts to bind. When this happens, agents increase investment again, while borrowing as much as they can against the high state and

¹⁵It turns out that the multipliers on the time 1 budget constraints do not vary with the agents' internal funds as shown in the appendix.

allowing repossession of capital in the low state to the extent necessary to keep agents with high cash flows from defaulting. As internal funds and investment continue to rise, the return on internal funds drops further, until it reaches a point where agents start to reduce their borrowing against both states of the world. Here again the agents keep the capital stock constant. The agents continue to reduce their borrowing until it reaches zero.

Once agents no longer borrow, they again increase investment, which is now entirely financed with internal funds. Agents in this range are constrained but do not borrow since the borrowing rate here turns out to be $\frac{R}{\pi(H)+\pi(L)\theta} > R$. Hence, there is an endogenous spread between borrowing and lending rates in our model due to the costly repossession. Agents continue to invest until they run the unconstrained optimal size firm. At this point, agents start to save part of their internal funds and lend them out at a return of R . We compute an example in the next section to illustrate the characterization.

It is interesting to consider what happens as the probability of a low cash flow, $\pi(L)$, goes to 1, that is, as the probability of bankruptcy goes up. We show in the appendix that in this case, agents will never borrow, since the high probability of low cash flow makes borrowing costly because repossession is likely. Agents will hence either lease capital or finance it entirely with internal funds.

3.6 Numerical Example

To illustrate our results we compute the equilibrium of an example economy numerically. The parameters of the example are in Panel A of Table 2 and are chosen to illustrate the base case discussed in the previous section. Panel B of Table 2 reports the equilibrium gross interest rate. Since $R > 1$, all agents set dividends at time 0 to zero. Figure 1 displays the results. In all panels, internal funds are on the x-axis. Total investment is increasing in the amount of internal funds (see the top left panel). Firms with few internal funds lease all their capital, firms in an intermediate range substitute toward owned capital, and firms with lots of internal funds buy all their capital (see the top and middle left panel). The bottom left panel shows the return on internal funds (which is the multiplier on the budget constraint at time 0, μ_0) which is decreasing in the amount of internal funds. It is strictly decreasing when agents are working down the marginal product of capital by investing more. It is flat when agents are simply substituting between different types of financing. The return

on internal funds is also constant at R for unconstrained agents who operate firms at optimal scale and save or lend at the market interest rate. In the intermediate range, the return on internal funds is constant in three regions, first when agents substitute away from leased capital, then when agents reduce the amount borrowed against the low cash flow state L , and lastly reduce the amount borrowed. In all these regions capital is constant. Everywhere else, capital is increasing in the amount of internal funds. The top right panel shows the debt in percent of total assets. Firms which lease all their capital have only implicit debt, but a large amount of it. For firms which buy all their capital, the fraction of debt financing decreases as internal funds increase, and unconstrained firms lend some of their internal funds. Finally, the fraction of capital repossessed is decreasing in internal funds. All leased capital is repossessed but only for quite low levels of internal funds is owned capital repossessed fully in the low state.

4 Empirical Evidence

We argue that leased capital is more easily repossessed and that it hence has higher debt capacity. Our model implies that credit constrained firms, and hence small firms, should lease more. In this section we provide evidence that the fraction of capital that firms rent is considerable and significantly related to measures of financial constraints and to firm size using data from the 1992 Census of Manufactures and Compustat. We find that firms which are smaller, pay lower dividends (relative to assets), have lower cash flow (relative to assets), and have higher Tobin's q , lease a larger fraction of their capital. Moreover, firms with a higher likelihood of low cash flow realizations lease more, consistent with our theoretical motivation that it is the lower cost of repossession of leased assets in bankruptcy which makes leasing attractive to credit constrained firms. This is true both for capital overall as well as separately for "buildings & other structures" and, to a lesser extent, for "machinery & equipment." We control for two alternative explanations, namely the tax reasons for leasing and the explanation that leased capital is more easily redeployed and hence operationally more flexible. The findings seem largely robust to controlling for these alternative explanations and we find at best limited support for these alternatives.

4.1 Data

The two main data sources that we use are the 1992 Census of Manufactures micro data and Compustat. The Census of Manufactures (CM) is a survey of manufacturing plants conducted every five years. We aggregate the plant level data to the firm level and restrict our sample to firms which have at least one plant in the Annual Survey of Manufactures (ASM).¹⁶ The main data item from the CM that we use is “total rental payments,” which is defined as “rental payments ... for use of such fixed assets as buildings, structures, and equipment.” There are specific instructions regarding the treatment of leases which imply that payments on operating leases are included in this item while capital leases (as defined by the accounting rules) are excluded (and instead treated as if the capital was owned). Thus, total rental payments includes only true leases, which benefit from the preferential treatment in bankruptcy discussed above. The primary aim of the question on rental payments is to improve the measurement of the amount of capital deployed in each industry in order to improve the measurement of industry productivity. In addition, we have data for “buildings & other structures” and “machinery & equipment” separately on rental payments, as well as on end of year assets, depreciation, and capital expenditures on new and used capital. Our data is unique in providing rental payments data for smaller firms than available in Compustat and in providing data separately for structures and equipment. Finally, we have data on the number of employees and total value of shipments.

To investigate the relationship between the fraction of capital which is rented and financial variables we merge the Census data with Compustat using a Census-Compustat bridge file. The definitions and descriptive statistics of the Compustat variables that we use are summarized in Table 4.¹⁷

¹⁶The ASM is a rotating panel of plants consisting of all large plants (with 250 employees or more) as well as a sample of smaller plants. The sample is redrawn every five years and the panel starts two years after a CM, that is, in 1989 for plants in our sample. We restrict our sample in this way to ensure data quality.

¹⁷In addition to Compustat variables, we use the estimates of the marginal tax rate before interest expense constructed by John Graham (see, e.g., Graham, Lemmon, and Schallheim (1998)). We thank John Graham for kindly providing us with these estimates.

4.2 Evidence on Leased Capital

We start by studying the fraction of capital which is rented as a function of size using Census data only. The benefit of using Census data only is that we are able to study the role of leasing across firms of all sizes, including very small firms, whereas the merged Census-Compustat data includes only publicly traded and hence much larger firms. The cost of using Census data only is that the only measure of the extent to which a firm is constrained is the size of the firm itself and we do not have explicit financial variables as in the merged data.

We use two measures of the fraction of capital which is rented. The first measure is the ratio of rental payments to the sum of rental payments plus an estimate of the user cost of owned capital. We estimate the user cost of owned capital as the sum of the estimated interest rate times the amount of owned capital plus depreciation. We use assets and depreciation from the Census data. We estimate the interest rate using the predicted values from a regression of the reported average interest rate on short term borrowings (Compustat Item 105) on assets from Census data. We run this regression on the merged data and then use the estimated coefficients to predict interest rates for all firms in our data. The second measure is the ratio of rental payments to the sum of rental payments plus capital expenditures. The denominator is hence the total cash expenditures on rent and investment. This “cash flow” measure of the fraction of capital leased has the advantage that it involves neither asset size nor Compustat data directly. We will focus on the first measure, but will report some results for the second measure for this reason.

Table 3 reports the average of these two measures across asset deciles in our data. In terms of the first measure, firms in the smallest decile rent more than 46% of their capital, whereas firms in the largest decile rent about 11% of capital on average, and the fraction rented is monotonically decreasing across size deciles. This is true for structures and equipment separately as well. Figure 2 shows the very strong relationship with size that emerges from the data graphically. The second measure behaves quite similarly. Leased capital is thus important for all firms, but is of particular importance for small firms. Indeed, it may be the most important source of external financing for very small firms. The fraction of capital leased is much higher for structures than for equipment. We would expect this given our model for two reasons: First, the moral hazard problem with respect to careful use and maintenance might be more severe for equipment and hence preclude leasing for some types of equipment. Second, since equipment on average depreciates faster, differences in the

ability to repossess may be somewhat harder to detect, since the user cost of the first period is a larger fraction of the price.¹⁸ As a robustness check, we scale the rental payments also by the number of employees and by the total value of shipments and obtain similar results (see again Table 3). Moreover, we compute the fraction of capital expenditures on used capital (i.e., used capital expenditures relative to total capital expenditures) which also decreases strongly across asset deciles. As Eisfeldt and Rampini (2005) argue, the fraction of capital expenditures on used capital may be an indicator of a firm’s financial constraints. Thus, this can be taken as further evidence that these small firms are indeed credit constrained or, perhaps, simply as independent evidence confirming the previous finding. To summarize, we find that the fraction of capital rented decreases as the size of the firm increases and this relationship seems quantitatively important.

To study the relationship between the fraction of capital which is rented and measures of financial constraints we run regressions of our two measures as dependent variables on financial variables in the merged Census-Compustat data. The results for regressions using capital overall are reported in Table 5. Panel A reports the results for the first measure, rental payments to total cost of capital services, and Panel B the results for the second measure, rental payments to sum of rental payments and capital expenditures. Note that all regressions include industry dummies at the two digit SIC code level, which are not reported. Thus, industry mean effects are accounted for. We estimate the relationship with OLS, but the results are similar when estimated with a Tobit regression accounting for left-censoring.¹⁹

The financial variables that we use are those in Kaplan and Zingales (1997), namely, dividends (relative to assets), long-term debt (relative to assets), cash flow (relative to assets), Tobin’s q , and cash (relative to assets), in addition to size (the logarithm of assets). We expect to find negative coefficients on size, dividends, cash flow, and cash, and positive coefficients on debt and q . In general, we expect that any variable which indicates that the firm is credit constrained and hence places a high value on internal funds will exhibit a positive correlation with the decision to lease. Most research on credit constraints finds that small firms are more constrained since external finance tends to be more costly in terms of transactions costs and costs of

¹⁸For example, if the depreciation rate were 100%, one would have to pay for the one period user cost of the equipment only even when buying (and not just when leasing the equipment), and there would be no difference.

