University of Agder
Kristiansand, Spring 2022

Leverage and Stock Performance

An Empirical Study of Leverage Ratio and Stock Returns in the Norwegian Market

Isak Haugen & Sunniva Volden

Supervisor: Nicha Lapanan

Master Thesis

MSc Business Administration

University of Agder

Preface & Acknowledgements

This master´s thesis will conclude our five year-long journey of becoming "siviløkonomer" at the University of Agder. It is in many ways a culmination of all courses, research papers and exams completed during this period. As we both find corporate finance exciting and interesting, writing about capital structure as our main subject allowed us to build on previously accumulated knowledge. The possibility to contribute to a topic which has not been excessively researched previously in the Norwegian market was also a motivating factor.

Writing this thesis has been a challenging and rewarding exercise. We want to thank our supervisor Nicha Lapanan for guidance during the process of writing, and additionally, we want to thank our friends and family for their support.

Finally, we want to thank the Business School at the University of Agder for five years of studies. Although we will probably not miss the countless hours spent in your reading halls preparing for exams, we will certainly look back at our time as students as a great experience, both academically and personally.

University of Agder

Kristiansand, May 2022

Isak Haugen

Sunniva Volden

Abstract

The purpose of this thesis is to investigate whether capital structure has an effect on stock returns, and if existing theories can explain a potential relationship. We gather data for firms listed on the Oslo Stock Exchange in the period 1990 - 2020. This includes 2910 observations distributed among 331 unique firms.

There are different theories regarding the topic, and previous empirical research has yielded contradictory results. Previous research about capital structure in the context of the Norwegian market is scarce, making it especially interesting to study.

This thesis explores the relationship between debt ratio and expected stock returns using a Fama-Macbeth two-step regression and a fixed-effects model. We include several control variables, which prior studies have found to affect stock returns. We find a statistically negative relationship between expected stock returns and the leverage level.

According to our results, investors are not being rewarded for the extra risk associated with debt financing, and the average firm does not optimize their capital structure if the goal is to maximize the share price.

Keywords – Corporate Finance, Capital Structure, Panel Data, Fama & Macbeth

Contents

List of Figures

List of Tables

1 Introduction

1.1 Background

Structuring a firm´s capital is an important part of management decisions. There has been an extensive amount of research regarding firms' capital structure since the introduction of the "theory of irrelevance" by Modigliani and Miller (1958). This theory has made a substantial impact on the theoretical basis regarding firm capital structure. Existing literature has focused on the determinants of capital structure, and how the capital structure decisions might affect the firm value (Modigliani and Miller, 1958, 1963; Myers, 1984; Kraus and Litzenberger, 1973). Empirical research has arrived at contradictory results, either supporting or disagreeing with fundamental capital structure theories.

1.2 Purpose and contribution

There have been many attempts to create models that explain how a firm's approach to financing can affect its future returns and stock performance. The topic of stock returns is extremely complex, and there is no one method to explain every fluctuation in a firm´s stock price.

All firms are dependent on either equity or debt to finance operations and investments (Myers, 2001). No matter the size, sector or market, a firm can not exist without capital. Some firms choose to only use equity acquired through investors, others mainly borrow through bank loans and obligations. There are advantages and disadvantages to both methods, and academics have proposed several different theories of how firms should approach their financing mixture.

How does the choice of capital structure affect the firm´s business? Does it have any effect on profitability and stock performance, or is it completely irrelevant? Some argue that firms should use mainly debt as their source of financing, as this does not diluted shares, and one does not have to tie up equity when making new investments (Modigliani and Miller, 1963; Myers, 1984). Others argue that high levels of debt should be avoided, as risks tied to default can create financial distress (Kraus and Litzenberger, 1973).

Research regarding this topic is scarce in the context of the Norwegian market. Empirical studies conducted in different markets (Cai and Zhang, 2011; Bhandari, 1988; Penman et al., 2007; Dimitrov and Jain, 2008) seem to have arrived at different conclusions, and we can therefore not assume that there is a clear relationship between stock returns and capital structure.

The purpose of this thesis is to study if capital structure decisions can potentially explain variations in a firm's stock price. The fundamental theories of capital structure will be applied to the findings, to see if they can explain a potential relationship in the context of the Norwegian market.

1.3 Research Question

Is there a relationship between capital structure and stock returns of firms listed on the Oslo Stock Exchange?

1.4 Structure

This paper consists of seven chapters. The next chapter presents theories and past research. Chapter three presents the data used in our analysis. In chapter four we present the methodology and choice of regression models. The results are presented in chapter five, along with the descriptive statistics. We present our findings in chapter six and discuss them towards the theoretical framework. Chapter six also discusses the meaning of our findings emphasising the current interest rate environment and includes limitations of the research. Finally, our conclusion and suggestions for further research are presented in the seventh chapter.

2 Theories and Past Research

In this chapter, we will first define and explain basic concepts of capital structure, based on commonly used definitions. We will further present and discuss the theoretical frameworks, and then present previous empirical research on capital structure determinants and implications. Our research hypothesis is formulated based on theories and past research and will be presented at the end of this chapter.

2.1 Definitions

Berk and DeMarzo (2011) define capital structure as the combination of equity and debt that a firm holds on its balance sheet. *Equity* is the capital invested into a firm by its shareholders. The investments made by shareholders give them ownership over a certain portion of the firm, and financial compensation in terms of dividends related to their degree of ownership. *Debt* is borrowed capital obtained from bank loans and issuing obligations, which is used to help finance the firm's current business and new investments as an alternative to equity financing.

Financing a firm's activities through equity has the advantages of low risk, low financial stress in terms of loan repayments and interest expenditure, and finally dedicated investors that have a high interest in the firm and its business (Berk and DeMarzo, 2011). When issuing new equity, firms must "dilute" the existing shares by creating new ones, which can be disadvantageous for those already invested in said firm. When firms invest in assets through equity they use capital that could have been used elsewhere. This means they could be unable to invest in new projects that could have yielded positive returns, as raising new equity can prove to be a long and costly process.

Debt makes firms able to raise capital without diluting their shares, and gain favourable tax benefits (Berk and DeMarzo, 2011). There are however risks associated with debt financing, as increased levels of leverage lead to an increased risk of bankruptcy and financial distress. When issuing new debt, a firm makes itself obligated to pay back said loan plus interest rates. Any over-leveraged firm may not be able to meet short-term obligations, and therefore is forced to default. This is referred to as the cost of bankruptcy and financial distress. Another risk when financing through debt is the concept of "debt overhang", introduced by Myers (1977). Debt overhang is caused by borrowing at a rate which makes new investments non-feasible, as any new earnings would be used to pay back creditors. Firms might find it difficult to escape debt overhang, as it is unable to make new investments that facilitate further growth.

The theoretical investor is perceived to be rational and risk-averse and will therefore demand a higher rate of return when an investment is associated with an increased level of risk. This compensation is defined as a "risk premium" (Duarte and Rosa, 2015). Levered firms must be careful not to overreach with their borrowing, as they might end up with a high risk of default, which could potentially scare away investors. While financing purely through equity might initially be safer, it might make firms unable to raise sufficient capital without significant share dilution, which could also be perceived badly by the market.

2.2 Theoretical Framework

2.2.1 Modigliani & Miller I

In a somewhat controversial article, Modigliani and Miller (1958) (MM) introduced the “Irrelevance Proposition Theorem”. This theory has had a great influence on the economic theory since its inception and has been the catalyst for large amounts of research on the concept of capital structure. The theory is based on a firm having two main sources of financing; equity and debt.

The theorem describes a market where:

- No taxes are present
- There are no bankruptcy costs
- No agency costs are present
- There is no asymmetric information

In such a market, the capital structure of any firm would be irrelevant to the firms underlying value, as the value of the company is calculated using the present value of future cash flows. Additionally, there would be no tax benefits associated with debt financing.

Proposition 1: $V_L = V_U$

V_L is the value of the levered firm, while V_U is the value of the unlevered firm. According to MM I these values are equal, and firms will always have an optimal capital structure.

Proposition 2: $r_E = r_A + (r_A - r_D) \times \frac{D}{E}$

Where equity (E), debt (D), expected return of assets (r_A) equity (r_E) and debt (r_D) give the total cost of levered equity. MM states that any changes in the leverage level have a directly proportional effect on the firm's cost of equity. Any increase in leverage will according to this proposition increase the risk of default, which inclines investors to demand a higher return on their investment.

2.2.2 Modigliani & Miller II

After the publication of their theorem, MM received a great amount of criticism and scrutiny, as their approach was deemed unrealistic in a real-world setting. Factors such as interest-bearing debt, transaction costs and financial instability make real-world financial markets much more complex than the perfect capital market described in MM's first theorem.

As a response to the critics, MM reformulated the theory. This new theorem accounts for the existence of real-world factors such as transaction costs, bankruptcy costs, and the presence of payable taxes (Modigliani and Miller, 1963).

Proposition 1: $V_L = V_U + t_C \times D$

The first proposition of MM's second theorem indicates that the value of a levered firm would be greater than its unlevered counterpart, as the tax benefits (t_C) associated with debt financing positively impact firm value. The increase in firm value caused by t_C is derived from present value future cash flows, which increases with the taxable benefits.

Proposition 2: $r_E = r_A + \frac{D}{E} \times (1 - t_C) \times (r_A - r_D)$

In their second proposition, MM adjusts the equation to better fit real-world markets by including the effect of tax shields. This equation shows that the cost of equity has a direct relationship with the leverage level, however, the inclusion of tax shields will affect the final value. Accordingly, investors should be looking for firms with a high leverage level, as the tax shields would boost their total value compared to similar financing through equity.

2.2.3 Agency Theory

Jensen and Meckling (1976) introduced the concept of agency costs and its effect on managerial behaviour. The main issue raised is that there can be discrepancies between the goals of managers and shareholders, a problem known as the principal-agent problem. To counter this problem, there must be sufficient incentive alignment, as this reduces asymmetrical information and agency costs. These costs can be attributed to equity holders and managers that might pursue projects that decrease the total firm value long term, but increases their own initial value, through means such as bonus and dividend payments (Jensen and Meckling, 1976). Agency costs can also arise if a firm is at risk of defaulting on its debt, as increased financial distress could lead to excessive risk-taking and the risk of not being able to partake in new profitable projects. On the other side, however, increasing leverage and therefore financial distress may force managers to pursue strategies and investments that are necessary to keep the firm competitive and liquid enough to meet their due debt payment. In short, high levels of debt can both increase and decrease agency costs. Myers (2001) points out that there is no perfect composition package that could eradicate agency costs, and there is no pure reliable method of observing managers´ actions.

2.2.4 Trade-off Theory

Building on the work of MM, Kraus and Litzenberger (1973) introduced the trade-off theory. Where MM argue that increased debt will lead to increased firm value, the trade-off theory accounts for the fact that while debt will raise its total capital level, the increase in the cost associated with borrowing will at one point cause firm value to decrease. Warner (1977) argues that firms should set a target debt ratio, where the benefits of debt financing such as tax shields are balanced with the disadvantages such as agency costs and financial distress, and deviate from this ideal ratio as little as possible. According to Graham and Leary (2011), larger firms are generally associated with greater stability and lower financial distress, and should therefore have a higher target debt ratio than that of their smaller counterparts. Trade-off has however met some criticism, as Graham and Leary (2011) argues that the trade-off theory does not account for profitability leading to higher tax benefits and that the theory fails to adequately explain the variation of leverage across firms.

2.2.5 Pecking Order Theory

Myers (1984) described the theory of pecking order to better understand how firms approach internal and external financing. In contradiction to the trade-off theory, firms will not have an optimal capital structure, but will instead follow a pecking order of incremental financing options. The theory places retained earnings at the top of the order, followed by debt, and when the firm reaches its debt capacity, the firm will issue new equity. The theory is based upon the idea that a firm's managers have a much higher level of information and understanding about the firm compared to outside investors, and thus view the cost of asymmetrical information as the leading determinant of capital structure. As mentioned, the theory implies debt should be prioritized over equity. This is based on 2 main arguments, firstly that there is a significant negative market reaction to new equity issues, and secondly that firms mainly fund investments through retained earnings, and net equity issues are small or negative on an aggregate level (Graham and Leary, 2011). Increasing debt levels can also have a negative effect, as it decreases the amount of additional debt a firm can issue without facing financial distress.

Pecking order has however also met some critique, as Fama and French (2005) find that equity issues are common among firms experiencing growth, and Frank and Goyal (2003) find that small and young firms tend to use equity to make up for their financing deficit.

2.2.6 Market Timing Theory

Baker and Wurgler (2002) introduced the concept of market timing related to capital structure. The basis of market timing is to utilize the form of new capital that is most advantageous at a given time, related to the current stock price. With asymmetric information, the manager should in theory be able to "time" the market when adjusting capital structure. According to Huang and Ritter (2005), managers with access to such information and understanding would accordingly issue new equity when the stock is trading at a premium and issue more debt when the stock trades at a discount. This is consistent with the arguments of Hovakimian et al. (2001), as managers tend to issue more equity than debt in periods where managers perceive the firm´s stock price to be high.

2.2.7 Theoretical Shortcomings

While these theories work to explain the behaviour of firm capital structure in different ways, and traditionally have been utilized in much of the research regarding this topic, neither of these theories can perfectly explain reality.

Graham and Leary (2011) argue that while both trade-off and pecking order theory work to explain some of the patterns observed between firm characteristics and leverage levels, neither of these models successfully explain the heterogeneity of capital structures across firms. This is consistent with Myers (2001), who points to several flaws in these models. He argues that they incorrectly either measures or value different variables related to capital structure, as managers do not behave in the manner that the theories suggest. Hovakimian et al. (2001) argue that the trade-off theory works better in the long term, as firm managers can move gradually towards a target debt ratio. In the short term, however, their findings indicate that profitable firms generally have less debt, in line with the pecking order theory.

The theories above will be used to discuss our findings in this paper. It is therefore important to be aware of both their strengths and shortcomings.

2.3 Previous Research

2.3.1 Capital Structure and Stock Returns

Previous research on the topic of the relationship between leverage and stock performance have yielded different results and conclusions. Titman and Wessels (1988) found that increased debt levels negatively affect the uniqueness of a firm's business and that the presence of transaction costs may be an important factor regarding the structure of a firm´s capital. Graham et al. (2015) found that aggregate debt to total capital in the US market has had a significant change increasing from a 10-15% to 35% between 1940 - 1970, before peaking at 47% in 1992 and settling at 35% in 2010. This suggests that firms have adjusted their approach to debt in this time period.

Panno (2003) investigated the determinants of capital structure of firms in the UK and Italy. The results provide support for a positive effect of size and profitability, and negative impact of liquidity conditions and bankruptcy risk on the financial leverage of companies. He also found that well developed financial markets were likely to have a long term target debt ratio. Using an infinite horizon model, Lucas and McDonald (1990) found that equity issues on average can be predicted by abnormal positive stock returns. According to the findings of Welch (2004), stock returns can explain about 40% of debt ratio dynamics in the US market using a time horizon of one to five years. Fama and French (1992) conducted a test of cross-sectional relationships related to stock performance. Their study found that the firm size, book-to-market, price/earnings ratio and leverage levels are all related to stock returns.

The studies mentioned above argue that there is a relationship between capital structure and returns. There is however disagreement on the nature of this relationship.

2.3.2 Positive relationship

Bhandari (1988) researched how debt to equity ratios potentially affect common stock returns. He argued that by combining the D/E ratio and beta, one could adequately adjust for the market risk. The paper concluded that the leverage ratio has a positive effect on the stock returns. An incremental increase in debt is associated with increased risk, and investors will therefore demand a risk premium. Hamada (1972) tested the tax leverage proposition from MM's theorems by examining the effect of capital structure on systematic risk on common stock. Hamada found a positive relationship between leverage and stock returns, and also between leverage and beta.

2.3.3 Negative relationship

Cai and Zhang (2011) found a significant negative relationship between expected stock returns and the changes in a firm´s leverage levels, using cross-sectional and time-series data from the US market. They concluded that a higher risk of default and financial distress leads to under-investment as a consequence of debt overhang, consistent with Myers (1977). Penman et al. (2007) decomposed a firm's book-to-market ratio into asset and leverage components, and identified that returns have a positive relationship with the asset component, and a negative relationship with leverage. Dimitrov and Jain (2008) find that annual changes in leverage will have a negative impact on current and future stock returns, as well as future earnings. They argue that a firm might increase its debt when financial performance is expected to decline.

2.4 Research hypothesis

Previous research regarding returns and capital structure has yielded many different and interesting results. With the theoretical frameworks and previous research in mind, we want to examine if stocks in the Norwegian market are affected by capital structure decisions. Academics seem to disagree on the nature of this relationship, and we wish to explore how theoretical frameworks hold up in the Norwegian market. Our research hypothesis is therefore:

H_0: There is not a significant relationship between stock returns and debt ratio.

H_A: There is a significant relationship between stock returns and debt ratio.

3 Data

3.1 Sample

To investigate the effect leverage has on stock returns in the Norwegian market, we have gathered price and accounting data for firms listed on Oslo Stock Exchange in the time-period 1990 to 2020. To reduce survivorship bias, we include companies that have active, inactive and delisting returns. Following the literature convention, we exclude all financial and utility firms defined by Fama and French (1997). We also follow Cai and Zhang (2011) and exclude firms with non-positive book values of equity as these firms will have extreme leverage ratios greater than 1. A firm will have a negative book value if the value of the liabilities exceeds the value of the total assets. However, this has no meaningful economical interpretation as shareholders´ liabilities are limited. Further, the firms need to have sufficient data, and firms with less than two years of observations have also been removed, to calculate returns.

