Essays on Corporate Leasing

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Abstract

Leasing is one of the most important sources of external finance to corporate firms. Better understanding of the determinants of corporate leasing behavior is critical for us to study the capital structure and investment of firms. However, it has been overlooked in the theoretical and empirical literature on investment. This thesis studies the determinants of corporate leasing. Each chapter presents a separate essay.

The first chapter studies the role of uncertainty and financial constraint in understanding firms' leasing decisions. Although leasing costs more than owning capital in the long run, it provides operational flexibility for firms. In addition, leases are easier to finance than purchases. The benefits of leasing are particularly attractive to firms with high uncertainty and more financial constraints. This chapter develops a dynamic model and predicts that firms with high uncertainty and firms that are more financially constrained lease more of their capital than firms with low uncertainty and firms that are less financially constrained. Using data on publicly-traded firms in the U.S., this chapter provides evidence consistent with the prediction of the model.

The second chapter documents that leasing is countercyclical over business cycles. Firms lease more during economic downturns, and are more willing to buy capital during up cycles. One key benefit of leasing is that leases are easier to finance than purchases. This benefit is particularly important to firms with financial constraints. Firms face tighter financing conditions during recessions. Therefore, leasing is more attractive during recessions. This chapter develops a model to explain the observed countercyclical pattern of leasing.

The third chapter utilizes data from 81 countries to examine how legal environments affect firms' leasing behavior. The results suggest that leasing

is less used in countries with weak legal environments. Firms in countries with weak legal environments tend to avoid the use of leasing contracts because the contracts are costly to enforce. I also find that leasing has a measurable impact on both firm growth and GDP growth. Leasing can help increase capital availability and improve operational efficiency, and thus may contribute to growth. The results provide a policy implication that possible adjustments in legal systems can facilitate the availability of leasing and thus may generate real economics gains.

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Dedication

To my parents, Yueying Tian and Shixiao Zhang;

to my husband Yixiang;

and to my lovely daughter Vera

Chapter 1

Leasing, Uncertainty, and Financial Constraint

1.1 Introduction

A lease is an agreement between two parties, the lessor and the lessee. Under a lease contract, the lessee pays rental fee and acquires the right to use the asset for a specified period of time, but the asset belongs to the lessor. As a source of external financing, leasing is comparable to long-term debt. Better understanding of the determinants of corporate leasing behavior is therefore critical for us to study the capital structure and investment of firms. According to the Compustat data[1], 99.8 percent of publicly-traded firms in the U.S. indicate their usage of operating lease[2], whereas 82.8 percent of firms have long-term debt. In addition, operating lease accounts for 7.5 percent of firms' total assets, and the value of long-term debt equals 11.7

[1]The sample consists of 98,557 observations for firms on Compustat over the period of 1975 through 2009. Foreign incorporated companies and a few industries are excluded. Details of the data are in Section 1.3.1

[2]For financial accounting purposes, a lease is classified either as an operating lease or a capital lease. A lease is treated as an capital lease if it meets any one of the following four conditions - (1) if the lease life exceeds 75% of the life of the asset; (2) if the lease transfers the ownership of the asset to the lessee at the end of the lease term; (3) if the lease contains a bargain purchase option; (4) if the present discounted value of the required lease payments exceeds 90% of the fair market value of the asset. Otherwise, it is an operating lease. Capital lease is reported as the corresponding debt obligation on balance sheet. In contrast, operating lease represents off-balance-sheet financing for the lessee, and is reflected on the income statement as rent expense. Capital lease is more like a secured debt. Hence, this work focuses on operating lease. All advantages and disadvantages of a lease discussed in this work only apply to an operating lease.

percent[3]. An average publicly-traded firm in the U.S. leases more than 37 percent of its capital. For small firms that are not publicly traded, leasing is even more important. Eisfeldt and Rampini (2009) use micro data from the 1992 U.S. Census of Manufactures and show that the smallest decile firms lease 46 percent of their capital. They claim that leasing may be the largest source of external finance for these small firms. Leasing is not only a key component of a corporate firm's external financing, but also of particular importance in understanding the capital investment decisions of corporate firms. Given its quantitative importance, this chapter studies the role of uncertainty and financial constraint in understanding the leasing decisions of corporate firms.

A lease provides operational flexibility in terms of adjusting to changes of technology and capacity; this is because the redeployment of leased capital is easier than that of owned capital. Generally, the lessor has a comparative advantage in disposing assets[4]. Consequently, the adjustment costs on leased capital are lower than those on owned capital. The low adjustment cost is valuable when future profits are uncertain, because firms are more likely to adjust their capital. Moreover, from the perspective of lessors, in the U.S. bankruptcy code, it is much easier for a lessor to repossess an asset than it is for a secured lender. The lessor is less concerned with the lessee's default, and thus is unlikely to require the lessee to provide collateral to be able to start a leasing agreement. The lessee only needs to pay a leasing fee for one period in advance. But on the other hand, if a firm purchases capital, they would need to pay the full price up front. Even if a firm uses debt to finance their purchase, the lender might require collateral for the loans. Therefore, these factors indicate that leases are easier to finance than

[3]Measures are from Graham et al. (1998). They report similar results that 99.9 percent of the firm-years report nonzero levels of operating leases, and 88 percent have nonzero levels of long-term debt in 1981-1992 Compustat data. They find that operating leases and long term debt are 8 percent and 14.2 percent of firm value respectively.

[4]Lewellen et al. (1976) state: "The lessor may be more active or skillful in dealing the associated second-hand asset market; his specialized knowledge may give him an edge." The potential advantage is from the reduction in search, information, and transaction costs associated with the lessor's provision of a centralized marketplace for the asset(Benston and Smith (1976)).

purchases. Besides operational flexibility and easiness in financing, leasing usually costs more in the long run. This is because that leasing involves a separation of ownership and control, which induces an agency cost. The lessee loses the residual value of the asset at the end of the lease term, because he doesn't own the asset. That is, the lessee has less incentive to care for the asset since the lessor bears the full cost. The abusive use of the asset by the lessee is anticipated by the lessor. The lessor therefore usually charges high fees to make the total cost greater than the purchase cost of the asset[5].

The benefits of leasing in terms of its lower adjustment costs and easiness to finance has to be weighed against the higher cost due to the agency problem. This is the basic tradeoff that determines whether it is advantageous to lease or buy[6]. Firms facing high uncertainty about their future profits might adjust their capital more frequently, and hence, value the benefit of lower adjustment cost. These firms are therefore more willing to lease capital. Moreover, the benefit of easiness to finance makes leasing more attractive to those financially constrained firms who have difficulties in financing their purchase on capital.

This chapter develops a dynamic model which implies that the decision to lease versus buy depends on firms' uncertainty and financial constraints. The model has four key factors: (1) Firms have heterogeneous stochastic profitability; (2) Capital can be bought or leased; (3) Firms face financing friction; (4) Firms incur transaction costs when selling owned capital. The model predicts that firms facing high uncertainty and firms with greater financial constraints prefer to lease more of their capital than those with low uncertainty and those with less financial constraints.

This chapter also provides empirical evidence using a firm level panel data set of publicly-traded companies in the U.S.. I measure the fraction of capital from leasing (the lease share) as a ratio of the rental expense to

[5]Gavazza (2010) estimates the lease rates are on average 20 percent higher than implicit rental rates on owned assets in the aircraft industry

[6]Tax benefits may be another reason for leasing. Leases allow for the transfer of tax shields from lessees to lessors.

the total cash expenditures on rent and investment; also, I measure uncertainty as the volatility of the firms' equity returns. Financial constraint is measured by an index which combines the information of cash flow, debt, firm size and firm age. I find that firms with high uncertainty and firms with more financial constraints have a larger lease share than firms with low uncertainty and firms with less financial constraints on average. The distributions of the lease shares of firms with high uncertainty and firms with more financial constraints first order stochastic dominate the distributions of firms with low uncertainty and firms with less financial constraints. Results from panel regressions indicate that uncertainty and financial constraint are significantly positively related to leasing. Approximately, a one standard deviation increase in uncertainty and the financial constraint index increases a firm's lease share by 3.5 percent and 9 percent respectively; these effects are economically significant. Moreover, the countercyclical pattern of leasing over business cycle also provides an indirect evidence. When firms face high uncertainty and tight financing conditions during recessions, they lease more.

There is an extensive literature in finance examining the corporate decisions to lease, but the main focus of the literature is tax considerations. The corporate lease-versus-buy decision is typically analyzed under the Miller-Modigliani framework with no transaction costs or information asymmetries. Firms are indifferent about choosing between leasing and purchasing except in situations in which they face different tax rates (e.g., Miller and Upton (1976), Myers et al. (1976)). Low tax rate firms lease more than high tax rate firms. However, the economics of leasing are recognized beyond tax minimization. Smith and Wakeman (1985) provide an informal list of non tax characteristics of users and lessors that influence the leasing decision. Following Smith and Wakeman (1985), several papers have focused on the non tax aspects of leasing. Krishnan and Moyer (1994) examine the use of capital leases and find that firms with lower retained earnings, higher growth rates, lower coverage ratios, higher debt ratios, higher operating risks and higher bankruptcy potential are more likely to lease. Sharpe and Nguyen (1995) empirically show that the lease share is higher at lower-rated, non-

dividend-paying, cash poor firms, which are more likely to face relatively high premiums for external funds. Gavazza (2010) uses data from the commercial aircraft industry and finds that more liquid assets make leasing more likely, have shorter operating leases, longer capital leases, and lower markups of operating lease rates.

Particularly related to this work are Eisfeldt and Rampini (2009) and Gavazza (2011). This work is not the first attempt at addressing the relationship between leasing and financial constraints. Eisfeldt and Rampini (2009) incorporate financial constraints into a model of the choice between leasing and secured lending. Their model also implies that more financially constrained firms lease more of their capital than less constrained firms. However, my work further considers uncertainty, which is a critical factor in firms' leasing decisions. Gavazza (2011) studies the role of leasing when trading is subject to frictions, and finds evidence from the commercial aircraft industry that leased assets trade more frequently and produce more output than owned assets. The main focus of his paper is on the effects of leasing on trading and allocation of assets while my research's focus is on firms' incentive to lease.

This chapter is also related to many theoretical and empirical papers that studies firms' investment under uncertainty through the role of irreversibility and adjustment costs (e.g., Dixit and Pindyck (1994), Abel and Eberly (1996), Leahy and Whited (1996), Bulan (2005) and Bloom et al. (2007)). High uncertainty raises the value of the option to wait and see and decreases investment. However, none of these papers consider the role of leased capital.

This work is the first, to the best of my knowledge, to provide a model and empirical evidence that captures how uncertainty affects firms' leasing decisions. This chapter establishes a link between uncertainty, financing frictions and leasing decisions, and provides an unique complement to the literature in both finance and macroeconomics.

The chapter is organized as follows. The next section lays out the model. Then, Section 3 presents the empirical analysis. Section 4 provides quantitative analysis. Concluding remarks are offered in Section 5.

1.2 Model

1.2.1 The Environment

I consider an economy with discrete time and infinite horizon. There is a fixed amount of homogeneous capital goods X. For simplicity, capital does not depreciate. Capital can be bought or leased. Owned capital and leased capital are perfect substitutes in the production. There are two types of agents in the economy, producing firms and a financial intermediary. In this economy, producing firms use owned or leased capital to produce final goods, and the financial intermediary supplies loans and leased capital to firms. All agents are risk neutral and discount the future at the interest rate of $r > 0$[7].

Producing Firms

There is a unit mass of producing firms. Firms' output function is specified as $y = zk$, where z is the productivity, and k is the unit of capital used in the production. We can also interpret the production function as a profit function, and z is the profitability. In order to be consistent with the literature, I use the term "productivity" instead of "profitability" in the model. Following Gavazza (2011), each firm can only operate at most one unit of capital. Thus, k is either one or zero. The productivity z is distributed in the population according to a distribution function $F(z)$. The productivity follows an independent stochastic process. Each firm receives a new productivity draw from $F(z)$ at rate $\alpha \geq 0$. The parameter α measures the volatility of a firm's productivity. Hence, I call α an uncertainty measure. All firms are facing the same uncertainty. When α is high, the productivity of firms change very frequently, and the uncertainty is high.

At the beginning of each period, each firm observes its productivity in this period and its capital holding position which is inherited from the last period, and then makes the decision on production. Firms can choose among

[7]Interest rate affects both the cost of purchasing capital and the rental rate of leasing capital. In the model, I assume interest rate is constant and it is given exogenously. But in real world, changes in interest rate may affect firms' leasing versus buying decisions.

three options: use owned capital to produce, use leased capital to produce, or not produce. If the firm chooses the option to use owned capital to produce and doesn't own any capital at the beginning of the period, it pays price p to purchase new capital. If the firm doesn't have enough internal fund to finance its purchase, it needs to borrow from the financial intermediary. If the firm decides to lease capital, it pays the per-period lease rate of u to the lessor. If the firm owns capital at the beginning of the period and chooses to not produce, it sells its owned capital. Owned capital is partially irreversible. There is a trade friction when selling capital. The seller receives a fraction of the price $p(1-\tau)$, where $\tau \in [0,1]$. At the end of the period, the production is done. The firm gets the output y. Leased capital should return to the lessor. Firms who borrowed from the financial intermediary pay their debt at interest rate of r and own the capital to the next period.

The letter S denotes the state of capital holding position. If a firm owns one unit of capital at the beginning of the period, then $S = 1$. Otherwise, $S = 0$. There are two state variables in the model: productivity z and capital holding position S. Let $V_O(z, S)$ be the value of a firm with productivity z and capital position S choose to own capital and produce; $V_L(z, S)$ be the value of a firm that leases capital to produce, and $V_N(z, S)$ be the value of a firm that does not produce. All these values are discounted to the beginning of the period. Firms choose the maximum value among $V_O(z, S)$, $V_L(z, S)$ and $V_N(z, S)$.

$$\begin{aligned} V_O(z, S=0) = &- p + \frac{z}{1+r} + \frac{1-\alpha}{1+r} V_O(z, S=1) \\ &+ \frac{\alpha}{1+r} E_x[\max(V_O(x, S=1), V_L(x, S=1), V_N(x, S=1))] \end{aligned} \tag{1.1}$$

A firm in state $(z, S = 0)$ pays p to buy the capital, and has z unit of output at the end of the period and discounts it to the beginning of the period. Then, the firm holds the capital to the next period ($S = 1$ for next period). At the beginning of the next period, at the rate of $1 - \alpha$,

the firm has the same productivity as the previous period. At rate α, the firm receives a new draw of productivity from the distribution, so the firm takes expectation over its optimal future actions. Here x is any possible productivity in the distribution.

$$\begin{aligned} V_O(z, S=1) =& \frac{z}{1+r} + \frac{1-\alpha}{1+r} V_O(z, S=1) \\ &+ \frac{\alpha}{1+r} E_x[\max(V_O(x, S=1), V_L(x, S=1), V_N(x, S=1)] \end{aligned} \tag{1.2}$$

It has similar interpretation as $V_O(z, S=0)$ except that the firm doesn't pay price p to buy new capital, because it already has capital at hand.

$$\begin{aligned} V_L(z, S=0) =& -u + \frac{z}{1+r} + \frac{1-\alpha}{1+r} V_L(z, S=0) \\ &+ \frac{\alpha}{1+r} E_x[\max(V_O(x, S=0), V_L(x, S=0), V_N(x, S=0))] \end{aligned} \tag{1.3}$$

A firm pays the per-period lease rate u to lease capital. The leased capital is returned to the lessor at the end of each period, so the firm doesn't have any capital at the beginning of the next period ($S = 0$ for the next period). If the productivity doesn't change in the next period, the firm would continue to lease. If the firm receives a new draw of productivity in the next period, the firm takes expectation over its optimal future actions.

$$\begin{aligned} V_L(z, S=1) =& (1-\tau)p - u + \frac{z}{1+r} + \frac{1-\alpha}{1+r} V_L(z, S=0) \\ &+ \frac{\alpha}{1+r} E_x[\max(V_O(x, S=0), V_L(x, S=0), V_N(x, S=0))] \end{aligned} \tag{1.4}$$

A firm sells its owned capital first and then leases. It earns $(1-\tau)p$ from selling. Actually, it is always not profitable to sell capital and then

lease to produce ($V_O(z, S = 1) \geq V_L(z, S = 1)\ \forall z$), which is proved in the Appendix. By selling owned capital and then leasing, firms would suffer two losses. One is the resale loss, and the other is the high lease rate. Hence, firms that own capital at the beginning of the period would never choose to lease capital; rather, they would only make a decision between using owned capital to produce or selling owned capital to not produce. Only those non-owners at the beginning of the period would make decision between owning and leasing capital.

$$\begin{aligned} V_N(z, S = 0) =& \frac{1-\alpha}{1+r} V_N(z, S = 0) \\ &+ \frac{\alpha}{1+r} E_x[\max(V_O(x, S = 0), V_L(x, S = 0), V_N(x, S = 0))] \end{aligned} \tag{1.5}$$

$$\begin{aligned} V_N(z, S = 1) =& (1-\tau)p + \frac{1-\alpha}{1+r} V_N(z, S = 0) \\ &+ \frac{\alpha}{1+r} E_x[\max(V_O(x, S = 0), V_L(x, S = 0), V_N(x, S = 0))] \end{aligned} \tag{1.6}$$

The value functions of not producing are similar to the value functions of leasing. But firms don't pay lease rates and don't produce any output. These value functions of not producing are independent of the current productivity z. All firms have the same value of not producing.

The Financial Intermediary

In this chapter, I mainly focus on the demand side of leased capital and assume the financial intermediary is the lessor. A competitive lessor maximizes its profit with the equilibrium leasing rate u as given. The lessor provides X_L unit of capital to the lessee. I assume that there is no deadweight cost when the lessor repossesses the capital[8]. And there are no transaction costs

[8] In the U.S. Bankruptcy law, a lessor has specific advantages over a secured lender in terms of the ability to regain control of an asset.

when trading leased capital[9]. The financial intermediary is able to sell the capital at the price of p. However, leased capital is subject to an agency problem due to the separation of ownership and control. The lessor has to spend mp on each unit of capital on maintenance after repossessing the capital (Eisfeldt and Rampini (2007); Rampini and Viswanathan (2011)). The lessor's problem is:

$$\max_{X_L} uX_L - pX_L + \frac{pX_L}{1+r} - \frac{mpX_L}{1+r}$$

Here X_L is the amount of leased capital. The first-order-condition implies that

$$u = \frac{(r+m)p}{1+r} \tag{1.7}$$

As long as the maintenance cost is greater than zero, the lease rate u is higher than the implicit rental rate on owned capital which is $rp/(1+r)$. The lessor makes zero profit in the equilibrium.

The financial intermediary is also a lender. It lends money to firms that wants to buy capital but don't have enough internal funds at the interest rate of r. In the equilibrium, the financial intermediary is indifferent between lending capital or lending money, and it earns zero profits.

1.2.2 Benchmark Economy: No Frictions and No Financial Constraint

Before considering the effects of frictions and financial constraint, this chapter analyzes the simple case of no frictions and no financial constraint. There is no trade friction ($\tau = 0$) and no agency cost ($m = 0$). The economy is a Miller-Modigliani world.

Proposition 1 *When there are no frictions ($\tau = 0$ and $m = 0$) and no financial constraint in the economy, firms are indifferent between leasing or owning capital. There exists a threshold value z^* such that firms whose*

[9]The lessor has a comparative advantage in disposing of the asset. As long as transaction costs on leased capital are lower than owned capital, we can normalize the transaction cost on leased capital to zero.

$z \geq z^*$ own or lease capital to produce, and those firms whose $z < z^*$ don't produce. The threshold value z^* satisfies $X = 1 - F(z^*)$. The equilibrium price p satisfies $p = \frac{z^*}{r}$.

The proofs of all these propositions are found in the Appendix. In this economy, firms can adjust their owned capital freely without any resale loss. The lessor doesn't charge a higher rental rate because of the lack of an agency cost. Without financial constraints, firms can always borrow enough to buy capital when they need to do so. Thus, all firms are indifferent between leasing or owning. When firms have low productivity, they would choose to not produce. The capital is reallocated to firms with high productivity.

In addition, the equilibrium threshold value of z^* and the price of p are independent of the uncertainty parameter α. In a perfect market, uncertainty does not affect firms' leasing decision.

1.2.3 An Economy with Frictions but No Financial Constraint

In this subsection, I introduce frictions into the model. There is a transaction costs when firms sell their owned capital ($\tau > 0$) but no transaction costs on leased capital. The lack of transaction costs on leased capital makes leasing attractive. However, the maintenance cost on leased capital ($m > 0$) causes the lease rate to be higher than the implicit rental rate on owned capital. Firms trade off the low transaction costs on leased capital and the low implicit rental rates on owned capital. Uncertainty matters in this setup. Firms with high uncertainty are more likely to change their productivity in the future. If the firm receives a high draw of productivity in the future, there is no extra gain or loss from owning capital today. But if the firm receives a low draw of productivity in the future, it will have to sell its owned capital and suffer from the resale loss. High uncertainty firms adjust their capital more frequently than low uncertainty firms, thus suffer more resale loss if they own capital. Therefore, leasing is particularly attractive to firms facing high uncertainty.

