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The Relationship between Financial Leverage and Stock Returns

An Empirical Study

Magnus Næss Tangen-Pedersen & Espen Bergset Jacobsen

Supervisor: Konrad Raff

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Preface

This thesis marks the end of our Master of Science in Economics and Business Administration in Financial Economics at the Norwegian School of Economics.

Our interest in this topic was sparked by researchers' contradictory and controversial results within such a central topic of corporate finance. Our motivation is to contribute to the discussion surrounding this economic puzzle, and we will seek to add interesting and relevant findings. The process of writing this thesis has been educational and challenging. Through econometric analysis, empirical and theoretical research, we have acquired valuable knowledge about capital structure. In our study, we have used Excel and R, which has helped improve and develop our abilities with these data tools.

We would like to express our deepest gratitude to our supervisor, Konrad Raff. He has provided us with valuable guidance and insight throughout the process, and challenged us to work independently.

Bergen, December 2022

Magnus Næss Tangen-Pedersen

Espen Bergset Jacobsen

Abstract

This thesis investigates how financial leverage affects equity returns across sectors on US stocks. Theory relevant to the subject suggests a positive relationship, while empirical studies have given contradictory results, with various research methods being used. Our cross-sectional regression models are based on the method developed by Fama and MacBeth (1973), and control for factors included in the CAPM, Fama French Five Factor model, and q-factor models. Our study provides evidence of how varying definitions of leverage can significantly impact the size and direction of the relationship between leverage and stock returns. Further, we find that the industry sector a company belongs to plays a role in explaining the relationship between leverage and stock returns.

Our results find book leverage to be negatively related to stock returns when adjusting for factors in the CAPM, Fama-French Five Factor, and q-factor models, supporting the findings by Fama and French (1992) and Cai and Zhang (2011). Results for market leverage did, however, prove a positive relationship to stock returns when including Fama-French factors, supporting initial findings by Modigliani and Miller (1958), Hamada (1972), and Bhandari (1988). Thus, our findings show contradictory evidence of leverage being related to stock returns. A further interesting takeaway is the consistency of results for Energy and Consumer Staples, showing negative relationships between book leverage and stock returns across most regressions.

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1 Introduction

The choice of capital structure is arguably one of the most important decisions managers face, and a change in leverage ratio can affect a firm's financing capacity, risk, cost of capital, investments and strategic decisions, and ultimately shareholder wealth (Cai and Zhang, 2010). Leverage and its role in explaining firm performance and value is a highly researched and debated topic. Although empirical work indicates a relationship between leverage and firm value, the nature and cause of this relationship are still disagreed upon. This thesis seeks to investigate the relationship between leverage and equity returns, while also exploring how varying definitions of leverage and sector classification affect this relationship.

Modigliani and Miller (1958; 1963) sparked the debate with propositions I and II, theorems that are still central in corporate finance literature. In addition, Hamada (1972) and Bhandari (1988) were among the earlier researchers on the subject. Their results indicated a positive relationship between market leverage and equity returns. More recent studies by Dimitrov and Jain (2005), Cai and Zhang (2011), and Koseoglu (2014) have found results contradicting previous findings, indicating a negative relationship between book leverage and equity returns.

While studies on leverage effects have provided results that differ greatly from each other, some researchers have pointed out the apparent factor in which industry a company operates affects the relationship between leverage and equity returns. This point arises from the fact that firm characteristics vary substantially across sectors, indicating that a relationship between leverage and return found for the market or a sector cannot be generalized to all industries. Among the later studies, Muradoglu and Sivaprasad (2012) found results indicating that the risk class of a company affects the relationship between leverage and stock returns. Hall and Weiss (1967) studied the relationship between firm size and profitability, and argued that the optimal rate of borrowing needed for profit or sales maximization would differ from industry to industry, thus making the industry sector an explanatory factor in a company's use of leverage. Based on previous literature, we present the following hypotheses:

> *"There is a negative relationship between book leverage and stock returns."*
>
> *"The sector a company belongs to, affects the relationship between the company's leverage and stock returns."*

The basis of this study is the relationship between leverage and equity returns. Our sample consists of companies listed on US stock markets, specifically the New York Stock Exchange (NYSE), the National Association of Securities Dealers Automated Quotations (NASDAQ) and The American Stock Exchange (AMEX). The data gathered for this thesis includes monthly stock returns and quarterly accounting data in the period 1980 to 2021. A total of 10 554 firms are part of the study. The data on US listed companies provides a sample with extensive, vetted data, allowing the study to examine each sector as a subset while still providing a large, trusted sample.

We divide sectors into subsets, enabling us to examine differences in effects of leverage between sectors. Companies are divided into sectors based on the Global Industry Classification Standard (GICS), while results for the Standard Industry Classification (SIC) will be provided in the appendix. We use the Fama-MacBeth method to run regressions, and control for factors introduced in the CAPM, Fama-French five factor and q-factor models. We report Newey-West standard errors to adjust for autocorrelation and heteroscedasticity in standard errors. To increase the robustness of our findings, we investigate how varying definitions of leverage, different sector classifications and sample periods affects results.

Our study finds a negative relationship between book leverage and stock returns for the market and proves that the effects of leverage differ between sectors. The sector of a company is therefore found to be an important explanatory factor when investigating leverage and stock returns. However, results show that the relationship between leverage and stock returns can vary significantly, both in size and direction, depending on which leverage definition is used. While results vary somewhat between the regressions, Energy and Consumer Staples consistently provide results corresponding to a negative relationship between leverage and stock returns. Results for market leverage show a positive relationship to stock returns for the market and several sectors. When adjusting for cash and cash equivalent in book leverage (book net leverage), the results indicate that there is no relationship between leverage and stock returns.

Our study finds results consistent with the findings of previous studies, as we find a negative relationship for book leverage in the market, supporting Fama and French (1992) and Cai and Zhang (2011). In line with Sivaprasad and Muradoglu (2008), we find significant differences between sectors in all regressions. Our results for market leverage support the initial findings by Modigliani and Miller (1958), Hamada (1972), and Bhandari (1988).

Based on our findings, the sector of a company is found to be an important factor when investigating leverage and stock returns, as argued by Sivaprasad and Muradoglu (2008). Furthermore, we find inverse relationships between market leverage and book leverage, which indicates that the argument made by Cai and Zhang (2011) about market leverage weakening the robustness of results due to a mechanical relation to stock returns should be accounted for. Our findings imply that theories and empirical findings related to leverage and capital structure cannot necessarily be applied to all companies, as both the definition of leverage and differences between sectors can impact the size and direction of the relationship between leverage and stock returns.

2 Literature review

This section introduces relevant theories and empirical evidence for our research question. We start by presenting theories on capital structure. Further, we present empirical work related to leverage and equity returns, before rounding off the section by discussing the research gap for this thesis.

2.1 Theoretical Framework

2.1.1 Modigliani and Miller

Empirical work on capital structure performed by Modigliani and Miller (1958) (hereafter referred to as MM), formed a foundation for theories related to capital structure. Their earliest studies formed MM Proposition 1, which states that *"in a perfect capital market, the total value of a firm's securities is equal to the market value of the total cash flows generated by its assets and is not affected by its choice of capital structure"* (Modigliani & Miller, 1958). In this context, perfect capital markets fulfil three conditions; (1) investors and firms can trade the same set of securities at competitive market prices equal to the present value of their future cash flow. (2) There are no taxes, transaction costs, or issuance costs associated with security trading. (3) A firm's financing decisions do not change the cash flows generated by its investments, nor do they reveal new information about them. As a result, the total cash flow paid out to the firm's security holders is equal to the total cash flow generated by the firm's assets (Berk & DeMarzo, 2017). Leverage would therefore not affect the total value of a firm since leverage merely changes the allocation of cash flow between debt and equity. MM Proposition I proposes the following:

$$E + D = U = A$$

The equation explains that the total market value of a firm's assets is equal to the market value of a firm's securities, independent of the firm's financing. Further, in MM (1958), they formed proposition II, which states that the cost of equity capital increases linearly with the firm's leverage:

$$r_E = r_U + \frac{D}{E}(r_U - r_D)$$

Where:

r_E: cost of levered equity

r_U: cost of unlevered equity

r_D: cost of debt

D/E: debt-to-equity ratio

They found that, fixing the asset beta, an increase in leverage raises the risk of the firm's equity. Thus, all else equal, expected return should increase with leverage, indicating a positive relationship between leverage and equity returns. The proposition argued that an increase in equity returns was offset by the risk premium of the increased financial risk.

In their revised proposition II, MM (1963) relaxed the limitation to represent the actual traits of the market better. This revision included payment of taxes, risk of bankruptcy costs and agency costs, and asymmetrical information. While MM Proposition II initially argued that the tax deductibility caused by debt increased firm value, a revision in 1977 concluded that personal taxes for investors offset said increase (Miller M. , 1977). These taxes caused leverage to have no effect on firm value, as investors would require higher rates of return, which would offset the debt benefits.

2.1.2 Theories on capital structure

Based on MM, several theories relating to capital structure have been formed, with some of the most central in corporate finance literature being trade-off theory, agency theory and pecking order theory.

The trade-off theory states that the debt in a firm is beneficial to investors as long as the benefit of tax deductibility of interest is bigger than potential bankruptcy costs. That is,

$$V^L = V^U + PV(Interest\ Tax\ Shield) - PV(Financial\ Distress\ Costs)$$

This equation shows that the total value of a levered firm results from the value of the firm as if it was unlevered plus the present value of the interest tax shield minus the present value of financial distress costs. To calculate the costs of financial distress accurately is difficult. However, three key factors in determining the costs are (1) the probability of financial distress, (2) the magnitude of the costs if the firm is in distress, and (3) the appropriate discount rate for financial distress costs (Berk & DeMarzo, 2017). The three key factors determining the present value of financial distress costs will vary from business to business and industry to industry. The trade-off theory argues that a firm should increase its leverage until the tax savings from increasing leverage are just offsetting the cost of financial distress. This point is referred to as the optimal level of debt. Put differently, according to the trade-off theory, there is a positive relationship between debt and equity returns up and until the optimal level of debt. Increasing debt beyond this point reduces equity returns, all else equal. However, as other theories highlight, tax shield and financial distress costs cannot alone explain the level of debt a firm chooses.

Capital structure can alter a manager's incentives and change their investment decisions, and therefore affect a firm's cash flow. Agency costs are costs that arise from different incentives between stakeholders. Jensen and Meckling (1976) found that there are generally two types of conflicts: between equity holders and debt holders and between managers and shareholders. The theory helps explain why a manager in a firm with a financial structure containing both debt and equity chooses activities for the firm such that the firm value is less than if the manager were the sole owner. Further, their theory explains that the sale of common stock is a viable source of capital even though managers do not maximize the firm's value by doing so.

In certain situations, mainly when a firm faces financial distress, shareholders can gain from an increase in risk by the firm, even when the projects have negative NPVs (Berk & DeMarzo, 2017). This phenomenon is referred to as excessive risk-taking, where taking on a risky investment can decrease the value of assets (and therefore also the firm), but the value for equity shareholders increases since value is shifted from debt holders to equity holders. Furthermore, when a firm faces financial distress, Myers (1977) found that it may choose not to undertake positive NPV projects, referred to as a debt overhang or under-investment problem. The decision to not undertake an investment is costly for debt holders and the firm value. As a result, growth for firms facing debt overhang problems will be limited. Therefore, too much debt, relative to having less debt, can result in lower equity returns if it hinders a firm from undertaking positive NPV projects.

A benefit of debt, suggested by Jensen and Meckling (1976), is that it allows a firm's original owners and managers to maintain their equity stake. Since the use of debt avoids dilution of ownership, management is incentivised to spend less on perks, cut costs and run the firm efficiently. Another benefit of debt formed by Jensen (1986) is the free cash flow hypothesis, which states that wasteful spending is more likely to occur when firms have high levels of cash flow in excess of what they need to make positive net present value investments and payments to debt holders. Therefore, managers will be incentivised to run the firm efficiently when cash is tight. Specifically, the free cash flow hypothesis states that higher debt increases the value of a firm, all else equal, since it commits the firm to make future debt payments and thereby reduces excess cash flows and wasteful investment by managers. Harris and Raviv (1990) had a similar idea, arguing that leverage can reduce managerial entrenchment due to managers being more likely to be fired when a firm faces financial distress. Therefore, less entrenched managers might be more worried about their performance and less likely to undertake wasteful investments. Further, when a firm is highly levered, creditors will monitor the manager's actions more closely, providing an added layer of management oversight. By combining the trade-off theory and agency theory, the value of levered firms can be summarised in the following formula:

$$V^L = V^U + PV(Interest\ Tax\ Shield) - PV(Financial\ Distress\ Costs) \\ - PV(Agency\ Costs\ of\ Debt) + PV(Agency\ Benefits\ of\ Debt)$$

The pecking order theory proposes the problem a company faces while financing. The theory suggests internal funds as the preferred way of financing (Stewart C. Myers, 1984). This occurrence is caused by asymmetric information between the manager and outside investors. The manager of a company faces three ways of financing; internal funds, debt and equity. As a manager seeks external financing by equity, it would signal a lack of confidence in the board and that the manager thinks the company is overvalued. The company would therefore make a profitable decision by issuing equity while the company is valued highly. If the manager signals an overvaluation by giving new equity, the share price will followingly drop.

By issuing debt, the board signals a profitable investment or an undervaluation of the stock, as the company prefers debt over equity. This signal would lead to an increase in share price. As internal funds have a lower cost than issuing debt or equity, it is the preferred way of financing.