For our analysis, we gather price and accounting data from Refinitiv Eikon Datastream, which is a database with comprehensive time-series data. Price data is gathered monthly, but we calculate the annual returns from the December close. Accounting data is gathered on a year-end basis. We have a sample of 331 firms, with a total of 2910 observations. We use Bloomberg to download monthly market data, i.e. market index and risk-free rates, as Refinitiv Eikon did not provide this data dating back to 1990.

We use R software for data cleaning and statistical computing, and the full script is attached at the end of our thesis.

3.2 Variables

The concepts of capital structure and stock returns are very complex and are affected by a multitude of different factors. The choice of variables used in this paper is based on previous research, available data and own judgements. We considered several measures of expected stock returns and capital structure before the measures best suited for this study were chosen. We also include a number of control variables, which prior studies have found to affect stock returns.

We will discuss and present the chosen variables, and provide the Datastream codes for each of the variables in the sections below.

3.2.1 Dependent Variable: Expected Stock Returns

When investigating some variables´ effect on stock performance, the expected return E(r) is often the dependent variable, because the current price is determined by the expected future cash flows. However, the expected return is difficult to directly observe in the market. Theoretically, the implied cost of capital is a good proxy for expected returns (Li et al., 2013). The implied cost of capital is estimated as the expected return that equates the current stock price to the present value of the expected future cash flows (Li et al., 2013). The implied cost of capital would be our preferred proxy for expected returns. Institutional Brokers´ Estimate System (I/B/E/S) provide estimates of future earnings and cash flows, but there is not sufficient data on all firms included in our sample. We therefore have to choose a different approach to calculate the expected return. Bhandari (1988) uses actual returns as a proxy for expected returns. More recent studies use the next period´s return as a proxy for expected return, and we choose to use this proxy following Cai and Zhang (2011). Instead of using raw price data to calculate the stock returns, we use the total return index (RI) provided by Datastream. RI includes the reinvestment of dividends, and the total returns can be calculated from the change in the return index over one year.

$$E(r_{i,t}) = \frac{(RI_{i,t} - RI_{i,t-1})}{RI_{i,t-1}}, \tag{3.1}$$

3.2.2 Independent Variable: Capital Structure

The literature uses either book leverage or market leverage to capture capital structure. Book leverage is the book value of total liabilities divided by the book values of total assets. Market leverage is the book value of total liability divided by the sum of the book value of total liabilities and the market value of common equity (Cai and Zhang, 2011). We use book leverage to capture capital structure, similar to Cai and Zhang (2011), and the total interest-bearing debt rather than liabilities to capture potential tax-shields effects.

$$Leverage = \frac{Total\ Debt}{Total\ assets} \tag{3.2}$$

3.2.3 Control Variables

Control variables are not the primary focus of the research, but including the right control variables help the study to establish the relationships between the independent and dependent variables. The control variables can be seen as an alternative explanation for the dependent variable, and they are important to include to assure that our variable of interest does not serve as a proxy for other firm characteristics.

Size Factor: Total Assets

Following Cai and Zhang (2011) and Fama and French (1992), we include firm size as a control variable. We measure firm size as the natural logarithm of total assets for each firm, as this incorporates the total value of the firm's assets (Homaifar et al., 1994).

$$Size = Log\ (Total\ Assets) \tag{3.3}$$

According to the findings of Fama and French (1992), smaller firms tend to have longer periods of poor stock returns than their larger counterparts. Studies such as Frank and Goyal (2009) and Grabowski (2018) find that the size variable is positively related to leverage. Grabowski's findings indicate that smaller firms are associated with greater risk and therefore have a higher cost of capital. Titman and Wessels (1988) suggest that smaller firms are associated with a proportionally higher cost of debt, and therefore are less likely to have a high leverage ratio. Cai and Zhang (2011) find that size negatively affects stock returns, indicating that smaller firms will have a higher expected return.

Profitability Factor: Return on Equity

Return on Equity (ROE) is a profitability ratio that measures the return on shareholders´ equity. This measure relates net income to the book value of equity invested. The earnings variable is one of the most standard concepts in economic theory, as without sufficient earnings, firms would simply be unable to survive long term.

$$ROE = \frac{Net\ Income\ After\ Preferred\ Dividends}{Common\ Equity} \tag{3.4}$$

Cai and Zhang (2011) found a significant relationship between ROE and stock returns. ROE and stock returns are generally associated with a positive relationship, as excessive return on the equity invested in a firm makes it attractive to new investors.

Value Factor: Book-to-Market

To measure the effect of firm value, we have chosen to include the book-to-market ratio as a control variable. Fama and French (1992) found that book-to-market had a significant explanatory power on returns, and was also confirmed by the findings of Cai and Zhang (2011), which concluded that there was a positive relationship between book-to-market ratio and stock returns.

$$Book - to - Market = \frac{Common\ Equity}{Market\ Value\ (Equity)} \tag{3.5}$$

A study conducted by Rajan and Zingales (1995) found that firms with higher book-to-market tended to have a lower degree of leverage. Fama and French (1992) use book-to-market values as one of three factors in their three-factor model used to explain variation in stock returns. They explain that firms with a low market value compared to book value have a higher inherent risk in the market, and they find a positive relationship between book-to-market values and returns.

Market Factor: CAPM Beta

The beta variable is used to measure the systematic risk of individual stocks or a portfolio compared to the market. The beta measure is based on a market proxy and describes the relationship between expected returns and market risk, introduced as a part of the Capital Asset Pricing Model (CAPM) by Sharpe (1964).

$$ER_i = R_f + \beta_i(ER_m - R_f) \tag{3.6}$$

Where

- ER_i = expected return of investment
- R_f = risk-free rate
- β_i = beta of an investment
- $ER_m - R_f$ = market risk premium

According to Campbell and Vuolteenaho (2004), beta has a substantial influence on the return required by rational investors. Bhandari (1988) argues that it is necessary to include both capital structure and beta to correctly measure risk when explaining stock returns.

We estimate a 12 month rolling beta for each firm using CAPM, equation 3.6, where actual returns are used as a proxy for expected returns. Norwegian government-issued bonds are considered risk-free and is a good measure of the risk-free rate. Monthly data on Norwegian risk-free interest rates dating back to 1990 are rather limited, and we ended up combining the 3-month treasury bill index (ST1X obtained from Bloomberg) from 1990 - 2011 and the generic NOK 3 month treasury bill from 2012 - 2020 (obtained from Bloomberg) to get a sufficient sample. Combining two different measures should have no significant impact on our analysis, as the differences are marginal.

The market risk premium is found by deducting the risk-free rate from the expected market return. We used actual monthly returns from MSCI Norway Index as a proxy for expected market returns. We choose MSCI Norway as this index dates back to 1990, and is assumed to capture the Norwegian market well given our time horizon.

Momentum Factor: Previous Period Returns

While past performance does not necessarily predict future returns, Ehsani and Linnainmaa (2019) points to momentum having a relationship to all factors regarding stock performance, consistent with Carhart (1997). Jegadeesh and Titman (1993) argue that there is a momentum presence in stock returns, and suggests that investors should buy stocks that have performed well in the short-term past, and sell those who have performed poorly. To control for the momentum factor in our model, we include the return at $t=0$.

Winsorizing

Our sample consists of a broad variety of firms, and when sorting through the data, it became clear that extreme outliers could potentially have an impact on the outcome of our statistical analysis. The outliers will not be an appropriate representation for the sample, and we decided to winsorize our variables. Winsorizing is a process that moderates the impact of outliers and makes the sample more robust, as explained by Blaine (2018). When winsorizing, one must choose the level appropriate to the underlying data. We found that the 99% level was the most appropriate for this analysis, as it removed the most extreme outliers, but still kept the sample close to its original state. The winsorizing was done annually, meaning that the most extreme values in the upper scale were set equal to the 0.99 percentile and the most extreme values in the lower scale were set equal to the 0.01 percentile.

3.2.4 Summary of Variables

Table 3.1: Summary of Variables

Variables			
Type	Name	Datastream Code	Short Name
Dependent	Return (t+1)	RI	return
Independent	Debt Ratio	WC03255/WC02999	debt_ratio
Control	Size	WC02999	size
Control	ROE	WC01706/WC03501	ROE
Control	Book-market	WC03501/MV	book_market
Control	CAPM beta		beta
Control	Return(t)	RI	return_t

4 Methodology

This chapter will present relevant methods that can be used to investigate the relationship between capital structure and stock returns, and the underlying assumptions. In addition, we will briefly explain the motivations for the selected methodology.

4.1 Regression Analysis

Regression analysis is concerned with describing and evaluating the relationship between a dependent variable (y), and one or more independent variables/regressors $(x_1, x_2....x_n)$. The dependent variable is assumed to be random, and the regression analysis attempt to explain movements in y by reference to movements in one or more of the independent variables (Brooks, 2014). Although regression analysis describes the statistical relationship between the dependent variable and the regressor(s), it does not necessarily imply *causation*, meaning that the regressors are the cause and the dependent variable is the effect. It is therefore important that the statistical relationship can be backed up with theory (Gujarati, 2021).

Brooks (2014) defines the multiple linear regression model, consisting of k regressors as:

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + ... + \beta_k x_{kt} + u_t, \quad t = 1, 2..., T \tag{4.1}$$

Where,

t denotes the observation number

y is the dependent variable

$x_{2t}, x_{3t}..., x_{kt}$ are the explanatory variables that are thought to influence y

$\beta_2, \beta_3...\beta_k$ are the parameters which quantify the effect of each regressor on Y

β_1 is the intercept term, also referred to as α: The average value of y if all of the regressors took a value of zero.

u_t is the error term which represents all other unobservable factors that may affect y

4.1.1 Ordinary Least Squares Regression

Ordinary Least Squares (OLS) regression produces a straight line that minimizes the sum of squared deviations of the actual values from its predicted values, that is, minimizes the predicted squared error term ${\hat{u}_t}^2$ (Brooks, 2014). As the error term u_t is random and unobservable, a set of assumptions regarding its value has been made:

Assumptions about the error terms	
1. $E(u_t) = 0$	Expected value of zero
2. $var(u_t) = \sigma^2 < \infty$	Constant variance: *Homoscedasticity*
3. $cov(u_i, u_j) = 0$	Independence: No *autocorrelation*
4. $cov(u_t, x_t) = 0$	No multicollineraty
5. $u_t \sim N(0, \sigma^2)$	Normality of the distribution
	(Brooks, 2014)

If assumption 1-4 holds, then the estimators $\hat{\beta}$ and $\hat{\alpha}$ obtained by the OLS regression will be the best linear unbiased estimators (BLUE), and will have desirable properties:

Estimator: $\hat{\beta}$ and $\hat{\alpha}$ are estimators of the true value of α and β.

Unbiased: On average, the estimators will be equal to their true values α and β.

Linear: $\hat{\beta}$ and $\hat{\alpha}$ are linear estimators.

Best: $\hat{\beta}$ has minimum variance among the class of linear unbiased estimators.

If a constant term is included in the regression equation, assumption 1) will never be violated (Brooks, 2014). Assumptions 2-4 will be further explained and tested in chapter 5.2

4.2 Panel Data

We gather data on individual firms over a given time period. Our data consists of both time series and cross-sectional elements and contain information across time and space. This kind of dataset would be known as panel data. The panel keeps the same individuals i and measures some quantity about them over time t. The setup of the data is described by the econometric equation:

$$y_{i,t} = \alpha + \beta \times x_{it} + u_{it} \tag{4.2}$$

α is the intercept term, while β is a k×1 vector of parameters to be estimated on the explanatory variables x. x_{it} is a 1×k vector of observations on the explanatory variable, and u_{it} is the error term.

The most basic way to analyze panel data is to estimate a pooled regression. This involves estimating a single equation on all the data together, without differentiating time-series data and cross-sectional data. The equation is then estimated using OLS (Brooks, 2014). However, for the OLS estimators to be the BLUE, the assumptions lined out in section 4.1.1 must hold.

We have a large number of observations over the specified time period. This means that we might come across cross-sectional correlations, implying that it might exist co-variance between the error terms, violating the assumption $cov(u_t, x_t) = 0$. When the error terms are correlated across observations, OLS standard errors can be biased and either over or underestimate the true variability of the estimated coefficients (Petersen, 2009).

4.3 Methodology Selection

We want to investigate whether and how the leverage ratio will affect stock returns. We therefore find it appropriate to adopt the same methodology as similar studies, such as Cai and Zhang (2011) and Bhandari (1988) to make our results comparable. For our main analysis, we will therefore use the Fama and MacBeth (1973) two-step regression analysis to study the cross-sectional relations. As we have a broad variety of individual unique firms, we are also interested in including potential individual firm effects and study the effect of leverage ratio over time for a given firm. We will therefore present a fixed-effects model or random-effects model in addition to our main analysis.

4.4 Fama & MacBeth (1973) two-step regression

The cross-sectional regression approach of Fama and MacBeth (1973) (FMB) is a popular method for estimating coefficients and standard errors robust to cross-sectional correlations. The method was first introduced and used in asset pricing models (Fama and MacBeth, 1973; Fama and French, 1992). The methodology has also been adapted in the field of corporate finance and was used by Cai and Zhang (2011), Bhandari (1988), Penman et al. (2007) and Dimitrov and Jain (2008) to study the relationship between capital structure and stock performance.

FMB regression is a two-step regression. Step one is to run the cross-sectional regression for each time period t, where x is a matrix of observation on k explanatory variables for each firm i for a given time period:

$$y_{i,t} = \alpha_t + x_{it} \times \beta_t + u_{it} \tag{4.3}$$

From this cross-sectional regression, we obtain a time-series of estimated intercepts $\hat{\alpha}_t$ and betas $\hat{\beta}_t$. Fama and MacBeth (1973) suggest that the beta estimates and intercepts can be computed as the simple average of all regressions. From this, we obtain estimated betas for each factor k. The significance of the estimators are then evaluated, providing evidence to claim whether the hypothesis hold or not.

$$\hat{\beta}_k = \frac{1}{T} \sum_{t=1}^{T} \hat{\beta}_{k,t} \tag{4.4}$$

We use the Fama and MacBeth (1973) approach for our main analysis, where we have the following regression:

$$r_{i,t+1} = \alpha_t + \beta_{D,t} D_t + \beta`_{control,t} \times control\ vector \tag{4.5}$$

Where,

$r_{i,t+1}$ is the next period stock return

α_t is the intercept term

D is the debt ratio

The additional variables control for firm characteristics such as size, earnings, price-to-book, systematic risk and momentum effects.

4.5 Fixed-Effects Model and Random-Effects Model

We are also interested in including a model that allow for individual effects. Two of the classic panel estimator approaches that allows for individual effects are the *fixed-effects* models and the *random-effects* models. We will apply either of these models, depending on the properties in our data. Tests will be carried out in chapter 5.2

4.5.1 Fixed-Effects Model

The fixed-effect model tries to capture the relationship between the independent variables and the dependent variable within a single unit (firm). Each firm has individual characteristics that may affect the dependent variable. The fixed-effect model has two important assumptions: First, the model assumes that something within the single company may impact or bias the predictor or outcome variables, which we need to control for. The fixed-effects model removes the effect of time-invariant characteristics, and we can assess the net effect of the independent variables on the dependent variable. Second, the model assumes that each company is unique and its error term and individual characteristics should not be correlated with the other companies (Torres-Reyna, 2007). The regression equation is defined as:

$$Y_{i,t} = \alpha_i + \beta_1 x_{it} + u_{it}, \qquad u_{it} = \mu_i + v_{it} \tag{4.6}$$

Where,

u_{it}, the error term, is divided into individual-specific effects μ_i and the 'remainder disturbance' v_{it} that varies over time and entities (Brooks, 2014).

This model could be estimated using dummy variables, which is termed the least squares dummy variable (LSDV) approach (Brooks, 2014), and is illustrated:

$$Y_{i,t} = \beta x_{it} + \mu_1 D1_i + \mu_2 D2_i + ... + \mu_N DN_i + v_{it} \tag{4.7}$$

D1....DN is a dummy variable that takes the value of 1 for all observations on the *n´th* firm and zero otherwise. To avoid the 'dummy variable trap', the intercept term is not included.

Further, it is also possible to include a time-fixed effect, λ_t, which captures factors that affect $Y_{i,t}$ and that vary over time but are constant cross-sectionally (Brooks, 2014). These could be factors such as inflation and interest rates.

One major drawback with the fixed-effects model is that it cannot be used to investigate time-invariant causes of the dependent variable, and the model is designed to study the causes of changes in the dependent variable *within* a company, thus the model cannot be used to make inferences about the population (Torres-Reyna, 2007).

4.5.2 Random-Effects Model

In the random-effects model, the variation across companies is assumed to be random and uncorrelated with the predictor or independent variables. This model is best suited if differences across companies might have some influence on the dependent variable (Torres-Reyna, 2007). The random effect model is defined by the equation:

$$Y_{i,t} = \alpha + \beta x_{it} + \omega_{it}, \qquad \omega_{it} = \epsilon_i + v_{it} \tag{4.8}$$

Where,

The error term ω_{it} includes the random variable ϵ_i that varies cross-sectionally. ϵ_i measures the random deviation of each firm´s intercept term from the 'global' intercept term (Brooks, 2014).