Proposition 2 *1. The choice between owning and leasing does not depend on the productivity z.*

2. $V_O(z, S = 0) - V_L(z, S = 0)$ is a decreasing function in α.

3. When τ is not small, there always exists a threshold uncertainty value α^* such that firms are indifferent between owning and leasing. If $\alpha > \alpha^*$, all firms prefer to lease if they want to produce. If $\alpha < \alpha^*$, all firms prefer to own capital.

Leased capital and owned capital are perfect substitutes in the production process. They produce the same amount of output. The difference between owning capital and leasing capital is only related to the expected value of the future. Thus, the choice between owning and leasing does not depend on the current level of productivity. Since firms are the same except their current productivity, all firms would have the same preference on leasing or owning. Figure 1.1 illustrates the choice between leasing and buying as a function of uncertainty in a numerical example. If α is low, firms adjust their capital less frequently, which means that the expected transaction costs from adjusting owned capital is lower than the costs of leasing capital from a high lease rate; hence, owning capital dominates leasing for all firms. When α increases to above the threshold, the expected transaction costs from adjusting owned capital is higher than the costs of leasing capital from high lease rates, as a result, leasing dominates purchasing. Firms facing higher uncertainty have higher incentives to lease.

Proposition 3 *If the uncertainty α is above the threshold α^* such that all firms prefer to lease than own, then the equilibrium lease rate u satisfies $X = 1 - F((1 + r)u)$. Firms whose productivity z is above $(1 + r)u$ would lease capital and produce, and those whose productivity z is below $(1 + r)u$ would not produce.*

When uncertainty is high, firms would always prefer leasing to owning. If their productivity is higher than the lease rate, they would lease capital to

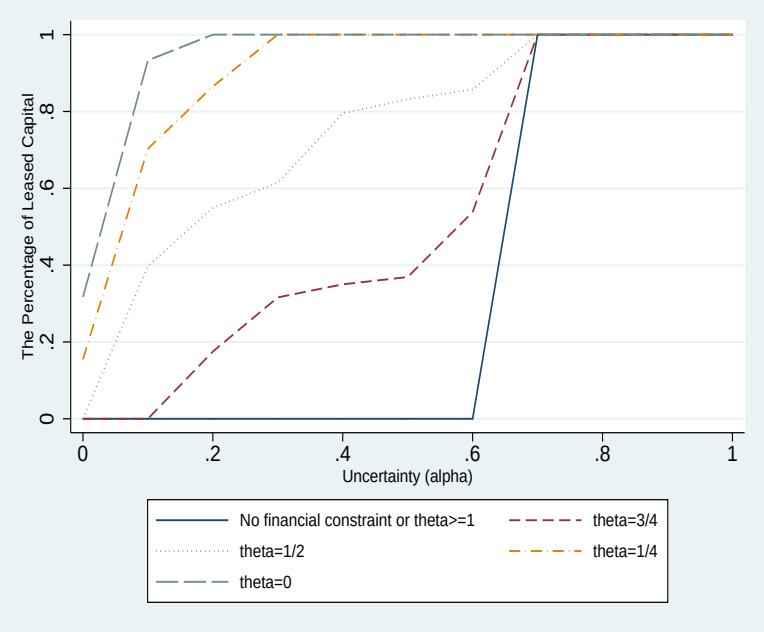

Figure 1.1: Percentage of Leased Capital as a Function of the Uncertainty α and the Financial Constraint Parameter θ. Notes: In this numerical example, baseline parameters are $X = 0.5, r = 0.03, \tau = 0.05, m = 0.015, \beta = 0.5$, and z is normally distributed with mean equals to 100 and standard deviation equals to 50. The larger the α, the higher level of uncertainty. The smaller the θ, the higher the degree of financial constraint.

produce. Otherwise, they would choose to not produce. In the equilibrium, all capital are leased, and the fraction of leased capital is one.

Proposition 4 *If the uncertainty α is below the threshold α^*, all firms would prefer to own capital rather than lease. A non-owner that purchases capital has productivity $z \geq z^*$. A owner that sells capital and does not produce has productivity $z < z^{**}$. And $z^* > z^{**}$.*

When uncertainty is low, firms always prefer to own capital than lease. Firms only invest when the condition is sufficiently good, and only disinvest when it is sufficiently bad. Transaction costs on owned capital generate an option value of waiting. In the region of inaction, the real-option value of waiting is worth more than the returns from investing and disinvesting. This inaction region is wider if uncertainty α is higher but still below the threshold α^*. This is consistent with the result in Bloom (2009). The Appendix reports all equilibrium conditions of this case. In the equilibrium, all capital are owned, and the fraction of leased capital is zero.

1.2.4 An Economy with Frictions and Financial Constraint

Without financial constraints, the fraction of leased capital in the equilibrium is either zero or one. In this subsection, I introduce the financial constraint into the model.

The financial constraint is built in a similar way to that of Jermann and Quadrini (2012). Suppose all producing firms have the same amount of internal fund θp. If $\theta \geq 1$, firms have enough internal fund to buy capital and are not financially constrained. If $\theta < 1$, firms need to borrow $(1-\theta)p$ from the financial intermediary when they make new purchases. Firms with smaller θ are more financially constrained since they have less internal funds and need to borrow more to finance their purchases. I call θ the financial constraint parameter. Now, the ability to borrow is bounded by the limited enforceability of debt contract as firms can default on their obligations. If firms default, the financial intermediary acquires the right to liquidate the firm. At the moment of contracting the loan, the liquidation value of the

firm is uncertain. With probability $1-\beta$, the financial intermediary can recover the full value of the firm. But with probability β, the recovery value is zero. If the financial intermediary can fully recover the firm, the ex-post value of defaulting for the firm is zero. If the financial intermediary cannot liquidate the firm, the ex-post value of defaulting for the firm at the end of the period is $(1+r)(V_O(z,S=0)+(1-\theta)p)$. Hence, the ex-ante value of defaulting is $\beta(1+r)(V_O(z,S=0)+(1-\theta)p)$. The value of not defaulting is $(1+r)V_O(z,S=0)$. Financial constraint requires that the value of not defaulting is not smaller than the expected value of defaulting, that is:

$$(1+r)V_O(z,S=0) \geq \beta(1+r)(V_O(z,S=0)+(1-\theta)p)$$

Rearrange the constraint to:

$$\frac{1-\beta}{\beta}V_O(z,S=0) \geq (1-\theta)p \tag{1.8}$$

Firm would not default if the financial constraint is satisfied. The financial constraint indicates that in order to borrow from the financial intermediary, the expected liquidation value of the firm should be greater than the loan. Firms with smaller θ face tighter financial constraints.

The financial constraint only works on those firms who don't have capital at the beginning of the period and want to make new purchases. Now, only those firms who satisfy the financial constraints are able to finance enough funds to buy capital.

When the uncertainty is fairly high such that all firms prefer to lease, all capital are leased in the economy; financial constraints cannot affect the equilibrium. Financial constraints affect the outcome only when the uncertainty is not high such that firms would prefer to own if they can borrow freely. Intuitively, if firms are not constrained at all, they can always buy capital using their internal funds. Firms would never lease and all capital are owned in the economy. On the other hand, if firms are constrained, they need to borrow some money to finance their purchases. Because of the financial constraints, only firms with very good project are able to borrow while others

are not. Then, only those firms with particularly high productivity can finance enough funds to purchase new capital. Those firms who can't borrow but still want to produce have to lease capital. In the equilibrium, both leasing and purchasing coexist. Particularly, when firms are more financially constrained, they need to borrow more. This causes the financial constraint to be tighter. The financial intermediary would lend more carefully and less firms are able to borrow. Thus, more firms have to lease capital to produce. The fraction of leased capital in the equilibrium should be higher when firms are more constrained.

The below proposition illustrates the equilibrium outcome when leasing and owning coexist in the economy. Non-owners with high productivity satisfy the financial constraint and are able to buy capital. Non-owners whose productivity is above the lease rate but does not satisfy the financial constraint use leased capital to produce. Owners with low productivity would sell their owned capital and not to produce.

Proposition 5 *Assume uncertainty α is low and financial constraint parameter θ is low such that leased and owned capital can coexist. Then, a firm that purchases a capital has productivity $z \geq z^*$. A firm that leases a capital has productivity $z \geq (1+r)u$ and $z < z^*$. A firm that sells an owned capital has productivity $z < z^{**}$. And $z^* > (1+r)u > z^{**}$.*

Since only those firms with highest productivity are able to satisfy the constraint, the threshold of buying capital with financial constraints is higher than the threshold of buying capital without financial constraints. In addition, the threshold of selling owned capital with financial constraints is lower than the threshold of selling without financial constraints. When the productivity is very low, owners want to sell their capital and choose not to produce. However, since there are financial constraints, they might not able to borrow money to buy new capital in the future if they sell their own capital. So, firms are more hesitant to sell even if they have low productivity.

An analytic characterization of how the financial constraint parameter θ affects firms' leasing choices cannot be provided. Their choices depend on the equilibrium price of the capital, which cannot be solved in closed

form. Thus, this chapter computes numerical solutions to illustrate firms' choices. The Appendix reports all equilibrium conditions. Figure 1.1 shows the percentage of leased capital in the equilibrium for different θ. Given constant uncertainty, when θ decreases, the percentage of leased capital increases. More financially constrained firms lease more. In this numerical example, even for those firms who don't face any uncertainty ($\alpha = 0$), if firms need to finance their purchase fully by borrowing ($\theta = 0$), some firms have to lease capital because they are very constrained and are not able to get loans from the financial intermediary.

Uncertainty affects the equilibrium outcome the same way as it does in the case without financial constraints. If financial conditions are constant, when uncertainty increases, leasing is more attractive because of the trade friction. Figure 1.1 shows that the percentage of leased capital increases monotonically as uncertainty increases.

The trade friction on owned capital τ and the maintenance cost m also affect the equilibrium outcome. An increase in the trade friction τ would shift the graph in Figure 1.1 to the left. When firms find that it is much more difficult to sell assets in the secondary market, they are more interested in leasing. An increase in the maintenance cost m would shift the graph to the right. High maintenance costs will cause the lease rates to be higher, and make leasing less attractive. Nonetheless, they don't affect the monotonic relationships of uncertainty and financial conditions on the fraction of leased capital in the economy.

The model predicts that uncertainty and financial constraints are important factors that affect the lease-or-buy decision. The lease ratio increases monotonically as uncertainty increases, and it also increases monotonically as firms are more financially constrained.

1.3 Empirical Evidence

This section uses data from publicly-traded firms in the U.S. to test the main qualitative implications of the model.

1.3.1 Data

The data set is a firm level panel from the Compustat and CRSP files. Included in the panel are annual observations from 1975 to 2009 [10]. Several industries are excluded from the panel in this work. I exclude firms from the financial (two-digit SIC codes: 60-67) and utilities (49) industries. I also exclude petroleum refining (29), mining (10-14), agriculture and fishery (1-9) industries, where real property or natural resources are a large fraction of the firm's capital. In this work, I focus on the leasing behavior of the lessee. Although commercial banks, insurance companies, and finance companies do most of the leasing, it is necessary to exclude those industries where the main business involves leasing such as auto repair (75) and computer rental and leasing (73). Thus, I examine firms in construction, manufacturing, transportation, wholesale, retail, service and public administration. This chapter uses daily firm-level equity returns from the CRSP to construct the estimate of uncertainty. I restrict the sample to firms that have traded for at least 50 percent of the trading days (125 days) in a year and have traded at least 1250 trading days (five years). These selection criterions yield an unbalanced panel of 8,734 U.S. firms with 98,557 firm-year observations. Outlier rules are imposed on the firms' variables by setting the values at the upper and lower tails equal to the 99th and 1st percentiles respectively.

1.3.2 The Measure of Leasing

The main data item from the Compustat that this chapter uses is the reported rental expenses (operating lease expenses) from the income statements. The fraction of capital from leasing (the lease share) is measured by the ratio of rental expense to the total cash expenditures on rent and investment[11]. The total cash expenditures on rent and investment is the sum of rental

[10] Only few observations have non missing data on leasing before 1975.

[11] Eisfeldt and Rampini (2009) use the same measure except that their information of rental expenses is from Census data.

expenses and capital expenditures.

$$lease\ share = \frac{rental\ expenses}{rental\ expenses + capital\ expenditures} \tag{1.9}$$

Lease shares below 0 are set equal to 0, and lease shares above 1 are set equal to 1.

A second measure of lease shares would be the ratio of rental expenses to the total capital cost which is the sum of rental expenses, depreciation expenses, and the opportunity cost of fixed assets (Sharpe and Nguyen (1995)). I use the firm's reported short-term average borrowing rate to represent the firms' opportunity costs. However, only about a quarter of my observations in the sample report the short-term average borrowing rate[12]. Although I did a robustness check for all empirical analysis by using the second measure of lease shares and found that all findings are robust, I will focus on the first measure of lease shares in this work.

1.3.3 The Measure of Uncertainty

The measure of uncertainty employed in this chapter is the volatility of a firm's stock returns taken from CRSP files. It is commonly used in many finance and macroeconomics literature (Leahy and Whited (1996), Bulan (2005), and Gilchrist et al. (2010)). The advantage of this measure is that stock returns capture the changing aspects of a firm's environment that investors view as important (Leahy and Whited (1996)). Increased volatility in the product market is translated into increased volatility in the stock market (Pindyck (1991)). Common stocks are claims on the future profits of a firm. Innovations to a firm's stock returns are reactions to news about

[12]For firms with missing values of short-term average borrowing rate, I use the sample average interest rate reported that year by firms with the same bond rating (as Sharpe and Nguyen (1995)). There are five rating groups based upon Standard and Poor's senior debt ratings. Five groups are AAA through AA-, A+ through A-, BBB+ through BBB-, BB+ through D, and unrated. The average reported interest of the top rated group was 1 to 2 percent lower than that of the unrated group. There are a few outliers whose reported short-term average borrowing rates are higher than 20 %. I replace such values with the sample average rate reported by firms with the same bond rating in the same year.

the firm's future profitability. Thus, the volatility of a firm's stock returns should reflect the variations in profits and provide an adequate measure of firms' uncertainty.

Estimating uncertainty for firm i in year t is based on a two-step procedure from Gilchrist et al. (2010). First, I remove the systematic component of stock returns using the standard Fama and French (1992) 3-factor model:

$$r_{it_n} - r^f_{t_n} = \alpha_i + \beta^M_i (r^M_{t_n} - r^f_{t_n}) + \beta^{SMB}_i SMB_{t_n} + \beta^{HML}_i HML_{t_n} + u_{it_n} \quad (1.10)$$

In this equation, i represents firms, while t_n are trading days n in years t. The quantity r_{it_n} denotes the return of firms, while $r^f_{t_n}$ denotes the risk free rate. Also, $r^M_{t_n}$ marks the return for the market, and SMB_{t_n} and HML_{t_n}[13] are the Fama-French risk factors. Secondly, I calculate the standard deviation of daily idiosyncratic returns for each firm i in year t:

$$\sigma_{it} = \sqrt{\frac{1}{N}\sum_{n=1}^{N}(\hat{u}_{it_n} - \hat{\bar{u}}_{it})^2} \quad (1.11)$$

Here $\hat{u}_{it_n}$ is the OLS residual from equation (1.10) and $\hat{\bar{u}}_{it}$ represents the mean of daily idiosyncratic returns of firm i in year t. Thus, from this equation, σ_{it} is an estimate of uncertainty for firm i in year t.

1.3.4 The Measure of Financial Constraint

The standard empirical approach adopts several separate financial characteristics, e.g. cash flow, debt, bond rating and etc., to represent the level of the firms' financial constraints. Eisfeldt and Rampini (2009) perform empirical analysis examining the relationship between lease shares and financial constraints using cash flow, firm size, dividend, and Tobin's Q as their financial constraints indicators. However, the use of separate financial variables cannot allow us to properly identify financially constrained firms. To study

[13] SMB (Small Minus Big) is the average return on three small portfolios minus the average return on three big portfolios. HML (High Minus Low) is the average return on two value portfolios minus the average return on two growth portfolios.

the role that financial constraints have on the behaviors of firms, it is better to have one measure of the severity of these constraints. This chapter constructs an index of the financial constraint of corporate firms and uses it to sort firms into two separate groups according to their level of constraints.

The commonly used index of financial constraints is the Kaplan and Zingales (1997) index (KZ index thereafter), which is constructed in Lamont et al. (2001). They classify firms into discrete categories of financial constraint, then use an ordered logit regression to relate their classifications to accounting variables, and finally use the regression coefficients to construct the KZ index. The KZ index loads positively on Tobin's Q and leverage, and negatively on cash flow, cash, and dividends[14]. However, Hadlock and Pierce (2010) argued that only cash flow and leverage are consistently significant with a sign that agrees with the KZ index. Other three components display insignificant or conflicting signs. An alternative to the KZ index is proposed by Whited and Wu (2006) (WW index thereafter), which is created by a Euler equation approach from a structural model of investment. The WW index has six factors: cash flow, leverage, size, dividend dummy, industry sales growth, and firm sales growth. Hadlock and Pierce (2010) find that only cash flow, leverage and firm size have significant coefficients that agree in sign with the WW index. Hadlock and Pierce (2010) also study several commonly used financial indicators and find that only firm sizes and ages are closely related to financial constraints. Therefore, they suggest using an index based on cash flow, leverage, size, and age.[15].

I rely on Hadlock and Pierce (2010) to construct the financial constraint index. The financial constraint index (FC index thereafter) is based on four factors. (1) Cash flow, proxied by operating income plus depreciation/beginning-of-year book assets. (2) Leverage, proxied by book value of long-term

[14]KZ Index = -1.002*Cash Flows/K + 0.283*Q + 3.139*Debt/Total Capital - 39.368*Dividends/K -1.315*Cash/K.

[15]They suggest there are two factors to caution. First, the endogenous nature of leverage may result in a nonmonotonic or sample-specific relationship between leverage and financial constraints. Secondly, there may be biases in qualitative disclosures on leverage and cash flow. Given these concerns, they suggest another similar financial constraint measure using only firm size and age.

debt/current book assets. (3) Firm size, proxied by the log of inflation deflated (to 2004) assets. (4) Firm age, proxied by the current year minus the first year that the firm has a non-missing stock price. The FC index is calculated using the regression coefficients from Hadlock and Pierce (2010).

$$FC = -0.592 * Cash\ Flow + 1.747 * Leverage - 0.357 * Firm\ Size - 0.025 * Firm\ Age \tag{1.12}$$

The bigger the FC, the higher the degree of financial constraint.

1.3.5 Summary Statistics

Descriptive statistics are given in Table 1.1. Leases account for 37.8 percent of the capital costs on average. The mean value of firms' uncertainty is 0.037, and the mean value of the financial constraint index is -1.969. Table 1.2 reports the correlations. The correlation of lease share and uncertainty is 0.288. The correlation of lease share and the FC index is 0.282. Both are positively significant. I also calculated the correlation of lease share with one year lagged uncertainty and FC index. The lagged correlations are a little bit larger than the correlations in the same year, and all are positively significant. These correlations suggest that firms with high uncertainty and firms with a high FC index (more financially constrained firms) tend to have high lease shares. The correlation between uncertainty and the FC index is 0.474. Firms with high uncertainty are more likely to be financially constrained.

I categorize firms by their level of uncertainty and their FC index. Firm i in year t is in the high uncertainty group if its uncertainty is above the median of all firms' uncertainty in year t. Otherwise, it belongs to the low uncertainty group. Similarly, I split firms to the less financially constrained group and the more financial constrained group according to their FC index. Panel A of Table 1.3 reports the average of lease shares across uncertainty groups. Firms in the high uncertainty group rent 43.6 percent of their capital, whereas firms in the low uncertainty group rent about 31.8 percent on average. Panel B of Table 1.3 shows the average lease share across financial constraint groups. Firms in the more financially constrained group lease

Table 1.1: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Median	Max.
Lease Share	98,557	0.378	0.245	0	0.332	1
Uncertainty	111,724	0.037	0.026	0.001	0.031	1.2
FC Index	101,632	-1.969	0.946	-5.356	-1.867	1.517

Notes: The Sample consists of firms in the U.S. on Compustat and CRSP files over the period 1975 through 2009. Firms in construction, manufacturing, transportation, wholesale, retail, service and public administration are included in the sample. Lease share is the fraction of capital from leasing, and is measured as a ratio of the rental expense to the total cash expenditures on rent and investment. Uncertainty is measured as the volatility of a firm's stock returns. Financial constraint is measured by an index (the FC index) which combines the information of cash flow, debt, firm size and firm age.

