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Determinants of Capital Structure in Listed Norwegian Firms

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Abstract

The main goal for most firms is to maximise firm value and the wealth of shareholders. In order to achieve this goal, firms should use an optimal combination of equity and debt that will result in a low weighted average cost of capital for the firm. It is therefore necessary for firms to be aware of the factors that influence their capital structure decision.

Several empirical studies have attempted to explain what determines the choice of capital structure in firms. However few have focused solely on Norwegian firms. Hence, the primary objective of this study is to examine what determines the capital structure in listed Norwegian firms.

DataStream was used to obtain the data needed for the statistical analysis and previous studies were used to calculate the measures for the firm-specific characteristics. The study was conducted over a period of 7 years, from 2007 to 2013, and there were a total of 90 firms in the sample, resulting in 876 observations.

The results from the study indicate that tangibility is the most important firm characteristic to consider when making capital structure decisions. Furthermore, the results indicate a difference between the book value and market value of debt. Book value of leverage finds support in the pecking order theory, while none of the theories fully explains the observed capital structure in Norwegian firms. Based on the evidence obtained from this research, firms should take these firm-specific factors into account when making capital structure decisions.

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Chapter 1: Introduction

The first chapter in this paper will give an introduction to the topic of capital structure and an overview of the thesis. This chapter will consist of four sections, background to the research topic, purpose of study, aims and objectives and an outline of the structure.

1.1 Background

Modern theory of capital structure began with Miller and Modigliani (1958) and their famous proposition that described how and why capital structure is irrelevant. Since then, an extensive amount of research has focused on how companies decide between equity and debt for financing. The financial crisis of 2008 contributed to increased attention towards capital structure decisions, as it highlighted the importance of deviations from Miller and Modigliani's irrelevance theorem (Kashyap and Zingales, 2010).

Several researchers have tried to determine what factors affect companies' financing decision. Overall this has resulted in two main theories, the pecking order theory and the trade-off theory. The trade-off theory explains that the choice of capital structure is a result of a trade-off between the benefits of debt, such as the debt tax shield, and the costs of debt, including bankruptcy costs and costs of financial distress. By contrast, the pecking order theory advances that companies prefer the cheapest source of funding. Because of information asymmetry, companies will prefer internal to external funding and debt over equity (Myers, 1984).

The two theories of capital structure represents the basis for many studies that have been done later, in which the analysis try to determine which model best explains the choice of financing and what factors might make up the capital structure decision.

However past empirical research has provided contradictory results and evidence of the theories' ability to explain capital structure remains limited. Researchers continuously strive to determine the most important determinants of capital structure and how it varies across companies, industries and countries.

This thesis analyses the explanatory power of established theories and firm-specific factors from the literature in explaining the choice of capital structure across Norwegian listed firms. This study is based on a panel data set from 2007 to 2013 and consists of 90 companies listed on the Oslo Stock Exchange. This study will use panel data regression analysis to empirically understand how different firm-specific factors impact firms' leverage ratio.

1.2 Research problem

The combination of debt and equity for a firm represents a firm's target capital structure, and is one of the most important decisions a firm has to make. In order to determine the target, firms should be aware of the factors that can influence their choice of capital. Based on previous empirical research, six firm-specific characteristics were chosen for this study; profitability, size, growth, tangibility, liquidity and non-debt tax shield. Furthermore, the effect of these characteristics will be examined for two measurements of leverage, book value and market value.

Several studies on this topic have already been conducted for different countries. However, except for Frydenberg (2004) and his research on capital structure in the Norwegian manufacturing sector, few have focused solely on the determinants of capital structure for Norwegian firms. This represents a gap in the existing literature and provides a purpose for this study.

1.3 Aims and Objectives

The aim of this study is to determine the effect firm-specific characteristics have on the capital structure of Norwegian listed firms. Based on this, the following secondary objectives have been formulated:

- Analyse whether firm-specific characteristics can explain the variation in capital structure across Norwegian firms.
- Determine if book value of leverage and market value of leverage produce different results.
- Look at the dominant theories of capital structure and examine if the trade-off theory and the pecking order theory can explain the observed capital structure of Norwegian firms.

1.4 Outline

Following the introduction, this paper is structured into four chapters

1. **Introduction**

   The first chapter describes the background for this paper, followed by the purpose of study and a presentation of the aims and objectives of this thesis.

2. **Theoretical Framework:**

   This chapter will present capital markets in a perfect and an imperfect setting, discuss the propositions of Miller and Modigliani and present the two most dominant theories of capital structure, the pecking order theory and the trade-off theory. Furthermore, previous empirical research will be analysed and discussed and an overview of how Norwegian companies have access to capital will be presented. Finally, the determinants of capital structure used in this paper will be presented.

3. **Methodology:**

   This chapter will present hypotheses that will be tested in this paper, as well as the research methods used. How the data is collected will also be described and estimation methods will be evaluated and illustrated.

4. **Analysis:**

   The fourth chapter will analyse the data by using the most feasible estimation model found in the previous chapter. The hypotheses will be tested and based on this the findings will be presented.