The model assumes that the firms´ error terms are not correlated with the predictors, which allows us to investigate the time-invariant causes of the dependent variable. The model allows us to generalize the inferences beyond the sample (Torres-Reyna, 2007).

5 Analysis

The following chapter will present descriptive statistics and the regression results. Before we run the regressions, we will evaluate and test the assumptions of the regression models, and make adjustments if required. The results obtained from the regression analysis will be the foundation upon which findings and discussion are built later on.

5.1 Descriptive Statistics

Table 5.1 present the descriptive statistics for the sampled non-financial and non-utility firms listed on Oslo Exchange from 1990 to 2020. The sample consists of 331 unique companies and in total 2,910 observations. To deal with the most extreme values, the variables have been winsorized annually at a 99% level, as discussed in the data section. Descriptive statistics for the non-winsorized sample can be found in Appendix 1.

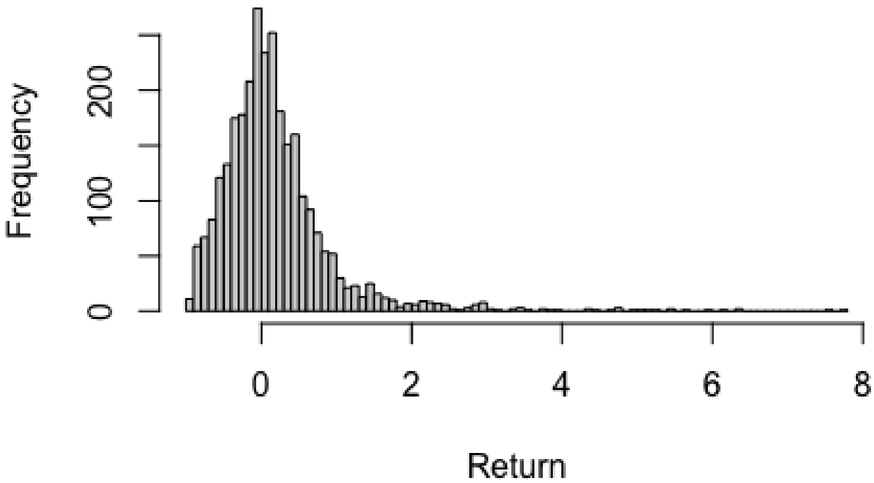
Table 5.1: Descriptive Statistics

	Mean	Min	Max	Std.dev	Median	Skew	Ex.kurtosis
Return	0.19	-0.94	7.71	0.79	0.06	3.09	17.02
Debt Ratio	0.29	0.00	0.82	0.21	0.27	0.30	-0.93
Log Total Assets	14.43	9.78	19.24	1.87	14.40	0.15	-0.51
ROE	-0.08	-15.50	1.21	0.75	0.06	-9.69	150.52
Book-to-Market	1.02	0.03	30.13	1.39	0.66	8.51	141.80
Total Assets (millions)	12973	10	1002475	59266	1788		

N observations: 2910

The annual mean return on Oslo Stock Exchange from 1990 to 2020 was 19%. This is the total return and includes reinvestment of dividends. Even though the returns have been annually winsorized, there are still large variations, with a standard deviation of 79% and ranging from -94% to 771%. The returns are equally weighted, thus there are large deviations at firm-level, as firm characteristics vary. The median return is 6% and less than the mean return, which indicates a positive skewness for the distribution of returns. In a positively skewed distribution, there are large, positive outliers, which move the mean upwards. The distribution of returns is presented in figure 5.1. With excess kurtosis of 17.02, the distribution is said to be leptokurtic. Compared to a normal distribution, the leptokurtic distribution is more peaked and has fatter tails. This means that there will be a greater percentage of small deviations from the mean and a greater percentage of extremely large deviations from the mean.

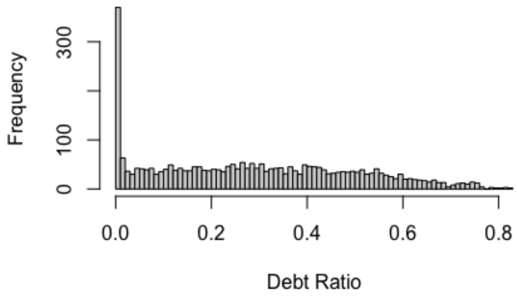
Figure 5.1: Return Distribution



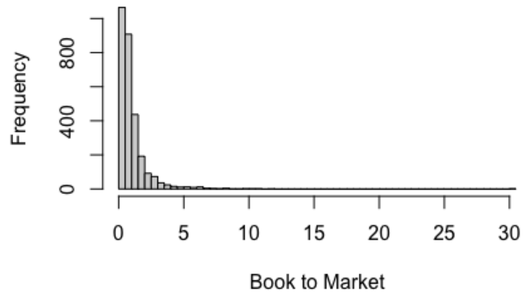
The debt ratio is defined as total debt/total assets, and the average firm has a debt ratio of 0.29. There are cross-sectional variations, ranging from all equity financed firms, to firms with large portions of debt, and the standard deviation is 21%. Figure 5.2a shows the debt ratio variations. The observations do not seem to be clustering around certain values, other than the observations with zero to very low debt levels. The average debt level in this sample is lower than Cai and Zhang (2011) found in their U.S sample from 1975-2002, which was 0.47. There are fewer companies on Oslo Stock Exchange, and those with little to no debt might be a larger portion of the total sample.

The mean book-to-market ratio is 1.02, suggesting that the stock prices reflect the book values *on average.* However, the median is 0.66 and less than the mean indicating a positive skew, and from table 5.1 we see that the skewness of the distribution is positive. In a positively skewed distribution, there are large, positive outliers, which will move the mean upwards. This can be seen in figure 5.2b. From the figure, we can also see that there are more observations centred around the lower quantiles, suggesting that *most* companies have book-to-market ratios well below 1.

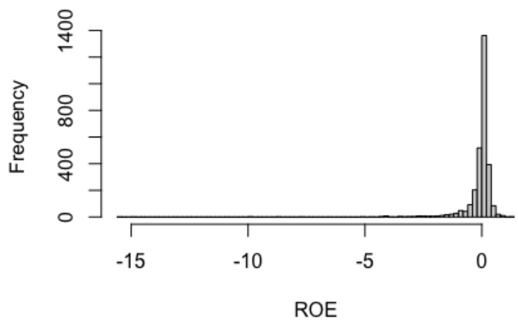
Figure 5.2: Distribution of variables



(a) Debt Ratio



(b) Book to Market.



(c) ROE

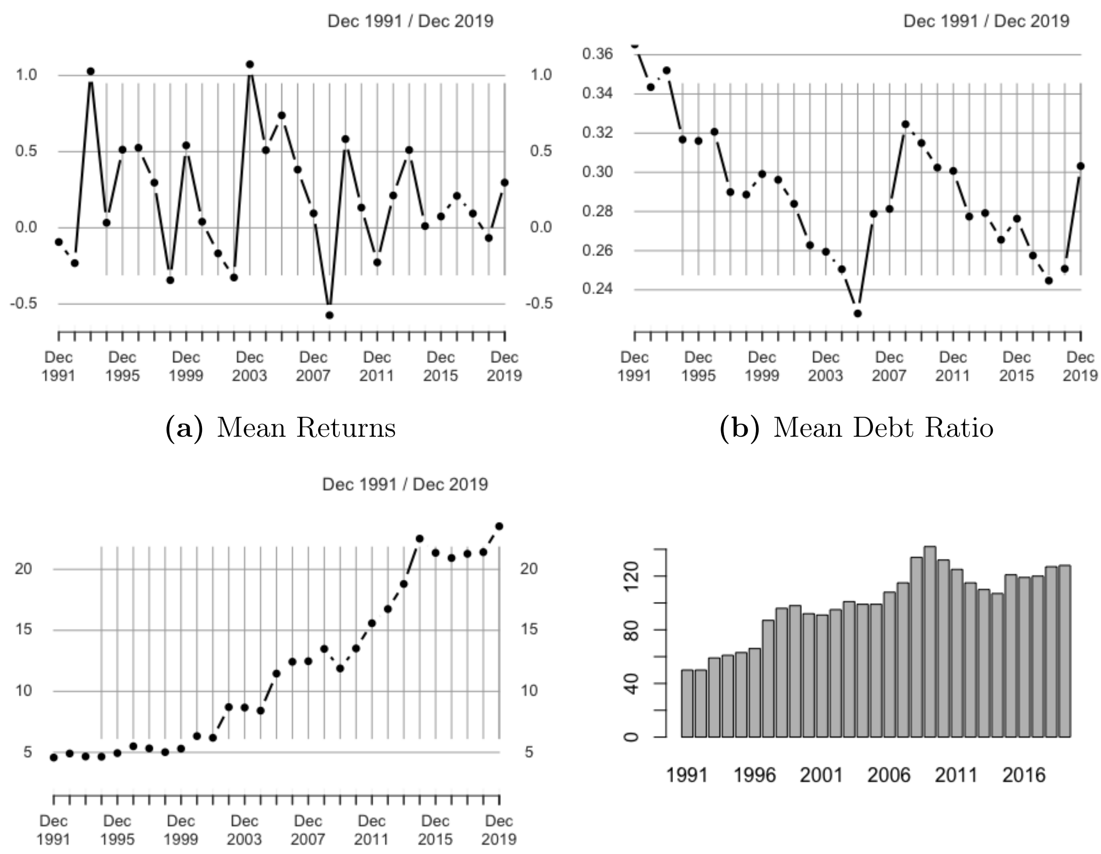
ROE is calculated as net income after preferred dividend/common equity, as we are interested in the net income that will be left to common equity holders. The mean is -8% while the median is 6%. This indicates a negatively skewed distribution, with large negative outliers, pushing the mean down, see figure 5.2c. Cai and Zhang (2011) found an average of 2% for the US firms in their sample. We choose to not exclude inactive and delisting returns to reduce survivorship bias, hence it is not surprising that ROE takes on large negative values.

As discussed in the data section, we use the log of total assets as a proxy for firm size. This variable is more difficult to interpret, hence we also include total assets in the descriptive statistics. The mean of total assets for the companies in the sample is 12.9 billion NOK, ranging from 10 million to 1002.5 billion.

Our sample ranges from 1990 to 2020, and it could also be of interest to illustrate the annual development of relevant variables and see how they change over time. Figure 5.3

illustrate this as the annual average of total assets, debt ratio and returns. The figure also provides an overview of the number of firms included in the sample each year.

Figure 5.3: Annual Development



(a) Mean Returns

(b) Mean Debt Ratio

(c) Mean Total Assets in Billions

(d) Unique Firms

From figure 5.3a we see that there are large annual deviations in returns. 1993 and 2003 was the year with the highest returns, with mean returns of ≈ 100%. From figure 5.3d we see that the number of firms in 1993 was approximately 50, hence few extreme observations would affect the sample mean greatly. The lowest mean return was -58%in 2008, coinciding with the financial crisis (2008). From figure 5.3b we can see that debt ratios were decreasing from 1990 to 2005, while they began increasing until 2008 when the crisis hit. We can also see that the volatility in returns is larger at the beginning of the period than in the more recent years. From figure 5.3c we see that firms have grown larger in terms of total assets over the total period, which might explain more stable returns. From this initial visual analysis, there is no clear relationship between debt ratio and returns (as t+1). In the following sub-chapters, we will further investigate if and how leverage can affect stock returns using two panel data regression models.

5.2 Initial Testing

Before the regressions are run, we need to identify what models are best suited to describe our research question at hand. We test for individual firm effects and test whether the effects are random or fixed using the Hausman (1978) test. Then we test all of the regressors in the model for multicollinearity. We proceed to residual diagnostics where we test u_i for autocorrelation and heteroskedasticity. The required corrections and adjustments will be presented in subchapter 5.2.6.

5.2.1 Individual Effects

If there is reason to believe that each entity has its own individual characteristics that may or may not influence the regressors, fixed-effects should be used (Torres-Reyna, 2007). The random-effects model further assumes that variations across companies are random and uncorrelated with the regressors, such as capital structure. It is reasonable to believe that each company have individual characteristics that may or may not affect the choice of capital structure, so according to theory, the fixed-effects model will be best suited for the analysis.

We first conduct an F test for individual effects, to determine whether there are individual effects or not. We evaluate this by running one regression with fixed firm effects and one regression without individual effects (pooled OLS) and then perform an F test for individual effects. The null hypothesis is that there are no individual effects.

Figure 5.4: F-test for Individual Effects

```
> pFtest(fixed, ols)

        F test for individual effects

data:  return ~ debt_ratio + beta + book_market + ROE + return_t + size
F = 1.4865, df1 = 330, df2 = 2573, p-value = 2.056e-07
alternative hypothesis: significant effects
```

Under the null hypothesis of no individual effects, the realization of the test statistic is extremely unlikely as indicated by the p-value of ≈ 0.00.

We verify that the individual effects are fixed rather than random by running one regression with fixed effects and one regression with random effects, and performing the Hausman test on the estimates. It tests whether the unique errors u_i are correlated with the regressors. The null hypothesis is that the random-effects model is the best model, meaning that u_i are not correlated to the regressors.

Figure 5.5: Hausman Test

```
> phtest(fixed, random)

        Hausman Test

data:  return ~ debt_ratio + beta + book_market + ROE + return_t + size
chisq = 524.28, df = 6, p-value < 2.2e-16
alternative hypothesis: one model is inconsistent
```

Under the null hypothesis of no correlation, the realization of the test statistic is extremely unlikely as indicated by the p-value of ≈ 0.00. Thus the Hausman test generates clear evidence against H_0, and we proceed with the fixed effect model.

5.2.2 Multicollinearity

Multicollinearity is when some of the regressors correlate with each other. It is problematic if there is a high correlation between the regressors. The explanatory power of the model will be high, but individual variables will not be significant (Brooks, 2014). We test whether the regressors are correlated, by calculating the Variance Inflation Factor (VIF). No formal criteria exist for deciding when a VIF is too large, but generic cutoff values of <5 and <10 are commonly used (Craney and Surles, 2002). We calculate the VIF by running a pooled regression with all the variables.

Figure 5.6: Variance Inflation Factor

```
> vif(ols)
 debt_ratio        beta book_market         ROE    return_t        size
   1.214102    1.013675    1.129646    1.088592    1.092386    1.206664
```

All values are below 5, and there is no reason to adjust for multicollinearity.

5.2.3 Autocorrelation

Autocorrelation is when the error terms u_i are correlated over time or cross-sectionally. We have panel data consisting of a time-series and cross-sectional dimension and need to check for both serial autocorrelation and cross-sectional autocorrelation.

Serial Autocorrelation

One common test for serial autocorrelation is the Durbin and Watson (1950) test, however this test is not applicable when the model has lagged values of the dependent variable as independent variables. As our model use lagged returns as an independent variable, the Breusch–Godfrey Test is applied to test for serial autocorrelation. The null hypothesis is that there is no serial-autocorrelation in the error terms.

Figure 5.7: Breusch–Godfrey Test

```
> pbgtest(fixed)

        Breusch-Godfrey/Wooldridge test for serial correlation in panel models

data:  return ~ debt_ratio + beta + book_market + ROE + return_t + size
chisq = 0.22617, df = 1, p-value = 0.6344
alternative hypothesis: serial correlation in idiosyncratic errors
```

With a p-value of 0.63, we fail to reject the null hypothesis of no serial autocorrelation, and there is no need to adjust the error terms u_i for this.

Cross-Sectional Autocorrelation

Cross-sectional independence of error terms in panel regression is highly unlikely, and the assumption of cross-sectional independent error terms is likely to be violated in practice (Brooks, 2014). For example, in our analysis, there are likely to be unspecified factors that affect all companies in the sample. These can be factors such as macro environment, geopolitical issues, trends, and fiscal-and monetary policies. We test for cross-sectional autocorrelation using the Pesaran (2015) CD test as we have a large sample of individual firms, that is; N>T. The null hypothesis is that there is no cross-sectional autocorrelation.

Figure 5.8: Pesaran CD Test

```
> pcdtest(fixed, test = c("cd"))

        Pesaran CD test for cross-sectional dependence in panels

data:  return ~ debt_ratio + beta + book_market + ROE + return_t + size
z = 5.5779, p-value = 2.434e-08
alternative hypothesis: cross-sectional dependence
```

With a p-value of ≈0.00, we reject the null hypothesis, and the test confirms that we are dealing with cross-sectional dependence in our data. If cross-sectional autocorrelation is ignored in the estimation of panel models can lead to severely biased statistical results Hoechle (2007), meaning that on average the estimators will not be equal to their true values. The Fama and MacBeth (1973) regression produces standard errors that are robust to cross-sectional autocorrelation, but we will need to make adjustments in the fixed-effects model.

5.2.4 Heteroskedasticity

Heteroskedasticity is when the variance of the standard errors is not constant. We conduct the Breusch and Pagan (1979) test, where the null hypothesis is constant variance, meaning that the variance of the residuals is homogeneous.

Figure 5.9: Breusch-Pagan Test

```
> bptest(fixed, studentize=F)

        Breusch-Pagan test

data:  fixed
BP = 1057.6, df = 6, p-value < 2.2e-16
```

The result of this test gives us a p-value of ≈ 0.00, and we reject the null hypothesis. From the test, we have revealed heteroskedasticity in the error terms. If heteroskedasticity is ignored, the estimator will no longer be the *best*, meaning the estimator will no longer have the minimum variance, and we will need to adjust for this.

