Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Economics and Management
NTNU Business School

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# Determinants of capital structure: An empirical study of Norwegian listed firms

Master's thesis in Economics and Business Administration

Supervisor: Denis Becker

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# Preface

This thesis is an end to a two-year Master´s degree in Economics and Business Administration with a major in Finance, at NTNU Business School in Trondheim. I would like to express my gratitude to my supervisor, Denis Becker at NTNU Business School, for helping me choose the topic for my thesis. The process would not have been the same without his great guidance. This semester has been quite interesting, as well as challenging. Studying this topic has been a great learning experience and despite the difficulties, it has been a rewarding few months.

The contents in this master thesis are not necessarily endorsed by NTNU Business School, and any errors or omissions are the author´s own.

# Abstract

The goal for most firms is to maximise the firm value and the wealth of shareholders. Theories suggests that in order to achieve this goal, firms should use an optimal combination of debt and equity in order to reduce the weighted average cost of capital for the firm. However, choosing the optimal debt ratio could prove to be difficult. Because of this, being aware of the factors that might influence the capital structure choices, could be important. So far, several empirical studies have been conducted in order to identify and explain the determining factors of capital structure. This thesis contributes to the literature on capital structure by examining the determining factors of capital structure in Norwegian firms. The contribution is made in an attempt to fill the gap that exists when it comes to capital structure studies conducted solely on Norwegian firms.

The Thomson Reuters Eikon database was used in order to obtain the data needed to perform the statistical analysis. The data consists of yearly observations from 119 Norwegian firms listed on the Oslo Stock Exchange in the period 2015-2019. Six firm-specific factors were chosen based on previous empirical research and the dominating capital structure theories: the static trade-off theory and the pecking order theory. These factors include: profitability, size, growth, tangibility, non-debt tax shields and liquidity. The aim was to examine if these factors could explain the variations in the capital structure of Norwegian listed firms, and further, if the results could be explained by the two conditional theories.

Multiple regression analysis was used in order to examine the effect of these factors on the debt ratio. The results suggest that profitability, tangibility and liquidity are negatively correlated with the amount of debt in Norwegian firms. Non-debt tax shields have a positive relationship with the debt ratio, while size and growth appear to have no significant impact on the debt ratio. The conclusion has been made that neither the trade-off theory nor the pecking order theory can fully explain the variations in capital structure. However, the pecking order theory can be used to explain some of the variation.

# Sammendrag

Det overordnede målet til de fleste bedrifter er å maksimere verdien av selskapet. For å oppnå dette målet bør bedrifter benytte en optimal kombinasjon av gjeld og egenkapital, slik at den vektede gjennomsnittlige kapitalkostnaden reduseres. Det å identifisere en slik optimal kombinasjon av gjeld og egenkapital, kan derimot vise seg å være svært krevende. Det vil derfor være viktig at bedrifter er klar over de ulike faktorene som kan påvirke valget av kapitalstruktur. Det er gjennomført flere empiriske studier for å identifisere og forklare effekten av slike faktorer. Denne oppgaven bidrar til litteraturen om kapitalstruktur ved å foreta en kvantitativ analyse, der målet er å kartlegge hvile faktorer som bestemmer valget av kapitalstruktur i norske bedrifter.

Datamaterialet består av årlige observasjoner fra 119 norske selskaper notert på Oslo Børs i perioden 2015-2019. Seks bedriftsspesifikke forklaringsfaktorer har blitt valgt, med bakgrunn i tidligere forskning og de to dominerende teoriene om kapitalstruktur: ”the static trade-off theory” og ”the pecking order theory”. De valgte faktorene inkluderer: Lønnsomhet, bedriftsstørrelse, vekst, andel anleggsmidler, skatteskjold og likviditet. Målet for oppgaven var å undersøke om disse faktorene kunne forklare variasjonene i kapitalstrukturen til norske børsnoterte selskaper, og videre om resultatene kunne forklares av de to teoriene.

Multippel regresjonsanalyse ble benyttet for å undersøke effekten av disse faktorene på gjeldsgraden til de utvalgte bedriftene. Resultatene indikerer at lønnsomhet, andel anleggsmidler og likviditet er negativt korrelert med andel gjeld i norske bedrifter. Skatteskjold har et positivt forhold til andel gjeld, mens bedriftsstørrelse og vekst ikke har noen betydelig innvirkning på gjeldsgraden. Som et resultat, konkluderer oppgaven med at hverken trade-off-teorien eller pecking order-teorien fullt forklarer variasjonene i kapitalstrukturen, men pecking order-teorien kan benyttes til å forklare deler av variasjonen.

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# List of Abbreviations

| | |
|---|---|
| OLS | Ordinary least squares |
| GLS | Generalized least squares |
| EBIT | Earnings before interest and taxes |
| SSR | Sum of squared residuals |
| LSDV | Least-squares dummy variable |
| WG | Within group |
| ROA | Return on assets |
| LEV | Dependent variable leverage |
| PROF | Independent variable profitability |
| SIZE | Independent variable size |
| GROW | Independent variable growth |
| TANG | Independent variable tangibility |
| NDTS | Independent variable non-debt tax shields |
| LIQ | Independent variable liquidity |
| Ln | Natural logarithm |
| $H_0$ | Null hypothesis |
| $H_a$ | Alternative hypothesis |
| Y | Dependent variable |
| X | Independent variable |
| Pnorm | Probability plot |
| Qnorm | quantile normal distribution plot |
| VIF | Variance inflation factor |
| LM | Lagrange multiplier |

# 1. Introduction

Empirical studies regarding capital structure strive to explain the composition of debt and equity companies favour when financing their investments. Ever since Modigliani and Miller introduced their irrelevance theorem in 1958, capital structure has been a growing research area within business economics. Modigliani and miller (1958) argue, with their irrelevance theorem, that capital structure and how a company finances their investments are not of any significance to the value of the company. However, the irrelevance theorem is based on the assumption of perfect capital markets, where in reality capital markets are not perfect. As a result, several theories emerged arguing that market imperfections can be a driving factor for the choice of capital structure.

The two main theories include the static trade-off theory and the pecking order theory. The trade-off theory suggests that the choice of capital structure is a result of a trade-off between the costs and benefits of debt. Meanwhile, the pecking order theory explains that companies prefer to use internal financing when available, and chose debt over equity when external financing is required (Myers, 1984).

These theories represent the foundation of many studies conducted on the choice of capital structure. The goal of these studies are often to determine which model best explains the financing preferences of companies, and which factors determine their capital structure. However, past empirical research provides contradictory results, and the theories' ability to explain the capital structure remain limited.

## 1.1 Purpose and research problem

This thesis tries to highlight the most important firm-specific factors that determine the capital structure of Norwegian firms. The study is based on data gathered from 119 Norwegian firms listed on the Oslo Stock Exchange in the period 2015-2019. The firm-specific factors are chosen based on the two conditional theories as well as prior empirical research. Most of these studies are conducted on international firms, and the assumption is made that existing theory and prior research is transferable to Norwegian firms.

Available theories regarding capital structure and previous empirical research are discussed and assessed with the aim of producing testable claims. The findings from Norwegian firms will be evaluated to see if they are consistent with the prediction made by the two theories and how they compare to previous empirical findings. The analysis is conducted using similar methods and models as previous studies, where the hypotheses are tested using regression models.

The following research problem is constructed:

***"Which firm-specific factors are of significance to the capital structure in Norwegian listed firms."***

Where the research problem can be further divided into three sub-problems.

i. *Can the chosen firm-specific factors explain the variation in capital structure of Norwegian listed firms?*

ii. *Can the capital structure of Norwegian listed firms be explained by the static trade-off theory and the pecking order theory?*

iii. *How does the result of the study compare to previous empirical findings?*

## 1.2 Structure

Based on the research problem presented in the previous section, this thesis will be divided into five chapters.

1. Introduction

   The introduction presents the background for this thesis, followed by the purpose and research problem.

2. Theoretical framework

   This chapter defines and discusses the term capital structure. The Modigliani and miller irrelevance theorem is presented, followed by the two main theories regarding capital structure: the static trade-off theory and the pecking order theory. Furthermore, some of the previous empirical research will be presented and discussed. Based on the theories and

empirical findings, the determining firm-specific factors of capital structure used in this thesis will be presented. This section contains the predictions made by both theories regarding the chosen factors, and how they compare to previous empirical findings.

3. Methodology and data

   The third chapter starts off by discussing the data sample, research methods and estimation models used in the study. A definition of the dependent and independent variables are then presented along with the constructed hypotheses.

4. Analysis and results

   In this chapter, the analysis is conducted based on the hypotheses defined in the previous chapter. The results are then presented and discussed based on the predictions made by the two theories, and how they hold up against previous empirical findings.

5. Conclusion

   The last chapter will summarise the thesis and provide a conclusion, followed by a brief discussion of the limitations of the study as well as recommendations for future research.

# 2. Theoretical framework

This chapter defines and discusses the term capital structure. The Modigliani and miller irrelevance theorem is presented, followed by the two main theories regarding capital structure: the static trade-off theory and the pecking order theory. Furthermore, some of the previous empirical research is presented and discussed. Based on the theories and empirical findings, the determining firm-specific factors of capital structure used in this thesis is presented. This section contains the predictions made by both theories regarding the chosen factors, and how they compare to previous empirical findings.

## 2.1. Capital structure

Decisions regarding capital structure are important for every type of business organization. The overall purpose of a firm can be seen as maximising firm value and creating value for shareholders. Firm value can be calculated by taking the present value of the expected future cash flows, and discounting it by the weighted average cost of capital. Maximizing firm value is no easy task, as it involves the selection of debt and equity securities in a balanced proportion, while also accounting for the different costs and benefits of these securities. Wrong decisions may lead to financial distress and bankruptcy.

The capital structure of a company tells us how the company has financed their assets, and can be defined as the relative proportions of debt, equity and other securities a company has outstanding. Investments are often financed through equity alone, or a combination of equity and debt (Berk & DeMarzo, 2013). There are countless various types of debt, equity and other securities. However, this thesis only distinguishes between equity, short term debt and long term debt. This could be seen as a simplification of the reality. In this study, the ratio between total debt and total assets is used as a measure of the capital structure in a company. Furthermore, total debt is the sum of long term and short term debt. Several theories refer to capital structure as a decision variable with an impact on the performance of a company. Finding an optimal mix of debt and equity can reduce the weighted average cost of capital and increase shareholder value, which in turn increases the firm value.

Over the years, different capital structure theories have been presented to determine the optimal capital structure. Modigliani and Miller laid the foundation for further research on the topic, when they in 1958 stated that capital structure was irrelevant to firm value, as it would remain the same regardless of how the firm was financed. Despite extensive research on the topic, there is still no definitive answer to the challenges regarding an optimal debt to equity ratio. This chapter presents the main theories of capital structure, which is the static trade-off theory and the pecking order theory. Underlying the two theories are the assumptions of Modigliani and Miller´s irrelevance theorem.

## 2.2 Capital structure in a perfect market

In 1958 Franco Modigliani and Merton Miller, two famous Nobel laureates, introduced the Modigliani-Miller irrelevance model. This was the first important insight into capital structure and its correlation with a firm's value. The Modigliani and Miller theory (Modigliani & Miller, 1958) argues that a firm´s financing choices has nothing to do with its value. Under the condition of perfect capital markets, they proposed the following equation, which would be known as Modigliani & Miller proposition I (Copeland, Weston, & Shastri, 2005).