5. **Conclusion:**

   This chapter will summarise this research paper and provide a conclusion, present the limitations of the study and provide recommendations for future research

Chapter 2: Theoretical framework

This chapter will first explain capital structure in a perfect market and present Miller and Modigliani proposition I and II. Thereafter, capital structure in an imperfect market will be explained by using the two main theories of capital structure; the trade off theory and the pecking order theory. Then I will discuss imperfect capital markets, before previous empirical research on the determinants of capital structure will be evaluated. This section will also include cross-country studies that involve Norway.

2.1 Defining capital Structure

The overall purpose of a firm is to maximise firm value and create value for shareholders. Firm value is calculated by the present value of its expected future cash flows, discounted by the weighted average cost of capital. In order to maximise the value of the firm, management need to make investments in order to generate cash flows. These investments requires funds and companies have to decide whether they want to use debt or equity. The optimal mix of debt and equity can minimise the weighted average cost of capital and increase shareholder value, and consequently the value of the firm (Berk and DeMarzo, 2013). Capital Structure is an expression of how a company is financing its total assets and is a decision that poses a lot of challenges for firms. Determining an appropriate mix of equity and debt is one of the most strategic decisions companies are confronted with (Modugu, 2013, p. 14). A firm has three main sources of financing at their disposal to fund their investments. This includes the use of retained earnings, issuing new shares and borrowing money. Together these financing options represent a firm's capital structure, as well as its ownership structure.

In 1958 Miller and Modigliani stated that capital structure was irrelevant as the value of the company would be the same regardless of how a company is financed. Based on this, discussions and theories have been developed in the literature aiming to explain if an optimal capital structure exists and what factors are determining the choice of capital structure. According to Myers (2003, p. 3) there does not exist a universal theory of capital structure, only useful conditional theories that differ in the factors that affect the choice of capital structure. The following chapter will present theories that are relevant for my research question and I will explain and discuss why I believe these theories are important for my analysis. Furthermore I will briefly present past studies on the determinants of capital structure.

2.2 Capital structure in a perfect market

With perfect capital markets there is not possible to influence a company's value through how the company is financed. Capital markets are said to be perfect in the absence of agency costs, taxes, transaction costs and asymmetrical information. In the real world, capital markets are not perfect. However, it can be useful to evaluate how closely the assumptions hold and consider the consequences of any deviations (Berk & Demarzo, 2013).

2.2.1. Miller and Modigliani

"The pizza delivery man comes to Yogi Berra after the game and says, Yogi, how do you want this pizza cut, into quarters or eights? And Yogi says, cut it in eight pieces. I'm feeling hungry tonight" [1] *(Miller, 1997 explains the irrelevance theorem)*

[1] In the book *Investment Gurus* (1997, p. 194), Peter J. Tanous interviews Merton Miller. When he is asked to quickly summarize the Miller & Modigliani proposition I he does it with a joke. He illustrates that the shape of the pizza pieces does not affect the actual size of the pizza. Similarly, the way a company decides on capital structure, do not affect the aggregate value of the firm.

The first important insights into the choice of capital structure and its correlation with firm value started with Miller and Modigliani in 1958. Under the conditions of perfect capital markets they demonstrated the following regarding the role of capital structure in determining firm value (Berk & Demarzo, 2013):

M&M proposition I: *In a perfect capital market, a company's total market value is independent of its capital structure*

Formula 1: *Miller & Modigliani Proposition I*:

$$V_L = V_U = V_A$$

The proposition implies that the total market value of a firm's securities is equal to the market value of its assets, regardless of whether the firm is leveraged or not. The cost of debt has traditionally been lower then that of equity when calculating the capital requirements, as debt is less risky. Arguably it will therefore be more beneficial to finance a company with debt, as it is relatively cheaper. However Miller and Modigliani states that the capital composition of a company is irrelevant as it does not affect the company's cash flow or its market value (Miller and Modigliani, 1958). On the balance sheet, the total market value of a firm's assets equals the total market value of the firm's liabilities, including securities issued to investors. Changing the capital structure will therefore only alter how the value of the assets is divided across securities, but not the total value of the firm (Berk and Demarzo, 2014). In a perfect capital market it would not be a problem for an investor to replicate any capital composition.

Their second proposition, which is a direct development of the first one, discusses how risk and return on equity change as a result of alterations in the debt ratio:

M&M proposition II: *The expected return on equity in a leveraged company will increase proportionally with the debt-to-equity ratio.*

By interpreting formula 1 in terms of market values we get the following expression:

Formula 2: *Cost of unlevered equity (Pretax WACC)*

$$r_u = \frac{E}{E+D} r_e + \frac{D}{E+D} r_d$$

By solving formula 2 for r_E we get the following expression for the levered return on equity (Berk and Demarzo, 2013):

Formula 3: *Miller & Modigliani Proposition II*

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

The return on levered equity (r_E) equals the unlevered return (r_U), plus and extra "kick" because of leverage ($D/E*(r_U-r_D)$). This effect causes an even higher return on levered equity when the firm performs well ($r_U > r_D$), but makes it drop even lower when the firm performs poorly ($r_U < r_D$) (Berk and Demarzo, 2013).

