INFLEXIBLE FIRM COMMITMENTS, OPERATING LEVERAGE RISK AND EXPECTED RETURNS

A Ph.D. Dissertation

by

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INFLEXIBLE FIRM COMMITMENTS, OPERATING LEVERAGE RISK AND EXPECTED RETURNS

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ABSTRACT

INFLEXIBLE FIRM COMMITMENTS, OPERATING LEVERAGE RISK AND EXPECTED RETURNS

Güneş Doğan, Figen

Ph.D. Dissertation in Management

Supervisor: Prof. Dr. Kürşat Aydoğan

July 2015

Labor is one of the most important input to the firm. Firms pay wages to employees in return for their human capital. Operating leases are the largest source of external financing to the firm. Labor costs and non-cancellable operating lease expenses are two large claims on firm cash flows. This dissertation is focused on how these almost fixed costs affect firm risk and expected returns. Three essays empirically examine the links among cost inflexibility, cash flow sensitivity to business cycle and operating leverage risk. The first essay empirically documents that firms with more operating lease commitments earn a significant premium over firms with fewer commitments, and this premium is countercyclical. The second essay shows that a measure of firm's labor intensity relative to its industry is associated with higher equity returns for manufacturing firms. The third essay, using ex-ante implied cost of capital as a proxy for equity risk, shows that the firms that carry a relatively high labor share, have higher ex-ante discount rates.

Keywords: Operating leverage, operating lease, labor, cross section of expected returns, implied cost of capital

ÖZET

ESNEK OLMAYAN ŞİRKET YÜKÜMLÜLÜKLERİ, OPERASYONEL KALDIRAÇ RİSKİ VE BEKLENEN GETİRİLER

Güneş Doğan, Figen

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İşgücü şirketin en önemli kaynaklarından birisidir. Şirketler işçilere işgücünün kullanımı karşılığında maaş öder. Operasyonel kiralama, şirketler için dışarıdan en büyük kaynak sağlama methodudur. Maaşlar ve operasyönel kira giderleri şirketlerin kaynak akımında önemli bir yer tutar. Bu tezde, sabit gider sayılabilecek işgücü ve operasyonel kira giderlerinin şirket riskini ve getirilerini nasıl etkilediğini ele alacağız. Tezin üç bölümü empirik olarak giderlerin esnekliğinin, nakit akımının ekonomik gelişmelere duyarlılığının ve operasyonel kaldıraç riskinin birbiriyle olan ilişkileri incelenecektir. İlk bölüm daha fazla operasyonel kira giderleri olan şirketlerin daha çok beklenen getirileri olduğunu gösterir. Ayrıca bu getiri farkı ekonomik dalgalanmaların tersine hareket eder. Tezin ikinci bölümünde sanayi şirketlerinde sektöre göre iş gücü yoğunluluğunun, şirketin getirileriyle olan ilişkisi gösterilir. Tezin üçüncü bölümünde, özkaynak riskliliği zımni sermaye maliyeti hesaplamaları kullanılarak ölçülür. Göreceli olarak gelirlerde işgücü maliyeti çok olan şirketlerin daha fazla riskli olduğu gösterilir.

Anahtar kelimeler: Operasyonel kaldıraç, operasyonel kiralar, işgücü, kesitler arası beklenen getiriler, zımni sermaye maliyeti.

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CHAPTER I

INTRODUCTION

This thesis consists of three essays that examine the relationship among the firm's inflexible commitments, firm risk and returns. Non-cancellable operating lease commitments and wages are two examples of inflexible commitments. Wages are the fees paid to the employees in return for their human capital. In the United States, wages represent roughly 60% of GDP. Operating leases are the most common and important source of off-balance sheet financing. Annual fees paid to inflexible commitments represent a major claim on firm cash flows. During the business cycle, firms cannot easily cancel or adjust the terms of contracts between their employees because of firing, hiring and other contractual costs. Similarly, operating leases which are studied in this thesis are non-cancellable during the lease term except in the event of Chapter 11 bankruptcy.

The inflexibility of the firm's lease and labor obligations creating cyclicality in the firm's cash flows is related to the concept of operating leverage. For the shareholders, labor and lease expense are forms of leverage making the cash flows more cyclical and equity more risky. During recessions (expansions) revenues fall (rise) but lease and labor commitments do not fall (rise) by as such as revenues. A growing literature on labor induced operating leverage is studied by Danthine and Donaldson (2002), Gourio (2007), Chen et al. (2011), Favilukis and Lin (2013) and Donangelo (2014). The idea of labor induced operating leverage, wages' limited comovement with revenues increasing the firm's risk, can also be extended to operating leases. These precommitted payments transfer the risk to shareholders. Consequently, shareholders require a higher rate of return for bearing this risk. Therefore those firms with higher levels of operating lease and labor commitments have higher expected returns.

The first essay explores the link between the firm's non-cancellable operating lease commitments and stock returns. Firms with more operating lease commitments earn a significant premium over firms with fewer commitments, and this premium is countercyclical. Non-cancellable operating lease commitments have a higher degree of inflexibility compared to other potential fixed costs. Firms with high operating leases have higher cash flow sensitivity to aggregate shocks, higher volatility of cash flow growth, higher standard deviation of stock returns and hence higher operating leverage. The relationship between operating leases and stock returns is stronger in small firms than in big firms.

In the second essay of the dissertation, I argue that industry adjusted labor intensity--number of employees to property, plant and equipment--is positively related to expected returns for firms in the manufacturing industry. To investigate the risk mechanism behind expected returns, I show that, on average at the firm level, revenues are more procyclical than labor costs and labor costs are less procyclical than capital expenditures. Therefore, although labor costs are not fixed, their responsiveness to aggregate shocks are limited compared to revenues. I also show that firms with higher labor intensity have higher cash flow sensitivity to the aggregate shocks than firms with lower labor intensity, since the former are more exposed to the business cycle. I include only manufacturing firms in the CRSP/Compustat database. Industry level wage data are at 4 digit Standard Industry Classification (SIC) code level from National Bureau of Economic Research (NBER) manufacturing industry database, provided by Becker and Gray (2009).

In the final essay, the link between the firm's relative labor share-wage expense to sales adjusted by industry average-and firm risk is further explored. By using ex-ante implied cost of capital as a proxy for equity risk, it is shown that the firms who carry a relatively high labor share, have higher ex-ante discount rates. When I use ex post stock returns as a proxy for equity risk, emprical results do not show a significant relationship between labor share and equity risk for the cross section of all U.S. firms in the Compustat database. A common concern about approximating expected returns with realized returns is that the realized returns are very volatile and can be a bad proxy for expected returns, especially with relatively short time series data (Fama and French, 1997). Therefore, implied cost of capital is used as a proxy for equity risk. The implied cost of equity capital of a firm is the internal rate of return that equates the firm's stock price to the present value of expected future cash flows. Specifically, I use implied cost of capital measures of Gebhardt et al. (2001), Hou et al. (2012), and Tang et al. (2013).

In the existing literature, operating leverage plays a critical role in theoretical works which show that a firm's operating leverage and the systematic risk of its stock are related.[1] However there is limited supporting empirical evidence and there isn't a consensus on how to measure operating leverage empirically. Novy-Marx (2011) uses a measure of operating leverage, the firm's cost of goods sold plus selling, general and administrative expenses divided by the firm's total assets, and also argues that firms with high operating leverage have higher expected returns. This measure includes a large set of costs such as material and overhead costs or advertising and marketing expenses. The degree of the inflexibility of these costs is mixed. Some of these costs are more variable than fixed. Firms declare the operating lease commitments, which are studied in this essay, as non-cancellable for the succeeding year. Examining the individual impact of operating leases is informative about the firm business cycle risk and expected return relations.

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[1] See Hamada (1972), Rubinstein (1973), Lev (1974), Bowman (1979), and Mandelker and Rhee (1984).

Firms' commitments to labor is less rigid than non-cancellable operating leases, since firms can adjust some of their labor expense by firing employees or by adjusting working hours. However there are adjustment costs to doing so, such as firing and hiring costs, loss of employee morale and productivity. Labor can create an operating leverage effect to the firm in many ways. First as in the case of operating leases, labor is the largest expense item to firm cash flows. Second, labor could be unionized limiting a firm's operating flexibility. Third, firms do not own their labor. Labor has the flexibility to leave the firm and take the firm specific capital. This lack of control over labor represents a risk factor for shareholders. Empirical literature on the interaction of labor market frictions and asset prices is mostly limited to evidence at the industry level. Also, the extant focus is on indirect effects of labor through unionization or its ability to move between firms or industries. The second and the third essays in this thesis provides evidence on labor's operating leverage impact on expected returns and implied cost of equity at the firm level.

All of the chapters serve to our understanding of the sources of operating leverage in the firm. The findings contribute to the growing literature of how firms' lease and labor commitments have an impact on the firm's riskiness, expected returns, and financial policy. Chapter 2 presents the literature review, Chapter 3 examines the relationship between lease commitments and expected returns, Chapter 4 examines the relationship between industry-adjusted labor intensity and stock returns, Chapter 5 examines the relationship between firm’s industry-adjusted labor intensity and implied cost of equity. Chapter 6 concludes the thesis.

CHAPTER II

LITERATURE REVIEW

2.1. The studies on the variation in the cross-section of expected stock returns

Over the last 50 years, a large volume of empirical and theoretical work has searched for ways to explain the variation in cross-section of expected stock returns. From the mid-1960s through the early 1990s the Capital Asset Pricing Model (CAPM) of Sharpe (1964), Lintner (1965) and Black (1972) was the accepted model for describing the risk-return relationship. CAPM argued that risk for an asset and a portfolio could be measured by market beta. CAPM's validity is examined due to the anomaly literature which proposed a number of other factors that influenced return in addition to market beta (e.g. Banz (1981) and Basu (1983)). The seminal work of Fama and French (1992 and 1993) became the widely accepted approach in which they found that the relationship between beta and returns was flat, and in which they confirmed the size and value anomalies. Then there came a stream of literature trying to explain the economic reasoning behind the explanatory power of the two factors, size and book-to-market. Recently, Fama and French (2014) propose a five-factor model including profitability and investment as additional factors to market, size and book-to-market. This new model better captures the patterns in average stock returns and performs better than the three-factor model of Fama and French (1993).

A large literature in asset pricing link firm characteristics to stock returns in the cross section. Fama and French (2008) provides a survey of this literature. To this literature, this thesis adds firm-level lease rate and labor intensity as variables that constitute parts of a firm's operating leverage risk and establishes links to expected stock returns. Part of this literature is trying to explain the systematic risk and expected return relationship through firm-level investment decisions.[2] Berk et al. (1999) are among the first in this literature. Using a dynamic model, they show that firm optimal investment decisions account for a predictable change in firm's assets-in-place and growth opportunities and this change in risk impacts the expected stock returns.

Similar to Berk et al. (1999) theoretical approach, Carlson et al. (2004) construct two dynamic models which relate endogenous firm investment to expected stock returns. They explain the role of operating leverage in the value premium. When demand falls during bad times, market value of equity declines while book value of

[2] See Gomes et al. (2003), Carlson et. Al. (2004), Zhang (2005), and Cooper (2006).

equity remains basically the same, leading to a higher book-to-market ratio. And they assume that fixed operating costs are proportional to the book value of capital. Therefore, higher operating leverage further amplify this risk.

Zhang (2005) shows that assets in place incorporate higher risk compared to growth options of the firm, especially in bad times where the risk premiums increase dramatically. His argument is based on an effect of “costly reversibility”, which states that disinvestment is more costly than investment. He argues that value firms hold more unproductive capital than growth firms in bad times, while in good times growth firms have more flexibility to adjust investment which makes value stocks riskier than growth stocks. These papers link expected returns to the firm's riskiness by exploring the interaction between the firm's assets, future prospects, and investment decisions. This thesis shows how both firm employment and leasing decisions which are also investments create inflexibility to the firm caused by irreversibility of the investment. However the focus in this thesis is on the cash flow effects of annual lease and labor payments rather than their capital stock value.

2.2. The studies on operating leverage

After the establishment of CAPM, a large number of studies have been conducted both theoretically and empirically to identify the determinants of systematic risk. Lev (1974) is one the first studies which shows a positive association between firm systematic risk and the operating leverage using a sample of power companies. He decomposes the total operating cost into variable and fixed components and the variable cost component is used as a measure of the operating leverage of the firm. The higher the variable cost component, the lower the operating leverage. Mandelker and Rhee (1984) decompose the systematic risk into three independent elements: degree of operating leverage, degree of financial leverage and the intrinsic business risk. They investigate the combined effects of operating leverage and financial leverage on systematic risk and report that, at portfolio level, operating and financial leverage approximately explains 40 percent of the cross-sectional variation in systematic risk.

Although conceptually operating leverage is similar to financial leverage, the empirical link between financial (book) leverage and stock returns is documented as insignificant or negative (Fama and French (1992), George and Hwang (2010)). There are several attempts to explain this puzzle in the literature. Gomes and Schmid (2010) explain that financial leverage and investment should be examined jointly. Firms with high levels of financial leverage are also more mature firms with relatively safe book assets and fewer risky growth opportunities. They say that as a result, cross-sectional studies fail to control for the interdependence of financial leverage and investment decisions. George and Hwang (2010) argue that firms with high distress costs choose low financial leverage to avoid distress, but they are exposed to the systematic risk of holding such distress costs in bad times. They show that the relation between financial leverage and returns is negative only if the risk associated with holding high distress costs and lower financial leverage dominates the amplification effect of higher financial leverage on equity risk. Studies that examine the joint effect of operating leverage and financial leverage on systematic risk conclude that the operating leverage effect is more significant than the financial leverage effect on systematic risk (Mandelker and Rhee (1984), and Toms et al. (2005)). Obreja (2013) argues that when operating leverage is economically significant, firms with high (low) operating (financial) leverage can have high equity premiums. Without operating leverage, firms with high financial leverage should have higher returns.

Empirical evidence on the impact of operating leverage on firm risk and returns is limited. This is partly due to the difficulty in the measurement of operating leverage. On the firm's financial statements, total operating leverage is unobservable and it is difficult to distinguish between variable and fixed costs. Previous studies used different measures of operating leverage to investigate the relationship among operating leverage, risk and expected returns. For example, Lev (1974) uses the unit variable costs as a measure for operating leverage. Novy-Marx (2011) uses the firm's cost of goods sold plus selling, general, and administrative expenses, divided by the firm's total assets as a measure of operating leverage. He argues that firms with high operating leverage have higher expected returns. Novy-Marx (2011) also shows that intra-industry differences in book-to-market are driven by differences in operating leverage, which lead to expected return differences.

2.3. The studies on leases' impact on returns

First chapter in this thesis contributes to the accounting literature that examines operating leases and equity risk. Imhoff et al. (1993), using six years of data, find that in the airline and grocery industries, debt-to-equity ratios, that are adjusted by capitalizing operating leases are more highly correlated with the standard deviation of stock returns than those that are not so adjusted. Imhoff et al. used OLS regressions to determine whether the explanatory power of a model explaining the relation between financial leverage and firm risk increased when the debt to assets ratio adjusted by capitalizing operating leases. They averaged annual observations for each firm. Ely (1995) tests whether using operating lease-adjusted debt-to-equity and return-on-assets (ROA) ratios has more power in explaining the standard deviations of stock returns. The author's sample period is nine years, with 202 firms. Ely (1995) finds a significant relation between the standard deviation of monthly returns and the debt-equity adjustment for operating leases. However, she finds mixed results with adjustments made to ROA ratios. Dhaliwal et al. (2011) also find that the cost-of-equity-capital is positively associated with adjustments to financial leverage from capitalizing off-balance sheet operating leases. The present study covers a longer period with a broader data set than previous studies. I investigate the direct relation between operating leases-induced operating leverage and stock returns, rather than the relation between financial leverage with capitalized operating leases and volatile stock returns or the cost-of-equity-capital.

2.4. The studies on labor impact on returns

There is a growing literature which links labor related risks to the firm returns. Some of these papers focus on proxies for aggregate human capital to explain the cross-section of expected stock returns. Jagannathan and Wang (1996), Campbell (1996), and Santos and Veronesi (2005) use aggregate measures of labor as a variable which covary with returns of some stocks (e.g., value stocks or small stocks). Another group of literature analyze the impact of labor market frictions on the aggregate stock market (Danthine and Donaldson (2002), Merz and Yashiv (2007)).

There are also some studies which link firm level labor related variables to firm risk and returns. For example, Belo et al. (2014) argue that firms with lower labor hiring and investment rates have on average higher expected returns in the cross-section. They find that hiring growth rates predict returns and explain this finding with a Q-theory model with labor and capital adjustment costs. Gourio (2007) uses the term "labor leverage". He argues that firms which have high labor costs "leverage" the smoothness of wages. Since revenues are more cyclical than costs, residual profits become highly procyclical. He shows that a factor model with market and aggregate wage growth as two factors explains part of the variation in the cross section of stock returns. Chen, et al. (2011) focus on unionization as a source of labor-induced operating leverage. Favilukis and Lin (2013) focus on rigid wages and infrequent wage negotiations as a source of labor-induced operating leverage. Donangelo (2014) focuses on labor mobility, and Eisfeldt and Papanikolaou (2013) focus on organizational capital rooted in the firm's key talent.

Another paper from the accounting literature is by Rosett (2003). He defines a labor leverage risk variable which is the number of firm's employees divided by market capitalization of the firm. He also has a measure of labor cost leverage, labor cost divided by market capitalization. He uses Compustat item "Labor and Related Expense" for labor cost and cover only about 10% of all US Compustat firms who voluntarily report their labor costs. He does not exclude financial and regulated firms from the sample. His results show that labor leverage is positively correlated with equity investment risk (standard deviation of daily returns). This study cover only firms who voluntarily report their labor expense, therefore it does not make any inferences about the cross section of stock returns. Also, the use of market capitalization to explain equity investment risk is not a pure measure. It has the problem of using information built already in prices (Berk, 1995).

2.5. The studies on cost of capital

In the literature, ex-post realized returns are used as a proxy for expected returns. However, because of information shocks realized returns are noisy proxies for expected returns, especially in finite samples (Elton (1999)). Elton (1999) and Fama and French (2002) demonstrate that information surprises do not cancel out over time or across firms which makes realized returns different from expected returns.

To mitigate this concern, first, accounting literature, then finance literature have developed an ex-ante approach to measure expected returns by estimating the implied cost of equity. The implied cost of equity is the internal rate of return that equates the current stock price to the present value of all expected future cash flows to equity. This approach uses stock prices and forecasts of a firm's dividends and earnings to infer a firm's cost of (equity) capital.

The ex-ante approach of Gebhardt et. al. (2001) is the most common implied cost of equity measure and has been used in several asset pricing studies (e.g., Lee et al. (2009), Pastor et al. (2008), Chava and Purnanandam (2010), Imrohoroglu and Tuzel (2013), and Donangelo(2014)). The Gebhardt et al. (2001) measure uses I/B/E/S consensus analyst forecasts to proxy for future earnings. However some studies such as Easton and Monahan (2005) argue that the analysts' forecasts are known to exhibit important biases and are not a good proxy for expected cash flows. For example analysts' earnings forecasts tend to be overly optimistic (O'Brien (1988)).

Hou et al. (2012) propose a way of estimating the firm-level implied cost of capital by using earnings forecasts produced by a cross-sectional model instead of using analysts' forecasts. Hou et al. (2012) run cross-sectional regressions of future earnings on total assets, dividends, earnings and accruals to estimate future earnings for horizons of one to five years. Their models builds on models in Fama and French (2000, 2006). Hou et al. (2012) model has been used in several studies such as Chang et al. (2012), Jones and Tuzel (2012), Lee at al. (2014) and Patatoukas (2011).

Tang et al. (2013) building on Gebhardt et al.(2001) and Hou et al. (2012) methods for computing implied cost of capital measures, forecast future profitability using cross-sectional regressions similar to those in Fama and French (2006) and include smaller firms. They estimate values of return on equity up to three years in the future using the Fama and MacBeth cross-sectional regressions. To enlarge the sample size, they use a shortened list of predictors to forecast return on equity.

CHAPTER III

NON-CANCELLABLE OPERATING LEASES AND OPERATING LEVERAGE

Introduction

Operating leases are the most common and important source of off-balance sheet financing, and operating lease use has increased substantially over the past several decades.[3] Cornaggia et al. (2013) document that operating leases increased 745% as a proportion of total debt from 1980 to 2007. According to Eisfeldt and Rampini (2009), leasing is of comparable importance to long-term debt, and for small firms, leasing may

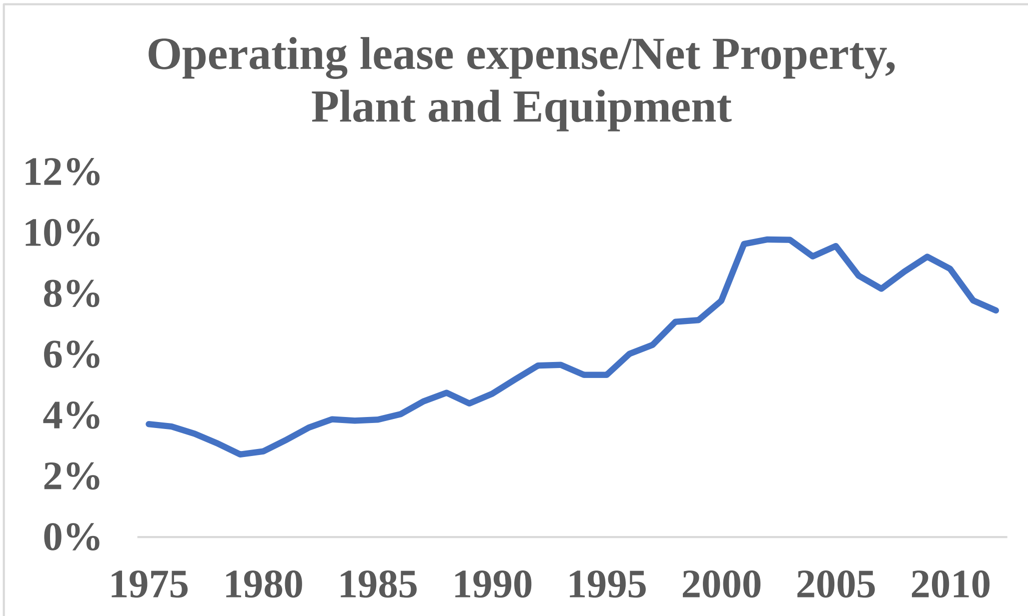
[3] The Financial Accounting Standards Board (FASB) in the United States and the International Accounting Standards Board (IASB) debated whether operating and capital leases should be combined and presented on the balance sheet (*The Wall Street Journal,* March 18 2014). The boards agreed to recognize certain operating leases on the balance sheet. However, they failed to reach a consensus on how to recognize expenses on the lessee's income statement.