Formula 1: M&M Proposition I:

$$V_L = V_U$$

$V_L$ = Value of the levered firm

$V_U$ = Value of the unlevered firm

This formula states that the value of the unlevered firm, where the firm finances only through equity, is equal to the value of the levered firm, where the financing is a mix between both equity and debt. Because the firm value is calculated based on the present value of future cash flows, the chosen capital structure does not affect it. In other words, the financing method is irrelevant.

Miller and Modigliani went on to support their position, using one of the very first arbitrage price arguments in finance theory. This argument can be illustrated by considering two different companies with different market values. Both companies have the same perpetual cash flow from operations, but only one of the firms has any debt. This would be a violation of proposition I, however, the difference would not persist as there would be an opportunity for arbitrage, which would in turn bring the market value of the two firms closer until they were identical. Therefore, M&M proposition I is a simple arbitrage argument. In a world without taxes the market value of the levered and the unlevered firm must be identical (Copeland et al., 2005).

Their second proposition is a development of the first one, and it discusses how risk and return on equity changes as a result of changes in the debt ratio. Proposition II states that the firm´s cost of equity is proportional to the firm´s leverage level. Increasing the leverage will cause a higher default probability, resulting in investors demanding a higher cost of equity to compensate for the additional risk.

Formula 2: Miller & Modigliani proposition II

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

$r_E$ = Cost of levered equity

$r_U$ = Cost of unlevered equity

$r_D$ = Cost of debt

$D/E$ = Debt ratio

Modigliani and Miller´s theory can be used as a theoretical framework for understanding capital structure. However, the Modigliani and Miller irrelevance theorem is based on restrictive assumptions that do not hold up in reality. When removing these assumptions, the choice of capital structure becomes an important factor for determining firm value. Their theory has been groundbreaking, and is an important foundation for understanding capital structure.

## 2.3 Capital structure in imperfect markets

In reality capital markets are not perfect, and the assumptions Modigliani and Miller made, highlights the need to consider factors such as tax advantages, financial distress, bankruptcy cost and asymmetric information. As a result, in 1963 they modified their propositions where they accounted for the tax advantages of debt. The interest rate on debt was considered to be offset by the tax savings from interest tax shields. They made the assumption that the debt was risk free and would be held permanently, so that the value of the tax shield could be considered a perpetuity (Berk & DeMarzo, 2013). The two propositions were then written as:

Proposition I:

$$V_L = V_U + r_c \times D$$

Proposition II creates an expression for the weighted average cost of capital, when tax is considered.

Formula 3: Weighted average cost of capital

$$r_{wacc} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D (1 - r_c)$$

The weighted average cost of capital represents the effective cost of capital after including the benefits of the interest tax shields. More debt will result in a lower weighted average cost of capital and more exploitation of the tax advantages of debt (Berk & DeMarzo, 2013).

### 2.3.1 The static trade-off theory

The static trade-off theory emerged as a result of the debate regarding Modigliani and Miller´s theorem. The theory incorporates agency costs and financial distress costs into the M&M model with corporate taxes. The trade-off theory states that a firm may set a target debt-to-value ratio where the tax benefit of one extra dollar in debt is equal to the cost of the increased probability of financial distress, where the firm gradually moves towards this target (Thanh & Huong, 2016). In other words, the firm trades off the tax benefits of debt against agency costs, financial distress costs and higher interest rates. The ability to move towards a target debt to equity ratio suggests

there exists some form of optimal capital structure that can maximize firm value. The theory states that the value of a levered firm equals the value of the unlevered plus the present value of the tax savings from debt minus the present value of financial distress costs (Berk & DeMarzo, 2013).

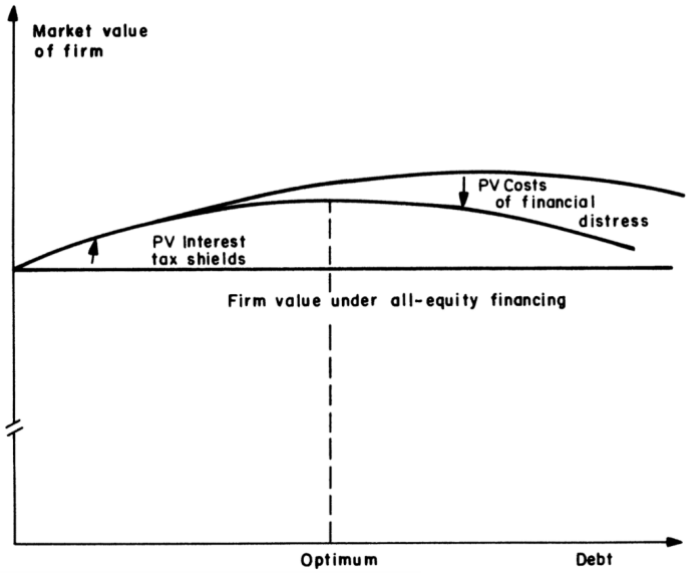
Formula 4: Value of a firm according to the trade-off theory

$$V_L = V_U + PV(Interest\ tax\ shield) - PV(Financial\ distress\ costs)$$

In addition to the trade-off between tax benefits and financial distress costs, a firm also has to make a trade-off between other costs and benefits relating to agency cost or agency conflict that arises when shareholders and managers have different objectives. The Free cash flow theory presented by Michael Jensen in 1986, states that if a firm generates too much free cash flow, managers might spend this for personal purposes which are not beneficial for the firm or the rights of the shareholders. To reduce the likelihood of this happening, the firm could reduce excess cash flow by either repurchasing stocks, paying higher dividends or acquiring more debt in their capital structure. Debt creation could mitigate the agency conflicts as debt obligations will bond the promise to pay out future cash flow, therefore forcing managers to be more disciplined otherwise the firm could face bankruptcy (Jensen, 1986).

According to the trade-off theory a firm is supposed to substitute debt for equity, or equity for debt until the value of the firm is maximized. This trade-off is illustrated in Fig.1.

Figure 1: Optimal firm value




Source: Myers (1984)

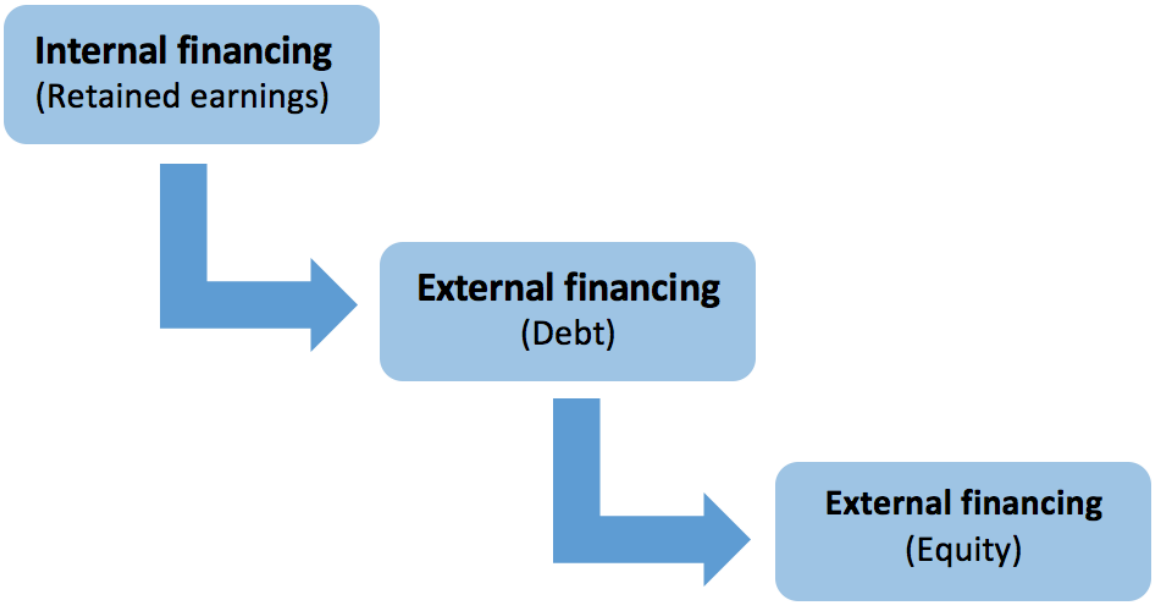
It is also important to consider the cost of adjustment. Without any cost of adjustment, each firm´s observed debt-to-value ratio should be its optimal ratio (Myers, 1984). Because there have to be cost associated with adjustment, the firm´s observed ratios could differ from the optimal ratio as it will take some time adjusting. The trade-off theory has strong practical appeal because it rationalizes moderate debt ratios. It is also consistent with certain facts, such as, firms with relatively safe tangible assets tend to borrow more than firms with risky intangible assets (Sheikh & Wang, 2011).

### 2.3.2 The pecking order theory

An alternative to the static trade-off theory is the pecking order theory developed by Myers and Majluf (1984) and Myers (1984). The theory is based on the assumption that managers are better informed about their firm´s prospects than outside investors are. In addition, the theory assumes managers act in the best interest of the shareholders. Under these two conditions, the firm will sometimes forgo positive net present value projects, if accepting them forces the firm to issue undervalued equity to new investors (Sheikh & Wang, 2011). Consequently, this provides a reason for firms to value financial slack, such as unutilized cash and unused debt capacity. Financial slack is there to help a firm through difficult times, such as periods of decreased revenues or profits. It allows a firm to undertake projects they otherwise would decline if they

had to issue new equity to investors. The pecking order theory suggests that firms prefer to use internal financing when they can, and prefer debt over equity when they require external financing. This financing hierarchy can be illustrated in figure 2.

Figure 2: The pecking order financing hierarchy




Source: own contribution

Under the pecking order conditions, the theory suggests that more profitable firms will tend to borrow less as they have more internal financing available compared to less profitable firms who tend to use more debt. The theory specifies no debt-to-value ratio, so the debt a firm has incurred is a result of the need for external financing, rather than a set target ratio (Myers, 1984). The theory emphasizes on asymmetric information. This occurs as a result of the different level of information available to the management and outside investors about the true value and quality of the firm. This makes it more difficult for investors to differentiate between good and bad quality companies. As a result, investors have to make up for this uncertainty by requiring a higher rate of return, making capital more expensive for companies (Frank & Goyal, 2007). Asymmetric information could lead to problems with adverse selection.

## 2.4 Empirical research

A wide range of empirical research has been carried out in order to examine the validity of capital structure theories, especially the static trade-off theory and the pecking order theory. This section will review a selection of the previous empirical studies on capital structure in international cases and also review some of the research including Norwegian firms. A full list of studies examined can be found in the appendix.

### 2.4.1 International research

The studies conducted on capital structure are often undertaken on the form of international analysis. They usually study the impact of firm-specific and country-specific factors on the financing pattern of firms in specific countries. Although the different studies often examine the financing behaviour of different firms in different countries, either in developing or developed countries, and is often conducted in different time periods, they still highlight the importance the firm-specific and country-specific factors can have on capital structure.

Sheikh & Wang (2011) researched the determinants of capital structure of firms in the manufacturing industry of Pakistan. The study was conducted using panel data procedures for a sample of 160 firms listed on the Karachi Stock Exchange during the period 2003-2007. The results suggested that profitability, liquidity, tangibility and earnings volatility are related negatively to the debt ratio. However, they found that firm size is positively linked to the debt ratio. In addition, they found that non-debt tax shields and growth opportunities did not appear to be significant to the capital structure of these firms.