Therefore, the company prioritises using internal funds before issuing debt when internal funds are depleted. When issuing debt is no longer rational or profitable, issuing equity will be used as a last resort.

To summarise, theories related to leverage and capital structure try to explain and rationalize what factors a decision made by a manager or company is based on, and how the decision followingly affects the company and its capital structure. The nature of these theories can be summarised by a quote from Stewart Myers; *"There is no universal theory of the debt-equity choice and no reason to expect one"* (Myers S. C., Capital Structure, 2001). This statement implies that traits of companies and industry sectors play an important role in their choice of capital structure and that no theory can be directly applied to all companies without considering other factors.

2.2 Empirical Studies

Leverage and its connection to firm performance is a heavily studied subject and has been a topic of debate since Miller and Modigliani presented their propositions. Following their theories and discoveries in 1958 and 1963, more research was done on the subject by other parties.

Arditti (1967) performed a study that tested the effect of leverage on a firm's value. His data consisted of companies listed on a Composite Index containing companies related to industrials, railroads, and utilities. The data contained stock returns from 1946 to 1963, and leverage defined as the ratio between book value of debt and market value of equity. The study resulted in an insignificant, negative relationship between leverage and stock returns. Based on this study, Arditti therefore concluded that a firm's stock returns and value are independent of their capital structure. In 1972, Robert Hamada tested the effect of firms' leverage on their profits after tax. The study resulted in a positive relationship between leverage and firm value. Although the link between profitability and firm value can be strong, the study's results cannot be seen as proof of a relationship between leverage and firm value. This is due to the numerous factors that play into the relationship between profitability and value.

Baker (1973) studied the effect of leverage on a firm's value by testing the connection between leverage and profitability. While defining leverage through the equity-to-assets ratio, the study found a significant negative connection between the equity-to-assets ratio and profits. This implies a positive relationship between leverage and profitability, as the equity-to-assets ratio and debt-to asset-ratio are counterparts in the same equation. Further, Black and Scholes (1974) tested the relationship between the volatility of stock returns and leverage. Several studies were done to test the relationship and found a positive connection between stock volatility and leverage. This means that more leverage in a company lead to higher volatility in its stock returns in the study.

Bhandari (1988) tested the effect of leverage on stock returns by using the Fama-Macbeth regression method. The regression used firm size and beta as control variables and showed a positive relationship between the debt-to-equity ratio and stock returns. Similar to Black and Scholes (1974), Schwert (1989) performed a study on the volatility of stock returns and the factors causing it. Leverage was one of these factors and was found to have a relation to stock volatility. The study did not determine whether the relation between leverage and stock returns was positive or negative, only that it increased volatility.

McConnell and Servaes (1995) studied the relationship between firm value and leverage. Their study examined companies listed on the New York Stock Exchange, with data from 1976 to 1989. The study differed between companies with high growth and companies with low growth. The results for high-growth companies showed a negative relationship between leverage and firm value, while in contrast, low growth companies showed the opposite.

Dimitrov and Jain (2005) examined leverage and returns, by building on models used in previous studies. The authors used stock returns and leverage data for companies listed on New York Stock Exchange, American Stock Exchange and NASDAQ. Reported earnings were considered a relevant factor in explaining returns, in addition to growth and leverage. Rather than using the level of leverage, the authors calculated the change in leverage between the start and end of a period. Leverage was defined as total debt divided by total assets, and the study found a significant negative relationship between leverage and adjusted stock returns. The study also found a negative relationship between leverage and future-adjusted stock returns.

Muradoglu and Sivaprasad (2008) studied the effect of a firm's leverage on stock returns based on the Modigliani and Miller valuation model. In contrast to the initial study by MM, Muradoglu and Sivaprasad tested the leverage effect in all risk classes. The study examined 792 companies listed on the London Stock Exchange from 1980 to 2004. Companies were excluded from the data based on the absence of matching leverage and stock data, too small size of the firm, and if they belonged to the financial sector. Companies were split into sectors based on their classification in DataStream, the authors' data source. Monthly stock returns and annual leverage ratios were used, and results were controlled for CAPM and Fama French variables, in addition to momentum. Results indicated that leverage is an important explanatory factor for stock returns. Returns increased with leverage in the model for the utilities sector, consistent with the findings of MM. The study did, however, find that increased leverage affected returns negatively in the overall sample, as well for Consumer Goods, Consumer Services and Industrials. The results were robust to other risk factors and indicated that a firm's risk class (sector) had an effect on the direction of the relationship between leverage and stock returns. The authors argued that results for the Utilities sector could not be generalised to all sectors, given the sector's highly regulated and capital-intensive nature.

Korteweg (2010) tried to estimate the market's valuation of a company's leverage and found net benefits of up to 5.5% of a firm's value. He further found that the optimal leverage ratios were higher for small and profitable companies. These findings coincide with previous studies and literature on the subject. Korteweg stated that companies used in the study tended to be slightly underlevered compared to the optimal leverage level. He did, however, include zero-leverage firms in the study, which would have affected the leverage levels in the sample. The study found a negative relationship between profitability and leverage, and argued that as a company gets higher profits, its equity will increase, and thus leverage will decrease. The results of a study between profits and leverage will therefore have a negative bias and most likely capture a negative relationship, even if leverage and profits are positively related.

A study by Cai and Zhang (2011) examined the effect of changes in leverage on stock returns. The study built on models by Dimitrov and Jain (2005), mentioned previously. Monthly stock data from 1975 to 2002 were sorted into ten portfolios based on changes in leverage. The first group contained companies with the lowest change in leverage, while the last group contained companies with the greatest change. On average, an increase in leverage lead to a decrease in value. The results were tested with controls for both the Capital Asset Pricing Model (CAPM) and Fama French factor models, and the results were consistent with the initial findings.

Similarly, Koseoglu (2014) examined the relationship between leverage and stock returns, while also exploring leverage premiums. A sample of 470 firms with data ranging from 2006 to 2013 was used in the study. Companies were sorted based on their book-to-market ratio, market capitalisation and leverage ratios. The study examined monthly stock returns and regressed them on excess returns in the market and the previously mentioned portfolios. Fama French factors and CAPM were used to test the effect of leverage. Results showed that the use of leverage variables increased the explanatory ability of the model. The relationship between leverage and stock returns was shown to be negative, consistent with the findings by Cai and Zhang (2011). In connection with the results, the authors pointed out an implication that companies with medium debt ratios see a premium for the ability to raise funds for investment projects.

Friewald et. Al. (2018) conducted a study on how leverage and the debt maturity structure of a company affect its equity returns. All levered, nonfinancial companies on NYSE, NASDAQ and Amex were part of the sample, and data ranged from 1976 to 2019. The results implied that short-term leverage positively affects equity returns, while long-term leverage does not.

Leverage and its connection to company valuation is a widely discussed topic, with studies providing varying results. Other than the theories and studies performed by MM, studies by Fama and French (1992) laid the foundation for empirical work related to leverage and company valuation. In the development of the Fama French factor model, the authors found that size and book-to-market factors played a significant role in explaining parts of the stock returns in their model. Thus, they found it necessary to extend the Capital Asset Pricing Model (CAPM) to accurately explain which factors were tied to returns. Leverage was among these factors and was incorporated into the model via the book-to-market factor.

The study found opposite effects on stock returns depending on how a company's leverage ratio was estimated. While leverage based on the market's valuation had a positive effect on stock returns, book leverage proved the opposite. Fama and French concluded that the variables give opposite effects, and that the difference between the market leverage and book leverage showed the effect of leverage. The book-to-market factor increases when the difference between the market value of debt and the book value of debt increases, and thus captures both the element of financial distress, and when the market finds the firm's performance as weak.

2.3 Research Gap

This thesis examines the effect of financial leverage on equity returns of companies listed on US stock markets, differentiating between sectors. The study seeks to add a useful angle and insight to a subject where previous research has provided ambiguous and contradictive results. First, there is no conclusion or unconditional answer to how financial leverage affects equity returns. We try to shed light on this problem by taking a cross-sectional approach where both sector classification and leverage definition play a role in explaining returns, while using an updated dataset providing data which has not been used in previous studies. Our conditional approach takes a dive into how traits within a sector can affect the effect of leverage rather than looking for a general, unconditional answer to the research question.

2.4 Definitions of Leverage

As mentioned previously, differing definitions of leverage have been used by researchers in previous studies on leverage effects. Fama and French (1992) highlighted the apparent negative relation between book leverage and equity returns, whereas market leverage showed a positive relationship. This effect was captured through the Book-to-Market factor. Hall and Weiss (1967) defined leverage inversely through equity divided by total assets when investigating the relationship between firm size and profitability. Baker (1973) later used this definition of leverage when he examined the relationship between risk, leverage and profitability. Bhandari (1988) defined leverage as the book value of total assets minus the book value of common equity divided by the market value of common equity.

The topic of an empirical study is naturally a significant contributor to the choice of definition for leverage. In a more recent study investigating the net benefit of leverage, Korteweg (2010) defined leverage as the market value of debt (net of cash) divided by the market value of equity and market value of debt (net of cash). Friewald et al. (2018) studied the effect of debt maturity structure on equity returns and defined leverage as the book value of short-term and long-term debt divided by the sum of the market value of equity, short-term debt and long-term debt. Cai and Zhang (2011) studied the relationship between leverage and stock prices, and used the book value of total liabilities divided by the book value of total assets as their independent variable. The researchers argued that market leverage was mechanically related to stock prices, and would thus affect the results.

This thesis aims to investigate the effect of leverage on equity returns between sectors in the US. As previous studies have used various definitions of leverage providing contradicting results, we would like to test our data for several definitions of leverage. Several definitions offer the opportunity to check for inconsistencies between definitions and observe how they might affect the direction and size of relationships in the results, as pointed out by Fama and French (1992).

The chosen leverage definitions for this study are Book Leverage, Book Net Leverage, and Market Leverage. The definition we use for book leverage was used by Dimitrov and Jain (2005), when they examined the value relevance of changes in financial leverage. A similar definition was used by Cai and Zhang (2011), with the exception that they used total liabilities instead of total debt in the numerator. We argue that total debt is more accurate than liabilities when examining the relevance of financial leverage for equity returns, as liabilities include many other components than just long-term and short-term debt. We define book leverage as:

$$Book\ leverage = \frac{short\ term\ debt + long\ term\ debt}{Total\ assets}$$

Multiple papers adjust for cash and cash equivalents when examining the effects of leverage. As mentioned above, Korteweg (2010) adjusted for cash in his definition of leverage. Further, Friewald, Nagler and Wagner (2022) cross-checked their spanning regression results by adjusting for cash in their leverage definition. They argued that cash, in some cases, can be viewed as "negative debt". Acharya, Almeida and Campello (2005) found that cash can, in some cases, be regarded as negative debt. Furthermore, Modigliani and Miller's proposition 2 states that the risk of equity and returns increases when leverage increases. Therefore, it could be argued that leverage should be adjusted for cash and cash equivalents, since excess cash and cash equivalents can be used to repay debt. To cross-check our results from using book leverage, we use book net leverage, which is defined in the following way:

$$Book\ net\ leverage = \frac{short\ term\ debt + long\ term\ debt - cash\ and\ cash\ equivalents}{Total\ assets - cash\ and\ cash\ equivalents}$$

Lastly, market leverage is a definition used by a wide range of researchers examining the effects of leverage. Our definition of market leverage is identical to the definition used by Friewald, Nagler and Wagner (2022), and similar to the definition of market leverage by Cai and Zhang

(2011) and Doshi, Jacobs, Kumar and Rabinovitch (2019). While Friewald, Nagler and Wagner (2022) used total debt in the numerator, Cai and Zhang (2011) and Doshi, Jacobs, Kumar and Rabinovitch (2019) used total liabilities. As argued above, we find the use of total debt rather than total liabilities to be more precise in our research. We define market leverage as:

$$Market\ leverage = \frac{short\ term\ debt + long\ term\ debt}{Market\ value\ of\ equity + short\ term\ debt + long\ term\ debt}$$

3 Data

This section will clarify our process and chosen method regarding data collection and metric definition.

3.1 Data source

The data for this thesis was collected from Wharton Research Data Services (WRDS) and Kenneth R. French's data library. We have used CRSP for gathering stock data and Compustat for gathering company accounting data. Both vendors are part of the WRDS database. Kenneth R. French's data library provides data for the Fama French factor regression analysis and the risk-free rate used in our research.

3.2 Data Filtering

As the retrieved data contains several thousand companies, there is naturally a need for filtering and cleansing of the dataset. First, the datasets from CRSP and Compustat, which contain stock returns and leverage info respectively, need to be merged. While CRSP use the variable PERMNO to identify each firm, Compustat use their own Global Company Key, GVKEY. Therefore, a linking table containing all unique values for PERMNO and GVKEY is needed to merge the datasets. The data is merged on date and company identifier. All observations with a missing value for either stock return or leverage on a specific date are removed in this process, as the merging requires values for all variables at each given date.

Further, all companies within the financial sector are removed, in line with Fama and French (1992). Companies with missing sector info, grouped by Compustat as "Missing", are also removed. Following Fama and French (1992), all companies with zero or negative equity and asset values are removed from the data. For consistency in our research, we required that all values for the following characteristics were available in the dataset: book leverage (BLEV), book net leverage (NLEV), market leverage (MLEV), monthly returns (RET), book-to-market ratio (BM), market equity (ME), operating profitability (OP), beta, investment-to-assets (I/A). Before filtering, the retrieved data contained 1.74 million observations in Compustat and 2.65

million observations in CRSP across 22 741 companies. The filtered data includes 1.3 million observations and 111 050 firm-year observations across 10 554 companies.