Table 1.2: Sample Correlations

	Correlation	Significant Level
Lease Share and Uncertainty	0.288	0.000
Lease Share and FC Index	0.282	0.000
Lease Share and Lagged Uncertainty	0.295	0.000
Lease Share and Lagged FC Index	0.286	0.000
Uncertainty and FC index	0.474	0.000

Notes: The FC index ia a financial constraint index. Larger number of the FC index indicates that a firm is more financially constrained.

44.2 percent of their capital, and firms in the less financially constrained group lease about 31.9 percent. I did a mean comparison test of lease share for different groups and report the t statistics and P-values in the last two columns of Table 1.3. Firms with high uncertainty and firms that are more financially constrained, on average according to the statistics, lease significantly more. Moreover, Figure 1.2 shows the trend of the mean lease shares across different groups over time[16]. Firms with high uncertainty and firms

[16]The correlation of a firm being in the high uncertainty group and in the more financial constrained group is 0.5104. It is higher than the correlation between the uncertainty and FC index because the variables are now dummy variables.

that are more financially constrained always lease more over the whole time series.

Table 1.3: Summary Statistics of Different Groups

PANEL A	High uncertainty	Low uncertainty	t-value	P-value
Lease Share	0.436	0.318	78.106	0
	(0.258)	(0.214)		
Uncertainty	0.052	0.022		
	(0.029)	(0.008)		
FC Index	-1.45	-2.465		
	(0.68)	(0.897)		
PANEL B	More FC	Less FC	t-value	P-value
Lease Share	0.442	0.319	77.456	0
	(0.262)	(0.210)		
Uncertainty	0.047	0.026		
	(0.03)	(0.015)		
FC Index	-1.26	-2.68		
	(0.495)	(0.732)		

Notes: The FC index ia a financial constraint index. Larger number of the FC index indicates that a firm is more financially constrained. Panel A shows the results of the uncertainty groups, and Panel B shows the results of the financial constraint groups. The t-value and the P-value refer to the t statistics and the P-value of the mean comparison test of two groups. Standard deviations are in parenthesis.

Figure 1.3 plots the empirical cumulative distributions of the lease shares of different groups. The cumulative distribution of the low uncertainty group is above the cumulative distribution of the high uncertainty group. The cumulative distribution of the less financially constrained group is above the cumulative distribution of the more financially constrained group. A standard Kolmogorov-Smirnov test rejects the null hypothesis of equal distributions at the one-percent level. The P-values of KS tests for both uncertainty groups and financial constraint groups are equal to zero, which is shown in the first column of Table 1.4.

Figure 1.2: Average Lease Shares at Different Levels of Uncertainty and Financial Constraints over Time Notes: The financial index starts from 1976 because the cash flow factor is divided by the lagged value of the book assets.

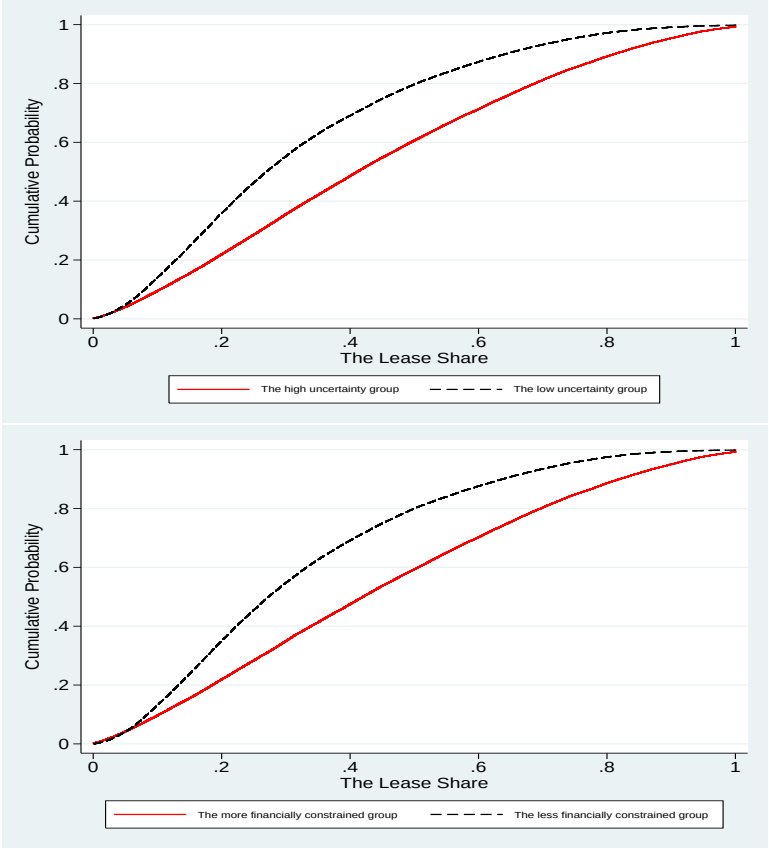

Figure 1.3: The Cumulative Distribution of the Lease Share across Different Groups

Table 1.4: Lease Share Distribution Tests

PANEL A	(1)	(2)
Uncertainty Groups	KS Test P-value	FOSD Test P-value
High versus Low	0.000	0.892
Low versus High		0.000
PANEL B		
Financial Constraint Groups	KS test P-value	FOSD test P-value
More FC versus Less FC	0.000	0.202
Less FC versus More FC		0.000

Notes: The KS test is the Knlmogorov-Smirnov test of equal distribution, and the FOSD test is a test of first order stochastic dominance. "High versus low" means that the null hypothesis is that the distribution of lease share of the high uncertainty group first order stochastically dominates the distribution of lease share of the low uncertainty group, and "Low versus High" means the opposite hypothesis. Similarly, "More FC versus Less FC" states that the null hypothesis is that the distribution of lease share of the more financially constrained group first order stochastically dominates the distribution of lease share of the less financially constrained group, and "Less FC versus More FC" means the opposite hypothesis.

In addition, I applied a non-parametric procedure which is proposed by Barrett and Donald (2003) to test for first-order stochastic dominance. The second column of Table 1.4 presents P-values for first order stochastic dominance tests of lease share distribution comparisons across groups. Panel A of Table 1.4 reports the results for uncertainty groups. The first row of panel A labeled "High versus low" contains P-values for testing whether lease share distribution of the high uncertainty group first order stochastically dominates lease share distribution of the low uncertainty group, while the second row tests the opposite hypothesis. The P-values are equal to 0.892 and 0, respectively. The first P-value implies that one cannot reject that the high uncertainty group dominates the low uncertainty group in lease share, and the second P-value implies that the converse can easily be rejected since the P-value is zero. Panel B of Table 1.4 presents the results for the financial constraint groups. The P-values suggest that the lease share distribution of the more financially constrained group first order stochastically dominates that of the less financially constrained group. These tests conclude that firms with high uncertainty and firms that are more financially constrained lease more even if we look at the whole distribution.

The results from comparing the mean and the distribution across different groups are consistent with the prediction of the model.

1.3.6 Regressions

To study the relationship between leasing, uncertainty and financial constraint, I run regressions of the leasing measure on the uncertainty and the FC index. The dependent variable in these regressions is the value of lease shares. Because the model predicts that firms with high uncertainty and firms that are more financially constrained lease more of their capital than firms with low uncertainty and firms that are less financially constrained, the coefficients on the uncertainty measure and the FC index are expected to be positive.

Table 1.5 reports the results of the OLS estimations. I control for firm fixed effects and time fixed effects in all OLS regressions. The first column

reports the base regression without additional control variables. Both the uncertainty and the FC index are significantly positively related to leasing. It is consistent with the prediction of the model. Uncertainty and financial constraint are also quantitatively important. Based on the first column in Table 1.5, a one standard deviation increase in uncertainty increases a firm's lease share by approximately 3.5 percent. A one standard deviation increase in the FC index increases the lease share by approximately 9 percent. Compared to that, the mean lease share of all firms is 37.8 percent; thus, it can be seen that the economic effects of uncertainty and the financial constraints on lease shares are large. Uncertainty and financial constraints are important determinants of firms' leasing decisions[17]. Moreover, the data I used is from publicly-traded firms. They are relatively large firms with low uncertainty and are less financially constrained. I can reasonably expect the effect of uncertainty and financial constraints to be much stronger for those small firms that are not publicly traded.

I control for other financial indicators like dividend, cash and Tobin's Q besides the FC index in a check for robustness. Column 2 of Table 1.5 reports the result with these additional financial controls. The dividend dummy variable equal to one for dividend paying firms and equal to zero for non-dividend paying firms. Cash/Asset is defined as the cash plus the marketable securities divided by the book assets. Tobin's Q is defined as the book assets minus the book common equity minus the deferred tax plus the market equity divided by the book assets. The coefficients on uncertainty and the FC index are still positive and significant, and the level of magnitude of these coefficients is close to those in the base regression. Based on the second column in Table 1.5, a one standard deviation increase in uncertainty and the FC index increases a firm's lease share by 3.5 percent

[17]The Compustat data does not distinguish between structures renting and equipment renting. But I expect that the effects of uncertainty and financial constraints are stronger using data on structures renting. Because structures are usually illiquid assets and are capital intensive, firms are more likely to face financial constraints and suffer more from resale loss if they choose to purchase structures. In Eisfeldt and Rampini (2009), they use census data and report the results for structures and equipment separately. They find that the effect of financial constraints on equipment leasing are weaker than on structures. This is consistent with my view.

Table 1.5: Results of the OLS Regressions

Regression	(1)	(2)	(3)	(4)
Uncertainty	1.345***	1.340***	1.228***	1.226***
	(0.031)	(0.031)	(0.038)	(0.038)
FC Index	0.095***	0.099***	0.110***	0.110***
	(0.002)	(0.002)	(0.002)	(0.002)
Dividend Dummy		-0.009***	-0.003	-0.003
		(0.002)	(0.002)	(0.002)
Cash/Asset		0.064***	0.049***	0.048***
		(0.005)	(0.006)	(0.006)
Tobin's Q		-0.009***	-0.009***	-0.009***
		(0.000)	(0.001)	(0.001)
Average Tax Rate			-0.003	-0.003
			(0.003)	(0.003)
R&D/Sales			-0.003***	-0.003***
			(0.001)	(0.001)
Total Use of Capital				-0.000***
				(0.000)
No. of firms	8,485	8,428	5,794	5,794
No. of Obs.	90,099	86,520	54,448	54,448
R^2 (within)	0.128	0.134	0.146	0.148

Notes: The dependent variable is the value of lease shares. I control for firm fixed effects and time fixed effects in each regression. Standard errors are in parentheses. *, **, *** statistically significantly different from zero at the 10%, 5% and 1% level of significance. Larger number of the FC index indicates that a firm is more financially constrained.

and 9.4 percent respectively. Moreover, the regression indicates that non-dividend paying firms significantly lease more. Surprisingly, the coefficient on cash to assets is significantly positive. Firms holding more cash lease more. The reason might be that, as pointed by Hadlock and Pierce (2010), the choice of cash holdings may not have straightforward relation to financial constraints. They find that cash holdings generally display a positive and significant coefficient in models predicting financial constraints if firm size and age are controlled. Although an increase in cash may help firm alleviate the financial constraints, the fact that a firm chooses to hold a high level of cash may indicate that the firm is constrained and it holds cash for precautionary reasons. Tobin's Q is always used as a measure of financial constraint. However, the coefficient estimate on Tobin's Q is significantly negative. The reason is that Tobin's Q might be highly correlated with other financial variables. These estimates are consistent with the findings in Eisfeldt and Rampini (2009). They find that the cash to assets ratio is not significantly related to leasing behaviors, and the effect of Tobin's Q is insignificant or negative when firm age is controlled[18].

I also include a measure of the average tax rate to control for the tax proposes. The average tax rate is approximated by the tax expense divided by the pre-tax income. Moreover, I control for the unique characteristics of specific firms' capital by using research and development expenditure to sales ratio. Klein et al. (1978) argued that an asset highly specialized to the firm is more likely to be purchased because it is less valued by other users. The results with the tax and R&D controls are presented in column 3 of Table 1.5. The average tax rate is insignificant. Firms with more R&D spending tend to lease less capital. More importantly, controlling for tax and asset specificity does not alter the results regarding the significance of uncertainty and the FC index. Both the uncertainty and the FC index are significantly positive. Approximately, a one standard deviation increase in uncertainty and the FC index increases a firm's lease share by 3.4 percent and 10.2 percent respectively. In addition, in order to avoid the issue that firms with high uncertainty lease more simply because they adjust their

[18]In my regression, firm age is included in the FC index.

capital more frequently, I control for the overall use of capital in the last column of Table 1.5. The results in column 4 are very close to the results in column 3. Again, the uncertainty and the FC index have statistically significant and positive coefficients.

Since the value of lease share is truncated between zero and one, I also test for robustness of the results with Tobit regressions[19]. The results of the Tobit regressions are shown in Table 1.6. The results of the Tobit regressions are similar to the results of the OLS regressions. Again, the uncertainty and the FC index have significant and positive coefficients. The estimated coefficients of the uncertainty and the FC index of the Tobit regressions are close to the estimates of the OLS regressions.

Lastly, I do another check for robustness by using the KZ index as a financial constraint indicator instead of my FC index. The results are presented in Table 1.7. The results in columns 1 and 2 of Table 1.7 are from the OLS regressions, and the results in columns 3 and 4 of Table 1.7 are from the Tobit regressions. In these regressions, the estimated coefficients on uncertainty are significant, and they are larger than those in Tables 1.5 and 1.6. The estimated coefficients on the KZ index are significant in most regressions but the magnitude is small[20].

Besides panel regressions, I examine cross section patterns as well. I run regressions for every year separately, and control for industry fixed effect in the regressions. The estimated coefficients on uncertainty and financial constraint index are statistically significant and positive in all year regressions. Table 1.8 report the results of some selected years.

Overall, both the panel regressions and cross sectional regressions suggest that the uncertainty and the financial constraint positively affect firms' leasing decisions, and the economic effects of uncertainty and financial constraint on lease shares are large.

[19] I control for time fixed effects and firm random effects in all Tobit regressions.

[20] The mean of the KZ index of all firms is -4.246, and the standard deviation of the KZ index is 12.379. Based on the results in Table 1.7, a one standard deviation increase in the KZ index increases a firm's lease share by approximately 1 percent.

Table 1.6: Results of the Tobit Regressions

Regression	(1)	(2)	(3)
Uncertainty	1.431***	1.421***	1.333***
	(0.030)	(0.031	(0.038)
FC Index	0.080***	0.082***	0.092***
	(0.002)	(0.002)	(0.002)
Dividend Dummy		-0.006***	0.001
		(0.002)	(0.002)
Cash/Asset		0.060***	0.041***
		(0.005)	(0.005)
Tobin's Q		-0.010***	-0.009***
		(0.000)	(0.001)
Average Tax Rate			-0.001
			(0.003)
R&D/Sales			-0.002***
			(0.001)
No. of firms	8,485	8,428	5,794
No. of Obs.	90,099	86,520	54,448

Notes: The dependent variable is the value of lease shares. I control firm random effects and time fixed effects in each regression. Standard errors are in parentheses. *, **, *** statistically significantly different from zero at the 10%, 5% and 1% level of significance. Larger number of the FC index indicates that a firm is more financially constrained.

Table 1.7: Robustness Check using the KZ Index

Regression	(1)	(2)	(3)	(4)
	OLS		Tobit	
Uncertainty	1.728***	1.654***	1.908***	1.889***
	(0.031)	(0.038)	(0.030)	(0.037)
KZ Index	0.001***	0.001***	0.000	0.001***
	(0.000)	(0.002)	(0.000)	(0.000)
Average Tax Rate		-0.003		-0.003
		(0.003)		(0.003)
R&D/Sales		0.000		0.002***
		(0.001)		(0.001)
No. of Firms	8,420	5,791	8,420	5,791
No. of Obs.	86,254	54,365	86,254	54,365
R^2 (within)	0.102	0.106		

Notes: The dependent variable is the value of lease shares. The KZ index is based on five factors as described in Lamont et al. (2001): cash flow, Tobin's Q, debt, dividend, and cash. Larger number of the KZ index indicates that a firm is more financially constrained. Each regression includes controls for time fixed effects. I control for firm fixed effects in the OLS regressions, and control for firm random effects in the Tobit regressions. Standard errors are in parentheses. *, **, *** statistically significantly different from zero at the 10%, 5% and 1% level of significance.

Table 1.8: Results of Some Selected Cross Sectional Regressions

Regression	Year1976	Year1981	Year1986	Year1991	Year1996	Year2001	Year2006
Uncertainty	3.492***	3.103***	2.937***	1.666***	2.415***	2.046***	3.623**
	(0.356)	(0.436)	(0.306)	(0.155)	(0.18)	(0.173)	(0.36)
FC index	0.015***	0.045***	0.042***	0.064***	0.029***	0.055***	0.06***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)
No. of Obs.	2202	1885	2303	2580	3299	3252	2829
Adj. R^2	0.181	0.166	0.173	0.225	0.214	0.231	0.217

Notes: The dependent variable is the value of lease shares. I control for industry fixed effects in all regressions. Standard errors are in parentheses. *, **, *** statistically significantly different from zero at the 10%, 5% and 1% level of significance.

1.3.7 Indirect Evidence

Zhang (2011) documents that leasing is countercyclical over business cycles. Firms lease more during economic downturns, and are more willing to buy capital during up cycles. Many literature indicate that uncertainty is high during recessions (Bloom et al. (2010), Gilchrist et al. (2010)). Moreover, firms face severe financing conditions during recessions than booms (Jermann and Quadrini (2012)). The survey among senior loan officers of banks finds that banks tighten the credit standards for commercial and industrial loans during recessions. High uncertainty and tight financial conditions might cause firms to lease more during recessions than during booms. We can view this countercyclical pattern as an indirect evidence to support that uncertainty and financial constraint are important determinants of the leasing decisions of corporate firms.

1.4 Quantitative Analysis

In this section, I calibrate the model in Section 2, and show simulation results of the model when the economy faces higher uncertainty and tighter financial constraint.

The model is highly non-linear. All parameters affect the outcome. The calibration faces challenges because the identification of some key parameters is very difficult. The data does not provide any direct evidence on the level of transaction cost and maintenance cost. I can only infer these costs from other literature. Therefore, this calibration is not an estimation of its structural parameters. It is an investigation on whether the model is quantitatively consistent with the data.

The time period in the model is one year. I assume the annual interest rate to 3 percent. This is a common setting in the literature. In Cooper and Haltiwanger (2006), they estimate that the transaction cost is from 2.5 percent to 20 percent depending on different specifications. In Bloom et al. (2007), they set the resale loss for capital to 20 percent. Based on the literature, I set the transaction cost to 20 percent. There are few lit-

erature estimating the maintenance cost of leased capital. Gavazza (2011) suggests that the maintenance cost of leased aircraft is about 2.7 percent. Following Gavazza (2011), the maintenance cost of leased capital is set to 3 percent. The mass of assets X affects all prices and thresholds in the equilibrium. However, what I focus on is the ratio of leased capital which is not sensitive to the choice of X. X is set to 0.5 which indicates that half of the firms produce in the equilibrium. I further assume that the productivity z is normal distributed with mean $E(z)$ and standard deviation $SD(z)$. Instead of the absolute value of the mean and standard deviation, it is the relative dispersion of the distribution that affects the lease ratio. Thus, I simply assume the mean $E(z)$ to 100, and calibrate the standard deviation $SD(z)$ to match the key moments. The probability of successful enforcement β is set to 0.5. The equilibrium outcome is affected by β and θ together, thus I set β and leave θ to match the key moments.

I choose three key parameters (uncertainty α, financial conditions θ, and standard deviation $SD(z)$) so that the moments computed from the model are close to the moments in the data. The first moment is the average lease share of firms in 35 years. The second moment is the serial correlation in lease share. And the last moment is the standard deviation of the average lease share of firms. Panel A of Table 1.9 reports the implied parameters, and Panel B of Table 1.9 reports the moments computed from the model and the data. The uncertainty parameter α equals to 0.195. The productivity is very sluggish because of the high serial correlation of firms investment decisions. The financial parameter θ equals to 0.28. Firms finance their capital mainly by secured debt $(1-\theta)$ which is more than 70 percent. The standard deviation SD is set to 70. All these parameters are suggestive and the magnitudes seem reasonable. The model is quantitatively consistent with the data.