¹⁹Standard errors are robust to heteroscedasticity, but results are similar when clustering at the industry level is allowed for.

asymmetric information for firms which are small. Firms which pay lower dividends to assets are likely to be more constrained as well. Lower payouts relative to assets reflect a high value of internal funds. In other words, a firm which is trading off a higher dividend today with the chance of having to raise external finance in the future as a result will be more likely to retain more of its internal funds and choose a lower dividend the higher the cost of external finance is expected to be. Firms with low cash flow, and firms with low cash, presumably have lower internal funds and would hence value an additional dollar of such funds more highly. Firms with high debt to assets may have reduced capacity for additional debt and are hence more constrained. Finally, firms with higher qs have investment opportunities that they cannot fully exploit and hence are likely constrained.

Columns 1-5 report the results for size and each of the financial variables individually. There is clearly a highly significant relationship with size as expected from the evidence across deciles above. In terms of the financial variables, higher dividends reduce the fraction rented significantly and so does higher cash flow. The other financial variables are not significant and while q has the predicted sign, long-term debt and cash do not. Thus, we do not find support for the “leasing puzzle” when controlling for industry and firm size. One reason why the cash variable may be problematic in this context is that leasing contracts at times require the lessee to hold minimum cash balances to cover lease payments.²⁰ When all six variables are included (column 6), the results are similar with q now also significant with the predicted sign. Thus, financial variables have a significant relation to the fraction of capital leased. The financial variables are also quantitatively important with a standard deviation increase in size, dividends, and cash flow reducing the fraction rented by approximately 3%, 2%, and 1%, respectively. Compared to a median fraction of rented capital of 12% this seems considerable. Moreover, since Compustat firms are relatively large, one might expect the relationship between financial variables and leasing to be even stronger for the Census firms for which financial characteristics are not observed.

To control for the tax reasons for leasing we include a measure of the average tax rate and dummies for small and large tax loss carry forwards in the regression (column 7) and, alternatively, an estimate of the marginal tax rate before financing

²⁰In our model, lease payments are paid at time 0, which is actually somewhat similar to having to hold the lease payment in cash.

(column 8).²¹ The tax argument typically predicts that it is beneficial for low tax rate firms to lease and hence we would expect a negative coefficient on the tax rate variables and a positive coefficient on the tax loss dummies. None of the tax variables turn out to be significant here and three out of four estimates do not have the predicted sign. Thus, the support for the tax explanation is rather limited in our data. More importantly for our purposes, controlling for taxes does not significantly alter our results regarding the significance of the financial variables. Controlling for the marginal tax rate before financing actually strengthens our results somewhat: the coefficients on dividends and cash flow increase (in absolute value) and the cash variable has the predicted sign, although the estimate is still not significant.

One might also argue that leasing is related to firms' desire and scope for operational flexibility. Since it is possible that leased capital can be more easily redeployed than owned capital, leasing may offer flexibility. This would suggest that measures of firms' desire for flexibility should raise the fraction of capital leased. Conversely, firms with more specific capital have less scope for flexibility or reversibility, and thus one expect firms with more specific capital to lease less. This might be because specific assets do not serve as good collateral, and are hence difficult to lease. We use R&D to sales ratios to measure how specific firms' capital is, with the idea that firms with more specific capital spend more on R&D. We proxy for firms' needs for flexibility using information on the likelihood of low sales growth realizations and low cash flow realizations.²² We use two measures for each, the fraction of negative realizations for firm years up to 1992, and the fraction of firm year realizations which are less than the industry mean minus the industry standard deviation in that year up to year 1992. We also control for firm age, since young firms in particular might require flexibility, although firm age may alternatively be interpreted as a measure of financial constraints. The results are in columns nine through eleven. Column nine shows that leasing is negatively related to expenditures on research and development, consistent with the idea that firms with more specific assets lease less. Column ten shows that leasing is, as expected, significantly negatively related to firm age, and significantly positively related to the likelihood of negative cash flow realizations. Surprisingly, leasing is significantly negatively related to the likelihood of negative sales growth realizations.²³ This may be due to the fact that although leasing offers fi-

²¹For a detailed description of the variables see Table 4.

²²See Petersen (1994) for a similar asymmetric measure of variability. He argues that it is downside variability which determines firms' desire for flexibility.

²³In unreported results, we found that the fraction of leased capital was also significantly nega-

nancial flexibility through higher debt capacity and less costly repossession, leases can be operationally less flexible than buying. Leases can restrict how the asset can be deployed or altered by the user, and it may at times be easier to sell an asset than to renegotiate a long-term lease with a lessor ex post. To account for the somewhat arbitrary cutoff at zero, column eleven reports similar results for the likelihood that sales growth and cash flow realizations are less than the industry mean minus the industry standard deviation. In this regression, of the three flexibility variables, only the positive coefficient on the likelihood of low cash flows is significant. Finally, column twelve includes all financial, tax and flexibility variables together and shows that the low dividend firms, and firms with a higher likelihood of low cash flow realizations lease statistically significantly more. All other financial variables except long-term debt to assets have the expected sign, while the tax variable and R&D to sales have the opposite sign to what one might expect when controlling for all financial and variability measures.

An alternative argument for why firms with higher variability of cash flows might lease more is a hedging argument. Firms might value leases as a way to transfer the risk of fluctuations in the value of the asset. Since firms which are credit constrained would value both the additional debt capacity due to the less costly repossession, as well as what may be for them a lower cost hedging strategy, it is difficult to distinguish these effects in our data. Either way, our results support a role for credit constraints in the lease vs. buy decision.

Panel B of Table 5 reports the results for the alternative dependent variable, rent over rent plus capital expenditures, with quite similar results. Size, dividends, and cash flow again have the predicted sign and are significant throughout. Both long-term debt and cash now have the predicted sign, but are only marginally significant when other financial variables are included. The marginal tax rate variable now has the predicted sign, but remains insignificant.

Table 6 reports the results for structures and equipment separately. We report the results for the first dependent variable, rent to total cost of capital services, only, since the results for the second dependent variable are comparable to those reported in Panel B of Table 5 for capital overall. Broadly speaking, the results are similar to the results for capital overall, although the results are weakened somewhat, at least for equipment. Size and dividends remain important, in particular in the regressions using data on structures. Tobin's q remains significant with the predicted sign for

tively related to the standard deviation of sales growth.

structures as well, but the results for cash are more mixed. As argued above, however, we might expect the effect of financial constraints to be harder to detect using data on equipment, since equipment typically has higher depreciation and since in addition it may not be possible to lease some types of equipment due to the severity of the moral hazard problem. The likelihood of low cash flow is again positively related to leasing, and significantly so for most specifications.

We conclude that there is a significant relationship between the fraction of capital leased or rented and financial variables, in particular size, dividends, cash flow, and the likelihood of low cash flow realizations, consistent with the predictions of our model. This relationship is robust to controlling for several alternative explanations. Additionally, in complementary empirical work using Compuastat data only, Sharpe and Nguyen (1995) find that financial variables explain financial commitments to operating leases, but not capital leases using data from footnotes describing operating lease commitments. This supports the idea that it is precisely the lower cost of repossessing capital under operating leases which generates the empirical relationship between financial characteristics and the fraction of capital leased which we find. When structures and equipment are considered separately, we find a similar relationship. The relationship is weakened for equipment, but this is consistent with the shorter lifespan, and higher potential for moral hazard in maintenance of equipment, which both weaken the benefits of leasing in our theoretical model.

5 Related Literature

Several explanations for leasing have been suggested in the literature. The main focus of the finance literature is the tax reason for leasing. But it has also been suggested that leasing can increase market power, leasing can reduce adverse selection, leasing can reduce the transaction costs of redeploying capital, and that leasing may be part of an optimal portfolio choice problem.

Following Miller and Upton (1976),²⁴ the finance literature has focused on the analysis of the leasing decision in a Modigliani-Miller environment, where firms are indifferent between leasing and buying, except when facing different tax rates.²⁵ Myers, Dill, and Bautista (1976) present a formula to evaluate the lease vs. buy decision

²⁴See also Lewellen, Long, and McConnell (1976).

²⁵Miller and Upton (1976) do however mention that there are differences between lessors and secured lenders in the ability to enforce their claim in two footnotes.

in such an environment, which is now widely used.²⁶ They show that differences in the tax rates across firms imply differences in the discount rate which may make it beneficial for low tax rate (and hence high discount rate) firms to lease, since the incremental cash flows of leasing are often positive early on and negative later on. Interestingly, the net gains to leasing decline as the fraction that firms can finance with debt when they buy declines, since the wedge between the discount rates declines. In contrast, in our model the higher debt capacity of leasing increases the benefits of leasing. Graham, Lemmon, and Schallheim (1998) provide evidence supporting the hypothesis that low tax rate firms lease more. They also include financial variables and find that firms with lower Altman Z-scores, negative book value of common equity, and higher variability of earnings lease more.

Ang and Peterson (1984) argue that theory suggests that debt and leases are substitutes, but empirically they find a positive relationship between the lease to book value of equity and debt to book value of equity ratio. Hence they conclude that there is a leasing puzzle. Lewis and Schallheim (1992) provide a resolution of the puzzle in an environment where leasing is motivated by tax considerations. They argue that leasing allows the transfer of tax shields which increases the benefits of debt financing for the lessee. Our model can be extended to provide an alternative resolution of the leasing puzzle. Suppose there are two types of capital, one of which cannot be leased. Constrained firms will both lease the capital that they can lease and borrow heavily against the other type of capital. Thus, constrained firms rely heavily on both sources of costly external finance.