Miller and Modigliani's theory provides a theoretical framework for understanding capital structure. However, it does not provide a realistic description of how companies should decide on an optimal capital structure (Frank & Goyal, 2005). By assuming perfect capital markets, they rather highlight the factors such as, taxes, asymmetry, bankruptcy etc. that makes capital structure relevant. As a result, their theory has been groundbreaking in the field of corporate finance and provides an important foundation for understanding capital structure.

2.3 Capital structure in an imperfect market

In reality, capital markets are not perfect, and the assumptions that Miller and Modigliani made did not consider factors such as the tax advantages of debt, asymmetric information, bankruptcy costs and financial distress. However in 1963 they modified their propositions in order to account for the tax benefits of debt. Today there are two main theories trying to explain how companies allocate their capital in an imperfect market, the "Trade-off theory" and the "Pecking order theory" (Myers, 1984).

2.3.1 Taxes and Capital structure

Miller and Modigliani (1963) modified their propositions and considered the interest rate on debt to be offset by the tax savings from the interest tax shield. They assumed that debt was risk-free and would be held permanently, so that the value of the tax shield could be considered a perpetuity (Berk and DeMarzo, 2013):

$$\text{PV (interest tax shield)} = \frac{\tau_c \times (r_f \times D)}{r_f} = \tau_c \times D$$

Proposition I can now be rewritten as: $V_L = V_U + \tau_c \times D$

By including taxes in formula 2, we can an expression for the weighted average cost of capital.

Formula 4: *The Weighted Average Cost of Capital*

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

The weighted average cost of capital represents the effective cost of capital to the firm, after including the benefits of the interest tax shield. The higher the firm's leverage, the more the firm will exploit the tax advantages of debt, and the lower its WACC is. When making financing decisions, the capital used should be a weighted average of the various costs of each capital component. (Berk and DeMarzo, 2013)

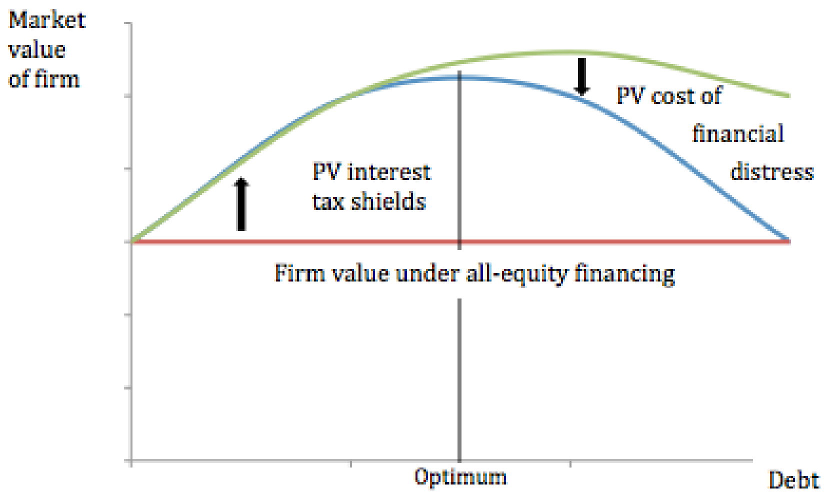
2.3.2 The Static Trade-Off theory

The Trade-Off theory emerged as a result of the debate over the Miller & Modigliani theorem (Frank and Goyal, 2008). The theory states that the "…total value of a levered firm equals the value of the firm without leverage plus the present value of the tax savings from debt minus the present value of financial distress costs" (Berk and DeMarzo, 2013, p. 574).

Formula 5: $V^L = V^U + PV\ (\text{Interest Tax Shield}) - PV\ (\text{Financial Distress Costs})$

Where V^L is leveraged firm value, V^U is unleveraged firm value and PV is present value. The optimal level of debt is what maximizes V^L. To maximise firm value, companies will operate at the top of the curve in figure 1.

Figure 1: Optimal firm value



Source: Own contribution adapted from Myers (1984)