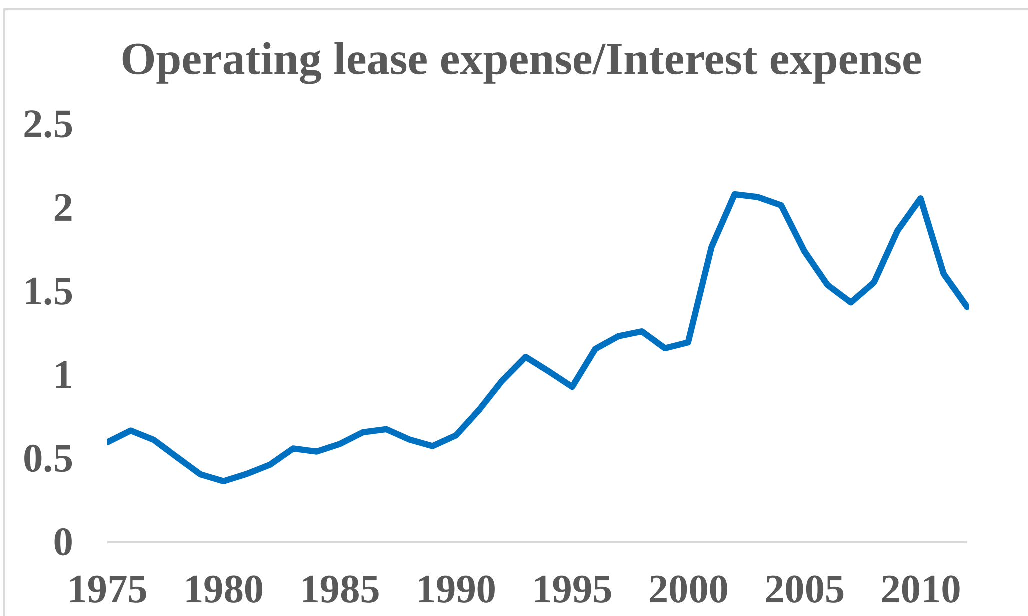
be the largest source of external financing. These authors report that "the proportion of capital that firms lease in merged Census–Compustat data is 16%, which is similar to the long-term debt-to-assets ratio of 19%." Graham et al. (1998) report that operating leases constitute 42% of fixed claims, whereas capital leases and debt are 6% and 52% of fixed claims, respectively, in the 1981–1992 Compustat data. My sample includes U.S. firms in the merged CRSP–Compustat database that report their lease commitments. In my sample, at the end of 2012, on average annual firm non-cancellable operating lease expense consists of 7.5% of their physical capital. Also, on average annual non-cancellable operating lease expense is 1.4 times of interest expense. Figure 3.1 shows the increasing trends in the ratios of operating lease expense to net property, plant and equipment and operating lease expense to interest expense during 1975 to 2012.

Operating lease payments represent a major claim on firms' cash flows. Some of these leases are short term; they may be reversible and provide flexibility to the firm compared to ownership. However, some operating leases are non-cancellable during the lease term except in the event of bankruptcy. During the business cycle, firms cannot easily cancel or adjust the terms of this type of lease contracts with their lessors. This inflexibility in operating lease costs increases firm risk. Firms with relatively high levels of operating lease commitments are more vulnerable to the business cycle than those with fewer commitments. Consequently, shareholders require a higher rate of return for

Figure 3.1

Trend in non-cancellable operating leases





bearing this risk, and expected stock returns of firms with higher levels of operating leases are greater compared to those of firms with lower levels of operating leases.

In this essay, I show that a firm's non-cancellable lease commitments are positively and monotonically related to expected returns. I construct a measure of the firm's operating lease ratio by dividing minimum lease commitments by the firm's total assets. This ratio represents the level of non-cancellable operating lease use. The sample includes U.S. firms in the merged CRSP–Compustat database that report their lease commitments. On average, firms with high lease ratios have higher expected stock returns than firms with low lease ratios: a difference of 11.0% per annum for equal-weighted portfolios and 4.7% per annum for value-weighted portfolios.

Firms with high levels of operating leases are riskier, especially during recessions. The return spread between high- and low-lease ratio firms is countercyclical and is about four times as high during recessions as it is during expansions. To investigate the risk mechanism behind expected returns, I show, first, that operating lease commitments have very limited comovement with sales. Second, the cash flows of firms with high levels of operating leases are more sensitive to aggregate shocks than those of firms with lower levels of operating leases. Third, I show that high-lease ratio firms have more volatile stock returns and cash flow growth.

The risks associated with holding non-cancellable operating leases are mentioned in the business press. For example, when UAL Corp., parent of United

Airlines, filed for Chapter 11 in December 2002, it had $25.2 billion of assets, $22.2 billion of liabilities and $24.5 billion in non-cancellable operating lease commitments. A UAL spokeswoman acknowledges the company's high lease costs were a factor in UAL's bankruptcy.[4] Similarly, US Airways filed for Chapter 11 in August 2002. Its chief executive officer, David Siegel, explained,[5]

> "While US Airways was able to successfully negotiate cost-savings from many of its employee groups, the company determined that it was unlikely to conclude consensual negotiations with certain vendors, aircraft lessors and financiers in a timeframe necessary to complete an out-of-court restructuring. Siegel cited as factors the large number of lessors and financiers and the company's inability to reject surplus aircraft leases and return excess aircraft outside of Chapter 11."

The inflexibility of the firm's lease obligations creates cyclicality in the firm's cash flows, which is related to the concept of operating leverage.[6] For shareholders, lease expense is a form of leverage that makes equity riskier. Danthine and Donaldson

[4] Jonathan Weil, "How Leases Play a Shadowy Role in Accounting" *The Wall Street Journal*, September 22, 2004.

[5] "US Airways to Complete Restructuring Plan in Chapter 11 Reorganization", *PRNewswire*, August 12, 2002.

[6] See Lev (1974), Mandelker and Rhee (1984), Carlson et al. (2004) and Novy-Marx (2011).

(2002) propose a general equilibrium model with labor-induced operating leverage.[7] Their model with fixed labor costs generates operating leverage and provides a better match to the observed equity premium. Tuzel and Zhang (2013) show that firms have lower industry-adjusted average returns in areas where wages strongly comove with aggregate shocks. The idea of labor-induced operating leverage, that is, wages' limited comovement with revenues affecting firm risk, can be extended to operating leases. During recessions revenues fall but lease commitments do not fall, by as much as revenues. These precommitted lease payments transfer the risk to shareholders. Therefore, in my setting, the operating leverage mechanism is created by the firm's non-cancellable leasing contracts.

The firm's financing and leasing decisions are possibly related. Debt and leases have been studied as both substitutes and complements.[8] Myers, Dill, and Bautista (1976) and Myers (1977) are the earliest papers, focusing on capital structure and analyzing the leasing-versus-owning decision in the framework of Modigliani and Miller (1958). Their emphasis is either on tax incentives or agency costs due to the separation of ownership and control (Smith and Wakeman,1985). Subsequently, Sharpe and Nguyen (1995) and Eisfeldt and Rampini (2009) by using firm-level data showed

[7] See Gourio (2007), Chen et al. (2011), Favilukis and Lin (2013),and Donangelo (2014) for examples of labor induced operating leverage studies.

[8] See Ang and Peterson (1984), Lewis and Schallheim (1992), Graham et al. (1998), Lasfer and Levis (1998), Yan (2006) and; Eisfeldt and Rampini (2009).

that smaller firms, that aproperty, plant and equipmentar more financially constrained, rent a larger fraction of their capital. Chen et al. (2014) argue that firms with more inflexible operating costs endogenously choose lower financial leverage ex ante to reduce the likelihood of default in future bad states. Supporting the substitute argument, I find that firms that use higher levels of operating leases have lower financial leverage. To investigate whether a firm's financial leverage has an impact on the relation between its operating leases and stock returns, I control for financial leverage and constraints in the Fama-Macbeth (1974) regressions and perform portfolio sorts with unlevered returns. Both results confirm that the lease premium is independent of financial leverage and financial constraints effects.

This essay makes the following contributions. A large body of literature on asset pricing links firm characteristics to stock returns in the cross-section. Fama and French (2008) provide a survey of this literature. To this literature, this essay adds the firm-level lease rate as a variable that constitutes part of a firm's operating leverage risk and establishes a link to expected stock returns.

Second, this essay contributes to the literature related to operating leverage. While the role of operating leverage on firm risk is studied in the theoretical works of Hamada (1972), Rubinstein (1973), Lev (1974), and Bowman (1979), there is limited supporting empirical evidence on the relation between the firm's operating leverage and stock returns. The difficulty in measuring operating leverage is deciding on which costs are fixed, and on the degree and duration of the inflexibility of costs. Although non-cancellable operating leases are only a component of a firm's inflexible commitments, they have a very high degree of inflexibility compared to other potential fixed costs. The firm discloses them as non-cancellable. Therefore, I can use the level of operating lease commitments as a direct measure of operating leverage. Examining the individual effect of operating leases is informative about the relation between cash flow sensitivity, operating leverage risk and expected returns.

Third, this essay contributes to the cost stickiness literature in accounting[9] and the wage stickiness literature in asset pricing. The literature related to cost stickiness studies adjustment costs, the magnitude of sales changes, expectations of future sales, and managerial empire-building behavior as reasons for cost stickiness in the cross-section. The present essay adds contractual operating lease commitments as a reason for cost stickiness.

Finally, this essay contributes to the accounting literature that examines operating leases and equity risk. Imhoff et al. (1993) and Ely (1995) find that debt-to-equity ratios, that are adjusted by capitalizing operating leases are more highly correlated with the standard deviation of stock returns than those that are not so adjusted. Dhaliwal et al. (2011) also find that the cost-of-equity-capital is positively associated with adjustments to financial leverage from capitalizing off-balance sheet operating

[9] See among others Anderson et al. (2003) and Chen et al. (2012).

leases. The present study covers a longer period with a broader data set than previous studies. I investigate the direct relation between operating leases-induced operating leverage and stock returns, rather than the relation between financial leverage with capitalized operating leases and volatile stock returns or the cost-of-equity-capital.

In summary, this essay shows that firms with high levels of non-cancellable operating lease commitments have more operating leverage, which amplifies exposure to business cycle risk, and consequently, these firms have higher expected stock returns. Section 2 examines the relation between lease commitments and expected returns, sales, financial leverage, industry effects, and cash flow sensitivity. Section 3 concludes the study.

Empirical Analysis and Results

This section demonstrates the empirical link between a firm's non-cancellable operating lease commitments and expected stock returns in the cross-section. I construct a measure of the firm's level of operating leases relative to its total assets, using widely available accounting data. I call this ratio the operating lease ratio. I follow two complementary empirical methodologies to examine the relation between the firm's operating lease ratio and its stock returns. In the first approach, I construct portfolios sorted on the lease ratio, and in the second approach, I run firm-level Fama-MacBeth regressions. These approaches allow a cross-check of the results and guide further testing to determine whether my operating lease variable is systematically related to firm risk.

3.1. Data

Statement of Financial Accounting Standards No. 13 requires firms to disclose future minimum rental payments for each of the five succeeding fiscal years and aggregate payments for years thereafter. For operating leases, Compustat has fields for one-year through five-year-out minimum operating lease commitments (MRC1, MRC2, MRC3, MRC4, MRC5), five-year total lease commitment (MRCT), commitments thereafter (beyond five years) (MRCTA), and rental expenses (XRENT). Short-term leases with lease term of less than one year is reported under XRENT. MRC1 is the minimum rental expense due in the first year under all existing non-cancellable operating leases.[10] For year *t*, MRC1 is reported at the end of year *t*-1 in a footnote to the balance sheet. Therefore, I use the minimum lease commitments due in year 1 (MRC1) lagged by one year as in Sharpe and Nguyen (1995) for the level of a firm's non-cancellable annual operating lease expense. This annual payment is divided by the firm's total assets. If I use net property, plant, and equipment or the firm's total operating expenses instead of

[10] At the end of each year, the firm reports its future rental commitments. For example at the end of year *t*, MRC2 is the minimum future lease payment due in year *t*+2.

its total assets, I obtain similar results.

Alternatively, I can estimate the present value of a firm's total non-cancellable operating lease commitments and use it instead of MRC1 (an annual expense measure). There are three major approaches in the literature for estimating the stock value of operating leases. The first is the present value method. This approach capitalizes the present value of minimum lease payments for five years (MRC1, MRC2, MRC3, MRC4, MRC5) plus the "thereafter" value (MRCTA) discounted at an appropriate discount rate. The second method is Moody's factor method, which capitalizes operating leases by eight times the current-year rent expense. The third method of operating lease capitalization, suggested by Lim et al. (2005), uses the perpetuity estimate of the operating lease payment. Lim et al. argue that the first method is known to significantly underestimate leased capital, since lease commitments are a lower bound on obligations and do not account for lease renewals; in addition, the availability of MRCTA is limited prior to 2000. The second and third methods either multiply or divide current-year operating lease expenses by a particular multiple or discount rate. Therefore, my measure of minimum operating lease commitments is a conservative measure of the non-cancellable operating lease obligation and is free from assumptions about the discount rates used in the estimation and the firm's accounting practices with respect to operating leases. I also study only non-cancellable minimum rental commitments. However, some operating leases are cancellable but subject to termination penalties. This type of contractual obligations also contributes to the operating leverage effect.

My key variable, the operating lease ratio, is as follows:

$$\text{Operating Lease Ratio} = \frac{\text{Firm's operating lease payments}}{\text{Firm's total assets}} = \frac{\text{MRC1}_{t\text{-}1}}{\text{Assets}_t} \tag{1}$$

I also track the following variables as control variables: Size is market capitalization of the firm in June of the year *t*+1, from CRSP. Book-to-market ratio is measured for the fiscal year ending in calendar year *t*. Following Fama and French, I define book equity as stockholders equity, plus balance sheet deferred taxes and investment tax credit (if available), plus post-retirement benefit liabilities (if available), minus the book value of preferred stock. Depending on availability, I use redemption, liquidation, or par value (in that order) for the book value of preferred stock. If stockholder equity is not available, I use the book value of common equity plus the book value of preferred stock. If common equity is not available, I compute stockholder equity as book value of assets minus total liabilities.

I compare my lease ratio with Novy-Marx's (2011) operating leverage measure, which is the sum of the cost of goods sold plus selling, general, and administrative expenses, divided by total assets. Financial leverage is the ratio of long-term debt plus debt in current liabilities, divided by total assets. As in Eisfeldt and Rampini (2009), I include cash and short-term investments to total assets ratio, and cash flow (income before extraordinary items plus depreciation and amortization) divided by total assets to indicate firms that are financially constrained. I also compute the Kaplan-Zingales (1997) index, the Whited-Wu (2006) index and the Hadlock-Pierce (2010) size-age index as alternative financial constraint measures. The five-variable Kaplan-Zingales index is constructed following Lamont et al. (2001). The six-variable Whited-Wu index is constructed following Whited and Wu (2006). The size-age index is calculated as (-0.737* Size) + (0.043* Size^2) – (0.040* Age), where Size equals the log of inflation-adjusted book assets and Age is the number of years the firm is listed with a nonmissing stock price in Compustat. Size is winsorized (i.e., capped) at (the log of) $4.5 billion and Age is winsorized at 37 years. Asset growth is change in the natural log of assets from year *t*-1 to year *t*, as in Cooper et al. (2008). Inventory growth is change in the natural log of total inventories, all measured from year *t*-1 to year *t*. The return on equity (ROE) is net income in year *t* divided by book equity for year *t*. The return on assets (ROA) is net income in year *t* divided by total assets for year *t*. The investment rate is capital expenditure minus sales of property, plant, and equipment at time *t* divided by the average property, plant, and equipment at time *t*-1 and *t*, as in Belo et al. (2014).

The sample is an unbalanced panel with 4926 distinct firms. Accounting data are from Compustat and span from 1975 to 2012. Monthly stock returns are from CRSP and from July 1976 to December 2013. My sample begins in 1975 since MRC1 is not available before 1975. Approximately 70% of firms in the Compustat population during this study's sample years report their minimum non-cancellable operating lease expense. I include only companies with ordinary shares and listed on NYSE, AMEX or

NASDAQ. I exclude firms with missing Standard Industrial Classification (SIC) codes, negative book values, missing June market values, and missing or zero minimum lease commitments due in one year. As is standard, I omit regulated firms whose primary SIC code is between 4900 and 4999 (regulated firms) or between 6000 and 6999 (financial firms). Following Vuolteenaho (2002) and Xing (2008), I require firms to have a December fiscal-year end to align the accounting data across firms. In other words, my sample includes firms with a fiscal year ending only in December to ensure that the accounting data are not outdated by the time of the sorting procedure. However, my results are very similar if I drop this December fiscal year-end restriction (see section 2.11). Following Fama and French (1993), I include only firms with at least two years of data in the sample. The data for the five Fama-French (2014) factors—small-minus-big, SMB; high-minus-low, HML; market, MKT; robust-minus-weak, RMW; and conservative-minus-aggressive, CMA—are from Kenneth French's web page.

3.2. Portfolio Sorts

I construct 10 one-way-sorted lease portfolios and investigate the characteristics of these portfolios' post-formation average stock returns. Following Fama and French (1993), I match CRSP stock return data from July of year t+1 to June of year t+2 with lease ratio information for the fiscal year ending in year t, allowing for a minimum of a six-month gap between the fiscal year-end and return tests. At the end of each June in year t+1, I sort the firms in the sample according to their lease ratio and group them into decile portfolios. Firms which do not use operating leases are not included in the sample since they finance their capital requirements in other ways, those firms do not carry the cash flow risk of operating leases.

Table 3.1 shows the dispersion in the descriptive characteristics of the lease ratio- sorted portfolios, and Table 3.2 shows the time-series averages of the cross-sectional Spearman rank correlations among other firm characteristics. The first row in Table 3.1 provides data on the average level of the lease ratio of the firms in these decile portfolios. The results in Table 1 indicate a monotonic relation between the lease ratio and size. Firms that have large non-cancellable lease obligations are small, with low financial leverage. These firms carry higher cash levels to fund lease payments and are financially constrained, as similarly measured in Eisfeldt and Rampini (2009) and Cosci et al. (2013). The profitability measure, ROA, which is also highly correlated to Eisfeldt and Rampini's internal available funds measure (cash flow), is monotonically and negatively related to operating lease commitments. The relation with the other measure of profitability, ROE, and the operating lease ratio is not monotonic. Asset growth and inventory growth, both decrease monotonically with operating leases. The high correlation between firm size and the lease ratio is expected, as documented in Eisfeldt and Rampini (2009).

Table 3.1

Descriptive statistics for portfolios sorted on lease ratio

This table reports the average value of firm characteristics of lease variable sorted portfolios averaged over the years (Portfolio 1 is labelled as "Low", and Portfolio 10 is labelled as "High"). OPLEASE is the ratio of non-cancellable operating lease payments to total assets, OPL PAY is the non-cancellable operating lease payments in million dollars, ASSETS is the total assets in million dollars, B/M is the book-to-market ratio, SIZE is the market capitalization in million dollars, OPLEV is the Novy-Marx's operating leverage measure, FINLEV is the financial leverage, CF is the cash flow divided by total assets, CASH is the cash divided by total assets, KZ is the Kaplan-Zingales index, INT/OPL is the interest expense divided by non-cancellable operating lease payments, INV is the investment rate, ROE is return on equity, ROA is return on assets, AG is asset growth rate, INVG is inventory growth rate.

	Low	2	3	4	5	6	7	8	9	High
OPLEASE	0.2%	0.4%	0.6%	0.8%	1.0%	1.3%	1.7%	2.3%	3.4%	8.3%
OPL PAY	8	20	20	22	24	22	22	22	26	34
ASSETS	3,930	5,155	3,363	2,842	2,428	1,709	1,271	958	765	453
SIZE	3,446	4,469	3,331	3,019	2,449	1,738	1,272	900	737	425
BM	0.87	0.84	0.82	0.77	0.77	0.80	0.81	0.82	0.83	0.79
OPLEV	0.64	0.80	0.91	1.00	1.06	1.13	1.21	1.29	1.42	1.75
FINLEV	0.27	0.25	0.24	0.22	0.21	0.21	0.21	0.21	0.20	0.19
CASH	0.14	0.15	0.15	0.16	0.16	0.17	0.18	0.18	0.18	0.17
CF	0.08	0.08	0.08	0.07	0.06	0.05	0.04	0.03	0.01	0.00
KZ	0.60	0.63	0.63	0.53	0.58	0.60	0.69	0.69	0.73	0.77
INT/OPL	16.93	5.12	3.30	2.36	1.84	1.45	1.15	0.88	0.61	0.30
INV	0.28	0.27	0.27	0.28	0.29	0.29	0.30	0.30	0.36	0.29
ROE	-0.06	-3.60	0.10	0.01	0.07	0.01	-0.11	-0.28	-0.27	-0.64
ROA	0.04	0.03	0.03	0.03	0.02	0.01	-0.01	-0.02	-0.03	-0.06
AG	0.57	0.33	0.26	0.24	0.20	0.18	0.17	0.14	0.10	0.08
INVG	2.88	0.34	0.23	0.25	0.19	0.21	0.19	0.18	0.12	0.16

The high positive correlation between Novy-Marx's (2011) operating leverage and my lease ratio is due to the similarity in the numerator. A firm's operating lease payments constitute a portion of the selling, general and administrative expenses.