The importance of nontax incentives for leasing is discussed by Smith and Wakeman (1985). They provide an informal list of characteristics of users and lessors which influence the leasing decision and explain many contractual provisions in leasing contracts. They mention that “it is simpler for a lessor to regain physical possession of a leased asset either prior to or after the declaration of bankruptcy than for a secured debt holder to acquire the pledged asset” (p. 899), but do not include the repossession advantage in their concluding list of eight nontax incentives to lease. The impact of financing constraints on the leasing decision is also the focus of two empirical studies. Krishnan and Moyer (1994) study capital leases and find that lessee firms have lower retained earnings relative to total assets, higher growth rates, lower coverage ratios, higher debt ratios, higher operating risk, and lower Altman Z-scores (i.e.,

²⁶See also McConnell and Schallheim (1983), who study the value of options embedded in lease contracts.

higher bankruptcy potential) than non-lessee firms.²⁷ Sharpe and Nguyen (1995) study both the capital lease share and the operating lease share of total capital costs and find that in particular the operating lease share is significantly higher for firms which pay no dividend, have lower earnings to sales, have lower credit ratings, and are smaller. The results in both these studies are broadly consistent with our findings and our model provides an explanation for the finding that it is specifically operating leases which are most affected by financial constraints. Operating leases are almost always true leases from the vantage point of the law and hence enjoy a repossession advantage not shared by capital leases.

Sale-and-leaseback transactions are modeled by Kim, Lewellen, and McConnell (1978) as a way for stockholders to expropriate existing bondholders by issuing higher priority claims. In contrast, our theory suggests that sale-and-leaseback transactions may be an efficient, albeit costly, way to raise additional external funds. Our theory also provides a different interpretation of the results in the empirical literature on sale-and-leaseback transactions. Slovin, Sushka, and Poloncheck (1990) find that such transactions are associated with positive abnormal returns to the lessees and conclude that this is due to a reduction in the present value of expected taxes induced by the transactions. However, this would also be consistent with the idea that financially constrained firms use sale-and-leaseback transactions to free up capital to take advantage of an investment opportunity, as the quote in footnote 5 above suggests. Ezzell and Vora (2001) also find positive abnormal returns associated with sale-and-leaseback transactions and moreover show that abnormal returns are higher for firms which do not pay dividends and which have lower interest coverage ratios, i.e., financially constrained firms. From the vantage point of our theory this suggests that the ability to raise additional external funds through sale-and-leaseback transactions is particularly valuable for more credit constrained firms.

Several additional explanations for leasing have been suggested in the literature. Leasing may allow a monopolist to extend his market power. Coase (1972) and Bulow (1986) argue that a durable goods monopolist may choose to lease goods to overcome the time inconsistency problem. Relatedly, Waldman (1997) and Hendel and Lizzeri (1999) argue that a durable goods monopolist may choose to lease in order to reduce the competition from used goods markets.²⁸ The role of leasing in reducing adverse selection in the secondary market for durable goods has been considered by Hendel

²⁷See Lasfer and Levis (1998) for related evidence using data on firms in the UK.

²⁸See also Anderson and Ginsburgh (1994) for a related argument.

and Lizzeri (2002) and Johnson and Waldman (2003).²⁹ Gilligan (2004) provides related empirical evidence. Leasing can also economize on transactions costs. Flath (1980) suggests that short-term leasing is valuable because it economizes on the cost of transferring ownership, including the costs of assuring quality. Eisfeldt and Rampini (2006) document the importance of capital reallocation and Gavazza (2005) argues that lessors have a transaction cost advantage in redeploying capital and hence are capital reallocation intermediaries.

The rent vs. buy decision has been extensively studied in the housing literature, typically as a portfolio choice problem.³⁰ Henderson and Ioannides (1983) consider a model where there is a moral hazard problem in utilization of rented housing which makes owning beneficial and distorts the portfolio choice problem. They assume that housing consumption is not an inferior good and find the counterfactual result that “higher wealth people will be renters” (p. 107) because their consumption demand exceeds their portfolio demand. Moreover, they consider a borrowing constraint, where agents cannot borrow against future income for current consumption, and find that this financial constraint cannot alter their general findings. Our model applied to the rent vs. buy decision for housing would in contrast provide a simple explanation for why lower wealth, credit constrained households choose to rent. The effects of down payment requirements on the rent vs. buy decision have been studied, for example, by Artle and Varaiya (1978), Stein (1995), and Engelhardt (1996). The models in this literature typically consider the choice of either renting or buying, whereas in our model agents can lease any fraction of their capital, i.e., the leasing decision is a convex problem.

The literature on trade credit provides arguments which may be the most closely related to our explanation for leasing. Frank and Maksimovic (1998) focus explicitly on the value of collateral in repossession and argue that a supplier is better able to capture the value of a repossessed input than a lender. Relatedly, Burkart and Ellingsen (2004) argue that it may be easier to keep a borrower from diverting inputs than from diverting cash and that hence a supplier may be able to lend more than a lender. Petersen and Rajan (1997) survey various theories of trade credit and provide

²⁹See also Hendel, Lizzeri, and Siniscalchi (2005), who study optimal rental contracts which completely eliminate the adverse selection problem, and Johnson and Waldman (2004), who study leasing in a model with both adverse selection and moral hazard regarding maintenance.

³⁰Risk sharing concerns have also been considered by Flath (1980) and Wolfson (1985). For a recent study of the rent vs. buy decision as a pure portfolio choice problem see Sinai and Souleles (2005), who consider a model with both rent and price risk, and the papers cited therein.

evidence that small and credit constrained firms use more trade credit.³¹

6 Conclusions

We argue that ownership affects the ability to repossess: It is easier for a lessor to repossess a leased asset from the lessee than for a secured lender to recover or foreclose on collateral. The repossession advantage of leasing in turn implies that a lessor is able to extend more credit against a leased asset than a secured lender would be. Thus, leased capital has a higher debt capacity and leasing “preserves capital.” However, allocating ownership with the agent who provides financing to facilitate repossession has a cost since it separates ownership and control. For agents who are sufficiently constrained, the benefit of the higher debt capacity of leased capital outweighs the costs due to the agency problem induced by the separation of ownership and control. Agents who are sufficiently constrained will hence lease capital, whereas agents who are less constrained or unconstrained will own all their capital.

The law in the U.S., in particular the U.S. bankruptcy code, implies that a lessor has specific advantages over a secured lender in terms of the ability to regain control of an asset. However, we believe that it is probably the case in most legal environments that retaining ownership facilitates regaining control of an asset and thus enables increased implicit credit extension. Indeed, this advantage may be particularly important in environments with weak legal enforcement and thus leasing or renting capital may be more prevalent there. This is not a foregone conclusion, though, and it is an empirical question how weak legal environments affect the relative merits of leasing and secured lending. One question is, for example, whether weak legal enforcement makes it relatively easier for a landlord to regain possession of the property than for a lender to foreclose on a mortgage. Similarly, it would be interesting to understand the relative prevalence of leasing vs. secured lending in economic history. This might furthermore shed light on the importance of the repossession and debt capacity incentives for leasing vis-à-vis the tax incentives.

The importance of financing constraints for leasing has implications for several key aspects of corporate finance. First, the fraction of the capital stock which is

³¹See also Brennan, Maksimovic, and Zechner (1988), who show that suppliers with market power may offer trade credit to be able to price discriminate, and Burkart, Ellingsen, and Giannetti (2005) for a recent survey of theories and empirical evidence as well as the papers cited therein.

leased, in particular under operating leases, can be used as a revealed preference indicator of the extent to which a firm is financially constrained. This may be an important ingredient for indices of credit constraints and the appropriate data is available from Compustat. Second, in measuring leverage considering the implicit debt due to leasing may be critical since it is the more constrained firms which lease more. Third, in studies of firm investment, and specifically in studies of the effect of financing constraints on firm investment, attention should not be limited to capital expenditures but leased capital should also be considered. For example, ignoring leasing when measuring investment cash flow sensitivities to assess the effect of credit constraints may be misleading since credit constrained firms lease more capital and thus the investment cash flow sensitivities are mismeasured and are likely overstated. Finally, from a macroeconomic perspective, the fact that small firms lease about half their capital suggests that understanding leasing is critical for understanding the behavior of small firms, which have been argued to play a key role in determining business cycle fluctuations and economic growth.

Appendix

This appendix provides the analytical characterization of the agent's problem stated in equations (1-8). The first order conditions of this problem are necessary and sufficient since the objective is linear and the constraint set convex. The Kuhn-Tucker multipliers are denoted by $\mu_0, \mu_1(s), \lambda(s), \lambda_r(s), \bar{\xi}_r(s), \eta(H)$, and $\eta(L)$ on (2), (3), (4), (5), (6), (7), and (8), respectively, and by $\nu_0, \nu_1(s), \xi_l, \xi_b$, and $\xi_r(s)$ on the non-negativity constraints on $d_0, d_1(s), i_l, i_b$, and $i_b^r(s)$, respectively. The first order conditions are, $\forall s \in \mathcal{S}$:

$$1 = \mu_0 - \nu_0 \quad (9)$$

$$\pi(s) = \mu_1(s) - \nu_1(s) \quad (10)$$

$$\mu_0 u_l = \sum_{s \in \mathcal{S}} (\mu_1(s) a(s) \alpha k^{\alpha-1} + \lambda_c(s) a(s) \alpha k^{\alpha-1}) + \xi_l \quad (11)$$

$$\mu_0 = \sum_{s \in \mathcal{S}} (\mu_1(s) (a(s) \alpha k^{\alpha-1} + (1 - \delta)) + \lambda(s) \theta (1 - \delta) + \lambda_c(s) a(s) \alpha k^{\alpha-1} + \bar{\xi}_r(s)) + \xi_b \quad (12)$$

$$\mu_0 \pi(s) = \mu_1(s) R + \lambda(s) R + \lambda_c(s) R + \eta(s) R - \eta(s') R, \quad s' \neq s, \quad (13)$$

$$\mu_1(H) (1 - \delta) (1 - \theta) = \lambda_c(H) \theta (1 - \delta) - \eta(H) (1 - \delta) (1 - \theta) + \underline{\xi}_r(H) - \bar{\xi}_r(H) \quad (14)$$

$$\mu_1(L) (1 - \delta) (1 - \theta) = \lambda_c(L) \theta (1 - \delta) + \eta(H) (1 - \delta) (1 - \theta) + \underline{\xi}_r(L) - \bar{\xi}_r(L). \quad (15)$$

The non-negativity constraints on dividends at time 1 are redundant since

$$\begin{aligned} d_1(s) &= a(s) k^\alpha + i_b (1 - \delta) - i_b^r (1 - \delta) (1 - \theta) - R b(s) \\ &\geq a(s) k^\alpha + i_b (1 - \delta) - i_b (1 - \delta) (1 - \theta) - \theta i_b (1 - \delta) \geq a(s) k^\alpha \geq 0, \end{aligned}$$

where we used the fact that the budget constraints hold with equality as well as equations (4) and (6). Since agents are required to collateralize promises, limited liability at time 1 is necessarily satisfied. Thus, $\mu_1(s) = \pi(s)$ and $\nu_1(s) = 0, \forall s \in \mathcal{S}$, and we can disregard these constraints. Moreover, if $R > 1$, the non-negativity constraint at time 0 binds, i.e., $d_0 = 0$, since summing (13) across states gives $\mu_0 = R + \sum_{s \in \mathcal{S}} (\lambda(s) + \lambda_r(s)) R > 1$ and hence $\nu_0 > 0$. We can hence disregard time 0 dividends.