5.2.5 Time Fixed Effects

Further, we run an F-test to test whether there are time-fixed effects. Time-fixed effects will capture factors varying over time, affecting the dependent variable. We estimate one model with fixed effects and one without. Then we run an F-test on the estimates to see whether the dummies for all years are equal to zero. The null hypothesis is that there are no time fixed effects.

Figure 5.10: F-test for Time Fixed Effects

```
> pFtest(fixed.time, fixed)

        F test for individual effects

data:  return ~ debt_ratio + beta + book_market + ROE + return_t + size +  ...
F = 22.048, df1 = 28, df2 = 2545, p-value < 2.2e-16
alternative hypothesis: significant effects
```

The result of this test gives us a p-value of ≈ 0.00, and we reject the null hypothesis. From the test we conclude that time fixed effects are present, thus we need to include time dummy variables in our fixed-effects model.

5.2.6 Adjustments

After inspecting the error terms u_i we detected cross-sectional autocorrelation and heteroskedasticity, and we will need to adjust for this in order to have a BLUE estimator. By using robust standard errors we are able to combat several concerns about the failure to meet assumptions outlined in section 4.1.1. The use of robust standard errors does not change the point estimates of the coefficients, but will change the standard errors and thus the test statistics. We implement heteroskedasticity- and autocorrelation-consistent (HAC) standard errors following Arellano et al. (1987). We also detected time-fixed effects, and we include dummy variables for time in the fixed-effects model.

5.3 Results Using Fama Macbeth Regression

We investigate the effect of leverage on stock returns using the Fama and MacBeth (1973) regression, where we control for CAPM beta, book-to-market, ROE, previous returns and size. The regression equation is shown in equation 5.1.

$$r_{i,t+1} = \alpha_t + \beta_{D,t} \times D_t + \beta`_{control,t} \times control\ vector \tag{5.1}$$

The practical implementation of the Fama Macbeth procedure is done using the "pmg" command in R. This is a *"mean groups"* estimator from the "plm" package (Croissant et al., 2021). This estimator is identical to the FMB method when we change the index order of firm and time (Landroni, 2012).

Table 5.2 reports the time-series averages of the estimated regression coefficients and the corresponding standard errors. The dependent variable is the next year´s return, serving as a proxy for expected returns. The full summarises for the regressions are found in Appendix 2.

Table 5.2: Fama Macbeth Model

	Dependent variable:					
	Return (t+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Debt Ratio	−0.208**	−0.201**	−0.243**	−0.263***	−0.270***	−0.179**
	(0.097)	(0.102)	(0.099)	(0.101)	(0.096)	(0.082)
CAPM Beta		0.025	0.031	0.024	0.011	0.010
		(0.021)	(0.021)	(0.021)	(0.019)	(0.020)
Book-to-Market			0.007	0.017	0.024	0.031
			(0.030)	(0.028)	(0.028)	(0.028)
ROE				0.025	−0.034	−0.001
				(0.072)	(0.053)	(0.047)
Return (t)					0.014	0.013
					(0.059)	(0.059)
Size						−0.033**
						(0.014)
Constant	0.271***	0.253***	0.238***	0.229***	0.191***	0.630***
	(0.080)	(0.076)	(0.071)	(0.071)	(0.068)	(0.231)
Observations	2,910	2,910	2,910	2,910	2,910	2,910
R^2	0.226	0.239	0.282	0.307	0.327	0.347
Note:						*p<0.1; **p<0.05; ***p<0.01

We use the t-statistics to determine whether the estimated coefficients are different from zero, and we have: $H_0 : \beta_k = 0$ for k [0, 1, 2, 3, 4, 5, 6] and $H_1 : \beta_k \neq 0$. If the null hypothesis is true, the test statistics t is T_{n-p} distributed where p=k+1. We use the T partial test p(T>|t|) to determine whether the test statistics is T distributed. Test statistics can be found in Appendix 2.

In regression (1) we only include the debt ratio and the intercept, and the estimator is negative and statistically significant at the 5% level. In regression (2) through (6) we include the control variables; CAPM beta, book-to-market, ROE, previous returns and size. For all six regressions, the average coefficient for the debt ratio is negative and statistically significant at a 5% level. Adding the control variables slightly changes the average coefficient of the debt ratio variable, but it is still negative and statistically significant. A one unit increase in the debt ratio will lead to 18 basis-points decrease in the average annual expected return, holding everything else constant (ceteris paribus).

The average coefficient estimates for the control variables are somewhat consistent with the existing literature. The CAPM beta has no explanatory power, consistent with the findings of Cai and Zhang (2011) and Fama and French (1992). The average coefficient of firm size is statistically significant and negative, consistent with the size effect (Fama and French, 2015). However, the book-to-market ratio has no explanatory power, contradicting the findings of Cai and Zhang (2011) and Fama and French (2015). Cai and Zhang (2011) found that ROE was positive and statistically significant, however, this is not the case for the Norwegian market. In our sample we have all firms with sufficient data, including active, inactive and delisting returns to reduce survivorship bias. This means that ROE which is calculated as net income/common equity might take on large negative values, and for our sample the average ROE was -8%, while Cai and Zhang (2011) found an average of 2%.

The R squared value suggests that the full regression model explains about 35% of the stock returns on average. However, it is important to be aware of the fact that several of the control variables are not significant, and including more variables will increase the explanatory power of the model.

5.4 Results Using the Fixed Effects Model

We are also interested in including a model that allows for firm individual effects. We estimate the fixed-effects model using individual firm effects and time effects shown in regression equation 5.2. Table 5.3 reports the results from the fixed effects model. Full summary can be found in Appendix 3.

$$r_{i,t+1} = \beta_1 D_{it} + \beta\text{‘}control\ vector + \mu_i Firm\ Effects + \lambda_t Time\ Effects + v_{it} \tag{5.2}$$

Table 5.3: Fixed Effects Model

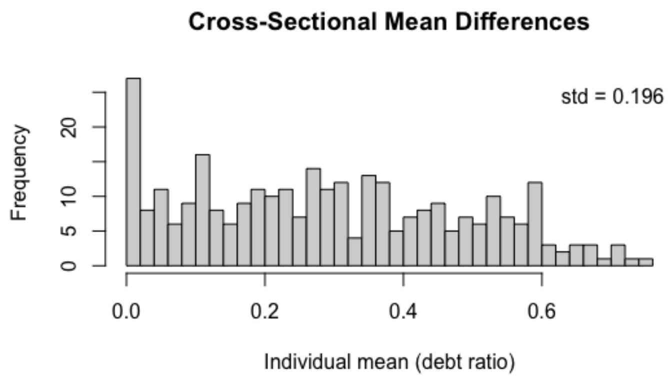
	Dependent variable:					
	Return (t+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Debt Ratio	0.350**	0.315**	0.281*	0.258*	0.255*	0.592***
	(0.146)	(0.142)	(0.144)	(0.139)	(0.139)	(0.151)
CAPM Beta		0.096*	0.095*	0.097*	0.098*	0.091
		(0.055)	(0.055)	(0.055)	(0.056)	(0.061)
Book-to-Market			0.093***	0.093***	0.090***	0.091***
			(0.029)	(0.029)	(0.030)	(0.032)
ROE				−0.021	−0.018	0.020
				(0.025)	(0.025)	(0.024)
Return (t)					−0.020	−0.028
					(0.026)	(0.027)
Size						−0.235***
						(0.043)
Time Fixed Effects	✓	✓	✓	✓	✓	✓
Observations	2,910	2,910	2,910	2,910	2,910	2,910
R^2	0.229	0.233	0.247	0.248	0.248	0.272
Note:				*p<0.1; **p<0.05; ***p<0.01		

From the regression results using the fixed effects model, we find that the debt ratio is positive and statistically significant on at least a 10% level after including the various control variables. These results are opposite of the findings obtained from the FMB analysis, where we found that the debt ratio negatively affects the expected returns.

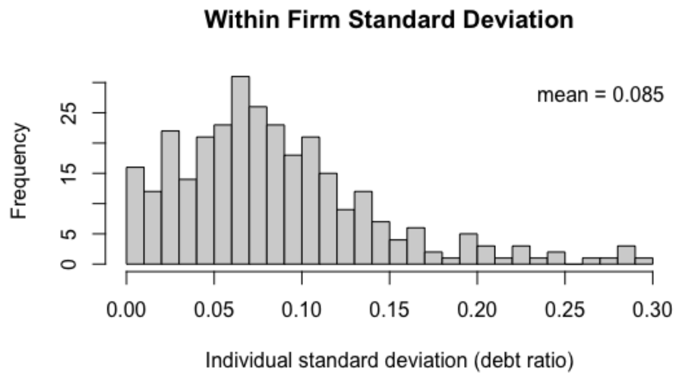
One important note is that the interpretation of the regressors differs in the two methodologies. In FMB regression, the coefficient of the debt ratio gives the marginal effect of the debt ratio on expected returns by exploiting the variation in debt ratios across firms. In the regression with firm fixed effects, the coefficient on debt ratio gives the marginal effect of debt ratio on expected returns by exploiting the variation in debt ratio over time for a given firm.

Given these two different results, it seems like there is more variation in the debt ratio across firms than for a given firm over time (within variation), which the differences in R^2 also suggest. Figure 5.11 shows the variation in debt ratios within and across firms, by illustrating individual means and standard deviations. Figure 5.11a shows the mean debt ratio for each firm and the standard deviation across firms, while figure 5.11b, shows the individual standard deviations for each individual firm and the average standard deviation within the firms.

Figure 5.11: Across and Within Debt Ratio Variations



(a) Cross-Sectional Mean Differences



(b) Within Firm Standard Deviation

Figure 5.11 confirm that there is more variation in the debt ratio across firms than within the firms. This is consistent with Lemmon et al. (2008) and Graham and Leary (2011) who found that leverage varies more cross-sectionally than within firms. Moreover, prior evidence (Panno, 2003) suggests that firms in the developed countries are more likely to have target debt-to-equity ratios, hence the leverage level will remain relatively constant at the firm level over time. When there is low variation within the firms, the use of the fixed effect model can pose several problems as discussed in DeHaan (2021). Including firms that have no within variations in a fixed-effects model, will contribute to the coefficient estimates μ_i and λ_t, and affect the estimated β through covariance between regressors and the other variables. DeHaan (2021) argues that one cannot rely on the interpretation of the fixed effects model when there are low within variations.

The FMB methodology is much more suitable for studying cross-sectional relations, and we will proceed with the results obtained from the FMB regressions.

5.5 Further Analysis

From our findings using both the FMB methodology and the fixed-effects model, we found that there were larger differences across firms than within the firms, hence FMB was the better model, and we found that leverage negatively affected expected stock returns for all firms on average.

It is also of interest to further investigate whether the effect of increasing debt is different for firms with already high debt levels than for firms with lower levels. We divide our sample into 0.3 and 0.7 quantiles based on the leverage ratios for a given year and run the FMB regression on the two samples. The sample statistics are presented in table 5.4 and 5.5, and the regression results are presented in table 5.6. Full summaries of the regressions are found in Appendix 4.

Table 5.4: Firms With the 30% Lowest Debt Ratios

	Mean	Min	Max	Std.dev	Median
Return	0.24	-0.89	7.71	0.88	0.05
Debt Ratio	0.05	0.00	0.24	0.05	0.02

N observations: 882

Table 5.5: Firms With the 70% Highest Debt Ratios

	Mean	Min	Max	Std.dev	Median
Return	0.14	-0.94	6.33	0.74	0.04
Debt Ratio	0.54	0.33	0.82	0.10	0.53

N observations: 879

Table 5.6: Sorting Low and High Levels of Debt

	Dependent variable:	
	Return (t+1)	
	(1)	(2)
Debt Ratio	0.265	-0.434^{*}
	(0.824)	(0.253)
CAPM Beta	0.043	0.049
	(0.048)	(0.045)
Book-to-Market	0.022	0.023
	(0.077)	(0.036)
ROE	0.188	0.035
	(0.220)	(0.108)
Return (t)	0.020	0.028
	(0.103)	(0.081)
Size	-0.065^{***}	-0.023
	(0.025)	(0.016)
Constant	0.968^{***}	0.620^{**}
	(0.313)	(0.305)
Observations	882	879
R^2	0.469	0.476
Note:	*p<0.1; **p<0.05; ***p<0.01	

From the regression results, we find that the coefficient for debt ratio is negative and statistically significant at the 10% level for firms with higher debt ratios, while it is positive but insignificant for firms with lower debt ratios.

6 Findings and Discussion

6.1 Findings

Overall, results obtained from the FMB regression and the fixed-effects model suggest that leverage has a significant effect on the expected stock price, and we can thus **reject** the null hypothesis. There is statistical evidence to support the alternative hypothesis: H_A There is a significant relationship between stock returns and debt ratio.

The FMB regression and fixed effect regression indicated the opposite direction of the relationship. Given the analysis and regression results, it seems like there is more variation in the debt ratio across firms than for a given firm over time. FMB methodology is more suitable for studying cross-sectional relations, and we therefore consider it the most relevant for our research. The FMB regression yielded results that indicated that the total debt ratio is **negatively** related to expected stock returns. A one unit increase in the debt ratio will lead to 18 basis-points decrease in the average annual expected return, ceteris paribus. In such a scenario, if a firm increases leverage more than equity, the value of the firm is likely to decrease.

Further, we investigated whether the effect of increasing debt is different for firms with already high debt levels than for firms with lower levels. We found a negative and statistically significant relationship for firms with higher debt ratios, while it was positive but insignificant for firms with lower debt ratios. These results *suggest* that firms with already higher levels of debt are more likely to be negatively affected by increasing debt ratio than firms with lower debt levels. However, there is not enough evidence to draw a sharp conclusion on this as the 90% confidence intervals for the estimator overlap each other, and the true β could in theory be similar for companies with high and low debt levels (Appendix A.4.3). Even though the estimators are not statistically different from each other, the point estimates indicate that firms with already higher levels of debt will be more negatively affected by increasing their debt ratio. For a company with high levels of debt, a one unit increase in the debt ratio will lead to 43 basis-points decrease in the average annual expected return, ceteris paribus. These results could indicate that the negative effect of leverage on stock returns is likely to be driven by a change in the default risk.

Our findings are also consistent with the empirical research conducted by Cai and Zhang (2011), Penman et al. (2007) and Dimitrov and Jain (2008) who performed similar research in other markets. Our findings are also in line with Myer´s arguments about "debt overhang", suggesting that the negative relationship might be a consequence of not being able to partake in new investments as a consequence of interest rates and debt payments.

6.2 Theoretical Implications

Even though the regression results describe a statistical relationship between leverage and expected stock returns, it does not necessarily imply causation. It is therefore important that the statistical relationship is evaluated under the theoretical framework, introduced earlier in the paper.

According to Modigliani & Miller's second theorem, there should be a positive relationship between leverage and returns, as the tax shields associated with debt would increase the firm value. Our findings indicate an opposite relationship, as increasing the debt ratio would lead to decreased stock returns.

The trade-off theory suggests that there exists an optimal leverage level, and any deviation from that level will have a negative effect on firm value. The theory suggests that increasing debt when levels are already high, could potentially increase default risk and financial distress cost more than the increased tax-shields benefits, which is consistent with our findings regarding firms that currently have higher debt ratios. For the firms with lower levels of debt, there was no significant relationship, which might indicate that these firms are balancing their trade-offs closer to the optimal level.

Pecking order theory suggests that when making investments, firms should use retained earnings as their preferred source of finance. Should firms need to raise *new* capital externally, debt should be prioritized over issuing equity. Our findings do not contradict the arguments related to retained earnings but do however suggest that firms should be wary of issuing new debt. We found that the negative effect of issuing new debt was significant for firms with higher levels of leverage. This is consistent with the pecking order theory, which implies that an increase in leverage reduces the firm´s debt capacity and may lead to future underinvestment.

Market timing theory suggests that managers are prone to issue new debt in periods when they perceive the stock to trade at a discount and equity when the stock trade at a premium. If managers are correct in their perception of the price, the leverage change caused by a firm's market timing action should be positively related to returns, which our findings contradict.

The negative relationship between expected returns and debt ratio suggests that investors are not rewarded with a risk premium for the increased risks associated with debt financing, especially among highly leveraged firms. This means that the potential advantages of debt financing do *not* out-weight the disadvantages when everything else is equal.

6.3 Interest Rates

Interest rate is an important foundation in the majority of accepted capital structure theories. Our study included firms listed on Oslo Stock Exchange during the time period 1990-2020, and the findings are consistent with Cai and Zhang (2011); Penman et al. (2007); Dimitrov and Jain (2008) whose studies were in respectively 1975-2002, 1992-1996 and 1973-2004. However, Bhandari (1988) conducted a similar study between 1948-1979 and found the opposite relationship, that leverage positively affected stock returns.

These differences are interesting, considering we have had 30 years of declining interest rates globally (Appendix 5), where the current low interest rate environment has been particularly well-entrenched since the Financial Crisis of 2008. Interest rates around the world declined further to handle the Covid-19 pandemic. Global supply chains have been greatly disrupted by the pandemic and the recent geopolitical conflicts of the Ukraine War 2022. In both the US and Euro economies, consumer price inflation rose this year to unusually high levels (Appendix 6). Central banks around the world have begun raising interest rates and indicate that they will increase even further going forward (NorgesBank, 2022; FED, 2022a). The potential changing interest rate environment is highly relevant for the capital structure decision going forward.