Despite the correlation, I show that my lease ratio has a significant impact after controlling for Novy-Marx's measure of operating leverage in Fama-MacBeth regressions.

One reason why firms lease their capital versus owning is given by Eisfeldt and Rampini (2009), who argue that although leasing is more costly due to the agency problem induced by the separation of ownership and control, financially constrained firms prefer leasing due to the benefit of higher debt capacity. Therefore, more financially constrained firms, which have limited internal funds, lease a larger proportion of their capital than less constrained firms do. The authors use the ratio of cash flow-to-assets as the most direct measure of available internal funds. In Table 1, cash flows-to-assets is negatively correlated with the proportion of leased capital. Firms with high lease commitments have lower cash flow-to-asset ratios and higher Kaplan-Zingales index values. The other measure of available funds, the cash-to-assets ratio, is positively correlated to my lease ratio. This cash measure, as explained by Eisfeldt and Rampini (2009), represents net working capital to fund firm operations. Therefore, firms with higher lease ratios have higher cash balances to compensate for their inflexible higher lease costs. However, their retained earnings are lower to finance capital investments. The fraction of interest expense to non-cancellable operating leases is also decreasing with the lease ratio. For firms in the higher lease ratio deciles, lease payments exceed interest expense.

Table 3.2

Spearman rank correlations

This table reports the time-series averages of the cross-section Spearman rank correlations among firm characteristics. In this table, OPLEASE is the ratio of non-cancellable operating lease payments to total assets, OPL PAY is non-cancellable operating lease payments, ASSETS is total assets, B/M is book-to-market ratio, SIZE is market capitalization, OPLEV is Novy-Marx's operating leverage, FINLEV is financial leverage, CF is cash flow divided by total assets, CASH is cash divided by total assets, KZ is Kaplan-Zingales Index, INV is investment rate, ROE is return on equity, ROA is return on assets, AG is asset growth rate, INVG is inventory growth rate.

	OPLEASE	SIZE	B/M	OPLEV	FINLEV	CASH	CF	KZ	INV	ROE	ROA	AG	INVG
OPLEASE	1.00												
SIZE	-0.28	1.00											
B/M	-0.02	-0.32	1.00										
OPLEV	0.42	-0.32	0.08	1.00									
FINLEV	-0.08	0.05	0.15	-0.11	1.00								
CASH	0.06	-0.07	-0.26	-0.10	-0.50	1.00							
CF	-0.10	0.34	-0.33	0.00	-0.24	0.05	1.00						
KZ	0.07	-0.14	0.08	0.00	0.77	-0.42	-0.38	1.00					
INV	0.09	-0.02	-0.31	0.01	-0.27	0.24	0.17	-0.15	1.00				
ROE	-0.10	0.36	-0.38	0.04	-0.07	0.02	0.79	-0.22	0.13	1.00			
ROA	-0.11	0.31	-0.36	0.04	-0.30	0.12	0.88	-0.42	0.19	0.89	1.00		
AG	-0.15	0.15	-0.31	-0.14	-0.04	0.08	0.31	-0.08	0.39	0.37	0.38	1.00	
INVG	-0.09	0.05	-0.19	-0.08	-0.02	0.00	0.13	0.01	0.26	0.17	0.18	0.52	1.00

3.3. Returns of Lease Ratio Sorted Portfolios

Table 3.3 investigates the relation between my lease ratio and expected excess returns (excess of the risk-free rate). Ex-post realized stock returns are used as a proxy for expected returns. The table shows the dispersion in both equal and value-weighted portfolio returns for firms sorted into 10 portfolios based on the lease ratio. Expected returns of the portfolios increase monotonically with the lease ratio. The annualized difference between the returns of high- and low-lease ratio firms is 11.0% for equal-weighted portfolios and 4.7% for value- weighted portfolios, both spreads being statistically significant.

To understand the relation between the lease ratio and expected returns over business cycles, I separate my sample into expansionary and contractionary periods around the portfolio formation period (see Imrohoroglu and Tuzel (2014) for a similar approach). I use (National Bureau of Economic Research) NBER business cycle dates as reported on the NBER website. I designate recession/expansion in June of each year and examine the returns of lease ratio-sorted portfolios over the succeeding 12 months. I find that the positive relation between the lease ratio and expected returns persists in both expansions and in contractions for equal-weighted portfolios. However, there are significant differences in returns over business cycles. The average level of expected returns is much higher in recessions than in expansions. The annualized spread between the returns of high and low lease ratio portfolios is also much higher during contractions, 29.0%, than during expansions, 7.2%, in equal-weighted portfolios. For value-weighted portfolios, the spread is 20.3% and is significant during contractions. However, the value-weighted spread is not significant during expansions.

Low-lease ratio firms have lower expected returns in recessions and high-lease ratio firms have lower expected returns during expansions compared to their average

Table 3.3

Portfolio sorts on the lease variable

This table reports average expected returns of the lease variable sorted portfolios (Portfolio 1 is labelled as "Low", and Portfolio 10 is labelled as "High"). R_{EW}^{e} is the equal-weighted monthly excess returns (in excess of the risk-free rate). R_{VW}^{e} is the value-weighted monthly excess returns (%) . δ_{EW}^{e} and δ_{VW}^{e} are the corresponding standard deviations. *t*-statistics are reported in parentheses. Expected returns are measured in the year following portfolio formation, from July of year *t*+1 to June of year *t*+2. Expansion and contraction periods are designated in June of year *t* +1 based on the NBER business cycle that year. Returns over expansions and contractions are measured from July of year *t*+1 to June of year *t*+2.

Expected Returns, July 1976-December 2013

	Low	2	3	4	5	6	7	8	9	High	High-Low
All states, 450 months											
R_{EW}^{e}	0.88	1.01	1.10	1.16	1.17	1.30	1.41	1.57	1.66	1.80	0.92
t	(3.07)	(3.67)	(4.02)	(4.12)	(4.20)	(4.45)	(4.49)	(5.02)	(5.41)	(5.68)	(5.14)
δ_{EW}^{e}	6.07	5.83	5.79	5.96	5.90	6.19	6.66	6.64	6.51	6.71	3.79
R_{VW}^{e}	0.51	0.61	0.68	0.73	0.70	0.81	0.55	0.67	0.82	0.90	0.39
t	(2.01)	(2.95)	(2.74)	(3.22)	(2.87)	(3.32)	(1.94)	(2.52)	(3.15)	(3.25)	(1.98)
δ_{VW}^{e}	5.33	4.36	5.27	4.81	5.17	5.18	5.98	5.67	5.51	5.87	4.20
Expansions, 378 months											
R_{EW}^{e}	0.90	0.97	1.00	1.04	1.04	1.16	1.26	1.42	1.49	1.51	0.60
t	(3.24)	(3.60)	(3.67)	(3.68)	(3.72)	(3.97)	(3.92)	(4.36)	(4.72)	(4.74)	(3.20)
δ_{EW}^{e}	5.42	5.23	5.30	5.52	5.41	5.68	6.27	6.33	6.15	6.18	3.66
R_{VW}^{e}	0.62	0.69	0.73	0.80	0.76	0.87	0.58	0.79	0.76	0.76	0.14
t	(2.45)	(3.20)	(2.98)	(3.49)	(2.95)	(3.46)	(2.05)	(2.96)	(2.80)	(2.73)	(0.67)
δ_{VW}^{e}	4.92	4.20	4.74	4.45	5.03	4.87	5.53	5.21	5.25	5.41	3.98
Contractions, 72 months											
R_{EW}^{e}	0.73	1.09	1.28	1.89	1.85	1.94	1.99	2.31	2.55	3.15	2.42
t	(0.72)	(1.24)	(1.73)	(1.89)	(1.99)	(2.07)	(2.19)	(2.49)	(2.66)	(3.19)	(5.42)
δ_{EW}^{e}	8.96	8.08	8.16	7.92	8.04	8.24	8.33	8.02	8.03	8.65	4.43
R_{VW}^{e}	(0.14)	0.19	0.22	0.46	0.28	0.43	0.34	0.63	0.63	1.55	1.69
t	(-0.14)	(0.30)	(0.27)	(0.56)	(0.37)	(0.61)	(0.38)	(0.76)	(0.71)	(1.72)	(2.52)
δ_{VW}^{e}	8.17	5.32	6.85	7.00	6.34	6.00	7.65	6.99	7.56	7.65	5.67

returns during all states. The increase in expected returns of high-lease portfolios is particularly large, from 18.1% in expansions to 37.8% in contractions. For low lease ratio firms, expected returns decrease from 10.9% in expansions to 8.8% in contractions in equal-weighted portfolios, and they decrease from 7.5% to -1.2% in value-weighted portfolios. A simple two-sample t-test with unequal variances confirms that the return spread in expansions is statistically different than in recessions.The *t*-statistics are -3.84 for the equal-weighted spread portfolio and -2.53 for the value-weighted spread portfolio. My interpretation of the spread in expected returns across these portfolios, especially in recessions, centers around the risk premia associated with the higher risk of high-lease ratio firms.

3.4. Firm-Level Fama-MacBeth Regressions

Portfolio sorts indicate a statistically and economically significant positive relation between the lease ratio and returns. I now use a different approach to investigate the strength of the relation between lease rates and stock returns. I run firm-level Fama-MacBeth cross-sectional regressions (Fama and MacBeth, 1973) to predict stock returns using the lagged firm-level lease rates as return predictors.

I estimate the following cross-sectional regression for firm i = 1, . . ., N in each month:

$$R_i = \propto + \beta\lambda_i + \gamma D_i + \varepsilon_i \tag{2}$$

where, i is a firm index, and monthly returns are denoted by R_i. My measure of the lease ratio is denoted by λ_i and D_i is a vector of controls. I measure λ_i and all control variables based on accounting ratios at the end of the preceding year. I run the cross-sectional regression for each month separately. I then take the time series of the estimated monthly cross-sectional regression coefficients and calculate the mean regression coefficients. To test their significance, I report autocorrelation and heteroskedasticity corrected Newey-West (1987) standard errors for the estimated coefficients. The average regression coefficients are reported in Table 3.4.

I find that the lease rate is strongly positively related to expected returns. The cross-sectional regression, in which the lease rate is the only explanatory variable, produces an average slope of 15.98. The magnitude of the effect is significant both statistically and economically. The 15.98 average regression coefficient translates into approximately 6.8% higher expected returns for firms in the highest lease decile compared to firms in the lowest lease decile. When I divide my sample into two time periods, the results are not sensitive to the sample period, although the effect is stronger in the first half of the sample period, fiscal years 1975 to 1993.

To understand the marginal predictive power of the lease rate, I control for several firm characteristics that could be related to my lease ratio variable. As in Fama and French (2008), I do not include market beta, since the market beta for individual stocks is not precisely measured in the data. I find that the cross-sectional regressions that include the log size, log book-to-market, momentum, and operating leverage all produce positive and statistically significant average slopes for the lease ratio.

In the literature, empirical evidence on the relation between financial leverage and stock returns is mixed. When other firm characteristics are included in regressions, financial leverage often becomes insignificant in predicting returns (Fama and French, 1992).[11] The firm's financial leverage does not impact the relation between its operating leases and stock returns.

Eisfeldt and Rampini (2009) argue that more financially constrained firms lease more of their capital than less constrained firms do. My results could be driven by financial constraints rather than the operating leverage effect. Therefore I control for four different measures of financial constraints, cash flow scaled by assets, the Kaplan-Zingales (1997) index, the size-age index of Hadlock and Pierce (2010) and the Whited-Wu (2006) index. After controlling for these measures of financial constraints, the relation between operating leases and returns remains. Cash flow scaled by assets ratio has a high correlation with ROA (0.88) and size-age (SA) index has a high correlation with size (0.84). Among those four measures, Hadlock and Pierce's size-age index is the most powerful and these financial constraint measures confirm the relation that greater financial constraint leads to higher stock returns. When I include other control

[11] George and Hwang (2010) provide further evidence that the book leverage premium is weak and potentially negative.

Table 3.4

Fama-MacBeth regressions employing the lease rate

This table reports the results from Fama-MacBeth regressions of firm returns on firm lease ratios. Specifications 2 to 6 include controls for firm characteristics. OPLEASE is the ratio of operating lease payments to total assets. B/M is the book-to-market ratio, SIZE is the market capitalization, MOM is the past performance measured at 12 to two months ($r_{12,2}$), OPLEV is the Novy Mark's operating leverage measure, FINLEV is the financial leverage, CF is the cash flow divided by total assets, CASH is the cash divided by total assets, KZ is the Kaplan-Zingales index, SA is the size-age index, WW is the Whited-Wu index, INV is the investment rate, ROE is the return on equity, ROA is the return on assets, AG is the asset growth rate, INVG is the inventory growth rate, PIN is the probability of informed trade. Operating lease ratio is winsorized at the top and bottom 0.5% to decrease the influence of outliers. *t*-statistics are reported in parentheses below the coefficient estimates (computed as in Newey-West(1987) with four lags). The sample covers July 1976 to December 2013.

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
OPLEASE	15.98	8.88	13.59	15.89	15.50	14.12	15.27	10.37	15.78	13.67	15.64	15.96	14.83	14.25	7.66	4.42
	(5.13)	(3.94)	(4.43)	(5.26)	(5.01)	(5.04)	(4.95)	(4.20)	(5.14)	(4.88)	(5.09)	(5.09)	(4.72)	(4.42)	(1.74)	(1.96)
Log(SIZE)		-0.24														-0.20
		(-4.95)														(-5.13)
Log(B/M)		0.20														0.15
		(2.25)														(2.07)
MOM		0.00														0.00
		(1.28)														(0.45)
OPLEV			0.14													0.07
			(2.69)													(1.23)
FINLEV				0.23												-0.09
				(0.64)												(-0.24)
CASH					0.39											
					(0.82)											
CF						-1.20										
						(-2.17)										
KZ							0.05									0.01
							(1.51)									(0.15)
SA								0.19								
								(3.13)								
WW									-0.67							
									(-2.28)							
ROA										-1.27						-0.20
										(-2.43)						(-0.41)
ROE											-0.15					
											(-1.51)					
INV												-0.46				-0.35
												(-1.99)				(-2.28)
AG													-0.32			-0.45
													(-3.93)			(-4.38)
INVG														-0.08		-0.01
														(-2.10)		(-0.25)
PIN															1.60	
															(1.35)	

variables and financial constraint measures all together in the Fama-MacBeth regressions, the choice of financial constraint measure does not have an impact on the significance of the lease ratio.

The empirical evidence shows that the firm's capital investment is inversely related to expected returns.[12] In Table 3.1, firms with high lease ratios have lower asset and inventory growth rates. However, the correlation between the firm's investment rate and lease ratio is positive. In the cross-sectional regressions, when I control for these investment-related variables, the operating lease ratio's coefficient remains significant and positive. These findings show that the operating lease effect is not due to investment and profitability relations.

I also control for the effects of possible information assymmetries created by the nature of operating lease transactions. Operating leases are typically found in the footnotes of financial statements and may not be properly reported. This accounting deficiency causes information risk. Probability of informed trade (PIN) is used as a measure of information risk in the literature (e.g., Easley et al., 2002; Chen et al., 2007). The PIN estimates span the period 1983-2001.[13] Although the coefficient of the lease ratio is lower when the PIN measure is included in the regressions, it remains positive

[12] See for example, Cochrane (1991), Titman et al. (2004), Xing (2008), Cooper et al. (2008), and Polk and Sapienza (2009).
[13] PIN estimates are from Soeren Hvidkjaer's web site. Only NYSE and AMEX listed firms have PIN measures in this sample.

and statistically significant.

In the literature, taxes are widely seen as one of the most important reasons to lease. According to Lasfer and Levis (1998), "while large companies lease mainly for tax savings, small companies lease to overcome their inability to access debt to finance growth opportunities and survival." Lewis and Schallheim's (1992) model implies that those firms with lesser ability to use tax shields are those for which leasing is most advantageous. I find that firms with high lease ratios have lower marginal tax rates.[14] Although the question of why firms use leases is not the focus of this essay, taxes may have a mechanical link to firm risk. When I control for marginal tax rates in my regressions, operating leases have a coefficient of 6.24, which is statistically significant at the 1% level.

Following Fama and French (2008), Table 3.5 presents the cross-sectional regression results for three groups of stocks—microcap, small, and big stocks—estimated separately. The three groups are classified using the Fama and French (2008) size breakpoints of the smallest 20%, the middle 20% to 50%, and the largest 50% of all NYSE firms. After controlling for size, book-to-market, and momentum, I observe that the relation between operating leases and expected returns is stronger in smaller stocks than in bigger stocks.

[14] Marginal tax rate estimates of Blouin et al. (2010) are used. The data are available from 1980.

Gomes and Schmid (2010) explain that the relation between financial leverage and stock returns is inconclusive because of the changing firm risk over the firm's life cycle. In their investment-based asset pricing model, mature, bigger firms have greater financial leverage with low underlying asset risk, while small firms are more subject to operating leverage. Fixed costs of default are more important for small firms. Cross-sectional regressions excluding microcaps and including control variables also produce significant coefficients for the lease ratio.

Table 3.5

Fama-MacBeth regressions employing the lease rate across different size groups

This table reports the results from Fama-MacBeth regressions of firm returns on firm lease ratios. Firms are assigned to size groups at the end of June each year. Microcap stocks (micro) are below the 20th percentile of the NYSE market cap at the end of June, small stocks are between the 20th and 50th percentiles, and big stocks are above the NYSE median. All but micro combines small and big stocks. OPLEASE is the ratio of operating lease payments to total assets. B/M is the book-to-market ratio, SIZE is the market capitalization, MOM is the past performance measured at 12 to two months. *t*-statistics are reported in parentheses below the coefficient estimates, computed as in Newey-West (1987) with four lags. The sample covers July 1976 to December 2013.

	Micro-cap	Small-cap	Big-cap	All but micro
OPLEASE	6.27	5.48	7.19	5.97
	(2.86)	(1.57)	(1.65)	(1.78)
Log(SIZE)	-0.63	-0.05	-0.07	-0.10
	(-6.82)	(-0.55)	(-1.41)	(-2.15)
Log(B/M)	0.10	0.21	0.18	0.19
	(1.01)	(2.08)	(1.95)	(2.13)
MOM	0.00	0.00	0.00	0.00
	(1.61)	(1.59)	(1.23)	(1.35)

3.5. Asset Pricing Tests

To investigate whether the variation in excess returns across these portfolios reflects a compensation for risk, I conduct time series asset pricing tests using the CAPM, Carhart (1997) four factor model, and the Fama–French (2014) five factor model as the benchmark asset pricing models. Fama–French five-factor model augments the Fama–French (1993) three-factor model of by adding profitability (RMW) and investment (CMA) factors. As demonstrated in Table 1, my lease ratio is related to size at the firm level. Therefore, I explore whether the returns of lease-ratio-sorted portfolios are systematically related to the SMB factor.

Table 3.6 presents the alphas (pricing errors) and betas of lease-ratio-sorted portfolios for the CAPM, Carhart and Fama–French models. Alphas are estimated as intercepts from the regressions of lease ratio-sorted portfolio excess returns on the market excess return portfolio (MKT), SMB, HML, momentum (MOM), robust minus weak (RMW) and conservative minus aggressive (CMA) factors. RMW is the return spread of the portfolios of the most profitable firms minus the least profitable, and CMA is the return spread of the portfolios of firms that invest conservatively minus aggressively. Fama and French (2014) measure profitability by revenues minus the cost of goods sold, interest expense, and selling, general, and administrative expenses, all divided by book equity and their measure of investment rate is the growth of total assets divided by total assets.

The first panel of the table reports the results for equal-weighted portfolios, and the next panel reports value-weighted portfolio results. I find that portfolios with high lease ratios load heavily on SMB, whereas the loadings of the low lease ratio portfolios are low, even negative in value-weighted portfolios. The loadings on HML, RMW, and CMA are non-monotonic. Value- weighted high lease ratio portfolios have higher loadings on MKT compared to low-lease ratio portfolios. Dropping the momentum factor has no material impact on these results.

None of the models completely explains the return spread in the equally weighted portfolios: The High-Low lease ratio portfolio has a CAPM alpha of 11.04%, a Carhart alpha of 11.40%, and Fama–French five factor alpha of 10.08%, all statistically significant. The spreads in the alphas of the value-weighted portfolios are not statistically significant. Based on these results, I do not propose that the lease ratio is a separate risk factor that is not captured by these factors, but rather that the lease ratio is systematically related to SMB.

Table 3.6

Alphas and betas of portfolios sorted on lease ratio

This table presents the regressions of equal-weighted and value-weighted excess portfolio returns on various factor returns. MKT, SMB, HML, MOM, RMW and CMA factors are taken from Kenneth French's website. The portfolios are sorted on lease ratio. Top panel reports the alphas and betas of equal-weighted portfolios. Bottom panel presents the results for value-weighted portfolios. *t*-statistics, computed using the Newey-West estimator, are in parentheses.