Next we show that there will be no repossession in the high state, i.e., $i_b^r(H) = 0$, since leasing dominates borrowing and letting capital be reposessed in both states. Suppose by contradiction that $i_b^r(H) > 0$ and $\underline{\xi}_r(H) = 0$. Then (14) implies that $\lambda_r(H) > 0$, and (5) in state H at equality implies that $b(H) > 0$. Equation (7) and (5) then imply that $i_b^r(L) > 0$. Consider increasing leased capital and decreasing owned capital as follows: $di_l = -di_b = -di_b^r(s) > 0$ and $db(s) = R^{-1} \theta (1 - \delta) di_b^r(s)$. This perturbation satisfies (4) through (8). Substituting into (2) yields $dd_0 = R^{-1} ((1 - \delta_l) - \theta (1 - \delta)) di_l > 0$ given our assumption, and substituting into (3) yields $dd_1(s) = 0$. This contradicts the optimality of $i_b^r(H) > 0$. Thus, we can disregard repossession in the high cash flow state.

The collateral constraint (4) in state L is redundant, since it is implied by the repayment constraint (5) and the upper bound on repossession (6):

$$Rb(L) \leq a(L)k^\alpha + \theta i_b^r(L)(1 - \delta) = i_b^r(L)(1 - \delta) \leq \theta i_b(1 - \delta).$$

Hence, we can set $\lambda(L) = 0$ and disregard this constraint. Finally, given the assumption that $a(H)k^\alpha > \theta k(1 - \delta)$, the repayment constraint (5) in state H is slack and can be disregarded as well.

We will now provide a characterization of the solution. Broadly speaking, the solution is as follows: agents who are sufficiently credit constrained lease capital; agents who are less constrained buy capital and (typically) borrow against it, which means that capital is repossessed in state L ; and agents who are unconstrained lend. To measure how constrained an agent is consider the value of internal funds, i.e., the multiplier on the time 0 budget constraint, μ_0 . From above, $\mu_0 = R(1 + \lambda(H) + \lambda_r(L))$. Agents with $\mu_0 = R$ will lend and hence are unconstrained. Agents with $\mu_0 > R$ are constrained and the higher μ_0 , the more constrained the agent. Recall also that the multipliers on the budget constraint at time 1 in state s are $\mu_1(s) = \pi(s)$ and do not vary across agents. Thus, the extent of credit constraints can be appropriately measured by studying μ_0 only. Also, taking internal funds at time 0 as the numeraire, agents discount cash flows at time 1 in state s by $\pi(s)/\mu_0$ and thus unconstrained agents discount cash flows at $\pi(s)/R$, while constrained agents discount cash flows at a rate higher than that.

The details of the solution depend on the value of δ_l given the other parameters. In particular, for some δ_l some regions for μ_0 collapse, because as δ_l decreases and leasing becomes more attractive, agents will no longer be as constrained when they substitute away from leased capital and fewer constraints will bind. Recall that given our assumptions δ_l is in the interval $(\delta, 1 - \theta(1 - \delta))$. The interval is partitioned into three subintervals, $(\delta, \bar{\delta}_l)$, $(\bar{\delta}_l, \bar{\bar{\delta}}_l)$, and $(\bar{\bar{\delta}}_l, 1 - \theta(1 - \delta))$, where $\delta < \bar{\delta}_l < \bar{\bar{\delta}}_l < 1 - \theta(1 - \delta)$ and $\bar{\delta}_l \equiv 1 - (\pi(H) + \pi(L)\theta)(1 - \delta)$ and $\bar{\bar{\delta}}_l \equiv 1 - (1 + \pi(H)(1 - \theta))\theta(1 - \delta)$.

The base case studied in the text is the case where $\delta_l \in (\bar{\bar{\delta}}_l, 1 - \theta(1 - \delta))$, i.e., where leasing is quite costly due to the higher depreciation. We discuss this case in a bit more detail first, and then briefly discuss the other two cases as well. Using the first order conditions, the following 3 critical levels of the value of internal funds can be derived: $\mu_0^1 \equiv \frac{R\pi(H)(1-\theta)(1-\delta)}{1-\delta_l-\theta(1-\delta)}$, $\mu_0^2 = \frac{R}{\theta}$, and $\mu_0^3 = \frac{R}{\pi(H)+\pi(L)\theta}$. For δ_l in this interval, we have $\mu_0^1 > \mu_0^2 > \mu_0^3 > R$.

Agents with the least internal funds lease all their capital and have a value of internal funds of $\mu_0 = \frac{\pi(H)a(H)\alpha k^{\alpha-1}}{u_l}$ where $k = \frac{e}{u_l}$, so capital is increasing in this region. For agents with higher internal funds, this value reaches μ_0^1 . At that point, agents keep the amount of capital constant and substitute toward owned capital as e increases. Moreover, agents borrow as much as they can against capital in both states of the world $b(s) = R^{-1}\theta i_b(1 - \delta)$,

which means that the collateral constraint binds and capital is fully repossessed in state L . This substitution requires additional internal funds at time 0 of $(1 - R^{-1}\theta(1 - \delta)) - (1 - R^{-1}(1 - \delta_l))$ since the amount of internal funds required to buy a unit of capital exceeds the leasing fee, but leaves the agent at time 1 in state H with the part of capital financed with internal funds, i.e., $(1 - \theta)(1 - \delta)$. Thus the expected return on this substitution is $\mu_0^1 \equiv \frac{R\pi(H)(1-\theta)(1-\delta)}{1-\delta_l-\theta(1-\delta)}$.

Once leased capital i_l reaches 0, agents start to increase the total capital k again, while continuing to borrow as much as they can against it. The return on doing so is $\mu_0 = \frac{\pi(H)a(H)\alpha k^{\alpha-1} + \pi(H)(1-\theta)(1-\delta)}{1-R^{-1}\theta(1-\delta)}$ where $k = \frac{e}{1-R^{-1}\theta(1-\delta)}$. The numerator in μ_0 is the return from increasing owned capital, which is externally financed to the extent possible, and the denominator the cost of doing so.

When μ_0 reaches μ_0^2 , agents keep k constant again and start to reduce the amount that they borrow against state L . Agents can borrow $R^{-1}\pi(L)\theta$ per unit of capital repossessed in state L and thus the expected return in this region is $\mu_0^2 = \frac{R}{\theta}$. Agents can reduce borrowing against state L only since in this region the incentive compatibility constraint (7) is slack; agents with high cash flow strictly prefer to repay $Rb(H)$.

When the incentive compatibility constraint (7) starts to bind, agents increase k again and continue to borrow as much as the collateral and incentive compatibility constraints allow. The value of internal funds is $\mu_0 = \frac{\pi(H)a(H)\alpha k^{\alpha-1} + (1-\theta)(1-\delta)}{1 - (\pi(H) + \pi(L)\theta)R^{-1}\theta(1-\delta)}$ and $k = \frac{e}{1 - (\pi(H) + \pi(L)\theta)R^{-1}\theta(1-\delta)}$. The cost of external funds is $\frac{R}{\pi(H) + \pi(L)\theta}$ since a promise to pay in state H has to be matched by an equal amount repossessed in state L because of the incentive constraint, but the amount repossessed only frees up $\pi(L)\theta$ at time 0 due to the deadweight cost.

Once μ_0 reaches $\mu_0^3 = \frac{R}{\pi(H) + \pi(L)\theta}$, agents start to reduce the amount borrowed in an incentive compatible way while keeping k constant, until borrowing reaches 0. At that point, agents increase k again but investment is fully internally financed, i.e., $\mu_0 = \pi(H)a(H)\alpha k^{\alpha-1} + (1 - \delta)$ and $k = e$. Once μ_0 reaches R , agents keep k fixed and start to save, i.e., are unconstrained.

For $\delta_l \in (\bar{\delta}_l, \bar{\bar{\delta}}_l)$, leasing is less costly in terms of depreciation than in the case just described. For low e , agents again lease all their capital. But when they substitute toward owned capital, they do not borrow so much that capital is fully repossessed in state L . Rather, the incentive compatibility constraint (7) binds, and $\bar{\mu}_0 \equiv \frac{R(1-\theta)(1-\delta)}{1-\delta_l-(\pi(H)+\pi(L)\theta)\theta(1-\delta)}$. Once leased capital reaches 0, they again increase k while borrowing as much as the collateral and incentive compatibility constraints allow. When μ_0 reaches μ_0^3 , k is again kept constant while borrowing is reduced until it reaches 0. Then k is increased using internal funds only until μ_0 reaches R , when agents start to save. Thus, the characterization is the same except that there are only two critical levels of the value of internal funds, $\bar{\mu}_0$ and μ_0^3 .