Eriotis, Vasiliou and Ventoura-Neokosmidi (2007) Researched 129 Greek companies listed on the Athens Stock Exchange during the period 1997-2001, in order to determine how firm characteristics affect capital structure. The hypothesis that was tested in the study was that the debt ratio depends on the size of the firm, the growth of the firm, its quick ratio and interest coverage ratio. They found that there was a negative relation between the debt ratio of the firms and their growth, their quick ratio and their interest coverage ratio. In addition, they found that the size of the firm had a positive relation to the debt ratio, which were consistent with the theoretical background presented in their paper.

Bauer (2004) analysed the determinants of capital structure of 72 Czech companies listed on the Prague Stock Exchange and in the Securities Centre of the Czech Republic data base. The study collected data from the period 2000-2001, which is a shorter period than most other studies. The determinants analysed in the study was size, profitability, tangibility, growth opportunities, tax, non-debt tax shields, volatility and industry classification. According to the results, leverage of Czech listed firms were positively correlated with size and tax, and negatively correlated with profitability, tangibility, growth and non-debt tax shields. No significant relationship was found between leverage and volatility.

Thanh & Huong (2016) explored the determining factors of capital structure using data containing 228 Vietnamese firms listed on the Ho Chi Minh Stock Exchange during the period 2010-2014. The results indicated that the pecking order theory better explain the financing behaviours of Vietnamese listed firms. In their study, size and growth opportunities had a significant positive relationship to leverage, when using total debt to calculate the leverage ratio. Meanwhile, liquidity and profitability had a negative relation to the leverage ratio. They also differentiated between short term debt and long term debt, which resulted in some interesting implications, where tangibility was negatively related to short term leverage and positively related to long term leverage.

### 2.4.2 Empirical studies on firms operating in Norway

Despite all the research conducted on capital structure, there is still a lack of empirical studies focusing solely on Norwegian firms. Still, there are a few studies that includes subsamples of Norwegian firms when analysing the differences in capital structure across countries. Country-specific factors, including institutional differences, could result in a change in the determining factors of capital structure. Reviewing some of these studies may help when deciding which factors to consider when analysing Norwegian firms and their capital structure.

Frydenberg (2004) has done one of the few empirical studies on the capital structure of Norwegian firms. The study analysed firms in the Norwegian manufacturing sector in the period 1990-2000. The results of the study suggest that profitable firms tend to have less debt, which is in line with the pecking order theory. He also found that firms with more tangible assets tend to

increase long-term debt and decrease short-term debt. In the study, non-debt tax shield is negatively correlated with the debt ratio.

Mjøs (2007) researched the capital structure of large Norwegian private and public companies during the period 1992-2005. The study found that firms were heterogeneous and show variability in the choice of capital structure. Large listed firms often have better access to outside capital because of lower information asymmetry. The study concluded that leverage increases with size and tangibility, while it decreases with profitability and interest levels. A study by Kayo & Kimura (2004) showed the mean and standard deviation of leverage for different countries. They reported a mean of 18% for long term debt ratio with respects to total assets in Norwegian firms.

In a cross-country study on bank-based and market-based financial systems, by Kunt & Levine (1999), they state that Norway can be considered a country with a bank-based financial system. As opposed to countries with market-based financial systems like the US, where financing primarily happens through capital markets, Norwegian companies tend to finance themselves through bank loans. The assumption is often made that firms in bank-based countries have higher leverage and more short term debt. However, the result of the study indicates that there is no cross-country empirical evidence for the fact that either a bank-based system or market-based system is superior to the other. In conclusion they suggest that other factors such as laws and enforcement mechanisms that govern equity and debt transactions, could be more important in describing cross country capital structure.

## 2.5 Determinants of capital structure

This section will briefly explain the chosen factors that could affect the amount of leverage a firm has. The attributes are based on the previously discussed theories of capital structure, as well as the prior research done on this subject. Determining the most important attributes can be a challenge, as there are quite a few factors that could be significant. However, the research outlines some common factors that could be seen as some of the more important ones. The two theories previously discussed also agrees on most of the factors that determine capital structure, but they differ in the expectations of the direction and extent of the different factors. The chosen attributes are denoted as profitability, size, growth, tangibility, non-debt tax shields and liquidity.

### 2.5.1 Profitability

Profitability has been the most significant and important factor in previous research regarding the capital structure of firms. Frank & Goyal (2009) highlight profitability as one of the core factors when explaining capital structure. Core factors are defined as the factors that have consistent signs and statistical significance cross many alternative treatments of data. The trade-off theory suggests that high profitability promotes the use of debt and provides the firm with an incentive to avail the benefit of tax shields on interest payments (Sheikh & Wang, 2011). Firms with a high profitability ratio will have less risk of bankruptcy, and debt providers are more willing to issue debt to profitable firms because of this. The theory expects a positive relationship between profitability and leverage. In comparison, the pecking order theory proposes that profitable firms would rather use funds that are internally generated when available, and chose debt over equity when external funding is required. This results in a negative relationship between profitability and leverage in this theory. This is in line with most of the empirical studies conducted on capital structure. Studies done by Rajan & Zingales (1995), Sheikh & Wang (2011), Thanh & Huong (2016) and Titman & Wessels (1988) all concluded with profitability having a negative impact on the leverage ratio. This suggests that profitable firms tend to act according to the pecking order theory and use retained earnings when financing investment opportunities.

### 2.5.2 Size

Several reasons are presented in the literature regarding firm size as an important factor linked with leverage. A study by Rajan and Zingales from 1995, where they studied firms in G-7 countries, reported that large firms often are more diversified, which leads to a lower probability of default. This is consistent with the expectations of the trade-off theory, which proposes that larger firms should borrow more, as they are more diversified. The probability of bankruptcy is lower in larger firms, and the cost of bankruptcy are relatively lower than that of smaller firms. Larger firms tend to have lower agency cost of debt, for example, lower monitoring cost as a result of less volatile cash flow and easy access to capital markets (Sheikh & Wang, 2011). The trade-off theory suggests a positive relationship between the firm size and leverage. In contrast, the pecking order theory suggest a negative relationship between size and leverage because the

issue of information asymmetry is more prominent in smaller firms, and less severe in larger firms. Larger firms should therefore borrow less, because of their ability to issue informationally sensitive securities like equity. Previous studies on this issue are mixed. While Chen (2004), who studied firms in China, reports a significant negative relationship between size and long-term leverage, several empirical studies reported a significant positive relationship between firm size and leverage (Bauer, 2004; Eriotis, Vasiliou, & Ventoura-Neokosmidi, 2007). Shah & Khan (2007) found that size had no significant impact on leverage.

### 2.5.3 Growth

Future growth opportunities can be classified as a form of intangible assets. The trade-off theory argues that firms with future growth opportunities tend to borrow less than firms with more tangible assets. This is because growth opportunities cannot be collateralized. The theory suggests a negative relationship between growth opportunities and leverage. Growing firms also tend to have higher agency cost of debt because debt holders fear that growing firms will invest in projects with more risk (Booth, Aivazian, Demirguc-Kunt, & Maksimovic, 2001). The trade-off theory also suggests that firms with more investment opportunities tend to prefer less debt, as managers do not want intervention from outsiders and risk associated with their opportunities, as this may increase the likelihood of bankruptcy. As a result of this, growth should reduce firm leverage. This is consistent with the results from Wald (1999) and Homaifar, Zietz & Benkato (1994), where they found a negative relationship between growth opportunities and leverage in developed countries. In contrast, Chen (2004) found a positive relationship between leverage and growth. The pecking order theory suggest a positive relationship because growing firms tends to acquire more debt over time when the internal funds are not sufficient to finance the investment opportunities.

### 2.5.4 Tangibility

Many studies show that a firm´s assets structure, or the nature of the assets, is of significance to the capital structure. In most studies, the explanatory variable represents the amount of tangible assets a firm has in regards to the total amount of assets. Assets such as buildings, machinery and inventory can all be classified as tangible assets. Compared to nonphysical, intangible assets, they

are easier to collateralize resulting in less of a loss if the firm were to go into financial distress. Tangible assets serve as a better collateral for debt, and is therefore associated with a higher leverage ratio. As a result, the trade-off theory predicts a positive correlation between the amount of tangible assets and the leverage ratio. Because tangible assets can be used as collateral when acquiring debt, a high tangibility ratio will reduce the information asymmetry between the firm and the debt issuer. This reduces the cost of debt, and as a result, the pecking order theory also expects a positive relationship between the amount of tangible assets and the amount of debt in a firm. This is consistent with most of the previous studies conducted on capital structure and tangible assets (J. J. Chen, 2004; Shah & Khan, 2007; Wald, 1999). Meanwhile Booth et al. (2001) suggests a negative relationship between leverage and tangibility.

### 2.5.5 Non-debt tax shields

Tax shields benefit on the use of debt finance can be reduced, or even eliminated if a firm is reporting a consistently low or negative income. Because of this, the burden of interest payments would be felt by the firm (Sheikh & Wang, 2011). DeAngelo & Masulis (1980) suggests that non-debt tax shields can be the substitute of the tax shields on debt financing. Consequently, firms with larger non-debt tax shields are expected to use less debt, which is in line with what the trade-off theory suggests. Meanwhile, the pecking order does not predict any obvious relationship between leverage and non-debt tax shields. Previous empirical findings are mixed. Shah & Khan (2007) found non-debt tax shields to be insignificant, while Wald (1999) reported a significant negative relationship between non-debt tax shields and leverage.

### 2.5.6 Liquidity

Liquidity can be defined as the ability for firms to cover their current liabilities using their current assets. The trade-off theory suggests a positive relationship between liquidity and leverage, as companies with a higher liquidity ratio should borrow more because they have the ability to meet their contractual obligations on time. In contrast, the pecking order theory suggests that firms with better liquidity tend to use internal funds when financing investments, thus, the theory predicts a negative relationship between liquidity and leverage. Prowse (1990) argues that the liquidity of a company´s assets can be used to show the extent to which the assets might be

manipulated by shareholders at the expense of bondholders. Ozkan (2001) reported a negative relationship between liquidity and leverage. He suggested that the negative correlation could be because of the potential conflicts between debtholders and shareholders. Than & Huong (2016) also reported a negative relationship between liquidity and total debt. However, they also differentiated between long term debt and short term debt, where their results indicated that there was a positive relationship between liquidity and long term debt, and a negative relationship between short term debt and liquidity.

Table 1: Expected relationship between variables and leverage.

| Variables | The static trade-off | The Pecking order |
|---|---|---|
| Profitability | + | - |
| Size | + | - |
| Growth | - | + |
| Tangibility | + | + |
| Non-debt tax shields | - | |
| Liquidity | + | - |

# 3. Methodology and data

The goal of this chapter is to present the methodical framework for this thesis and develop hypotheses based on the theory presented in chapter 2. The chapter starts off by presenting the data sample, the research methods and estimation models used in this study. The characteristics of the data sample is discussed, including omitted observations and data quality. The econometric procedure used in the study will then be presented, including the statistical approach. Furthermore, a definition of the dependent and independent variables are presented alongside the chosen hypotheses.

## 3.1 Data

This thesis conducts a quantitative analysis using panel data procedures for a sample of Norwegian firms listed on the Oslo Stock Exchange in the period 2015-2019. Assumptions are made about which firm specific variables determines the capital structure in firms, based on existing theories and previous empirical research. The purpose is to examine whether a causal relationship between expected explanatory variables and leverage can be found, and to see if this relationship is in line with the conditional theories and previous empirical research conducted on capital structure. Prior empirical findings are mostly made on the basis of companies that are not necessarily comparable to the sample in this thesis. As a result, this thesis uses a deductive research method, which is based on a subjective assumption that existing theory and previous research is transferable to Norwegian listed firms.