The dates associated with the quarterly accounting data in Compustat represent the end of each quarter, not when the data is made public to investors. This could, followingly cause a delayed reaction to changes in leverage unless adjusted for. For that reason, we applied a conservative six-month lag to accounting data, in line with Friewald, Nagler and Wagner (2022). Further, we constructed returns adjusted for delistings as presented by Bali, Engle, and Murray (2016).

3.3 Population and sampling

This thesis examines the relationship between financial leverage and company stock performance in US markets. The study investigates listed companies exclusively, motivated by the high availability of standardised, firm-specific information. The chosen stock exchanges for this study are the New York Stock Exchange (NYSE), the National Association of Securities Dealers Automated Quotation System (NASDAQ) and The American Stock Exchange (AMEX). AMEX was acquired in 2008 by NYSE and has later been named NYSE American (SEC, 2008).

The sampling period runs from January 1980 until December 2021. During this period, three different industry classifications have been used in the US. Standard Industrial Classification (SIC) was introduced in the 1930s and was replaced by the North American Industry Classification System (NAICS) in 1997. Global Industry Classification Standard (GICS) was introduced in 1999 and is used as the basis for the Standard and Poor (S&P) index (MSCI). GICS is our preferred sector classification, as this standard sees revisions yearly, is used globally, and is designed to represent companies of the modern market. Therefore, each firm in the dataset is placed in a subset based on its GICS code.

The GICS system contains 11 sectors. As the financial sector is excluded from this study, ten sectors will be examined. The filtered data includes 10 554 firms, 678 firms in the Energy sector, 643 in Materials, 1856 in Industrials, 2259 in Consumer Discretionary, 522 in Consumer Staples, 1788 in Health Care, 2156 in Information Technology, 319 in Communication Services, 265 in Utilities and 68 in Real Estate.

3.3 Variables

3.3.1 Dependent variable

The dependent variable used to examine firm performance in this study is excess stock returns for each firm. Stock returns are extracted directly from CRSP and are defined as the change in value per dollar of an initial investment, shown in percentage. The risk-free rate used to calculate excess returns is collected from Kenneth R. French's library.

3.3.2 Independent variables

The independent variables used in this study are various definitions of leverage for each firm. Values for short-term debt, long-term debt, cash and cash equivalents, and total assets are extracted from Compustat. The variables are defined as follows:

- Book Leverage (BLEV): Book value of short-term debt & Book value of long-term debt divided by Book value of assets.
- Book Net Leverage (NLEV): Book value of short-term debt & Book value of long-term debt adjusted for Cash & Cash Equivalents, divided by Book value of assets adjusted for Cash & Cash Equivalents.
- Market Leverage (MLEV): Book value of short-term debt & Book value of long-term debt divided by Book value of debt & Market value of equity.
- Change in Book Leverage ($BLEV^2$): Book value of short-term debt & Book value of long-term debt divided by Book value of assets, squared

3.3.3 Control Variables

Fama French 5-factor variables:

- Size Factor (SMB): Market capitalisation for each company, measured by Small Minus Big
- Book-to-Market factor (HML): Ratio between the book value of equity and market capitalisation, measured by High Minus Low

- Profitability Factor (RMW): Operating income divided by the book value of equity, measured as Robust Minus Weak
- Investment Factor (CMA): The difference in investment between companies is measured in percentage change from one quarter to another. Factor defined as Conservative Minus Aggressive.
- Market Excess return (MKT-excess): Market Return for US markets adjusted for risk-free rate (rf). Rf is collected directly from Kenneth French's library.
- Operating profitability is calculated as total revenue minus cost of goods sold, selling general and administrative expenses and interest expenses, divided by book equity, as defined by Fama and French (2015).

CAPM variables:

- Market Return: Collected from Kenneth R. French's data library. The index uses a weighted average and consists of all companies on CRSP listed on either NYSE, AMEX or NASDAQ.
- Beta: Based on a rolling-window estimation where we use monthly stock returns. More specifically, we regress a stock's excess returns on Fama French market factor returns over the preceding 60 months, requiring at least 48 months of return data to compute the betas.

q-factors:

- Market excess return: Market Return for US markets adjusted for risk-free rate (rf). Rf is collected directly from Kenneth French's library.
- Market equity: Defined by Xou, Xue, and Zhang (2015) as stock price per share times shares outstanding. In the q-factor model, market equity is referred to as the size factor and represents the difference in simple average returns from nine small-size portfolios and simple average returns of nine big-size portfolios (Hou, Xue, & Zhang, Which Factors?, 2019).
- Investment-to-assets: Calculated as the annual change in total assets divided by 1-year-lagged total assets, which is in line with the definition from Hou, Xue, and Zhang (2015). In the q-factor model, the investment factor is the difference between the

average returns on six portfolios of low investment-to-assets firms and the average returns on six portfolios of high investment-to-assets firms (Hou, Xue, & Zhang, Which Factors?, 2019).

- ROE: ROE is calculated as income before extraordinary items divided by one-quarter-lagged book equity. Book equity is defined as shareholders' equity plus balance sheet deferred taxes and investment tax credit minus the book value. These variables are defined in line with Hou, Xue, and Zhang (2015). The quarterly version of the annual book equity measure is used, as done by Davis, Fama and French (2000). In the q-factor model, the ROE factor is the difference between the average returns on six high ROE portfolios and the average returns on six low ROE portfolios (Hou, Xue, & Zhang, Which Factors?, 2019).
- Expected growth: Expected growth is based on a forecast for future investment-to-assets changes. The expected growth factor is the difference between the average returns on two high expected growth portfolios and the average returns on two low expected growth portfolios (Hou, Xue, & Zhang, Which Factors?, 2019).

3.4 Data Limitations

As proved by Walter, Weber and Weiss (2022), portfolio sorts can strongly impact estimated premiums depending on what decisions are taken in the sorting process. These findings imply that choices taken while sorting data may cause a bias. For this thesis, data is filtered based on the aforementioned criteria before being divided by sector. Which sector classification the data is sorted by could naturally influence the results. Further, data within each sector is split into quintiles based on leverage ratios and will be discussed in our summary statistics. Thresholds and number of quintiles will also cause a possibility of selection bias.

As mentioned in section 2, previous studies have provided contradicting results using various research methods and definitions of financial leverage. Each definition of leverage can provide different results from another, and the chosen definition of leverage can therefore be seen as a limitation. To mitigate this possible weakness, we have decided to examine several leverage definitions, as described in the independent variables section.

4 Methodology

The methodology section presents our research method. We will build on the previous sections by explaining how we use the retrieved data in our models to conduct our research.

4.1 OLS regressions

Regressions will be run on the market and for each sector. These regressions introduce different leverage definitions, and control for variables in the CAPM, Fama French Five Factor, and q-factor models. The regressions are defined as follows:

(1) $R_{it} = \alpha + \beta 1 * BLEV, NLEV, MLEV$

(2) $R_{it} = \alpha + \beta 1 * BLEV + \beta 2 * BLEV^2$

(3) $R_{it} = \alpha + \beta 1 * BLEV + \beta 2 * Beta$

(4) $R_{it} = \alpha + \beta 1 * \log(market\ equity) + \beta 2 * Beta + \beta 3 * BLEV$

(5) $R_{it} = \alpha + \beta 1 * BLEV + \beta 2 * Market\ excess\ return + \beta 3 * SMB + \beta 4 * HML + \beta 5 * RMW + \beta 6 * CMA + \varepsilon_{it}$

(6) $R_{it} = \alpha + \beta 1 * BLEV + \beta 2 * Market\ excess\ return + \beta 3 * ME + \beta 4 * \frac{I}{A} + \beta 5 * ROE + \beta 6 * eg$

Where:

r_{it}*:* Monthly stock returns adjusted for risk-free rate, *i* represents company, *t* represents time

BLEV: Book Leverage

NLEV: Book Net Leverage

MLEV: Market Leverage

$BLEV^2$*:* Book Leverage squared

SMB, HML, RMW, CMA: Fama French Variables, as explained in the Data section

ME, ROE, I/A, eg: q-factor variables, as described in Data section

4.2 Fama-French Five Factor Model

The Fama-French Five Factor model introduces new factors proven to have good capabilities in explaining returns. By including these factors in regressions, we will be able to test whether including factors related to size, book-to-market value, profitability, and investment affects results. The model was developed by Fama French (2015) and builds on the previous three-factor model. The three-factor model was developed in 1992 by Fama and French, and was built as an extension of the CAPM model.

In addition to the excess return of the market, which is already used in CAPM, the three-factor model includes the risk factors "Small minus Big" (SMB) and "High minus Low" (HML), which accounts for the difference in size and value premium of companies. The SMB factor splits companies sorted on market capitalisation, and simulates a portfolio short on big market capitalisation stocks and long on small market capitalisation stocks. The HML factor simulates a portfolio which is long on stocks with high book-to-market values and short on stocks with low book-to-market values.

This model was later expanded with more risk factors. "Robust minus Weak" (RMW) accounts for variation in operating profitability in firms, by simulating portfolios which are long in stocks with robust profitability and in stocks with weak profitability. The RMW factor represents the difference between these portfolios. The "Conservative minus Aggressive" (CMA) factor accounts for differences in investment between companies. The factor simulates two portfolios, where one includes companies with conservative investment and the other includes companies with aggressive investment. The factor is defined as the difference in return between these two portfolios.

4.3 Fama-MacBeth Regression

As the dataset and regressions examine 1.3 million observations across 10 000 companies, there is a reasonable possibility of correlation between the error terms. The Fama-MacBeth regression model adjusts for this possibility by correcting standard errors for cross-sectional correlation. The approach is split into two main steps. The first step entails running a regression on monthly stock returns and risk factors every period for each stock, while the second step estimates the coefficient of each risk factor. The first step is represented through the regression model:

$$r_{i,t} - r_{f,t} = \hat{\alpha}_{i,t} + \sum_{j}^{J} \beta_i^j f_{j,t} + \hat{\epsilon}_{i,t}$$

As in the OLS regressions, stock returns are measured through excess return, $r_{i,t} - r_{f,t}$, where i represents the company and f represents the point in time. α represents the estimated alpha, i. e. the constant intercept for each stock. β denotes the coefficient of each risk factor, and f represents each risk factor. $\in$ is the estimated error term for each stock, each point in time.

Following the estimation of each stock's risk factor in the first regression, the second step estimates the coefficient for each factor:

$$\hat{\beta}_j = \frac{1}{T}\sum_{t=1}^{T} \beta_{j,t}$$

β_j is measured as the average of slopes from the first step across all observations and represents the estimate for each factor. T represents each time period.

4.4 q-factor model

The q-factor model was developed by Xou, Xue and Zhang in 2015, and consists of the market factor, a size factor, an investment factor, and a profitability factor. The model has shown good capabilities of summarising the cross-section of average stock returns, and to subsume other models in summarising cross-sectional features of stock returns (Hou, Xue, & Zhang, Which Factors?, 2019).

The q-factor model started as a four-factor model and describes the expected excess return of a stock. The first factor is the market excess return, which is also a part of the CAPM model and the Fama and French factor models. The second factor is the difference between the return on portfolios of small-size stocks and the return on portfolios composed of big-size stocks, similar to the SMB factor included in Fama and French factor models. Third, is the difference between the return on portfolios with stocks with a low ratio of investments and the return on portfolios of stocks with a high ratio of investments, which is similar to the CMA factor in the Fama and French 5 factor model. The fourth factor is the difference between the return on portfolios of high profitability and those of low profitability, where profitability is measured through return on equity (Hou, Xue, & Zhang, Digesting Anomalies: An Investment, 2015).

In 2020, the q-factor model was revised to include another factor, namely expected growth. In this revision, they argued that firms with high expected investment growth should earn higher expected returns than firms with low expected investment growth, holding expected profitability and current investment constant. The expected growth factor is the difference between the average returns on portfolios with high expected growth portfolios and the average returns on low expected growth portfolios. They found that including expected growth in their q-factor model substantially improves the explanation of the cross-sectional stock returns, making it the best performing factor model (Hou, Mo, Xue, & Zhang, 2020).

4.5 Robustness

As the model risks having its results affected by heteroskedasticity and autocorrelation, the Newey-West estimator provides the t-stat value, following Newey and West (1987). This estimator provides a t-stat value adjusted for heteroskedasticity and autocorrelation, and is thus considered a HAC-estimator ("heteroskedasticity and autocorrelation consistent"). The estimator is implemented through the R-function *NeweyWest(),* included in the *sandwich* package. To increase the robustness of our findings, we use three different definitions of leverage in regressions. Further, we examine the effect of the sample period by rerunning regressions for the periods 1980 to 2000 and 2001 to 2021.

As stated in section 3.4 regarding data limitations, portfolio sorting can cause biases in a sample. As this thesis aims to investigate differences in leverage effects between sectors, forming portfolios based on sector codes is an essential step in our method. Sector classification could, however, introduce a bias in our data. As clarified previously, GICS is our preferred classification system. Results for the SIC system, used extensively in previous research, will be provided in the appendix. This will allow for a closer comparison to studies which have used the same system, while also providing the opportunity to compare the effect of using different sector systems.

5 Results

This section presents the results for the study. The results include summary statistics and results for each regression.