Dependent variable: Excess returns, July 1976-December 2013

Equal Weighted Portfolios

	Low	2	3	4	5	6	7	8	9	High	High-Low
CAPM											
alpha	0.17	0.30	0.40	0.44	0.46	0.58	0.66	0.81	0.93	1.09	0.92
	(1.18)	(2.46)	(3.23)	(3.38)	(3.56)	(3.88)	(3.75)	(4.81)	(5.44)	(5.46)	(5.09)
MKT	1.17	1.16	1.15	1.18	1.16	1.18	1.23	1.25	1.21	1.17	-0.03
	(36.73)	(42.53)	(42.24)	(40.51)	(40.44)	(35.99)	(31.46)	(33.50)	(32.26)	(26.51)	(-0.08)
Carhart											
alpha	0.16	0.33	0.37	0.46	0.45	0.53	0.66	0.79	0.84	1.07	0.95
	(1.30)	(3.73)	(4.18)	(5.61)	(5.53)	(6.08)	(6.25)	(7.42)	(7.60)	(8.32)	(5.59)
MKT	1.11	1.07	1.07	1.05	1.05	1.03	1.03	1.07	1.04	0.98	-0.13
	(39.80)	(52.51)	(52.56)	(54.77)	(55.37)	(50.95)	(41.79)	(42.92)	(40.59)	(32.75)	(-3.18)
HML	0.23	0.13	0.18	0.08	0.12	0.06	-0.01	-0.02	0.09	0.13	-0.11
	(5.42)	(4.24)	(5.71)	(2.73)	(4.11)	(1.99)	(-0.25)	(-0.43)	(2.24)	(2.75)	(-1.72)
SMB	0.57	0.58	0.61	0.71	0.72	0.89	1.02	0.95	0.96	1.09	0.53
	(14.09)	(19.76)	(20.75)	(25.75)	(26.35)	(30.32)	(28.58)	(26.58)	(25.68)	(25.27)	(9.24)
UMD	-0.22	-0.24	-0.20	-0.23	-0.21	-0.16	-0.22	-0.17	-0.14	-0.29	-0.06
	(-7.60)	(-12.31)	(-10.13)	(-12.56)	(-11.75)	(-8.56)	(-9.22)	(-7.14)	(-5.87)	(-10.20)	(-1.69)
Fama French 5 factor model											
alpha	0.09	0.25	0.25	0.36	0.31	0.48	0.59	0.69	0.77	0.94	0.84
	(0.71)	(2.25)	(2.32)	(3.22)	(2.76)	(4.60)	(4.36)	(5.59)	(6.91)	(5.38)	(4.25)
MKT	1.10	1.07	1.09	1.07	1.07	1.05	1.06	1.09	1.07	1.00	-0.09
	(32.07)	(32.14)	(35.02)	(35.19)	(36.09)	(36.34)	(37.76)	(31.84)	(27.31)	(22.10)	(-1.98)
HML	0.40	0.27	0.19	0.09	0.12	0.02	-0.10	-0.15	-0.04	0.12	-0.28
	(4.33)	(3.35)	(2.25)	(1.19)	(1.65)	(0.32)	(-1.41)	(-1.97)	(-0.46)	(1.16)	(-3.46)
SMB	0.56	0.55	0.58	0.66	0.70	0.84	0.92	0.90	0.92	1.02	0.47
	(7.76)	(9.55)	(9.26)	(11.17)	(11.82)	(18.45)	(17.12)	(15.34)	(11.98)	(13.89)	(6.85)
RMW	-0.13	-0.12	-0.09	-0.17	-0.05	-0.15	-0.27	-0.15	-0.12	-0.18	-0.05
	(-1.29)	(-1.30)	(-1.03)	(-2.30)	(-0.56)	(-2.68)	(-3.39)	(-2.02)	(-1.39)	(-1.78)	(-0.59)
CMA	-0.36	-0.26	-0.01	0.00	-0.02	0.02	0.15	0.20	0.14	-0.02	0.34
	(-3.41)	(-2.55)	(-0.09)	(0.03)	(-0.23)	(0.16)	(1.40)	(1.87)	(1.10)	(-0.12)	(2.08)

Table 3.6 (continued)

	Value Weighted Portfolios										
	CAPM										
	Low	2	3	4	5	6	7	8	9	High	High-Low
alpha	-0.12	0.08	0.04	0.15	0.08	0.18	-0.14	0.00	0.17	0.22	0.34
	(-0.98)	(0.88)	(0.36)	(1.46)	(0.69)	(1.69)	(-0.96)	(-0.02)	(1.32)	(1.53)	(1.73)
MKT	1.04	0.87	1.06	0.97	1.03	1.03	1.14	1.12	1.07	1.12	0.08
	(37.99)	(41.58)	(44.86)	(44.01)	(42.57)	(43.04)	(35.09)	(40.30)	(38.58)	(34.71)	(1.81)
	Carhart										
alpha	0.14	0.14	0.18	0.15	0.27	0.30	0.05	0.05	0.18	0.26	0.12
	(1.18)	(1.63)	(1.75)	(1.49)	(2.49)	(2.79)	(0.36)	(0.42)	(1.35)	(1.93)	(0.61)
MKT	1.00	0.93	1.07	0.98	1.00	0.97	1.07	1.08	1.07	1.06	0.07
	(35.96)	(46.63)	(44.68)	(41.03)	(39.43)	(38.65)	(32.92)	(36.44)	(35.08)	(34.20)	(1.53)
HML	-0.23	0.10	-0.01	0.04	-0.20	-0.13	-0.05	-0.01	0.02	0.15	0.38
	(-5.35)	(3.26)	(-0.27)	(1.00)	(-5.14)	(-3.37)	(-1.06)	(-0.21)	(0.48)	(3.11)	(5.52)
SMB	-0.15	-0.26	-0.16	-0.05	-0.12	0.14	0.20	0.15	0.04	0.38	0.53
	(-3.83)	(-8.95)	(-4.66)	(-1.56)	(-3.20)	(3.79)	(4.36)	(3.40)	(0.90)	(8.48)	(8.34)
UMD	-0.18	-0.08	-0.15	-0.02	-0.11	-0.11	-0.27	-0.10	-0.04	-0.22	0.04
	(-6.91)	(-4.20)	(-6.60)	(-0.93)	(-4.79)	(-4.57)	(-8.83)	(-3.66)	(-1.23)	(-7.45)	(0.91)
	Fama French 5 factor										
alpha	0.11	0.03	0.06	0.09	0.17	0.26	-0.15	-0.13	-0.10	-0.05	-0.16
	(0.97)	(0.37)	(0.55)	(0.88)	(1.23)	(2.26)	(-0.92)	(-1.01)	(-0.71)	(-0.34)	(-0.79)
MKT	1.00	0.95	1.10	0.99	1.02	0.99	1.11	1.12	1.12	1.11	0.12
	(29.34)	(39.41)	(34.22)	(41.83)	(34.05)	(37.11)	(28.12)	(34.47)	(26.99)	(26.39)	(2.31)
HML	-0.05	0.05	0.01	0.04	-0.19	-0.11	0.03	-0.02	-0.09	0.27	0.32
	(-0.59)	(1.00)	(0.15)	(0.71)	(-2.25)	(-1.71)	(0.31)	(-0.30)	(-0.95)	(2.80)	(2.97)
SMB	-0.20	-0.28	-0.20	-0.03	-0.14	0.08	0.15	0.18	0.15	0.47	0.67
	(-4.27)	(-7.09)	(-3.33)	(-0.57)	(-1.90)	(1.72)	(1.46)	(2.40)	(2.27)	(6.31)	(9.31)
RMW	-0.16	0.00	-0.07	0.09	-0.02	-0.13	-0.09	0.15	0.42	0.31	0.47
	(-2.35)	(-0.01)	(-0.74)	(1.50)	(-0.18)	(-1.99)	(-0.71)	(1.09)	(4.26)	(2.96)	(3.84)
CMA	-0.26	0.17	0.07	-0.01	0.06	0.04	0.03	0.09	0.23	-0.14	0.12
	(-2.16)	(2.24)	(0.75)	(0.07)	(0.42)	(0.41)	(0.18)	(0.56)	(1.92)	(-1.08)	(0.84)

3.6. Cost Inflexibility

Eventually all costs are variable in the long run. In the short run, it is hard to decide which costs are fixed, their degree of inflexibility and their duration of inflexibility (one month, one quarter or one year). As Novy-Marx (2011) explains, for operating leverage to significantly impact the riskiness of the firm requires both high levels of operating costs, and "limited operational flexibility", which is the revenue beta minus cost beta. The level of fixed costs and the degree of operational inflexibility could be correlated across firms. Firms with high levels of inflexible costs could become more proficient in managing their fixed cost exposure. This leads to higher cost betas and high operational flexibility.

For example, one of the largest expense items, wage expense is sticky and acts as a fixed cost according to Shimer (2005), Hall (2005), and Favilukis and Lin (2013). At the same time, Tuzel and Zhang (2013) show that there are differences among firms in their flexibility to adjust wages in response to aggregate shocks. Firms located in cyclical areas can adjust wages better than firms located in less cyclical areas, leading to lower risk for the former. Labor is possibly a quasi-fixed cost and, since labor expense is not reported on firm income statements as a separate expense item but, rather, under the cost of goods sold and selling, general and administrative expenses, it is difficult to measure its degree of flexibility.

We know that non-cancellable lease commitments are non-cancellable except when the firm enters into Chapter 11 bankruptcy. Interest expense and pension and retirement expense are other potential inflexible operating costs to the firm and are reported separately in the financial statements. We have limited information on the ability of firms to manage their exposure to these costs. For example, firms enter into interest rate swaps and financial derivatives contracts to manage their interest rate risk related to fixed rate borrowings. In addition, interest rates fluctuate according to business cycles. Generally, in good times interest rates are high, and in bad times interest rates are low. Interest rates decreased over the three years during the financial crisis and firms benefited from this drop through lower interest expenses if the total borrowing remained the same. Table 3.7 shows that these other potential fixed costs—pension and retirement expense and interest expense—have a higher degree of operating flexibility than operating leases do.

First, I test the flexibility of costs using aggregate data, and then at the firm level. Fixed costs should have limited comovement with sales. For each year, I aggregate all the sales, non-cancellable lease commitments, interest expenses, and pension and retirement expenses for firms into aggregate-level variables. I calculate the growth rate of these series. Then, I regress different cost components on aggregate sales growth. Annual data are from 1976 to 2012, with 37 observations. Table 3.7 reports the coefficients, *t*-statistics in parentheses, and R^2 values. Operating lease expense have a much smaller coefficient and R^2 values compared to other cost items.

Table 3.7

Comovement of different costs with respect to sales at the market level

This table reports the results from regressions of different market (aggregate) cost growths on market sales growth. Each year, operating lease expense, interest expense, pension and retirement expense and sales are summed over all firms that year. Growth rate is calculated as the natural logarithm of the growth rate. Annual data are from 1976 to 2012 with 37 observations. Standard errors are Newey-West adjusted for three lags. Table reports the regression coefficients and R^2 values. *t*-statistics are in parentheses.

	Dependent Variable		
	Market Operating Lease Expense Growth	Market Interest Expense Growth	Market Pension&Retirement Expense Growth
Market Sales Growth	0.36	1.04	1.13
	(2.76)	(5.51)	(3.71)
R^2	23.71%	43.76%	37.51%

Next, I follow Anderson et al. (2003) and investigate the sensitivities of these costs to increases and decreases in sales. I estimate the following regression:

$$Log(Cost_{i,t}/Cost_{i,t-1})=$$

$$\beta_0+\beta_1\, log(Sales_{i,t}/Sales_{i,t-1})+\beta_2*(Dummy_{i,t}*log(Sales_{i,t}/Sales_{i,t-1}))+\varepsilon_{i,t} \qquad (3)$$

where “Cost” is either a non-cancellable lease commitment, interest expense, or pension and retirement expense for firm *i*. *Dummy*, takes the value of one when sales decreases between years $t-1$ and t, and zero otherwise. The coefficient β_1 measures the percentage increase in costs with a 1% increase in sales. Because the value of *Dummy* is one when sales decreases, the sum of the coefficients, $\beta_1+\beta_2$, measures the percentage decrease in costs with a 1% decrease in sales. Table 3.8 reports the coefficients, the *t*-statistics in parentheses and R^2 values from the pooled ordinary least squares regression. The β_1 coefficient of operating leases is smaller than for other costs and $\beta_1+\beta_2$ is close to zero, meaning that a 1% decline in sales results in a 0.02% increase in operating lease expenses.

Table 3.8

Comovement of different costs with respect to sales at the firm level

This table reports the results from regressions of different cost growths on sales growth. The ratios are winsorized at the top and bottom 0.5% to decrease the influence of outliers. Only firms with non-missing non-cancellable lease commitment, interest expense, pension and retirement expense growth rates are included in the regressions to be able to compare the regression coefficients. The table reports the regression coefficients and R^2 values. *t*-statistics are in parentheses.

	Operating Lease Expense Growth	Interest Expense Growth	Pension Expense Growth
β_1	0.46	0.88	0.64
	(42.26)	(44.00)	(42.43)
β_2	-0.48	-0.48	-0.19
	(-16.87)	(-9.30)	(-4.86)
$\beta_1+\beta_2$	-0.02	0.39	0.45
R^2	6%	9%	10%

These results jointly indicate that among these costs, a non-cancellable operating lease expense behaves as a fixed cost and has less comovement with sales than other costs do. Therefore, operating lease commitments are a source of operating leverage risk to the firm.

3.7. Unlevered Equity Returns

I also consider whether the impact of the lease ratio is related to financial leverage. In Table 3.1, high lease ratio firms have lower financial leverage. This negative relation could imply that leasing and debt are substitutes, or that managers offset the risk of lease commitments on equity through lower financial leverage. In the Fama-MacBeth regressions, financial leverage has no impact on the marginal power of the lease ratio. However, I cross-check my results using portfolio sorts with unlevered excess returns. For each firm, I compute the unlevered cost of equity from the standard weighted average cost of capital formula, as follows:

$$R^{U}_{i,m,t}=\left[R_{i,m,t}\left(1\text{-}L_{i,t\text{-}1}\right) + R^{B}_{i,m,t}\, L_{i,t\text{-}1}(1\text{-}\rho_{t\text{-}1})\right]\text{-}\, R^{T}_{m,t} \tag{4}$$

where $R_{i,m,t}$ denotes the monthly stock return of firm *i* over month *m* of year *t*, $R^{T}_{m,t}$ denotes the one-month Treasury bill rate in month *m* of year *t*, $R^{B}_{i,m,t}$ denotes the monthly debt return of firm *i* over month *m* of year *t*, and $L_{i,t\text{-}1}$ denotes the leverage ratio, defined as the book value of debt over the sum of the book value of debt plus the market value of equity at the end of year *t-1*. ρ_{t-1} is the firm's tax rate.

Firm-level corporate bond data are limited, and only a small percentage of firms have corporate bond ratings in Compustat (item SPLTICRM). To construct bond returns, $R^{B}_{i,m,t}$, for firms without bond ratings, I follow Liu et al. (2009). The computation involves imputing bond ratings for all firms in my sample following the procedure of Blume et al. (1998). To impute bond ratings, I first estimate an ordered probit model that relates credit ratings to observed explanatory variables using all firms that have credit ratings. Second, from this regression, I calculate the cutoff values for each rating. Third, I estimate the credit scores for firms without credit ratings using the coefficients estimated from the ordered probit model and impute bond ratings by applying the cutoff values for the different credit ratings. Finally, I match the corresponding corporate bond returns to a given credit rating for all firms with the same credit rating. The bond return data are from Barclays Capital U.S. Long Term Corporate Bond Returns for the Aaa, Aa, A, Baa and high yield rating categories. The data source is Morningstar.

The ordered probit model contains the following explanatory variables: interest coverage;[15] ratio of operating income after depreciation (item OIADP) plus interest expense (item XINT) to interest expense; operating margin, ratio of operating income

[15] Interest coverage ratios of less than zero are replaced by zero and any interest coverage ratio greater than 10 is set to 10^4, as in Blume et al. (1998).

before depreciation (item OIBDP) to sales (item SALE), long-term leverage, ratio of long-term debt (item DLTT) to assets (item AT); total leverage, ratio of long-term debt plus debt in current liabilities (item DLC) plus short-term borrowing (item BAST) to assets; natural logarithm of the market value of equity (item PRCC_C times item CSHO) deflated to 1973 by the consumer price index; and market beta (CRSP data item BETAV) and standard deviation of returns (CRSP data item SDEVV). Data on rating categories are available from January 1973 onward. I measure ρ_{t-1} as the statutory corporate income tax rate. From 1973 to 1978, the tax rate was 48%, dropping to 46% in 1986, and then to 40% in 1987, and further to 34% in 1987 and then staying at that level thereafter. The data source is the Commerce Clearing House, annual publications.

I repeat the portfolio sorts using unlevered expected excess returns as the cost of capital measure. Table 3.9 presents the equal- and value-weighted expected excess unlevered returns of decile portfolios sorted by lease ratio. In equal-weighted and value-weighted returns, the spreads are slightly smaller, but still significant.

3.8. Industry Adjusted Lease Ratio

The capital composition of firms can vary across industries. For example, airlines and retail industries are known to be heavy users of operating leases. To compare firms from different industries, I calculate industry-adjusted lease ratios for firms. Every year, I

Table 3.9

Excess unlevered returns for lease ratio-sorted portfolios

This table reports the average unlevered expected returns of the lease variable sorted portfolios (I report Portfolio 1, is labeled as "Low" and Portfolio 10, labeled as "High"). R_{EW}^{e} is the equal-weighted monthly excess returns (excess of risk-free rate). R_{VW}^{e} is value-weighted monthly excess returns (%). δ_{EW}^{e} and δ_{VW}^{e} are the corresponding standard deviations. t-statistics are reported in parentheses.

Expected Returns, July 1976-December 2013

	Low	2	3	4	5	6	7	8	9	High	High-Low
All states, 450 months											
R_{EW}^{e}	0.58	0.65	0.74	0.78	0.80	0.90	1.01	1.09	1.12	1.26	0.68
t	(2.67)	(3.19)	(3.65)	(3.68)	(3.73)	(4.05)	(4.10)	(4.49)	(4.76)	(5.07)	(4.75)
δ_{EW}^{e}	4.59	4.32	4.28	4.52	4.53	4.74	5.23	5.14	5.00	5.27	3.05
R_{VW}^{e}	0.40	0.44	0.53	0.56	0.54	0.63	0.40	0.47	0.59	0.74	0.35
t	(1.89)	(2.66)	(2.59)	(2.98)	(2.67)	(3.03)	(1.71)	(2.17)	(2.81)	(3.17)	(1.91)
δ_{VW}^{e}	4.46	3.48	4.31	4.02	4.32	4.41	4.92	4.60	4.44	4.98	3.87
Expansions, 378 months											
R_{EW}^{e}	0.61	0.62	0.69	0.74	0.73	0.83	0.95	1.00	1.04	1.08	0.46
t	(2.97)	(3.14)	(3.44)	(3.49)	(3.44)	(3.70)	(3.74)	(4.00)	(4.32)	(4.32)	(3.09)
δ_{EW}^{e}	4.01	3.83	3.88	4.14	4.12	4.34	4.92	4.85	4.69	4.85	2.92
R_{VW}^{e}	0.51	0.51	0.57	0.64	0.62	0.68	0.45	0.57	0.56	0.62	0.11
t	(2.39)	(2.99)	(2.85)	(3.33)	(2.85)	(3.20)	(1.94)	(2.61)	(2.55)	(2.61)	(0.59)
δ_{VW}^{e}	4.12	3.32	3.87	3.71	4.22	4.11	4.50	4.24	4.24	4.61	3.67
Contractions, 72 months											
R_{EW}^{e}	0.40	0.82	1.01	1.01	1.15	1.32	1.34	1.57	1.55	2.22	1.83
t	(0.49)	(1.10)	(1.43)	(1.39)	(1.56)	(1.74)	(1.73)	(2.06)	(2.06)	(2.70)	(4.53)
δ_{EW}^{e}	8.96	8.08	8.16	7.92	8.04	8.24	8.33	8.02	8.03	8.65	4.43
R_{VW}^{e}	(0.19)	0.04	0.31	0.18	0.15	0.39	0.11	(0.05)	0.75	1.41	1.59
t	(-0.27)	(0.08)	(0.44)	(0.29)	(0.26)	(0.57)	(0.15)	0.07	(1.19)	(1.82)	(2.94)
δ_{VW}^{e}	5.87	4.17	6.10	5.31	4.78	5.75	6.66	6.15	5.37	6.57	4.59

form industry portfolios using two-digit SIC codes and calculate the average lease ratio within each portfolio. Then I subtract the corresponding industry's average lease ratio from the firm's lease ratio. The industry adjusted lease ratios of firms are the lease ratios in excess of their industry averages. In June of each year, I rank stocks according to this industry-adjusted lease ratio and group them into decile portfolios. There must be at least five firms each year from each two digit SIC code to include firms from that industry. Following Fama and French (1993), I match the CRSP stock return data from July of year t+1 to June of year t+2 with the industry-adjusted lease ratio for the fiscal year ending in year t. Table 3.10 presents the excess returns and unlevered returns of industry-adjusted lease ratio-sorted portfolios. The results show that the spread is higher (lower) in value-weighted (equal-weighted) portfolios sorted with industry adjustment compared to the portfolios formed without industry adjustment.

As in Novy-Marx (2011), I decompose the operating lease ratio into industry and intra-industry components using two different methodologies. The first method uses the operating lease ratio demeaned by the industry average as the intra-industry operating lease ratio. This industry adjusted lease ratio generates significant spread in returns as shown in Table 3.10. The industry average lease ratio is the component of the lease ratio related to industry variation. The second method uses the firm's operating lease ratio ranking within its industry as the intra-industry measure and the ranking of the operating lease ratio of the firm's industry as the industry measure. These rankings are percentiles parameterized between zero and one.

Table 3.10

Portfolio sorts on industry-adjusted lease ratio

This table reports the average excess returns of industry-adjusted lease variable sorted portfolios (Portfolio 1 is labeled as "Low" and Portfolio 10 labeled as "High"). R^e_{EW} is the equal-weighted monthly excess return (in excess of the risk-free rate). R^e_{VW} is the value-weighted monthly excess return (%). δ^e_{EW} and δ^e_{VW} are the corresponding standard deviations. *t*-statistics are reported in parentheses. Expected returns are measured in the year following portfolio formation, from July of year *t*+1 to June of year *t*+2. Industry adjusted lease ratio is the firm's lease ratio demeaned by the average lease ratio of the industry to which the firm belongs. Financials and utilities are excluded.