I then simulate the model when the economy faces higher uncertainty and tighter financial constraint. The simulation results can help us separate the effects of uncertainty and financial constraints. Panel C of Table 1.9 reports the simulated average lease share of different scenarios. The parameters are from the calibration. First, I increase the uncertainty α by

5 percent given other parameters unchanged. When there is a 5 percent increase in uncertainty, the average lease share in the economy changes to 0.405 and increases 7.1 percent. Higher uncertainty induces firms to adjust their capital position more frequently, and makes leasing more attractive. Firms lease more of their capital than in the steady state. In the second scenario, the financial constraint parameter θ decreases 5 percent. Firms have less internal funding to support their purchase, and face tighter financial constraints. Less firms are able to finance their purchase, and more firms have to lease capital. A 5 percent decreases in the financial conditions increases the average lease share by 2.6 percent. The results suggest that uncertainty may have stronger effect on leasing than financial constraints have. Lastly, I increase uncertainty by 5 percent and decrease the financial parameter by 5 percent together. Now, firms face both higher uncertainty and tighter financial constraints. Both factors increase the average lease share. The average lease share in the third scenario increases 9.6 percent. The magnitude of the change is almost the same as the sum of changes caused by the uncertainty and financial constraints separately. The interaction effect of uncertainty and financial constraints is negligible. Uncertainty and financial constraints seem to affect leasing through separate channels. Although the simulation helps us distinguish uncertainty from financial constraints, there is a caveat. All simulation results are suggestive. They are sensitive to the values of the parameters.

1.5 Concluding Remarks

This chapter investigates how uncertainty and financial constraints affect corporate leasing decisions. Leasing incurs an agency costs due to the separation of ownership and control; hence, it costs more in the long run than owning capital. However, leasing provides firms with operational flexibility, since the leased capital can be more easily disposed at low transaction costs. The low transaction costs of leasing are particularly attractive to firms whose future profit is highly uncertain and expect to frequently adjust their capital. Another advantage of leasing is that leases are easier to finance than

Table 1.9: Calibration and Simulation

Panel A: Parameters		
The mass of asset X	0.5	
Interest rate r	0.03	
Trade friction τ	0.2	
Maintenance cost m	0.03	
Probability of successful enforcement β	0.5	
Mean of productivity $E(z)$	100	
Standard deviation of productivity $SD(z)$	70	
Uncertainty α	0.195	
Financial Constraint parameter θ	0.28	
Panel B: Moments		
Average lease share	0.378	
Serial correlation of the lease share	0.8	
Standard deviation of the lease share	0.245	
Panel C: Simulation Results		
	Average Lease Share	Percentage Change
A 5% increase in uncertainty α	0.405	7.1%
A 5% decrease in FC parameter θ	0.388	2.6%
A 5% increase in α and a 5% decrease in θ	0.414	9.6%

purchases. It is unlikely that the lessee would have to provide any collateral to be able to start a lease. Despite the high cost of leasing in the long run, firms that are more financially constrained would value the ease of financing leases due to their high level of financial constraints. This chapter develops a dynamic model including these tradeoffs. The model predicts that firms with high uncertainty and firms that are more financially constrained lease more of their capital than firms with low uncertainty and firms that are less financially constrained.

Then, this chapter finds empirical evidence to support the prediction of the model by using the data of publicly-traded firms in the U.S.. I find that on average, firms with high uncertainty and firms with more financial constraints have a larger lease share than firms with low uncertainty and firms with less financial constraints. The distributions of the lease shares of firms with high uncertainty and firms with more financial constraints first order stochastic dominate the distributions of firms with low uncertainty and firms with less financial constraints. Results from panel regressions indicate that uncertainty and financial constraint are significantly positively related to leasing. Approximately, a one standard deviation increase in uncertainty and the financial constraint index increases a firm's lease share by 3.5 percent and 9 percent respectively; these effects are economically significant. Moreover, the countercyclical pattern of leasing over business cycles also provides an indirect evidence. Firms facing high uncertainty and tight financial condition during recessions tend to lease more of their capital.

The findings of this chapter have implications for corporate finance and macroeconomics. In studies of the effects of uncertainty and financial constraints on firms' investment, we should consider leased capital. From a macroeconomic perspective, credit constraint is recognized as an important transmission mechanism of business cycles. Moreover, uncertainty shocks are recently proposed as a new shock that drives business cycles in the literature. Better understanding of the effects of uncertainty and financial constraints on firms' investment behavior is therefore critical for us to study economic growth and business cycles. Lastly, corporate leasing behavior has many features in common to the housing decisions of households. Under-

standing corporate leasing behavior can help us understand the rent versus buy decision in the housing market.

Chapter 2

Leasing and Business Cycles

2.1 Introduction

How firm financing varies over business cycles is an important research question. An increase or decline in the amount of external funds that firms can raise is directly related to firm investment, and thus in turn further alleviate or worsen the recession. Research often focuses on debt and equity finance. It is important to include leasing finance, which is one of the most important external sources of financing. This chapter explores the role of business cycles in determining firms' leasing decisions. It empirically documents the countercyclical behavior of leasing, and develops a model to provide explanations for this countercyclical pattern.

Leasing is of first order importance as a source of financing. According to the Compustat data[21], nearly all listed firms in the U.S. indicate their usage of operating leases[22], whereas 86 percent of firms have long-term debt. In addition, operating leases accounts for 7.4 percent of firms' total assets, and the value of long-term debt equals 10.6 percent[23]. As a source of external financing, leasing is comparable to long-term debt. An average publicly-traded firm in the U.S. leases more than 30 percent of its capital. For small firms that are not publicly traded, leasing is even more important. Eisfeldt and Rampini (2009) use micro data from the 1992 U.S. Census of Manufactures and show that the smallest decile firms lease 46 percent of

[21] The sample consists of 122,297 observations for firms on Compustat over the period of 1984 through 2008. Foreign incorporated companies and a few industries are excluded. Details of the data are in Section 2.

[22] A lease is classified either as an operating lease or a capital lease for financial accounting purposes. This work focuses on operating lease.

[23] Measures are from Graham et al. (1998).

their capital. They claim that leasing may be the largest source of external finance for these small firms. Therefore, leasing has a particular importance in understanding the capital structure and investment of firms, which have been argued to play a key role in determining business cycle fluctuations and economic growth.

This chapter uses a firm level panel data set of listed firms in the U.S. from 1984 to 2008. I adopt two approaches from Covas and Den Haan (2011) to investigate the cyclical behavior of leasing. The first approach forms firm size groups, and constructs the time series data of the average lease share in each group. Cyclicality of leasing is then measured by the correlation between the cyclical components of these average lease share series and the cyclical component of real GDP. The first approach indicates a significantly negative correlation between the cyclical component of GDP and average lease share. The second approach is a panel data approach that relates firms' lease share to both firm-specific variables and a business cycle indicator. This panel data approach can quantitatively assess the effect of the business cycle on firms' leasing behavior. The estimated coefficients of the business cycle indicator are significantly negative. According to the estimation, the lease share decreases approximately 2 percent when the economy condition changes from the worst (Year 1991 in the sample period) to the best (Year 2000). Both approaches conclude that leasing is countercyclical over business cycles. Firms prefer to lease more of their capital during economic downturns, and are more willing to buy capital during up cycles.

Why do firms lease more capital when the economy is in recession? This is because firms face tight financing conditions during recessions than booms. Leases are easier to finance than purchases (Zhang (2012)). Although leasing is a more costly way of financing than owning capital because of the agency costs originated from the separation of ownership and control, the benefit of easiness to finance outweighs the high cost for financially constrained firms. More financially constrained firms lease more of their capital than less constrained firms (Eisfeldt and Rampini (2009) and Zhang (2012)). Firms face more severe financing conditions during recessions than

booms (Jermann and Quadrini (2012)). Figure 2.1 shows an index of credit tightness constructed from a survey among senior loan officers of banks. Clearly, banks tighten credit standards for commercial and industrial loans in recessions. Firms have difficulties in obtaining bank loans to support their purchases in recessions, thus choose to lease capital instead. Therefore, leasing is more prevalent in recessions.

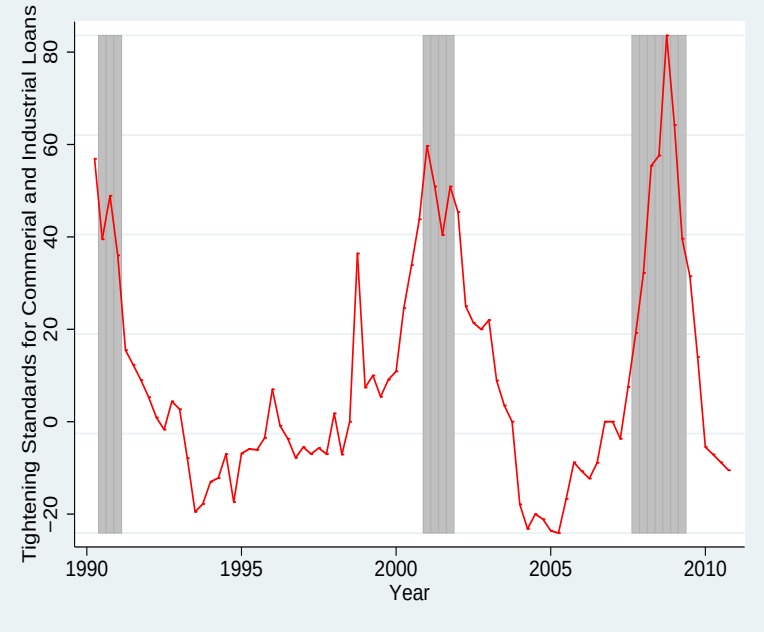

Figure 2.1: Financial Conditions Notes: Sources: Federal Reserve Bank. Gray shaded area is quarters in recession defined by NBER.

In this chapter, I also develop a model to explain the observed countercyclical pattern of leasing. The model analyzes the decision of leasing versus secured borrowing in an economy with overlapping generations. I use this model to simulate the impact of a temporary technology shock during the business cycle. I find that a positive technology shock generates a rapid decrease in the average lease share in the economy. The model's simulation is consistent with the observed countercyclical fact.

There is an extensive literature on leasing in finance, but the main focus

of literature is tax considerations. However, the economics of leasing are recognized beyond tax minimization. Smith and Wakeman (1985) provide an informal list of non tax characteristics of users and lessors that influence the leasing decision. Following Smith and Wakeman (1985), a small but growing literature have focused on the non tax aspects of leasing. In particular, Eisfeldt and Rampini (2009) incorporate financial constraints into a model of the choice between leasing and secured lending. Their model implies that more financially constrained firms lease more of their capital than less constrained firms. Zhang (2012) investigates the role of uncertainty and financial constraint in understanding the leasing decisions of corporate firms. She finds that firms with high uncertainty over their future profits and firms that are more financially constrained prefer to lease more of their capital than firms with low uncertainty and firms that are less financially constrained. All these papers focus on firms' incentive to lease while this work's focus is on how firms leasing behavior changes over business cycles.

This chapter is also related to a series of papers study the cyclical behavior of other sources of external finance. Jermann and Quadrini (2012) use aggregate data and find that debt is procyclical and equity issuance is countercyclical. In contrast, Covas and Den Haan (2011) document that both debt and equity issuance are procyclical for most size-sorted firm categories of listed U.S. firms by using Compustat data. I am the first, to the best of my knowledge, to document the cyclical behavior of leasing and theoretically explain the countercyclical pattern.

The findings of this chapter have implications for corporate finance and macroeconomics. In studies of firm investment over business cycles, attention should not be limited to capital expenditures. Leased capital should also be considered. From a macroeconomic perspective, current business cycle models typically assume that external finance occurs only through one-period debt contracts (e.g. Kiyotaki and Moore (1997), Bernanke et al. (1999)). In these models, the key mechanism by which the effects of shocks persist and are amplified is the dynamic interaction between credit limits of secured borrowing and asset price returns. The facts that firm lease more that 30 percent of their capital and their leasing behavior is countercyclical

over business cycle suggest studying a new transmission mechanism.

This chapter is organized as follows. The next section empirically documents the countercyclical behavior of leasing by examining the correlation and running panel regressions to quantify the magnitude. Section 3 lays out the model and presents the simulation analysis. Concluding remarks are offered in Section 4.

2.2 Empirical Results

2.2.1 Data

The data source that this work uses is Standard and Poor's Compustat. Included in the panel are annual observations of publicly listed U.S. firms from 1984 to 2008. Foreign incorporated companies are excluded. This chapter focuses on the period after 1984 for three reasons. First, by excluding the seventies, the analysis avoids issues related to possible missing values and the bad coverage of some variables by Compustat during this period. Second, several empirical studies have documented a change in the behavior of several economic variables, and the so–called Great Moderation of 1984. Third, as documented in Jermann and Quadrini (2012), major changes have been seen in U.S. financial markets during this period compared to the previous period. These changes can have impacts on firms' external finance.

Several industries are excluded from the panel in this work. I exclude financial (two-digit SIC codes: 60-67), utilities (49) and public administration (91-97)[24]. I also exclude industries including those where real property or natural resources are a large portion of firm's capital, like petroleum refining (29), mining (10-14), agriculture and fishery (1-9). In this work, I focus on the leasing behavior of the lessee. Although commercial banks, insurance companies, and finance companies do most of the leasing, it is necessary to exclude those industries where the main line of business involves leasing such as auto repair (75) and computer rental and leasing (73). Thus, I examine

[24]The economy condition could directly affect government spending that is very important to public administration industry. Thus, I exclude firms in the public administration industry.

firms in construction, manufacturing, transportation, wholesale, retail, and service.

My full data set is an unbalanced panel of 13,691 firms with 122,297 firm-year observations. Firm entry or exit could distort the dependence of the cyclical properties. For example, new entry firms are typically small firms and prefer to lease capital. Therefore, I consider a survivor subset sample in which firms are only included if they have been in the Compustat data set for all 25 years from 1984 to 2008. There are 891 firms in the subset sample. In the main text, I report results for both the full sample and the subset sample.

Firms are categorized by firm size. Firm size categories are based on the mean of the deflated book value of assets[25]. Four quartile size categories are used in the analysis.

2.2.2 The Measure of Leasing

The main data item from the Compustat that this chapter uses is the reported rental expenses (operating lease expenses) from the income statements. The fraction of capital from leasing (the lease share) is measured by the ratio of rental expense to the total cash expenditures on rent and investment[26]. The total cash expenditures on rent and investment is the sum of rental expenses and capital expenditures.

$$lease\ share = \frac{rental\ expenses}{rental\ expenses + capital\ expenditures} \tag{2.1}$$

Lease shares below 0 are set equal to 0, and lease shares above 1 are set equal to 1.

A second measure of lease shares would be the ratio of rental expenses to the total capital cost which is the sum of rental expenses, depreciation expenses, and the opportunity cost of fixed assets (Sharpe and Nguyen

[25] I also categorizes firms by their number of employees, and all empirical findings are robust.

[26] Eisfeldt and Rampini (2009) use the same measure except that their information of rental expenses is from Census data.

(1995)). I use the firm's reported short-term average borrowing rate to represent the firms' opportunity costs. However, only about a quarter of my observations in the full sample report the short-term average borrowing rate[27]. Although I did a robustness check for all empirical analysis by using the second measure of lease shares and found that all findings are robust, I will focus on the first measure of lease shares in this work.

My measure for real activity is real gross domestic product per capita.

2.2.3 Sample Statistics

Table 2.1 presents the mean values of lease share by firm size group. The Panel A of Table 2.1 reports the summary statistics for the full sample. In the full sample, an average firm leases 33.5 percent of its capital. Firms in the smallest quartile rent more than 40 percent of their capital, whereas firms in the top quartile rent about 25.8 percent of capital on average. The fraction of leased capital is monotonically decreasing across size groups. Small firms lease more of their capital than large firms. It is consistent with the findings in Sharpe and Nguyen (1995) and Eisfeldt and Rampini (2009).

The Panel B of Table 2.1 shows the descriptive statistics of the subset sample. Leases account for 28.8 percent of the capital on average. The lease share ranges from a low of 24.8 percent for the largest quartile firms to a high of 36.2 percent for the smallest quartile firms. In the subset sample, the fraction of leased capital is still monotonically decreasing across size groups. Leased capital is important for all firms, but is of particular importance for small firms. The average lease share in the subset sample is smaller than the average lease share in the full sample.

[27]For firms with missing values of short-term average borrowing rate, I use the sample average interest rate reported that year by firms with the same bond rating (as Sharpe and Nguyen (1995)). There are five rating groups based upon Standard and Poor's senior debt ratings. Five groups are AAA through AA-, A+ through A-, BBB+ through BBB-, BB+ through D, and unrated. The average reported interest of the top rated group was 1 to 2 percent lower than that of the unrated group. There are a few outliers whose reported short-term average borrowing rates are higher than 20 %. I replace such values with the sample average rate reported by firms with the same bond rating in the same year.

Table 2.1: Lease Share of Total Capital Costs

Panel A: Full sample

Firm Size Group	Mean	Std. Dev.	Obs.
0%-25%	0.439	0.237	23,353
25%-50%	0.364	0.206	28,950
50%-75%	0.322	0.201	32,078
75%-100%	0.258	0.184	37,916
Total	0.335	0.214	122,297

Panel B: Subset sample

Firm Size Group	Mean	Std. Dev.	Obs.
0%-25%	0.362	0.235	4,473
25%-50%	0.268	0.182	4,724
50%-75%	0.279	0.190	4,839
75%-100%	0.248	0.161	4,907
Total	0.288	0.197	18,943

2.2.4 Correlation Results

It is well known that debt and equity issuance are procyclical (Covas and Den Haan (2011)). However, less is known about leasing. I adopt two approaches which are used in Covas and Den Haan (2011) to examine the cyclical pattern of leasing behavior. The first approach measures cyclicality by using the correlation between the cyclical components of lease share series and the cyclical component of real GDP. This approach is commonly used in the macroeconomics literature. The correlation between an individual firm's lease share and the real GDP is likely to be small because of idiosyncratic shocks. Therefore, I first generate time series of average lease share by size group, and then document the cyclical behavior by looking at the correlation between the HP-filtered group average lease shares and HP-filtered GDP[28].

The cyclical properties of leasing is documented in Table 2.2. The corre-

[28]I use a weight of 100 in the filter to extract the cyclical component from annual data.

lation of output and the lease share of all firms in the full sample is negative, with a point estimate of -0.462. For the subset sample the correlation is -0.563, strongly negative and statistically significant. The countercyclical nature of firms' leasing behavior is more clearly presented when graphed. Figure 2.2 plots the cyclical components of average lease share series of all firms in the full sample and in the subset sample against GDP. All lease share series counter move with GDP[29]. The boom in 2000 is associated with considerable drop in the level of lease share, and the recession in 1991 is associated with a rise in the lease share. I conclude that leasing is countercyclical over business cycles. These properties also hold, and are even stronger when we use the book value of asset as weights in calculating the aggregate lease share series.

Table 2.2: Cyclical Behavior of the Lease Share

Full Sample		Subset Sample	
Size Group	Correlation	Size Groups	Correlation
0%-25%	-0.322	0%-25%	-0.331
	(0.354)		(0.31)
25%-50%	-0.426	25%-50%	-0.628***
	(0.324)		(0.214)
50%-75%	-0.54**	50%-75%	-0.638***
	(0.241)		(0.186)
75%-100%	-0.649***	75%-100%	-0.575**
	(0.193)		(0.242)
All firms	-0.462	All firms	-0.563**
	(0.3)		(0.24)

Notes: Standard errors are computed using a GMM approach adapted from the Hansen, Heaton, and Ogaki GAUSS programs, and are reported in parentheses. *, **, *** statistically significantly different from zero at the 10%, 5% and 1% level of significance.

[29]The lease share is defined as rental expenses over the sum of rental expenses and capital expenditures. I examine the cyclical patterns of rental expenses and capital expenditures separately. The rental expenses are countercyclical over business cycles, whereas the capital expenditures are procyclical. Firms substitute their purchases by leasing capital during recessions.

Figure 2.2: Cyclical Behavior of Lease Share

As documented in Table 2.2, I find that for both samples, the countercyclical pattern is not very strong in the bottom quartile group (0%-25%). The correlation coefficients in the bottom quartile group are small and insignificant. The second quartile group (25%-50%) of the full sample has higher negative value than it has in the bottom quartile group, but the correlation coefficient is still insignificant. The leasing behaviors in all remaining large size groups for the full sample are significantly countercyclical. For the subset sample, all quartile groups except the bottom one have significantly countercyclical pattern.

2.2.5 Panel Regressions

Although it is common in the macroeconomics literature to characterize cyclicality by looking at the correlation, it cannot quantitatively assess the cyclical movements. The correlation coefficients do not help us evaluate the magnitudes of the changes in the lease share over the business cycle. In this subsection, I use panel regressions to provide such an assessment.