For $\delta_l \in (\delta, \bar{\delta}_l)$, leasing is even more beneficial which means that agents substitute

toward owned capital only at a point where the value of internal funds is so low that they can fully internally finance the capital they buy. There is then only one critical level of μ_0 , $\bar{\mu}_0 \equiv \frac{R(1-\delta)}{1-\delta_l}$, where agents substitute internally financed owned capital for leased capital. Once they own all their capital, they increase k again until μ_0 reaches R .

We now show how the partition of $(\delta, 1 - \theta(1 - \delta))$ into the three subintervals changes first as the probability of low cash flow, $\pi(L)$, varies, and then as the ability to repossess, θ , varies.

As the probability of the low cash flow, and hence repossession, goes to 1, $\lim_{\pi(L) \rightarrow 1} \bar{\delta}_l = \lim_{\pi(L) \rightarrow 1} \bar{\bar{\delta}}_l = 1 - \theta(1 - \delta)$, that is agents never borrow and instead finance all purchases of capital entirely with internal funds, for all δ_l . The high probability of low cash flow makes borrowing costly since repossession is likely.

In contrast, as the probability of the low cash flow goes to 0, $\lim_{\pi(L) \rightarrow 0} \bar{\delta}_l = \delta$ and $\lim_{\pi(L) \rightarrow 0} \bar{\bar{\delta}}_l = 1 - (2 - \theta)\theta(1 - \delta) > \delta$, thus for all values of δ_l , as agents substitute away from leased capital, they will either borrow such that all capital is repossessed in state L or such that the collateral and incentive compatibility constraint bind.

As the ability to repossess θ goes to 0, $\lim_{\theta \rightarrow 0} \bar{\delta}_l = 1 - \pi(H)(1 - \delta)$ and $\lim_{\theta \rightarrow 0} \bar{\bar{\delta}}_l = 1 - \theta(1 - \delta)$, thus capital will not be fully repossessed in state L for any value of δ_l . Repossession becomes too costly. Finally, as the ability to repossess goes to 1, $\bar{\delta}_l$, $\bar{\bar{\delta}}_l$, and $1 - \theta(1 - \delta)$ all go to δ . However, $\lim_{\theta \rightarrow 1} \frac{\bar{\bar{\delta}}_l - \bar{\delta}_l}{(1 - \theta(1 - \delta)) - \delta_l} = 0$, that is, as agents substitute away from leased capital, they will either borrow such that all capital is repossessed in state L or finance purchases internally.

References

- Alchian, Armen, and Harold Demsetz, 1972, Production, information costs, and economic organization, *American Economic Review* 62, 777- 795
- Anderson, Simon P., and Victor A. Ginsburgh, 1994, Price discrimination via second-hand markets, *European Economic Review* 38, 23-44.
- Andrew, Gary M., and Dennis J. Gilstad, 2005, A generation of bias against leasing, *Journal of Equipment Lease Financing* 23 (2).
- Ang, James, and Pamela P. Peterson, 1984, The leasing puzzle, *Journal of Finance* 39, 1055-1065.
- Artle, Roland, and Pravin Varaiya, 1978, Life cycle consumption and home ownership, *Journal of Economic Theory* 18, 38-58.
- Ayer, John D., and Michael L. Bernstein, 2002, *Bankruptcy in Practice* (American Bankruptcy Institute, Alexandria)
- Ayer, John D., Michael L. Bernstein, and Jonathan Friedland, 2003, What every secured creditor (and its lawyer) should know about Chapter 11, *American Bankruptcy Institute Journal* 22 (9).
- Ayer, John D., Michael L. Bernstein, and Jonathan Friedland, 2004a, Bankruptcy issues for landlords and tenants, *American Bankruptcy Institute Journal* 23 (8).
- Ayer, John D., Michael L. Bernstein, and Jonathan Friedland, 2004b, Executory contracts under §365, *American Bankruptcy Institute Journal* 23 (9).
- Ayotte, Kenneth M., and Stav Gaon, 2005, Asset-backed securities: Costs and benefits of “bankruptcy remoteness,” Working Paper, Columbia Business School.
- Brealey, Richard A., Stewart C. Myers, and Franklin Allen, 2005, *Principles of Corporate Finance*, 8th Edition (McGraw-Hill, New York).
- Brennan, Michael J., Vojislav Maksimovic, and Josef Zechner, 1988, Vendor financing, *Journal of Finance* 43, 1127-1141.
- Bulow, Jeremy, 1986, An economic theory of planned obsolescence, *Quarterly Journal of Economics* 101, 729-749.

- Burkart, Mike, and Tore Ellingsen, 2004, In-kind finance: A theory of trade credit, *American Economic Review* 94, 569-590.
- Burkart, Mike, Tore Ellingsen, and Mariassunta Giannetti, 2005, What you sell is what you lend? Explaining trade credit contracts, Working Paper, Stockholm School of Economics.
- Coase, R. H. 1972, Durability and monopoly, *Journal of Law and Economics* 15, 143-149.
- Diamond, Douglas W., 1984, Financial intermediation and delegated monitoring, *Review of Economic Studies* 51, 393-414.
- Eisfeldt, Andrea L., and Adriano A. Rampini, 2005, New or used? Investment with credit constraints, Working Paper, Northwestern University.
- Eisfeldt, Andrea L., and Adriano A. Rampini, 2006, Capital reallocation and liquidity, *Journal of Monetary Economics* 53, 369-399.
- Engelhardt, Gary V., 1996, Consumption, down payments, and liquidity constraints, *Journal of Money, Credit, and Banking* 28, 255-271.
- Ezzell, John R., and Premal P. Vora, 2001, Leasing versus purchasing: Direct evidence on a corporation's motivations for leasing and consequences of leasing, *Quarterly Review of Economics and Finance* 41, 33-47.
- Flath, David, 1980, The economics of short-term leasing, *Economic Inquiry* 18, 247-259.
- Frank, Murray, and Vojislav Maksimovic, 1998, Trade credit, collateral, and adverse selection, Working Paper, University of British Columbia and University of Maryland.
- Gavazza, Alessandro, 2005, Leasing and secondary markets: Theory and evidence from commercial aircraft, Working Paper, New York University.
- Gilligan, Thomas W., 2004, Lemons and leases in the used business aircraft market, *Journal of Political Economy* 112, 1157-1180.

- Graham, John R., Michael L. Lemmon, and James S. Schallheim, 1998, Debt, leases, taxes, and the endogeneity of corporate tax status, *Journal of Finance* 53, 131-162.
- Hart, Oliver, and John Moore, 1994, A theory of debt based on the inalienability of human capital, *Quarterly Journal of Economics* 109, 841-879.
- Hendel, Igal, and Alessandro Lizzeri, 1999, Interfering with secondary markets, *RAND Journal of Economics* 30, 1-21.
- Hendel, Igal, and Alessandro Lizzeri, 2002, The role of leasing under adverse selection, *Journal of Political Economy* 110, 113-143.
- Hendel, Igal, Alessandro Lizzeri, and Marciano Siniscalchi, 2005, Efficient sorting in a dynamic adverse-selection model, *Review of Economic Studies* 72, 467-497.
- Henderson, J. Vernon, and Yannis M. Ioannides, 1983, A model of housing tenure choice, *American Economic Review* 73, 98-113.
- Johnson, Justin P., and Michael Waldman, 2003, Leasing, lemons, and buy-backs, *RAND Journal of Economics* 34, 247-265.
- Johnson, Justin P., and Michael Waldman, 2004, Leasing, lemons, and moral hazard, Working Paper, Cornell University.
- Kaplan, Steven N., and Luigi Zingales, 1997, Do investment-cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics* 112, 169-215.
- Kim, E. Han, Wilbur G. Lewellen, and John J. McConnell, 1978, Sale-and-leaseback agreements and enterprise valuation, *Journal of Financial and Quantitative Analysis* 13, 871-881.
- Kiyotaki, Nobuhiro, and John Moore, 1997, Credit cycles, *Journal of Political Economy* 105, 211-248.
- Krishnan, V. Sivarama, and R. Charles Moyer, 1994, Bankruptcy costs and the financial leasing decision, *Financial Management* 23 (2), 31-42.
- Lacker, Jeffrey M., 2001, Collateralized debt as the optimal contract, *Review of Economic Dynamics* 4, 842-859.

- Lasfer, M. Ameziane, and Mario Levis, 1998, The determinants of the leasing decision of small and large companies, *European Financial Management* 4, 159-184.
- Lewellen, Wilbur G., Michael S. Long, and John J. McConnell, 1976, Asset leasing in competitive capital markets, *Journal of Finance* 31, 787-798.
- Lewis, Craig, and James Schallheim, 1992, Are debt and leases substitutes? *Journal of Financial and Quantitative Analysis* 27, 497-511.
- McConnell, John J., and James S. Schallheim, 1983, Valuation of asset leasing contracts, *Journal of Financial Economics* 12, 237-262.
- Miller, Merton, and Charles Upton, 1976, Leasing, buying, and the cost of capital services, *Journal of Finance* 31, 761-786.
- Myers, Stewart C., David A. Dill, and Alberto J. Bautista, 1976, Valuation of financial lease contracts, *Journal of Finance* 31, 799-819.
- Nöldeke, Georg, and Klaus M. Schmidt, 1998, Sequential investments and options to own, *RAND Journal of Economics* 29, 633-653.
- Petersen, Mitchell A., 1994, Cash flow variability and firms pension choice: A role for operating leverage, *Journal of Financial Economics* 36, 361- 383.
- Petersen, Mitchell A., and Raghuram Rajan, 1997, Trade credit: Theory and evidence, *Review of Financial Studies* 10, 661-691.
- Rampini, Adriano A., 2005, Default and aggregate income, *Journal of Economic Theory* 122, 225-253.
- Ross, Stephen A., Randolph W. Westerfield, and Jeffrey F. Jaffe, 2002, *Corporate Finance*, 6th Edition (McGraw-Hill, New York).
- Schallheim, James S., 1994, *Lease or Buy? Principles of Sound Decision Making* (Harvard Business School Press, Boston).
- Sharpe, Steven A., and Hien H. Nguyen, 1995, Capital market imperfections and the incentive to lease, *Journal of Financial Economics* 39, 271-294.
- Sinai, Todd, and Nicholas S. Souleles, 2005, Owner-occupied housing as a hedge against rent risk, *Quarterly Journal of Economics* 120, 763-789.