Levered Returns, July 1976-December 2013

	Low	2	3	4	5	6	7	8	9	High	High-Low
R^e_{EW}	1.16	1.08	1.13	1.24	1.09	1.12	1.29	1.45	1.59	1.90	0.74
t	(4.01)	(3.73)	(4.06)	(4.46)	(3.90)	(3.97)	(4.54)	(4.81)	(4.98)	(5.76)	(5.30)
δ^e_{EW}	6.13	6.15	5.92	5.89	5.95	5.98	6.04	6.41	6.76	7.00	2.98
R^e_{VW}	0.61	0.63	0.65	0.63	0.60	0.73	0.80	0.63	0.81	1.05	0.44
t	(1.85)	(2.35)	(2.90)	(2.98)	(2.58)	(3.11)	(3.17)	(2.33)	(2.83)	(3.55)	(2.09)
δ^e_{VW}	7.02	5.66	4.76	4.51	4.93	4.96	5.33	5.77	6.08	6.30	4.47

Unlevered Returns, July 1976-December 2013

	Low	2	3	4	5	6	7	8	9	High	High-Low
R^e_{EW}	0.77	0.76	0.79	0.83	0.70	0.80	0.89	1.00	1.09	1.31	0.54
t	(3.58)	(3.47)	(3.66)	(4.05)	(3.22)	(3.74)	(4.05)	(4.32)	(4.46)	(5.06)	(4.73)
δ^e_{EW}	4.54	4.64	4.56	4.37	4.61	4.54	4.64	4.89	5.19	5.49	2.43
R^e_{VW}	0.50	0.56	0.44	0.46	0.48	0.50	0.67	0.46	0.59	0.81	0.31
t	(1.97)	(2.66)	(2.34)	(2.66)	(2.45)	(2.57)	(3.26)	(2.05)	(2.52)	(3.19)	(1.86)
δ^e_{VW}	5.34	4.51	4.00	3.68	4.12	4.16	4.33	4.73	5.00	5.35	3.53

Table 3.11 shows the results from Fama-MacBeth regressions employing measures of the operating lease ratio within and across industries. Under both decomposition methods, the intra-industry measure has significantly more power than

the industry measure. The coefficients of the intra-industry measure are large and highly significant, while the coefficients of the industry measure are smaller and insignificant. These results further confirm that the operating lease operating leverage effect is independent of industry effects. The impact of operating leases on the risk and returns of the firm is more pronounced within industries than across industries.

Table 3.11

Fama-MacBeth regressions employing measures of the lease ratio within and across industries

This table reports the results from Fama-MacBeth regressions of firm returns on intra-industry and industry operating lease ratio measures. Specifications 1 to 3 include operating lease ratio de-meaned by the industry and the industry average operating lease ratio. Specifications 4 to 6 include operating lease ratio percentile within the industry and the industry operating lease ratio percentile. Regressions include controls for size, the book-to-market and prior year's performance ($r_{12,2}$).

	Operating lease ratio demeaned by industry			Operating lease ratio percentile within industry		
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)
Intra-industry	4.08		4.22	0.46		0.48
	(3.38)		(3.46)	(5.11)		(5.28)
Industry		1.29	1.64		0.27	0.30
		(0.35)	(0.44)		(1.19)	(1.31)
Log(SIZE)	-0.25	-0.26	-0.25	-0.24	-0.25	-0.23
	(-5.13)	(-5.13)	(-5.03)	(-5.01)	(-5.06)	(-4.83)
Log(B/M)	0.19	0.18	0.19	0.19	0.19	0.21
	(2.06)	(1.99)	(2.09)	(2.14)	(2.13)	(2.33)
MOM	0.00	0.00	0.00	0.00	0.00	0.00
	(1.28)	(1.25)	(1.20)	(1.29)	(1.19)	(1.14)

3.9. Cash Flow Sensitivity

I investigate further whether there are systematic differences in the sensitivity of high and low lease ratio firm cash flows to aggregate shocks in the economy. Such a difference could support the operating leverage mechanism behind the risk and return differences between high- and low-lease ratio firms. I expect that the cash flows of firms with high lease ratios would be more sensitive to aggregate shocks than the cash flows of low-lease ratio firms. The measure for cash flow is firm income before extraordinary items plus depreciation. I estimate the following pooled time series/cross-sectional regressions:

$$\Delta CashFlow_{i,t} = \propto_i + \beta \Delta CashFlow_{agg,t} + u_{i,t} \tag{5}$$

where $\Delta CashFlow_{i,t}$ is the change in cash flows of firm *i* between year *t* -1 and *t*, scaled by firm assets in year *t*-1. The term $\propto_i$ captures the individual firm effect and I proxy for aggregate shocks with the cross-sectional average of $\Delta CashFlow_{i,t}$ over all firms in the sample. Since I use $\Delta CashFlow$ on each side of the regression, at the firm level on the left hand side and aggregate on the right hand side, I can interpret the regression coefficient as the firm's cash flow beta to aggregate shocks. I divide firms into 10 lease ratio deciles based on their lease ratio in year *t*-1, and I run panel regressions in each lease ratio decile and present the regression coefficients in Table 3.12. High-lease ratio firms have greater sensitivity to aggregate shocks in the economy. The regression coefficients are 1.45 for firms in the highest lease ratio group and 0.27 for the lowest lease ratio group. Firms' cash flow betas increase monotonically with their operating lease ratios.

Table 3.12

Cash flow regressions for lease ratio-sorted panels

The top panel presents the results of panel regressions of changes in firm-level cash flow on changes in aggregate cash flow. Changes in cash flow are measured as the level difference between cash flows at time *t* and *t*-1, scaled by total assets at time *t*-1. Changes in aggregate cash flow are measured as the cross-sectional average of firm-level changes. Firms are sorted into 10 decile groups based on the past year's lease ratios. The sample period is from 1975 to 2012. Firm fixed effects are included. Standard errors are clustered by firm. *t*-statistics are in parentheses. The bottom panel presents the standard deviation of the average cash flow growth of the lease ratio-sorted decile portfolios.

Dependent Variable: $\Delta CashFlow_{i,t}$

	Low	2	3	4	5	6	7	8	9	High
$\Delta CashFlow_{agg,t}$	0.27	0.40	0.47	0.69	0.54	0.70	0.69	0.69	1.06	1.45
	(2.07)	(3.80)	(3.42)	(4.02)	(3.44)	(4.27)	(3.79)	(4.16)	(3.67)	(6.75)

Volatility of cash flow growth

	Low	2	3	4	5	6	7	8	9	High
δ^{CF}	2.1%	1.9%	1.9%	2.1%	1.5%	1.8%	2.3%	2.8%	3.2%	4.7%

The link between firm sensitivity to existing sources of risk and the firm's operating leverage implies that volatility should increase with operating leverage. I show that the firm's cash flow sensitivity to aggregate shocks is increasing with operating lease-induced operating leverage. At the same time, firms with high lease ratios have greater cash flow growth volatility. The bottom panel of Table 3.12 reports the decile portfolios' standard deviations in annual average cash flow growth. Table 3.3 also shows that those firms with high levels of operating leases have more volatile returns. Except for the first decile, the standard deviations of portfolio returns increase with the lease ratio. Tuzel (2010) supports this finding; firms with high levels of operating leases have much more volatile returns than firms that do not have a significant amount of operating leases.

3.10. Persistency of the Lease Ratio

I am also interested in whether the level of operating leases is a firm characteristic that shows persistence in the short run. I expect that the firm's fraction of leased capital change over time depending on the firm's life cycle. However, the probability of a firm moving from a particular decile to other deciles in the following year should not be high since leased capital is difficult to adjust in the short-run. Table 3.13 presents the transition probability matrix for the firms in the study's sample sorted into lease ratio decile portfolios. The probability of staying in the lowest lease ratio portfolio is 61%, whereas the probability of staying in the highest lease ratio portfolio is 68%. The higher probabilities along the diagonal show some persistency in the ratio of operating leases. The drop-off probabilities in Table 3.13 shows the probability that a firm in a given portfolio will disappear from the sample in the following year. The reasons for drop-off can be either firm failure or a missing data item in the succeeding year. The probability of drop-off is higher for firms in the highest lease ratio portfolio. Except for the first decile, the drop-off rate increases monotonically. Therefore, I interpret the higher drop-off rates of high-lease ratio firms as indicating a higher probability of failure.

Table 3.13

Portfolio transition probabilities

This table reports the transition probability matrix for the firms sorted into lease ratio decile portfolios. The drop-off value is the probability that a firm in a given lease ratio portfolio will disaproperty, plant and equipmentar from the sample in the succeeding year.

		Year t										
		Low	2	3	4	5	6	7	8	9	High	Drop off
	Low	61%	16%	5%	2%	2%	1%	1%	0%	0%	0%	11%
	2	14%	43%	20%	6%	3%	2%	1%	1%	0%	0%	9%
	3	4%	16%	36%	19%	8%	4%	2%	1%	1%	0%	9%
	4	2%	6%	17%	32%	20%	8%	4%	2%	1%	0%	9%
Year	5	1%	3%	6%	18%	32%	19%	7%	3%	1%	0%	10%
t-1	6	1%	1%	3%	6%	17%	32%	19%	7%	2%	1%	11%
	7	1%	1%	1%	3%	6%	16%	34%	20%	6%	1%	11%
	8	0%	0%	1%	2%	2%	5%	17%	39%	19%	3%	11%
	9	0%	0%	0%	1%	1%	2%	5%	16%	48%	16%	12%
	High	0%	0%	0%	0%	0%	1%	2%	2%	13%	68%	13%

3.11. Ex-Ante Discount Rates of Lease Ratio Sorted Portfolios

The two different proxies for expected returns are: ex-post realized stock returns, and measures of implied cost of capital (ICC). In both the portfolio approach and the Fama-MacBeth regressions reported in the previous sections, we proxy expected returns with ex-post realized returns. Realized returns may have data quality problems especially with short time series data. As an alternative, I use an ex-ante measure of the discount rates, the implied cost of capital, and examine its cross-sectional relationship with lease ratio.

The implied cost of capital of a firm is the internal rate of return that equates the firm's stock price to the present value of expected future cash flows. I follow Imrohoroglu and Tuzel (2013) to examine the cross-sectional relationship between lease ratio and cost of capital. There are three alternative implied cost of capital measures. The first one, GLS, by Gebhardt, Lee, and Swaminathan (2002), employs analyst earnings forecasts to proxy for the market expectation of the firm's earnings. The second one, HVDZ, by Hou, van Dijk, and Zhang (2012), use earnings forecasts from a cross-sectional model. The last one, TWZ, by Tang, Wu and Zhang (2013), employs cross sectional regressions to forecast return on equity.

Implied cost of capital for each firm is estimated at the end of June of each calendar year t using the end of June firm market value and the earnings and return on equity forecasts made at the previous fiscal year end. Implied cost of capital estimates of individual firms' with these firms' are matched with lease ratio measured at the previous fiscal year end. HVDZ and TWZ based implied cost of capital measures span the July 1970 - June 2011 period, GLS based measures start in July 1976. Table 3.14 presents the average implied cost of capital estimates for portfolios sorted on lease ratio. The relationship between lease ratio and the cost of capital measured from all three implied cost of capital measures is positive and quite monotonic. The firms with high lease ratios have higher discount rates (implied cost of capital) than firms with low lease ratios using all implied cost of capital measures and both for equal and value-weighted portfolios. The spreads between the high and low lease ratio firms' expected returns are all positive and statistically significant except the value weighted GLS portfolios. This implies that firms with high lease ratios are riskier than low lease ratio firms and therefore have higher ex-ante discount rates.

3.12. Non-lagged Measure of Operating Lease Ratio

In the calculation of operating lease ratio, non-cancellable operating lease commitments which are announced at time t-1 is divided by firm's total assets at time t and matched with CRSP stock return data from July of year t+1 to June of year t +2. Financial statements for year t-1 announced operating leases as non-cancellable for year t.

Table 3.14

Implied cost of capital for lease ratio sorted portfolios

This table reports the average implied cost of capital estimates of lease ratio sorted portfolios (Portfolio 1 is labeled as "Low" and Portfolio 10 labeled as "High"). GLS_{EW}, $HVDZ_{EW}$; and TWZ_{EW} are equal-weighted implied cost of capital; GLS_{VW}, $HVDZ_{VW}$; and TWZ_{VW} are value-weighted implied cost of capital, annual, averages are taken over time (%). Firm level GLS, HVDZ, and TWZ estimates are from Imrohoroglu and Tuzel (2013). *t*-statistics are reported in parentheses.

	Low	2	3	4	5	6	7	8	9	High	High-Low
$HVDZ_{EW}$	8.97	9.82	9.65	9.94	10.10	10.56	11.20	11.26	12.13	12.88	3.92
											(12.23)
$HVDZ_{VW}$	7.98	7.98	7.48	7.48	7.45	7.73	8.18	7.98	8.10	9.12	1.14
											(3.26)
TWZ_{EW}	7.77	8.38	8.41	8.48	8.64	8.89	9.16	9.18	9.27	9.62	1.85
											(7.47)
TWZ_{VW}	8.06	7.86	7.54	7.49	7.45	7.75	8.23	8.03	7.89	8.74	0.68
											(2.02)
GLS_{EW}	9.19	9.33	9.55	9.45	9.62	9.67	9.97	9.82	9.99	10.40	1.21
											(4.52)
GLS_{VW}	8.79	8.83	8.64	8.34	8.74	8.71	9.00	8.96	8.55	9.30	0.51
											(1.47)

Therefore there is more than one year gap between the announcement date and matching returns. I calculate operating lease ratio with non-cancellable operating lease commitments announced at time *t* divided by firm's total assets at time *t* and matched with CRSP stock return data from July of year *t*+1 to June of year *t* +2. When I use this non-lagged measure of operating lease ratio in Fama MacBeth regressions, I obtain similar results to using lagged operating lease ratio. The coefficient on the non-lagged operating lease ratio is 11.74 with a t-statistic of 4.12, whereas when I use lagged operating lease ratio, the coefficient on the lagged operating lease ratio is 15.98 with a t-statistic of 5.13.

3.13. December Fiscal Year End Requirement

In the calculation of expected returns, CRSP stock return data from July of year *t*+1 to June of year *t* +2 is matched with accounting information for the fiscal year ending in year *t*, as in Fama and French (1992, 1993). This six month gap between the accounting information and returns guarantees that the accounting information is already impounded into the stock prices. To ensure that the accounting data are not outdated by the time of the sorting procedure, my sample includes only firms with a fiscal year ending in December. However, the results are very similar if I drop this December fiscal year-end restriction. Tables 3.15 to 3.17 reproduce the main results (Tables 1 and 2 for descriptive statistics and Table 3 for excess returns) based on the entire cross-section of firms that report their MRC1 in the Compustat/CRSP merged database. The annual return spread for the equal-weighted portfolios is 8.4% and the corresponding spread for the value-weighted portfolios is 5.2%.

Table 3.15

Descriptive statistics for portfolios sorted on lease ratio including non-December fiscal year end firms

This table reports average value of firm characteristics of the lease variable sorted portfolios averaged over the years (Portfolio 1 is labelled as “Low”, and Portfolio 10 is labelled as “High”). OPLEASE is the ratio of non-cancellable operating lease payments to total assets. OPL PAY is the non-cancellable operating lease payments. ASSETS is the total assets. B/M is the book-to-market ratio. SIZE is the market capitalization. OPLEV is the Novy-Marx’s operating leverage measure. FINLEV is the financial leverage. CF is the cash flow divided by total assets. CASH is the cash divided by total assets. KZ is the Kaplan-Zingales index. INT/OPL is the interest expense divided by non-cancellable operating lease payments. INV is the investment rate. ROE is the return on equity. ROA is the return on assets. AG is the asset growth rate. INVG is the inventory growth rate.

	Low	2	3	4	5	6	7	8	9	High
OPLEASE	0.2%	0.5%	0.7%	0.9%	1.2%	1.6%	2.1%	2.9%	4.6%	11.3%
OPL PAY	7	15	17	19	19	17	15	18	24	46
ASSETS	3,300	3,426	2,647	2,226	1,714	1,118	750	657	586	480
SIZE	3,272	3,612	3,187	2,455	1,830	1,273	846	672	582	639
BM	0.91	0.88	0.84	0.88	0.85	0.88	0.88	0.88	0.90	0.92
OPLEV	0.76	0.95	1.04	1.11	1.18	1.26	1.36	1.46	1.65	2.04
FINLEV	0.25	0.24	0.23	0.22	0.22	0.21	0.21	0.21	0.20	0.18
CASH	0.15	0.15	0.15	0.16	0.16	0.16	0.17	0.17	0.17	0.15
CF	0.08	0.08	0.07	0.07	0.05	0.05	0.04	0.02	0.00	0.01
KZ	0.53	0.66	0.65	0.66	0.67	0.73	0.73	0.83	0.84	0.78
INT/OPL	16.46	4.57	2.96	2.18	1.68	1.31	1.02	0.76	0.50	0.23
INV	0.28	0.27	0.27	0.28	0.28	0.29	0.30	0.29	0.30	0.26
ROE	-0.06	-2.16	0.03	0.05	-0.06	-0.10	-0.29	-0.24	-0.09	-0.71
ROA	0.03	0.03	0.03	0.02	0.01	0.00	-0.01	-0.03	-0.05	-0.05
AG	-0.16	-0.12	-0.10	-0.09	-0.08	-0.07	-0.05	-0.03	0.01	0.03
INVG	1.59	0.31	0.19	0.22	0.18	0.15	0.14	0.16	0.09	0.08

Table 3.16

Spearman rank correlations

This table reports the time-series averages of the cross-sectional Spearman rank correlations among firm characteristics. OPLEASE is the ratio of non-cancellable operating lease payments to total assets, OPL PAY is the non-cancellable operating lease payments. ASSETS is the total assets, B/M is the book-to-market ratio. SIZE is the market capitalization. OPLEV is the Novy-Marx's operating leverage measure. FINLEV is the financial leverage. CF is the cash flow divided by total assets. CASH is the cash divided by total assets. KZ is the Kaplan-Zingales index. INV is the investment rate. ROE is the return on equity. ROA is the return on assets. AG is the asset growth rate. INVG is the inventory growth rate.

	OPLEASE	SIZE	B/M	OPLEV	FINLEV	CASH	CF	KZ	INV	ROE	ROA	AG	INVG
OPLEASE	1.00												
SIZE	-0.27	1.00											
B/M	-0.01	-0.35	1.00										
OPLEV	0.45	-0.25	0.10	1.00									
FINLEV	-0.10	0.01	0.13	-0.06	1.00								
CASH	0.06	-0.03	-0.24	-0.15	-0.52	1.00							
CF	-0.09	0.39	-0.27	0.01	-0.20	0.03	1.00						
KZ	0.05	-0.15	0.02	0.03	0.77	-0.45	-0.37	1.00					
INV	0.07	0.07	-0.30	-0.03	-0.26	0.22	0.17	-0.17	1.00				
ROE	-0.11	0.41	-0.32	0.04	-0.07	0.00	0.81	-0.23	0.16	1.00			
ROA	-0.12	0.38	-0.30	0.02	-0.26	0.09	0.89	-0.40	0.19	0.91	1.00		
AG	-0.16	0.24	-0.30	-0.14	-0.04	0.06	0.34	-0.10	0.39	0.41	0.42	1.00	
INVG	-0.11	0.12	-0.16	-0.03	-0.01	-0.05	0.17	-0.01	0.22	0.22	0.21	-0.48	1.00

Table 3.17

Portfolio sorts on the lease variable including firms with a non-December fiscal year-end

This table reports the average expected returns of lease variable sorted portfolios (Portfolio 1 is labelled as "Low", and Portfolio 10 is labelled as "High"). R_{EW}^{e} is the equal-weighted monthly excess returns (in excess of the risk-free rate). R_{VW}^{e} is the value-weighted monthly excess returns (%) . δ_{EW}^{e} and δ_{VW}^{e} are the corresponding standard deviations. *t*-statisitics are reported in parentheses. Expected returns are measured in the year following portfolio formation, from July of year *t*+1 to June of year *t*+2. Expansion and contraction periods are designated in June of year *t* +1 based on the NBER business cycle that year. Returns over the expansions and contractions are measured from July of year *t*+1 to June of year *t*+2.

	Expected Returns, July 1976-December 2013										
	All states, 450 months										
	Low	2	3	4	5	6	7	8	9	High	High-Low
R_{EW}^{e}	0.80	0.94	1.00	1.08	1.13	1.13	1.26	1.31	1.43	1.50	0.70
t	(2.85)	(3.38)	(3.56)	(3.79)	(3.89)	(3.84)	(4.09)	(4.34)	(4.63)	(4.69)	(4.40)
δ_{EW}^{e}	5.98	5.88	5.98	6.06	6.18	6.26	6.56	6.42	6.58	6.81	3.38
R_{VW}^{e}	0.47	0.65	0.67	0.77	0.66	0.54	0.78	0.86	0.79	0.90	0.44
t	(1.93)	(3.05)	(2.76)	(3.25)	(2.48)	(2.03)	(2.84)	(3.27)	(3.06)	(3.16)	(2.13)
δ_{VW}^{e}	5.14	4.53	5.11	5.00	5.63	5.65	5.80	5.56	5.51	6.07	4.36
	Expansions, 378 months										
R_{EW}^{e}	0.75	0.86	0.89	0.94	0.99	0.97	1.09	1.08	1.19	1.15	0.40
t	(2.73)	(3.11)	(3.17)	(3.24)	(3.36)	(3.20)	(3.45)	(3.46)	(3.72)	(3.67)	(2.46)
δ_{EW}^{e}	5.36	5.36	5.47	5.63	5.70	5.88	6.17	6.07	6.20	6.10	3.14
R_{VW}^{e}	0.54	0.72	0.68	0.83	0.69	0.53	0.80	0.75	0.74	0.70	0.16
t	(2.17)	(3.22)	(2.79)	(3.43)	(2.47)	(1.92)	(2.95)	(2.81)	(2.75)	(2.38)	(0.74)
δ_{VW}^{e}	4.82	4.32	4.76	4.70	5.47	5.36	5.29	5.21	5.22	5.68	4.13
	Contractions, 72 months										
R_{EW}^{e}	1.07	1.35	1.57	1.84	1.91	1.99	2.16	2.53	2.74	3.37	2.29
t	(1.07)	(1.42)	(1.65)	(1.97)	(1.97)	(2.13)	(2.22)	(2.72)	(2.85)	(3.01)	(4.80)
δ_{EW}^{e}	8.52	8.08	8.10	7.93	8.22	7.91	8.26	7.91	8.16	9.50	4.06
R_{VW}^{e}	0.09	0.31	0.56	0.44	0.46	0.60	0.62	1.40	1.09	1.99	1.90
t	(0.12)	(0.47)	(0.72)	(0.58)	(0.61)	(0.73)	(0.67)	(1.68)	(1.35)	(2.19)	(3.12)
δ_{VW}^{e}	6.55	5.51	6.67	6.37	6.42	6.95	7.93	7.08	6.85	7.72	5.17

Conclusion

This essay provides empirical evidence about the link between a firm's level of non-cancellable operating lease commitments and expected stock returns, offering an economic explanation as to how firm characteristics can predict returns. The interpretation of the return differences of the lease ratio portfolios is that firms that have higher levels of operating leases also have higher operating leverage, and consequently are riskier than firms with lower levels of operating leases. Such firms with high levels of non-cancellable operating leases are particularly risky in recessionary periods.