The literature has pointed out that cash flow and Tobin's Q are likely to be indicators of future firm profitability. It is important to establish the empirical finding of firms' leasing behavior while controlling for cash flows and Tobin's Q. The specification is similar to the well known regression specification used to study the effects of cash flows and Tobin's Q on investment. The specification of the regression equation is the following:

$$\begin{aligned} LS_{i,t} =& \alpha_0 + \sum_{j=1}^{J} I_{i,j}(j)(\alpha_{j,t}t + \alpha_{j,t}t^2 + \alpha_{j,Y^c}Y_t^c + \alpha_{j,CF}(\frac{CF_{i,t}}{A_{i,t}} - \frac{\overline{CF_{j,t}}}{A_{j,t}}) \\ &+ \alpha_{j,Q}(Q_{i,t} - \overline{Q_{j,t}})) + v_i + u_{i,t} \end{aligned} \tag{2.2}$$

$LS_{i,t}$ is the lease share of firm i at year t. $I_{i,t}(j)$ is an indicator function that takes on a value equal to 1 if firms i is in group j and equal to 0 if not in group j. I use the same four size groups for both the full sample and the subset sample. For the cyclical component of output Y_t^c, I use the scaled

HP-filtered GDP. The minimum observed value of HP-filtered GDP (Year 1991 in the sample period) is set to 0 and the maximum observed value (Year 2000 in the sample period) is equal to 1. Thus, the scaling ensures that the coefficient α_{j,Y^c} measures the change in the lease share when the economy moves from the worst to the best. The lease share displays trend, therefore, I add a linear and a quadratic trend as explanatory variables. Firm level cash flow is scaled by the total assets. In order to measure how the firms' cash flow and Tobin's Q change relative to the observed values of the other firms in the same group, I subtract cash flow over assets and Tobin's Q from each group mean in the corresponding period. In addition, I control for firm fixed effect v_i in the regressions.

The results for panel regressions are reported in Table 2.3. Panel A reports the results for the full sample. All size groups have highly significant and negative coefficients on the cyclical component of GDP. The lease share is countercyclical in all size groups. The lease share increases approximately 2 percent when the economy moves from the best condition (Year 2000) to the worst condition (Year 1991). Coefficients on cash flow are insignificant in most size groups except in the second quartile. [30]. Tobin's Q is significantly and positively related to leasing in all size categories. Tobin's Q is used as a measure of financial constraints since such constraints imply that the value of capital inside the firm exceeds its replacement cost. Low cash flow and high Tobin's Q indicate that the firm is financially constrained. A positive relationship between Tobin's Q and leasing suggests that financially constrained firms lease more of their capital.

Panel B of Table 2.3 reports the panel regression results of the subset sample which only includes firms that are in the Compustat data set in all 25 years. The lease share is also countercyclical in all size groups. When the economy changes from the best condition (year 2000) to the worst condition (year 1991), the fractions of leased capital increases more than 2 percent.

[30] I also have a robustness check by adding interaction terms of cash flow and Yc. The coefficients on the interaction terms for all size groups are slightly positive. The results indicate that GDP fluctuations have smaller effects on the leasing behavior of those firms that have more cash flow and are less financially constrained.

Table 2.3: Panel Regression Results for the Lease Share

Panel A: Regression of the Full Sample

	Y^c	Cashflow/Asset	Q
Size 0%-25%	-0.018***	0.000	0.000**
	(0.003)	(0.000)	(0.000)
Size 25%-50%	-0.028***	-0.011***	0.004***
	(0.003)	(0.001)	(0.000)
Size 50%-75%	-0.032***	0.002	0.004***
	(0.003)	(0.002)	(0.000)
Size 75%-100%	-0.026***	0.001	0.002***
	(0.002)	(0.004)	(0.000)
Within R^2		0.032	
No. of Obs.		101,908	

Panel B: Regression of the Subset Sample

	Y^c	Cashflow/Asset	Q
Size 0%-25%	-0.021***	-0.001	0.002***
	(0.006)	(0.001)	(0.000)
Size 25%-50%	-0.023***	-0.033**	0.003***
	(0.006)	(0.013)	(0.001)
Size 50%-75%	-0.022***	-0.053**	-0.001
	(0.006)	(0.020)	(0.002)
Size 75%-100%	-0.024***	-0.059**	0.003*
	(0.006)	(0.025)	(0.002)
Within R^2		0.041	
No. of Obs.		17,237	

Notes: In the regressions, I control for firm fixed effects. Standard errors are in parentheses. *, **, *** statistically significantly different from zero at the 10%, 5% and 1% level of significance.

Cash flow to assets is negatively related to leasing, and Tobin's Q is positively related to leasing in most size groups.

Overall, the panel regressions suggest that leasing is countercyclical for all size-sorted categories of listed U.S. firms.

2.2.6 Distribution

The results of the panel regressions together with the negative correlation between the HP-filtered lease share and GDP suggest that leasing is countercyclical over business cycles. It is worth a comparison of the distributions of lease share in booms and recessions. Using the subset sample to draw the distributions avoids the disturbance from firms' enter and exit since the subset sample only includes firms who are in the data set every year.

Figure 3.3 plots the distributions of lease share of the subset sample in 1991, 1999, 2000, and 2008. Year 1991 and year 2008 are two recessions over the sample period, and the boom years are 1999 and 2000. We clearly see that the distribution shifts to right in recession years. Firms lease more capital in recessions.

2.2.7 Why Leasing is Countercyclical

From the prospective of lessors, in the U.S. bankruptcy code, it is much easier for a lessor to repossess an asset than it is for a secured lender. The lessor is less concerned with the lessee's default, and thus is unlikely to require the lessee to provide collateral for a leasing agreement. The lessee only needs to pay a leasing fee for one period in advance. But on the other hand, if a firm purchases capital, they would need to pay the full price up front. Even if a firm uses debt to finance their purchase, the lender might require collateral for the loans. Therefore, leases are easier to finance than purchases. This is one advantage of leasing. As a result, firms who are more financially constrained would lease more of their capital, as suggested by Eisfeldt and Rampini (2009) and Zhang (2012). In terms of business cycles, firms are more financially constrained during recessions than during booms. During recessions, demand and sales are low; thus firms have

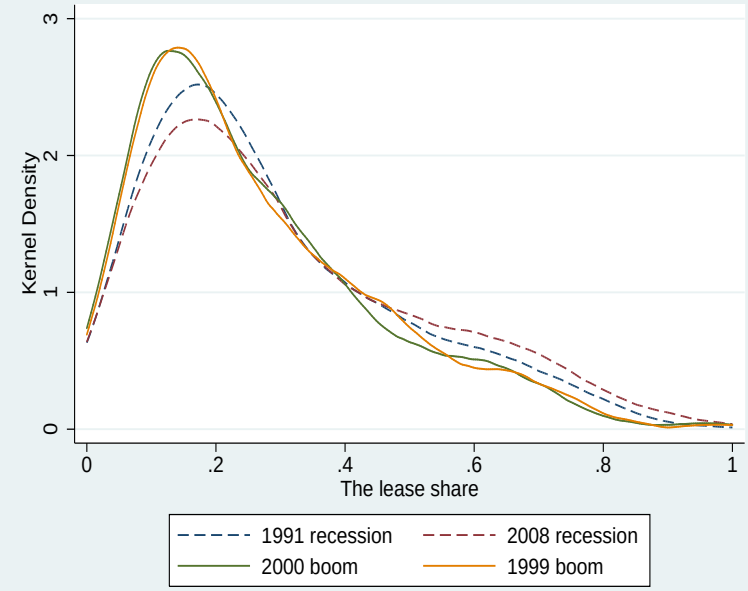

Figure 2.3: Distributions of Lease Share

less sales revenue and less internal funding. Moreover, debt and equity are both procyclical (Covas and Den Haan (2011)). As suggested by Figure 2.1, banks tighten credit standards for loans in recessions. The amount of funds that firms can raise externally through debt and equity issuance decline during an economic downturn. Firms don't have enough internal funding and can't raise enough external finance through debt and equity to support their capital purchases. Therefore, they decrease their investment on purchasing capital. Since firms buy less capital in recessions than they should have, the marginal return of capital is higher, and thus leasing is more attractive in recessions. Although leasing costs more in the long run, the benefits of leasing outweigh the costs. Firms lease more in recessions.

2.3 Financial Constraint, Leasing versus Secured Borrowing

2.3.1 The Environment

I consider an economy with overlapping generations. Time is discrete and indexed by $t = 0, 1, 2, ...$ At each time t, a generation with measure one is born. Generations live for two periods. In the economy, I have two goods, a durable asset and a nondurable commodity. Like Kiyotaki and Moore (1997), we can think of the durable asset as land, which does not depreciate and has a fixed total supply of $\bar{K}$[31]. The nondurable commodity may be thought of as consumption good. Agents have identical preferences, born with the same endowments of land (e), and access to the same aggregate productive technologies (A_t). But agents differ in their idiosyncratic productivity (ω). The preference of an agent born in generation t are $d_{0t} + \beta d_{1t+1}$, where d_{0t} and d_{1t+1} are the non-negative dividends at time t and at time $t + 1$.

At time t, each agent in generation t receives the endowment of land e, and observes the aggregate productivity A_t and his idiosyncratic productiv-

[31] Fixed supply of capital is not the crucial factor to the mechanism of the model. The key mechanism is the financial constraint.

ity $\omega \in \Omega$ which is distributed independently and identically across agents with density $\pi(\omega)$ on Ω. Each young agent has access to a concave production technology that produces consumption good of $A_t \omega e^{\alpha}$. At the end of period t, each young agent chooses how much to pay dividend, and how much to invest in buying capital and leasing capital to use in the production at the next period time $t+1$. They can buy capital (i_b) or lease capital (i_l), and both i_b and i_l are non-negative. Owned capital and leased capital are assumed to be perfect substitutes in production, $k = i_b + i_l$. Furthermore, an agent can borrow or save at a rate of return $R = 1/\beta$, which is determined exogenously. An agent can only borrow against a fraction $0 \leq \theta \leq 1$ of the resale value of his owned capital and cannot borrow against future output. Thus, the agent needs to provide collateral for loans.

At time $t+1$, each old agent (generation t) produces consumption good of $A_{t+1}\omega_{t+1}k^{\alpha}$, where k is the capital that the agent chooses at the end of period t. The ω_{t+1} is agent's new idiosyncratic productivity which is distributed independently and identically across agents with density $\pi(\omega)$ on Ω. After the production, each old agent sells his owned capital to agents from the next generation (generation $t+1$), returns the leased capital to the lessor, pays his debt and pays the remaining consumption goods as dividend. The government collects a tax $1-\phi$ from holding the capital for both firms and financial intermediary. Therefore, the government has $(1-\phi)\bar{K}$ unit of capital and give this equally to new born agents.

I consider a stationary equilibrium where the price of the capital is determined such that the capital market is clear.

2.3.2 The Agent's Problem

Consider the problem of an agent in generation t, $t \in 0, 1, 2, ...$ Since all generations are identical, I only consider the problem of one generation to simplify notation. Agents take the price of owning capital q_t, the price of leasing capital U_L, and the rate of return R as given. They maximize their utility by making choice of paying dividends, investment in buying capital and leasing capital, and borrowing after observing the first period aggre-

gate productivity and idiosyncratic productivity. Specifically, the agent's problem is:

$$\max_{(d_{0t},d_{1t+1},i_b,i_l,b)} E_t(d_{0t} + \beta d_{1t+1})$$

subject to

$$d_{0t} + q_t i_b + U_L i_l = A_t \omega e^{\alpha} + \phi q_t e + b \tag{2.3}$$

$$d_{1t+1} + Rb = A_{t+1}\omega_{t+1}(i_b + i_l)^{\alpha} + \phi q_{t+1} i_b \tag{2.4}$$

$$Rb \leq \phi\theta E_t(q_{t+1} i_b) \tag{2.5}$$

$$0 \leq i_l \tag{2.6}$$

$$0 \leq i_b \tag{2.7}$$

$$0 \leq d_{0t} \tag{2.8}$$

$$0 \leq d_{1t+1} \tag{2.9}$$

Equations (2.3) and (2.4) are the budget constraints of generation t for time t and $t+1$. Constraint (2.5) is the borrowing constraint which restricts borrowing to a fraction θ of the resale value of capital after tax. Moreover, (2.6), (2.7), (2.8) and (2.9) are the non-negativity constraints on investments and dividends.

2.3.3 Lessor's Problem

In this work, I mainly focus on the demand side of leasing capital and assume the financial intermediary is the lessor. A competitive lessor maximizes its profits with the equilibrium leasing rate U_L as given. The lessor provides i_l unit of capital to the lessee. I assume that there is no deadweight cost when the lessor repossesses the capital[32]. And there are no transaction costs when trading leased capital. The financial intermediary is able to sell the amount of capital i_l at the price q_{t+1} when the capital is returned at time

[32]In the U.S. Bankruptcy law, a lessor has specific advantages over a secured lender in terms of the ability to regain control of an asset.

$t+1$, and needs to pay a fraction of tax. However, leased capital is subject to an agency problem due to the separation of ownership and control. The lessor has to spend m units of final good on maintenance after repossessing the capital. The lessor's problem is:

$$\max_{i_l} U_L i_l - q_t i_l + \frac{\phi q_{t+1} i_l}{R} - \frac{m i_l}{R}$$

The first-order-condition implies that

$$U_L = q_t + \frac{m}{R} - \frac{\phi q_{t+1}}{R} \tag{2.10}$$

As long as the maintenance cost is greater than zero, the lease rate U_L is higher than the implicit rental rate on owned capital which is $q_t - \frac{\phi q_{t+1}}{R}$. The lessor makes zero profits in equilibrium.

The financial intermediary is also a lender. It lends money to firms who want to borrow to finance their purchases at the exogenously given rate of return R. In the equilibrium, The financial intermediary is indifferent between lending capital or lending money, and it earns zero profits.

2.3.4 Equilibrium

A equilibrium for an economy $\{\beta, \alpha, m, \theta, \phi, \Omega, \pi(\omega)\}$ is a sequence of prices q_t and an allocation of dividends $\{d^*_{0t}(\omega), d^*_{1t+1}(\omega)\}$, investments in leased and owned capital $\{i^*_{bt}(\omega), i^*_{lt}(\omega)\}$, and borrowing $\{b^*_t(\omega)\}$ for all $\omega \in \Omega$ such that:

1. The allocation solves the problem of each agent, $\forall \omega \in \Omega, t$,
2. Given the price of capital q_t, the capital market clear $\forall t$:

$$\sum_{\omega \in \Omega} \pi(\omega)(i^*_{lt}(\omega) + i^*_{bt}(\omega)) = \phi \bar{K}$$

The left hand side is the aggregate amount of capital bought or leased by generation t at the end of period t. The right hand side is the aggregate amount of capital which are available for purchasing or leasing at the end

of period t. The government collects a fraction of $1-\phi$ of $\bar{K}$ at the end of period t, and distribute them equally to new born generation $t+1$ at the beginning of period $t+1$. In this work, I only consider a partial equilibrium, and I assume that the financial intermediary is willing to provide debt to agents at a exogenous given rate of return R. Therefore, the debt market is not clear in equilibrium.

2.3.5 Characterization

If the purchase price of the capital was not expensive in terms of its leasing rate, then all agents would only buy capital, since the implicit rental rate on owning capital is cheaper than the lease rate as long as the maintenance cost is greater than zero. In this case, all capital is purchased in the economy. On the other hand, if the purchase price of the capital was too expensive in terms of its leasing rate, then all agents would never purchase their capital and instead choose to lease capital. Under the condition, all capital is leased in the economy. In order to guarantee an equilibrium in which leasing and purchasing coexists, the price of capital is assumed to satisfy the following assumption.

Assumption 1 *The price of capital satisfies* $\frac{Rm}{1-\phi} > q > \frac{Rm}{1-\beta\theta\phi}$ *in equilibrium.*

The proofs of all assumptions and propositions are in the Appendix.

I characterize the solution to the agent's problem under the assumption. In such an economy, any agent who leases a positive amount of capital must be financially constrained and he pays zero dividend in the first period. The financially constrained agent always wants to postpone paying dividend because the preference is linear. I obtain the following proposition.

Proposition 6 *Suppose* $\frac{Rm}{1-\phi} > q > \frac{Rm}{1-\beta\theta\phi}$. *If* $i_l > 0$, *then the multiplier on the borrowing constraint* $\lambda_B > 0$ *and* $d_0 = 0$.

I characterize the solution to the agent's problem as a function of his first period idiosyncratic productivity ω.

Proposition 7 *There exist cutoff levels of idiosyncratic productivity* $\bar{\omega}_L < \bar{\omega}_B < \bar{\bar{\omega}}$ *and levels of capital* $\bar{k} < \bar{\bar{k}}$ *such that the solution to the agent's problem satisfies:*

1. *For* $\omega \leq \bar{\omega}_L$, $i_l > 0$, $i_b = 0$, *and* $b = 0$. *Moreover,* $\frac{\partial i_l}{\partial \omega} > 0$.
2. *For* $\bar{\omega}_L \leq \omega \leq \bar{\omega}_B$, $i_l > 0$, $i_b > 0$, *and* $b = \frac{\phi\theta q i_b}{R}$. $i_l + i_b = \bar{k}$. *Moreover,* $\frac{\partial i_l}{\partial \omega} < 0$ *and* $\frac{\partial i_b}{\partial \omega} > 0$.
3. *For* $\bar{\omega}_B \leq \omega \leq \bar{\bar{\omega}}$, $i_l = 0$, $i_b > 0$, *and* $b = \frac{\phi\theta q i_b}{R}$. *Moreover,* $\frac{\partial i_b}{\partial \omega} > 0$.
4. *For* $\omega > \bar{\bar{\omega}}$, $i_l = 0$, $i_b = \bar{\bar{k}}$, *and* $b < \frac{\phi\theta q i_b}{R}$.

The lease versus buy decision depends on agents' first period idiosyncratic productivity. Agents with low idiosyncratic productivity ($\omega < \bar{\omega}_L$) are most financially constrained firms. Their marginal cost of leasing capital is smaller than their marginal cost of buying capital. Thus, they only lease capital. Since they don't own capital to be the collateral, they can't borrow from the financial intermediary. Moreover, their marginal product of producing is larger than their marginal cost of leasing. They lease as much capital as they can. When the idiosyncratic productivity increases to a range $(\bar{\omega}_L, \bar{\omega}_B)$, agents invest in both leased capital and owned capital. Now, the marginal cost of leasing is the same as the marginal cost of owning. As idiosyncratic productivity increases, agents substitute leasing by purchasing capital. When agents' idiosyncratic productivity is in the range of $(\bar{\omega}_B, \bar{\bar{\omega}})$, they only purchase capital. They are also financially constrained, and borrow at their full debt capacity. When agents have very high idiosyncratic productivity ($\omega > \bar{\bar{\omega}}$), they are not constrained. They only purchase capital. They choose a optimized amount of capital to make the marginal product equals to the marginal cost. Their collateral constraints are relaxed as idiosyncratic productivity increases.

2.3.6 A Temporary Increase in Aggregate Productivity

As mentioned in the last subsection, there are several cutoff levels of idiosyncratic productivity which determine lease versus buy decision in the equilib-

rium. These cutoff levels depend on the first period aggregate productivity. When we have a temporary positive shock to aggregate productivity, these cutoff levels of idiosyncratic productivity decrease.

Because it is a temporary shock on aggregate productivity at time t, it doesn't affect generation $t+1$'s investment decision. The demand side of the capital at period $t+1$ would not change. In addition, generation t has to sell all his owned capital at the end of period $t+1$, the supply side of the capital in period $t+1$ is also fixed. Therefore, the price of capital q_{t+1} in the period $t+1$ would not change. A temporary shock to aggregate productivity at time t only affects agents in the current generation t.

Agents are richer when a positive aggregate productivity shock hits, and they are less financially constrained compared to with no shock. They would like to invest more capital because of larger net worth. Thus, the price of capital would increase since there is a constant supply of capital in the economy. The lease rate of capital also goes up. Meanwhile, their cutoff level of idiosyncratic productivity of leasing ($\bar{\omega}_L$) goes down. Some agents, who would only lease capital before, both purchase and lease capital now. The cutoff level of idiosyncratic productivity of purchasing capital ($\bar{\omega}_B$) goes down as well. Some agents who would both lease capital and purchase capital only purchase capital now. Putting it together, there are less agents who lease capital when the shock hits. Moreover, an increase in the lease rate decrease the amount of capital agents can lease although they face a positive aggregate productivity shock. Those agents who lease lease less of their capital compared to with no shock. Therefore, the total amount of leased capital in the economy decreases.

A numerical example can give us a good understanding about how things go when there is a positive productivity shock. Table 2.4 shows the original steady state value of the numerical example and the new values when there is a 1 percent temporary increase in the aggregate productivity. When the shock hits, the price of capital is 0.17 percent higher than the original steady state, and the leasing price increase 1.19 percent. All cutoff levels of idiosyncratic productivity drop. Now, few agents lease capital. The extensive margin decreases leasing by 1.39 percent. In addition, a one per-

cent increase in aggregate productivity induces a one percent increase in net worth, but the leasing price increase more than one percent. For those agents who lease, they lease less than they should if no shock hits. This is the intensive margin. The intensive margin decreases leasing activity by 2.7 percent. Together, the leasing activity decreases 4.1 percent in total. This numerical example clearly shows that a positive shock to aggregate productivity causes agents lease less capital. The financial constraint can explain the countercyclical pattern we observed in section 2.