One point of view is that the relationship between leverage and stock performance might invert if interest rates increase significantly in the future. We can relate this to the findings of Bhandari (1988) whose study was conducted when interest rates were significantly higher than they have been for the past 30 years. Drawing on Trade-off theory, the net effect of increased interest rates might be positive, meaning that tax-shield benefits from holding larger portions of debt will out-weight the financial distress costs, hence increasing firm value.

The other possibility is that higher interest rates will affect the financial distress costs greatly, thus negatively affecting firm value and stock performance. Firms with already high levels of debt might struggle to meet their obligations and the likelihood of default will increase. If investors are not rewarded for taking on this risk, returns will start decreasing. Higher rates will also lead to higher interest rate expenditure, reducing available funds needed for future investments. Future investments will also be more heavily discounted, reducing the net present value of new investments.

It is not clear how higher interest rates will affect firm value, or if it will, but firm managers and investors should be aware of possible effects.

6.4 Limitations

Our findings contradict some of the general capital structure theories. Potential causes for discrepancies could be differences in methodology, definitions, variable measurements or sample selection.

Due to lack of available data, we were not able to use the implied cost of capital as a proxy for expected returns, thus we used the next period´s actual returns. Even though it is a proxy, it does not correctly reflect the market expectations. Expectations and actual returns might deviate greatly, especially when unforeseen events occur, such as the financial crisis of 2008 or the Covid-19 pandemic. The market is not able to predict these events and incorporate them into the expectations, and the use of actual returns will not reflect the expected returns at all.

Previous capital structure research has been focused on larger financial markets such as the US and UK markets. Our research is limited to the Norwegian stock market, which could differ in terms of the composition of companies, macro-environment, government regulations and corporate governance. Norway also has a higher degree of partially state-owned firms on the stock exchange, and our findings might not be adaptable to other markets.

7 Conclusion

The purpose of this study is to investigate a potential relationship between stock returns and capital structure and examine how fundamental theories could explain said relationship. Our sample consists of 30 years of cross-sectional and time-series data, and we used two panel data regression models: Fama and French (1992) two-step regression and a fixed-effects model. We found a significant relationship between expected returns and debt ratio, using both methodologies. However, the regression results suggest that there is more variation in the debt ratio across firms than within firms, thus the FMB methodology is more suitable for studying cross-sectional relations.

We found evidence that there is a negative relationship between leverage and expected stock returns, suggesting that investors are not rewarded with a risk premium for the increased risks associated with debt financing. The results contradict acknowledged theories such as the arguments of Modigliani & Miller I & II and the market timing theory, while the arguments of pecking order and trade-off are somewhat consistent with our findings. Previous empirical research such as Cai and Zhang (2011); Penman et al. (2007); Dimitrov and Jain (2008) are consistent with our findings. Bhandari (1988) found the opposite relationship, however his study was conducted in a different time period.

Our findings indicate a negative relationship between leverage and stock performance when everything else remains constant. A scenario where everything else remains constant is however, purely theoretical. We find that firms on average do not optimize their capital structure if the goal is to maximize the share price. Both firm managers and potential investors should be aware of the risks associated with debt financing and evaluate how each individual firm will react in a given context. In the real world, firms have to utilize debt as a tool to remain competitive and make new investments. The financial world is extremely complex and unpredictable, so firms must be careful when approaching capital structure. Our results mealy suggest that firms should be aware of the pitfalls concerning financially distress, debt overhang and bankruptcy costs.

7.1 Future Research

Research and academic literature regarding capital structure has since its inception been discussed and explored with many different methods and theoretical approaches. It would therefore be surprising to us if the debate regarding the topic would seize any time soon. We do however have some suggestions for future research.

The combination of Covid-19 and Russia's invasion of Ukraine has created an uneasy global economy. Inflation and interest rates have increased substantially, potentially affecting operational costs and the cost of capital. Firms might therefore be more prone to have problems with financial distress. It would therefore be interesting to see how firms adjust their capital structures to combat these issues.

Factors not accounted for in our model, such as inflation, interest rates and growth prospects are just some of the additional explanatory variables one could include. There are also alternative methods of measuring the variables included. By splitting debt into short-term and long-term, one could distinguish between short term credit loans and more long term debt used for investments.

Furthermore, one should consider including an industry-level analysis. Industries might have different approaches to capital structure, and variation across industries in the Norwegian market should therefore be explored further.

References

Arellano, M. et al. (1987). Computing robust standard errors for within-groups estimators. *Oxford bulletin of Economics and Statistics*, 49(4):431–434.

Baker, M. and Wurgler, J. (2002). Market timing and capital structure. *The journal of finance*, 57(1):1–32.

Berk, J. and DeMarzo, P. (2011). Corporate finance, global ed. *Essex: Person Education Limited.*

Bhandari, L. C. (1988). Debt/equity ratio and expected common stock returns: Empirical evidence. *The journal of finance*, 43(2):507–528.

Blaine, B. E. (2018). Winsorizing. *The SAGE encyclopedia of educational research, measurement, and evaluation*, page 1817.

Breusch, T. S. and Pagan, A. R. (1979). A simple test for heteroscedasticity and random coefficient variation. *Econometrica: Journal of the econometric society*, pages 1287–1294.

Brooks, C. (2014). *Introductory Econometrics for Finance*, volume 112. Cambridge University Press.

Cai, J. and Zhang, Z. (2011). Leverage change, debt overhang, and stock prices. *Journal of Corporate Finance*, 17(3):391–402.

Campbell, J. Y. and Vuolteenaho, T. (2004). Bad beta, good beta. *American Economic Review*, 94(5):1249–1275.

Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of finance*, 52(1):57–82.

Craney, T. A. and Surles, J. G. (2002). Model-dependent variance inflation factor cutoff values. *Quality engineering*, 14(3):391–403.

Croissant, Y., Millo, G., Tappe, K., Toomet, O., Kleiber, C., Zeileis, A., Henningsen, A., Andronic, L., Schoenfelder, N., and Croissant, M. Y. (2021). Package 'plm'. *Choice*, 139(1):227–240.

DeHaan, E. (2021). Using and interpreting fixed effects models. *Available at SSRN 3699777.*

Dimitrov, V. and Jain, P. C. (2008). The value-relevance of changes in financial leverage beyond growth in assets and gaap earnings. *Journal of Accounting, Auditing & Finance*, 23(2):191–222.

Duarte, F. and Rosa, C. (2015). The equity risk premium: a review of models. *FRB of New York Staff Report*, (714).

Durbin, J. and Watson, G. S. (1950). Testing for serial correlation in least squares regression: I. *Biometrika*, 37(3/4):409–428.

Ehsani, S. and Linnainmaa, J. T. (2019). Factor momentum and the momentum factor. Technical report, National Bureau of Economic Research.

Eitrheim, Ø., Erlandsen, S. K., Gerdrup, K. R., Grytten, O. H., Holter, J. P., Klovland, J. T., and Qvigstad, J. F. (2004). *Historical monetary statistics for norway 1819–2003 (pp.99-180)*. Occasional Papers No. 35, Oslo.

Fama, E. F. and French, K. R. (1992). The cross-section of expected stock returns. *the Journal of Finance*, 47(2):427–465.

Fama, E. F. and French, K. R. (1997). Industry costs of equity. *Journal of financial economics*, 43(2):153–193.

Fama, E. F. and French, K. R. (2005). Financing decisions: who issues stock? *Journal of financial economics*, 76(3):549–582.

Fama, E. F. and French, K. R. (2015). A five-factor asset pricing model. *Journal of financial economics*, 116(1):1–22.

Fama, E. F. and MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *Journal of political economy*, 81(3):607–636.

FED (2022a). Federal Reserve [press release, March 16, 2022]. Available at https://www.federalreserve.gov/monetarypolicy/files/monetary20220316a1.pdf. Accessed: May 18, 2022.

FED (2022b). Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity (GS10). Available at https://fred.stlouisfed.org/series/GS10. Accessed: May 15, 2022.

FED (2022c). Sticky Price Consumer Price Index. Available at https://fred.stlouisfed.org/series/STICKCPIM157SFRBATL. Accessed: May 18, 2022.

Frank, M. Z. and Goyal, V. K. (2003). Testing the pecking order theory of capital structure. *Journal of financial economics*, 67(2):217–248.

Frank, M. Z. and Goyal, V. K. (2009). Capital structure decisions: which factors are reliably important? *Financial management*, 38(1):1–37.

Grabowski, R. J. (2018). The size effect continues to be relevant when estimating the cost of capital. *Business Valuation Review*, 37(3):93–109.

Graham, J. R. and Leary, M. T. (2011). A review of empirical capital structure research and directions for the future. *Annu. Rev. Financ. Econ.*, 3(1):309–345.

Graham, J. R., Leary, M. T., and Roberts, M. R. (2015). A century of capital structure: The leveraging of corporate america. *Journal of financial economics*, 118(3):658–683.

Gujarati, D. N. (2021). *Essentials of econometrics*. SAGE Publications.

Hamada, R. S. (1972). The effect of the firm's capital structure on the systematic risk of common stocks. *The journal of finance*, 27(2):435–452.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica: Journal of the econometric society*, pages 1251–1271.

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The stata journal*, 7(3):281–312.

Homaifar, G., Zietz, J., and Benkato, O. (1994). An empirical model of capital structure: some new evidence. *Journal of Business Finance & Accounting*, 21(1):1–14.

Hovakimian, A., Opler, T., and Titman, S. (2001). The debt-equity choice. *Journal of Financial and Quantitative analysis*, 36(1):1–24.

Huang, R. and Ritter, J. R. (2005). Testing the market timing theory of capital structure. *Journal of Financial and Quantitative Analysis*, 1(2):221–246.

Jegadeesh, N. and Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of finance*, 48(1):65–91.

Jensen, M. C. and Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics*, 3(4):305–360.

Kraus, A. and Litzenberger, R. H. (1973). A state-preference model of optimal financial leverage. *The journal of finance*, 28(4):911–922.

Landroni (2012). Fama-MacBeth and Cluster-Robust (by Firm and Time) Standard Errors in R. Available at https://www.r-bloggers.com/2012/06/fama-macbeth-and-cluster-robust-by-firm-and-time-standard-errors-in-r/. Accessed: May 22, 2022.

Lemmon, M. L., Roberts, M. R., and Zender, J. F. (2008). Back to the beginning: persistence and the cross-section of corporate capital structure. *The journal of finance*, 63(4):1575–1608.

Li, Y., Ng, D. T., and Swaminathan, B. (2013). Predicting market returns using aggregate implied cost of capital. *Journal of Financial Economics*, 110(2):419–436.

Lucas, D. J. and McDonald, R. L. (1990). Equity issues and stock price dynamics. *The journal of finance*, 45(4):1019–1043.

Modigliani, F. and Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American economic review*, 48(3):261–297.

Modigliani, F. and Miller, M. H. (1963). Corporate income taxes and the cost of capital: a correction. *The American economic review*, 53(3):433–443.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of financial economics*, 5(2):147–175.

Myers, S. C. (1984). Capital structure puzzle. *The journal of finance*, 39(3):574–592.

Myers, S. C. (2001). Capital structure. *Journal of Economic perspectives*, 15(2):81–102.

NorgesBank (2022). Rentebeslutning Mars 2022.

OECD (2022). Consumer Price Index: Harmonized Prices: Total All Items for the Euro Area. Available at https://fred.stlouisfed.org/series/CPHPTT01EZM659N. Accessed: May 22, 2022.

Panno, A. (2003). An empirical investigation on the determinants of capital structure: the uk and italian experience. *Applied financial economics*, 13(2):97–112.

Penman, S. H., Richardson, S. A., and Tuna, I. (2007). The book-to-price effect in stock returns: accounting for leverage. *Journal of accounting research*, 45(2):427–467.

Pesaran, M. H. (2015). Testing weak cross-sectional dependence in large panels. *Econometric reviews*, 34(6-10):1089–1117.

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *The Review of financial studies*, 22(1):435–480.

Rajan, R. G. and Zingales, L. (1995). What do we know about capital structure? some evidence from international data. *The journal of Finance*, 50(5):1421–1460.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The journal of finance*, 19(3):425–442.

Titman, S. and Wessels, R. (1988). The determinants of capital structure choice. *The Journal of finance*, 43(1):1–19.

Torres-Reyna, O. (2007). Panel data analysis fixed and random effects using stata (v. 4.2). *Data & Statistical Services, Priceton University*, 112.

Warner, J. B. (1977). Bankruptcy costs: Some evidence. *The journal of Finance*, 32(2):337–347.

Welch, I. (2004). Capital structure and stock returns. *Journal of political economy*, 112(1):106–131.

Appendix

A1 Appendix 1: Non-Winsorized descriptives

Table A1.1: Descriptive Statistics

	mean	min	max	std.dev	median	skew	ex.kurt
Return	0.21	-1.00	23.29	0.98	0.06	7.76	130.55
Debt Ratio	0.29	0.00	0.99	0.21	0.27	0.33	-0.82
Log Total Assets	14.44	9.23	20.73	1.91	14.40	0.21	-0.21
ROE	-0.17	-159.27	10.42	3.22	0.06	-42.40	2054.40
Book-to-Market	1.09	0.00	111.11	2.65	0.66	27.95	1064.25
Total Assets (millions)	12973	10	1002476	59266	1788		

N observations: 2910

A2 Appendix 2: Fama Macbeth Regression

Model Summary

Model 1

```
Mean Groups model

Call:
pmg(formula = return ~ debt_ratio, data = wind, index = c("Year",
    "isin"))

Unbalanced Panel: n = 29, T = 50-142, N = 2910

Residuals:
      Min.    1st Qu.     Median    3rd Qu.       Max.
-1.9714342 -0.3648081 -0.0959446  0.2134307  6.4696415

Coefficients:
             Estimate Std. Error z-value  Pr(>|z|)
(Intercept)  0.270696   0.079682  3.3972 0.0006808 ***
debt_ratio  -0.207618   0.097479 -2.1299 0.0331823 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Total Sum of Squares: 1811.3
Residual Sum of Squares: 1393.4
Multiple R-squared: 0.23072
```

Model 2

```
Mean Groups model

Call:
pmg(formula = return ~ debt_ratio + beta, data = wind, index = c("Year",
    "isin"))

Unbalanced Panel: n = 29, T = 50-142, N = 2910

Residuals:
       Min.     1st Qu.      Median     3rd Qu.        Max.
-2.59583587 -0.35459988 -0.08808929  0.21340452  6.44717799

Coefficients:
             Estimate Std. Error z-value  Pr(>|z|)
(Intercept)  0.253076   0.075577  3.3486 0.0008123 ***
debt_ratio  -0.201182   0.101679 -1.9786 0.0478615 *
beta         0.025122   0.021462  1.1705 0.2417891
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Total Sum of Squares: 1811.3
Residual Sum of Squares: 1365.5
Multiple R-squared: 0.24614
```

Model 3

```
Mean Groups model

Call:
pmg(formula = return ~ debt_ratio + beta + book_market, data = wind,
    index = c("Year", "isin"))

Unbalanced Panel: n = 29, T = 50-142, N = 2910

Residuals:
       Min.     1st Qu.      Median     3rd Qu.        Max.
-3.16224091 -0.33943214 -0.08149397  0.22254357  6.24609070

Coefficients:
              Estimate Std. Error z-value  Pr(>|z|)
(Intercept)  0.2379167  0.0714480  3.3299 0.0008687 ***
debt_ratio  -0.2428538  0.0988848 -2.4559 0.0140521 *
beta         0.0306698  0.0206748  1.4834 0.1379575
book_market  0.0074676  0.0302920  0.2465 0.8052799
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Total Sum of Squares: 1811.3
Residual Sum of Squares: 1284.3
Multiple R-squared: 0.29095
```

Model 4

```
Mean Groups model

Call:
pmg(formula = return ~ debt_ratio + beta + book_market + ROE,
    data = wind, index = c("Year", "isin"))

Unbalanced Panel: n = 29, T = 50-142, N = 2910

Residuals:
       Min.     1st Qu.      Median     3rd Qu.        Max.
-3.06523797 -0.33053823 -0.07487955  0.22244697  6.22886155

Coefficients:
             Estimate Std. Error z-value Pr(>|z|)
(Intercept)  0.229360   0.071426  3.2112 0.001322 **
debt_ratio  -0.262853   0.101408 -2.5920 0.009541 **
beta         0.024361   0.020970  1.1617 0.245355
book_market  0.016575   0.028050  0.5909 0.554578
ROE          0.025409   0.072333  0.3513 0.725382
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Total Sum of Squares: 1811.3
Residual Sum of Squares: 1236.1
Multiple R-squared: 0.31759
```

Model 5

```
Mean Groups model

Call:
pmg(formula = return ~ debt_ratio + beta + book_market + ROE +
    return_t, data = wind, index = c("Year", "isin"))

Unbalanced Panel: n = 29, T = 50-142, N = 2910

Residuals:
       Min.     1st Qu.      Median     3rd Qu.        Max.
-2.99713773 -0.32467497 -0.06866863  0.22255279  5.95474617

Coefficients:
             Estimate Std. Error z-value Pr(>|z|)
(Intercept)  0.191084   0.067779  2.8192 0.004814 **
debt_ratio  -0.270161   0.096269 -2.8063 0.005011 **
beta         0.010524   0.018852  0.5583 0.576667
book_market  0.023589   0.028255  0.8349 0.403793
ROE         -0.033553   0.052550 -0.6385 0.523152
return_t     0.014400   0.058641  0.2456 0.806018
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Total Sum of Squares: 1811.3
Residual Sum of Squares: 1196.9
Multiple R-squared: 0.33919
```