There are several dimensions of operating leases that my simple lease ratio ignores here. For example, the nature of the lease contract, the maturity structure and restrictions on how the asset can be deployed or utilized (Tuzel, 2010) could affect the flexibility of the lease commitments. Currently, the FASB and IASB are working on a converged accounting standard for firms' leasing activities. When these regulatory bodies implement the new accounting rule on leases, future work in this area will provide a better picture of a firm's operating lease activities in the financial statements.

CHAPTER IV

LABOR INTENSITY AND OPERATING LEVERAGE IN MANUFACTURING FIRMS

Introduction

Labor is one of the most important factors of production. Labor affects firm value whenever there are frictions in the labor market (Merz and Yashiv (2007)). In this essay, I show that a firm's labor intensity relative to its industry is associated with higher equity returns.

Firms do not own their labor input. Labor can only be rented. Wages are the rental fees paid to the employees in return for their human capital. The concept of wage rigidity and smoothness relative to marginal product of labor is well established in the literature (Shimer (2005), and Hall (2006)). Labor expense is a quasi-fixed cost to the firm. During the business cycle, revenues drop, however the wage expense stays the same. Firms cannot easily cancel or adjust the terms of contracts between their employees because of firing, hiring and other contractual costs.

This essay is an extension to the growing literature on labor-induced operating leverage by Danthine and Donaldson (2002), Chen et al. (2011), Favilukis and Lin (2013), and Donangelo (2014). Chen et al. (2011) show that the cost of equity is significantly higher for firms in more unionized industries since unionization reduces operating flexibility. Favilukis and Lin (2013) develop a production-based asset pricing model with sticky wages and employment adjustment costs. They show that wage growth negatively forecasts stock returns at the industry level and this dependence is stronger if labor share is higher, or if wages are more rigid. Donangelo (2014) shows that firms face greater operating leverage by providing flexibility to mobile workers. Therefore Donangelo(2014) argues that firms in mobile industries are riskier and have higher expected returns.

In this essay, I construct a measure of the firm's relative labor intensity by dividing the firm's labor intensity into the industry average. Then, I run Fama-Macbeth panel regressions employing relative labor intensity ratio to document the relation between labor intensity and expected returns. Higher labor intensity is associated with higher expected stock returns for manufacturing firms. To investigate the risk mechanism behind expected returns, I show that, on average at the firm level, revenues are more procyclical than labor costs and labor costs are less procyclical than capital expenditures. I also show that firms with higher labor intensity have higher cash flow sensitivity to the aggregate shocks and thus are more exposed to the business cycle.

I include only manufacturing firms in the CRSP/Compustat database. Industry level data are at 4 digit Standard Industry Classification (SIC) code level from National Bureau of Economic Research (NBER) manufacturing industry database, provided by Becker and Gray (2009). Although I include only manufacturing firms, sub-industries within the manufacturing industry differ in their capital composition within the manufacturing industry. For example, apparel industry is more labor intensive compared to petroleum refining industry. Therefore, to compare firms from different industries, I adjust the firm's labor intensity by the corresponding 4 digit SIC level industry average. The measure of labor intensity is the firm's number of employees divided by the firm's net property, plant and equipment.

I further decompose property, plant and equipment into structures and equipment and show that when only structures are used in the denominator of labor intensity ratio, the association between labor intensity and expected returns becomes insignificant. For manufacturing firms in the Compustat database, structures, on average, constitute around 30% of firm capital. Structures are also a risky type of capital to the firm due to their slow depreciation rates. Firms with high levels of structures are more exposed to the business cycle risk assuming costly irreversibility and asymmetric adjustment costs (Tuzel, 2010). On the other hand, labor-induced operating leverage mechanism works even when there are moderate adjustment costs.

This essay is also related to the literature on the relationship between stock returns and operational and distress risk.[16] Higher labor intensity, holding everything else constant, leads to higher cash flow sensitivity and default risk during bad times. Labor is only a part of the firm's inflexible commitments and therefore partially contributes to the operating leverage. Also, risks related to labor constitute only a part of operational risks. Managers may offset the risk of labor intensity on equity through lower financial leverage, higher cash positions or in other ways. However, examining the direct impact of labor alone is also informative about the firm risk and return relation.

In summary, this essay provides new empirical evidence on the relation between labor intensity and expected stock returns at the firm level using NBER manufacturing industry database. Section 2 discusses the basic intuition behind the risk of labor intensity and shows the relationship between expected returns and labor intensity ratio. Section 3 concludes.

[16] See Vassalou and Xing (2004), Garlappi and Yan (2011)

Empirical Analysis and Results

In this section, I show the empirical link between the firm's relative labor intensity and expected stock returns in the cross section. I construct a measure of the firm's level of labor intensity using data from firm financial statements and then divide this firm level labor intensity with industry level labor intensity. I call this ratio, "relative labor intensity ratio". This ratio tells us whether the labor intensity ratio of the firm is high or low compared to the industry average. My key variable, relative labor intensity ratio, is as follows:

$$\text{Relative Labor Intensity Ratio} = \frac{\text{Firm's number of employees/Property, plant and equipment}}{\text{Industry's number of employees/Industry capital stock}}$$

The number of employees and property, plant and equipment data items are from Compustat. Industry level data are from NBER manufacturing industry database. In the U.S., only regulated firms are obliged to report their labor costs. This represents about 5% of all firms. There are some firms who voluntarily report their labor costs but that represent only another 5% of all firms in the Compustat database. Furthermore, this voluntary reporting is irregular. Therefore, I use firms' number of employees as a proxy for the level of labor intensity. I normalize firms' number of employees by firms' net property, plant and equipment since NBER manufacturing database has "capital stock" data item at the industry level.

I include firms whose SIC code is between 2000 and 3999. The sample is an unbalanced panel with 1823 distinct firms and 128 distinct industries. Accounting data span the period from 1963 to 2009. Accounting data end in 2009 because NBER manufacturing industry database is available until 2009. Following Fama and French (1993), I match CRSP stock return data from July of year *t+1* to June of year *t+2* with labor intensity information for fiscal year ending in year *t*. Monthly stock returns are from CRSP and span the period July 1964 to November 2011. I include only companies with ordinary shares and listed on NYSE, AMEX or NASDAQ. I exclude firms with missing SIC codes, negative book value, and missing June market values. I require a firm to have a December fiscal-year end in order to align the accounting data across firms. Following Fama and French (1993), I include only firms with at least two years of data to be included in the sample.

4.1 Descriptive Statistics

Labor intensity could be related to firm characteristics that are found to be related to firm risk and expected returns. Table 4.1 shows the dispersion in descriptive characteristics of firms with high and low labor intensity and the time-series averages of the cross-section Spearman rank correlations between other firm characteristics. Firms with high labor intensity are smaller. Their financial leverage is lower. Financial leverage is calculated as the ratio of long term debt plus debt in current liabilities divided by total assets. Chen et al. (2014) argue that firms with more inflexible operating costs endogenously choose lower financial leverage ex ante to reduce the likelihood of default in future bad states.

Table 4.1

Descriptive statistics

Labor intensity	Relative labor intensity ratio	Size (millions)	Book-to-market	Financial leverage	Operating leverage	Cashflow-to-assets
Low	2.05	2,833	0.78	0.23	0.92	0.08
Medium	5.04	2,157	0.78	0.20	1.08	0.06
High	21.83	1,076	0.72	0.17	1.17	0.02

Spearman rank correlations

	Relative labor intensity	Size	Book-to-market	Financial Leverage	Operating leverage	Cashflow-to-assets
Relative labor intensity	1.00					
Size	(0.23)	1.00				
Book-to-market	(0.09)	(0.29)	1.00			
Financial leverage	(0.15)	0.02	0.18	1.00		
Operating leverage	0.23	(0.32)	0.14	(0.00)	1.00	
Cashflow-to-assets	(0.11)	0.37	(0.31)	(0.26)	0.04	1.00

The top panel reports the mean value of firm characteristics averaged over the years. The bottom panel reports the time-series averages of the cross-section Spearman rank correlations between the firm characteristics.

Labor intensive firms have lower internal available funds, cash flow to assets. Cash flow-to-assets ratio, which is income before extraordinary items plus depreciation and amortization divided by total assets, indicate firms that are financially constrained, as in Eisfeldt and Rampini (2009). Labor intensive firms have higher operating leverage, which is measured as the sum of cost of goods sold plus selling, general and administrative expenses, divided by total assets, as in Novy-Marx (2011).

4.2 Firm-Level Fama-Macbeth Regressions

To investigate the relationship between the labor intensity ratio and the expected excess returns (excess of the risk-free rate), I run firm level Fama-Macbeth cross-sectional regressions (Fama and MacBeth, 1973) using the lagged firm level labor intensity ratio as a return predictor. I estimate the following cross-sectional regression for firm $i = 1, . . ., N$ in each month:

$$\mathrm{R_i} = \propto + \beta\lambda_\mathrm{i} + \gamma \mathrm{D_i} + \varepsilon_\mathrm{i} \tag{1}$$

In the specification above, *i* is a firm index, and monthly returns are denoted by R_i. The measure of the labor intensity rate is denoted by λ_i, and D_i is a vector of controls. I measure λ_i and all control variables based on accounting ratios at the end of the previous year. In Table 4.2, I show that labor intensity ratio is positively related to expected returns. The cross sectional regressions that include size, and book-to-market produce positive and statistically significant average slope for the labor intensity ratio. As in Fama and French (2008), I do not include the market beta since the market beta for individual stocks is not precisely measured in the data.

In the literature, although the theoretical relationship between financial leverage and firm systematic risk is well established, empirical evidence on the relationship between financial leverage and stock returns is mixed. When other firm characteristics are included in regressions, financial leverage often becomes insignificant in predicting returns (Fama and French, 1992). In Table 4.1, I document that labor intensive firms have lower financial leverage and Fama-Macbeth regressions show that, financial leverage is not significantly related to expected returns.

Table 4.2

Fama-MacBeth regressions employing relative labor intensity ratio

Independent variables	(1)	(2)	(3)	(4)	(5)
Labor intensity ratio	0.013	0.010	0.006	0.007	
	(2.46)	(2.17)	(1.53)	(1.72)	
Log(Size)		-0.215	-0.192	-0.203	-0.190
		(-4.12)	(-4.27)	(-4.58)	(-4.24)
Log(B/M)		0.252	0.291	0.290	0.279
		(2.45)	(2.99)	(2.93)	(2.84)
Financial leverage			0.035	0.060	0.030
			(0.10)	(0.17)	(0.09)
Operating leverage			0.093		0.111
			(0.82)		(0.99)
Cashflow-to-assets			0.233	0.166	0.073
			(0.30)	(0.21)	(0.09)

This table reports results from Fama-MacBeth regressions of firms' returns on firms' relative labor intensity ratios. Specifications 2–5 include controls for firm characteristics. t-statistics are reported in parentheses below coefficient estimates (computed as in Newey-West with four lags).

Firms' capital and labor utilization decisions may depend on financial constraints. Livdan, Sapriza, and Zhang (2009) argue that tighter financial constraints leads to higher stock returns. I control for financial constraints, cash flow-to-assets ratio (measure of the firm's available internal funds) in Fama-Macbeth regressions since the source of risk may be financial constraints rather than labor intensity. Labor intensity has still a significant coefficient after controlling for financial constraints.

In Table 4.1, labor intensity is positively correlated with operating leverage. This is expected since labor costs constitute a significant portion of cost of goods sold and selling, general, and administrative expenses. Marginal effect of labor intensity becomes insignificant when I include Novy-Marx operating leverage measure. However, Novy-Marx operating leverage measure's coefficient is insignificant when firm characteristics other than labor intensity are included in the regressions.[17]

4.3 Capital Composition

Physical capital is heterogeneous. Equipment and structures are the two components of the firm's capital stock in the NBER manufacturing database. Structures depreciate

[17] Novy-Marx (2011) sample includes all industries except financials whereas my sample includes only manufacturing firms.

slowly whereas equipment depreciates much faster. Due to costly reversibility, firms cannot easily reduce their structures in a recession. Tuzel (2010) show that firms with high real estate holdings are more vulnerable to bad productivity shocks and therefore are riskier and have higher expected returns.

The denominator of my measure of labor intensity includes the sum of structures and equipment as the firm's total capital. In my sample, on average, equipment and structures account for 61% and 30% of property, plant and equipment, respectively. The remaining 8% and 1% belong to capital leases and other property, plant and equipment. Capital leases can both be structures and equipment. To further investigate the impact of labor intensity on firm risk, I decompose the capital stock into two parts in my relative labor intensity ratio: firm number of employees divided by equipment relative to the industry ratio of number of employees divided by equipment and firm number of employees divided by structures relative to the industry ratio of number of employees divided by structures. The two ratios are as follows:

$$\text{RLI Ratio 1} = \frac{\text{Firm's number of employees/Equipment}}{\text{Industry's number of employees/Industry equipment capital stock}}$$

$$\text{RLI Ratio 2} = \frac{\text{Firm's number of employees/Structures}}{\text{Industry's number of employees/Industry structures capital stock}}$$

Property, plant and equipment data in Compustat is decomposed into buildings, capitalized leases, machinery and equipment, natural resources, land and improvements, and construction in progress starting from 1969. I assume buildings, natural resources, land and improvements, and construction in progress constitute structures. The Compustat data on the composition of the property, plant and equipment are “net of depreciation” over 1969-1993 and “historical cost” over 1984-2009. I use net values until 1984 and switch to historical cost values starting in 1984, as in Tuzel (2010). I run Fama-Macbeth cross-sectional regressions using these ratios as return predictors. Results in Table 3 show that only relative labor intensity ratio 1 is significantly related to the firm’s expected returns. Including capital leases as equipment or structures do not change these results.

Relative labor intensity ratio 1 (RLI Ratio 1), which is basically number of employees per dollar invested in machinery and equipment is a measure of the degree of automation in firm’s production technology. Labor intensity has been decreasing steadily over the years. Employees can be replaced by machines but cannot be replaced by buildings. When deciding on labor-capital mix, firms take into account both the technical aspects of production and the costs of different inputs. Since my measure of labor intensity is adjusted for industry at the 4 digit SIC code level, the managerial choice is between labor and equipment rather than labor and building, given the firm specific characteristics and constraints.

Table 4.3

Fama-MacBeth regressions employing relative labor intensity ratio

Independent variables	(1)	(2)	(3)	(4)
Labor intensity ratio 1	0.048		0.035	
	(2.59)		(2.19)	
Labor intensity ratio 2		0.001		0.000
		(0.94)		(0.03)
Log(Size)			-1.180	-0.145
			(-3.65)	(-3.14)
Log(B/M)			0.335	0.324
			(3.48)	(3.07)
Financial leverage			0.040	0.343
			(0.11)	(0.91)
Operating leverage			0.094	0.080
			(0.70)	(0.61)
Cashflow-to-assets			-0.207	0.728
			(-0.28)	(0.84)

This table reports results from Fama-MacBeth regressions of firms' returns on firms' relative labor intensity ratios. Specifications 3 and 4 include controls for firm characteristics. t-statistics are reported in parentheses below coefficient estimates (computed as in Newey-West with four lags).

4.4 Gdp Betas

This essay builds on the idea that the firm's labor costs are inflexible during the business cycle. On average, revenues are more procyclical than costs. Furthermore, labor costs are less procyclical than capital expenditures. In order to show this proposition, I regress firms' real growth in revenues, wage expenses, and capital expenditures on real GDP growth with firm-fixed effects, as follows:

$$\Delta Revenues_{i,t} = \propto_i + \beta_1 \Delta GDP_t + \varepsilon_{i,t}$$

$$\Delta Wages_{i,t} = \propto_i + \beta_2 \Delta GDP_t + \varepsilon_{i,t}$$

$$\Delta Capitalexpenditures_{i,t} = \propto_i + \beta_3 \Delta GDP_t + \varepsilon_{i,t}$$

Only 11% of the firms in my sample report their labor expense. In order to include all manufacturing firms in the cross section, I use a proxy for labor expense. I measure the industry-specific wage rate using data from the NBER manufacturing industry database. The data for industry level compensation per employee is available at the four digit SIC code. Firm level wage rate is computed by matching the firm-specific Compustat SIC code to the corresponding SIC code average annual wage data from NBER, and then by multiplying wages by the number of employees of the specific firm. Data on GDP are from BEA's NIPA Table 1.1.1. The corresponding GDP deflator is used to transform firm variables to real values. The term $\propto_i$ captures the individual firm effect. Table 4.4 below reports the regression coefficients, GDP betas, which measure the cyclicality in costs and revenues.

The GDP beta of wage growth is lower than GDP betas of revenue growth and capital expenditure growth. As expected, labor costs have lower exposure to fluctuations in GDP than revenues and capital expenditure at the firm level.

Table 4.4

Sensitivity to GDP growth

	Dependent variable		
	Δrevenues	Δwages	Δcapitalexpenditure
ΔGDP	4.25	2.95	11.59
	(2.41)	(6.95)	(4.56)
R^2	0%	0%	0%
Number of observations	19,679	19,679	19,679

This table reports coefficients of panel data regressions of revenue, wage and capital expenditure growth on aggregate GDP growth. t-statistics are in parentheses. The sample period is from 1964 to 2009.

4.5 Cash Flow Sensitivity

I investigate further whether labor intensity is related to systematic differences in the sensitivity of firms' cash flows to aggregate shocks in the economy. The existence of such a difference could support the operating leverage mechanism behind the labor intensity and return relationship. I expect that the cash flows of firms with high labor intensity would be more sensitive to aggregate shocks than the cash flows of low labor intensity firms. Labor expenses have a priority claim in firm cash flows. After the labor expense is paid, residual cash flows are used for dividends and investment. The measure for cash flow is net cash flow from operating activities. I estimate the following pooled time series/cross sectional regressions:

$$\Delta CashFlow_{i,t} = \propto_i + \beta \Delta CashFlow_{agg,t} + u_{i,t} \qquad (2)$$

where $\Delta CashFlow_{i,t}$ is the change in cash flows of firm i between year *t -1* and *t*, scaled by firm assets in year *t-1*. $\propto_i$ captures the individual firm effect, and I proxy aggregate shocks with the cross-sectional average of $\Delta CashFlow_{i,t}$ over all firms in my sample. Since I use ΔCashFlow on each side of the regression, at the firm level on the left hand side and aggregate on the right hand side, I can interpret the regression coefficient as the firm's cash flow beta to aggregate shocks. I divide firms into 3 labor intensity groups based on their labor intensity ratio in year *t-1*, and I run panel regressions in each labor intensity ratio group and present the regression coefficients in Table 4.5. High labor intensity firms have higher sensitivity to aggregate shocks in the economy. The regression coefficient is 1.33 for firms in the high labor intensity group, and 0.63 for the low labor intensity group.

A firm's cash flow sensitivity to existing sources of risk implies that volatility should increase with labor intensity. I further show that, firms with high labor intensity have higher volatility of cash flow growth. High labor intensity group's standard deviation of annual average cash flow growth is 2.18%, whereas low labor intensity group has a standard deviation of 1.16%.

Table 4.5

Cash flow regressions

Dependent Variable: $\Delta CashFlow_{i,t}$

	Low	Medium	High
$\Delta CashFlow_{agg,t}$	0.63	0.80	1.33
	(0.11)	(3.73)	(2.01)
Number of observations	3,388	4,503	3,236

Volatility of cash flow growth

	Low	Medium	High
δ^{CF}	1.16%	1.46%	2.18%

The top panel in this table presents results of panel regressions of change in firm level cash flow on change in aggregate cash flow. Change in cash flow is measured as the level difference between operating net cash flows at time *t* and *t-1*, scaled by total assets at time *t-1*. Change in aggregate cash flow is measured as the cross sectional average of firm level changes. Firms are sorted into 3 groups based on the past year's relative labor intensity. The sample period is 1988-2009 since operating net cash flow data item is available from 1988. Firm fixed effects are included. t-statistics are in parentheses. The bottom panel presents the standard deviation of average cash flow growth of labor intensity groups.

Conclusion

This essay provides new empirical evidence about the link between firms' industry adjusted labor intensity and expected stock returns. I show that at the firm level that labor costs are less procyclical than capital expenditures and revenues. Therefore, residual cash flows become more procyclical in firms with high labor intensity. I also show that labor intensive firms have higher cash flow volatility and their cash flows are more sensitive to aggregate shocks.

There are several dimensions of labor that the labor intensity ratio ignores here. For example, differences in the composition of firms' labor (skilled and unskilled) can lead to cross-sectional differences in firms' risk because the skilled labor is more costly to adjust (Belo and Lin, 2012). Also, the length and terms of contracts and unionization have an impact on the degree of the flexibility of the labor force.