The dataset is a combination of cross-sectional and time series data, called panel data. Cross-sectional data contains observations of different individuals or groups at a single point in time. Time series data is a set of observations collected over a longer time period, often with equally spaced time intervals. Combining these two data types, makes it into panel data by observing different individuals or groups over a longer time period. The main advantages of panel data are that it is possible to examine several entities over time, which leads to heterogeneity. Furthermore, it is possible to obtain a larger amount of data, often more informative with a greater variety (Gujarati & Porter, 2009). Estimation methods for panel data are presented in section 3.2.5.

The data sample is collected from the Thomson Reuters Eikon database. The Thomson Reuters Eikon database is a financial database with company and market information. The sample collected contains Norwegian firms listed on the Oslo Stock Exchange in the period 2015-2019. Financial firms, such as banks and insurance companies are excluded from the sample. The data sample will be analysed using STATA in order to determine if a significant relationship between the chosen variables and capital structure can be found.

### 3.1.1 Excluded observations

As stated, financial firms have been excluded from the data sample. Firms with missing values has also been dropped. This includes firms with missing values for total assets in 2014 as this is needed to evaluate the growth in the first year. Extreme outliers are data points that lies an abnormal distance from the others values in a data set. OLS is very sensitive to these kind of observations as they can have a major impact on the estimation of the regression coefficients. Consequently, the results of the regression may produce unreliable and biased results (Johannesen, Christoffersen, & Tufte, 2011). Removing these outliers can be done through statistical programs or by deciding which types of observations should be removed, and then removing them manually.

A few observations were removed after evaluating the data set. Firms with a leverage ratio above 1.5 have been removed, which included three firms, where two of them had a value above 2. Firms with an abnormal growth rates have been removed as there were some firms with growth rates above 2000%. One firm had a liquidity ratio of 330, and was removed. After removing financial firms, extreme observations and firms with missing values, the final data set contains 595 observations from 119 firms during the period 2015-2019. The final list of firms included in the sample can be found in the appendix.

### 3.1.2 Data quality

The data is collected from the Thomson Reuters Eikon database, which is considered a reliable data source, however, some errors could occur. The values collected for the given firms include Total assets, Total liabilities, EBIT, Current assets, current liabilities, fixed assets and

depreciation. These values were then used to calculate the values for the chosen variables over the entire time period. The definition and formula for these variables are presented later in this chapter. Some quality checks were conducted to maintain the quality of the data set. Some of the reported values were compared to the given firm´s annual report. The calculations for the given variables were checked for several firms to detect any errors. All the values were gathered in the same currency. To further secure the reliability of the data sample, a comparison could have been made with other financial databases to see if the reported values were the same, however this was not done because of restricted access to the various financial databases. A drawback of the data is the one regarding survivorship bias. Firms that were delisted during the period were excluded from the analysis because of missing values. This could cause biased results because the included companies are the ones who were successful enough to survive until the end of the time period. By including only firms listed on the Oslo Stock Exchange, smaller unlisted firms were excluded, which could cause skewed results.

## 3.2 Econometric analysis

To answer the research question of this thesis, the panel data gathered from Norwegian listed firms in the period 2015-2019 will be analysed using multiple regression analysis in Stata. The analytical technique used in this thesis, including statistical model, regression analysis, assumptions for the model and estimation techniques for panel data are presented in the following section.

### 3.2.1 Statistical model

Similar studies that analyses the determinants of capital structure are often conducted using a linear regression model where the goal is to explain changes in leverage, as the dependent variable, using a set of independent variables. Similar to these studies, this thesis uses linear regression to examine the determining factors of capital structure in Norwegian listed firms. The variables included in the model are also inspired by prior research. As a result, the analysis will be conducted using the same statistical model as in previous studies, but differs from previous research in regards to the data used. The leverage ratio can be expressed as a function of several

determining factors. This thesis makes the assumption that leverage is a function of six different variables which are further explained later in this chapter.

Formula 5: Explanatory variables for leverage

$$Leverage = f(Profitability, Size, Growth, Tangibility, Nondebt\ tax\ shields, Liquidity)$$

### 3.2.2 Correlation

Correlation is a way of numerically quantifying the association between two individual variables and the strength and direction of this relationship. The correlation coefficient always exists between -1 and +1, where -1 suggests perfect negative correlation, and +1 indicates perfect positive correlation. A correlation coefficient equal to 0 implies that there exists no linear relationship between the variables.

Table 2: Correlation coefficients

| **Magnitude** | **Indicates** |
|---|---|
| Between 0.9 and 1 | Very highly correlated |
| Between 0.7 and 0.9 | Highly correlated |
| Between 0.5 and 0.7 | Moderately correlated |
| Between 0.3 and 0.5 | Slightly correlated |
| Below 0.3 | Little or no correlation |

Source: own contribution based on Koop 2013

### 3.2.3 Regression analysis

Econometricians use regression analysis to make quantitative estimates of economic relationships that previously have been completely theoretical in nature. Regression analysis is a statistical

technique that tries to explain movements in one variable, the dependent variable (Y), as a function of movements in a set of other variables, the independent variables $(X_1, X_2, X_3, \dots, X_K)$. This is attempted through the quantification of one or more equations (Studenmund, 2014).

### 3.2.4 Ordinary Least Squares

A simple regression model tries to explain the linear relationship between two variables, while a multiple regression model takes into account that the independent variables could affect one another and jointly affect the dependent variable. A panel data ordinary least squares (OLS) regression can be described as:

Formula 6: Ordinary least squares (OLS)

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_K X_{Ki} + \epsilon_i$$

Where i, ranges from 1 to N and indicates the observation number. $X_{1i}$ indicates the *i*th observation of independent variable $X_1$, and $X_{2i}$ indicates the *i*th observation of another independent variable, $X_2$. More specifically *"...a multivariate regression coefficient indicates change in the dependent variable associated with a one-unit increase in the independent variable in question, holding constant the other independent variables in the equation"* (Studenmund, 2014, p. 41).

$\beta_1$ measures the impact on Y of a one unit increase in $X_1$, holding constant $X_2$, $X_3$,… and $X_K$, but not any relevant variables that might have been omitted from the equation, such as $X_{K+1}$. $\beta_0$ represents the value of Y when all Xs and the error term is equal to zero, and is a constant factor. The error term, $\epsilon_i$, captures all other unobserved factors that are constant over time, and the regular residuals which vary over time.

To estimate the coefficients $\beta_0$ and $\beta_K$, the method of OLS is used. The model has (N-K) degrees of freedom, where N is the number of observations and K is the numbers of parameters in the model. The goal of OLS is to choose the βs that minimize the summed squared residuals, where the sum of squared residuals can be defined as:

Formula 7: Summed squared residuals

$$SSR = \sum_{i=1}^{n} (y_i - \beta_0 - \beta_1 X_{1i} - \cdots - \beta_K X_{Ki})^2$$

The Ordinary Least Squares regression model is based on several assumptions, that are necessary for the model to be valid (Studenmund, 2014).

#### 3.2.4.1 Model specification

OLS assumes that all relevant independent variables are included in the regression model, in addition all irrelevant variables should be excluded. The model should be correctly specified and have an additive error term. The assumption that the residual term is not correlated with any of the explanatory variables is also made. If there exists a correlation between the residual term and any of these variables, it could indicate that a relevant variable has been omitted. If this assumption is violated, the estimated relationship between the dependent and the independent variables could be partly or entirely spurious, resulting in inaccurate regression coefficients. This can be handled by including the omitted variables in the model. However, detecting these variables could be difficult (Johannesen et al., 2011).

#### 3.2.4.2 Linearity

The ordinary least squares regression model also assumes that there is a linear relationship between the dependent variable and the independent variables. In the absence of linearity, the regression model will try to estimate a linear relationship between variables that do not follow a straight line. This can cause unreliable estimates of the regression coefficients. By transforming the variables or using dummy variables, the problems regarding non-linearity can be improved or eliminated completely. As an example, it might be beneficial to express the variable in quadric or logarithmic form (X. Chen, Ender, Mitchell, & wells, 2003).

#### 3.2.4.3 Normality

Regression analysis assumes that the error term is normally distributed. Normality is necessary to avoid inaccurate results when dealing with hypotheses testing. Normality ensures us that the p-values for t-tests and F-tests are valid. Normality is however not necessary to estimate valid regression coefficients. Small deviations from the normality assumption can be accepted and still produce valid test results, especially when dealing with large data sets. A transformation of the independent variables might be appropriate to deal with violations of this assumption (X. Chen et al., 2003).

#### 3.2.4.4 Homoscedasticity

One of the most important assumptions when conducting an ordinary least squares regression analysis is that the residuals have constant variance. This is called homoscedasticity. If the model is well specified, the residuals around the regression line should not form any specific pattern. If the residuals do not have constant variance, the assumption regarding homoscedasticity is violated resulting in a presence of heteroscedasticity. This can cause incorrect standard errors and erroneous results when conducting a hypothesis test.

#### 3.2.4.5 Multicollinearity

If there is a perfect, or close to perfect linear relationship between two or more independent variables, the assumption of no multicollinearity is violated. Collinearity happens when there is a near perfect relationship between two independent variables. If this is true for more than two variables, it is called multicollinearity. The main problems regarding multicollinearity is that the estimates of the regression coefficients are sensitive to small changes in the model or the data, and the standard error of the coefficients can be significantly inflated as the degree of multicollinearity increases (X. Chen et al., 2003).

#### 3.2.4.6 Autocorrelation

Autocorrelation occurs when the residual term of an observation is correlated with the residual term of another observation. A Presence of autocorrelation is common when dealing with time series data because the value of a variable may depend on the value of the variable in the previous period. This can result in inaccurate standard errors and cause problems when testing a hypothesis. In other words, the assumption of no autocorrelation requires that the observations should be independent of each other.

### 3.2.5 Regression analysis for panel data

When analysing data that combines cross-sectional and time-series data, it may be beneficial to use panel data estimation methods. When dealing with panel data, there are some assumptions that must be valid in order for the estimated coefficients to be accurate. This section presents three different estimation methods for panel data: pooled ordinary least squares, the fixed effect model and the random effects model.

#### 3.2.5.1 Pooled ordinary least squares

When performing a pooled ordinary least squares regression, all the observations are pooled together before the regression analysis is conducted. By doing this, the assumption is made that the regression coefficients are the same for all units. That is, there is no distinction between any of the units, one unit is as good as the other, which is an assumption that might be difficult to maintain. Equation 1) shows the general pooled OLS model.

1) $Y_{it} = \beta_1 + \beta_2 X_{it} + \cdots + \beta_k X_{it} + u_{it}$

*Where:*

$Y_{it}$ = Dependent variable

$\beta_0$ = Intercept

$\beta$ = Vector of the independent variables coefficient

$X_{it}$ = Vector of the independent variable

$u_{it}$ = Error term

The heterogeneity that might exist among the units is not directly observable. Because pooled OLS ignores heterogeneity, often called unobserved effects, this will be included in the error term. If we include the unobserved effects, $\alpha_{it}$, in equation 1), it can be written as follows:

2) $Y_{it} = \beta_1 + \beta_2 X_{it} + \cdots + \beta_k X_{it} + v_{it}$

$$Where\ v_{it} = \alpha_{it} + u_{it}$$

In a situation where the unobserved effects are not zero, heterogeneity could influence the assumption of no autocorrelation and exogeneity (Gujarati & Porter, 2009). In this case, the model will provide biased and inconsistent estimators. The fixed effects model and the random effects model might be more suitable in this situation, as they have ways to deal with the described problems.