Table 2.4: Results of a Numerical Example

	Original	1% Temporary Increase in TFP	
	Steady State	New Value	Percentage Change
Price of Capital	16.679	16.708	0.17%
Lease Rate	2.428	2.457	1.19%
Total Leased Capital	8.466	8.119	-4.10%
Cutoff Level 1 $\bar{\omega}_L$	0.166	0.162	-
Cutoff Level 2 $\bar{\omega}_B$	0.514	0.5	-
Cutoff level 3 $\bar{\bar{\omega}}$	2.418	2.361	-
Total Debt	1,053	1,057	0.38%
Extensive Margin		-0.118	-1.39%
Intensive Margin		-0.229	-2.70%

Notes: In this numerical example, I assume that the production technology parameter $\alpha = 0.3$, the collateralization rate $\theta = 0.8$, the tax rate of selling capital $1 - \phi = 0.05$, the discount factor $\beta = 0.96$, and the interest rate $R = 1.04$. I also assume that the steady state aggregate productivity A_t is equal to 1. I assume there are 2000 agents in each generation, and their idiosyncratic productivity is uniformly distributed: $\omega = [0.001 : 0.001 : 2]$. The mean of the idiosyncratic productivity is 1. The maintenance cost for the lessor of one unit of capital is assumed to be one unit of final good. There are 100 unit of capital in the economy.

2.4 Concluding Remarks

This chapter documents the cyclical behavior of leasing of listed U.S. firms. I find that leasing, as one of the most important external sources of financing, is countercyclical over the business cycle. Firms lease more during bad times, and are more willing to buy capital in up cycles. The distribution of the lease

share shifts to the right in recession years. I provide a plausible explanation about this countercyclical pattern. One key benefit of leasing is that leases are easier to finance than purchases. This benefit is particularly important to firms with financial constraints. Firms face tighter financial constraints during recessions. Therefore, leasing is more attractive during recessions. In this chapter, I also develop a model to explain the observed countercyclical pattern of leasing by including the financial constraint. The model predicts that a positive technology shock can generate a rapid decrease on the lease share in the economy. It is consistent with the empirical evidence.

Zhang (2012) suggests that uncertainty affects corporate leasing decisions. We know that over business cycles, uncertainty is strongly countercyclical (Bloom et al. (2010), Gilchrist et al. (2010)). Uncertainty could be another explanation of the countercyclical pattern of leasing. Future work might consider developing a model with both the financial constraint and uncertainty to match the observed pattern.

Furthermore, current business cycle models typically assume that external finance occurs only through one-period debt contracts. It would be interesting to modify the current business cycle models and examine the effects of shocks on the real economy by introducing the option of leasing.

Chapter 3

Leasing, Legal Environments, and Growth: Evidence from 81 countries

3.1 Introduction

Previous literature shows that leasing is one of the most important sources of external finance for both publicly traded firms and small and medium-size firms[33]. However, our knowledge about corporate leasing has been mostly derived from the U.S. firm data. There was little evidence of leasing in other countries. Given the importance of leasing in corporate external financing, the use of leasing across different countries should be a topic of significant research interest to academics and an issue of great importance to policy makers around the world. This study attempts to fill the gap in the literature by examining panel data about 70,000 listed firm-year observations in 81 developed and developing countries from Compustat Global.

In this chapter, I first examine the leasing choices of listed firms across different countries. Evidence suggests that firms in the developed countries lease more of their capital than those in the developing countries. For example, Japan has the highest ratio of lease share (51 percent) while an average firm in Egypt only leases 5 percent of its capital. Why do some countries have so much larger lease share than others? Then, I investigate what factors can explain this large difference. Many literature suggests that the differ-

[33]Zhang (2012) found that an average publicly-traded firm in the U.S. leases more than 37 percent of its capital, and Eisfeldt and Rampini (2009) indicated that the smallest decile firms in the census data lease 46 percent of their capital.

ences in the legal maturity might help explain why firms are financed so differently in different countries (La Porta et al. (1997) and La Porta et al. (1998)). Following their thoughts, I examine the relationship between leasing and legal environments. I use three variables – the rule of law, legal rights, and economic freedom to measure the legal environments. Previous literature (Eisfeldt and Rampini (2009), Berger and Udell (2006)) indicates that leasing should be prevalent in low income countries and in environments with weak law enforcement. However, I find that leasing decisions depends on legal environments but in an opposite way. The use of leasing increases significantly with increasing in the rule of law, legal rights, and economics freedom. Although leasing might be a good source of external finance in weak legal environments where firms have difficulty to obtain loans, firms would tend to avoid the use of leasing contracts because the contracts are costly to enforce.

I also investigate the relationship between leasing and growth. My analysis indicates that leasing has a measurable positive effect on firm growth. Leasing can help firms increase their capital availability and improve their operation efficiency, and thus may facilitate firm growth. Consequently, I examine the relationship between leasing and growth at the aggregate level. I find that subsequent growth in GDP per capita is significantly positively related to the average lease share of the country. Taken together, leasing finance might play a positive rule in growth. The results provide a policy implication that possible adjustments in legal systems could facilitate the availability of leasing and thus might generate real economic gains.

The chapter is organized as follows. The next section reviews the related literature. Then, Section 3 describes the data sets, and in section 4 I present the main results of the work. Concluding remarks are offered in section 5.

3.2 Literature Review

This chapter is related to several strands of literature. First, a series of paper study the corporate decisions to lease. Main focus of the corporate finance literature is the tax advantages of leasing. However, the economics

of leasing are recognized beyond tax minimization. Smith and Wakeman (1985) provide an informal list of non tax characteristics of users and lessors that influence the leasing decision. Following Smith and Wakeman (1985), a small but growing literature have focused on the non tax aspects of leasing. In particular, Eisfeldt and Rampini (2009) incorporate financial constraints into a model of the choice between leasing and secured lending. Their model implies that more financially constrained firms lease more of their capital than less constrained firms. Zhang (2012) investigates the role of uncertainty and financial constraint in understanding the leasing decisions of corporate firms. She finds that firms with high uncertainty over their future profits and firms that are more financially constrained prefer to lease more of their capital than firms with low uncertainty and firms that are less financially constrained.

One key potential benefit of leasing, as analyzed in Eisfeldt and Rampini (2009) and Zhang (2012), is to allow firms that are subject to financial constraints and don't have enough assets to pledge for loan collateral to access capital. Furthermore, people commonly believe that firms in low income countries or in environments with weak law enforcements are difficult to obtain loans. Thus, it is believed that the advantage of leasing on easy access to capital may be particularly important in low income countries and countries with weak legal environments. Moreover, there are more uncertainty about property rights in countries with weak legal environments. Leasing would be a better source of external finance than loans in low income countries and countries with weak legal environments. Although there is not a finite conclusion, previous literature indicates that leasing should be prevalent in low income countries and in environments with weak legal environments. However, the findings in this work do not support the hypothesis. I find that developed economies have higher usage of leasing activities than developing economies, and firms in strong legal environments lease more than those in weak legal environments. A study by Casas-Arce and Saiz (2010) rejects the above hypothesis as well by using evidence from housing markets in the developing countries. They show that renting of housing is underutilized in countries with weak law environments. Market participants will tend to

avoid the use of renting contracts in countries with weak legal systems because the contracts are costly to enforce. Leasing is a substitute of bank financing in presence of weak legal environments, but weak institutions at the same time also hinder the development of leasing.

Secondly, a strand of cross-country research in the literature investigates the impact of business environments on finance. La Porta et al. have a series of paper (La Porta et al. (1997) and La Porta et al. (1998)) study law and finance by using country level data from 49 countries. They show that countries with poorer investor protections, measured by the character of legal rules and the quality of law enforcement, have smaller and narrower capital markets. And they find that common-law countries generally have the strongest legal protections of investors, and French-civil-law countries have the weakest. Several papers also explore the relationship between institutions and external finance by using firm level data. For example, Chavis et al. (2011) study small firms in over 100 countries by using World Business Environment Survey data set. They find that across all countries younger firms rely less on bank financing and more on informal financing. Particularly related to this work is Brown et al. (2011). Their research utilizes data from the World Bank Investment Climate Survey, and studies the use of all sources of external financing around the world. They find countries with weak rule of law use much less formal financing (bank and lease financing) but instead rely more on informal sources of capital (friends and family financing). Their sample is a cross sectional data while my sample is a panel data set. Their sample includes small and medium-sized firms and well represents low income countries. My sample focuses on listed large firms which have more precise accounting procedures and financial statements, and my sample covers more high income countries. In addition, their paper focuses more on the switch out of informal finance toward to formal finance while my work's focus is on how legal environments affect leasing activities.

Lastly, this work is related to the literature on growth. Cross-country evidence has shown positive effects of financial system development on GDP growth (Levine et al. (2000), Levine (2005)). Moreover, several papers explore the effect of capital structure decisions on firm performance, at both

the firm and the country level. For instance, Saeed (2009) find that formal financing sources facilitate firm growth in transition economies. Ayyagari et al. (2010) studies a sample of Chinese companies, and conclude that although more firms used informal financing than bank financing, only bank financing was associated with higher growth rates. In particular, several papers point out the special role of lease financing in growth (Berger and Udell (2006), Brown et al. (2011)). Leasing can be useful in facilitating greater access to finance and helps alleviate firms' growth constraints. My work adds to this literature by examining the effect of leasing on both firm growth and GDP growth.

3.3 Data and Measurements

3.3.1 Data

The data source that this work uses is Standard and Poor's Compustat Global. Included in the panel are annual observations of listed firms from 1995 to 2010[34]. I restrict the sample to countries that have at least 5 firm observations in the sample period. Thus, in the sample, I have firms from 81 countries [35]. Several industries are also excluded from the panel in this work. I exclude financial (two-digit SIC codes: 60-67), and utilities (49). I also exclude industries including those where real property or natural resources are a large portion of firm's capital, like petroleum refining (29), mining (10-14), agriculture and fishery (1-9). In this work, I focus on the leasing behavior of the lessee. Although commercial banks, insurance companies, and finance companies do most of the leasing, it is necessary to exclude those industries where the main line of business involves leasing such as auto repair (75) and computer rental and leasing (73). Thus, I examine firms in construction, manufacturing, transportation, wholesale, retail, service and public administration. These selection criterions yield an unbalanced panel of 13,563 firms with 75,398 firm-year observations in 81 countries.

[34]The earliest measure of legal environments starts from 1995

[35]Detail information about 81 countries is shown in the appendix.

3.3.2 The Measure of Leasing

The main data item from the Compustat that this work uses is the reported rental expenses from the income statements. The fraction of capital from leasing (the lease share) is measured by the ratio of rental expense to the total cash expenditures on rent and investment[36]. The total cash expenditures on rent and investment is the sum of rental expenses and capital expenditures.

$$lease\ share = \frac{rental\ expenses}{rental\ expenses + capital\ expenditures} \tag{3.1}$$

Lease shares below 0 are set equal to 0, and lease shares above 1 are set equal to 1.

An alternative measure of lease shares would be the ratio of rental expenses to the total capital cost which is the sum of rental expenses, depreciation expenses, and the opportunity cost of fixed assets (Sharpe and Nguyen (1995)). However, the Compustat Global data set doesn't have any information, such as reported short-term average borrowing rate, to represent the firms' opportunity costs. I will focus on the measure of lease shares constructed by rental expense over total cash expenditures on rent and investment in this chapter.

3.3.3 Measures of Legal Environments

In my analysis, I use three measures of legal environments that have been identified by previous studies as important institutional characteristics for external finance and that are available for a wide range of countries and years that I examine.

The first measure is the rule of law which is from the Worldwide Government Indicators (WGI) project over the period 1996 to 2010. The rule of law (Kaufmann et al. (2010)) captures "perceptions of the extent to which agents have confidence in and abide by the rules of society, and in partic-

[36]Eisfeldt and Rampini (2009) use the same measure except that their information of rental expenses is from Census data.

ular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence". It is a broad measure of the legal environment, but it also contains specific factors that are particularly related to external finance, such as the quality of contract enforcement and property rights. The rule of law ranges from -2.5 to 2.5. In the sample, Zimbabwe is the country with the weakest rule of law. Four northern European countries, Finland, Norway, Denmark, and Sweden, have the highest scores of the rule of law.

In order to supplement the rule of law, I utilize a second indicator of legal environment – legal rights from the World Bank. The legal rights measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. The index ranges from 0 to 10, with higher scores indicating that these laws are better designed to support access to credit. The information of legal rights is available since 2004. New Zealand, United Kingdom, Singapore, Hong Kong, Latvia, Malaysia, South African, and Kenya have the highest legal rights (10 points), while Venezuela has the lowest score (just 1 point).

Lastly, I consider the economic freedom index which is constructed by the Heritage Foundation. It is on a scale of 0 to 100 and collected since 1995. The index of economic freedom measures country performance in 10 separate areas, property rights, freedom from corruption, fiscal freedom, government spending, business freedom, labor freedom, monetary freedom, trade freedom, investment freedom, and financial freedom. Hong Kong is the region with the highest economic freedom, and Zimbabwe is the least economic free country.

These three measures capture a wide range of important legal factors related to the possible determinants of firms' leasing behavior. The correlations of these measures are shown in Table 3.1. Although these three measures are significantly correlated, they appear to capture different features of legal environments.

Table 3.1: Correlations between Measures of Legal Environments

	Rule of Law	Legal Rights	Economic Freedom
Rule of Law	1		
Legal Rights	0.338	1	
	(0.003)		
Economic Freedom	0.83	0.42	1
	(0)	(0)	

Notes: numbers in parentheses report the significance level of each correlation coefficient.

3.4 Results

3.4.1 Summary Statistics

Table 3.2 reports country-level (Panel A) and firm-level (Panel B) summary statistics of my sample by country income group[37]. I use the World Bank definitions to categorize countries into low income, lower-middle income, upper-middle income, and high income groups. I have a limit coverage on low income countries. Only three low income countries are covered in the sample (Kenya, Zimbabwe, and Bangladesh). But other country income groups are well represented. The average lease share ranges from 16 percent in lower-middle income countries to over 30 percent in high income countries. GDP per capita ranges from 434 constant 2000 USD in low-income countries to 22,933 USD in high-income countries. Although the average lease share does not strictly monotonically increase with GDP per capita at country income group level, firms in higher income countries use leases more frequently than those in lower income countries. As a more careful investigation, I plot the relation of the average lease share at the country level and the average GDP per capita in Figure 3.1. The results reveal a positive relation between leasing and GDP. It indicates that leasing is associated with the increase of GDP.

[37]Descriptive statistics of each country are given in the Appendix.

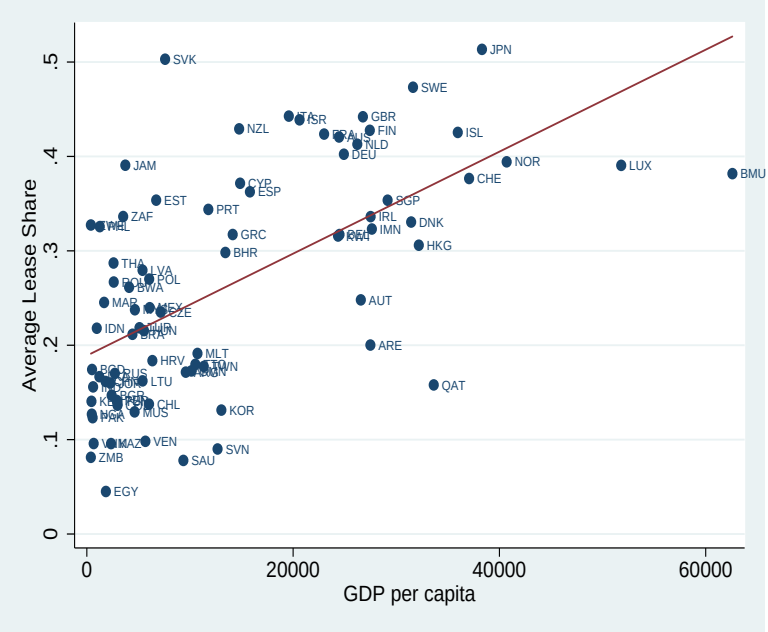

Figure 3.1: Leasing and GDP per capita Notes: The unit of GDP per capita is constant 2000 USD. Average lease share is the mean of lease share of all firm year observations in the country.

Table 3.2: Summary Statistics

Panel A: Country-Level Variables

	Low Income	Lower-Middle Income	Upper-Middle Income	High Income	All Countries
No. of Country	3	10	23	45	81
No. of Country-Year Obs.	35	110	245	534	924
Average Lease Share	0.223	0.163	0.194	0.313	0.26
	(0.142)	(0.128)	(0.13)	(0.158)	(0.16)
GDP per Capita	434	878	3808	22933	14166
	(75)	(431)	(1675)	(12310)	(13726)
Rule of Law	-1.149	-0.428	-0.039	1.204	0.567
	(0.391)	(0.442)	(0.633)	(0.57)	(0.944)
Legal Rights	8	5.507	5.679	6.802	6.339
	(1.449)	(2.402)	(2.462)	(2.117)	(2.336)
Economic Freedom	46.84	55.314	62.269	70.335	65.305
	(10.845)	(4.129)	(7.167)	(7.862)	(9.899)
GDP growth (%)	0.531	3.663	3.325	1.9	2.449
	(5.989)	(2.828)	(4.482)	(3.575)	(3.965)

Panel B: Firm-Level Variables

	Low Income	Lower-Middle Income	Upper-Middle Income	High Income	All Countries
No. of Firms	42	2,349	2,064	9,108	13,563
No. of Firm-Year Obs.	172	14,227	10,496	50,503	75,398
Sales growth (%)	-36.8	8.6	3.6	6.8	6.6
	(164.7)	(54.5)	(52.6)	(58.8)	57.9
Asset growth (%)	-53.4	7.7	5.5	9.3	8.2
	(152.2)	(39.2)	(39)	(46.6)	(44.6)
Profit growth (%)	-23.2	13.3	5.3	8	8.7
	(151.4)	(102.5)	(91.9)	(89.9)	(93.4)

Notes: The Sample consists of firms on Compustat Global files over the period 1995 through 2010. Firms in construction, manufacturing, transportation, wholesale, retail, service and public administration are included in the sample. Reported values are sample means except numbers in parentheses are standard deviation. Income groups are determined by World Bank Classification. The unit of GDP per capita is constant 2000 USD. GDP growth is the GDP per capita growth.

slower growth.

The Panel B of Table 3.2 presents firm-level statistics. I have a large number of firms in low-middle, upper-middle, and high income countries in the sample. Each group has more than 2,000 firms and 10,000 firm-year observations. But there are fewer firms and firm year observations in the low income group. The data set contains only listed firms, and low income countries have few listed firms. I also report firm growth in terms of sales, assets, and profits in the panel B of Table 3.2. Firms in lower-middle income countries have the fastest growth in sales and profit, and firms in high income countries have the fastest growth in assets. Firms in low income countries have negative growth rates in both sales, assets, and profits.

3.4.2 Leasing and Legal Environments

Previous literature (Eisfeldt and Rampini (2009), Zhang (2012)) compared the relative merits of leasing and purchasing which is usually financed by debt. The law in the U.S. implies that a lender has less ability than a lessor to regain control of an asset, if firms default or are in bankruptcy. They believe it is probably the case in most legal environments that leasing facilitates regaining control of an asset, and thus leasing is easier to finance and enables firms access more capital. They also suggest that this advantage may be particularly important in a weak legal environment because firms would have difficulties to finance their purchase by debt with weak legal enforcements. Thus, the literature (Berger and Udell (2006)) indicates that leasing might be more prevalent in environments with weak legal enforcements. In this subsection, I test this hypothesis.

At a first pass, I plot the relations of leasing and measures of legal environments at country level. Figure 3.2 plots the use of leasing over the rule of law, Figure 3.3 plots the relationship between leasing and legal rights, and Figure 3.4 plots leasing and economic freedom. These plots suggest that leasing has a strong positive relation to all measures of legal environments. The positive relation is against the hypothesis that leasing is more prevalent in weak legal environments. However, these plots do not control for other

factors, and do not provide formal tests.