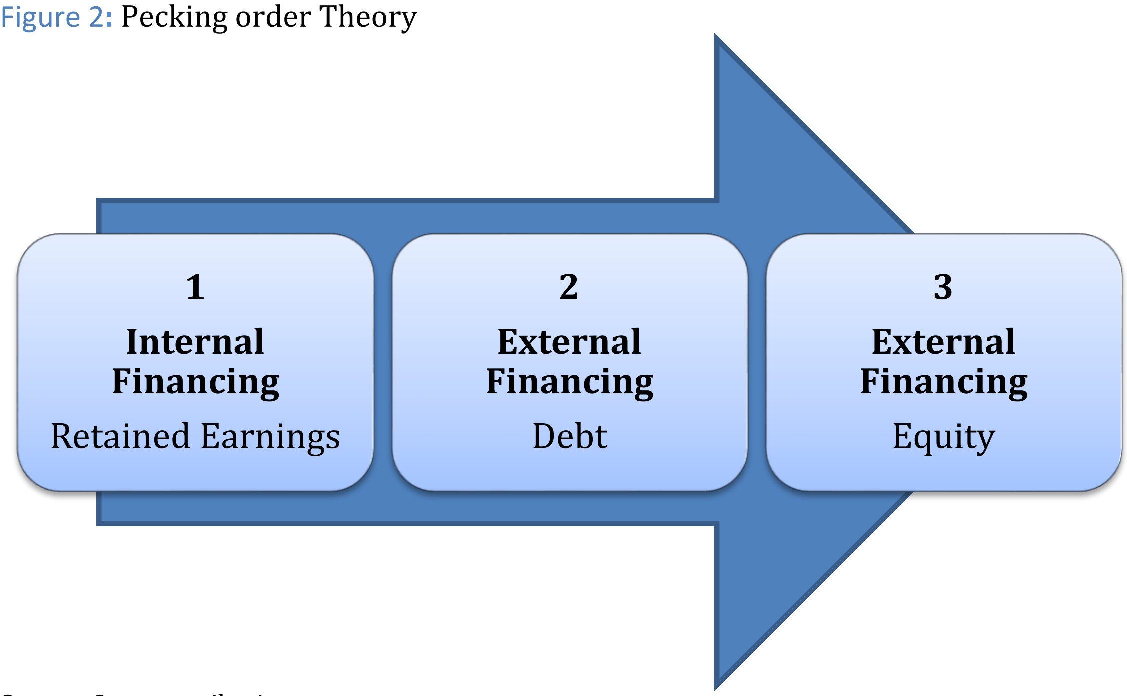
According to Myers (1984), more debt involves increased costs associated with bankruptcy and financial distress. When the risk of incurring these costs increases, the value of the firm will decrease and capital will become more expensive. As a result, there exists an optimal capital structure that reflects a trade-off between the costs of bankruptcy or financial distress and the tax benefits of debt. This implies that companies should set a target financial debt ratio (Frank and Goyal, 2008; Swinnen et al., 2005). However the optimal debt ratio will vary across firms because tax rate, bankruptcy costs and the impact of financial distress vary across firms. With regards to determinants of capital structure, the theory claims that profitable firms will try to protect their profits from debt, resulting in a higher level of leverage. Furthermore, growth will have a negative impact on debt because the risk of financial distress will be higher for growing firms.

2.3.3 Pecking order theory

The Pecking order theory was developed by Stewart C. Myers in 1984 and defines a ranking of preferred capital. Furthermore Myers (2003, p. 3) claims that"…financing adapts to mitigate problems created by differences in information between insiders and outside investors". The theory can be explained from the existence of transaction costs and the perspective of asymmetric information (Swinnen et al. 2005). Because of this, companies prefer retained earnings to debt and will only under extreme circumstances use equity as financing (Myers, 1984). As a result, variation in a company's debt level is driven by the company's net cash flow and not by the trade-off between the costs and benefits of debt (Fama & French, 2002). Information asymmetry occurs when the owner-managers have full information about the true value and quality of the company, whereas investors have less information. This makes it difficult for investors to separate good and bad quality companies. Investors make up for this uncertainty by requiring a higher rate of return and thus make capital more expensive for companies (Frank & Goyal, 2008). Asymmetric information can in turn lead to adverse selection problem

Under pecking order conditions companies prefer internal to external financing. Therefore profitable firms will borrow less as they have more internal financing available (Myers, 2003, p. 27) and less profitable firms will use more debt. There is no specific debt-to-value ratio for firms in this theory, so the level of debt a company has incurred reflects the need for external finance, rather than a specific target (Myers, 1984, p. 576). Furthermore, companies with more volatile net cash flows are according to the theory, are more likely to have less leverage (Fama & French, 2002)

Figure 2: Pecking order Theory



Source: Own contribution

2.3.4 International Capital Markets

International capital markets have experienced rapid changes since the mid 1970's. Financial markets have been deregulated, capital controls have been reduced, new financial instruments have emerged and investors have seen the benefit of reduced risk in holding a diversified portfolio. In addition, new technology has led to lower transaction costs and made the access to international markets easier (Errunza & Miller, 2000). Despite this, research have shown that investors prefer to invest in their home country regardless of the lower risk associated with holding an international portfolio. This implies that it exist barriers to international capital mobility and thus capital markets are imperfect (Bayoumi, 1997). The literature presents several factors that may serve as barriers to international capital mobility. Medeiros & Quinteiro (2008) suggest that transaction costs is the main barrier, stressing that it will induce concentration in domestic portfolios. Transaction costs include taxes and restrictions to capital markets, as well as informational disadvantages. Additionally, Eiteman et al (2013) states that other barriers include exchange rate risk, illiquidity in the domestic financial market and different market risk-return trade offs.

2.3.4.1 The Cost of Capital

The capital market imperfects have important influence on a firms' marginal cost of capital, and thus their weighted average cost of capital (See appendix A).