- Slovin, Myron B., Marie E. Sushka, and John A. Poloncheck, 1990, Corporate sale-and-leasebacks and shareholder wealth, *Journal of Finance* 45, 289-299.
- Smith, Clifford W., Jr., and L. MacDonald Wakeman, 1985, Determinants of corporate leasing policy, *Journal of Finance* 40, 895-908.
- Stein, Jeremy, 1995, Prices and trading volume in the housing market: A model with down-payment constraints, *Quarterly Journal of Economics* 110, 379-406.
- Stulz, René M., and Herb Johnson, 1985, An analysis of secured debt, *Journal of Financial Economics* 14, 501-521.
- Waldman, Michael, 1997, Eliminating the market for secondhand goods: An alternative explanation for leasing, *Journal of Law and Economics* 40, 619-2.
- Wolfson, Mark A., 1985, Tax, inventive, and risk-sharing issues in the allocation of property rights: The generalized lease-or-buy problem, *Journal of Business* 58, 159-171.

Table 1: Types of Leases: Law, Taxation, and Accounting

<p>Bankruptcy Law and Commercial Law Bankruptcy Code, Chapter 11, §361-363, and §365; U.C.C. §1-201 (37).</p>	
<p>True Lease</p> <ul style="list-style-type: none"> · Executory contract: Contractual obligations of both parties largely remain to be performed. · Lessor retains effective ownership. · In Chapter 11, lessee can assume the lease (and continue to make payments) or reject the lease (and return asset). 	<p>Lease Intended as Security</p> <ul style="list-style-type: none"> · Lessor has merely security interest. · Lessee acquires effective ownership. · In Chapter 11, lease is recharacterized as secured credit and asset is subject to automatic stay which prohibits recovery of or foreclosure on collateral.
<p>Criteria for Security Interest Lease not subject to termination and</p> <ol style="list-style-type: none"> (1) Lease duration exceeds remaining economic life. (2) Lessee bound to renew lease for remaining life or bound to become owner. (3) Lessee has option to renew lease for remaining life for no additional (or nominal) consideration. (4) Lessee has option to become owner for no additional (or nominal) consideration. 	
<p>Taxation Revenue Procedure 2001-28.</p>	
<p>True Lease</p> <ul style="list-style-type: none"> · Lessee expenses rental payments. · Lessor treats asset as capital expenditure (with associated depreciation) and rental payments as income. 	<p>Conditional Sales Contract</p> <ul style="list-style-type: none"> · Lease treated like term loan or installment purchase contract. · Lessee treats asset as capital expenditure (with associated depreciation) and deducts implicit interest.
<p>Criteria for True Lease (Meeting all criteria is required. Focus is on intent.)</p> <ol style="list-style-type: none"> (1) Minimum “at risk” investment: Lessor’s investment exceeds 20% at all times. Remaining life of asset exceeds 20% of economic life. Residual value of asset exceeds 20% of original value. (2) No bargain purchase option when lease expires. Lessor has no option to sell. (3) Limits on investments (improvements, modifications, and additions) by lessee. (4) No lessee loans or guarantees to lessor. (5) Profit requirement: Lessor expects profits. 	
<p>Accounting SFAS No. 13, “Accounting for Leases.”</p>	
<p>Operating Lease</p> <ul style="list-style-type: none"> · Lease does not substantially transfer risks and benefits of ownership to lessee. · Lease off balance sheet. · Lessee discloses future minimum rental payments in aggregate and for each of next 5 years in footnotes. 	<p>Capital Lease</p> <ul style="list-style-type: none"> · Lease on balance sheet. · Lessee capitalizes leased asset and records corresponding debt obligation on balance sheet.
<p>Criteria for Capital Lease (Meeting one criterion is sufficient.)</p> <ol style="list-style-type: none"> (1) Transfer of ownership before the end of lease term without additional compensation. (2) Bargain purchase option (option to buy at price sufficiently below value at exercise date) when lease expires. (3) Lease term exceeds 75% of economic life. (4) Lease payments exceed 90% of asset’s value in present value. 	

Table 2: Numerical Example

Panel A: Parameter Values					
Technology	α	δ	δ_l	$\pi(H)$	$\pi(L)$
	0.33	0.1	0.15	0.5	0.5
Collateralization Rate	θ				
	0.90				
Distribution of Internal Funds	e			$\pi(e)$	
	[0.001 : 0.001 : 0.8]			[1/800, ..., 1/800]	
Panel B: Equilibrium Implications					
Gross Interest Rate	R				
	1.165				

Table 3: Ratio of Rental Payments to Measures of Total Capital and Firm Size Across Asset Deciles

The table describes the ratio of rental payments to various measures of total capital and firm size across asset deciles. We use the 1992 Census of Manufactures micro data which includes data on rental payments (which includes payments made on operating leases), end of year assets, depreciation, and capital expenditures on new and used capital for both “buildings and other structures” and “machinery and equipment,” as well as employment and total value of shipments. We aggregate the plant level data to firm level data and restrict the sample to firms which have at least one plant which is part of the Annual Survey of Manufactures. We use the end of year assets as our measure of size in determining the deciles. There are 37,730 observations in our data. We compute the various ratios as the average of the ratios for all firms in each size decile. We also report the lower cutoffs for each decile. The interest rate is the predicted value using coefficients estimated in a regression of the average interest rate on short-term borrowing (Compustat Item 106) on assets from Census in merged Census-Compustat data.

Variable	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Rent to Total Cost of Capital Services ($\frac{rent}{rent+r\% \times assets+depreciation}$)										
Total	46.64%	38.18%	32.04%	28.62%	27.09%	23.21%	20.70%	17.61%	14.81%	10.65%
Structures	74.76%	69.93%	65.01%	61.21%	56.68%	51.42%	45.18%	39.49%	32.87%	23.28%
Equipment	20.66%	15.38%	12.22%	10.83%	10.35%	8.38%	8.30%	7.42%	7.16%	5.93%
Rent to Sum of Rent and Capital Expenditures ($\frac{rent}{rent+capital\ expenditures}$)										
Total	51.38%	46.92%	42.98%	41.45%	41.10%	37.76%	34.22%	30.31%	25.05%	18.30%
Structures	43.97%	40.57%	35.92%	37.21%	37.21%	37.40%	34.43%	33.19%	29.08%	23.68%
Equipment	25.48%	22.03%	20.21%	20.08%	19.54%	17.58%	17.61%	17.65%	17.82%	15.05%
Rent to Employment ($\frac{rent}{number\ of\ employees}$) (in thousands)										
Total	1.986	2.075	1.857	1.875	1.925	1.781	1.675	1.552	1.445	1.291
Structures	1.347	1.387	1.323	1.314	1.356	1.252	1.178	1.046	0.915	0.678
Equipment	0.639	0.688	0.534	0.561	0.568	0.528	0.491	0.496	0.523	0.558
Rent to Total Shipments ($\frac{rent}{total\ value\ of\ shipments}$)										
Total	2.92%	2.63%	2.18%	2.18%	2.09%	1.65%	1.47%	1.35%	1.12%	0.75%
Structures	1.87%	1.74%	1.51%	1.47%	1.37%	1.18%	1.05%	0.88%	0.74%	0.40%
Equipment	1.05%	0.89%	0.67%	0.70%	0.72%	0.47%	0.42%	0.47%	0.38%	0.32%
Used Capital Expenditures to Total Capital Expenditures ($\frac{used\ capital\ expenditures}{total\ capital\ expenditures}$)										
	18.17%	16.61%	18.04%	15.98%	15.30%	13.67%	13.29%	11.10%	8.93%	6.19%
Decile Cutoff (millions)										
	0	0.08	0.18	0.34	0.64	1.2	2.2	4.1	8.1	21

Table 4: Descriptive Statistics

The table shows the descriptive statistics for the variables used in the regressions of the fraction of capital services rented on various financial and control variables. Data is micro data from a cross section of manufacturing plants from the 1992 Census of Manufactures for the dependent variable (aggregated to the firm level), firm age, and the industry dummies, and from Compustat for financial and tax variables and the standard deviation of sales growth. See Table 3 for the details of the construction of the dependent variables using Census data. Assets are Item 6 (Assets - Total/Liabilities and Stockholders' Equity - Total); dividends are Item 21 (Dividends - Common) plus (where available) Item 19 (Dividends - Preferred); long-term debt is Item 9 (Long-Term Debt - Total); cash flow is Item 18 (Income Before Extraordinary Items) plus Item 14 (Depreciation and Amortization); Tobin's q is Item 6 plus Item 24 (Price - Close) times Item 25 (Common Shares Outstanding) minus Item 60 (Common Equity - Total) minus Item 74 (Deferred Taxes - Balance Sheet) all divided by Item 6; cash is Item 1 (Cash and Short-Term Investments). The average tax rate is Item 16 (Income Taxes) divided by the sum of Item 16 and Item 18, zero if Item 16 is negative, and one if Item 16 is positive and Item 18 negative. The marginal tax rate is the before interest expense marginal tax rate constructed by John Graham (see, e.g., Graham, Lemmon, and Schallheim (1998)). The small (large) tax loss dummy is an indicator variable which is one when Item 52 (Net Operating Loss Carry Forward) is positive and smaller (larger) than the sum of Item 18, Item 14, Item 16, and Item 15 (Interest Expense). R&D to sales is Item 46 divided by Item 12. The firm age variable is the age of the firm according to Census data. The % of negative sales growth and cash flow variables are the fraction of firm year observations with negative values up to year 1992. The % of sales growth and cash flow less than $\mu_{ind} - \sigma_{ind}$ are the fraction of firm year observations with values less than the industry mean minus the industry standard deviation up to year 1992. The industry dummies are the industry of the largest plant of a firm measured by the value of shipments.