Model 6

```
Mean Groups model

Call:
pmg(formula = return ~ debt_ratio + beta + book_market + ROE +
    return_t + size, data = wind, index = c("Year", "isin"))

Unbalanced Panel: n = 29, T = 50-142, N = 2910

Residuals:
       Min.     1st Qu.      Median     3rd Qu.        Max.
-3.05845440 -0.31275773 -0.05753605  0.21893730  5.77046976

Coefficients:
               Estimate  Std. Error z-value Pr(>|z|)
(Intercept)  0.62979407  0.23130684  2.7228 0.006474 **
debt_ratio  -0.17862849  0.08171590 -2.1860 0.028818 *
beta         0.00975448  0.01985142  0.4914 0.623162
book_market  0.03135310  0.02813447  1.1144 0.265107
ROE         -0.00094069  0.04683947 -0.0201 0.983977
return_t     0.01291807  0.05947070  0.2172 0.828039
size        -0.03290496  0.01388440 -2.3699 0.017792 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Total Sum of Squares: 1811.3
Residual Sum of Squares: 1157.8
Multiple R-squared: 0.3608
```

T Statistics

Model 1

```
t test of coefficients:

             Estimate Std. Error t value  Pr(>|t|)
(Intercept)  0.270696   0.079682  3.3972 0.0006899 ***
debt_ratio  -0.207618   0.097479 -2.1299 0.0332660 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Model 2

```
t test of coefficients:

             Estimate Std. Error t value  Pr(>|t|)
(Intercept)  0.253076   0.075577  3.3486 0.0008226 ***
debt_ratio  -0.201182   0.101679 -1.9786 0.0479557 *
beta         0.025122   0.021462  1.1705 0.2418850
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Model 3

```
t test of coefficients:

              Estimate Std. Error t value  Pr(>|t|)
(Intercept)  0.2379167  0.0714480  3.3299 0.0008795 ***
debt_ratio  -0.2428538  0.0988848 -2.4559 0.0141103 *
beta         0.0306698  0.0206748  1.4834 0.1380659
book_market  0.0074676  0.0302920  0.2465 0.8052973
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Model 4

```
t test of coefficients:

              Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.229360   0.071426  3.2112 0.001336 **
debt_ratio  -0.262853   0.101408 -2.5920 0.009589 **
beta         0.024361   0.020970  1.1617 0.245450
book_market  0.016575   0.028050  0.5909 0.554624
ROE          0.025409   0.072333  0.3513 0.725407
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Model 5

```
t test of coefficients:

              Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.191084   0.067779  2.8192 0.004847 **
debt_ratio  -0.270161   0.096269 -2.8063 0.005045 **
beta         0.010524   0.018852  0.5583 0.576710
book_market  0.023589   0.028255  0.8349 0.403862
ROE         -0.033553   0.052550 -0.6385 0.523203
return_t     0.014400   0.058641  0.2456 0.806036
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Model 6

```
t test of coefficients:

              Estimate  Std. Error t value Pr(>|t|)
(Intercept)  0.62979407  0.23130684  2.7228 0.006513 **
debt_ratio  -0.17862849  0.08171590 -2.1860 0.028897 *
beta         0.00975448  0.01985142  0.4914 0.623199
book_market  0.03135310  0.02813447  1.1144 0.265199
ROE         -0.00094069  0.04683947 -0.0201 0.983978
return_t     0.01291807  0.05947070  0.2172 0.828054
size        -0.03290496  0.01388440 -2.3699 0.017857 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

A3 Appendix 3: Fixed Effects Regression Model

```
Oneway (individual) effect Within Model

Call:
plm(formula = return ~ debt_ratio + beta + book_market + ROE +
    return_t + size + factor(Year), data = wind, model = "within",
    index = "isin")

Unbalanced Panel: n = 331, T = 1-29, N = 2910

Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-2.172226 -0.333812 -0.038404  0.225158  5.942623

Coefficients:
                  Estimate Std. Error t-value  Pr(>|t|)
debt_ratio        0.591891   0.133872  4.4213 1.022e-05 ***
beta              0.090801   0.027098  3.3508 0.0008174 ***
book_market       0.091043   0.013152  6.9226 5.593e-12 ***
ROE               0.019964   0.020927  0.9540 0.3401908
return_t         -0.027736   0.019863 -1.3964 0.1627252
size             -0.234988   0.025487 -9.2201 < 2.2e-16 ***
factor(Year)1992  1.185084   0.140135  8.4567 < 2.2e-16 ***
factor(Year)1993  0.296723   0.137409  2.1594 0.0309105 *
factor(Year)1994  0.709409   0.137030  5.1770 2.431e-07 ***
factor(Year)1995  0.853927   0.138730  6.1553 8.679e-10 ***
factor(Year)1996  0.713198   0.137970  5.1692 2.533e-07 ***
factor(Year)1997  0.061232   0.133298  0.4594 0.6460127
factor(Year)1998  0.762203   0.133886  5.6929 1.392e-08 ***
factor(Year)1999  0.335227   0.133963  2.5024 0.0123985 *
factor(Year)2000  0.158599   0.135296  1.1722 0.2412109
factor(Year)2001  0.050429   0.135165  0.3731 0.7091112
factor(Year)2002  1.313466   0.136122  9.6492 < 2.2e-16 ***
factor(Year)2003  0.822467   0.135820  6.0555 1.606e-09 ***
factor(Year)2004  0.930032   0.135153  6.8813 7.438e-12 ***
factor(Year)2005  0.726158   0.137658  5.2751 1.439e-07 ***
factor(Year)2006  0.574160   0.137107  4.1877 2.914e-05 ***
factor(Year)2007 -0.060893   0.137597 -0.4425 0.6581328
factor(Year)2008  1.035434   0.137798  7.5142 7.884e-14 ***
factor(Year)2009  0.614094   0.135996  4.5155 6.603e-06 ***
factor(Year)2010  0.285452   0.136704  2.0881 0.0368873 *
factor(Year)2011  0.586368   0.137918  4.2516 2.199e-05 ***
factor(Year)2012  0.918748   0.138557  6.6308 4.062e-11 ***
factor(Year)2013  0.491795   0.139911  3.5151 0.0004473 ***
factor(Year)2014  0.568939   0.142115  4.0034 6.423e-05 ***
factor(Year)2015  0.666399   0.142898  4.6635 3.270e-06 ***
factor(Year)2016  0.592710   0.142446  4.1609 3.275e-05 ***
```

```
factor(Year)2017  0.489242   0.142443  3.4346 0.0006028 ***
factor(Year)2018  0.878219   0.143687  6.1120 1.135e-09 ***
factor(Year)2019  0.923294   0.144413  6.3934 1.923e-10 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    1621.8
Residual Sum of Squares: 1180.3
R-Squared:      0.27222
Adj. R-Squared: 0.16813
F-statistic: 27.9984 on 34 and 2545 DF, p-value: < 2.22e-16
```

A4 Appendix 4: Sorting Low and High Levels of Debt

Model Summary

Low Levels of Debt

```
Mean Groups model

Call:
pmg(formula = return ~ debt_ratio + beta + book_market + ROE +
    return_t + size, data = low_level, index = c("Year", "isin"))

Unbalanced Panel: n = 29, T = 15-43, N = 882

Residuals:
       Min.     1st Qu.      Median     3rd Qu.        Max.
-2.66500306 -0.30866576 -0.05187872  0.22374585  4.39221271

Coefficients:
             Estimate Std. Error z-value Pr(>|z|)
(Intercept)  0.967534   0.313248  3.0887 0.002010 **
debt_ratio   0.264949   0.824270  0.3214 0.747881
beta         0.042516   0.047646  0.8923 0.372216
book_market  0.022150   0.077255  0.2867 0.774334
ROE          0.188454   0.220440  0.8549 0.392607
return_t     0.019525   0.102604  0.1903 0.849075
size        -0.064727   0.024788 -2.6112 0.009022 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Total Sum of Squares: 689.16
Residual Sum of Squares: 349.81
Multiple R-squared: 0.49241
```

High Levels of Debt

```
Mean Groups model

Call:
pmg(formula = return ~ debt_ratio + beta + book_market + ROE +
    return_t + size, data = high_level, index = c("Year", "isin"))

Unbalanced Panel: n = 29, T = 15-43, N = 879

Residuals:
       Min.     1st Qu.      Median     3rd Qu.        Max.
-2.26308936 -0.29281207 -0.04453235  0.22282716  5.03313451

Coefficients:
             Estimate Std. Error z-value Pr(>|z|)
(Intercept)  0.620285   0.304742  2.0354  0.04181 *
debt_ratio  -0.434491   0.253398 -1.7147  0.08641 .
beta         0.048684   0.044966  1.0827  0.27896
book_market  0.022963   0.035874  0.6401  0.52211
ROE          0.035379   0.108326  0.3266  0.74397
return_t     0.028011   0.081074  0.3455  0.72972
size        -0.023399   0.015568 -1.5031  0.13283
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Total Sum of Squares: 486.24
Residual Sum of Squares: 244.13
Multiple R-squared: 0.49792
```

T Statistics

Low Levels of Debt

```
t test of coefficients:

             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.967534   0.313248  3.0887 0.002074 **
debt_ratio   0.264949   0.824270  0.3214 0.747958
beta         0.042516   0.047646  0.8923 0.372461
book_market  0.022150   0.077255  0.2867 0.774402
ROE          0.188454   0.220440  0.8549 0.392841
return_t     0.019525   0.102604  0.1903 0.849119
size        -0.064727   0.024788 -2.6112 0.009176 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

High Levels of Debt

```
t test of coefficients:

             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.620285   0.304742  2.0354  0.04211 *
debt_ratio  -0.434491   0.253398 -1.7147  0.08676 .
beta         0.048684   0.044966  1.0827  0.27925
book_market  0.022963   0.035874  0.6401  0.52228
ROE          0.035379   0.108326  0.3266  0.74405
return_t     0.028011   0.081074  0.3455  0.72980
size        -0.023399   0.015568 -1.5031  0.13319
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

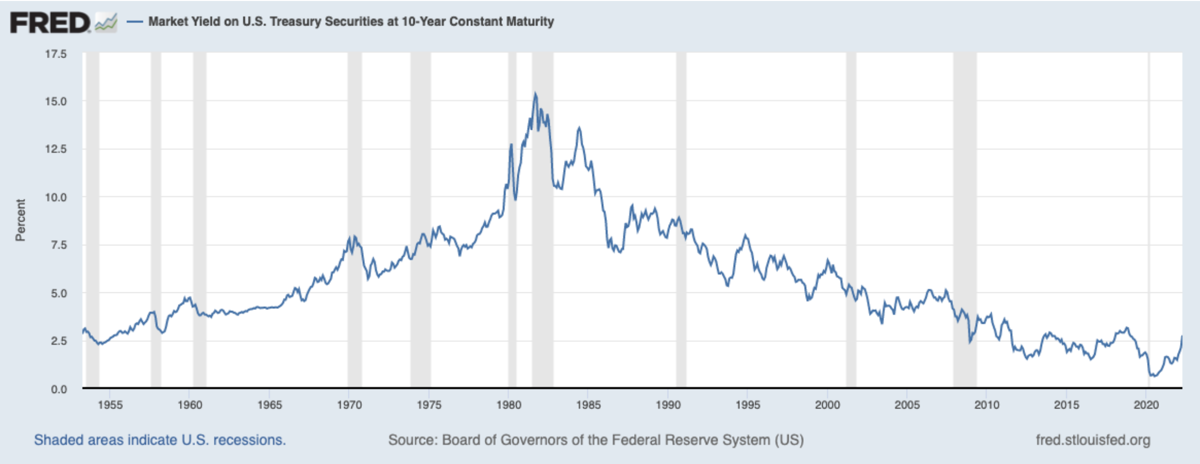
Confidence Intervals

Table A4.1: 90% Confidence Intervals

	Point Estimate	Lower Boundary	Upper Boundary
Low Leverage	0.265	-1.091	1.620
High Leverage	-0.435	-0.851	-0.018

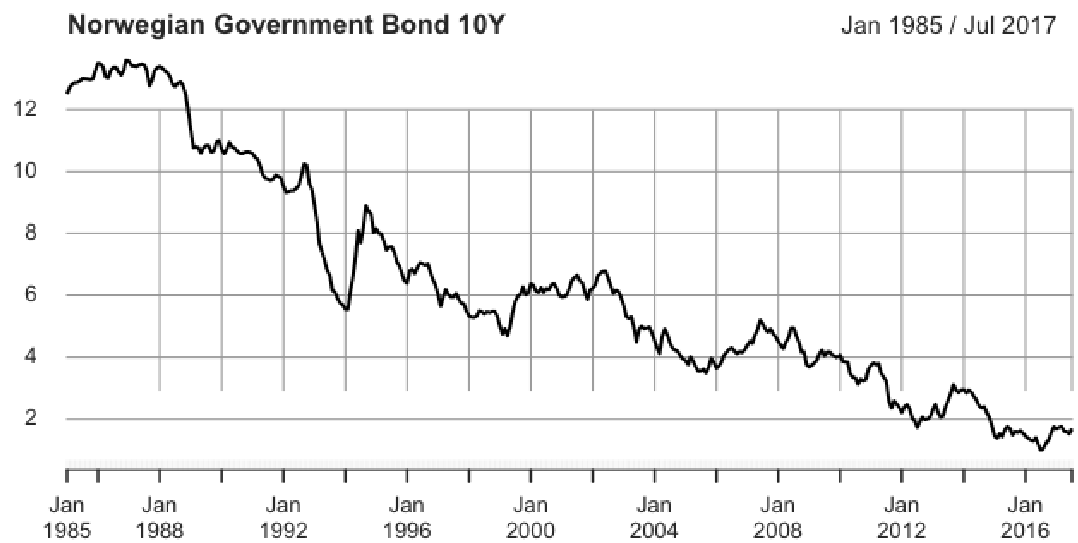
A5 Appendix 5: Interest Rates

Figure A5.1: U.S Government Bond 10Y (monthly data)



Source: FED (2022b)

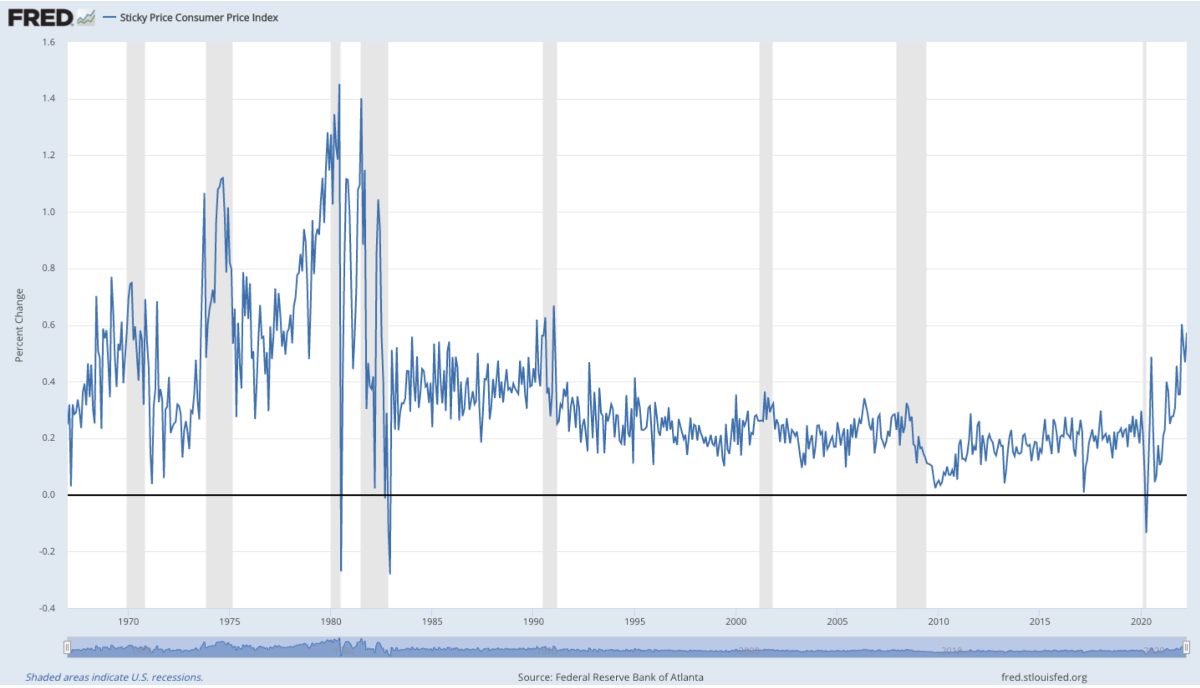
Figure A5.2: Norwegian Government Bond 10Y (monthly data)



Source: Eitrheim et al. (2004)

A6 Appendix 6: Consumer Price Indices

Figure A6.1: Sticky Price Consumer Price Index



Source: FED (2022c)

This index is calculated from a subset of goods and services from the US CPI that change price relatively infrequently. Because these prices change relatively infrequently, they are thought to incorporate expectations about future inflation in a good way (FED, 2022c).

Figure A6.2: Consumer Price Index: Harmonized Prices: Total All Items for the Euro Area

Source: OECD (2022)

This CPI from the Euro area include food and energy prices, which are goods with very volatile prices. This index is thought to give a good representation of the current environment in Europe, where energy and food prices have increased substantially over the past year, and even further due to the geopolitical conflicts of the Ukraine War 2022.