CHAPTER V

RELATIVE LABOR SHARE AND THE COST OF EQUITY

Introduction

In this essay, I document a positive association between the firm's relative labor share and the firm's riskiness using three different ex ante cost of equity capital measures. My measure of relative labor share is the firm's labor share divided by the corresponding industry average labor share. Firm labor share is wage expense divided by the firm's sales. Industries differ in their input requirements. For example, services industry is known to be more labor intensive whereas metals industry is known to be more capital intensive. Between industry variation constitutes 37% of the total variation in firm labor intensity. In order to compare firms from different industries, I isolate the effect of industries and calculate the industry-adjusted labor share in my measure. My proxy for equity risk is the implied cost of capital (ICC). Specifically, I use ICC measures of Gebhardt et al. (2001), Hou et al. (2012), and Tang et al. (2013). The relationship between relative labor share and risk is robust to alternative measures of ICC, and holds after controlling for size and book-to-market effects.

Labor increases a firm's risk in at least three ways. First, labor is mobile and the lack of full control over labor represents a risk factor for shareholders. Donangelo (2014) finds that firms in mobile industries are riskier and have higher expected returns. Second, limited comovement of wages with revenues creates an operating leverage effect to the firm.[18] Danthine and Donaldson (2002) propose a general equilibrium model with labor-induced operating leverage. In their model, wages are less volatile than profits, and their model generates a better match to the observed equity premium. Third, labor unions limit firms' operating flexibility. Chen et al. (2011) show that the cost of equity is significantly higher for firms in more unionized industries.

Empirical literature on the interaction of labor market frictions and asset prices is mostly limited to evidence at the industry level. Also, the extant focus is on indirect effects of labor through unionization or its ability to move. I provide emprical evidence on the industry adjusted labor share's direct impact on the cost-of-equity capital at the firm level. A closely related paper by Rosett (2003) supports my hypothesis that firms

[18] Favilukis and Lin (2014) also show that industries with high and counter-cyclical labor share have higher equity volatility and higher CAPM betas.

with high labor stock have high risk. Rosett defines a labor leverage risk variable that is labor cost divided by market capitalization of the firm. He uses Compustat item “Labor and Related Expense” for labor cost and therefore covers only about 10% of all US Compustat firms who report their labor expenses. He includes regulated firms in his sample of firms. His results show that labor leverage is positively correlated with equity risk (standard deviation of daily returns). This essay differs from Rosett (2003) in three ways. First, I include all firms excluding regulated firms. Second, my measure is free from price based variables. The use of market capitalization to explain equity risk is subject to the Berk critique of characteristic variables based on transformations of price (Berk, 1995). Finally my proxy for firm risk is based on ex-ante discount rates.

Empirical Analysis

5.1 Data

In this section, I show the empirical link between the firm’s relative labor share and ICC in the cross section. I construct a measure of firm’s relative labor share with respect to the industry the firm belongs to. The firm’s labor share is wage expense divided by sales. In the U.S., only regulated firms are obliged to report their labor costs. This represents about 5% of all firms. There are some firms who voluntarily report their labor costs but that represent only another 5% of all firms in the Compustat database. This voluntary reporting is irregular. I obtain the industry-specific wage rate using data from the Bureau of Economic Analysis (BEA) website, GDP-by-Industry accounts. The data for industry level compensation per employee are available at the two and three digit Standard Industry Classification (SIC) code. Firm level wage expense is computed by matching the firm-specific Compustat SIC code to the corresponding SIC code wage rate data from BEA, and then by multiplying annual wage number by the number of employees of the specific firm.

The capital composition of firms differ among industries. In order to compare firms from different industries, I calculate the relative labor share for each firm. Every year, I form industry portfolios using two-digit or when available, three-digit SIC codes and calculate the average labor share within each portfolio. Then I divide the firm's labor share to the corresponding industry's labor share. This fraction tells us whether the labor share of the firm is high or low compared to the industry average. In June of each year, I rank stocks according to this relative labor share measure and group them into quintile portfolios. There must be at least five firms each year from each two digit SIC code in order to include firms from that industry. I define relative labor share as follows:

$$\text{Relative Labor Share}_{it} = \frac{\text{Labor share}_{it}}{\text{Labor share}_{it}^{\text{SIC2}}}$$

The sample is from 1970 to 2011 with 60 industries and 9,367 firms. I include only companies with ordinary shares and listed on NYSE, Amex or Nasdaq. Data source is Compustat. I exclude firms with missing SIC codes, zero employees, zero sales, negative book values and missing June market values. As is the standard, I omit firms whose primary standard industry classification is between 4900 and 4999 (regulated firms) or between 6000 and 6999 (financial firms) and also I require a firm to have a December fiscal-year end in order to align the accounting data across firms. Following Fama and French (2008), I set the portfolio breakpoints based on a sample of firms that excludes microcap firms. While this sorting procedure leads to more stable and balanced portfolios, I get similar results when I compute the breakpoints based on the entire cross section of firms. Table 5.1 below shows the dispersion in descriptive characteristics of relative labor share ratio sorted portfolios and the correlations between other firm characteristics. Results in Table 5.1 indicate that firms with higher relative labor share are smaller and have higher book-to-market ratios. The average annual wage level is lower in firms with higher relative labor intensity.

5.2 Stickiness of Labor Costs

At the aggreagate level wages are smooth and slow moving compared to investment and profits. The Table 5.2 below shows average annual growth rates and the volatility of the growth rates of private sector wages, corporate profits and GDP. I also regress real wage and profit growth on real GDP growth. The slope coefficients from the regression are

Table 5.1

Descriptive statistics for portfolios sorted on relative labor share

	Low	2	3	4	High
Relative labor share	0.23	0.48	0.70	0.95	1.50
Labor share	0.16	0.21	0.26	0.31	0.50
Book-to-market	0.62	0.70	0.74	0.80	0.77
Size	194	166	160	150	73
Sales	155	149	178	213	91
Wage	$37,639	$35,480	$34,135	$31,738	$31,815

Correlations

	Relative labor share	Book-to-market	Size
Relative labor share	1		
Book-to-market	0.16	1	
Size	-0.21	-0.33	1

Notes: The top panel reports the median value of firm characteristics of relative labor share sorted portfolios averaged over the years (I report portfolio 1, which I label as "Low", and 5, which I label as "High"). The bottom panel reports the correlations. Labor share= Wage expense to sales, SIZE= Market capitalization, Wage=Average annual wage level.

used as proxies for procyclicality. Data are from Bureau of Economic Analysis's NIPA tables. The corresponding GDP deflator is used to transform wages and profits to real values. Sample period is from 1963 to 2013.

Table 5.2

Wage smoothness

	GDP	Wages	Profits
Mean	3.16	2.73	3.93
Std. deviation	2.46	2.67	10.35
Slope on gdp growth	1	0.67	2.38
R^2		27%	23%

than profits. However wage volatility is slightly bigger than the GDP volatility.

If the firm can adjust the quantity of the labor force according to the business cycle, wage smoothness does not necessarily generate an operating leverage risk to the firm. Next I investigate the sensitivities of firm labor costs and number of employees to increases and decreases in sales. I estimate the following regression:

$$\text{Log}(\text{Cost}_{i,t}/\text{Cost}_{i,t-1}) =$$

$$\beta_0+\beta_1 \log(\text{Sales}_{i,t}/\text{Sales}_{i,t-1})+\beta_2*(\text{Dummy}_{i,t}*\log(\text{Sales}_{i,t}/\text{Sales}_{i,t}))+\varepsilon_{i,t}$$

where "Cost" is either wage bill or number of employees for firm *i*. *Dummy*, takes the value of one when sales decreases between years $t-1$ and t, and zero otherwise. The coefficient β_1 measures the percentage increase in costs with a 1% increase in sales. Because the value of *Dummy* is one when sales decreases, the sum of the coefficients, $\beta_1+\beta_2$, measures the percentage decrease in costs with a 1% decrease in sales. Table 5.3

reports the coefficients, the *t*-statistics in parentheses and R^2 values from the pooled ordinary least squares regression. The β_1 coefficient of employment growth is smaller than for other expenses and $\beta_1 + \beta_2$ is 0.36, meaning that a 1% decline in sales results in a 0.36% decrease in employment.

Table 5.3

Wage expense stickiness

	Employment Growth	Wage Expense Growth	Capital Expenditure Growth	Operating Expense Growth
β_1	0.46	0.50	0.77	0.76
	(142.93)	(139.89)	(59.63)	(314.50)
β_2	-0.10	-0.10	0.45	-0.12
	(-11.55)	(-10.44)	(13.09)	(-18.38)
$\beta_{1+}\beta_2$	0.36	0.40	1.22	0.64
R^2	31%	30%	10%	69%
Number of observations	76,606	76,606	74,806	76,606

Notes: This table reports the results from regressions of employment and expense growths on sales growth. The ratios are winsorized at the top and bottom 0.5% to decrease the influence of outliers. The table reports the regression coefficients and R^2 values. *t*-statistics are in parentheses. Sample period is from 1963 to 2011.

This finding shows that firms are reluctant or slow at adjusting their labor force during good times and they can mildly adjust their labor force during bad times.

Although operating expenses are sticky, the $\beta_1 + \beta_2$ coefficient, 0.64, is much lower than the wage expense alone, 0.40. Overall, these results jointly tell us that aggreagate wages are relatively smooth and firms' wage expenses are sticky. Therefore a firm's level of labor share creates an operating leverage effect on firm riskiness.

5.3 Implied Cost of Capital Estimates

The implied cost of equity capital of a firm is the internal rate of return that equates the firm's stock price to the present value of expected future cash flows. The following equation gives the implied cost of capital, r_e.

$$P_t = \sum_{k=1}^{\infty} \frac{E_t(D_{t+k})}{(1+r_e)^k}$$

P_t is the stock price at time t. D_t are dividends paid at time t. ICC measures differ in their use of expected earnings estimates and forecast horizons. The first measure I use, GLS, by Gebhardt, Lee, and Swaminathan (2002), employs analyst earnings forecasts to proxy for the market expectation of the firm's earnings. The second one, HVDZ, by Hou, van Dijk, and Zhang (2012), use earnings forecasts from a cross-sectional model. The last one, TWZ, by Tang, Wu and Zhang (2013), employs cross sectional regressions to forecast return on equity, similar to those in Fama and French (2006). Following

Imrohoroglu and Tuzel (2014), ICC for each firm is estimated at the end of June of each calendar year t using the end of June firm market value and the earnings and return on equity forecasts made at the previous fiscal year end. I match ICC estimates of individual firms' with these firms' relative labor share measured at the previous fiscal year end. HVDZ and TWZ based ICC measures span the July 1970 - June 2011 period, GLS based measures start in July 1976. Table 5.4 presents the average ICC estimates for portfolios sorted on relative labor share. The relationship between labor share and the cost of capital measured from all three ICC is positive and quite monotonic.

Firms with high relative labor shares have higher discount rates (ICC) than firms with low relative labor shares using all three ICC measures and both for equal and value-weighted portfolios. The spreads between the high and low relative labor share firms' expected returns are all positive and highly statistically significant except the value weighted GLS portfolios. This implies that firms with high relative labor shares have higher ex-ante discount rates, and so are riskier than low relative labor share firms.

Table 5.4

Portfolio sorts on relative labor share

	Low	2	3	4	High	High-Low
$HVDZ_{EW}$	10.25	10.23	10.70	10.94	12.22	1.97
						(12.20)
$HVDZ_{VW}$	7.54	7.80	8.00	8.18	8.09	0.55
						(2.76)
TWZ_{EW}	8.34	8.47	8.84	9.15	9.28	0.94
						(9.42)
TWZ_{VW}	7.43	7.82	8.15	8.23	8.03	0.60
						(3.32)
GLS_{EW}	9.51	9.61	9.76	10.03	10.15	0.65
						(4.08)
GLS_{VW}	8.51	8.74	9.12	9.09	8.85	0.34
						(1.48)

Notes: This table reports the average ICC estimates of relative labor share variable sorted portfolios. GLS_{EW}, $HVDZ_{EW}$, and TWZ_{EW} are equal-weighted ICC, GLS_{VW}, $HVDZ_{VW}$, and TWZ_{VW} are value-weighted ICC, annual, averages are taken over time (%). *t*-statistics are reported in parentheses Firm level GLS, HVDZ, and TWZ estimates are from Imrohoroglu and Tuzel (2014).

Portfolio sorts indicate that there is a statistically and economically significant positive relation between a firm's relative labor share and cost-of-equity. I also use a different approach to investigate the strength of relationship between relative labor share and cost-of-equity. Table 5.5 reports results of panel data regressions of the ICC measures on relative labor share, with size and book-to-market controls and year effects. Overall, there is a positive relation between ICC measures and relative labor share.

However the coefficient of relative labor share becomes much more smaller when size and book-to-market are included in the regressions.[19]

Table 5.5

Panel Data Regressions of Implied Cost of Capital on Relative Labor Share

	HVDZ				WZ				GLS			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Labor share	2.13***	0.74***	0.86***	0.40*	1.04***	0.74***	0.09	0.16**	0.88***	0.55***	0.39***	0.20*
	(0.24)	(0.19)	(0.22)	(0.26)	(0.09)	(0.09)	(0.07)	(0.07)	(0.12)	(0.12)	(0.11)	(0.11)
Log(SIZE)		-0.21***		-0.16***		-0.46***		-0.20***		-0.65***		-0.49***
		(-0.06)		(-0.06)		(0.02)		(0.02)		(0.04)		(0.02)
Log(B/M)			4.65***	2.83***			3.57***	3.79***			2.17***	1.92***
			(0.16)	(0.17)			(0.04)	(0.04)			(0.09)	(0.09)
R^2(%)	4.32	11.40	9.64	13.01	27.70	29.82	47.73	48.05	4.53	6.15	7.58	8.49
Obs.	48,128	48,128	48,128	48,128	48,217	48,217	48,217	48,217	38,472	38,472	38,472	38,472

Notes: This table reports estimates and standard errors of panel data regressions with year effects of measures of cost of capital on lagged relative labor share and firm characteristics. The remaining variables are defined in Table 1 and 2. Standard errors are clustered by firm. Variables are winsorized at the 1% level. Significance levels are denoted by * = 10% level, ** = 5% level, and *** = 1% level.

5.4 Ex-post Realized Returns and "Instrumented Returns"

I also use ex-post returns as a proxy for cost of equity in the panel regressions. The annual return is the buy-and-hold return of each security compounded over 12 months starting in July of year *t*+1. Following the method by Hann et al. (2013), I construct a

[19] As in Fama and French (2008) I do not include the market beta since the market beta for individual stocks is not precisely measured in the data.

third measure of cost of equity which Hann et al. (2013) call “instrumented returns”. This measure combines information from ex post and ex ante approaches to expected returns and attempts to solve the problem of information shocks in realized returns which are noisy measures of expected returns. To obtain this measure, first, I regress ex post realized returns on 6 different ex-ante measures of cost of capital and then use the fitted value from the regression as the proxy for expected returns. GLS, HVZ, TWZ, expected returns from the Fama-French five-factor model, earnings yield, and earnings yield adjusted for growth are the ex-ante measures of cost of capital in the first stage regression. The basic idea is summarized in Elton (1999). Returns can be decomposed into expected returns and unexpected returns as follows:

$$R_t = E_{t-1}(R_t) + e_t$$

where R_t is the realized return in period t, $E_{t-1}(R_t)$ is the return at t conditional on information available at $t-1$, and e_t is the unexpected return. Unexpected returns result from systematic factors or firm specific events. Then we can proxy expected returns with realized returns with the assumption that unexpected returns are independent and they approach to mean of zero as the number of observations grow. However, Elton (1999) argues that there are large information surprises or a sequence of these surprises is correlated and consequently, these surprises can have a significant permanent effect on the realized mean. Therefore, the following equation includes the significant information event, I_t :

$$R_t = E_{t-1}(R_t) + I_t + \varepsilon_t$$

If the first stage regression, in which I regress realized returns on a combination of expected return proxies, eliminates the information surprises in realized returns, this measure of "instrumented" returns is likely to be superior to realized returns as a proxy of expected returns.

To calculate Fama-French five factor expected returns, first, I estimate factor loadings using 24 months of prior excess returns, and then multiply the loadings with corresponding factor risk premium for the following year. I exclude observations with negative Fama-French five factor cost of equity estimates and negative earnings from the regression. As in Hann et al. (2013), earnings yield is computed as the ratio of net income in year *t* to market value of equity in year *t*-1. Because earnings yield also contains information about growth opportunities, I include another proxy, earnings yield growth-adjusted, calculated as the sum of earnings yield and growth in net income from year *t* to *t*-1. Table 6 presents the results of panel data regressions of the "instrumented returns" and realized returns on relative labor share. In the regressions with realized returns, there is an insignificant relation between buy-and-hold return and relative labor share. In the regressions with instrumented returns, there is a positive significant relation between instrumented returns and relative labor share. However the coefficient of relative labor share becomes insignificant when size is included in the regressions. A high negative correlation between size and labor share is expected since high labor share firms are less capital intensive and therefore they have lower levels of book assets.

Table 5.6

Panel Data Regressions of Instrumented Returns and Realized Returns on Relative Labor Share

	Instrumented Returns				Realized Returns			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Labor share	0.006***	0.00	0.02**	0.00	-0.009	-0.019	-0.014	-0.021
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
Log(SIZE)		-0.009***		-0.005***		-0.016***		-0.12***
		(0.00)		(-0.06)		(0.00)		(0.05)
Log(B/M)			0.034***	0.030***			0.048***	0.039***
			(0.02)	(0.02)			(0.01)	(0.01)
R^2(%)	13.83	22.76	34.16	37.03	10.17	10.45	10.53	10.66
Obs.	17,955	17,955	17,955	17,955	17,955	17,955	17,955	17,955

Notes: This table reports estimates and standard errors of panel data regressions with year effects of measures of instrumented and realized returns on lagged relative labor share and firm characteristics. The remaining variables are defined in Table 1 and 2. Standard errors are clustered by firm. Significance levels are denoted by * = 10% level, ** = 5% level, and *** = 1% level.

5.5 Variance Decomposition of Labor Share

To confirm that labor share varies across industries, I decompose the variance of firm labor share into three components: across industries, across firms within an industry, and within a firm. Following Graham and Leary (2011), I construct three components of firm labor share as follows:

$$\sum_i \sum_j \sum_t \left(X_{ijt} - \overline{\overline{\overline{X}}}\right)^2 = \sum_i \sum_j \sum_t \left[\left(X_{ijt} - \overline{X_{ij}}\right)^2 + \left(\overline{X_{ij}} - \overline{\overline{X_j}}\right)^2 + \left(\overline{\overline{X_j}} - \overline{\overline{\overline{X}}}\right)^2\right]^2$$

$$= \sum_i \sum_j \sum_t \left(X_{ijt} - \overline{X_{ij}}\right)^2 \qquad \text{within firm}$$

$$= \sum_i \sum_j \sum_t \left(\overline{X_{ij}} - \overline{\overline{X_j}}\right)^2 \qquad \text{within industry}$$

$$= \sum_i \sum_j \sum_t \left(\overline{\overline{X_j}} - \overline{\overline{\overline{X}}}\right)^2 \qquad \text{between industry}$$

where X is labor share variable, i represents firm, j represents industry and t represents year. $\overline{X_{ij}}$ is the within-firm mean for firm i, $\overline{\overline{X_j}}$ is the industry mean for industry j, and $\overline{\overline{\overline{X}}}$ is the grand mean. Within firm variation, represents 33% of the variation. Within industry variation is 30% and between industry variation captures the remaining 37%. This decomposition results show that there is some cross-sectional variation across industries. Therefore it is necessary to adjust the labor share for industry effects. The Table 7 below shows the results of panel data regressions of the ICC measures on firm labor share without industry adjustment. There is a positive relation between HVZ measure and labor share. However the relation between labor share and TWZ and GLS is negative and significant. Therefore it is necessary to analyze the relative, industry-adjusted, labor share measure to address the risk return relationship since a high percentage of the variation on firm labor share depends on the industry of the firm.

Table 5.7

Panel Data Regressions of Implied Cost of Capital on Firm Labor Share

	HVDZ	WZ	GLS
	(1)	(2)	(3)
Labor share	0.20***	-0.02 ***	-0.01 ***
	(0.08)	(0.00)	(0.04)
R^2(%)	4.71	25.40	5.79
Obs.	48,128	48,217	38,472

Notes: This table reports estimates and standard errors of panel data regressions with year effects of measures of cost of capital on lagged labor share. Standard errors are clustered by firm. Significance levels are denoted by * = 10% level, ** = 5% level, and *** = 1% level.

5.6 Industry Wage Levels and the Source of Risk of Labor Share

High labor share may affect firm risk through higher adjustment costs or through the firm's lack of control on labor input rather than the cyclical cash flows channel. Eisfeldt and Papanikolaou (2013) argue that firms with high levels of organizational capital are riskier since employees with high human capital can leave the firm if their outside option exceeds their inside value and therefore demand wages that match their outside options. Belo and Lin (2012) argue that firms in skill-intensive industries carry higher risk. In their model, it is more costly for firms to invest in high-skilled workers due to training costs and other labor adjustment costs. I assume that industry wage level is a proxy for the adjustment costs and human capital skills. Employees with high adjustment costs and higher levels of human capital are usually paid higher. I divide my sample into two according to the average industry wage level. Crude petroleum and natural gas industry has the highest annual wage level of $136,599 and restaurants has the lowest annual wage level of $21,545. In Table 5.1, firms with high relative labor share have lower annual wage levels. Table 5.8 presents the GLS measure for portfolios sorted on relative labor share and further grouped into two according to the industry wage level.

Firms with high relative labor shares have higher discount rates than firms with low relative labor shares for equal and value-weighted portfolios in both high and low wage groups. One exception is the insignificant GLS spread in value-weighted portfolios in the high wage group. The GLS spread between the high and low relative labor share firms is higher in low wage group compared to the high wage group in equal-weighted portfolios.

Therefore the relationship between relative labor share and GLS as a proxy of expected returns is not stronger in high wage industries. These results suggest that the risk difference between high and low relative labor share firms are not due to the lack of control on human capital or adjustment cost effects.