#### 3.2.5.2 Fixed effects model

The fixed effects model allow heterogeneity between units, by allowing each unit to have its own intercept value. There are several variations of the fixed effects model: fixed-effects within-group (WG), first difference fixed effects and the least-squares dummy variable model (LSDV). The term fixed effects is due to the fact that, although the intercept may differ across the subjects, each unit´s intercept does not vary over time and is therefore time-invariant (Gujarati & Porter, 2009). Equation 3) below is known as the fixed effects model, and it is the starting point for any fixed effects regression model.

3) $Y_{it} = \beta_{1i} + \beta_2 X_{it} + \cdots + \beta_k X_{it} + u_{it}$

One way to estimate a pooled regression is by eliminating the fixed effect, $\beta_{1i}$, by expressing the value of the dependent and the independent variables for each unit as deviations from the respective mean values. This is done for each unit before all the mean-corrected values are pooled and an OLS regression is performed (Gujarati & Porter, 2009).

4) $Y_{it} - \hat{Y}_l = \beta_{1i}(1-1) + \beta_2(X_{it} - \hat{X}_l) + \cdots + \beta_k(X_{it} - \hat{X}_l) + (u_{it} - \hat{u}_l)$

Equation 4) shows the mean-corrected variables. The mean value of the intercept, $\beta_{1i}$, is constant, thus eliminating the fixed effect. The equation can therefore be written as:

5) $\ddot{Y}_{it} = \beta_2\ddot{X}_{it} + \cdots + \beta_k\ddot{X}_{it} + \ddot{u}_{it}$

An alternate WG estimator is the first-difference method, where unobserved effects are removed by subtracting the value of the variables in the previous time period for all the observations:

6) $\Delta Y_{it} = \beta_2 \Delta X_{it} + \cdots + \beta_k \Delta X_{it} + (u_{it} - \hat{u}_{i,t-1})$

If there are only two time periods, the methods will give the same result. A drawback of these models is that manipulation of the variables, such as lagging or mean-adjusting can result in the loss of important information regarding the effect of the independent variables on the dependent variable.

Another method of dealing with fixed effects is the inclusion of dummy variables. In the LSDV model, each unit except one, is given its own dummy variable, as illustrated in equation 7), where $\alpha_1$ expresses the intercept of unit 1. The intercept of the remaining units are given by $\alpha_1 + \alpha_i$. By not giving each unit a dummy variable, perfect collinearity is avoided. This is called the "dummy-variable trap". The unit without the dummy variable will be the reference point (Gujarati & Porter, 2009).

7) $Y_{it} = \alpha_1 + \alpha_2 D_{2i} + \cdots + \alpha_n D_{ni} + \beta_2 X_{it} + \cdots + \beta_k X_{it} + u_{it}$

Equation 3) is a "one way fixed effects model" because the intercepts are allowed to differ between the units. The LSDV model can also allow for time effects by including dummy variables for the time periods. By doing this the model is expanded to a "two way fixed effects model", because it allows both individual and time effects. A drawback of the LSDV model is that it often lacks degrees of freedom. This is because we lose one degree of freedom for every dummy variable in the equation. Another drawback, is that no substantive explanatory variable that vary across entities, but do not vary over time within each entity, can be used as they would create perfect multicollinearity (Studenmund, 2014).

#### 3.2.5.3 Random effects model

An alternative model to the fixed effects model is called the random effects model. While the fixed effects model assumes that each cross-sectional unit has its own intercept, the random effects model makes the assumption that the intercept for each cross-sectional unit is drawn from a distribution centered around a mean intercept. As a result, each intercept is a random draw from an intercept distribution, and is therefore independent of the error term for any particular observation (Studenmund, 2014). The random effects model uses the same starting point as the fixed effects model, as shown in equation 3), but instead of treating $\beta_{1i}$ as a constant it is assumed to be a random variable with a mean value of $\beta_1$. The intercept for each unit can then be expressed as follows:

8) $\beta_{1i} = \beta_1 + \varepsilon_i$

The term $\varepsilon_i$ is a random error term with a mean value of zero and variance of $\sigma_\varepsilon^2$. This means that all of the units have a common mean value from the intercept, $\beta_1$. The individual differences in

the intercept values of each unit are reflected in the error term $\varepsilon_i$. By combining equation 3) and 8) we get:

9) $$Y_{it} = \beta_1 + \beta_2 X_{it} + \cdots + \beta_k X_{it} + \omega_{it}$$

$$where\ \omega_{it} = \varepsilon_{it} + u_{it}$$

The combined error term consists of two components: $\varepsilon_i$ which is the cross-section, or individual-specific, error term, and $u_i$, which is the combined time series and cross-section error term (Gujarati & Porter, 2009).

The random effects model is estimated using generalized least squares (GLS). The GLS estimator will still be efficient in the presence of autocorrelation and heteroscedasticity, as opposed to OLS. There are some advantages to using the random effects model over the fixed effects model. Particularly, the random effects model will have more degrees of freedom, because rather than estimating an intercept for every cross-sectional unit, it only estimates the parameters that describe the distribution of the intercepts. The biggest downside to the random effects model is that it requires us to assume that the unobserved impact of the omitted variables is uncorrelated with the independent variables, if we´re going to avoid omitted variable bias (Studenmund, 2014).

## 3.3 Chosen variables and hypotheses

In this section the dependent and independent variables will be defined based on the previous empirical research on determining factors of capital structure. The hypotheses for each of the firm-specific variables will be developed based on the predictions made by the trade-off theory and the pecking order theory.

### 3.3.1 Dependent variable

The chosen definition of the dependent variable is in line with the previous studies conducted on Norwegian firms (Frydenberg, 2004; Mjøs, 2007). The dependent variable is the debt ratio (LEV), and is given as the ratio of total debt to total assets.

Formula 8: Dependent variable (LEV)

$$LEV = \frac{Total\ debt}{Total\ assets}$$

### 3.3.2 Independent variables

By studying the prior empirical research and the conditional theories regarding capital structure, the author have chosen to continue with some of the factors that seems to be relevant in determining the capital structure in firms. There are a total of six different firm specific factors which are represented by the independent variables.

#### 3.3.2.1 Profitability

The profitability of a firm can be measured in many different ways, but is often a variation of the return on assets (ROA). Based on previous empirical research, profitability is denoted as the total earnings before interest and tax divided by the total assets (Sheikh & Wang, 2011). The trade-off theory predicts a positive relationship between PROF and LEV, while the pecking order theory predicts a negative relationship between the two variables.

Formula 9: Independent variable 1 (PROF)

$$PROF = \frac{EBIT}{Total\ assets}$$

***Hypotheses***

| Trade-off theory: | The pecking order theory: |
|---|---|
| $H_0$: *PROF has a positive effect on LEV* | $H_0$: *PROF has a negative effect on LEV* |
| $H_a$: *PROF has a negative effect on LEV* | $H_a$: *PROF has a positive effect on LEV* |

#### 3.3.2.2 Size

Firm size could be defined by the number of employees, sales revenues or total assets. In this study size is defined as the natural logarithm of assets (Thanh & Huong, 2016). The trade-off theory predicts a positive relationship between SIZE and LEV, while the pecking order theory predicts a negative relationship.

Formula 10: Independent variable 2 (SIZE)

$$SIZE = Ln(Total\ assets)$$

***Hypotheses***

| Trade-off theory: | The pecking order theory: |
|---|---|
| $H_0$: *SIZE has a positive effect on LEV* | $H_0$: *SIZE has a negative effect on LEV* |
| $H_a$: *SIZE has a negative effect on LEV* | $H_a$: *SIZE has a positive effect on LEV* |

#### 3.3.2.3 Growth

The growth variable is often included in empirical research to measure growth or growth opportunities. In the literature there are several different ways to measure growth as it depends on the data available. In this study growth is defined as the percentage change in total assets (Thanh & Huong, 2016). The trade-off theory suggests a negative relationship between GROW and LEV, while the pecking order theory predicts a positive relationship.

Formula 11: Independent variable 3 (GROW)

$$GROW = \%\ change\ in\ total\ assets$$

***Hypotheses***

| Trade-off theory: | The pecking order theory: |
|---|---|
| $H_0$: *GROW has a negative effect on LEV* | $H_0$: *GROW has a positive effect on LEV* |
| $H_a$: *GROW has a positive effect on LEV* | $H_a$: *GROW has a negative effect on LEV* |

#### 3.3.2.4 Tangibility

The tangibility variable is more straight forward, and most studies defines it as the ratio between either net fixed assets or fixed assets, and total assets. This study defines tangibility as the ratio between fixed assets and total assets (Bauer, 2004; Thanh & Huong, 2016). Both the conditional theories predict a positive relationship between TANG and LEV.

Formula 12: Independent variable 4 (TANG)

$$TANG = \frac{Fixed\ assets}{Total\ assets}$$

***Hypotheses***

| Trade-off theory: | The pecking order theory: |
|---|---|
| $H_0$: *TANG has a positive effect on LEV* | $H_0$: *TANG has a positive effect on LEV* |
| $H_a$: *TANG has a negative effect on LEV* | $H_a$: *TANG has a negative effect on LEV* |

#### 3.3.2.5 Non debt tax shields

The variable for non-debt tax shields can be defined as the depreciation expense divided by total assets (Bauer, 2004; Sheikh & Wang, 2011; Thanh & Huong, 2016). The trade-off theory

suggests a negative relationship between NDTS and LEV. The pecking order does not suggest any specific relationship between the two variables.

Formula 13: Independent variable 5 (NDTS):

$$NDTS = \frac{Depreciation\ expense}{Total\ assets}$$

***Hypotheses***

| Trade-off theory: | The pecking order theory: |
|---|---|
| *$H_0$: NDTS has a negative effect on LEV* | - |
| *$H_a$: NDTS has a positive effect on LEV* | - |

#### 3.3.2.6 Liquidity

Liquidity is defined as the availability of the current assets. The liquidity of a firm represents its ability to cover short term liabilities. In this study liquidity is defined as the ratio between current assets and current liabilities (Sheikh & Wang, 2011; Thanh & Huong, 2016). The trade-off theory predicts a positive relationship between LIQ and LEV, while the pecking order theory suggests a negative relationship.