8 R-Script

This section include the R-code used in our analysis.

```
####-----------------------------------------------------------------####
#### Script 1 - Intital Data Cleaning                                ####
####-----------------------------------------------------------------####

rm(list=ls(all=TRUE))
#load package
library(dplyr) #for data cleaning

#Read monthly data, formate date
monthly_df <- read.csv("Monthly stock market data.csv", header=TRUE, sep=";")
monthly_df <- monthly_df[!is.na(monthly_df$RI), ]
monthly_df <- monthly_df %>% separate(col = month, into = c("Year", "Month"),
                                      sep = "m")
monthly_df <- monthly_df %>% mutate(across(Year:Month, as.numeric))
#Use December close as a reference point in time
monthly_df<-monthly_df[!monthly_df$Month %in% (1:11),]
#read annual accounting data
yearly_df <- read.csv("Yearly accounting data.csv", header=TRUE, sep=";")
colnames(yearly_df)<- c("isin", "Year",  "revenue", "net_income", "cash",
                        "ppe","intangible", "total_assets", "short_debt",
                        "long_debt","total_debt", "treasury_stock",
                        "common_equity", "capex","purch_reed_ret_conv",
                        "operating_cf", "dividend")
#Merge data
joined_df<- merge(monthly_df, yearly_df, by=c("isin","Year"))
#remove rows with missing data on the variables we need
joined_df<-drop_na(joined_df, total_debt, total_assets, net_income,
                   common_equity,capex, MV)

#Load static data (sector)
static_df <- read.csv("Static data.csv", header=TRUE, sep=";")
joined_df<- merge(joined_df, static_df, by="isin")
#Exclude financial/utilities firms and non-positive book values of equity
joined_df <- joined_df[!joined_df$WC07021 %in% c(4900:4999, 6000:6099,
                                                 6100:6199,6300:6399,
                                                 6400:6411, 6500:6553,
                                                 6200:6299, 6700:6799),]
joined_df <- joined_df[!joined_df$common_equity < 0,]

#Make variables
joined_df$debt_ratio<-joined_df$total_debt/(joined_df$total_assets)
joined_df$size<-log(joined_df$total_assets)
joined_df$ROE<-joined_df$net_income/joined_df$common_equity
```

```
joined_df$book_market<-joined_df$common_equity/(joined_df$MV*1000)

# Calculating returns:
# Make a dataframe with RI and lagged RI
RI_df <-  joined_df %>% select(c('isin','Year', 'RI'))
RI_df <- RI_df %>% group_by(RI_df$isin) %>% filter(n() > 2)
f <- function(x) {
  RI <- ts(x$RI, start = x$Year[1])
  idx <- seq(length = length(RI))
  lag_RI <- cbind(RI, lag(RI, -1))[idx,]
  cbind(x[,1:2], lag_RI, row.names = NULL)
}
return_df <- do.call("rbind", by(RI_df, RI_df$isin, f))

# 2 dataframes, one with returns (t+1) and one return(t)
return_df$return<-(return_df$RI/return_df$`lag(RI, -1)`)-1
return_df <- data.frame(return_df$isin, return_df$Year, return_df$return)
colnames(return_df)<- c("isin", "Year",  "return")
return_df<-return_df[!is.infinite(return_df$return),]
return_t<-return_df   #"return now df
colnames(return_t)<-c("isin", "Year", "return_t")
return_df$Year<-as.numeric(return_df$Year) - 1


#merge the data
joined_df<-merge(joined_df, return_df, by=c("isin","Year"))
joined_df<-merge(joined_df, return_t, by=c("isin","Year"))


#create a new data with the RELEVANT variables
final_df<-data.frame(joined_df$isin, as.integer(joined_df$Year),
                      joined_df$return, joined_df$debt_ratio,
                      joined_df$size, joined_df$ROE,
                     joined_df$book_market,joined_df$WC07021,
                     joined_df$return_t,
                      joined_df$total_assets)
colnames(final_df)<- c("isin", "Year",  "return", "debt_ratio",
                        "size", "ROE",  "book_market",
                        "sector", "return_t", "tot_assets")
final_df<-final_df[!is.nan(final_df$return),] #remove nan

#Data from 1990
final1990_df <- final_df[!final_df$Year %in% 1980:1989,]

#save the file
write.csv(final1990_df,"final.csv", row.names = FALSE)

####-----------------------------------------------------------------####
```

```r
#### Script 2 - Analysis                                                  ####
####--------------------------------------------------------------------####

rm(list=ls(all=TRUE))
library(plm)       #for panel data
library(moments)   #for descriptives
library(xtable)    #for tables
library(stargazer) #for tables
library(pastecs)   #for descriptives
library(xts)       #for plotting
library(tseries)   #for plotting
library(car)       #for variance inflation factor

#read data and merge
final_df <- read.csv("final.csv", header=TRUE, sep=",")
final_df<-final_df[!is.na(final_df$return_t),]
beta_df<-read.csv("beta.csv",
                  header=TRUE, sep=";") #12 month rolling,calculated using Stata
beta_df <- data.frame(beta_df$isin,beta_df$Year, beta_df$Beta )
colnames(beta_df)<-c("isin","Year","beta")
final_df<- merge(final_df, beta_df, by=c("isin","Year"))


#Winsorize
wind <- final_df %>%
  group_by(Year) %>%
  mutate(debt_ratio = Winsorize(debt_ratio, probs = c(0.01,0.99)),
         book_market = Winsorize(book_market,probs = c(0.01,0.99)),
         ROE = Winsorize(ROE,probs = c(0.01,0.99)),
         size = Winsorize(size,probs = c(0.01,0.99)),
         return = Winsorize(return,probs = c(0.01,0.99)),
         return_t = Winsorize(return_t,probs = c(0.01,0.99)),
         beta = Winsorize(beta,probs = c(0.01,0.99))
  )
n_distinct(wind$isin) #331 companies in our sample


#---------------------Descriptive Analysis-----------------------------------#
desc<-stat.desc(wind[, c(3:7,10)])
desc<-desc[c(9,4:5,13,8),]
desc<-t(desc) #transpose
skewness<-rbind(skewness(wind$return), skewness(wind$debt_ratio),
                skewness(wind$size), skewness(wind$ROE),
                skewness(wind$book_market),
                skewness(wind$tot_assets))
colnames(skewness)<-"skew"
ex.kurt<-rbind((kurtosis(wind$return)-3), (kurtosis(wind$debt_ratio)-3),
               (kurtosis(wind$size)-3), (kurtosis(wind$ROE)-3),
```

```
                (kurtosis(wind$book_market)-3),
                (kurtosis(wind$tot_assets)-3))
colnames(ex.kurt)<-"ex.kurt"
desc<-cbind(desc, skewness)
desc<-cbind(desc, ex.kurt)
desc<-as.data.frame(desc)
desc[6,]<-desc[6,]/1000
desc_table<-xtable(desc, digits = 2)
print(desc_table)

#non- winsorized
desc<-stat.desc(final_df[, c(3:7,10)])
desc<-desc[c(9,4:5,13,8),]
desc<-t(desc) #transpose
skewness<-rbind(skewness(final_df$return), skewness(final_df$debt_ratio),
                skewness(final_df$size), skewness(final_df$ROE),
                skewness(final_df$book_market),
                skewness(final_df$tot_assets))
colnames(skewness)<-"skew"
ex.kurt<-rbind((kurtosis(final_df$return)-3), (kurtosis(final_df$debt_ratio)-3),
               (kurtosis(final_df$size)-3), (kurtosis(final_df$ROE)-3),
               (kurtosis(final_df$book_market)-3),
               (kurtosis(final_df$tot_assets)-3))
colnames(ex.kurt)<-"ex.kurt"
desc<-cbind(desc, skewness)
desc<-cbind(desc, ex.kurt)
desc<-as.data.frame(desc)
desc[6,]<-desc[6,]/1000
desc_table<-xtable(desc, digits = 2)
print(desc_table)

#Distribution of Variables
hist(wind$debt_ratio,
     xlab = "Debt Ratio",
     main = " ",
     breaks = 100)
hist(wind$book_market,
     xlab = "Book to Market",
     main = " ",
     breaks = 100)
hist(wind$ROE,
     xlab = "ROE",
     main = " ",
     breaks = 100)
hist(wind$return,
     xlab = "Return",
     main = " ",
     breaks = 100)
```

```
#Annual development
annual_return<-aggregate(wind$return_t, list(wind$Year), FUN=mean)
colnames(annual_return)<-c("Year", "return")
annual_debt<-aggregate(wind$debt_ratio, list(wind$Year), FUN=mean)
colnames(annual_debt)<-c("Year", "debt_ratio")
annual_size<-aggregate(wind$tot_assets, list(wind$Year), FUN=mean)
colnames(annual_size)<-c("Year", "size")
annual<- merge(annual_return, annual_debt, by="Year")
annual<- merge(annual, annual_size, by="Year")
#Indexing
annual_zoo<-read.zoo(annual)
return.years<-as.yearmon(annual_return$Year)
return.years<-as.Date(return.years, frac = 12)
return.years<-as.yearmon(return.years)
return_zoo<-xts(annual$return, order.by = return.years)
#plotting
plot(return_zoo, type="b",pch=16, main = "",
     ylim = c(-0.6,1.2 ))
debt_zoo<-xts(annual$debt_ratio, order.by = return.years)
plot(debt_zoo, type="b",pch=16, main = "",
     ylim=c(0.225,0.365))
size_zoo<-xts(annual$size/1000000, order.by = return.years)
plot(size_zoo, type="b",pch=16, main = "",
     ylim=c(2.5,25))
barplot(with(wind, tapply(isin, Year, function(v) length(unique(v)))))


#-----------------Initial testing----------------------#
#Model estimation, used for testing
fixed <- plm(return ~ debt_ratio+ beta + book_market +ROE+ return_t + size,
             data=wind, index="isin", model="within")
random <- plm(return ~ debt_ratio+ beta + book_market +ROE+ return_t + size,
              data=wind, index="isin", model="random")
ols <- plm(return ~ debt_ratio+ beta + book_market +ROE+ return_t + size,
           data=wind, index="isin", model="pooling")
fixed.time <- plm(return ~ debt_ratio+ beta + book_market +ROE+ return_t + size
                  + factor(Year), data=wind, index="isin", model="within")
#Testing
pFtest(fixed, ols) #Test for individual effects
phtest(fixed, random) #Test for ui correlation to regressors
vif(ols) #multicollinarity
pbgtest(fixed) #Serial Autocorrelation
pcdtest(fixed, test = c("cd")) #Cross-sectional Autocorrelation
bptest(fixed, studentize=F) #Heteroskedacity
pFtest(fixed.time, fixed) #Time Fixed Effects

#-----------------Fama Macbeth Regression---------------------------#
```

```
#Model estimation
model1 <- pmg(return ~  debt_ratio, wind,
              index=c("Year","isin"))
model2 <- pmg(return ~ debt_ratio+ beta, wind,
              index=c("Year","isin"))
model3<-pmg(return ~ debt_ratio+ beta + book_market, wind,
            index=c("Year","isin"))
model4<-pmg(return ~ debt_ratio+ beta + book_market +ROE, wind,
            index=c("Year","isin"))
model5<-pmg(return ~ debt_ratio+ beta + book_market +ROE+ return_t , wind,
            index=c("Year","isin"))
model6<-pmg(return ~ debt_ratio+ beta + book_market +ROE+ return_t + size,
            wind, index=c("Year","isin"))

#summary of full model
summary(model1)
summary(model2)
summary(model3)
summary(model4)
summary(model5)
summary(model6)
#T statistics
coeftest(model1)
coeftest(model2)
coeftest(model3)
coeftest(model4)
coeftest(model5)
coeftest(model6)
#Make table
stargazer(model1, model2, model3,model4,model5,model6,
          digits = 3,
          header = FALSE,
          type = "latex")



#------------------Fixed Effects Regression----------------------------#
#Model estimation
fix1 <- plm(return ~  debt_ratio+factor(Year), wind,
            index="isin", model="within")
fix2 <- plm(return ~ debt_ratio+ beta + factor(Year), wind,
            index="isin", model="within")
fix3 <- plm(return ~ debt_ratio+ beta + book_market+ factor(Year),
            wind, index="isin", model="within")
fix4 <- plm(return ~ debt_ratio+ beta + book_market +ROE+ factor(Year),
            wind, index="isin", model="within")
fix5 <- plm(return ~ debt_ratio+ beta + book_market +ROE+ return_t+
              factor(Year), wind, index="isin", model="within")
```

```
fix6 <- plm(return ~ debt_ratio+ beta + book_market +ROE+ return_t + size+
              factor(Year), wind, index="isin", model="within")

#HAC standard errors
cov1<- vcovHC(fix1, method = "arellano")
se1     <- sqrt(diag(cov1))
cov2<- vcovHC(fix2, method = "arellano")
se2     <- sqrt(diag(cov2))
cov3<- vcovHC(fix3, method = "arellano")
se3     <- sqrt(diag(cov3))
cov4<- vcovHC(fix4, method = "arellano")
se4     <- sqrt(diag(cov4))
cov5<- vcovHC(fix5, method = "arellano")
se5     <- sqrt(diag(cov5))
cov6<- vcovHC(fix6, method = "arellano")
se6     <- sqrt(diag(cov6))


#write table
stargazer(fix1,fix2, fix3,fix4,fix5,fix6,
          digits = 3,
          header = FALSE,
          se=list(se1,se2,se3,se4,se5,se6),
          type = "latex")




#Cross /within
individual_sd<-aggregate(wind$debt_ratio, list(wind$isin), FUN=sd)
colnames(individual_sd)<-c("isin", "sd")
individual_mean<-aggregate(wind$debt_ratio, list(wind$isin), FUN=mean)
colnames(individual_mean)<-c("isin", "mean")
individual<-merge(individual_sd, individual_mean, by="isin")
individual<-individual[!is.na(individual$sd),] #some firms only have data for 1y
cross_sd<-round(sd(individual$mean), digits=3)
mean_sd<-round(mean(individual$sd), digits=3)

hist(individual$mean,breaks = 30, main = "Cross-Sectional Mean Differences",
     xlab = "Individual mean (debt ratio)")
legend('topright',legend=parse(text=sprintf('paste(std,\' = %s\')',
                                            cross_sd)),bty='n')
hist(individual$sd,breaks = 30, main = "Within Firm Standard Deviation",
     xlab = "Individual standard deviation (debt ratio)")
legend('topright',legend=parse(text=sprintf('paste(mean,\' = %s\')',mean_sd))
       ,bty='n')
```

```r
#------Sorting Low and High Levels of Debt into 0.3 and 0.7 quantiles-------#
#Sorting 0.3 and 0.7 quantiles
debt_level <- ddply(wind, .(Year), mutate,
                    debt_sort = cut(debt_ratio,
                                    quantile(debt_ratio, c(0, 0.3,0.7, 1)),
                                    labels = c(1,2,3), include.lowest = T))
low_level<- debt_level[debt_level$debt_sort %in% 1,]
high_level<- debt_level[debt_level$debt_sort %in% 3,]

#model estimation
model_low<-pmg(return ~ debt_ratio+ beta + book_market +ROE+ return_t + size,
               low_level, index=c("Year","isin"))
model_high<-pmg(return ~ debt_ratio+ beta + book_market +ROE+ return_t + size,
                high_level, index=c("Year","isin"))

summary(model_low)
summary(model_high)
coeftest(model_low)
coeftest(model_high)
confint(model_high, level = 0.9)
confint(model_low, level = 0.9)
#write table
stargazer(model_low, model_high,
          digits = 3,
          header = TRUE,
          type = "latex")

#descriptives
desc<-stat.desc(high_level[, c(3:4)])
desc<-desc[c(9,4:5,13,8),]
desc<-t(desc) #transpose
desc_table<-xtable(desc, digits = 2)
print(desc_table)

desc1<-stat.desc(low_level[, c(3:4)])
desc1<-desc1[c(9,4:5,13,8),]
desc1<-t(desc1) #transpose
desc_table<-xtable(desc1, digits = 2)
print(desc_table)
```

9 Discussion Paper

9.1 International

Discussion Paper- Sunniva Volden

Master's Programme in Business Administration

Analytical Finance

Introduction

The title of our master thesis is " Leverage and Stock Performance: An Empirical Study of Leverage Ratio and Stock Returns in the Norwegian Market". The thesis is written as a part of my master´s degree in Analytical Finance, and was written together with Isak Haugen. We previously wrote our bachelor thesis together, and the cooperation have worked very well. We both have different strengths and weaknesses, and it has been an advantage to be able to benefit from each other's knowledge and skills. We found that writing a thesis in the field of Corporate Finance would suit both of us well, and bring together our previous knowledge and skills. I find the field of Corporate Finance very interesting, and after choosing Corporate Finance as an elective in my third semester, I was sure I wanted to write my master thesis about something within this field.

Corporate Finance

The field of Corporate Finance is not only theoretical, but also very practical focusing on real-world subjects. One of the fundamental questions in corporate finance is how firms choose to finance their operations, whether debt or equity, and why they have chosen the capital structure they currently have. It is interesting questions, and there exists a broad variety of research and studies on these particular questions. There are well known theories such as Modigliani and Miller (1958), Modigliani and Miller (1963), Trade-off Theory, Pecking Order theory, Agency Theory and Market Timing Theory. These theories all try to explain the capital structures of a firm, and how the choice between equity and debt might affect the firm value.