The availability of capital depends on whether a firm can gain liquidity for its securities and their price based on international rather than national standards. Eiteman et al. (2013, p. 382) stresses that firms that are able to attract foreign investors can "...escape the constraints of their own illiquid or segmented market". Furthermore the international availability of capital to firms may let them lower their cost of equity and debt. In addition, it allows firms to maintain a desired debt ratio, even if significant amounts of debt need to be raised. Arguably, as a result, firm's that have the opportunity to source funds internationally have a constant marginal cost of capital for large parts of their capital budget (Eiteman, 2013). However empirical studies differ in their results regarding whether or not multinational firms have a higher cost of capital compared to firms that only source funds domestically.

Henderson et al. (2006) mentions several reasons for why firms would choose to raise capital in globally rather than in their home country, including risk sharing, lower cost of capital and potentially lower transaction costs. They find evidence of credit market segmentation and that a volatile environment affects capital structure choice for firms. Moreover, they argue that a firms' decision to issue equity is influenced by both firm-specific factors and macroeconomic conditions. They show that firms are more likely to issue equity in favourable macroeconomic conditions where the equity market is overvalued. This research is supported by studies conducted by Stultz (1995), Singh & Nejadmalayeri and Errunza & Miller (2000) who also provide evidence of the beneficial impact of sourcing funds internationally in order to gain a lower cost of capital. However Lee & Kwok (1988) arrived at the opposite conclusion when they discovered evidence that international funding could potentially lead to a higher cost of capital. Their study found that multinational firms have higher bankruptcy costs, political risk and asymmetric information compared to firms that kept to their domestic capital markets.

2.4 Empirical research

Previous empirical research regarding capital structure provides no general model on the determinants of capital structure. Appendix B.1 lists some recent studies on the matter and it shows that each researcher considers different factors when analysis the level of debt for companies. After considering the available data, the most common determinants based on previous research and theory was decided upon. As a result, the final set of independent variables includes six factors; Profitability, non-debt tax shield, tangibility, firm size, liquidity and growth.

2.4.1 Analysis of selected previous empirical research

Antoniou et al. (2002) researched the determinants of capital structure of French, British and German companies using panel data from 1969-2000. They chose to examine these countries together as they are characterised by different financial systems and traditions, something that may affect the amount of leverage in a company. Surprisingly enough, their findings suggest that factors affect the three countries in the same way despite of this. Further they get a positive relationship between leverage and size, while the opposite is the case for growth and leverage. For fixed assets, profitability and effective tax rates, they discover that the factors varies in the direction and degree of influence on leverage across the sample countries. This shows that capital structure decisions do not only depend on firm-specific factors, but also the environment the company operates in.

Nunkoo & Boateng (2009) researched non-financial Canadian companies between 1996 and 2004 using panel data and a dynamic regression model. Their result suggested that firms have long-term target debt ratios, but with a slow adjustment ratio. Furthermore they find that profitability and tangibility have a positive effect on the amount of leverage a company has, while there was a negative effect based own size and growth opportunities.

Titman & Wessels (1988) researched the explanatory power of different factors from theories of optimal capital structure. Their data is collected from American industrial companies from 1974-1982. They did not find any significant relationship between leverage and volatility, tangibility, growth and non-debt tax shield. However, they discovered a negative relationship between debt and profitability and a negative correlation between size and short-term debt. The most surprising discovery in their study is that the level of debt is negatively correlated with the uniqueness of the company.

Frank & Goyal (2004) did a similar study but on publicly traded U.S firms from 1950 to 2000. They discover that firms tend to have lower levels of debt the more profitable they are. Furthermore their results suggest that firm tangibility is significant and causes firms to have more debt, the more collateral they have. In addition they conclude that larger firms tend to have more leverage compared to smaller firms. Finally they found that dividend-paying firms have less leverage and that leverage tends to be higher when the US inflation rate is high. Overall they find that the pecking order theory does a poor job in explaining capital structure.

Frydenberg (2004) has conducted one of the few empirical studies that have been done on capital structure of Norwegian firms. He focuses on firms in the Norwegian manufacturing sector between 1990 and 2000. He discovers that the pecking order theory finds significant support in the results of the study. His findings suggest that profitable firms tend to have less debt and that firms with a large amount of fixed assets tend to increase long-term debt and decrease short-term debt. The effect of the non-debt tax shield is significant and negative in his study. Which indicates that firms substitute debt for such tax shields.

2.4.2 Cross-country studies including Norway

As presented in the previous section, there has been a lot of research conducted regarding capital structure. However, few have focused solely on Norway, which leaves a gap in relation to knowledge concerning capital structure in Norwegian firms. Nevertheless, some cross-country studies have included subsamples of Norwegian companies when exploring differences in capital structure across countries. Because country-specific factors, including institutional differences, may induce a change in the determinants of capital structure, this may help decide on what determinants are most important for Norwegian companies. It will also be of interest to explore potential differences in the results related to prior research.