Formula 14: Independent variable 6 (LIQ):

$$LIQ = \frac{Current\ assets}{Current\ liabilities}$$

***Hypotheses***

| Trade-off theory: | The pecking order theory: |
|---|---|
| $H_0$: *LIQ has a positive effect on LEV* | $H_0$: *LIQ has a negative effect on LEV* |
| $H_a$: *LIQ has a negative effect on LEV* | $H_a$: *LIQ has a positive effect on LEV* |

Table 3: Summary of testable hypotheses

| Variable | Trade-off theory | Pecking order theory |
|---|---|---|
| **Profitability** | *H0: PROF has a positive effect on LEV*<br>*HA: PROF has a negative effect on LEV* | *H0: PROF has a negative effect on LEV*<br>*HA: PROF has a positive effect on LEV* |
| **Size** | *H0: SIZE has a positive effect on LEV*<br>*HA: SIZE has a negative effect on LEV* | *H0: SIZE has a negative effect on LEV*<br>*HA: SIZE has a positive effect on LEV* |
| **Growth** | *H0: GROW has a negative effect on LEV*<br>*HA: GROW has a positive effect on LEV* | *H0: GROW has a positive effect on LEV*<br>*HA: GROW has a negative effect on LEV* |
| **Tangibility** | *H0: TANG has a positive effect on LEV*<br>*HA: TANG has a negative effect on LEV* | *H0: TANG has a positive effect on LEV*<br>*HA: TANG has a negative effect on LEV* |
| **Non-debt tax shields** | *H0: NDTS has a negative effect on LEV*<br>*HA: NDTS has a positive effect on LEV* | |
| **Liquidity** | *H0: LIQ has a positive effect on LEV*<br>*HA: LIQ has a negative effect on LEV* | *H0: LIQ has a negative effect on LEV*<br>*HA: LIQ has a positive effect on LEV* |

# 4. Analysis and results

In this chapter, the analysis is conducted based on the hypotheses defined in the previous chapter. The results are then presented and discussed based on the predictions made by the two theories, and how they compare to previous empirical findings.

## 4.1 Descriptive statistics

Descriptive statistics summarizes the basic features of the dependent and independent variables included in the study. It provides a summary of the sample and measures. Table 4 presents a summary of the observed firms during the period 2015-2019. It includes the number of observations, the mean value, standard deviation as well as the minimum and maximum values for each of the observed variables.

Table 4: Descriptive statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| **Leverage** | 595 | .566 | .226 | .06 | 1.457 |
| **Profitability** | 595 | -.006 | .234 | -2.317 | .393 |
| **Size** | 595 | 22.001 | 2.041 | 16.112 | 27.667 |
| **Growth** | 595 | 11.165 | 46.414 | -82.78 | 437.892 |
| **Tangibility** | 595 | .502 | .269 | .001 | .949 |
| **Non-debt tax shield** | 595 | .041 | .044 | 0 | .497 |

The dependent variable leverage, has a mean of 0.566. this implies that about 56,6% of the average firm´s total assets are financed by debt. Compared to previous empirical studies this seems to be a relatively normal estimate. Sheikh & Wang (2011) reported an average leverage of 60% in their study on Pakistani firms, while Thanh & Huong (2016) found an average leverage of 48% in Vietnamese listed firms. However, the leverage is lower compared to a previous study on Norwegian manufacturing firms done by Frydenberg (2004), where he reported an average leverage ratio of 67,2%. There is a large spread in the leverage ratio with a standard deviation of 0,226, where the observations range from a minimum value of 0.06 to the maximum value of 1.457.

The independent variables also show large variations in the dataset. Profitability has a mean of -0.006 which implies that the profitability of the average firm is close to zero, but slightly negative. The standard deviation is 0.23 which indicates a large variation in the observations, ranging from -2.317 to 0.393. Sheikh & Wang (2011) and Thanh & Huong (2016) both reported a positive average profitability of 0.05 and 0.1, and standard deviation of 0.11 and 0.081 respectively. Size has a mean of 22. However, the proxy for the size variable is the logarithm of total assets. Consequently, the mean, minimum and maximum values makes little economic sense. The standard deviation of 2.041 implies a large variation in the size of the firms included in this study.

Growth has a mean value of 11.16, which indicates that the average growth is equal to 11.16%. The standard deviation of 46.4 is substantially lower than the one reported by Thanh & Huong (2016), which used the same proxy for growth. They reported a mean of 52,8% and a standard deviation of 120. The Tangibility variable has an average of 0.502, which indicates that on average 50,2% of the total assets are fixed assets. Frydenberg (2004) reported an average fixed to total assets ratio of 0.367 in Norwegian manufacturing firms, which is lower than the average of the firms in this study. The standard deviation reported was 0.206 compared to the standard deviation of 0.269 in this study, which indicates a substantial variation in the variable. The variable non-debt tax shield has a mean of 0.041 and a standard deviation of 0.044. The mean reported by Frydenberg (2004) is 0.0009, which is substantially lower than the one observed in this study. However, the standard deviation was 0.059 which is higher than the one detected in this sample.

## 4.2 Correlation

To evaluate if there are any correlation between the individual variables, a correlation matrix can be computed, as shown in table 5. When using panel data for the regression analysis, most of the collinearity effect between variables is eliminated. However, collinearity will still cause problems if the correlation coefficient is greater than 0.7 (Johannesen et al., 2011). The two variables leverage and liquidity are slightly negatively correlated, with a coefficient of -0.415. Meanwhile, size is slightly positively correlated with both profitability and tangibility with coefficients of

0.428 and 0.449 respectively. Collinearity problems should not occur, as neither of these values are close to 0.7. The rest of the variables show little or no correlation with coefficients below 0.3.

Table 5: Correlation matrix

| Variable | LEV | PROF | SIZE | GROW | TANG | NDTS | LIQ |
|---|---|---|---|---|---|---|---|
| **LEV** | 1.000 | | | | | | |
| **PROF** | -0.011 | 1.000 | | | | | |
| **SIZE** | 0.215 | 0.428 | 1.000 | | | | |
| **GROW** | -0.102 | 0.133 | 0.015 | 1.000 | | | |
| **TANG** | 0.208 | 0.138 | 0.449 | -0.101 | 1.000 | | |
| **NDTS** | 0.159 | -0.181 | -0.044 | -0.125 | 0.262 | 1.000 | |
| **LIQ** | -0.415 | -0.085 | -0.225 | 0.096 | -0.140 | -0.146 | 1.000 |

## 4.3 General regression model

A regression is an advanced approach to analyse the relationship between variables. The main objective is to evaluate how the value of the dependent variable (Y) changes when the value of one of the independent variables (X) changes by one unit. In this study the dependent variable is a firm´s leverage (LEV), while the independent variables include profitability (PROF), firm size (SIZE), growth opportunities (GROW), amount of tangible assets (TANG), non-debt tax shield (NDTS) and liquidity (LIQ). The general regression model is shown below.

Formula 15: General regression model

$$LEV = \beta_0 + \beta_1 \times PROF_{it} + \beta_2 \times SIZE_{it} + \beta_3 \times GROW_{it} + \beta_4 \times TANG_{it} + \beta_5 \times NDTS_{it} + \beta_6 \times LIQ_{it} + \varepsilon_{it}$$

In order to decide which of the three panel data estimation methods that best fits the data set, the characteristics of the sample is studied. First the data is examined for linear regression assumptions. This includes tests regarding normality, autocorrelation, heteroscedasticity and multicollinearity. The OLS regression analysis conducted on the model can be found in the appendix.

### 4.3.1 Linearity

The OLS model assumes a linear relationship between the dependent variable and the independent variables. If the variables do not have a linear relationship and a linear model is fitted to them, it could produce biased results. Perfect linearity rarely exists in empirical research, but detecting and examining non-linearity between variables could suggest that the variables should have a different functional form. Individual plots for each of the independent variables against the dependent variables are created to show the relationship between them. The plots are available in the appendix. Some of the plots suggest linearity, while some of the plots suggests there are not perfect linearity between the variables and the assumption of linearity might not be met.

### 4.3.2 Normality

Testing for normality is necessary because normality in the residuals assures us that the p-values for the t-statistic and the F-test are reliable. Testing for normality in the residuals can be done by constructing a kernel density estimate followed by a standard normal probability plot (pnorm) and a quantile normal distribution plot (qnorm). These tests illustrate the issue graphically, and can be found in the appendix. From the kernel density estimate we can see that the residuals are approximately normally distributed. The pnorm plot shows no evidence of non-normality, while the qnorm plot shows deviations from normality in the tails. However, when the sample size is sufficiently large, the assumption of normality is not needed as the Central Limit Theorem ensures that the distribution will approximate normality (Gujarati & Porter, 2009).

### 4.3.3 Heteroscedasticity

Testing for the presence of heteroscedasticity is important because OLS assumes that all the residuals are drawn from a population with a constant variance. If the residuals do not have a constant variance, it can lead to wrong computation of the standard errors, and as a consequence wrong conclusion about the results can be made. To test for heteroscedasticity, we can use the Breusch-Pagan test, where the null hypotheses of homoscedasticity is rejected if the test statistic

has a p-value below 0.05. As shown in table 6, testing the model for heteroscedasticity results in a rejection of the null hypotheses

Table 6: Breusch-Pagan test

| Model | chi2 | Prob > chi2 |
|---|---|---|
| LEV | 32.95 | 0.000 |

To validate the result, it is also common to conduct a Cameron and Trivedi test. As shown in table 7, the test is in line with the Breusch-Pagan test, and we can conclude that there exist elements of heteroscedasticity.

Table 7: Cameron and Trivedi test

| Source | chi2 | df | p |
|---|---|---|---|
| Heteroscedasticity | 149.480 | 27 | 0.000 |
| Skewness | 58.070 | 6 | 0.000 |
| Kurtosis | 5.080 | 1 | 0.024 |
| Total | 212.630 | 34 | 0.000 |

### 4.3.4 Autocorrelation

Autocorrelation in panel data can be detected by using a Wooldridge test, where the null hypotheses is that there is no first-order autocorrelation. Based on the results from the Wooldridge test shown in table 8, we reject the null hypotheses at the 5% significance level as the model have a probability below 0.05. In conclusion, there is a presence of autocorrelation in the dataset.

Table 8: Wooldridge test

| Model | F(1,118) | Prob > F |
|---|---|---|
| LEV | 16.359 | 0.0001 |

### 4.3.5 Multicollinearity

As shown in section 4.2, there are no variables that are strongly correlated, but a variable inflation test (VIF) is still conducted to make sure that there is no multicollinearity in the data. Multicollinearity could be a problem if the mean VIF value is above 10. We can conclude that there are no multicollinearity in the data, based on the results in table 9, where the mean VIF value is equal to 1.26.

Table 9: VIF test

| Variable | VIF |
|---|---|
| SIZE | 1.58 |
| TANG | 1.40 |
| PROF | 1.28 |
| NDTS | 1.18 |
| LIQ | 1.09 |
| GROW | 1.05 |
| **Mean VIF** | **1.26** |

## 4.4 Panel data effects

In section 3.2.5 the three main regression models for analysing panel data were presented. In the following section an attempt to find the most suitable model is made, based on further testing. First we have to test for panel data effects by conducting a Lagrange multiplier test so we can determine if OLS can be used, or if the fixed effects model or the random effects model is more suitable. The null hypotheses tested is that the cross-sectional variance across all components is zero, and thus no panel data effects exists.

Table 10: Breusch and Pagan Lagrangian multiplier test

| Model | Chibar2 | Prob >chibar2 |
|---|---|---|
| LEV | 526.69 | 0.0000 |

Based on the result in table 10, we reject the null hypotheses at the 5% significance level, as the probability is below 0.05. This indicates that there are panel effects present, and we should use either the fixed effects model or the random effects model instead of OLS.

### 4.4.1 Hausman test

The Hausman test is conducted to decide between the fixed effects model or the random effects model, as we concluded that OLS is not suitable. The null hypothesis of the test is that the random effects model is appropriate, while the alternative hypothesis is that the fixed effects model is more suitable.