5.1 Summary Statistics

Table 1

Characteristics of Sample

Table 1 reports the mean value, standard deviation, minimum value and maximum value for relevant firm characteristics, namely book leverage (BLEV), book net leverage (NLEV), market leverage (MLEV), monthly returns (RET), book-to-market ratio (BM), the market value of equity in USD million (ME), beta, operating profitability (OP), investment-to-assets (I/A) and return on equity (ROE). Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	BLEV	NLEV	MLEV	RET	BM	ME	Beta	OP	I/A	ROE
Mean	0.237	0.079	0.247	0.013	0.792	3,267	1.131	0.131	0.143	0.007
Standard Deviation	0.198	0.335	0.236	0.180	0.908	20,531	0.754	0.294	1.841	0.298
Min	0.000	-1.000	0.000	-0.994	0.000	0	-13.022	-0.499	-0.998	-0.838
Max	1.000	0.993	0.997	19.000	134.680	2,232,279	10.323	0.858	679.392	0.507

The sample shows higher mean values for market leverage compared to book leverage, while book net leverage naturally provides a lower mean than book leverage, as the definition adjusts for cash and cash equivalents.

Table 2

Book Leverage in Each Sector

Table 2 reports the mean, standard deviation, minimum and maximum value of book leverage for the market and each sector. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	Mean	Standard Deviation	Min	Max
Market	0.237	0.198	0.000	1.000
Energy	0.279	0.198	0.000	0.999
Materials	0.262	0.166	0.000	1.000
Industrials	0.242	0.186	0.000	0.999
Consumer Discretionary	0.271	0.212	0.000	1.000
Consumer Staples	0.265	0.182	0.000	0.992
Health Care	0.183	0.202	0.000	1.000
Information Technology	0.147	0.169	0.000	0.999
Communication Services	0.329	0.235	0.000	0.998
Utilities	0.372	0.098	0.000	0.979
Real Estate	0.366	0.254	0.000	0.999

Table 2 reports the mean value, standard deviation, minimum value and maximum value for book leverage for the market and each sector. Health care and Information Technology are the only sectors that report mean values below the market mean, whereas Communication Services, Utilities and Real Estate show the highest mean values for book leverage. The Utilities sector also shows a relatively compact sample with a standard deviation of 0.098. An explanation for this occurrence, could be the high regulation in this industry caused by the importance of the goods produced in this sector.

Further, Utilities and Real Estate have the highest average book leverage across sectors of 0.372 and 0.366, respectively, compared to the market of 0.237. There can be multiple explanatory factors for this occurrence. Utilities and Real Estate can be described as capital-intensive sectors, meaning that they require high investments to produce goods, and therefore high capital expenditures which need to be funded. Further, these companies typically possess a high amount of physical assets, which can be used as collateral when taking on debt (Frankenfield, 2020). Tangible assets also tend to reduce the magnitude of the costs if the firm is in distress, as the assets can be liquidated.

The Utilities sector typically includes mature firms, which tend to have few good investment opportunities and high relative free cash flows and earnings. High earnings increase the tax shield, which all else equal increases the optimal level of debt according to the trade-off theory. High cash flows tend to increase the incentive benefits associated with debt. With the addition of debt, firms are obligated to debt payments and restricted by covenants, which reduces the potential for wasteful investments by the management. All else equal, this increases the optimal level of debt according to agency theory. In addition, Utilities firms provide everyday amenities like water, electricity and natural gas (Murphy, 2022). These products are in many cases critical to society, and are needed whether the economy is in a downturn or not. Consequently, firms in the Utility sector are known to have stable earnings and cash flows, and historically perform well during recessions. Stable earnings and cash flows tend to improve loan terms and make it possible for higher financial gearing. Stable earnings and cash flows also, all else equal, usually reduce the probability of financial distress, which increases the optimal level of debt according to the trade-off theory.

Information technology and health care are the sectors with the lowest average book leverage of 0.147 and 0.183, respectively. There can be multiple explanations for this occurrence. One explanation is the wish for financial flexibility. Information Technology is among the sectors with the highest mergers and acquisitions activity (BCG, 2022). Therefore, the low leverage ratio in Information Technology can partly be explained by the possibility of a debt overhang problem, where too high leverage can constrain a firm from committing to lucrative acquisition and investment opportunities. Since Information Technology has historically been one of the sectors with the highest growth and growth opportunities, the cost of debt overhang will likely be higher relative to other sectors. Further, covenants from lenders can constrain a firm's investments decision and strategic leeway.

Information Technology and Health Care consist of companies with comparatively low cash flows and earnings, meaning there is little need for debt to be used as a tax shield or to control managerial spending. These sectors are also largely dependent on human capital, and there will most likely be considerable costs in case of financial distress. With lower benefits from tax shield, control of managerial spending, and higher cost of financial distress and agency costs, trade-off theory and agency theory argue that the optimal level of debt will decrease. In addition, firms in Information Technology and Health Care sectors tend to have more unstable cash flows and earnings and, therefore, more risk than other sectors. Banks and other lenders want compensation for the higher risk in terms of higher interest rates, which increases borrowing costs. Young Information Technology firms and Health Care companies that are in the development of a medication can also be unable to raise debt due to too high risk.

Table 3

Book Net Leverage in Each Sector

Table 3 reports the mean, standard deviation, minimum and maximum value of book net leverage for the market and each sector. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	Mean	Standard Deviation	Min	Max
Market	0.079	0.335	-1.000	0.993
Energy	0.187	0.270	-0.992	0.987
Materials	0.183	0.232	-0.997	0.989
Industrials	0.136	0.267	-0.998	0.992
Consumer Discretionary	0.166	0.292	-0.994	0.993
Consumer Staples	0.170	0.262	-0.994	0.992
Health Care	-0.150	0.412	-1.000	0.992
Information Technology	-0.098	0.315	-1.000	0.973
Communication Services	0.197	0.340	-0.951	0.993
Utilities	0.346	0.117	-0.958	0.919
Real Estate	0.262	0.323	-0.885	0.983

Table 3 presents the mean, standard deviation, minimum and maximum values for book net leverage for the market and each sector. Utilities has the highest average book net leverage across sectors of 0.346, followed by Real Estate with an average book net leverage of 0.262. At the other end of the spectrum, Health Care and Information Technology have negative book net leverage of -0.150 and -0.098, respectively. These values are driven by high cash and cash equivalents in the firms making up the sectors, as shown in the summary statistics. The full sample (market) has an average book net leverage of 0.079.

With book net leverage, cash and cash equivalents are subtracted from total debt in the numerator and denominator, but apart from that, book net leverage is similar to book leverage. Compared with book leverage and market leverage, we witness a much larger difference between book leverage and book net leverage. For the full sample (market), the difference between book leverage and book net leverage is 0.157, and the most prominent difference is within Health Care and Information Technology, with a difference of 0.333 and 0.245, respectively. At the other end of the spectrum, with a difference of 0.026, Utilities is the sector with the smallest difference between book leverage and book net leverage. Put differently, Health Care and Information Technology hold a higher relative amount of cash compared to the Utilities sector.

We see many of the same arguments of having low leverage as holding large amounts of cash. Health Care and Information Technology firms are usually R&D intensive (Gerlach, Rønde, & Stahl, 2008). The availability of projects does not follow a consistent pattern, and lucrative investment opportunities can occur when a firm's cash is tight. Hence, R&D-intensive firms tend to hold high amounts of cash since they value financial flexibility higher than less R&D-intensive firms. Therefore, as highlighted by Sánchez and Yurdagül (2013), the amount of cash held by a firm is closely related to the R&D intensity of a firm. Further, according to the pecking order theory, firms prefer to finance new investments with retained earnings. Since covenants hinder management flexibility, it is likely to be more profitable to finance investments with cash rather than debt for Information Technology and Health Care relative to other sectors.

Table 4

Market Leverage in Each Sector

Table 4 reports the mean, standard deviation, minimum and maximum value of market leverage for the market and each sector. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	Mean	Standard Deviation	Min	Max
Market	0.247	0.236	0.000	0.997
Energy	0.299	0.236	0.000	0.991
Materials	0.291	0.216	0.000	0.984
Industrials	0.269	0.234	0.000	0.993
Consumer Discretionary	0.301	0.256	0.000	0.997
Consumer Staples	0.273	0.233	0.000	0.986
Health Care	0.134	0.180	0.000	0.997
Information Technology	0.136	0.179	0.000	0.995
Communication Services	0.328	0.264	0.000	0.996
Utilities	0.467	0.148	0.000	0.988
Real Estate	0.349	0.266	0.000	0.993

In Table 4, the mean, standard deviation, minimum and maximum values for market leverage (MLEV) are presented for the market and each sector. The average market leverage for the full sample (market) is 0.247. Again, we see that the two most leveraged sectors are Utilities and Real Estate with market leverage of 0.467 and 0.349, respectively. Further, the two least leveraged sectors are once again Health Care and Information Technology, with market leverage of 0.134 and 0.136, respectively.

For all three definitions of leverage (Table 2, 3 and 4), we witness a quite consistent pattern in the rankings of most leveraged sectors to least levered sectors. In all three definitions of leverage, the two most leveraged sectors and the two least leveraged sectors are the same. Market leverage and book leverage have, for the sample and across sectors, quite similar averages. Book leverage and market leverage for the market are 0.237 and 0.247, respectively, representing a difference of 0.010. The largest difference between market leverage and book leverage is in Utilities, with a difference of 0.095.

Table 5

Mean of Characteristics for Each Sector

Table 5 reports the mean of book leverage (BLEV), book net leverage (NLEV), market leverage (MLEV), monthly returns, book-to-market ratio (BM), market value of equity in USD million (ME), beta, operating profitability (OP), investment-to-assets (I/A) and return on equity (ROE), for the market and each sector. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	BLEV	NLEV	MLEV	RET	BM	ME	Beta	OP	I/A	ROE
Market	0.237	0.079	0.247	0.013	0.792	3,267	1.131	0.131	0.143	0.007
Energy	0.279	0.187	0.299	0.010	0.957	4,427	1.117	0.082	0.161	-0.023
Materials	0.262	0.183	0.291	0.013	0.896	2,100	1.064	0.171	0.098	0.049
Industrials	0.242	0.136	0.269	0.013	0.851	2,135	1.074	0.175	0.128	0.049
Consumer Discretionary	0.271	0.166	0.301	0.012	0.911	2,097	1.093	0.186	0.130	0.042
Consumer Staples	0.265	0.170	0.273	0.014	0.778	6,017	0.775	0.244	0.124	0.097
Health Care	0.183	-0.150	0.134	0.015	0.491	3,654	1.242	0.004	0.236	-0.124
Information Technology	0.147	-0.098	0.136	0.015	0.644	3,720	1.478	0.068	0.139	-0.025
Communication Services	0.329	0.197	0.328	0.014	0.900	9,961	1.146	0.160	0.162	-0.014
Utilities	0.372	0.346	0.467	0.012	1.113	3,106	0.461	0.178	0.082	0.071
Real Estate	0.366	0.262	0.349	0.012	0.820	1,478	0.928	0.096	0.083	-0.006

In Table 5, we summarise the characteristics used in our analysis with the mean for each characteristic for the market and across sectors. The full sample (market) has an average book-to-market ratio (BM) of 0.792. Utilities has the highest BM of 1.113, and Health Care has the lowest of 0.491. The average beta for the full sample (market) is 1.131, and the highest beta is observed within Health Care and Information Technology. Furthermore, Health Care and Information Technology have the lowest operating profitability (OP). We witness the same story with return on equity (ROE), where Health Care and Information Technology are at the end of the spectrum. By looking at these characteristics, Health Care and Information Technology can be described as the riskiest sectors in GICS. As a result, the probability of default is likely higher in these sectors relative to others, which, all else equal, increases the financial distress costs. As the trade-off theory states, this lowers the optimal leverage level.

As discussed above, Health Care and Information Technology are the sectors with the lowest leverage for all the three definitions we use.

The market has an average investments-to-assets of 0.143. Health care is by far the sector with the highest investments-to-assets of 0.236, followed by communication services with a ratio of 0.162. Utilities and real estate are the sectors with the lowest investment-to-assets of 0.082 and 0.083, respectively. Information Technology and Health Care are the sectors with the highest average monthly returns with 1.5% compared to the market of 1.3%. Interestingly, Information Technology and Health Care are the sectors with lowest average leverage across all three leverage definitions. Further, Utilities and Real Estate, which are the most leveraged sectors by all three leverage definitions, have an average monthly return of 1.2%, which is below the average monthly return for the market of 1.3%. These observations indicate that we could see a negative relationship between leverage and returns.

Table 6

Portfolio Sorting on Leverage

Table 6 consists of Panel A, B and C, which presents the statistics from portfolio sorting on book leverage (BLEV), book net leverage (NLEV) and market leverage (MLEV). In the panels, we divided the sample into five portfolios. For each portfolio, we report the mean of the characteristics market equity in million (ME), Beta, book-to-market ratio (BM), operating profitability (OP), investments-to-assets (I/A), return on equity (ROE), value-weighted (VW) excess returns (RET) and equally weighted (EW) excess return (RET). Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

Panel A: Portfolio Sorting on Book Leverage

	1	**2**	**3**	**4**	**5**
BLEV	0.011	0.088	0.215	0.331	0.533
NLEV	-0.319	-0.104	0.112	0.256	0.452
MLEV	0.014	0.096	0.232	0.357	0.529
ME [in USD million]	1,310	3,167	5,267	4,746	3,064
Beta	1.188	1.175	1.095	1.009	1.113
BM	0.670	0.733	0.787	0.863	0.874
OP	0.054	0.093	0.144	0.163	0.200
I/A	0.155	0.131	0.133	0.131	0.167
ROE	-0.008	0.015	0.043	0.037	-0.051
RET [VW in %]	0.915	0.800	0.856	0.723	0.706
RET [EW in %]	1.102	1.123	1.077	0.957	0.876

Panel A presents five portfolios sorted on book leverage, where each column represents a subset of companies. The quintiles of stocks are consistent across leverage definitions, in the sense that all values for leverage are rising from portfolio 1 through 5. The mean market equity shows the largest value for quintile 3, meaning companies operating with leverage level around the centre of the spectrum have the highest values for market capitalization. Further, quintiles 1 and 2 show the highest values for beta, meaning stocks within these portfolios have higher systematic risk compared to the rest of the sample. Interestingly, the Book-to-Market factor shows rising levels from quintile 1 through 5, meaning companies with more leverage tend to be more undervalued, relative to companies in lower quintiles.