Bancel and Mittoo (2004) surveyed managers in sixteen European countries on the determinants of capital structure. They discovered that financial flexibility is the most important factor when issuing debt, while earnings per share dilution is the primary concern when issuing common stock. In their survey, 91% of managers' rank financial flexibility as important compared to only 59% of US CFO's in a survey conducted by Graham and Harvey (2001). This difference may suggest that European companies would try to preserve financial flexibility by keeping a lower level of debt. Bancel and Mittoo (2004)'s results suggest that the differences in firms' financial decisions across countries are the most significant between Scandinavian and Non-Scandinavian firms.

La Porta et al. (1997) examined the ability of firms in different legal environments to raise external finance through equity or debt. They confirm that countries' legal rules matters for the size of a country's capital markets and that differences in shareholder rights, bankruptcy law and the quality of law enforcement have strong impact on capital structure. Furthermore they find that the credit rates in Norway are stronger than in US, but shareholder rights are weaker. This implies that we should expect a higher debt level in Norway compared to the US.

Levine et al. (1999) states that Norway can be considered a country with a bank-based financial system. This suggests that most companies finance themselves through bank loans, in contrast to market based financial systems, like the US, where firms mostly fund themselves through the capital markets. It is often assumed that companies in bank-based countries have higher leverage and more short-term debt. His results however indicate that there is no cross-country empirical evidence for the superiority of either the bank-based or the market-based financial system. As a conclusion he suggest that specific laws and enforcement mechanisms that govern debt and equity transactions are more useful in describing cross-country capital structure.

2.4.3 Summary of previous empirical research

Overall the results from previous empirical research show that in general, the same characteristics affect the choice of capital structure across countries, however institutional factors may lead to differences in the sensitivity of these factors. Previous empirical papers are reaching contradictory results in their investigation of the relationship between capital structure and company specific factors. There are differences both across industries and geographic areas, as well as considerable variation within individual industries. Even though the effect of the capital structure determinants differs, there are still indications that the same factors are evident across several studies.

2.5 Firm-Specific Determinants of capital structure

There is a large amount of possible determinants of capital structure choice. This makes it challenging to decide which are the most important and how to establish a good model to measure the different variables and their degree of significance (Harris & Raviv, 1991). However, there is still some consensus amongst researchers that there exist some common factors. The two theories described in chapter 2, mostly agrees on the factors that determines how a company is finances. However, the assumptions and expectations on the extent and direction of how the factors affect capital structure differ between the theories.

This section will present a brief discussion on the determinants that different theories of capital structure suggest may affect the amount of leverage in firms. These determinants are profitability, size, tangibility, growth, liquidity and non-debt tax shield. These determinants, their relationship to capital structure and their link to established theories will be discussed individually below.

Profitability

Profitability has been the most significant determinant in previous studies regarding capital structure. It indicates how well management are able to utilise total assets to generate earnings. According to the trade-off theory, the higher the profitability of the firm, the more likely the company is to issue debt as it is reducing its tax liability. In addition, firms with high a high profitability ratio have less risk of bankruptcy and financial distress. Moreover, debt providers will be more willing to lend to profitable firms because the probability of default is lower. Therefore the theory predicts a positive relationship between leverage and probability. In comparison, the pecking order theory predicts a negative relationship, as companies prefer to finance themselves through retained earnings. A profitable firm will retain more earnings and as a result, the leverage needed should decrease. Nunkoo and Boateng (2009) studied the capital structure in Canadian firms and discovered a significant positive relationship between profitability and debt. However most of the previous empirical research shows that profitability has a negative effect on leverage (Shah & Khan, 2007; Gonsález & Gonsáles, 2012; Ozkan, 2001; etc.).

Size

Size is also linked with the leverage of a company. According to the trade-off theory large firms will have less risk because they are more diversified and have more stable cash flow. Hence, larger firms will have a lower financial distress costs and a lower probability of bankruptcy costs. Additionally, larger firms will have a better reputation in the debt market because they would receive higher credit ratings since their default risk is lower. This implies a positive relationship between size and leverage (Frank & Goyal, 2005; Titman & Wessels, 1988). With regards to the pecking order theory, Rajan and Zingales (1995) suggested that this relationship could be negative. Larger firms have less information asymmetry. Consequently, the chance of issuing undervalued equity is reduced and will encourage larger firms to use equity financing. Frank and Goyal (2009) agrees, and argues that larger firms have easier access to the capital market than their smaller counterparts. As a result, it will be easier to attract equity and these firms will thus have less debt. Previous studies vary in concluding whether size is a significant factor for capital structure. Empirical studies done by Chen (2004), Mazur (2007), Nunkoo & Boateng (2009) amongst others, found a negative relationship between size and leverage, while Sbeiti (2010) and Olayinka (2011) discovered a positive relationship. Other studies found that size did not have any significant impact on leverage (Shah & Khan, 2007; Noulas & Genimakis, 2011, etc.).

Tangibility

Tangible assets include fixed assets, such as machinery and buildings, and current assets, such as inventory. Compared to intangible, nonphysical assets, tangible assets are easier to collateralize so they will suffer a smaller loss if the company goes into financial distress. Tangible assets are associated with a higher leverage ratio as they can serve as better collateral for debt (Rajan & Zingales, 1995). Moreover, a high tangibility ratio will lower expected agency costs and problems. According to both theories, tangibility will positively affect leverage (Frank & Goyal, 2009). This is consistent with the majority of previous empirical research (Shah & Khan 2007; Chen, 2004; Nunkoo & Boateng 2009 etc.) that discovers that companies with more tangible assets has higher leverage ratios. However, Booth et al. (2001) suggests a negative relationship between tangibility and debt based on their results.