Table 11: Hausman test

| | (b) | (B) | (b-B) | sqrt(diag(V_b-V_B)) |
|---|---|---|---|---|
| **Variable** | **FE** | **RE** | **difference** | **S.E.** |
| PROF | -0.3340 | -0.2798 | -0.0542 | 0.0083 |
| SIZE | 0.0308 | 0.0370 | -0.0061 | 0.0132 |
| GROW | 0.0002 | 0.0002 | 0.0001 | 0.0000 |
| TANG | -0.2397 | -0.0991 | -0.1406 | 0.0382 |
| NDTS | 0.9885 | 0.9183 | 0.0702 | 0.0317 |
| LIQ | -0.0076 | -0.0104 | 0.0028 | 0.0004 |

| Model | chi2(6) | Prob > Chi2 |
|---|---|---|
| LEV | 102.80 | 0.0000 |

The results of the Hausman test indicates that we reject the null hypothesis, and therefore conclude that the fixed effects model is more suitable for our data sample.

### 4.4.2 Sargan-Hansen test

Because we detected a presence of autocorrelation and heteroscedasticity in our data set, the Hausman test cannot be used as it is only valid under homoscedasticity. Because of this both the fixed effects model and random effects model should be run with robust standard errors.

Deciding between the two models when using robust standard errors is done by conducting a Sargan-Hansen test, where a rejection of the null hypothesis tells us that the fixed effects model is the better model as opposed to the random effects model. The test results in a rejection of the null hypotheses and we can conclude that the fixed effects model with robust standard errors is the better model.

Table 12: Sargan-Hansen test

| Model | Chi-sq(6) | P-value |
|---|---|---|
| LEV | 49.956 | 0.0000 |

### 4.4.3 Chosen panel data model

The empirical analysis will be conducted using the fixed effects model with robust standard errors. The advantage of this model is that it avoids bias due to omitted variables that do not change over time or that change over time equally for all entities (Studenmund, 2014). The fixed effects model is also widely used in similar empirical studies. Studies conducted by Degryse, Goeij & Kappert (2010), Sheik & Wang (2011) and Shah and Khan (2007) found the fixed effects model to be better suited than the random effects model. After conducting a LM test where we found that there is a presence of panel data effects, we concluded that OLS was not suitable for this analysis.

A Hausman test was then conducted to decide between the fixed effects model and the random effects model. The result of the test indicated that the fixed effects model was more suitable. However, we detected both heteroscedasticity and autocorrelation in our data set. Because of this the analysis should be run with robust standard errors. To decide between the two models when using robust standard errors, a Sargan-Hansen test was conducted. The result of this test indicated that the fixed effects model with robust standard errors should be chosen as the model.

## 4.5 Fixed effects regression

Based on the tests and discussion done in the previous section, the fixed effects model with robust standard errors is the chosen model for this study. The result of the regression analysis is presented in table 13, where the coefficients for each of the independent variables represents the effect they have on the dependent variable. The study uses a significance level of 5%, and the null hypothesis is that all of the regression coefficients are equal to zero. The null hypothesis is rejected because the p-value is 0.000, and we conclude that the coefficients are different from zero, thus indicating that the regression model is significant.

Table 13: Robust Fixed effects regression

| **Variables** | **Leverage** | **Robust standard errors** |
|---|---|---|
| **Profitability*** ** | -0.3340 | (0.0559) |
| **Size** | 0.0308 | (0.0338) |
| **Growth** | 0.0002 | (0.0002) |
| **Tangibility** ** | -0.2397 | (0.1150) |
| **Non-debt tax shield*** ** | 0.9885 | (0.3452) |
| **Liquidity** ** | -0.0076 | (0.0030) |
| **Constant** | -0.0199 | (0.7303) |
| | | |
| Observations | 595 | |
| Number of firms | 119 | |
| R-Squared | **0.3206** | |
| *** p<0.01, ** p<0.05, * p<0.1 | | |

R-squared measures the explanatory power of the model. The overall R-squared is 0.3206, which indicates that the variables profitability, growth, size, tangibility, non-debt tax shield and liquidity explains 32,06% of the variation in the leverage of firms in this data set. The explanatory power of the model is comparable to the study done by Thanh & Huong (2016), where they presented a R-squared of 34,04%. Sheikh & Wang (2011) reported a R-squared of 82,57 when using the fixed effects model. however, some of the proxies they used for the independent variables differ from the ones used in this study which are more comparable to the ones used by Thanh & Huong (2016).

### 4.5.1 Effect of firm level explanatory variables on capital structure

In the following section, the coefficients will be analysed and discussed to determine the effect the chosen firm-specific factors have on the capital structure in Norwegian listed firms. A significance level of 5% is chosen, which is widely used in economic studies. The main focus will be on the signs of the coefficients, rather than the size. According to Parson & Titman (2008), this type of research is suitable for deciding which explanatory variables affect the debt ratio, and the sign of these. They are however, not suitable for explaining how much the explanatory variables affect the dependent variable. They argue that in order to say something about the size of the effect, it is required to take into account the advantages and disadvantages of different debt ratios, as well as how sensitive each of the variables are to changes in the debt ratio.

#### 4.5.1.1 Profitability

Table 14: Profitability coefficient

| Variable | Leverage |
|---|---|
| Profitability*** | -0.3340 |

The profitability variable is significant at the 1% significance level with leverage as the dependent variable. The coefficient is negative, which indicates that more profitable firms tend to have a lower leverage ratio. This negative relationship between profitability and leverage is consistent with the study conducted by Mjøs (2007), where Norwegian firms were analysed. Compared to international empirical research, studies done by Rajan & Zingales (1995), Sheikh & Wang (2011), Thanh & Huong (2016) and Titman & Wessels (1988) all concluded with profitability having a negative impact on the leverage ratio.

The two conditional theories presented in chapter two, provides different views on the relationship. The trade-off theory suggests that high profitability promotes the use of debt and provides the firm with an incentive to avail the benefit of tax shields on interest payments. The risk of bankruptcy is also lower in more profitable firms, and debt providers are more willing to issue debt because of this. The theory suggests a positive relationship between profitability and

leverage. Meanwhile, the pecking order theory predicts a negative relationship because profitable firms tend to use internally generated fund when available. The result of the regression analysis is in line with the pecking order theory.

***Result of hypothesis***

$\boldsymbol{H_0}$*: PROF has a positive effect on LEV (Rejected)*

$\boldsymbol{H_0}$*: PROF has a negative effect on LEV (Accepted)*

#### 4.5.1.2 Size

Table 15: Size coefficient

| Variable | Leverage |
|---|---|
| Size | 0.0308 |

The size variable suggests a positive relationship between the size of the firm and its leverage ratio. However, the variable is not significant at the 5% significance level, implying that size has no significant impact on the leverage of a firm. This result differs from the ones presented by Frydenberg (2004). He suggested a significant positive relationship between size and leverage when using the fixed effects model. International studies are mixed. Chen (2004) reports a significant negative relationship, while several studies reports a positive relationship between size and leverage (Bauer, 2004; Eriotis et al., 2007). However, Shah & Khan (2007) also found that size had no significant impact on leverage, which is comparable to the results of this analysis.

The two theories both claim that size has a significant impact on a firm's leverage. The trade-off theory suggests a positive relationship between size and leverage, because larger firms are more diversified and their probability of bankruptcy is lower. The pecking order theory suggests that large firms have more free cash and accumulated earnings, thus requiring less external financing. Larger firms usually do not have problems with agency cost and information asymmetry, which can facilitate the choice of equity.

***Results of hyptheses***

$\boldsymbol{H_0}$*: SIZE has a positive effect on LEV (Not significant)*

$\boldsymbol{H_0}$*: SIZE has a negative effect on LEV (Not significant)*

#### 4.5.1.3 Growth

Table 16: Growth coefficient

| Variable | Leverage |
|---|---|
| Growth | 0.0002 |

The results of the regression analysis imply that there is no significant relationship between growth and leverage at the 5% significance level. Frydenberg (2004) reports a positive relationship between leverage and growth, however, the results were only significant at the 10% significance level when using the robust fixed effects model. His study was mainly focused on the manufacturing industry, which might indicate that growth is more of a determining factor for capital structure in manufacturing firms, rather than general Norwegian listed firms. Growth as an insignificant variable is not in line with most of the prior empirical research conducted on capital structure. Homaifar et al. (1994) and Wald (1999) reports a significant negative relationship between growth and leverage, while Chen (2004) found a positive relationship.

The results do not match the predictions made by the trade-off theory or the pecking order theory. They both suggest that growth is a significant variable in determining capital structure. The trade-off theory suggests a negative relationship between growth and leverage. Firms with future growth opportunities tend to borrow less because growth opportunities cannot be collateralized. Growing firms also tend to have higher agency cost of debt because debt holders fear that growing firms will invest in projects with more risk. The theory also suggests that firms with more investment opportunities tend to prefer less debt, as they do not want intervention from outsiders and risk associated with their opportunities. The pecking order theory however suggest that firms with less growth opportunities tends to acquire more debt over time when the internal funds are not sufficient to finance the investment opportunities.

***Results of hypotheses***

$\boldsymbol{H_0}$*: GROW has a negative effect on LEV (Not significant)*

$\boldsymbol{H_0}$*: GROW has a positive effect on LEV (Not significant)*

#### 4.5.1.4 Tangibility

Table 17: Tangibility coefficient

| Variable | Leverage |
|---|---|
| Tangibility** | -0.2397 |

Tangibility is significant at the 5% significance level. The coefficient suggests that firms with more tangible assets tend to acquire more debt. This result differs from the studies conducted by Frydenberg (2004) and Mjøs (2007), where they both reported a positive relationship between the amount of tangible assets and leverage. Frank & Goyal (2008) and Rajan and Zingales (1995) both reports the same. Sheikh & Wang (2011) and Thanh & Huong (2016) reports a significant negative relationship between tangibility and leverage, which is in line with the results in this study.

Both of the conditional theories predicts a positive relationship. Tangible assets are easier to collateralize resulting in less of a loss if the firm were to go into financial distress. Tangible assets also serve as better collateral for debt and is often associated with a higher leverage ratio. The result from this study does not comply with the predictions made by the two theories, and the null hypotheses is therefore rejected.

***Result of hypotheses***

$\boldsymbol{H_0}$*: TANG has a positive effect on LEV (Rejected)*

#### 4.5.1.5 Non-debt tax shield

Table 18: Non-debt tax shield coefficient

| Variable | Leverage |
|---|---|
| Non-debt tax shield*** | 0.9885 |

The non-debt tax shield variable has the largest coefficient and is significant at the 1% significance level. This suggest a strong positive relationship between the tax benefits from depreciation and leverage in Norwegian firms. The trade-off theory suggests that firms with larger non-debt tax shields are expected to use less debt, which is not in line with the results from this analysis. Frydenberg (2004) also reports a negative relationship between non-debt tax shields and leverage when using total debt to calculate the leverage ratio. Sheikh & Wang (2011) also reports a negative relationship in their study, which is in line with most prior empirical research on capital structure. However, Bradley, Jarell & Kim (1984) found a positive relationship between non-debt tax shields and leverage. They concluded that a possible explanation could be that non-debt tax shields are an instrumental variable for the securability of the firm´s assets, with more securable assets leading to higher leverage ratios. The same result is reported by Chaplinsky & Niehaus (1993), however, both of these studies used different proxies for non-debt tax shields, compared to the one in this thesis.