Operating profitability shows a fairly linear increase across all quintiles. This occurrence could be due to how the variable is defined, following the definition by Fama and French (2015). Since the formula divides the profitability values by the equity of a company, the operating values increase as companies are able to invest more, while equity stays constant. The I/A ratio shows larger values for the quintiles at each end of the spectrum, while highest value for ROE is found in the centre of the spectrum. Notably, quintiles at each end show negative ROE values. In regard to excess return, the lower quintiles show higher values, with quintile 1 showing the highest equally weighted return, and quintile 2 showing the highest value weighted return.

Panel B: Portfolio Sorting on Book Net Leverage

	1	**2**	**3**	**4**	**5**
NLEV	-0.407	-0.058	0.124	0.273	0.480
BLEV	0.040	0.102	0.204	0.319	0.517
MLEV	0.032	0.098	0.217	0.351	0.536
ME [in USD million]	1,890	3,258	4,967	4,545	3,009
Beta	1.302	1.146	1.087	1.003	1.040
BM	0.597	0.732	0.795	0.880	0.928
OP	0.016	0.107	0.147	0.171	0.215
I/A	0.191	0.122	0.131	0.117	0.155
ROE	-0.054	0.027	0.045	0.044	-0.025
RET [VW in %]	1.058	0.911	0.765	0.657	0.730
RET [EW in %]	1.103	1.184	1.056	0.936	0.858

Panel B presents five portfolios sorted on book net leverage, where each column represents a subset of companies. The quintiles of stocks are consistent across leverage definitions, in the sense that all values for leverage are rising from sector 1 through 5. The mean market equity shows the largest value for quintile 3, meaning companies operating with leverage levels around the centre of the spectrum have the highest values for market capitalization. Further, quintiles 1 and 2 show the highest values for beta, meaning stocks within these portfolios have higher systematic risk compared to the rest of the sample. The Book-to-Market factor shows rising levels from quintile 1 through 5, consistent with panel A.

Operating profitability shows a fairly linear increase across all quintiles, which was also the case for panel A. The I/A ratio shows larger values for the quintiles at each end of the spectrum, while ROE is the biggest in the centre of the spectrum. Notably, quintiles at each end show negative ROE values. The lower quintiles show higher values for excess return, with quintile 1 showing the highest equally weighted return, and quintile 2 showing the highest value weighted return. In short, panel B shows both values and patterns similar to panel A. This is expected, as the definitions are so closely linked.

Panel C: Portfolio sorting on market leverage

	1	**2**	**3**	**4**	**5**
MLEV	0.008	0.078	0.206	0.370	0.652
BLEV	0.017	0.130	0.258	0.355	0.502
NLEV	-0.320	-0.089	0.130	0.260	0.416
ME [in USD million]	1,770	5,213	5,431	3,265	1,778
Beta	1.210	1.184	1.079	1.026	1.081
BM	0.569	0.538	0.633	0.823	1.370
OP	0.060	0.114	0.164	0.159	0.157
I/A	0.176	0.153	0.141	0.118	0.130
ROE	-0.008	0.023	0.052	0.030	-0.062
RET [VW in %]	0.927	0.842	0.780	0.725	0.845
RET [EW in %]	1.054	0.966	0.984	0.990	1.147

Panel C presents five portfolios sorted on market leverage, where each column represents a subset of companies. The quintiles of stocks are still consistent across leverage definitions. The mean market equity shows the largest value for quintile 3, which was also the case in panel A and B. Further, quintiles 1 and 2 show the highest values for beta, meaning stocks within these portfolios have higher systematic risk compared to the rest of the sample. The Book-to-Market factor does not show rising levels from quintile 1 through 5, in contrast to panel A and B, as quintile 2 has a lower value than quintile 1. Operating profitability does not show rising levels as observed in Panel A and B, as quintiles 4 and 5 show a slight decrease after reaching a peak in quintile 3.

The I/A ratio shows larger values for the quintiles 1 and 2, while ROE is the biggest in the center of the spectrum. Notably, quintiles at each end show negative ROE values, as in panels A and B. Regarding excess return, the pattern of previous panels does not coincide with panel C. Quintile 1 shows the highest value-weighted return, while quintile 5 shows the highest equally weighted return.

5.2 Leverage and Equity Returns

Table 7

Table 7 consists of Panel A, B, and C, which present the results from Fama and Macbeth cross-sectional regressions at the individual firm level using ordinary least squares. In the three panels, we use three different definitions of leverage as independent variables, namely, book leverage (Panel A), book net leverage (Panel B), and market leverage (Panel C). The dependent variable is monthly excess returns. In each table, we report the risk premium associated with the independent variable, more specifically, the time series mean of the estimated coefficients. To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the risk premiums, we compute Whitney K. Newey and West's (1987) standard errors. For each definition of leverage, we run the Fama-Macbeth regression for the entire market and each sector, totalling eleven regressions per definition. The risk premiums are presented in the second column, firm-year observations are reported in the third column, and number of observations is reported in the fourth column for each table. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

Panel A: Book leverage and Equity Returns

	BLEV	Firm year observations	N
Market	-0.005	111,050	1,332,605
Energy	-0.014***	6,834	82,004
Materials	-0.004	7,747	92,965
Industrials	-0.002	22,245	266,944
Consumer Discretionary	-0.003	21,887	262,643
Consumer Staples	-0.009***	6,811	81,731
Health Care	-0.001	15,797	189,564
Information Technology	0.001	20,447	245,368
Communication Services	0.009	3,098	37,176
Utilities	-0.007	5,320	63,842
Real Estate	-0.004	864	10,368

****, ** and * represent statistical significance levels at 1%, 5% and 10% respectively*

Panel A presents the results from regressing book leverage on monthly excess returns, and reports no significant relationship between book leverage and equity returns for the market. Energy and Consumer Staples have negative, significant coefficients at a 1% level. These values indicate a negative relationship between book leverage and equity returns for Energy and Consumer Staples firms, meaning that higher leverage results in lower equity returns. The other sectors have insignificant coefficients, indicating no relationship between book leverage and equity returns.

Panel B: Book Net Leverage and Equity Returns

	NLEV	Firm year observations	N
Market	-0.001**	111,050	1,332,605
Energy	-0.004	6,834	82,004
Materials	0.000	7,747	92,965
Industrials	-0.001	22,245	266,944
Consumer Discretionary	-0.001	21,887	262,643
Consumer Staples	-0.001	6,811	81,731
Health Care	0.000	15,797	189,564
Information Technology	0.000	20,447	245,368
Communication Services	0.003	3,098	37,176
Utilities	-0.004	5,320	63,842
Real Estate	-0.005	864	10,368

****, ** and * represent statistical significance levels at 1%, 5% and 10% respectively*

Panel B presents the results from regressing book net leverage on monthly excess returns. The results show, in contrast with Panel A, that there is a significant relationship between book net leverage and equity returns for the market. The market has a negative, significant coefficient at a 5% level, indicating that higher leverage results in lower equity returns. This relationship is relatively weak, though, where a 1% increase in leverage results in 0.001% lower monthly returns on average. All sectors have insignificant coefficients, indicating no relationship between book leverage and equity returns for the sectors.

A possible explanation for the change in results between book leverage and book net leverage, might be explained by the purpose of cash. As highlighted by Friewald, Nagler, and Wagner (2022) and Acharya, Almeida, and Campello (2005), cash can, in some cases be viewed as negative debt. Since the relationship between leverage and returns disappears when adjusting book leverage for cash and cash equivalents (book net leverage) in the Energy and Consumer Staples sector, it could indicate that cash and cash equivalents can be viewed as negative debt.

Panel C: Market leverage and equity returns

	MLEV	Firm year observations	N
Market	0.002	111,050	1,332,605
Energy	-0.002	6,834	82,004
Materials	0.002	7,747	92,965
Industrials	0.005	22,245	266,944
Consumer Discretionary	0.001	21,887	262,643
Consumer Staples	0.000	6,811	81,731
Health Care	0.007	15,797	189,564
Information Technology	0.012**	20,447	245,368
Communication Services	0.005	3,098	37,176
Utilities	0.006	5,320	63,842
Real Estate	0.002	864	10,368

****, ** and * represent statistical significance levels at 1%, 5% and 10% respectively*

Panel C presents the results from regression 1 on market leverage. It reports that there is no significant relationship between market leverage and equity returns for the market. Excluding Information Technology, the sectors have insignificant coefficients, indicating no relationship between market leverage and equity returns. The Information Technology sector has a positive, significant coefficient at a 5% level. This observation indicates a positive relationship between market leverage and equity returns in the Information Technology sector, meaning that higher leverage results in higher equity returns.

When comparing the results of the three measures of leverage, the choice of definition is proved to have a significant effect on the outcome. While the use of book leverage provides significant, negative relationships of -0.014 and -0.009 for Energy and Consumer Staples, book net leverage only proves a significant, negative relationship of -0.001 for the market. However, none of these relationships appear with the use of market leverage, as a positive relationship of 0.012 for Information Technology is the only significant effect found, at a 5% significance level.

These differences point to an important factor when discussing leverage effects. As each definition provides a difference in both size and direction of the relationship between leverage and equity returns, the choice of definition is proven to be an important factor when investigating leverage effects. As pointed out by Cai and Zhang (2011), market value of equity is mechanically related to stock prices. As market value of equity is used in the calculation of market leverage, this definition could followingly cause a bias in results between market leverage and stock returns. This connection could be part of the reason why market leverage provides a significant, positive relationship for Information Technology, a sector that was found to have no significant relationship when using both book leverage and book net leverage.

5.3 Book leverage squared and equity returns

Table 8

Table 8 presents the results from Fama and Macbeth cross-sectional regressions at the individual firm level using ordinary least squares. In the analysis, we regress book leverage (BLEV) and squared book leverage ($BLEV^2$) on monthly excess returns. To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the risk premiums, we compute Whitney K. Newey and West (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	Constant	**BLEV**	**$BLEV^2$**	**Firm year observations**	**N**
Market	0.011***	-0.006	0.002	111,050	1,332,605
Energy	0.009***	-0.002	-0.017	6,834	82,004
Materials	0.009***	0.010	-0.022	7,747	92,965
Industrials	0.011***	-0.003	0.001	22,245	266,944
Consumer Discretionary	0.011***	-0.009	0.008	21,887	262,643
Consumer Staples	0.011***	0.016**	-0.042***	6,811	81,731
Health Care	0.012***	-0.002	0.001	15,797	189,564
Information Technology	0.013***	-0.008	0.021	20,447	245,368
Communication Services	0.013***	-0.027*	0.05**	3,098	37,176
Utilities	0.001	0.047	-0.07*	5,320	63,842
Real Estate	0.007*	0.007	-0.002	864	10,368

****, ** and * represent statistical significance levels at 1%, 5% and 10% respectively*

Table 8 presents results from Regression 2, which tests the quadratic relationship between BLEV and stock returns. Both the market and all sectors except Consumer Staples and Communication Services show insignificant coefficients for book leverage. Consumer Staples shows significant values for both a linear and quadratic relationship. While the BLEV variable provides a coefficient of 0.016 significant at a 5% level, $BLEV^2$ shows a coefficient of -0.042 significant at a 1% level. Communication Services shows a coefficient of -0.027 for BLEV, significant at a 10% level, and a coefficient of 0.05 for $BLEV^2$, significant at a 5% level.

Interestingly, Consumer Staples and Communication Services show inverse quadratic relationships between leverage and stock returns when compared. Coefficients for BLEV and $BLEV^2$ equate to a turning point of 0.19 for Consumer Staples, and 0.27 for Communication Services. With a negative coefficient for $BLEV^2$ in the Consumer Staples, the turning point represents the leverage level related to the highest values for stock returns. Part of the debate surrounding the use of leverage is whether there exists an optimal level of financing. These findings support this theory, as the optimal level of book leverage for the Consumer Staples sector is proved to be 0.27. For Communication Services, the turning point represents the level of leverage associated with the weakest stock return value. Increasing leverage above 0.27 will increase stock returns for the company. The highest stock returns in Communication Services will followingly be associated with the maximum level of leverage, according to the model.