Growth

According to Frank & Goyal (2005; 2009), there should be a negative relationship between leverage and growth opportunities based on the trade-off theory. This is mainly because growing firms loose more of their value when they go into financial distress than mature firms. Growing firms will also have higher agency costs of debt because debt holders fear that these growing firms will invest in risky projects for the future (Booth et al. 2001). As a result, growth will reduce firm leverage. This is consistent with the results from Olayinka (2011) and Ozkan (2010). By contrast, Chen (2004) and Booth et al. (2001) estimated a positive relationship between leverage and growth. According to the pecking order theory, growing firms should get more debt over time if internal funds are not sufficient to finance investment opportunities. Hence the amount of leverage in growing firms should be considerably more than for a stagnant firm.

Liquidity

Liquidity can be defined as the ability for firms to use current assets to cover their current liabilities. Thus, it says something about how well firms meet their short-term obligations. In the pecking order theory, internal financing is the most preferable source of capital for firms. Therefore, companies are more likely to create reserves from retained earnings (Ali et al. 2013). Firms that are able to convert their assets into cash, use these inflows to finance their investments instead of using debt. Conclusively, liquidity will have a positive effect on leverage. This is supported by the research conducted by Sbeiti (2010) and Ozkan (2001).

Non-Debt Tax Shield

According to Ali et al. (2013) debt financing is less attractive if non-debt related corporate tax shields exist, such as investments or depreciation. Companies can use these non-interest items to reduce their tax bills. In other words, according to the trade-off theory, companies with higher non-debt tax shield are likely to use less debt (Titman & Wessels, 1988). This is supported by studies conducted by Heshmati (2001) and Ozkan (2001). However, Shah & Khan (2007) found non-debt tax shield to be insignificant. The pecking order theory does not predict anything obvious with regards to non-debt tax shields.

Chapter 3: METHODOLOGY

The main goal of this chapter is to present the methodical framework for this study and develop hypotheses based on the theory presented in the previous part. This section will start by describing the data, followed by the general econometric procedure and the statistical approach that will be used. The methodical choices that are being made before and during a research process are important in order to achieve results that answer the research question and are of good quality.

3.1 Dataset

Deciding on the time dimension is important for how the research is carried out. The most widely used classification for different types of data are; cross-sectional data, time series data and panel data. Cross-sectional data are data from units observed at the same time or in the same time period. Time-series data are data from a unit or a group of units, observed in several successive periods. While panel data is a combination of the two and consist of observations of multiple devices over multiple periods. The different types of data have different advantages and disadvantages when it comes to possibilities, limitations and complexity regarding regression analysis and results (Koop, 2009). The choice of data is therefore essential in order to appropriately conduct the research.

3.1.2 Data sample

For the purpose of this study, the data is collected from secondary sources and the researcher intend to use quantitative data based solely on data collected from DataStream. DataStream is a financial database with company- and market information. The sample collected contains Norwegian companies listed on the Oslo

Stock Exchange in the period from 2007-2013. Financial companies, such as banks are excluded from this sample because of the financial regulations for these companies. Furthermore companies with missing information will be dropped, as well as companies with zero in assets as this would not provide a measure for leverage. A list of the companies included in the sample can be found in appendix C. The financial information of listed Norwegian companies will be analyzed in STATA in order to examine if there is significant relationship between capital structure and its determinants.

3.2 Econometric analysis

Econometrics is the art and science of using statistical methods for evaluating economic relationships and testing economic theories. This paper will therefore use econometrics to analyse the data collected. This section will present a summary of the econometric models that will be used, as well as their assumptions and limitations.

3.2.1 Correlation

Correlation is a way of numerically quantifying the association between two variables. Furthermore it measures the strength and direction of this relationship (Koop, 2013). The correlation coefficient always lies between -1 and +1, where -1 indicates that the variables are perfectly negatively correlated, while +1 implies perfectly positive correlation. A correlation coefficient equal to 0 indicates that there is no linear relationship between the variables.

Table 1: The 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	Low correlation
Below 0.3	Little or no correlation

Source: Own contribution based on Koop (2013)

3.2.2 Ordinary Least Squares

A regression analysis is a more advanced approach to evaluate the relationship between variables and it is the most common tool used in applied economics (Koop, 2013). The main objective of a regression analysis is to investigate how the value of the dependent variable (Y) changes when the value of one of the independent variables ($X_1, X_2, X_3,\ldots, X_k$) changes by one unit. A simple regression model analyses the linear relationship between two variables, while a multiple regression model take into account that the independent variables can affect each other and jointly affect the dependent variable. A panel data OLS regression can be described as:

Formula 6: $Y_{it} = \alpha + \beta_{1it}X_{1it} + \beta_2 X_{2i} + \ldots + \beta_{itk}Xit_k + v_{it} \qquad i = 1,2, \ldots , N$

Where Y is the dependent variable, explained by a constant (α), and a specific relationship (β_k) between the explanatory variables (X_k). The composite error term $v_{it} = (a_i + u_{it})$ captures all the other unobserved factors that are constant over time (a_i), and the regular residuals (u_{it}) which now vary over time. To estimate the coefficients (α) and (β_k) the method of 'ordinary least squares' (OLS) is used. This model will have (N-k) degrees of freedom, where N is the number of observations and k is the number of parameters in the model.