***Result of Hypotheses***

$\boldsymbol{H_0}$*: NDTS has a negative effect on LEV (Rejected)*

#### 4.5.1.6 Liquidity

Table 19: Liquidity coefficient

| Variable | Leverage |
|---|---|
| Liquidity** | -0.0076 |

The liquidity variable is significant at the 5% significance level, with a coefficient of -0.0076. This indicates that Norwegian firms with better liquidity tend to favour less debt compared to less

liquid firms. The trade-off theory expects a positive relationship between leverage and liquidity. This is because companies with a higher liquidity ratio should borrow more because they have the ability to meet their contractual obligations on time. The pecking order theory predicts a negative relationship because firms with a high liquidity ratio tend to use their internal funds when financing investments. Ozkan (2001) reported a negative relationship between liquidity and leverage and suggested that the negative effect might be due to potential conflicts between debtholders and shareholders of firms. Sheikh & Wang (2011) also found a negative relationship. Thanh & Huong (2016) differentiated between short term leverage ratio and long term leverage ratio and found that liquidity had a positive relationship with long term leverage and a negative relationship with short term leverage. The total leverage had a negative relationship with liquidity, which indicates that a differentiating between long term and short term leverage could further explain the relationship between leverage ratios and liquidity in firms. The results from the analysis is comparable to the predictions made by the pecking order theory, which could indicate that Norwegian listed firms prefer to finance their investments through internal reserves as opposed to using external financing.

***Results of hypotheses***

$\boldsymbol{H_0}$*: LIQ has a positive effect on LEV (Rejected)*

$\boldsymbol{H_0}$*: LIQ has a negative effect on LEV (Accepted)*

# 5. Conclusion

This last chapter will summarise the thesis and provide a conclusion based on the research problem presented in chapter one, followed by a brief discussion of the limitations of the study as well as recommendations for future research.

## 5.1 Summary

The main research problem of this thesis is *"Which firm-specific factors are of significance to the capital structure in Norwegian listed firms."*

This thesis contributes to the literature on capital structure by examining the capital structure of 119 Norwegian firms listed on the Oslo stock exchange during the period 2015-2019. The contribution is made in an attempt to fill the gap that exists when it comes to capital structure studies conducted solely on Norwegian firms. The thesis examines six firm-specific explanatory factors: profitability, size, growth, tangibility, non-debt tax shields and liquidity. These factors were expected to help explain the observed debt ratios of Norwegian firms, based on existing capital structure theories, including the trade-off theory and the pecking order theory, and previous empirical research.

Multiple regression analysis was used to examine the effect of these factors on the debt ratio. The results suggest that profitability, tangibility and liquidity are negatively correlated with the amount of debt a firm has. Non-debt tax shields have a positive relationship with the debt ratio, while size and growth appear to have no significant impact on the debt ratio. In order to answer the research problems presented in this thesis, the findings were then compared to the predictions made by the trade-off theory and the pecking order theory, in addition to previous empirical findings to determine if they could help explain the financing behaviours of Norwegian firms.

The thesis divides the research problem into three sub-problems, where the first one is "*Can the chosen firm-specific factors explain the variation in capital structure of Norwegian listed firms?* The $R^2$ value for the statistical model indicated that the independent variables were able to explain 32% of the variance in debt ratio, which was comparable to the explanatory power in similar studies using similar proxies for the chosen variables. Based on the assumption that

identifying and including all the relevant variables would be near impossible, the conclusion is made that the chosen firm-specific factors were able to explain some of the variation in the capital structure, but not all of it.

The second sub-problem is "*Can the capital structure of Norwegian listed firms be explained by the static trade-off theory and the pecking order theory?".* Profitability and liquidity had a negative relationship with the debt ratio. This indicates that firms with greater returns and a better ability to cover their current liabilities have a reduced need for debt. This is in line with the predictions made by the pecking order theory, where the assumption is made that firms with a higher liquidity ratio and greater returns tend to use retained earnings when financing their investment opportunities. Tangibility was negatively correlated with the leverage ratio, indicating that firms with more tangible assets tend to borrow less, which is a contradiction of both theories´ predictions. The results of the study indicated that non-debt tax shields had a positive effect on the debt ratio, indicating that firms with greater non-debt tax shields prefer more debt. While the pecking order theory makes no prediction for this variable, the results contradicts the prediction made by the trade-off theory. Size and growth were found to have no significant impact on the capital structure. Based on the findings, the conclusion is that neither of the two theories can fully explain the capital structure choices of Norwegian firms. However, the pecking order theory can explain some of it.

To answer the third sub-problem *"How does the result of the study compare to previous empirical findings?"*, a comparison was made between the results from the regression analysis and a few chosen empirical studies. Because of the lack of research done solely on Norwegian firms, the results were also compared to international studies using similar proxies as the ones chosen in this study. Most of the previous empirical research suggested a negative relationship between profitability and leverage, which matches the results of this study. This was not the case for size, growth and non-debt tax shields, where the findings from the majority of recent studies did not match the ones in this analysis. The two remaining variables, tangibility and liquidity found some support in previous empirical studies. However, the previous findings on these determining factors were mixed. In conclusion, the results of this study does not match the majority of the previous empirical findings regarding three of the six factors, while the remaining factors finds support in previous studies.

## 5.2 Limitations of the study

There are several limitations to this study, one of the most important being that the statistical model used provides a relatively low explanatory power, with an $R^2$ of 32%. This suggests that all relevant explanatory variables are not included in the model. However, including all the relevant variables would be difficult, if not impossible, because some of them could be hard to measure. Furthermore, as previously mentioned, it is difficult to evaluate the extent of the effect the individual variables have on the dependent variable. However, this is also the case for similar studies conducted on the determining factors of capital structure. It is also worth mentioning that the dependent variable, leverage, consists of total debt. There is no differentiation made between short-term and long-term debt, which could further explain the relationship between the independent variables and the leverage ratio.

Some of the results from the regression analysis differ from the ones found in most empirical studies. This is the case for three of the chosen independent variables, including growth, tangibility and non-debt tax shields. The results for these variables also contradicts the predictions made by the two conditional theories. This might suggest that further analysis is required, where a case can be made for the use of different proxies for the given variables. The results were comparable to a few recent studies, however, they were conducted using different data sets and in some cases different proxies.

Another limitation to the study is the chosen time period, where the observations were limited to the period 2015-2019. Expanding the time period could potentially improve the reliability of the results, however, this could also bias the results because firms might change their financing behaviours over longer time periods. In addition, a case can be made for including macroeconomic factors in the analysis, as the data sample collected from the given time period might not represent a "normal situation" for Norwegian firms. A problem regarding survivorship bias could also be present in the data set. Firms that were delisted during the period were excluded from the analysis. This could cause biased results because the included companies are the ones who were successful enough to survive until the end of the time period. In addition, by only including firms listed on the Oslo Stock Exchange, smaller unlisted firms were excluded.

## 5.3 Recommendations for future research

Naturally, a continuation of the research would be to remedy the limitations previously mentioned. This thesis conducts a quantitative analysis of the determining factors of capital structure in Norwegian listed firms, using explanatory variables frequently used in similar studies. Future research could expand on this by including additional firm-specific factors, in addition to macroeconomic country-specific factors. This could be done in an attempt to identify other significant variables and increase the explanatory power of the model. This might include a qualitative analysis in order to determine which variables managers emphasizes when deciding on how to finance investment opportunities. In addition to this, different proxies for the firm-specific factors could be used in order to see if the conclusion would remain the same.

In order to avoid the problem regarding survivorship bias, a study including firms that were delisted during the observed time period could be conducted. However, this would also cause the panel data set to be unbalanced as there would be an unequal amount of observations for the included firms. Smaller unlisted firms could also be included, as there could be differences in financing preferences between listed and unlisted firms.

Another expansion of this study could be to differentiate between short-term debt and long-term debt, when creating a measure for leverage. Additional models could be added, where the proxy for leverage could be the amount of either short-term debt or long-term debt in regards to the total amount of assets. This could help further explain the relationship between the independent variables and the chosen capital structure of firms.

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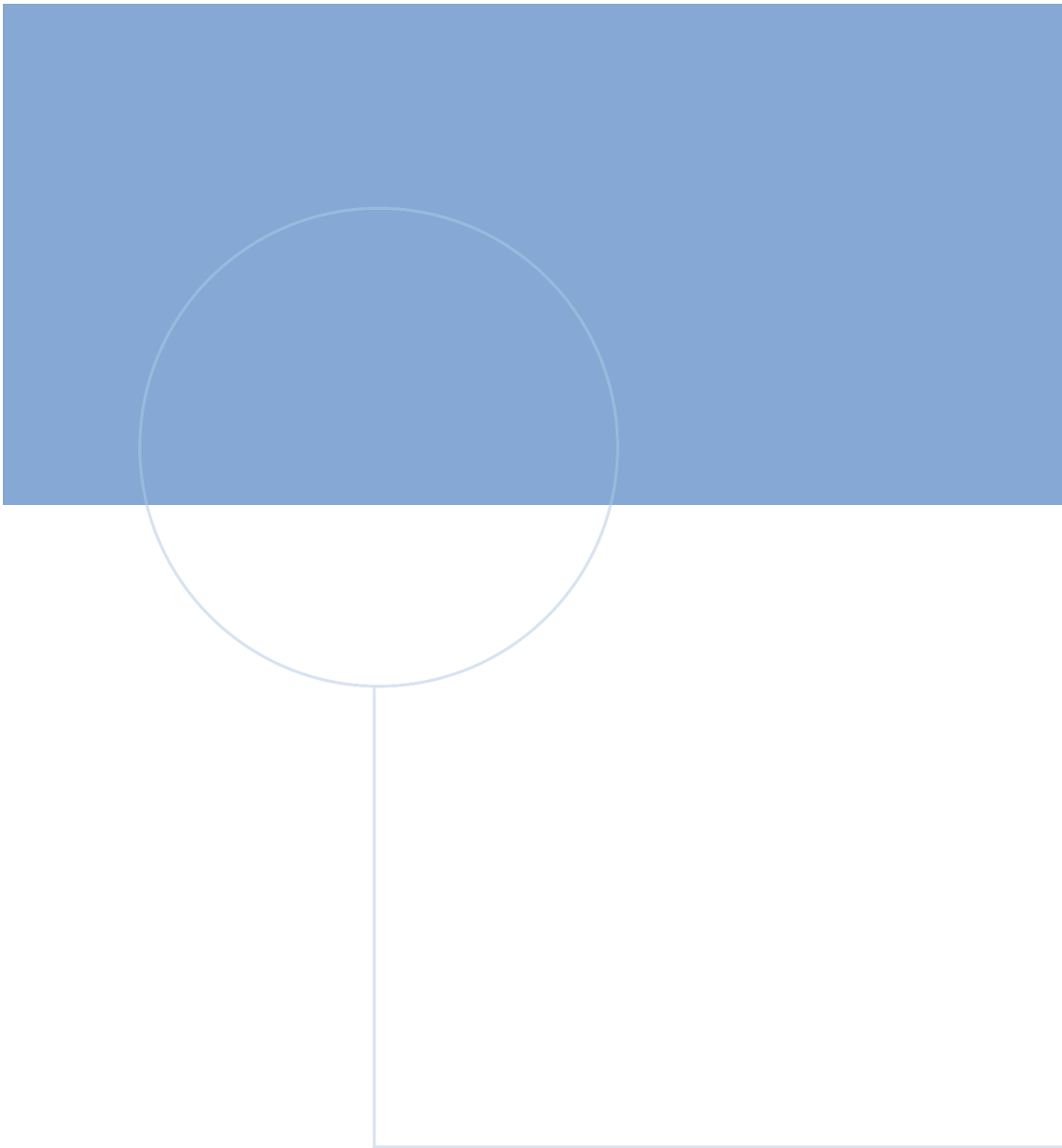

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