Dependent Variables		Observations	Mean	Std. Dev.	Median
$\frac{\text{rental pmts.}}{\text{rental pmts.} + r\% \times \text{assets} + \text{depr.}}$	Overall	1649	16.35%	15.74%	12%
	Equipment	1649	7.86%	10.12%	4.5%
	Structures	1637	33.77%	28.89%	25%
$\frac{\text{rental pmts.}}{\text{rental pmts.} + \text{cap. ex.}}$	Overall	1625	24.01%	21.30%	19%
	Equipment	1366	17.09%	21.23%	8.8%
	Structures	1317	35.66%	32.03%	25%
Independent Variables					
	log(assets)	1649	5.26	2.03	5.1
	$\frac{\text{dividends}}{\text{assets}}$	1649	1.28%	2.00%	0.40%
	$\frac{\text{long-term debt}}{\text{assets}}$	1649	19.15%	17.95%	15%
	$\frac{\text{cash flow}}{\text{assets}}$	1637	6.27%	11.99%	8.3%
	q	1507	1.67	1.11	1.30
	$\frac{\text{cash}}{\text{assets}}$	1649	10.40%	12.86%	5.2%
	Average tax rate	1648	33.73%	26.41%	36%
	Marginal tax rate	1364	30.17%	7.85%	34%
	Small tax loss dummy	1649	0.10	0.31	0
	Large tax loss dummy	1649	0.19	0.39	0
	$\frac{\text{R\&D}}{\text{sales}}$	1532	3.94%	9.28%	0.99%
	Firm age	1062	13.91	4.07	16
	% negative sales growth	1463	23.45%	16.34%	21.88%
	% negative cash flow	1517	10.76%	18.84%	0
	% sales growth < $\mu_{ind} - \sigma_{ind}$	1463	10.28%	11.82%	6.67%
	% cash flow < $\mu_{ind} - \sigma_{ind}$	1517	10.53%	18.88%	0

Table 5: Regression Results: Fraction of Capital Services Rented for Capital Overall

The table shows the coefficients of regressions of two measures of the fraction of capital services rented for capital overall on various financial and control variables (controlling for industry dummies at the two digit SIC code level). Heteroscedasticity corrected standard errors are in parenthesis. Data is micro data from a cross section of firms from the 1992 Census of Manufactures for the dependent variables, firm age, and the industry dummies, and from Compustat for financial variables, tax variables, and the standard deviation of sales growth. For a detailed definition of the variables see the description in Table 4. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Panel A: Dependent Variable: Rental Payments / (Rental Payments + $r\%$ × Assets + Depreciation)

Regression	1	2	3	4	5	6	7	8	9	10	11	12
log(assets)	-0.0131*** (0.0022)	-0.0148*** (0.0021)	-0.0146*** (0.0021)	-0.0150*** (0.0022)	-0.0145*** (0.0021)	-0.0123*** (0.0024)	-0.0120*** (0.0025)	-0.0103*** (0.0025)	-0.0123*** (0.0025)	-0.0076** (0.0032)	-0.0051 (0.0032)	-0.0053 (0.0036)
$\frac{\text{dividends}}{\text{assets}}$	-0.8405*** (0.2196)					-0.9029*** (0.2583)	-0.8879*** (0.2574)	-1.2155*** (0.2155)	-0.8546*** (0.2812)	-0.7293*** (0.2788)	-0.6572** (0.2866)	-0.8265*** (0.2948)
$\frac{\text{long-term debt}}{\text{assets}}$		-0.0050 (0.0207)				-0.0051 (0.0260)	-0.0050 (0.0260)	-0.0311 (0.0277)	-0.0100 (0.0270)	0.0249 (0.0301)	0.0138 (0.0296)	-0.0001 (0.0344)
$\frac{\text{cash flow}}{\text{assets}}$			-0.0891** (0.0370)			-0.0970*** (0.0372)	-0.0770* (0.0402)	-0.1546*** (0.0515)	-0.1218*** (0.0419)	-0.0881 (0.0689)	-0.0407 (0.0723)	-0.0442 (0.0857)
q				0.0056 (0.0035)		0.0104*** (0.0037)	0.0102*** (0.0037)	0.0127*** (0.0045)	0.0130*** (0.0040)	-0.0024 (0.0050)	0.0004 (0.0049)	0.0001 (0.0053)
$\frac{\text{cash}}{\text{assets}}$					0.0479 (0.0342)	0.0134 (0.0368)	0.0139 (0.0368)	-0.0132 (0.0418)	0.0295 (0.0419)	-0.0301 (0.0493)	-0.0452 (0.0500)	-0.0153 (0.0617)
Avg. tax rate							0.0123 (0.0155)					
Mrg. tax rate								0.0697 (0.0669)				0.1317 (0.0935)
Small tax loss								-0.0045 (0.0116)				
Large tax loss								0.0162 (0.0118)				
$\frac{\text{R\&D}}{\text{sales}}$									-0.0970* (0.0542)			0.0349 (0.0975)
Firm age										-0.0026* (0.0015)	-0.0020 (0.0015)	-0.0010 (0.0015)
% negative sales growth										-0.1270*** (0.0358)		
% negative cash flow										0.0834** (0.0410)		
% sales growth < $\mu_{ind} - \sigma_{ind}$											-0.0751 (0.0495)	-0.0701 (0.0575)
% cash flow < $\mu_{ind} - \sigma_{ind}$											0.1312** (0.0515)	0.1336** (0.0627)
adj. R^2	13.78%	12.76%	13.41%	12.61%	12.90%	14.40%	14.40%	13.66%	14.67%	14.49%	13.99%	12.55%
Observations	1649	1649	1637	1507	1649	1498	1498	1245	1390	888	888	715

Panel B: Dependent Variable: Rental Payments / (Rental Payments + Capital Expenditures)

Regression	1	2	3	4	5	6	7	8	9	10	11	12
log(assets)	-0.0241*** (0.0029)	-0.02761*** (0.0029)	-0.0241*** (0.0029)	-0.0274*** (0.0030)	-0.0271*** (0.0029)	-0.0250*** (0.0033)	-0.0244*** (0.0033)	-0.0225*** (0.0036)	-0.0250*** (0.0034)	-0.0175*** (0.0044)	-0.0149*** (0.0043)	-0.0142*** (0.0049)
<u>dividends</u> assets	-1.1067*** (0.2736)					-0.7411** (0.3044)	-0.7030** (0.3032)	-0.9826*** (0.3017)	-0.7271** (0.3260)	-0.7039* (0.3802)	-0.6597* (0.3874)	-1.0112** (0.4201)
<u>long-term debt</u> assets		0.1023*** (0.0300)				0.0624* (0.0374)	0.0625* (0.0374)	0.0299 (0.0430)	0.0517 (0.0385)	0.0427 (0.0447)	0.0305 (0.0442)	0.0216 (0.0505)
<u>cash flow</u> assets			-0.2428*** (0.0553)			-0.2177*** (0.0570)	-0.1788*** (0.0605)	-0.2807*** (0.0789)	-0.2515*** (0.0658)	-0.2888** (0.1315)	-0.2730** (0.1280)	-0.1586 (0.1361)
<i>q</i>				-0.0146*** (0.0052)		-0.0051 (0.0055)	-0.0054 (0.0055)	-0.0019 (0.0060)	-0.0023 (0.0058)	-0.0114 (0.0083)	-0.0077 (0.0079)	-0.0118 (0.0088)
<u>cash</u> assets					-0.0989** (0.0423)	-0.0640 (0.0451)	-0.0616 (0.0449)	-0.0941* (0.0529)	-0.0308 (0.0479)	-0.0687 (0.0622)	-0.0811 (0.0620)	-0.0431 (0.0743)
Avg. tax rate							0.0280 (0.0220)					
Mrg. tax rate								-0.0290 (0.1063)				-0.0776 (0.1551)
Small tax loss								-0.0032 (0.0161)				
Large tax loss								0.0328** (0.0168)				
<u>R&D</u> sales									-0.1902** (0.0906)			-0.0812 (0.1587)
Firm age										-0.0024 (0.0019)	-0.0022 (0.0019)	-0.0014 (0.0020)
% negative sales growth										-0.0736 (0.0534)		
% negative cash flow										0.0937 (0.0668)		
% sales growth < $\mu_{ind} - \sigma_{ind}$											0.0664 (0.0783)	0.0216 (0.0891)
% cash flow < $\mu_{ind} - \sigma_{ind}$											0.0863 (0.0627)	0.1030 (0.0708)
adj. R^2	11.85%	11.57%	13.13%	11.04%	11.20%	14.09%	14.29%	14.22%	14.17%	13.14%	13.24%	12.23%
Observations	1625	1625	1614	1486	1625	1478	1478	1229	1373	885	885	713

Table 6: Regression Results: Fraction of Capital Services Rented for Structures and Equipment

The table shows the coefficients of regressions of the fraction of capital services rented for structures and equipment on various financial and control variables (controlling for industry dummies at the two digit SIC code level). Heteroscedasticity corrected standard errors are in parenthesis. Data is micro data from a cross section of firms from the 1992 Census of Manufactures for the dependent variables, firm age, and the industry dummies, and from Compustat for financial variables, tax variables, and the standard deviation of sales growth. For a detailed definition of the variables see the description in Table 4. Statistical significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Panel A: Structures (Dependent Variable: Rental Payments / (Rental Payments + $r\%$ × Assets + Depreciation))