5.4 Leverage and equity returns, controlling for beta

Table 9

Table 9 presents the results from Fama and Macbeth cross-sectional regressions at the individual firm level using ordinary least squares. In the analysis, we regress book leverage (BLEV) on monthly excess returns, while controlling for beta. To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the risk premiums, we compute Whitney K. Newey and West's (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	BLEV	Beta	Firm year observations	N
Market	-0.005*	-0.001	111,050	1,332,605
Energy	-0.013***	-0.003**	6,834	82,004
Materials	-0.004	-0.001	7,747	92,965
Industrials	-0.003	0.000	22,245	266,944
Consumer Discretionary	-0.003	0.000	21,887	262,643
Consumer Staples	-0.008***	-0.001	6,811	81,731
Health Care	-0.001	-0.002	15,797	189,564
Information Technology	-0.001	0.000	20,447	245,368

Communication Services	0.008	0.000	3,098	37,176
Utilities	-0.009*	-0.001	5,320	63,842
Real Estate	-0.001	0.004*	864	10,368

****, ** and * represent statistical significance levels at 1%, 5% and 10% respectively*

Regression 3 uses the book leverage definition as defined previously, and includes beta in the regression to control for systematic risk. The sectors showing significant relationships for leverage are Energy, Consumer Staples, and Utilities. While Energy and Consumer Staples show significant effects at a 1% level, Utilities reports a significant coefficient at a 10% level. The regression shows leverage coefficients of -0.013, -0.008 and -0.009, for Energy, Consumer Staples, and Utilities respectively. However, significant effects of Beta are captured, with a negative effect of 0.003 for Energy and a positive effect of 0.004 for Real Estate. The effect of beta is significant at a 5% level for the Energy sector and a 10% level for Real Estate.

In regression 3, we see that the negative relationship between book leverage and excess returns for Energy and Consumer Staples, found in regression 1 Panel A, are robust for the inclusion of beta. Further, with the inclusion of beta, the market and Utilities have negative coefficients, which are significant at a 10% level. Therefore, beta is needed as a control variable to capture the possible relationship between book leverage and equity returns for the market and the Utilities sector.

5.5 Book leverage, beta, market equity and equity returns

Table 10

Table 10 presents the results from Fama and Macbeth cross-sectional regressions at the individual firm level using ordinary least squares. In the analysis, we regress book leverage (BLEV) on monthly excess returns, while controlling for beta and the natural logarithm of market equity (log[ME]). To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the risk premiums, we compute Whitney K. Newey and West's (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	Beta	BLEV	log[ME]	Firm year observations	N
Market	-0.001	-0.004	-0.001**	111,050	1,332,605
Energy	-0.003**	-0.011**	-0.001*	6,834	82,004
Materials	-0.001	-0.004	-0.001**	7,747	92,965
Industrials	0.000	-0.003	-0.001***	22,245	266,944
Consumer Discretionary	0.000	-0.003	-0.001	21,887	262,643
Consumer Staples	-0.001	-0.008***	0.000	6,811	81,731
Health Care	-0.002	0.001	-0.001	15,797	189,564
Information Technology	0.001	-0.002	-0.002***	20,447	245,368
Communication Services	-0.001	0.010*	-0.001*	3,098	37,176
Utilities	-0.002	-0.008	-0.001**	5,320	63,842
Real Estate	0.004	-0.001	0.000	864	10,368

****, ** and * represent statistical significance levels at 1%, 5% and 10% respectively*

Regression 4 uses the book leverage definition as defined previously, and includes beta and change in market equity in the regression to control for systematic risk and change in market capitalization. The sectors showing significant relationships for leverage are Energy, Consumer Staples and Communication Services, with coefficients of -0.011, -0.008, and 0.01, respectively. While leverage results for Consumer Staples remain statistically significant at a 1% level, leverage results for Energy are now statistically significant at a 5% level. When controlling for beta and change in market equity, the effects of leverage are now statistically significant for Communication Services at a 10% level.

Effects of Beta are only significant for the Energy sector, at a 5% significance level. Effects of change in market equity are statistically significant for the market and 6 of the 10 sectors, with remarkably similar relationships, but varying significance levels. For the Energy sector, change in market equity seems to capture some of the effects shown in the previous regression.

5.6 Book Leverage and equity returns, controlling for Fama French 5 factors

Table 11

Table 11 presents a regression on book leverage (BLEV) and monthly excess returns, while controlling for Fama and French 5 factors as defined in Fama and French (2015). The factors consist of market excess returns (Mkt excess), size (SMB), value (HML), profitability (RMW), and investments (CMA). To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the coefficients, we compute Whitney K. Newey and West (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	BLEV	Mkt_excess	SMB	HML	RMW	CMA	Firm year observations	N
Market	-0.004***	1.001***	0.753***	0.137***	-0.096***	0.104***	111,050	1,332,605
Energy	-0.017***	1.184***	0.779***	0.678***	0.020	0.268	6,834	82,004
Materials	-0.005	1.096***	0.685***	0.376***	0.21***	0.158**	7,747	92,965
Industrials	-0.002	1.014***	0.805***	0.272***	0.179***	0.1**	22,245	266,944
Consumer Discretionary	-0.002	1.084***	0.896***	0.381***	0.296***	0.004	21,887	262,643
Consumer Staples	-0.011***	0.781***	0.519***	0.066	0.396***	0.202***	6,811	81,731
Health Care	0.001	0.899***	0.884***	-0.247***	-0.431***	0.21***	15,797	189,564
Information Technology	0.001	1.115***	0.861***	-0.267***	-0.702***	0.002	20,447	245,368
Communication Services	0.007	1.048***	0.486***	0.13*	-0.389***	0.018	3,098	37,176
Utilities	-0.010	0.543***	-0.011	0.213***	0.099**	0.288***	5,320	63,842
Real Estate	0.004	0.806***	0.633***	0.533***	0.271***	-0.165*	864	10,368

****, ** and * represent statistical significance levels at 1%, 5% and 10% respectively*

Regression 5 uses the book leverage definition as defined previously, and includes the Fama French Five Factor model as control variables. These variables include excess return of the market, and factors related to size (SMB), value (HML), profitability (RMW), and investment (CMA). The effects of leverage are statistically significant for the market, Energy, and Consumer Staples. All factors of the Fama French model show high levels of explanation, with coefficients showing significantly larger values compared to leverage coefficients. Effects of leverage for Energy and Consumer Staples stay relatively consistent when including control variables, as both the direction and size of the relationships are consistent with results of previous regressions. Among the control variables, excess return of the market appears to be the factor with the most impact on stock returns, with most sectors showing coefficients above or close to 1.

5.7 Leverage and equity returns, controlling for q-factors

Table 12

Table 12 presents the results from a regression on book leverage (BLEV) and monthly excess returns, while controlling for the q-factors presented by Hou, Mo, Xue, & Zhang (2020). The factors consist of market excess returns (Mkt excess), market equity (ME), investments-to-assets (I/A), return on equity (ROE), and expected growth (EG). To adjust for autocorrelation when reporting standard errors of the coefficients, we compute Whitney K. Newey and West's (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. Our data is sampled on a monthly basis and includes nonfinancial firms listed at NYSE, NASDAQ and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	BLEV	Mkt_excess	ME	I/A	ROE	EG	Firm year observations	N
Market	-0.004***	0.936***	0.641***	0.176***	-0.37***	-0.044*	111,050	1,332,605
Energy	-0.014**	1.015***	0.436***	0.972***	-0.37***	-0.778***	6,834	82,004
Materials	-0.005	1.019***	0.48***	0.512***	-0.166**	-0.171**	7,747	92,965
Industrials	-0.002	0.947***	0.645***	0.342***	-0.143***	-0.119***	22,245	266,944
Consumer Discretionary	-0.002	1.007***	0.653***	0.502***	-0.178**	-0.179**	21,887	262,643
Consumer Staples	-0.01***	0.748***	0.409***	0.319***	0.079	0.027	6,811	81,731
Health Care	0.001	0.823***	0.91***	-0.217***	-0.545***	0.14**	15,797	189,564
Information Technology	0.003	1.046***	0.854***	-0.562***	-0.903***	0.277***	20,447	245,368
Communication Services	0.007	0.952***	0.347***	0.114	-0.485***	-0.316***	3,098	37,176
Utilities	-0.010	0.536***	0.007	0.506***	0.131***	-0.002	5,320	63,842
Real Estate	0.003	0.777***	0.464***	0.396***	-0.081	-0.136	864	10,368

****, ** and * represent statistical significance levels at 1%, 5% and 10% respectively*

Table 12 presents the empirical results from regression 6 for the full sample and each sector. In the analysis, we regress book leverage (BLEV) on monthly excess returns, while controlling for the q-factors from the q-factor model by Hou, Mo, Xue, & Zhang (2020). The factors consist of market excess returns (Mkt excess), market equity (ME), investments-to-assets (I/A), return on equity (ROE), and expected growth (EG). In line with regression 5, the coefficient for book leverage for the market is negative, which is also significant at a 1% level.

Energy and Consumer Staples report negative coefficients, significant at a 5% and 1% level, respectively. Therefore, our results from regression 6 suggest that there is a negative relationship between book leverage and equity returns for Energy and Consumer Staples when controlling for the q-factors. The remaining sectors report insignificant coefficients for book leverage, indicating that leverage does not affect returns in these sectors when we control for the q-factors.

6 Discussion

For many of our regression models, we observe a negative relationship between book leverage and returns for the Energy sector. These observations indicate that energy firms would, on average, gain returns from reducing their leverage. The Energy sector, according to GICS, is mostly composed of firms within the industries Energy Equipment and Services and Oil, Gas and Consumable Fuels. Oil and gas are commodities with historically volatile prices, which makes earnings and cash flows volatile for firms within these industries. Volatility could increase the cost of financial distress, because the probability of default is usually higher when earnings and cash flows are more volatile. According to the trade-off theory, higher probability of default lowers the optimal level of debt.

In a cyclical sector like Energy, firms tend to overinvest when commodity prices are high, and earnings are high. This argument is, to some extent, backed by the cash flow hypothesis, because high commodity prices tend to increase excess cash flow in these firms, increasing wasteful spending and overinvestment. Richardson (2006) found that overinvestment is concentrated in companies with the highest levels of free cash flow, and results from Irawan and Okimoto (2021) suggests that commodity price inflation plays a role in inducing firms' overinvestment. As seen in the summary statistics, Energy reported above average leverage ratios relative to the market in the period 1980 to 2021. Following several years of high investments in a commodity market due to attractive market conditions, supply can exceed demand in the market, usually resulting in falling commodity prices. If the prices stay low for an extended period of time, firms with high leverage can face financial distress. The firms with more moderate leverage ratios are then often left standing as winners. An example of this occurrence was in 2014 to 2016, when the oil price fell from more than $110 per barrel to less than $30 per barrel. Up and until the price collapse, US oil and gas companies invested heavily due to good market conditions, and many took on a substantial amount of debt. Following bad market conditions several US oil and gas companies went bankrupt or had to go through bankruptcy reorganization, often referred to as Chapter 11, diluting the existing equity owners (Scheyder & Wade, 2016).

The occurrence mentioned above can be linked to the phenomenon of overconfidence by the management, which is described in, among others, Roll (1986), Stein (2001) and Heaton (2002). Managers are overconfident about the market conditions going forward, and they take on more debt than what is optimal for the firm. Therefore, the negative relationship between leverage and returns in the Energy sector can, to some extent, be caused by firms taking on too much debt when the market conditions are good. Excessive amounts of debt increase the probability of default and can create a debt overhang problem, and could potentially offset the positive effects of leverage.

Throughout many of the regression models, the leverage coefficient for Consumer Staples is negative and significant. Consumer Staples consists of companies selling essential products, like food and beverages, used by consumers. As a result, the sector is considered to be non-cyclical, with a stable demand from customers. Further, Consumer Staples is a sector that tends to have high dividend yields relative to other sectors (Chen, 2021). This tendency is mainly due to the stable cash flows and low growth opportunities in the Consumer Staples sector. With high dividends, the excess cash flow in a firm is typically low. With low growth opportunities on top of that, the incentive benefits from debt are likely to be lower compared to other sectors. On the other hand, stable and high cash flows tend to reduce the cost of financial distress and increase the tax shield. This results in, all else equal, higher firm value by taking on more debt. From the summary statistics we observe a leverage ratio that is above the market average and with a standard deviation that is below the market. Our model indicates that firms in the Consumer Staples sector could, on average, gain higher stock returns by decreasing their leverage.

6.1 Leverage Definitions

As presented in Table 7, Panel A, B and C, our models find contradicting results when regressing different definitions of leverage on excess equity returns. When comparing results between book leverage and book net leverage in regression 1, we witness a weaker leverage effect for book net leverage. To further investigate this occurrence, we ran regression 5 with book net leverage as independent variable instead of book leverage (appendix 8.3). The results show that, for the market and for all sectors, there are no significant relationships between book net leverage and returns. As highlighted by Friewald, Nagler and Wagner (2022) and Acharya, Almeida and Campello (2005), cash can in some cases be viewed as negative debt. In these cases, the usage of book net leverage could be incorporated into a model to give a clearer picture of how companies use leverage. Since we see the effect leverage has on returns when adjusting for cash disappears, it could indicate that for some firms, cash can be viewed as negative debt.

The more dramatic difference is found between book leverage and market leverage. For book leverage and book net leverage, the significant coefficients were negative across all regressions. However, market leverage shows a significant positive coefficient for Information Technology in regression 1, indicating a positive relationship between leverage and equity returns. To further investigate this difference, we ran regression 5 with market leverage as independent variable instead of book leverage (Appendix 8.2). These results further strengthen our findings from regression 1. By replacing book leverage with market leverage in regression 5, we find a significant, positive relationship between leverage and equity returns for the market, Industrials, Consumer Discretionary, Health Care, Information Technology and Utilities.

The findings of a positive relationship between market leverage and returns and a negative relationship between book leverage and returns are consistent with the findings in Fama and French (1992). Further, as pointed out by Cai and Zhang (2011), market value of equity is mechanically related to stock prices. As market value of equity is used in the calculation of market leverage, this definition could followingly cause a bias in results between market leverage and stock returns. This connection could be part of the reason why market leverage provides a significant, positive relationship between leverage and returns for the market and multiple sectors, and book leverage provides a significant, negative relationship for the market and two sectors.