Our thesis

The main objective of our thesis is to find out if there is a relationship between firm leverage and stock performance, focusing on the Norwegian market. The research question is quite interesting, as there have been done similar studies using the same methodologies, but with differing results. Bhandari (1988) researched US stocks in the period 1949-1979 and found that stock returns are positively affected by the debt ratio. Bhandari (1988) argues that holding a larger portion of debt in the capital, will increase the risk, thus equity holders are compensated with higher returns. However, Cai and Zhang (2011) found that increasing the leverage, will negatively affect next period stock returns, which contradicts the findings of Bhandari. Further they find evidence of the existence of “debt overhang” (Myers, 1984) which will lead to sub-optimal investments.

We were inspired by these studies, and we gathered data on individual firms listed on Oslo Stock Exchange over the time period 1990-2020, and the data consist of both time series and cross-sectional elements, with information across time and space, referred to as panel data. We used the methodology of Fama and MacBeth (1973), which is a two-step regression. We first regressed each of the stock returns against their assumed factors, which is a ordinary least square (OLS) time-series regression. Then we used the average of the estimated coefficients for each stock from the OLS regressions, and performed a cross-sectional regression on all firms. The significance of the estimated beta values for each factor was then evaluated, providing evidence to claim whether the hypothesis hold or not. We found evidence that the debt ratio negatively affects stock returns, also after controlling for CAPM beta, book-to-market ratio, return on equity, previous period return and size. We also included a fixed effects model in our analysis, which provided evidence for the existence of a relationship between leverage and stock returns. The fixed effects model gave the opposite result, that leverage ratio positively affected stock returns. We found that there is more variation in debt ratios across firms, than for a given firm over time, hence the Fama MacBeth methodology was better suited to study cross-sectional relations. Further, we divided our sample into 0.3 and 0.7 percentiles based on their level of leverage. We found that firms with higher levels of leverage seems to be more negatively affected by increasing debt ratios, than firms with lower levels.

It has been very interesting and educational to work with large sets of data, and skills and knowledge developed throughout my masters degree, have been very useful for this kind of analysis.

International

The UIA School of Business and Law has three key concepts in its mission statement and strategy: International, innovative, and responsible. These concepts are considered by the School of Business and Law as particularly relevant for responsible and productive professionals within the field of business administration. In this next section, I will illustrate how our theme and findings are relevant to the concept International.

The capital structure theme is relevant on an international basis. The choice and balance between equity and debt is an important consideration that firm managers around the world faces, and there are several factors that need to be assessed in relation to this. The capital structure of the firms is also an important consideration for investors around the world when they evaluate which firms they want to invest in, and when assessing the risk of the companies.

Our focus have been on the Norwegian market, but our findings can be related to international trends and forces. We have had 30 years of declining interest rates globally, and the current low interest rate environment has been particularly well-entrenched since the Financial Crisis of 2008. Interest rates around the world declined further to handle the Covid-19 pandemic. Global supply chains have been greatly disrupted by the pandemic, and more recently the geopolitical conflicts of the Ukraine War 2022. In both the US and Euro economies, consumer price inflation rose this year to the highest levels in years. Central banks around the world have begun raising interest rates and indicate that they will increase even further (NorgesBank, 2022; FED, 2022). The future is uncertain, and investors, household and companies worldwide are worried that we are heading in to an economic environment of stagflation.

These international trends are particularly interesting for our thesis and findings. Our data was from 1990-2020, where we experienced falling interest rates over major economies. We found that high levels of debt negatively affected stock returns for this period. As we are now potentially entering a new economic environment, our findings and the meaning of the findings need to be evaluated.

One point of view is that increased leverage might not affect stock returns, when we potentially enter a higher interest rate environment. We can relate this to the findings of Bhandari (1988) whose study was in times of higher interest rates. Drawing on Trade-off theory, the net effect of increased interest rates on tax-shield benefits and financial distress costs might be positive, meaning that tax-shield benefits from holding larger portions of debt will increase firm value, thus stock returns.

Another view is that increased interest rates will affect the financial distress costs greatly, thus negatively affect firm value and stock performance. Firms with already high levels of debt, might struggle to meet their obligations and the likelihood of default increase. Higher interest rates leads to higher interest rates expenditures, which might negatively affect the net present value of new investments, thus growth will stagnate.

It is also important to note that our findings were inconsistent with some of the capital structure theories. These theories was developed based on evidence from other markets, but one can not draw the conclusion that the Norwegian market is very different. Most of the theories were developed and formulated in times when interest rates were substantially higher than they are today, which could potentially be a cause of these differences. Our findings were in line with Cai and Zhang (2011), Dimitrov and Jain, (2008) and Penman et al., (2007) whom conducted similar research in other markets.

The trends of rising interest rates and rising inflation are trends that will affect the financial markets and investors world-wide, and it is also interesting to evaluate this from an investor perspective. The correlation between equity and bond prices, moved from positive in the 1980´s and 1990´s, to negative since 2000 (Mortensen, 2021). Now that inflation is on the rise again, we might possibly experience a positive correlation again in, which means that investors does not get the desired diversifying effect from holding equity and bond, and they might need to look for other methods to diversify their portfolios. These trends are international, and investors around the world will need to consider this issue going forward.

Even though our study was conducted on the Norwegian market, some findings can relate to previous studies on an international basis. Panno (2003) found that companies in the developed financial markets were likely to have a target debt ratio. We found that the debt-ratio variations within Norwegian firms were small, and it is likely that the target debt-ratio is valid, also for the Norwegian market, which is a market considered well-developed.

Previous capital structure research has been focused on more international markets, such as the US. It is important that both firm managers and investors are aware of differences across the countries that might affect the capital structure decisions. We have studied the Norwegian market, and our findings are best suited to describe the current conditions here. This could differentiate from other countries in terms of composition of companies, macro environment, government regulations and corporate governance. Norway also has a higher degree of partially state owned firms on the stock exchange, and our findings might not be adaptable to other markets.

The companies listed on Oslo Stock Exchange are also affected by international trends and forces. Environmental, Social and Governance (ESG) has become increasingly important over the past years, and it is important that companies and investors include this as a part of their decisions process. Several companies listed on the Oslo Stock Exchange voluntarily follow international standards when reporting on ESG issues, such as the global reporting initiative standard (GRI) or Sustainability Accounting Standards Board (SASB).

Historically, companies were rated based on their Credit scores which was considered a big risk factor for the investor. Today, companies also receive ESG scores, and is also an important factor for the companies and investors. The focus on ESG might be important for a firms cost of capital and cost of debt, which might influence the capital structure decision greatly. Investors might demand a higher risk premium if companies does not have the desired ESG score, or companies might not get the best borrowing rates if they are not considered sustainable.

To sum up, international forces and trends are very relevant for the capital structure decision for Norwegian firms (as well as for the rest of the world). Global inflation and interest rates are two current topics all firms have to deal with. The global focus on ESG will also be important for the capital structure decisions, as investors incorporate such risks in their investment evaluation. Companies receive ESG scores, and investors have the opportunity to use this in their decision process. This can cause investors to demand a higher risk premium if the company does not have the desired ESG score. Creditors might also not wish to lend their money to companies that are not ESG compliant, and companies faces potential higher costs of debt.

Conclusion

Writing a thesis about capital structure have been very educational, and it will be very interesting to see how firms will react to international trends and forces going forward. Maybe previous theories regarding capital structure might not longer be valid going forward, and new theories will develop. However, there is no doubt that the capital structure decision will be of importance for both investors and companies.

9.2 Responsible

Discussion Paper- Isak Haugen

Master's Programme in Business Administration

Management Accounting

Responsible

In this discussion paper I will dive into challenges, experiences and achievements that I have been lucky enough to have at the University of Agder Business School. I have been enrolled in the University of Agder since 2017, and completed my bachelor's degree in 2020, before starting my master's degree in business administration, with a specialization in management. During my time here at the university, I have had a multitude of classes that has incorporated the importance of acting responsibly, as a student and in the workplace, but also generally in life. I will soon have completed five years at the university (of which one semester was abroad in Strasbourg, France), I am now well into writing my master's thesis. This thesis is being written together with my partner Sunniva Volden, which is also enrolled in the business administration program, although she is specializing in finance. We have previously written a bachelor's thesis together, which was a valuation of TrollAktiv AS, an adventure park in Evje. As our bachelor's thesis achieved the highest grade possible, we felt it natural to write our master's thesis together as well. Our supervisor is Nicha Lapanan.

Masters Thesis

The working title of our thesis per writing this paper is: “Leverage and Stock Performance: An Empirical Study of Leverage Ratio and Stock Returns in the Norwegian Market”. As you can probably tell, this thesis is mainly about finance, which is my partners specialization. I too, however, enjoy writing about this topic, as I have had several finance-related classes both in my bachelor’s and master’s program, in which I usually have achieved top grades. The main objective of our thesis is to research the matter of capital structure of Norwegian firms noted on the Oslo Stock Exchange and explore the data to see if there is any underlying correlation between changes in structures and stock performance. This is done through statistical analysis of large datasets. This data contains information such as firm size, stock performance, debt, equity etc. of all firms noted on the Oslo Stock Exchange since its inception up until the end of 2021. The challenge for us regarding all this data is to decide which variables to include in our analysis, and which to exclude. Using the statistical analysis program R-Studio, we have been able to create a rigid and concise analysis, which has so far yielded promising results. We have previously used this program in courses related to research method and finance, which we found was very valuable experience. In relation scientifical background, the historical background of the theories used in our paper is mainly rooted in the frameworks of Modigliani Miller, two frameworks that were introduced in the 1950’s – 1960’s (Modigliani and Miller, 1958), (Modigliani and Miller, 1963). Though the frameworks are “old”, they are still very much relevant in today’s research regarding capital structure. In short, the first framework explain how capital structures would be irrelevant in perfect capital markets, although they later introduced the second framework which includes the advantages of tax benefits using debt financing.

The main topic of this discussion paper is the concept of “responsible”. Responsible is defined as “answerable or accountable, as for something within one’s power, control, or management” (Dictionary.Com). In the context of this discussion paper, the matter of reasonability is connected to the writing and completion of my master’s thesis. So in what way can I ensure that I am acting in a responsible manner during the writing and completion of my thesis?

Academical responsibility

There are several points of discussion that could be important considering academical responsibility when writing a master's thesis. When writing a thesis, it is (at least in my opinion) important to write about something that you have experience with, find somewhat interesting, and have the ability to complete. If you choose a topic in which one or more of these factors are not present, the end product will not be optimal. As your thesis is in some way meant to be a culmination of the knowledge gathered over five years of studying, choosing something that is outside your base of experience is therefore not ideal. If you find the topic that you decide to write about boring or uninteresting, you will probably not have the motivation and drive to deliver a product on par with something more exiting. The process of writing a thesis is of course not all fun all the time, but you must have some level of interest in what you are writing about to be dedicated. Finally, you must choose a topic on which you have the ability to complete the process of writing the thesis. What I mean by this is that as a student, you must chose a topic on which you have the competence to create an end product that holds up to academical standards. If you have no technical experience or skill, choosing to write a quantitative thesis where you have to utilize complex analytical tools such as R or STATA, is not recommended, as you might end up with an end product that is either plagued by incorrect inputs or false conclusions. You must be able to not just compute, but also to understand and put the data into context of what you are researching. Now, what does all this have to do with responsibility? As master students, our responsibility is to be able to research and write about topics that are of interest to an academic community, not just ourselves. It is therefore of the upmost importance that the three factors I mentioned above are present when writing a thesis. If you were to deliver your thesis, and it had false conclusions, wrong data inputs, lacking theoretical background etc. you are effectively decreasing the academical level of your education community. It is therefore the responsibility of any master student to see to it that their thesis is on an adequate academical level. On a more practical note, it is of course of the upmost importance to use relevant academical literature and be able to cite said literature in a correct manner. It is also very important that the student puts the references into the right context, and to have a general and thorough understanding of the literature and theories on which his/her thesis is based. When it comes to my own thesis, I have spent several hours reading scientific published papers, and used much of my time deciding how to best integrate them into my research, as this is what I see as my responsibility.

Ethical Responsibility

When discussing the concept of responsibility in the context of a master's program and master's thesis, it is not just the practical and academical responsibilities one must consider. Ethical responsibility is very important, and is a theme that has been integrated into many of the courses of both my master's program and bachelor's program. In fact, my very first exam at the University of Agder was in the course SE-109 Innføring I økonomisk tenking og etikk, and the largest course of my master's program was TFL-400 Sustainable Capitalism, which also touched on the subject of ethical behavior and sustainability.

Ethical responsibility is defined as "ethical responsibility is the ability to recognize, interpret and act upon multiple principles and values according to the standards within a given field and/or context." (Empire, 2022). In context of the topic on which me and my partner has chosen to write our thesis, we must ask ourselves how might we act ethical? It is first of all important to use sources and literature from well known sources and journals, as mentioned previously. If one is to use resources such as google scholar or similar search engines, one must be able to differentiate between well written and acknowledge papers from the more unclear and unverified research. For our paper, there is a plethora of relevant and well known authors and articles which we can base our research upon, but for other students with other topics, it might not be as clear. If you were to write about the damages of oil pollution, one should be very critical when using reports published by oil drilling companies, as they are far from an objective source on the matter. For us however, it has been fairly easy to find good and well done research. Another important factor when discussing ethical responsibility in the context of writing a master's thesis is that you must be able to accept results which are not "in line" with what you wanted. It is of course always fun to see that your research is able to confirm your hypothesis, but it has to be done without malicious data manipulation and other unethical methods. This is true for both quantitative and qualitative research. Even when interviewing individuals or publishing surveys, you must be aware of potential questions that can be misleading, which makes the subject inclined to answer in another manner than what he/she would if the question was phrased differently. This is something we have touched upon in previous research method courses, and I think it is something that should be taught even more, as it is far to easy to fall into that “trap”. Another important factor of interview different types of subjects, as to not have a very biased response. If I was researching the political ideology of Kristiansand’s population, and I just were to interview students enrolled at the university, I might get very different answers than if I were to interview a broader group of individuals. Finally, it is very important to be able to have a good understanding of protection of privacy. If you tell your subjects that the interviews are anonymous, the data you gather should reflect this, meaning you do not require personalia such as name, surname, phone number etc., as age and occupation should be enough (depending on your topic of research). While this is not relevant for my own thesis, as I am conducting quantitative research on firms noted on the Oslo Stock Exchange, me and my partner must also be ethical in our research. In terms of data manipulations, one should remove outliers and extreme values where it is needed, but one must be careful not to manipulate the data just to get significant results. A smart and easy way to avoid this, is by making the process replicable for potential readers, as it removes any potential “secret” actions. Had the data been private however, this might not be possible.

General responsibility

Finally, as an enrolled student at a respected educational institution, I carry with a duty to enact a general level of responsibility. Of course tied to my institution, but also to myself as a person. The importance of acting responsible in every day activities could be said to be more important than anything else. Acting responsible is not always easy to do, as challenges can arise every day. Socially, one should act responsibly by being including, listing to others and generally by being a good person. Career wise, one must be careful not to act irresponsibly towards customers, co-workers, bosses, employees etc.

Summary

To summarize, it is very important for students to act responsibly. To act responsible is not always as straight forward as it seems, and students should continuously ask themselves if what they are doing is the correct actions, in terms of academical responsibility, ethical responsibility and general responsibility. No one is able to be responsible at all given times, but if you do your best and genuinely try, one can be defined as a responsible person.

Finally, I want to thank the University of Agder for five years of studies. These years have made a huge impact on me, and I will use the knowledge and experiences gathered in Kristiansand to act responsible in both my social life and career in the years coming.

9.3 References - Discussion Paper

Bhandari, L. C. (1988). Debt/equity ratio and expected common stock returns: Empirical evidence. *The journal of finance,* 43(2):507–528.

Cai, J. and Zhang, Z. (2011). Leverage change, debt overhang, and stock prices. *Journal of Corporate Finance,* 17(3):391–402.

Dictonary.Com (2022). Responsible. [May 16, 2022] https://www.dictionary.com/browse/responsible

Dimitrov, V. and Jain, P. C. (2008). The value-relevance of changes in financial leverage beyond growth in assets and gaap earnings. *Journal of Accounting, Auditing Finance,* 23(2):191–222.

Empire, S. (2022). Ethical Responsability. [May 16, 2022] www.esc.edu/global-learning-qualifications-framework/learning-domains/ethical-responsibility/

Fama, E. F. and MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *Journal of political economy,* 81(3):607–636.

FED (2022). Federal Reserve [press release, March 16, 2022]. Available at https://www.federalreserve.gov/monetarypolicy/files/monetary20220316a1.pdf. Accessed: May 18, 2022.

Modigliani, F. and Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American economic review,* 48(3):261–297.

Modigliani, F. and Miller, M. H. (1963). Corporate income taxes and the cost of capital: a correction. *The American economic review,* 53(3):433–443.

Mortensen, P. (2021). Is the stock-bond correlation positive or negative? Available at https: //russellinvestments.com/us/blog/is-the-stock-bond-correlation-positive-or-negative. Accessed: May 27, 2022.

Myers, S. C. (1984). Capital structure puzzle.

NorgesBank (2022). Rentebeslutning Mars 2022.

Panno, A. (2003). An empirical investigation on the determinants of capital structure: the uk and italian experience. *Applied financial economics*, 13(2):97–112.

Penman, S. H., Richardson, S. A., and Tuna, I. (2007). The book-to-price effect in stock returns: accounting for leverage. *Journal of accounting research*, 45(2):427–467.