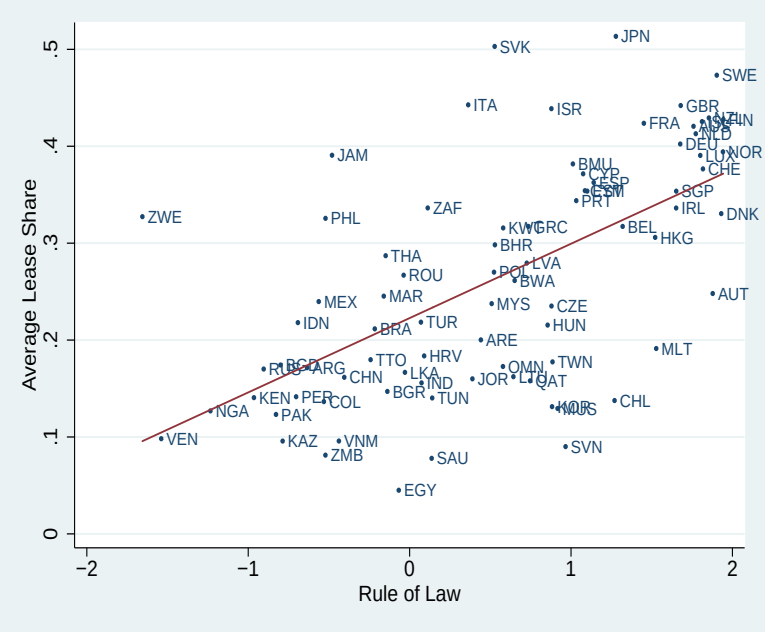

Figure 3.2: Leasing and the Rule of Law Notes: The value of leasing is the mean of all firm year observations of the country in the sample. The value of the rule of law is the mean of the rule of law of the country over the sample period.

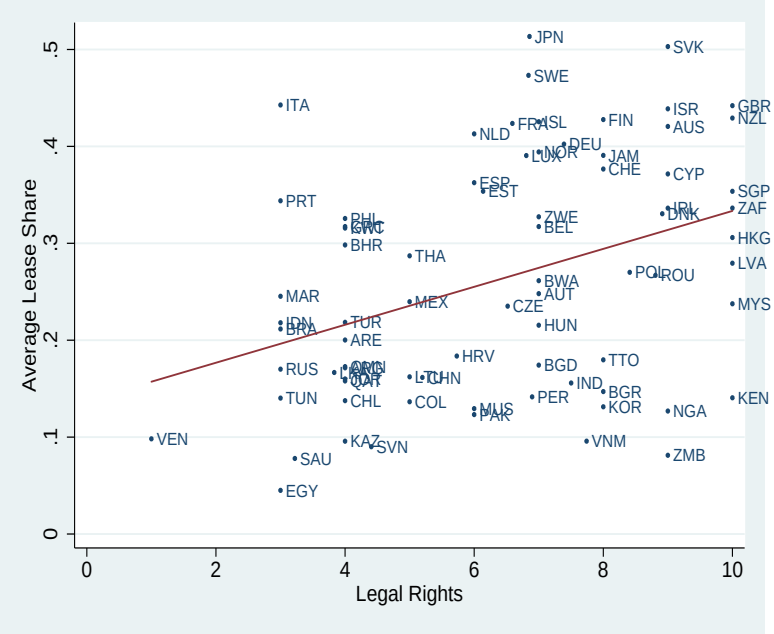

Figure 3.3: Leasing and Legal Rights Notes: The value of leasing is the mean of all firm year observations of the country in the sample. The value of the legal rights is the mean of the legal rights of the country over the sample period.

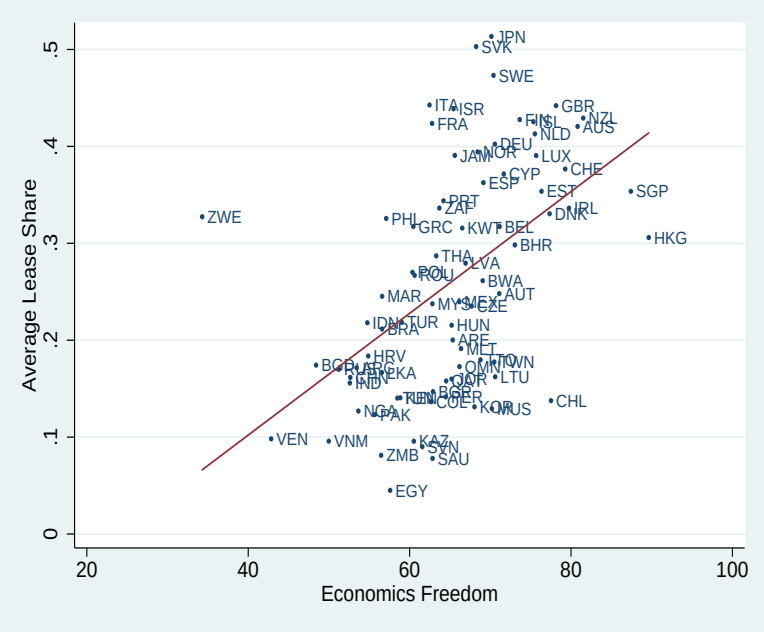

Figure 3.4: Leasing and Economic Freedom Notes: The value of leasing is the mean of all firm year observations of the country in the sample. The value of the economic freedom is the mean of the economic freedom of the country over the sample period.

To more rigorously estimate the relations between leasing behavior and legal environments, I estimate multiple regressions. First, I estimate regressions at country level and present the results in the panel A of Table 3.3. The first three columns in the panel A of Table 3.3 show the results of pooled OLS regressions. The dependent variables are the average lease share of each country in each year. The independent variables are log of GDP per capita and indicators of legal environments. Coefficients on the GDP in the first three columns are significantly positive. Developed countries use leasing more extensively than developing countries. It is consistent with Figure 3.1. What more important is that all measures of legal environments have positive effects on countries' average lease share. A one standard deviation increases in the rule of law, legal rights, and economic freedom increase the average lease share by approximately 3.3 percent, 4.2 percent, and 1 percent. The economic effects are large. The adjusted R square is high when I include legal rights as one independent variable. The legal rights, which measures how collateral and bankruptcy laws protect the rights of borrowers and lenders, contains the most relevant legal factor to explain the leasing activity. Overall, the results of the pooled OLS regressions suggest that weak legal environments constrain leasing activity. It is opposite to the view suggested by some previous research that weak legal environments promote leasing.

Legal environments can affect leasing in two aspects. On one hand, from the lessee's prospective, firms in weak legal environments can be difficult to obtain loans. Thus, leasing is valuable in those countries, and leasing could be a better alternative option for firms who want to access capital. According to this logic, leasing should be popular in countries with weak legal environments. However, on the other hand, potential lessors would tend to avoid the use of leasing contracts in countries with weak legal systems. Because the contracts could be very costly to enforce. Lessors may decide to avoid possible contractual disputes by choosing not to lend capital. In addition, the rights of the lessor to regain control of an asset is affected by legal environments. Although it is easier than a loan lender, the lessor might still have difficulties to repossess its owned asset in weak legal

Table 3.3: Leasing and Legal Environments

Panel A: Results of Regressions at the Country Level

	Pooled OLS Regressions			IV Regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
GDP per Capita	0.033***	0.053***	0.042***	-0.012	0.007	0.055***
(log)	(0.007)	(0.004)	(0.005)	(0.019)	(0.012)	(0.004)
Rule of Law	0.035***			0.116***		
	(0.01)			(0.032)		
Legal Rights		0.018**			0.014***	
		(0.002)			(0.003)	
Economic Freedom			0.001**			0.008***
			(0.001)			(0.002)
No. of Obs.	722	496	877	706	489	859
Adj. R^2	0.232	0.358	0.178	0.176	0.37	0.115

Panel B: Results of Regressions at the Firm Level

	Pooled OLS Regressions			IV Regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
GDP per Capita	0.04***	0.054***	0.061***	0.04***	0.054***	0.049***
(log)	(0.003)	(0.002)	(0.002)	(0.004)	(0.002)	(0.003)
Rule of Law	0.034***			0.036***		
	(0.006)			(0.01)		
Legal Rights		0.003**			0.003**	
		(0.001)			(0.002)	
Economic Freedom			-0.001**			0.001***
			(0.000)			(0.000)
Firm Specific Controls	YES	YES	YES	YES	YES	YES
Time Fixed Effects	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES
No. of Obs.	13,296	10,457	14,093	13,295	10,457	14,092
Adj. R^2	0.345	0.371	0.341	0.345	0.371	0.34

Notes: The dependent variables in Panel A are the average value of lease shares of each country-year. The dependent variables in Panel B are the value of lease shares of each firm in each year. Firm specific controls are firm size, cash flow, leverage, dividend, R&D and tax. The first three columns in each panel are the pooled OLS regressions, and the last three columns are the IV regressions. The instruments for the rule of law, legal rights, and economic freedom are legal origin dummies. Standard errors are in parentheses. *, **, *** statistically significantly different from zero at the 10%, 5% and 1% level of significance.

environments with bad property rights and bankruptcy law if lessee firms default or in bankruptcy. With these concerns, potential lessors are hesitant to lend capital, and the supply of leasing in weak legal environments can be very small. Moreover, potential lessees might also worry about the high enforcement cost in case of contractual disputes, and thus have less incentive to use leasing contracts. From this aspect, weak legal environments constrain the development of leasing. The results suggest that the second aspect dominates the first one[38].

Possible problems with the pooled OLS regressions are the endogenity issue and the reverse causality. To address these issues I use the legal origin dummies as instruments to measures of legal environments. Most countries in the world inherited their legal system from colonial time. Legal systems are affected by their origins. Legal systems based on the laws of England are described common law tradition, compared to French, German, and Scandinavian civil law. In general, common law countries tend to have less regulation, stronger property rights protection, less corruption and more efficient governments, and more political freedom than countries with any other origins (La Porta et al. 1999). Law origins are highly correlated with legal environments. Moreover, except for the role through legal environments, legal origins should be exogenous to firms' financing decisions. Therefore, I use legal origin dummies as instruments of legal environments. I use four dummies to identify the legal origin of each country: English Common Law; French Commercial Code; German Commercial Code; Scandinavian Commercial Code; and Socialist/Communist laws. The results of the IV regressions are presented in the last three columns of the panel A of Table 3.3. Again, legal environments have significant and positive coeffi-

[38]This result that leasing is associated with the increase of legal environments is not apparently contrary to the conclusion of the first two chapters. In the first two chapters, I only consider the lessee side and find that firms who are more constrained lease more capital. However, different countries have different leasing markets and different lessors. Lessors decide how much capital they would provide to the market. In those low income countries and countries with weak legal environments, lessors are hesitant to provide capital. They want to avoid possible contractual disputes, and they are worried about the repossessing process. Thus, leasing is less popular in low income countries and countries with weak legal environments.

cients on the average lease share. The estimated coefficients of legal rights and economic freedom in the IV regressions are close to the estimates of the pooled OLS regressions, but the estimated coefficient of the rule of law in the IV regression is much larger than it is in the pooled OLS regressions.

Brown et al. (2011) have a similar analysis of probit regressions by using data of small and medium firms from the World Bank Investment Climate Surveys. Their dependent variable is a binary variable describing the use of leasing. They showed that firms' decision to use leasing or not is positively correlated with the rule of law[39]. My results are consistent with their conclusion but more robust.

I also estimate regressions at firm level. The dependent variables are the lease share of firm i in year t. The independent variables are log of per capita GDP and measures of legal environments. In these firm year level regressions, I control some firm-specific variables which could affect leasing decisions. Firm-specific control variables are firm size (proxied by number of employees), cash flow (proxied by operating income plus depreciation/beginning-of-year book assets), leverage (proxied by book value of long-term debt/current book assets), dividend dummy (equals to 1 if paying dividend, otherwise equals to 0), R&D (proxied by R&D expenses over sales), and tax (proxied by average tax rate). Moreover, firms in different industries could behave very differently. Manufacturing industry has the lowest ratio of lease share and retail industry has the highest ratio of lease share. Retail stores often rent the place, and rental fee is a large fraction of their total expenses on capital. Therefore, it is necessary to control for industry fixed effects[40]. I control for time fixed effects as well.

Firm level results of both OLS regressions and IV regressions are presented in the panel B of Table 3.3[41]. The instruments of legal environments

[39]Their results about legal rights are insignificant.

[40]I am interested in the effects of legal environments on firms' leasing behavior. Legal environments are the same to every firm in the same country. Firm fixed effects include country fixed effects. Thus, I don't control for firm fixed effects in these regressions but instead control for industry fixed effects.

[41]Many firms have missing data on firm specific variables. Thus, sample size shrinks to over 10000 observations.

are still dummies of legal origins. For simplicity, I only report the coefficients on the log GDP per capita and legal environment measures. The results indicate that both GDP and legal environments are important determinants of firms' leasing decisions. The rule of law and legal rights are significantly and positively related to the use of lease financing in both OLS and IV regressions. The OLS regression suggests that economic freedom negatively affects firm's leasing behavior, but the IV regression indicates a positive relationship between economic freedom and leasing. The results in the second panel of Table 3.3 also suggest that weak legal environments constrain leasing activities.

3.4.3 The Effect of Leasing on Growth

Clearly, leasing pattern varies across firms and countries. Then one question naturally raises. Does leasing play a role in promoting growth? My panel data allow me to provide some insight on this question both at the firm and country level.

We know that there is a positive relation between leasing and firm growth. One possible explanation is the reverse causality. Firms with faster growth prefer to use more leasing. Although I cannot rule out reverse causality, there are two possible explanations for the positive effect. First, leasing can help increase capital availability. As previous literature pointed out (Eisfeldt and Rampini (2009), Zhang (2012)), leasing is particularly important for those firms with financial constraints. Leasing may enable firms to access capital based on their cash flows rather than their credit, or collateral. Moreover, leasing lowers the down payment, and helps firms finance more capital than from bank borrowing. Leasing can also provide a channel for accessing foreign capital outside of the domestic market. For instance, the International Lease Finance Corporation, the founder of the aircraft-leasing business, describe its business as leasing aircrafts to airlines throughout the world. Second, leasing can help firms improve their operational efficiency. Because of the specialization and division factors, capital becomes differentiated. Leasing is a result of the differentiation. Some particular asset is leased

from the lessor and the lessor provide expertise in operations and logistics to the lessee. The differentiation improves the operational efficiency[42]. Moreover, Carter et al. (1996) and Zhang (2012) note that leasing provides operational flexibility. It is usually faster to process a leasing transaction than a loan. Further, leased capital has higher utilization and produces more output. Gavazza (2011) shows that leased aircrafts are less frequently parked inactive than owned aircrafts, and that, conditional on being in use, leased aircrafts have a higher capacity utilization than owned aircrafts. Putting it together, leasing can have an effect on both capital availability and operational efficiency. Therefore, leasing may contribute to firm growth.

I also analyze the effect of leasing on country level growth. Examining country level growth is meaningful from a policy perspective. For instance, if leasing only allows listed firms to grow more quickly at the expense of small and medium size firms, there might be no gains for the whole economy. I use the growth rate of GDP per capita (percent level) of each country as the dependent variable. The key independent variable that I am interested in is the last period average lease share of the country. I use one year lagged value in order to reduce reverse causality. In the pooled OLS regression, I also include the measures of legal environments and the log level of GDP per capita. All these controls variables are using one year lagged values. Moreover, the growth rate of GDP are usually very persistent. Thus, I control for this persistence by adding the growth rate of the last year as one independent variable. The result is shown in Table 3.4. Leasing has a statistically significant and positive impact on the rate of GDP per capita growth. The economic significance of the effects is not small. A one standard deviation increase in the average lease share increases GDP per capita growth by approximately 0.52 percent. Brown et al. (2011) estimate that a one standard deviation in using leasing increases GDP per capita growth by 0.2 percent. My result is consistent with their estimation. The whole economy might benefit from enhanced leasing activities. The results confirms the International Finance Corporation's efforts to promote leasing in

[42]Thanks to Professor Mick Devereux for pointing out this explanation. Many growth models in the literature are based on differentiation.

emerging markets (Carter et al. (1996)). This finding has important policy implications. It suggests that possible adjustments to legal policy and other policies that promote leasing may generate significant real economic gains.

Table 3.4: Leasing and Country Growth Rates

Average Lease Share	3.26*
	(1.769)
Log GDP per Capita	-1.274***
	(0.288)
GDP per Capita Growth	0.415***
	(0.045)
Rule of Law	0.462
	(0.446)
Economic Freedom	0.027
	(0.035)
Legal Rights	-0.107
	(0.101)
No. of Obs.	420
Adj. R^2	0.243

Notes: The dependent variable is country growth rate of GDP per capita. The independent variables are one year lagged values. Standard errors are in parentheses. *, **, *** statistically significantly different from zero at the 10%, 5% and 1% level of significance.

3.5 Concluding Remarks

This chapter utilizes detailed firm-level panel data for publicly listed companies in 81 countries to compare the leasing activities across countries. I find that firms in the developed countries lease more of their capital than firms in the developing countries. I then look at how legal environments affect leasing. Previous literature believes that leasing should be more prevalent in countries with weak legal environments because firms might have difficulty in obtaining loans in these countries. However, the evidence suggests that

leasing is less used in countries with weak legal environments. Although leasing might be a good alternative to loans, firms tend to avoid the use of leasing contracts because the contracts are costly to enforce in weak legal environments. Moreover, I find that leasing may have a measurable impact on growth. Leasing can help increase capital availability and improve operational efficiency, and thus may contribute to growth. The results provide a policy implication that possible changes in legal systems could facilitate the availability of leasing and thus may generate significant real economics gains.

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Appendix A

Appendix to Chapter 1

Equations (1.1) (1.2) (1.3) (1.4) (1.5) (1.6) can be written as

$$V_O(z, S=1) = \frac{z}{r+\alpha} + \frac{\alpha}{r+\alpha} E_x[\max(V_O(x, S=1), V_L(x, S=1), V_N(x, S=1)] \tag{A.1}$$

$$V_O(z, S=0) = -p + V_O(z, S=1) \tag{A.2}$$

$$V_L(z, S=0) = \frac{z-(1+r)u}{r+\alpha} + \frac{\alpha}{r+\alpha} E_x[\max(V_O(x, S=0), V_L(x, S=0), V_N(x, S=0)] \tag{A.3}$$

$$V_L(z, S=1) = (1-\tau)p + V_L(z, S=0) \tag{A.4}$$

$$V_N(z, S=0) = \frac{\alpha}{r+\alpha} E_x[\max(V_O(x, S=0), V_L(x, S=0), V_N(x, S=0)] \tag{A.5}$$

$$V_N(z, S=1) = (1-\tau)p + V_N(z, S=0) \tag{A.6}$$

I prove that owners would always prefer to own capital rather than sell

their owned capital and then lease capital.

$$\begin{aligned} V_O(z, S=1) = (1-\tau)p + \frac{z}{1+\alpha} \\ + \frac{\alpha}{r+\alpha} E_x[\max(V_O(x, S=0) + \tau p, V_L(x, S=0), V_N(x, S=0)] \\ \geq V_L(z, S=1) \; \forall z \end{aligned}$$

Proof of Proposition 1

There are no frictions ($\tau = 0$ and $m = 0$). Using equations (A.1) (A.2) and (A.3), I obtain that

$$\begin{aligned} V_O(z, S=0) = -\frac{rp}{r+\alpha} + \frac{z}{r+\alpha} \\ + \frac{\alpha}{r+\alpha} E_x[\max(V_O(x, S=0), V_L(x, S=0), V_N(x, S=0)] \\ = V_L(z, S=0) \end{aligned}$$

And $V_L(z, S=1) = V_O(z, S=1)$. Firms are totally indifferent between leasing or buying capital.

Using equations (A.1) and (A.5), I get that

$$V_O(z, S=0) - V_N(z, S=0) = V_O(z, S=1) - V_N(z, S=1) = \frac{z - rp}{r+\alpha}$$

There exists a threshold value $z^* = rp$, such that firms with $z > z^*$ choose to own or lease capital to produce.

The market clear condition determines the threshold value z^*.

$$X = 1 - F(z^*) \tag{A.7}$$

Uncertainty parameter α does not affect any equilibrium condition.

Proof of Proposition 2

The choice between leasing and owning is based on the value of $V_O(z, S = 0) - V_L(z)$.

$$\begin{aligned}
&V_O(z, S=0) - V_L(z, S=0) \\
&= \frac{\alpha}{r+\alpha} E_x \max[V_O(x, S=1), V_L(x, S=1), V_N(x, S=1)] \\
&+ \frac{(m-\alpha)p}{r+\alpha} - \frac{\alpha}{r+\alpha} E_x \max[V_O(x, S=0), V_L(x, S=0), V_N(x, S=0)]
\end{aligned} \tag{A.8}$$

The value of $V_O(z, S = 0) - V_L(z, S = 0)$ is independent of the productivity z. Hence, the choice between owning and leasing does not depend on the productivity. All firms would have the same preference about leasing or owning regardless their current productivity.

$$\begin{aligned}
&\frac{\partial(V_O(z, S=0) - V_L(z))}{\partial \alpha} \\
&= \frac{(1-\alpha)(E_x \max[V_O(x, S=1), V_L(x, S=1), V_N(x, S=1)] - p)}{(r+\alpha)^2} \\
&- \frac{(1-\alpha)(E_x \max[V_O(x, S=0), V_L(x, S=0), V_N(x, S=0)] + mp)}{(r+\alpha)^2} \\
&< 0
\end{aligned} \tag{A.9}$$

When α increases, owning capital is less attractive.