6.2 Sample Period

By comparing our results to previous studies, other researchers seemed to experience higher absolute values of leverage coefficients. These studies often used older data samples. To investigate the effect time has on our regression results, we reran regression 5, limiting the time period for the regression from 1980 to 2000 and from 2001 to 2021 (Appendix 8.4.1 and 8.4.2). The results shows that most of the negative effect leverage has on returns is from 1980 to 2000. In the period 1980 to 2000, the market had a coefficient for leverage of -0.012, which is significant at a 1% level. In the 2001 to 2021 sample, the coefficient for leverage is insignificant at a 10% level. As a result, we see a much weaker connection between leverage and returns for the market for the full sample period from 1980 to 2021, with a coefficient of -0.004.

Information Technology has a significant negative relationship, on a 10% level, between leverage and returns in the period 1980 to 2000. Interestingly, in the period 2000 to 2021, this relationship switches into being positive, which is significant at a 5% level. We observe the same phenomenon in Health Care, where a significant negative relationship between leverage and returns for the period 1980 to 2000 switches into a positive one for the period 2001 to 2021. The sectors Energy, Materials, Consumer Discretionary and Consumer Staples have significant negative coefficients for leverage on a 5% level for the period 1980 to 2000. For the period 2001 to 2021 most of these effects disappear, where only Consumer Staples has a negative coefficient for leverage which is significant at a 5% level. In addition, the coefficient for leverage for Consumer Staples is lower in absolute value for the 2001 to 2021 sample than in the 1980 to 2000 sample with coefficients of -0.010 and -0.015 respectively. As a result, we see clear indications of a higher effect of leverage on returns, and in some sectors even a switch from negative to positive leverage coefficients, for the period 1980 to 2000 compared to 2001 to 2021.

The occurrence found above is also shown by doing the same exercise, but with market leverage as independent variable instead of book leverage (Appendix 8.4.3 and 8.4.4). The results show that from the period 1980 to 2000, there is a negative relationship between leverage and returns for the market, and the leverage coefficient is significant at a 5% level. In the period from 2001 to 2021, this relationship switches into being positive, indicating that higher leverage results in higher returns for the market. These results are significant at a 1% level.

There can be multiple reasons for the occurrence discussed above, but interest rates or borrowing costs can be an explanatory factor. From 1980 to 2000, the average annual Federal Funds Rate in the US was ~7.5%, while in the period 2001 to 2021, the same number was ~1.4% (Macrotrends, 2022). As a result, debt funding has been a lot cheaper from 2000 to 2021 compared to the period 1980 to 2000. Therefore, part of the explanation for the negative relationship between leverage and returns in 1980 to 2000, might be caused by the high borrowing costs in the period. In the time period 2001-2021, debt funding was a lot cheaper, and can be part of the explanation that the negative relationship between leverage and returns disappears, and even turns into a positive relationship for some sectors. Cheaper debt could enable firms to undertake profitable investments that may not have been profitable with higher interest rates.

However, by running regression 5 for market leverage, we find a significant, positive relationship between leverage and returns in the Utilities sector for the period 1980 to 2000, but in the period 2001 to 2021 the relationship disappears. From the summary statistics, we found that the Utilities sector was the most levered sector. One could therefore argue that in a highly levered sector like Utilities, it would be profitable to increase leverage when interest rates are low, not high. On the other hand, because of the low historical growth opportunities in the Utilities sector relative to other sectors, the debt overhang problem is likely to be lower compared with other sectors, making the agency cost of debt lower. Further, according to the free cash flow theory, the managers will be motivated to run the firm more efficiently when cash is tight. All else equal, higher interest rates increase a firm's interest payments, reducing the excess cash flow. According to the free cash flow hypothesis, lower excess cash flows reduce wasteful investment by managers, increasing the value of the firm. Since the Utilities sector has historically been a sector with stable and high cash flows, and a high leverage ratio, the incentive benefits from leverage is likely to be higher when the interest rates is higher compared with other sectors.

As described above, when rerunning regression 5 for book leverage, our results showed a negative relationship between leverage and returns for the Information Technology sector in the period 1980 to 2000, and a positive relationship in the period 2001 to 2021. Information Technology companies are generally companies that grow fast both organically and through M&A activity. According to BCG, the Technology, Media and Telecom (TMT) sector has been the second most active sector in terms of M&A activity in the period 2001 to 2021 (BCG, 2022). Lower interest rates reduce the probability of a debt overhang problem, all else equal. Therefore, a sector with high amounts of investment and growth opportunities like Information Technology can potentially benefit more compared to other sectors from a reduction in interest rates.

From the summary statistics, we observed lower return on equity and operating profitability for Information Technology relative to other sectors. Low return on equity and operating profitability is often related to low relative cash flow in a firm. Since the relative cash flows in Information Technology tend to be lower than other sectors, the incentive benefits regarding the cash flow theory have less effect on firm value. As a result, one could argue that Information Technology benefits less from incentive benefits of debt relative to Utilities.

6.3 Sector Classification

Since the way companies are split into sectors can affect the outcome of our results, we ran all the initial regressions presented in section 4.1 for both Global Industry Classification Standard (GICS) and Standard Industrial Classification (SIC). The regression results for GICS are presented in section 5, while the regression results for SIC is presented in Appendix section 8.1. When regressing market leverage on excess returns using SIC sector classification, the results indicate that there is no relationship between market leverage and equity returns for the market and for all sectors. This is in contrast to regression 1 using the GICS sector classification, where Information Technology has a positive and significant coefficient. Further, when regressing book leverage on monthly excess returns using SIC, Mining is the only sector with a significant coefficient. Using GICS, both Energy and Consumer Staples have significant coefficients. In addition, regression 5 and 6, gives negative, significant coefficients for Mining and Manufacturing using SIC. Regression 5 and 6 using GICS gave negative, significant coefficients for Energy and Consumer Staples. We observe, in line with GICS, that by using MLEV instead of BLEV for regression 5, the relationship for many sectors is positive using SIC. Overall, the sector classifications do not have substantial impact on our results.

7 Conclusion

The aim of this thesis is to investigate how financial leverage affects equity returns across sectors on US stocks. Our regression models are based on the method developed by Fama and MacBeth (1973), and control for factors included in the CAPM, Fama French Five Factor model and q-factor models. The study investigates results for the sample as a whole, in addition to each sector individually. Our model provides evidence of how varying definitions of leverage can have an important impact on both the size and direction of the relationship between leverage and stock returns. Further, we find that the industry sector a company belongs to plays a role in explaining the relationship between leverage and stock returns.

Regarding results for the market, represented through the entirety of our sample, book net leverage is the only leverage definition showing a significant leverage effect in regression 1. The relationship between book net leverage and stock returns was found to be negative at a 5% significance level. Both book leverage and market leverage showed insignificant effects in regression 1 for the market. However, when including CAPM, Fama-French and q-factor variables in regressions, book leverage shows negative effects on stock returns, significant at a 10% level for regression 3 and at a 1% level for regression 5 and 6. Energy and Consumer Staples show significant, negative relationships between book leverage and stock returns across regressions, where leverage effects stay consistent when including control variables.

Our models find mixed results of leverage being related to stock returns. As our study finds book leverage to be negatively related to stock returns, it supports the findings by Fama and French (1992) and Cai and Zhang (2011). Results for market leverage did however prove a positive relationship to stock returns when including Fama-French factors, supporting initial findings by Modigliani and Miller (1958), Hamada (1972) and Bhandari (1988). A further interesting takeaway is the consistency of results for Energy and Consumer Staples, showing negative relationships between book leverage and stock returns across most regressions.

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8 Appendix

8.1 Regressions with Standard Industrial Classification (SIC)

Regression 1: Leverage and Equity Returns

This table consists of Panel A, B, and C, which present the results from Fama and Macbeth cross-sectional regressions at the individual firm level using ordinary least squares. In the three panels, we use three different definitions of leverage as independent variables, namely, book leverage (Panel A), book net leverage (Panel B), and market leverage (Panel C). The dependent variable is monthly excess returns. In each table, we report the risk premium associated with the independent variable, more specifically, the time series mean of the estimated coefficients. To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the risk premiums, we compute Whitney K. Newey and West's (1987) standard errors. For each definition of leverage, we run the Fama-Macbeth regression for the entire market and each sector, totalling eleven regressions per definition. The risk premiums are presented in the second column, firm-year observations are reported in the third column, and number of observations is reported in the fourth column for each table. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

Panel A: Book leverage and equity returns

	BLEV	Firm year observations	N
Market	-0.005	98,181	1,178,166
Agriculture	-0.022	293	3,515
Mining	-0.015***	5,534	66,407
Construction	0.002	1,371	16,456
Manufacturing	-0.004	51,893	622,720
Transportation	0.002	4,807	57,687
Utilities	-0.002	5,576	66,911
Wholesale	-0.005	4,691	56,295
Retail	-0.005	7,580	90,961
Services	-0.004	15,538	186,452
Public	-0.030	897	10,762

Panel B: Book net leverage and equity returns

	NLEV	Firm year observations	N
Market	-0.001**	98,181	1,178,166
Agriculture	-0.008	293	3,515
Mining	-0.002	5,534	66,407
Construction	0.003	1,371	16,456
Manufacturing	-0.001	51,893	622,720
Transportation	0.001	4,807	57,687
Utilities	0.000	5,576	66,911
Wholesale	-0.003	4,691	56,295
Retail	0.000	7,580	90,961
Services	-0.001	15,538	186,452
Public	-0.017	897	10,762

Panel C: Market leverage and equity returns

	MLEV	Firm year observations	N
Market	0.002	98,181	1,178,166
Agriculture	-0.001	293	3,515
Mining	-0.005	5,534	66,407
Construction	0.008	1,371	16,456
Manufacturing	0.003	51,893	622,720
Transportation	0.002	4,807	57,687
Utilities	0.005	5,576	66,911
Wholesale	0.003	4,691	56,295
Retail	0.005	7,580	90,961
Services	0.002	15,538	186,452
Public	-0.059	897	10,762

Regression 2: Book leverage, book leverage squared and equity returns

This table presents the results from Fama and Macbeth cross-sectional regressions at the individual firm level using ordinary least squares. In the analysis, we regress book leverage (BLEV) and squared book leverage ($BLEV^2$) on monthly excess returns. To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the risk premiums, we compute Whitney K. Newey and West (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	BLEV	$BLEV^2$	Firm year observations	N
Market	-0.006	0.002	98,181	1,178,166
Agriculture	0.039	-0.094	293	3,515
Mining	-0.03**	0.021	5,534	66,407
Construction	0.036*	-0.051*	1,371	16,456
Manufacturing	0.000	-0.006	51,893	622,720
Transportation	-0.008	0.012	4,807	57,687
Utilities	0.000	-0.003	5,576	66,911
Wholesale	-0.009	0.007	4,691	56,295
Retail	0.012	-0.027**	7,580	90,961
Services	-0.026***	0.034***	15,538	186,452
Public	-0.035	0.038	897	10,762

Regression 3: Book leverage and equity returns, controlling for beta

This table presents the results from Fama and Macbeth cross-sectional regressions at the individual firm level using ordinary least squares. In the analysis, we regress book leverage (BLEV) on monthly excess returns, while controlling for beta. To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the risk premiums, we compute Whitney K. Newey and West's (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	Beta	BLEV	Firm year observations	N
Market	-0.001	-0.005*	98,181	1,178,166
Agriculture	-0.004	-0.002	293	3,515

Mining	-0.003*	-0.016***	5,534	66,407
Construction	0.002	0.000	1,371	16,456
Manufacturing	0.000	-0.004	51,893	622,720
Transportation	-0.001	0.003	4,807	57,687
Utilities	-0.002	-0.003	5,576	66,911
Wholesale	-0.002	-0.005	4,691	56,295
Retail	0.001	-0.004	7,580	90,961
Services	0.000	-0.004	15,538	186,452
Public	-0.026*	0.035	897	10,762

Regression 4: Size, beta and book leverage

This table presents the results from Fama and Macbeth cross-sectional regressions at the individual firm level using ordinary least squares. In the analysis, we regress book leverage (BLEV) on monthly excess returns, while controlling for beta and the natural logarithm of market equity (log[ME]). To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the risk premiums, we compute Whitney K. Newey and West's (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	Beta	BLEV	log[ME]	Firm year observations	N
Market	-0.001	-0.004	-0.001**	98,181	1,178,166
Agriculture	-0.014	0.016	0.000	293	3,515
Mining	-0.002	-0.013**	-0.001**	5,534	66,407
Construction	0.005	-0.003	-0.002**	1,371	16,456
Manufacturing	0.000	-0.003	-0.001**	51,893	622,720
Transportation	-0.002	0.003	-0.001	4,807	57,687
Utilities	-0.003	0.000	-0.001***	5,576	66,911
Wholesale	-0.002	-0.005	-0.002**	4,691	56,295

Retail	0.000	-0.005	-0.001	7,580	90,961
Services	0.000	-0.005	-0.002***	15,538	186,452
Public	0.003	0.162	-0.030	897	10,762