Table 5.8

Portfolio sorts on relative labor share and industry wage level

		Low	2	3	4	High	High-Low
Low wage	GLS_{EW}	9.76	9.90	9.95	10.18	10.30	0.54
							(2.95)
	GLS_{VW}	8.14	8.42	8.54	8.99	8.76	0.62
							(3.51)

		Low	2	3	4	High	High-Low
High wage	GLS_{EW}	9.19	9.30	9.71	9.71	10.16	0.98
							(3.99)
	GLS_{VW}	8.71	8.67	9.11	9.31	9.21	0.34
							(1.48)

Notes: This table reports the average GLS estimates of relative labor share variable sorted portfolios. In addition firms are sorted into high and low wage industries according to wage rate data from BEA. GLS_{EW} are equal-weighted ICC, and GLS_{VW} are value-weighted ICC, annual, averages are taken over time (%). *t*-statistics are reported in parentheses.

Conclusion

This essay is an extension to the growing literature on labor's impact on firm's riskiness. I contribute to this literature by showing that a firm's industry-adjusted labor share is positively associated with its implied cost of capital. This relationship holds after controlling for known predictors of the firm's risk such as the firm's size and book-to-market ratio. Also this evidence is robust to using alternative measures of implied cost of capital.

In this essay, I first document that compensation of employees is much smoother compared to corporate profits at the aggregate level. Therefore, wage smoothness transfers the risk to shareholders in terms of more cyclical profits. Wage smoothness alone will not create an operating leverage effect if the firm can adjust the quantity of its labor force. I also show that, at the firm level, firm's wage bill or employment growth are stickier compared to firm's operating expenses. Therefore during bad times, a 1% decline in sales is compensated with 0.4% drop in wage bill.

This essay also provides evidence that realized returns are a noisy proxy for expected returns. Although the relationship between relative labor intensity and equity risk is insignificant in ex-post realized returns, this relationship is significant when implied cost of equity capital and "instrumented returns" are used as proxies of firm's equity risk.

CHAPTER VI

CONCLUSION

This theses examines how inflexible commitments have an impact on the firm's risk, expected returns and cost of equity. Results in the third chapter document a statistically significant relationship between the firm's non-cancellable operating lease commitments and expected returns. Results in the fourth chapter document a statistically significant relationship between the firm's industry adjusted labor intensity and expected returns including only manufacturing firms. Results in the fifth chapter document a statistically significant relationship between the firm's relative labor share and cost of equity capital. A large literature in asset pricing links firm characteristics to stock returns in the cross section. To this literature, this theses adds the firm's level of operating lease and labor commitments as firm characteristics that contribute to the firm's operating leverage and establishes a link to firm's risk and expected stock returns.

The first building block in this thesis is showing that firms' non-cancellable operating leases and labor expenses are less cyclical, more inflexible and stickier compared to other operating costs and revenues. The second building block is showing that operating leverage mechanism amplifies the business cycle impact on firm cash flows. Firms with high inflexible commitments have more volatile cash flows and higher cash flow sensitivities to aggregate shocks. Then the next step is documentation of this cash flow risk on expected returns. For example, in the third chapter, to investigate the risk mechanism behind expected returns, I show, first, that operating lease commitments have very limited comovement with sales. Second, the cash flows of firms with high levels of operating leases are more sensitive to aggregate shocks than those of firms with lower levels of operating leases. Third, I show that high-lease ratio firms have more volatile stock returns and cash flow growth.

Both non-cancellable operating leases and labor expense induce an operating leverage effect on firm cash flows through contractual mechanisms between firm employees/lessors and shareholders. Firms have other contractual commitments to suppliers, such as purchase obligations. Purchase obligations are usually smaller in size compared to labor costs and operating leases. Although purchase obligations are reported in the footnotes of the financial statements, Compustat does not have a separate data item for purchase obligations. Therefore, this thesis is silent about firms' contractual commitments to suppliers.

In addition, firms differ in their sales and product price response to aggregate shocks. Some firms have more cyclical sales than others. They have higher revenue betas to aggregate demand. In this thesis, I show that firms with high levels of operating lease and labor commitments have inelastic cost betas and therefore have higher operating leverage. However the first step in this analysis is the recognition that some firms are more vulnerable to the business cycle risk due to high cyclicality in their sales. Two firms with same level of inflexible commitments differ in their cash flow risk if their sales responsiveness to aggregate shocks differ. Therefore a complete analysis would focus on firms' inflexible costs relative to sales.

My future research will focus on how firm's level of non-cancellable lease utilization affects firm's capital expenditure policy during different phases of the business cycle, how non-cancellable operating leases create an incentive mechanism for Chapter 11 bankruptcy, and how different labor regulations and employment culture in different countries have an impact on the comovement of firm sales with labor costs and consequently on firm risk.

Firm's capital expenditure and leasing policy are joint decisions. During recessions, firms with high levels of non-cancellable operating leases cut capital expenditures relatively more compared to firms with lower levels of non-cancellable operating leases. Chang et al. (2014) decompose the business cycle into different phases rather than only expansion and recession. Studying the capital expenditure policy of firms with high levels of non-cancellable operating leases during the different phases of business cycle such as crest of the expansion compared to early recovery is informative about how firms adjust their physical capital to changing macroeconomic conditions.

The second future work is based on the observation that firm's with high levels of non-cancellable operating leases are more likely to violate debt covenants. The related research question on this work is, whether the firms with high levels of non-cancellable lease commitments are more likely to enter into Chapter 11 bankruptcy, since only in Chapter 11, firms can reject some of their operating leases. Therefore, Chapter 11 may be preferred by these firms rather than an out of court restructuring.

Finally, a growing literature investigates the relationship between firms' location and stock returns. Tuzel and Zhang (2013) show that firms in local U.S. metropolitan areas where wages comove a lot with aggregate shocks have lower industry-adjusted returns and conditional betas. Wages limited comovement with sales differs across countries with different labor rights. For example, France provides a large protection of workers' rights in labor laws, while the United States prefers deregulation and free market economics. The analysis focuses on whether this country-level variation affects firm performance and cash management policy after controlling for firm and country level risk factors.

BIBLIOGRAPHY

Anderson, M. C., Banker, R. D., and Janakiraman, S. N., 2003. Are selling, general, and administrative costs “sticky”? Journal of Accounting Research, 41, 47–63.

Ang, J., and Peterson, P. P., 1984. The leasing puzzle, Journal of Finance, 39, 1055–1065.

Banz, R.W., 1981. The relationship between return and market value of common stock. Journal of Financial Economics, March, pp.3-18.

Ballester, M., J. Livnat and C. Seethamraju, 1998. Individual-Firm Style Loadings, Unrecorded Economic Assets and Systematic Risk, Journal of Accounting, Auditing and Finance, 13:3, pp. 275-296.

Basu, J., Sherm, C., 1982. Residual risk, firm size and returns for NYSE common stocks: Some empirical evidence. Working paper, McMaster University.

Becker R.A. and W.B. Gray, 2009. NBER-CES Manufacturing Industry Database, available at http://www.nber.org/nberces.

Belo, F. and Lin, X., 2012. Labor heterogeneity and asset prices: The importance of skilled labor, unpublished working paper, University of Minnesota, Ohio State University.

Belo, F., Lin, X., and Bazdresch, S., 2014. Labor hiring, investment, and stock return predictability in the cross section, Journal of Political Economy, 122, 129–177.

Bentolila, S. and Bertola G., 1990. Firing costs and labour demand: how bad is eurosclerosis? Review of Economic Studies, 57(3); 381-402.

Berk, J. B., 1995. A Critique of Size Related Anomalies, Review of Financial Studies, 8, 275-286.

Berk, J. B, Green, R. C. and Naik,V. 1999. Optimal investment, growth options and security returns, Journal of Finance, 54; 1553-1607.

Black, F., 1972. Capital market equilibrium with restricted borrowing, Journal of Business, 444-455.

Bloom, N., 2009. The Impact of Uncertainty Shocks," Econometrica, 773, 623- 685.

Blouin, J., Core, J. E., and Guay, W., 2010. Have the tax benefits of debt been overestimated? Journal of Financial Economics, 98, 195–213.

Blume, M. E., F. Lim, and A. C. MacKinlay, 1998. The Declining Credit Quality of U.S. Corporate Debt: Myth Or Reality? Journal of Finance, 53, 1389.1413.

Bowman, R.G., 1979. The Theoretical Relationship Between the Systematic Risk and Financial Accounting Variables, Journal of Finance, 34, 617-630.

Campbell, John Y. , 1996. Understanding risk and return, Journal of Political Economy, 104, 298-345.

Carhart, M. M., 1997. On persistence in mutual fund performance, Journal of Finance, 52, 57–82.

Carlson, M., Fisher, A., and Giammarino, R., 2004. Corporate investment and asset price dynamics: Implications for the cross section of returns, Journal of Finance, 59(6); 2577-2603.

Chang, W., Landsman, W., and Monahan, S., 2012. Selecting an accounting based valuation model. Working paper, INSEAD and University of North Carolina.

Chang, X. S., Chen, Y., and Dasgupta, S., 2014. Macroeconomic Conditions and Firms' Financing Decisions: A Reinvestigation. Working paper. Hong Kong University of Science and Technology, Tsinghua University and Nanyang Business School.

Chava, S., and Purnanandam, A. , 2010. Is default risk negatively related to stock returns?. Review of Financial Studies, hhp107.

Chen, C. X., Lu, H., and Sougiannis, T., 2012. The agency problem, corporate governance, and the asymmetrical behavior of selling, general, and administrative costs, Contemporary Accounting Research, 29, 252–282.

Chen, H. J., Kacperczyk, M., and Ortiz-Molina, H., 2011. Labor unions, operating flexibility, and the cost of equity, Journal of Financial and Quantitative Analysis, 46, 25-58.

Chen, S., Shevlin T., and Tong Y., 2007. Are dividend changes associated with changes in the pricing of information risk?. Journal of Accounting Research, 45, 1–40.

Chen, Z., J. Harford, and A. Kamara, 2013. Operating Inflexibility, Profitability and Capital Structure, Profitability and Capital Structure, August 05, 2013.

Cochrane, J., 1991. Production–based asset pricing and the link between stock returns and economic fluctuations, Journal of Finance 46, 209–237.

Cooper, I., 2006. Asset pricing implications of nonconvex adjustment costs and irreversibility of investment, Journal of Finance, 61(1), 139-170.

Cooper, M., Gulen H. and Schill M. J., 2008. Asset Growth and the Cross-Section of Stock Returns, Journal of Finance, 63 (4), 1609-1651.

Cornaggia, K. J., Franzen, L. A., and Simin, T. T., 2013. Bringing leased assets onto the balance sheet, Journal of Corporate Finance, 22, 345–360.

Cosci, S., Guida, R., and Meliciani, V., 2013. Leasing decisions and credit constraints: Empirical analysis on a sample of Italian firms, European Financial Management, 21, 377–398.

Danthine, J. and Donaldson, J. B., 2002. Labor relations and asset returns, Review of Economic Studies, 69, 41-64.

Dhaliwal, D., Lee, H. S. G., and Neamtiu, M., 2011. The impact of operating leases on firm financial and operating risk, Journal of Accounting, Auditing and Finance, 26(2), 151–197.

Donangelo, A., 2014. Labor mobility: Implications for asset pricing, Journal of Finance, 69, 1321-1346.

Easley, D., Hvidkjær S., and O'Hara M., 2002. Is information risk a determinant of asset returns? Journal of Finance, 57, 2185–2221.

Easton, P. D., and Monahan, S. J., 2005. An evaluation of accounting-based measures of expected returns, The Accounting Review, 80(2), 501-538.

Eisfeldt, A. L., and Papanikolaou D., 2013. Organization capital and the cross-section of expected returns, Journal of Finance, 68, 1365–1406.

Eisfeldt, A. L. and Rampini A. A., 2009. Leasing, ability to repossess, and debt capacity, Review of Financial Studies, 22, 1621–1657.

Elton, E. J., 1999. Expected return, realized return, and asset pricing tests, Journal of Finance, 54, 1199–1220.

Ely, K. M., 1995. Operating Lease Accounting and the Market's Assessment of Equity Risk, Journal of Accounting Research, 33, 397–415.

Fama, E. F. and MacBeth, J. D., 1973. Risk, return, and equilibrium: empirical tests, Journal of Political Economy, 81, 607-636.

Fama, Eugene F., and Kenneth R. French, 1992. The Cross-Section of Expected Stock Returns, Journal of Finance, 47; 427-466.

Fama, E. F. and French, K. R., 1993. Common risk factors in the returns on stocks and bonds, Journal of Financial Economics, 33, 3-56.

Fama, E. F. and Kenneth R. F. 2006. Profitability, investment, and average returns, Journal of Financial Economics, 82, 491–518.

Fama, E. F., and French, K. R., 2008. Dissecting anomalies, Journal of Finance, 63, 1653–1678.

Fama, E. F., and French, K. R., 2014. A five–factor asset pricing model. Working paper, University of Chicago, Dartmouth College and the National Bureau of Economic Research.

Fama, E. F., and MacBeth, J. D., 1973. Risk, return, and equilibrium: Empirical tests, Journal of Political Economy, 81, 607–636.

Favilukis J., and Lin, X., 2013. Does wage rigidity make firms riskier? Evidence from long–horizon return predictability. Working paper. London School of Economics and Ohio State University.

Garlappi, L., and Yan, H., 2011. Financial distress and the cross-section of equity returns. Journal of Finance, 66, 789-822.

Gebhardt, W.R., C.M.C. Lee, and B. Swaminathan, 2001, Toward an Implied Cost of Capital, Journal of Accounting Research, 39,135-176.

George, T. J., & Hwang, C. Y., 2010. A resolution of the distress risk and leverage puzzles in the cross section of stock returns, Journal of Financial Economics, 96(1), 56-79.

Gomes, J. F., L. Kogan, and L. Zhang, 2003. Equilibrium cross section of returns, Journal of Political Economy, 111, 693-732.

Gomes, J. F., and Schmid, L., 2010. Levered returns, Journal of Finance, 65, 467–494.

Gourio, F., 2007. Labor leverage, firm's heterogeneous sensitivities to the business cycle, and the cross–section of returns. Working paper, Boston University.

Graham, J. and M. Leary, 2011. A review of empirical capital structure research and directions for the future. Annual Review of Financial Economics,3, 309-345.

Graham, J. R., M. L. Lemmon, and J. S. Schallheim, 1998. Debt, Leases, Taxes, and the Endogeneity of Corporate Tax Status, Journal of Finance, 53,131–162.

Hadlock, C. J., and Pierce, J. R., 2010. New evidence on measuring financial constraints: Moving beyond the KZ index, Review of Financial Studies, 23, 1909–1940.

Hann, R. N., Ogneva, M., and Ozbas, O., 2013. Corporate diversification and the cost of capital, Journal of Finance, 68(5), 1961–1999.

Hall, R., 2005. Employment fluctuations with equilibrium wage stickiness, American Economic Review, 95, 50–65.

Hamada, R.S., 1972. The effect of the firms capital structure on the systematic risk of common stock, Journal of Finance, 27, 435–452.

Hamermesh, D.S., 1993, Labor Demand, Princeton University Press.

Hou, K., A. M. van Dijk, and Y. Zhang, 2012. The Implied Cost of Capital: A New Approach, Journal of Accounting and Economics, 53, 504-526.

Imhoff, E. A., Lipe, R. C., and Wright, D.W., 1991. Operating leases: Impact of constructive capitalization, Accounting Horizons, 5, 51–63.

Imhoff, E. A., Lipe, R. C., and Wright, D.W., 1993. The effects of recognition versus disclosure on shareholder risk and executive compensation, Journal of Accounting Auditing and Finance, 8, 335–368.

Imrohoroglu, A., and Tuzel, S., 2014. Firm level productivity, risk, and return, Management Science, 60, 2073–2090.

Jagannathan, R. and Wang, Z., 1996. The Conditional CAPM and the Cross-Section of Expected Returns, Journal of Finance, 51, 3-53.

Jagannathan, R. and Wang, Z., K. Kubota and H. Takehara, 1998, Relationship between Labor Income Risk and Average Return: Empirical Evidence from the Japanese Stock Market, Journal of Business, Vol. 71, pp. 319-47.

Jones, C. S., and Tuzel, S., 2012. New orders and asset prices. Review of Financial Studies, 107, 557–579.

Kaplan, S. N., and Zingales, L., 1997. Do investment–cash flow sensitivities provide useful measures of financial constraints? Quarterly Journal of Economics, 112, 159–216.

Kogan, Leonid., 2001. An equilibrium model of irreversible investment. Journal of Financial Economics, 62, 201-245.

Kogan, 2004; Asset prices and real investment, Journal of Financial Economics, 73 (3), 411.

Lamont, O., Polk, C., and Saa–Requejo, J., 2001. Financial constraints and stock returns, Review of Financial Studies, 14, 529–554.

Lasfer, M. A., and Levis, M., 1998. The determinants of the leasing decision of small and large companies, European Financial Management, 4, 159–184.

Lee, C., Ng, D., and Swaminathan, B., 2009. Testing international asset pricing models using implied costs of capital, Journal of Financial and Quantitative Analysis, 44(02), 307-335.

Lee, C. M., So, E., and Wang, C. C., 2014. Evaluating implied cost of capital estimates. Working paper. Stanford University.

Lev, B., 1974. On the association between operating leverage and risk, Journal of Financial and Quantitative Analysis, 9, 627–641.

Lewis, C. M., and Schallheim, J. S., 1992. Are debt and leases substitutes? Journal of Financial and Quantitative Analysis, 27, 497–511.

Lim, C. S., Mann, C. S., and Mihov T. V., 2005. Market evaluation of off–balance sheet financing: You can run but you can't hide. Working paper, Texas Christian University.

Lintner, J., 1965. Security prices, risk and maximal gains from diversification. Journal of Finance, 20, 587–615.

Liu, L. X., Whited T. M., and Zhang L., 2009. Investment–based expected stock returns, Journal of Political Economy 117, 1105–1139.

Livdan, D., Sapriza, H., and Zhang, L. 2009. Financially constrained stock returns. Journal of Finance, 64, 1827-1862.

Lustig, H., and Van Nieuwerburgh, S., 2008. The Returns on Human Capital: Good News on Wall Street is Bad News on Main Street, Review of Financial Studies, 21(5), 2097–2137.

Mandelker, G.N., and Rhee S. G., 1984. The impact of the degrees of operating and financial leverage on systematic risk of common stock, Journal of Financial and Quantitative Analysis, 19, 45–57.

Mayers, D., 1972. Non-marketable Assets and Capital Market Equilibrium under Uncertainty, in Jensen, M., Studies in the Theory of Capital Markets, Praeger, New York, 223-248.

Merz, Monika and Eran Yashiv., 2007. Labor and the market value of the firm, American Economic Review, 97 (4), 1419-1431.

Newey, W., and West, K., 1987. A simple, positive semi–definite, heteroskedasticity and autocorrelation consistent covariance matrix, Econometrica, 55, 703–708.

Novy–Marx, R., 2011. Operating leverage, Review of Finance, 15, 103–134.

Obreja, I., 2013, Book-to-market Equity, Financial Leverage, and the Cross-Section of Stock Returns, Review of Financial Studies, 265, 1146-1189.

O'Brien, T.J. and P.A. Vanderheiden, 1987, Empirical Measurement of Operating Leverage for Growing Firms, Financial Management, 16, 45-53.

Patatoukas, P. N., 2011. Customer-Base Concentration: Implications for Firm Performance and Capital Markets: The Accounting Review, 87(2), 363-392.

Pástor, Ľ., Sinha, M., and Swaminathan, B., 2008. Estimating the intertemporal risk–return tradeoff using the implied cost of capital, Journal of Finance, 63(6), 2859-2897.

Polk, C., and Sapienza, P., 2009. The stock market and corporate investment: A test of catering theory, Review of Financial Studies, 22, 187–217.

Rosett, Joshua G., 2003, Labor leverage, equity risk, and corporate policy choice, European Accounting Review, 12, 699-732.

Rubinstein, M. E., 1973. A mean–variance synthesis of corporate financial theory, Journal of Finance, 28, 167–182.

Santos, T. and P. Veronesi, 2006, Labor Income and Predictability of Stock Returns, Review of Financial Studies, 19; 1-44.

Sharpe, A. S., and Nguyen, H. H., 1995. Capital market imperfections and the incentive to lease, Journal of Financial Economics, 39, 271–294.

Shimer, R., 2005. The assignment of workers to jobs in an economy with coordination frictions, Journal of Political Economy, 113, 996–1025.

Shimer, R., 2005. The cyclical behavior of equilibrium unemployment and vacancies, American Economic Review, 95, 25–49.

Tang, Y., Wu, J., and Zhang, L., 2013. Do anomalies exist ex ante?, Review of Finance, 18, 843-875.

Titman, S., Wei, K., and Xie, F., 2004. Capital investment and stock returns, Journal of Financial and Quantitative Analysis, 39, 677–700.

Toms, S., Salama, A., and Nguyen, D.T., 2005. The Association between accounting and market-based risk measures. Working Paper, Department of Management Studies, University of York.

Tuzel, S., 2010. Corporate real estate holdings and the cross section of stock returns, Review of Financial Studies, 23 (6), 2015, 2268–302.

Tuzel, S. and Zhang, M. B., 2013. Local risk, local factors, and asset prices. Working paper, University of Southern California and University of Texas at Austin.

Vassalou, M., and Xing, Y., 2004. Default risk in equity returns. Journal of Finance, 59, 831-868.

Vuolteenaho, T., 2002. What drives firm–level stock returns? Journal of Finance, 57, 233–264.

Whited, T. M., and Wu, G., 2006. Financial constraints risk, Review of Financial Studies, 19, 531–559.

Xing, Y., 2008. Interpreting the value effect through the q–theory: An empirical investigation, Review of Financial Studies, 45, 56–99.

Yan, A., 2006. Leasing and debt financing: substitutes or complements? Journal of Financial and Quantitative Analysis, 41, 709–731.

Zhang, Lu, 2005. The value premium, Journal of Finance, 60 (1), 67-103.