Regression	1	2	3	4	5	6	7	8	9	10	11	12
log(assets)	-0.0267*** (0.0039)	-0.0297*** (0.0038)	-0.0298*** (0.0037)	-0.0306*** (0.0040)	-0.0286*** (0.0038)	-0.0253*** (0.0041)	-0.0222*** (0.0042)	-0.0203*** (0.0044)	-0.0265*** (0.0043)	-0.0145*** (0.0055)	-0.0091* (0.0055)	-0.0078 (0.0061)
<u>dividends</u> assets						-1.6945*** (0.4234)	-1.7020*** (0.4219)	-2.0629*** (0.4307)	-1.5139*** (0.4549)	-2.0305*** (0.4593)	-1.9860*** (0.4773)	-1.8993*** (0.5370)
<u>long-term debt</u> assets		-0.0137 (0.0384)				-0.0219 (0.0461)	-0.0213 (0.0458)	-0.0499 (0.0536)	-0.0283 (0.0481)	-0.0011 (0.0576)	-0.0239 (0.0584)	-0.0224 (0.0684)
<u>cash flow</u> assets			-0.1617** (0.0647)			-0.1807*** (0.0674)	-0.1010 (0.0729)	-0.2711*** (0.0985)	-0.1638** (0.0764)	-0.1195 (0.1251)	-0.0758 (0.1257)	0.0127 (0.1622)
q				0.0077 (0.0062)		0.0145** (0.0066)	0.0145** (0.0066)	0.0217*** (0.0077)	0.0139* (0.0073)	-0.0005 (0.0099)	0.0095 (0.0095)	-0.0005 (0.0109)
<u>cash</u> assets					0.1635*** (0.0615)	0.1084 (0.0667)	0.1047 (0.0663)	0.0551 (0.0778)	0.0950 (0.0758)	0.0466 (0.0953)	0.0285 (0.0958)	0.0403 (0.1137)
Avg. tax rate								-0.0330 (0.0283)				
Mrg. tax rate									0.0048 (0.1350)			0.0614 (0.1997)
Small tax loss												
Large tax loss												
<u>R&D</u> sales										0.0229 (0.1073)		0.4024* (0.2071)
Firm age										-0.0054** (0.0025)	-0.0045* (0.0025)	-0.0031 (0.0027)
% negative sales growth												
% negative cash flow												
% sales growth < $\mu_{ind} - \sigma_{ind}$												
% cash flow < $\mu_{ind} - \sigma_{ind}$												
$adj. R^2$	14.39%	13.36%	14.37%	13.19%	13.84%	15.59%	16.02%	14.19%	15.50%	13.92%	11.90%	10.88%
Observations	1637	1637	1625	1496	1637	1487	1487	1235	1379	883	883	710

Panel B: Equipment (Dependent Variable: Rental Payments / (Rental Payments + $r\%$ × Assets + Depreciation))

Regression	1	2	3	4	5	6	7	8	9	10	11	12
log(assets)	-0.0050*** (0.0014)	-0.0059*** (0.0014)	-0.0059*** (0.0014)	-0.0061*** (0.0015)	-0.0058*** (0.0014)	-0.0057*** (0.0017)	-0.0061*** (0.0017)	-0.0055*** (0.0017)	-0.0057*** (0.0017)	-0.0065*** (0.0022)	-0.0053*** (0.0021)	-0.0060*** (0.0023)
<u>dividends</u> assets						-0.3283* (0.1874)	-0.3062 (0.1876)	-0.5204*** (0.1445)	-0.3042 (0.2047)	-0.0286 (0.1951)	0.0262 (0.2006)	-0.1109 (0.1883)
<u>long-term debt</u> assets		0.0095 (0.0134)				0.0154 (0.0175)	0.0152 (0.0175)	-0.0094 (0.0175)	0.0107 (0.0181)	0.0339* (0.0197)	0.0283 (0.0193)	0.0133 (0.0211)
<u>cash flow</u> assets			-0.0315 (0.0263)			-0.0304 (0.0274)	-0.0245 (0.0285)	-0.0921** (0.0381)	-0.0455 (0.0313)	-0.0653 (0.0563)	-0.0321 (0.0567)	-0.0559 (0.0666)
q				0.0012 (0.0024)		0.0038 (0.0026)	0.0037 (0.0026)	0.0048 (0.0032)	0.0049* (0.0028)	-0.0052 (0.0035)	-0.0047 (0.0035)	-0.0034 (0.0038)
<u>cash</u> assets					-0.0017 (0.0218)	-0.0049 (0.0229)	-0.0034 (0.0229)	-0.0275 (0.0244)	0.0042 (0.0266)	-0.0448 (0.0296)	-0.0544* (0.0295)	-0.0370 (0.0376)
Avg. tax rate							0.0199* (0.0118)					
Mrg. tax rate									0.1058** (0.0511)			0.1129* (0.0702)
Small tax loss								0.0023 (0.0076)				
Large tax loss								0.0070 (0.0082)				
<u>R&D</u> sales									-0.0358 (0.0424)			-0.0045 (0.0989)
Firm age										-0.0007 (0.0010)	-0.0004 (0.0009)	-0.0002 (0.0009)
% negative sales growth										-0.0422* (0.0250)		
% negative cash flow										0.0398 (0.0308)		
% sales growth < $\mu_{ind} - \sigma_{ind}$											-0.0188 (0.0370)	-0.0034 (0.0417)
% cash flow < $\mu_{ind} - \sigma_{ind}$											0.0783** (0.0358)	0.0755* (0.0409)
adj. R^2	5.62%	5.20%	5.33%	4.78%	5.18%	5.26%	5.36%	6.17%	4.94%	8.87%	9.25%	7.79%
Observations	1649	1649	1637	1507	1649	1498	1498	1245	1390	888	888	715

Figure 1: Investment in Owned Capital and Leased Capital

Top Left Panel: Investment in owned capital (dash dotted), leased capital (solid), and total investment (dotted) as a function of the amount of internal funds. Middle Left Panel: Leased capital as percentage of total capital. Bottom Left Panel: Return on internal funds μ_0 (solid) as a function of the amount of internal funds. The downward sloping lines (dashed) are the marginal product of capital in appropriate in the various ranges and the horizontal lines (dashed) are the values of μ_0^1 , μ_0^2 , μ_0^3 , and R , respectively. See the appendix for details. Top Right Panel: Explicit debt (dash dotted) and implicit (leasing) debt (solid). Bottom Right Panel: Fraction of leased capital repossessed (solid) and fraction of owned capital repossessed in state L (dash dotted) as a function of the amount of internal funds.

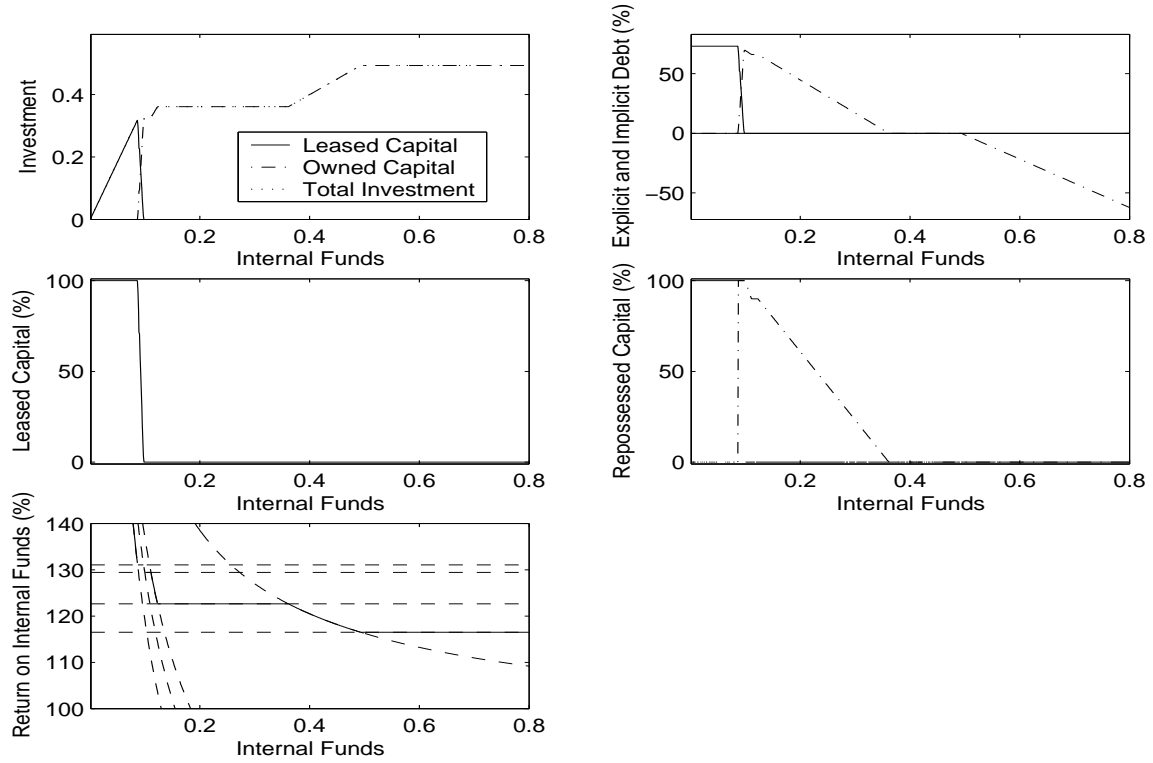


Figure 2: Ratio of Rental Payments to Total Payments for Capital Services Across Asset Deciles

Fraction of rental payments (including payments on operating leases) relative to total payments for capital services (sum of rental payments, interest rate times total assets, and depreciation) across asset deciles for total capital (solid), buildings and other structures (dashed), and machinery and equipment (dotted). We use the 1992 Census of Manufactures micro data. See Table 3 for a detailed description of the data construction.