Regression 5: Leverage and equity returns controlling for Fama French 5 factors

This table presents a regression on book leverage (BLEV) and monthly excess returns, while controlling for Fama and French 5 factors as defined in Fama and French (2015). The factors consist of market excess returns (Mkt excess), size (SMB), value (HML), profitability (RMW), and investments (CMA). To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the coefficients, we compute Whitney K. Newey and West (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	BLEV	Mkt_excess	SMB	HML	RMW	CMA	Firm year observations	N
Market	-0.004***	1.002***	0.755***	0.133***	-0.1***	0.104***	98,181	1,178,166
Agriculture	-0.031*	0.645***	0.886***	0.130	0.211*	0.105	293	3,515
Mining	-0.017***	1.118***	0.827***	0.636***	-0.105	0.391**	5,534	66,407
Construction	0.003	1.214***	0.962***	0.515***	0.228***	0.025	1,371	16,456
Manufacturing	-0.004**	1.023***	0.801***	0.053*	-0.16***	0.134***	51,893	622,720
Transportation	0.004	1.091***	0.527***	0.298***	-0.090	0.003	4,807	57,687
Utilities	-0.001	0.581***	0.056	0.249***	0.13***	0.251***	5,576	66,911
Wholesale	-0.005	0.999***	0.822***	0.195***	0.141***	0.055	4,691	56,295
Retail	0.000	1.071***	0.877***	0.319***	0.446***	0.040	7,580	90,961
Services	-0.003	0.988***	0.801***	-0.039	-0.247***	-0.042	15,538	186,452
Public	0.006	1.148***	1.299***	-0.256***	-0.612***	0.187	897	10,762

Regression 6: Leverage and equity returns controlling for q-factors

This table presents the results from a regression on book leverage (BLEV) and monthly excess returns, while controlling for the q-factors presented by Hou, Mo, Xue, & Zhang (2020). The factors consist of market excess returns (Mkt excess), market equity (ME), investments-to-assets (I/A), return on equity (ROE), and expected growth (EG). To adjust for autocorrelation when reporting standard errors of the coefficients, we compute

Whitney K. Newey and West's (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. Our data is sampled on a monthly basis and includes nonfinancial firms listed at NYSE, NASDAQ and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	BLEV	Mkt_excess	ME	I/A	ROE	EG	Firm year observations	N
Market	-0.004***	0.936***	0.644***	0.17***	-0.373***	-0.045*	98,181	1,178,166
Agriculture	-0.03*	0.612***	0.799***	0.204	-0.039	0.062	293	3,515
Mining	-0.016***	0.957***	0.504***	0.981***	-0.479***	-0.743***	5,534	66,407
Construction	0.003	1.15***	0.779***	0.516***	-0.086	-0.130	1,371	16,456
Manufacturing	-0.004**	0.969***	0.729***	0.072**	-0.42***	0.071**	51,893	622,720
Transportation	0.004	1.014***	0.379***	0.277***	-0.28***	-0.257***	4,807	57,687
Utilities	-0.001	0.567***	0.045	0.511***	0.114**	-0.040	5,576	66,911
Wholesale	-0.004	0.933***	0.664***	0.273***	-0.209***	-0.061	4,691	56,295
Retail	0.001	0.988***	0.616***	0.547***	-0.083	-0.206*	7,580	90,961
Services	-0.002	0.902***	0.683***	-0.176***	-0.513***	-0.023	15,538	186,452
Public	0.006	0.9***	1.216***	-0.167	-0.595***	0.017	897	10,762

8.2 Market leverage and equity returns, controlling for Fama French 5 factors

This table presents a regression on market leverage (MLEV) and monthly excess returns, while controlling for Fama and French 5 factors as defined in Fama and French (2015). The factors consist of market excess returns (Mkt excess), size (SMB), value (HML), profitability (RMW), and investments (CMA). To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the coefficients, we compute Whitney K. Newey and West (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	MLEV	Mkt_excess	SMB	HML	RMW	CMA	Firm year observations	N
Market	0.003**	1***	0.752***	0.137***	-0.096***	0.103***	111,050	1,332,605
Energy	-0.004	1.184***	0.779***	0.678***	0.020	0.267	6,834	82,004
Materials	0.001	1.096***	0.684***	0.376***	0.209***	0.157**	7,747	92,965

Industrials	0.006***	1.013***	0.804***	0.271***	0.178***	0.098**	22,245	266,944
Consumer Discretionary	0.004*	1.083***	0.895***	0.381***	0.295***	0.002	21,887	262,643
Consumer Staples	0.001	0.781***	0.518***	0.066	0.395***	0.201***	6,811	81,731
Health Care	0.013***	0.899***	0.884***	-0.247***	-0.430***	0.209***	15,797	189,564
Information Technology	0.014***	1.114***	0.861***	-0.267***	-0.702***	0.000	20,447	245,368
Communication Services	0.011*	1.047***	0.485***	0.131*	-0.389***	0.017	3,098	37,176
Utilities	0.010**	0.542***	-0.014	0.21***	0.097**	0.284***	5,320	63,842
Real Estate	0.006	0.805***	0.632***	0.533***	0.271***	-0.166*	864	10,368

8.3 Book net leverage and equity returns, controlling for Fama French 5 factors

This table presents a regression on book net leverage (NLEV) and monthly excess returns, while controlling for Fama and French 5 factors as defined in Fama and French (2015). The factors consist of market excess returns (Mkt excess), size (SMB), value (HML), profitability (RMW), and investments (CMA). To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the coefficients, we compute Whitney K. Newey and West (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2021. In total, there are 1.3 million observations on 10 554 firms.

	NLEV	Mkt_excess	SMB	HML	RMW	CMA	Firm year observations	N
Market	0.000	1.001***	0.753***	0.137***	-0.096***	0.104***	111,050	1,332,605
Energy	0.000	1.183***	0.778***	0.678***	0.020	0.266***	6,834	82,004
Materials	0.000	1.096***	0.684***	0.376***	0.21***	0.158***	7,747	92,965
Industrials	0.000	1.014***	0.805***	0.272***	0.179***	0.1***	22,245	266,944
Consumer Discretionary	0.000	1.084***	0.896***	0.381***	0.296***	0.004	21,887	262,643
Consumer Staples	0.000	0.781***	0.518***	0.066**	0.395***	0.201***	6,811	81,731
Health Care	0.000	0.899***	0.884***	-0.247***	-0.43***	0.21***	15,797	189,564
Information Technology	0.000	1.115***	0.861***	-0.267***	-0.702***	0.002	20,447	245,368
Communication Services	0.000	1.048***	0.487***	0.129**	-0.388***	0.019	3,098	37,176

Utilities	-0.001	0.543***	-0.012	0.213***	0.098**	0.287***	5,320	63,842
Real Estate	0.004	0.806***	0.632***	0.532***	0.272***	-0.165*	864	10,368

8.4 Testing for Effects of Sample Period

8.4.1 Book leverage and equity returns, controlling for Fama French 5 factors, in sample period 1980-2000

This table presents a regression on book leverage (BLEV) and monthly excess returns, while controlling for Fama and French 5 factors as defined in Fama and French (2015). The factors consist of market excess returns (Mkt excess), size (SMB), value (HML), profitability (RMW), and investments (CMA). To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the coefficients, we compute Whitney K. Newey and West (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2000. In total, there are 637 246 observations on 7003 firms.

	BLEV	Mkt_excess	SMB	HML	RMW	CMA	Firm year observations	N
Market	-0.012***	0.952***	0.744***	0.165***	-0.007	0.107**	53,104	637,246
Energy	-0.017**	1.114***	0.456***	0.351**	-0.171	0.846***	3,348	40,178
Materials	-0.012**	1.057***	0.64***	0.357***	0.187**	0.214***	4,427	53,123
Industrials	-0.008**	0.973***	0.801***	0.294***	0.278***	0.118*	11,735	140,815
Consumer Discretionary	-0.01***	0.989***	0.816***	0.372***	0.35***	-0.077	11,493	137,917
Consumer Staples	-0.015***	0.838***	0.562***	0.082*	0.491***	0.292***	3,693	44,312
Health Care	-0.012**	0.985***	1.028***	-0.324***	-0.182**	0.557***	5,392	64,703
Information Technology	-0.011*	1.041***	0.995***	-0.166**	-0.5***	-0.19*	8,180	98,154
Communication Services	0.009	0.852***	0.368***	-0.043	-0.398**	-0.205	1,044	12,532
Utilities	-0.009	0.577***	0.013	0.412***	0.045	0.161	3,478	41,735
Real Estate	0.000	0.851***	0.698***	0.643***	0.349***	-0.076	315	3,776

8.4.2 Book leverage and equity returns, controlling for Fama French 5 factors, in sample period 2001-2021

This table presents a regression on book leverage (BLEV) and monthly excess returns, while controlling for Fama and French 5 factors as defined in Fama and French (2015). The factors consist of market excess returns (Mkt excess), size (SMB), value (HML), profitability (RMW), and investments (CMA). To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the coefficients, we compute Whitney K. Newey and West (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 2001-2021. In total, there are 695 359 observations on 6692 firms.

	BLEV	Mkt_excess	SMB	HML	RMW	CMA	Firm year observations	N
Market	0.002	1.07***	0.676***	0.12***	-0.073**	0.059	57,947	695,359
Energy	-0.008	1.329***	0.89***	0.763***	0.310	-0.177	3,447	41,359
Materials	-0.006	1.21***	0.602***	0.377***	0.392***	0.001	3,400	40,795
Industrials	0.002	1.085***	0.717***	0.257***	0.206***	0.048	10,744	128,923
Consumer Discretionary	0.006*	1.206***	0.82***	0.34***	0.376***	-0.043	10,288	123,451
Consumer Staples	-0.01***	0.713***	0.444***	0.11**	0.276***	0.114	3,243	38,911
Health Care	0.006*	0.866***	0.788***	-0.179***	-0.546***	0.167**	10,116	121,395
Information Technology	0.008**	1.184***	0.662***	-0.266***	-0.755***	0.061	12,065	144,775
Communication Services	0.007	1.098***	0.489***	0.141*	-0.358***	0.010	2,021	24,248
Utilities	-0.011	0.538***	0.017	0.060	0.17**	0.473***	2,068	24,821
Real Estate	0.005	0.816***	0.566***	0.532***	0.278***	-0.242**	557	6,680

8.4.3 Market leverage and equity returns, controlling for Fama French 5 factors, in sample period 1980-2000

This table presents a regression on market leverage (MLEV) and monthly excess returns, while controlling for Fama and French 5 factors as defined in Fama and French (2015). The factors consist of market excess returns (Mkt excess), size (SMB), value (HML), profitability (RMW), and investments (CMA). To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the coefficients, we compute Whitney K. Newey and West (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 1980-2000. In total, there are 637 246 observations on 7003 firms.

	MLEV	Mkt_excess	SMB	HML	RMW	CMA	Firm year observations	N
Market	-0.004**	0.952***	0.744***	0.166***	-0.007	0.106**	53,104	637,246

Energy	-0.006	1.114***	0.456***	0.352**	-0.170	0.844***	3,348	40,178
Materials	-0.006	1.058***	0.641***	0.358***	0.188**	0.214***	4,427	53,123
Industrials	0.001	0.973***	0.801***	0.295***	0.277***	0.117*	11,735	140,815
Consumer Discretionary	-0.004	0.989***	0.817***	0.374***	0.35***	-0.078	11,493	137,917
Consumer Staples	-0.004	0.838***	0.564***	0.084*	0.491***	0.291***	3,693	44,312
Health Care	-0.005	0.986***	1.028***	-0.323***	-0.183**	0.557***	5,392	64,703
Information Technology	0.002	1.041***	0.995***	-0.166**	-0.501***	-0.189*	8,180	98,154
Communication Services	0.013	0.851***	0.367***	-0.045	-0.397**	-0.203	1,044	12,532
Utilities	0.013**	0.575***	0.007	0.406***	0.042	0.159	3,478	41,735
Real Estate	0.005	0.851***	0.697***	0.642***	0.349***	-0.075	315	3,776

8.4.4 Market leverage and equity returns, controlling for Fama French 5 factors, in sample period 2001-2021

This table presents a regression on market leverage (MLEV) and monthly excess returns, while controlling for Fama and French 5 factors as defined in Fama and French (2015). The factors consist of market excess returns (Mkt excess), size (SMB), value (HML), profitability (RMW), and investments (CMA). To adjust for autocorrelation and heteroscedasticity when reporting standard errors of the coefficients, we compute Whitney K. Newey and West (1987) standard errors. Our data is sampled on a monthly basis, and includes nonfinancial firms listed at NYSE, NASDAQ, and Amex over the period 2001-2021. In total, there are 695 359 observations on 6692 firms.

	MLEV	Mkt_excess	SMB	HML	RMW	CMA	Firm year observations	N
Market	0.011***	1.069***	0.674***	0.12***	-0.074**	0.054	57,947	695,359
Energy	0.002	1.328***	0.89***	0.763***	0.310	-0.179	3,447	41,359
Materials	0.003	1.21***	0.599***	0.377***	0.39***	-0.003	3,400	40,795
Industrials	0.012***	1.085***	0.713***	0.256***	0.204***	0.043	10,744	128,923
Consumer Discretionary	0.013***	1.206***	0.815***	0.34***	0.372***	-0.050	10,288	123,451
Consumer Staples	0.003	0.713***	0.442***	0.109**	0.274***	0.112	3,243	38,911

Health Care	0.024***	0.865***	0.788***	-0.179***	-0.546***	0.164**	10,116	121,395
Information Technology	0.025***	1.183***	0.66***	-0.265***	-0.755***	0.056	12,065	144,775
Communication Services	0.015**	1.096***	0.489***	0.143*	-0.358***	0.009	2,021	24,248
Utilities	0.007	0.539***	0.014	0.059	0.169**	0.469***	2,068	24,821
Real Estate	0.006	0.816***	0.565***	0.531***	0.277***	-0.243**	557	6,680