When $\alpha = 0$, $V_O(z, S = 0) - V_L(z, S = 0) = \frac{mp}{r} > 0$. If there is no uncertainty, firms would prefer to own capital. If τ is not small, I can always find an α that is large enough to make $V_O(z, S = 0) - V_L(z, S = 0) < 0$. Hence, there exists an α^* such that firms are indifferent between purchasing capital and leasing capital.

Proof of Proposition 3

Since the uncertainty is high, firms would make their choice between leasing and not producing. We know that $V_L((1 + r)u) = V_N$. Hence, when $z \geq (1 + r)u$, $V_L((1 + r)u) \geq V_N$, and firms lease capital. Otherwise, they would

not produce. The market clear condition $X = 1 - F((1+r)u)$ determines the lease rate u in equilibrium.

Proof of Proposition 4

In this setup, firms only consider to own capital or not produce. Therefore, z^* satisfies the indifference between buying the capital or not, and z^{**} satisfies the indifference between keeping the capital or selling it.

I obtain that z^* satisfies $V_O(z^*, S = 0) = V_N(z^*, S = 0)$. All firms with productivity $z \geq z^*$ purchase capital, while firms with $z < z^*$ do not purchase capital. Similarly, z^{**} satisfies $V_O(z^{**}, S = 1) = V_N(z^{**}, S = 1)$. All firms with productivity $z \geq z^{**}$ keep the capital they owned, while firms with productivity $z < z^{**}$ sell their owned capital. We know that $V_O(z^*, S = 1) - p = V_O(z^{**}, S = 1) - (1-\tau)p$, and $V_O(z, S = 1)$ is increasing in z, thus $z^* > z^{**}$.

Equilibrium: An Economy with Frictions but No Financial Constraint

An equilibrium in which uncertainty is high such that firms always prefer to own capital requires that the following conditions hold:

1. Leasing rate $u = (r+m)p/(1+r)$
2. All firms prefer to own $V_O(z, S = 0) > V_L(z, S = 0)\ \forall z$
3. The marginal firm purchasing capital has z^* satisfies $V_O(z^*, S = 0) = V_N(z^*, S = 0)$
4. The marginal firm selling capital has z^{**} satisfies $V_O(z^{**}, S = 1) = V_N(z^{**}, S = 1)$
5. Market clear condition

$$X = X(1-\alpha) + X\alpha(1 - F(z^{**})) + (1-X)\alpha(1 - F(z^*))$$

The first item on the right hand side is firms whose productivity don't change and still own capital in the next period. The second item is firms whose productivity change but above the threshold of selling capital in the next period. The last item indicates that firms who purchase new capital in the next period. Rearrange the market clear condition, I obtain that:

$$X = \frac{1 - F(z^*)}{1 - F(z^*) + F(z^{**})}$$

Equilibrium requires all above equations are satisfied. In this equilibrium, nobody lease and all capitals are owned, and the percentage of leased capital is zero.

Proof of Proposition 5

In this setup, z^* satisfies the financial constraint such that

$$\frac{1-\beta}{\beta} V_O(z^*, S = 0) \geq (1 - \theta)p$$

Since in the equilibrium both leased and owned capital coexist, so

$$\frac{1-\beta}{\beta} V_O((1 + r)u, S = 0) < (1 - \theta)p$$

Thus, $z^* > (1 + r)u$.
Moreover, z^{**} satisfies the indifference between keeping the capital or selling it

$$V_N(z^{**}, S = 1) = V_O(z^{**}, S = 1)$$

We know that $V_L((1 + r)u, S = 0) = V_N((1 + r)u, S = 0)$. Firms always prefer to own capital if no constraint, so

$$V_O((1 + r)u, S = 0) > V_L((1 + r)u, S = 0)$$

Thus, I can get

$$V_O((1+r)u, S=0) > V_N((1+r)u, S=0)$$

$$V_O((1+r)u, S=0) > V_O(z^{**}, S=1) - (1-\tau)p$$

$$V_O((1+r)u, S=0) > V_O(z^{**}, S=0)$$

Therefore, $(1+r)u > z^{**}$.

Equilibrium: An Economy with Frictions and Financial Constraint

An equilibrium in which leased and owned capital coexist requires the following conditions hold:

1. Leasing rate $u = (r+m)p/(1+r)$
2. All firms prefer to own if without financial constraint $V_O(z, S=0) > V_L(z, S=0)\ \forall z$
3. The marginal firm purchasing capital z^* is the smallest number that satisfies the financial constraint $\frac{1-\beta}{\beta} V_O(z^*, S=0) > (1-\theta)p$
4. The marginal firm leasing capital has $(1+r)u$
5. The marginal firm selling capital has z^{**} satisfies $V_O(z^{**}, S=1) = V_N(z^{**}, S=1)$
6. Denote X_O as the amount of owned capital $X_O = \frac{1-F(z^*)}{1-F(z^*)+F(z^{**})}$. It is derived similarly to the one in the equilibrium without financial constraint
7. Denote X_L as the amount of leased capital

$$\begin{aligned} X_L =& X_L(1-\alpha) + X_L\alpha(F(z^*) - F((1+r)u)) \\ &+ (1 - X_O - X_L)\alpha(F(z^*) - F((1+r)u)) \end{aligned}$$

The first item on the right hand side is firms whose productivity don't change and still lease capital. The second item is firms whose productivity change but above the threshold of leasing capital and below the threshold of buying capital. The last item indicates that firms who didn't produce last period change productivity to lease this period. Rearrange it:

$$X_L = (1 - X_O)(F(z^*) - F((1 + r)u))$$

8. Market clear condition: $X_O + X_L = X$

Equilibrium requires all above equations are satisfied.

Appendix B

Appendix to Chapter 2

This appendix provides the analytical characterization of the agent's problem. The multipliers on the budget constraints (2.3) (2.4) and financial constraint (2.5) are denoted by μ_0, μ_1 and λ_B. The multipliers on the non-negativity constraints (2.6) (2.7) and (2.8) are denoted by λ_L, λ_N, and λ_d, respectively. The non-negativity constraint on the dividend at time $t+1$ (2.9) is redundant. It is always satisfied if the financial constraint is satisfied. The first-order conditions of the agent's problem are

$$\lambda_d = \lambda_B R \tag{B.1}$$

$$\mu_1 = \beta \tag{B.2}$$

$$\mu_0 = 1 + \lambda_B R \tag{B.3}$$

$$\mu_0 q_t = \alpha\beta E_t A_{t+1}\omega_{t+1}(i_b + i_l)^{\alpha-1} + \beta\phi q_{t+1} + \lambda_B\phi\theta q_{t+1} + \lambda_N \tag{B.4}$$

$$\mu_0 U_L = \alpha\beta E_t A_{t+1}\omega_{t+1}(i_b + i_l)^{\alpha-1} + \lambda_L \tag{B.5}$$

Proof of Assumption 1

Substituting (2.10) into (B.5) and subtracting (B.5) from (B.4) gives:

$$\lambda_B[(1-\beta\phi\theta)q_{t+1} - Rm] = [m - \beta(1-\phi)q_{t+1}] + \lambda_N - \lambda_L \tag{B.6}$$

If $(1-\beta\phi\theta)q_{t+1} - Rm < 0$, then λ_L is always greater than zero, which means firms never lease capital. If $m - \beta(1-\phi)q_{t+1} < 0$, then λ_N is always greater than zero, which means firms never purchase capital. Thus, we need $(1-\beta\phi\theta)q_{t+1} - Rm > 0$ and $m - \beta(1-\phi)q_{t+1} > 0$ to guarantee that leasing and buying coexist in the equilibrium.

Proof of Proposition 6

Suppose assumption 1 holds, we know that $(1-\beta\phi\theta)q_{t+1} - Rm > 0$ and $m - \beta(1-\phi)q_{t+1} > 0$. If $i_l > 0$, then the multiplier $\lambda_L = 0$. From equation (B.6), we can get that λ_B must be greater than zero. It indicates that $\lambda_d > 0$ and $d_0 = 0$.

Proof of Proposition 7

By the theorem of the maximum, the maximizing choices are continuous in the idiosyncratic productivity ω.

First, suppose $i_l > 0$. Then we know that the multiplier $\lambda_L = 0$. By Proposition 6, we know that $\lambda_B > 0$ and $b = \phi\theta i_b / R$. In the case where $i_b = 0$, the first order condition (B.5) can be written as

$$\mu_0 U_L = \alpha\beta E_t A_{t+1}\omega_{t+1} i_l^{\alpha-1}$$

using (B.3) to substitute for μ_0, and totally differentiating we can get

$$\frac{\partial i_l}{\partial \omega} = \frac{R}{\alpha - 1}\frac{\partial \lambda_B}{\partial \omega} > 0$$

Next, consider the case where both $i_l > 0$ and $i_b > 0$, such that the first order conditions (B.4) and (B.5) become to:

$$\mu_0 q_t = \alpha\beta E_t A_{t+1}\omega_{t+1} k^{\alpha-1} + \beta\phi q_{t+1} + \frac{\mu_0 - 1}{R}\phi\theta q_{t+1} \tag{B.7}$$

$$\mu_0 q_t + \mu_0 m/R - \mu_0 q_{t+1}/R = \alpha\beta E_t A_{t+1}\omega_{t+1} k^{\alpha-1} \tag{B.8}$$

Rearrange the above two equations (B.7) and (B.8), and make all items with μ_0 on the left hand side of equations. Then, I can divide the two equations by each other and get

$$\frac{q_t - \phi\theta q_{t+1}/R}{q_t + m/R - q_{t+1}/R} = \frac{\alpha\beta E_t A_{t+1}\omega_{t+1}k^{\alpha-1} + \beta\phi q_{t+1} - \phi\theta q_{t+1}/R}{\alpha\beta E_t A_{t+1}\omega_{t+1}k^{\alpha-1}} \tag{B.9}$$

The equation (B.9) suggests that the capital is constant, and the value of $\bar{k}$ is determined by (B.9).

Then, the first cutoff level of idiosyncratic productivity $\bar{\omega}_L$ is determined by the following equation

$$\bar{\omega}_L = \frac{\bar{k}U_L - q_t e}{A_t e^{\alpha}} \tag{B.10}$$

The second cutoff level of idiosyncratic productivity $\bar{\omega}_B$ is pinned down by

$$\bar{\omega}_B = \frac{\bar{k}(q_t - \phi\theta q_{t+1}/R) - q_t e}{A_t e^{\alpha}} \tag{B.11}$$

Totally differentiating the second period budget constraint (2.4) gives

$$\frac{\partial d_{1t+1}}{\partial \omega} = (1-\theta)\phi q_{t+1}\frac{\partial i_b}{\partial \omega} \tag{B.12}$$

From Proposition 6, we know that $d_{0t} = 0$. When the idiosyncratic productivity increases, firms enjoy more dividend in the second period $\frac{\partial d_{1t+1}}{\partial \omega} > 0$. Thus, $\frac{\partial i_b}{\partial \omega} > 0$.

Since the capital k is constant, $\frac{\partial i_l}{\partial \omega} = -\frac{\partial i_b}{\partial \omega} < 0$.

Finally, suppose $i_b > 0$ and $i_l = 0$. In the case that where agents' idiosyncratic productivity is not very high and $\lambda_B > 0$, agents are financially constrained. We differentiate the first period budget constraint (2.3). We can get $\frac{\partial i_b}{\partial \omega} > 0$.

In the case where agents' idiosyncratic productivity is very high and $\lambda_B = 0$, agents are unconstrained. Then $\mu_0 = 1$. The first order condition (B.4) simplifies to

$$q_t = \alpha\beta E_t A_{t+1}\omega_{t+1}k^{\alpha-1} + \beta\phi q_{t+1} \tag{B.13}$$

The above equation defines $\bar{\bar{k}}$. From the budget constraint, we can derive the third cutoff level of idiosyncratic productivity

$$\bar{\bar{\omega}} = \frac{\bar{\bar{k}}(q_t - \phi\theta q_{t+1}/R) - q_t e}{A_t e^{\alpha}} \tag{B.14}$$

Since the maximizing choices are continuous functions, I conclude that agents whose idiosyncratic productivity is below $\bar{\omega}_L$ lease capital only, agents whose idiosyncratic productivity is between $\bar{\omega}_L$ and $\bar{\omega}_B$ lease capital and purchase capital, and agents whose idiosyncratic productivity is above $\bar{\omega}_B$ purchase capital. Moreover, the agent is financially constrained below $\bar{\bar{\omega}}$ and unconstrained above that value.

Appendix C

Appendix to Chapter 3

Table C.1: Summary Statistics by Country

Country	Code	Lease Share	GDP per Capita	Growth Rate of GDP per Capita	Rule of Law	Legal Rights	Economic Freedom	No. of Firm-Year Obs.
United Arab Emirates	ARE	0.20	27,490.97	-6.87	0.44	4.00	65.35	105
Argentina	ARG	0.17	9,591.11	5.63	-0.63	4.00	53.43	89
Australia	AUS	0.42	24,452.90	1.29	1.76	9.00	80.82	5,129
Austria	AUT	0.25	26,563.48	1.00	1.88	7.00	71.10	237
Belgium	BEL	0.32	24,499.49	0.54	1.32	7.00	71.14	269
Bangladesh	BGD	0.17	505.26	4.78	-0.80	7.00	48.41	69
Bulgaria	BGR	0.15	2,404.94	3.84	-0.14	8.00	62.90	37
Bahrain	BHR	0.30	13,432.39	-5.00	0.53	4.00	73.04	20
Bermuda	BMU	0.38	62,590.48	1.28	1.01			3,362
Brazil	BRA	0.21	4,425.37	2.99	-0.22	3.00	56.59	489
Botswana	BWA	0.26	4,099.00	-0.03	0.65	7.00	69.05	13
Switzerland	CHE	0.38	37,061.79	1.03	1.82	8.00	79.28	714
Chile	CHL	0.14	6,031.94	2.14	1.27	4.00	77.52	94
China	CHN	0.16	1,824.71	10.19	-0.40	5.20	52.64	787
Colombia	COL	0.14	2,973.79	2.45	-0.53	5.00	62.62	69
Cayman Islands	CYM	0.35			1.09			2,383
Cyprus	CYP	0.37	14,859.64	1.19	1.08	9.00	71.67	105
Czech Republic	CZE	0.24	7,167.62	2.89	0.88	6.52	67.69	28
Germany	DEU	0.40	24,919.99	1.31	1.68	7.39	70.56	1,820
Denmark	DNK	0.33	31,443.97	-0.51	1.93	8.91	77.35	351
Egypt	EGY	0.05	1,848.80	3.48	-0.07	3.00	57.59	20

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Table C.1 – continued from previous page

Country	Code	Lease Share	GDP per Capita	Growth Rate of GDP per Capita	Rule of Law	Legal Rights	Economic Freedom	No. of Firm-Year Obs.
Spain	ESP	0.36	15,809.96	-0.43	1.14	6.00	69.14	291
Estonia	EST	0.35	6,725.51	2.31	1.10	6.14	76.34	65
Finland	FIN	0.43	27,435.59	0.64	1.94	8.00	73.64	427
France	FRA	0.42	23,006.47	0.13	1.45	6.59	62.78	885
United Kingdom	GBR	0.44	26,766.62	1.81	1.68	10.00	78.15	11,299
Greece	GRC	0.32	14,141.76	0.02	0.74	4.00	60.46	378
Hong Kong	HKG	0.31	32,184.71	3.49	1.52	10.00	89.63	1,803
Croatia	HRV	0.18	6,354.17	1.18	0.09	5.73	54.88	84
Hungary	HUN	0.22	5,543.11	1.78	0.86	7.00	65.20	41
Indonesia	IDN	0.22	964.71	3.36	-0.69	3.00	54.76	1,143
Isle of Man	IMN	0.32	27,635.55	6.24				12
India	IND	0.16	611.15	6.17	0.07	7.50	52.60	11,940
Ireland	IRL	0.34	27,513.62	2.44	1.65	9.00	79.74	432
Iceland	ISL	0.43	35,962.78	-0.55	1.81	7.00	75.33	23
Israel	ISR	0.44	20,621.47	1.77	0.88	9.00	65.44	666
Italy	ITA	0.44	19,582.48	-1.01	0.36	3.00	62.46	718
Jamaica	JAM	0.39	3,731.98	-0.50	-0.48	8.00	65.60	28
Jordan	JOR	0.16	2,276.39	4.03	0.39	4.00	65.20	63
Japan	JPN	0.51	38,309.28	0.82	1.28	6.86	70.13	11,497
Kazakhstan	KAZ	0.10	2,347.73	4.27	-0.79	4.00	60.52	6
Kenya	KEN	0.14	448.92	1.84	-0.96	10.00	58.84	64
Korea, Rep.	KOR	0.13	13,044.17	4.00	0.88	8.00	68.04	29
Kuwait	KWT	0.32	24,357.53	2.79	0.58	4.00	66.52	79

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Table C.1 – continued from previous page

Country	Code	Lease Share	GDP per Capita	Growth Rate of GDP per Capita	Rule of Law	Legal Rights	Economic Freedom	No. of Firm-Year Obs.
Sri Lanka	LKA	0.17	1,213.92	5.25	-0.03	3.83	56.56	157
Lithuania	LTU	0.16	5,405.70	2.97	0.64	5.00	70.61	71
Luxembourg	LUX	0.39	51,808.80	1.18	1.80	6.81	75.67	88
Latvia	LVA	0.28	5,398.95	0.45	0.73	10.00	66.94	52
Morocco	MAR	0.25	1,676.98	3.45	-0.16	3.00	56.60	56
Mexico	MEX	0.24	6,097.29	0.12	-0.56	5.00	66.16	179
Malta	MLT	0.19	10,728.40	1.65	1.53		66.38	40
Mauritius	MUS	0.13	4,631.81	3.51	0.92	6.00	70.19	59
Malaysia	MYS	0.24	4,658.48	2.93	0.51	10.00	62.82	5,935
Nigeria	NGA	0.13	479.25	4.68	-1.23	9.00	53.65	25
Netherlands	NLD	0.41	26,222.16	1.10	1.77	6.00	75.52	462
Norway	NOR	0.39	40,702.76	0.01	1.94	7.00	68.43	436
New Zealand	NZL	0.43	14,768.38	0.43	1.85	10.00	81.51	529
Oman	OMN	0.17	10,130.69	3.15	0.58	4.00	66.18	200
Pakistan	PAK	0.12	562.80	1.90	-0.83	6.00	55.68	222
Peru	PER	0.14	2,897.25	5.80	-0.70	6.90	64.48	40
Philippines	PHL	0.33	1,253.30	2.99	-0.52	4.00	57.10	573
Poland	POL	0.27	6,046.13	4.40	0.52	8.41	60.36	264
Portugal	PRT	0.34	11,780.25	-0.05	1.03	3.00	64.20	103
Qatar	QAT	0.16	33,633.73	0.99	0.75	4.00	64.53	73
Romania	ROU	0.27	2,607.96	3.47	-0.04	8.81	60.62	26
Russian Federation	RUS	0.17	2,716.96	4.38	-0.90	3.00	51.25	242
Saudi Arabia	SAU	0.08	9,359.20	0.27	0.14	3.22	62.84	112

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Table C.1 – continued from previous page

Country	Code	Lease Share	GDP per Capita	Growth Rate of GDP per Capita	Rule of Law	Legal Rights	Economic Freedom	No. of Firm-Year Obs.
Singapore	SGP	0.35	29,160.54	3.37	1.65	10.00	87.41	3,462
Slovak Republic	SVK	0.50	7,590.02	4.27	0.53	9.00	68.25	11
Slovenia	SVN	0.09	12,673.81	1.48	0.97	4.41	61.56	35
Sweden	SWE	0.47	31,623.80	0.97	1.90	6.84	70.40	1,396
Thailand	THA	0.29	2,588.66	2.50	-0.15	5.00	63.30	476
Trinidad and Tobago	TTO	0.18	10,521.63	2.82	-0.24	8.00	68.78	20
Tunisia	TUN	0.14	2,939.10	3.31	0.14	3.00	58.48	38
Turkey	TUR	0.22	5,103.35	1.76	0.07	4.00	59.02	374
Taiwan	TWN	0.18	11,340.00	3.69	0.89		70.49	20
Venezuela	VEN	0.10	5,678.49	2.16	-1.54	1.00	42.84	10
Vietnam	VNM	0.10	664.37	5.76	-0.44	7.74	49.98	85
South Africa	ZAF	0.34	3,523.94	1.94	0.11	10.00	63.69	1,319
Zambia	ZMB	0.08	390.78	3.72	-0.52	9.00	56.47	6
Zimbabwe	ZWE	0.33	391.05	-4.81	-1.66	7.00	34.29	39

Notes: Reported numbers are sample means except for the last column number of firm-year observations.
The unit of GDP per capita is constant 2000 USD .