The OLS-estimation determines the regression coefficients so that the regression line lies as close to the observed data as possible. The vertical difference between a data point and the line is called a residual. The sum of squared residuals is mathematically defined as:

Formula 7:
$$SSR = \sum_{i=1}^{n}(y_i - \beta_0 - \beta_1 X_{1_i} - \ldots - \beta_k X_{ki})^2$$

The OLS-estimates are found by choosing the values of α and $\beta_1, \beta_2, \ldots, \beta_k$ that minimize the SSR (Koop, 2013). The OLS regression model is based on several underlying assumptions that is necessary for the model to be valid shown in table 6. More information about the assumptions are found in appendix 2.

Table 2: OLS-Assumptions

	Assumption	Explanation
1	**Linearity**	The dependent variable should be a linear function of the independent variables and the error term
2	**Exogenity**	The expected value of errors is zero and errors are not correlated with any regressors
3	**Homoscedasticity**	Errors have the same variance
4	**Nonautocorrelation**	Errors are not related to one another
5	**Not stochastic**	Independent variables are fixed in repeated samples without measurement errors.
6	**No multicollinearity**	There is no exact linear relationship among independent variables.

Source: Park (2011), Koop (2013)

3.2.3 Panel Data

Panel data are also called longitudinal or cross-sectional time-series data. They have observations in several different time periods and on the same units (Kennedy, 2008). A panel data set has "multiple entities, each of which has repeated measurements at different time periods (Park, 2011). The data set used in this research can be classified as panel data as the accounting data are from different time periods but at the same time the companies and the variables are the same. The panel dataset used is defined as balanced because the same years are used for each company.

3.2.4 Panel data estimation Methods

Based on the literature, it is common to use panel data estimation methods for data that combines cross-sectional and time-series data. When using penal data there are some assumptions that must be valid for the estimated coefficients to be valid. In this analysis the focus will be on three different methods; pooled ordinary least squares, fixed effects model and random effects model. The assumptions for each method can be found in appendix B.

Pooled OLS

If there is no individual heterogeneity, i.e. no cross-sectional or time specific effect (u_i = 0), than ordinary least squares (OLS) provides consistent and efficient parameter estimates to use on panel data (Park, 2011).

Formula 8: $Y_{it} = \beta_0 + \beta X_{it} + \varepsilon_{it}$

Where:

- Y_{it}: Dependent variable
- β_0: Intercept
- β: Vector of the independent variables coefficient
- X_{it}: Vector of the independent variable
- ε_{it}: Error term where $u_i = 0$

If individual effects are not zero in panel data, heterogeneity may influence the assumption of exogenity and nonautocorrelation, and the model will provide biased and inconsistent estimators. If this is the case, the fixed effects model and the random effect model provide ways to deal with these problems (Park, 2011)

Fixed Effects Model

The fixed effects (FE) model takes the presence of unobserved heterogeneity into account and divides the error term into two components; one that captures the variation between the different firms analysed (u_i) and one that captures the remaining disturbance (v_{it}).

Formula 9: $Y_{it} = (\beta_0 + u_i) + \beta X_{it} + v_{it}$

The fixed effects model controls for any possible correlation among the independent variables and omitted variables by treating u_i as a fixed effect. This means that OLS assumption 2 will not be violated. The fixed effects model is estimated by using least squares dummy variable (LSDV) estimation and a within effect estimation method.

Random Effects Model

A random effects model assumes that heterogeneity is not correlated with any regressor and that the error variance estimates are specific to firms. Hence u_i is a component of the composite error term (ε).

Formula 10: $Y_{it} = \beta_0 + \beta X_{it} + (u_i + v_{it})$

The slopes and intercept of regressors will be the same across firms, but the difference between firms will lie in their individual errors and not in their intercepts. The random effects model is estimated by using generalized least squares (GLS) or an OLS estimator. The difference between them is that the GLS estimator will still be efficient in the presence of autocorrelation and heteroscedasticity, while OLS will not. On the basis of this, the appropriate estimator depends on what assumptions hold.

Selection of Estimation Model

In order to decide on what estimation model that fits the available data best, the characteristics of the data should be examined. Firstly, the model should be tested for the underlying OLS-assumptions (normality, heteroscedasticity, multicollinearity, autocorrelation), then for panel data effects. If there is a presence of panel data effects, the pooled OLS method should be excluded and random- or fixed estimation models should be used. The Hausman specification test will then be conducted in order to indicate whether the FE- or RE-model is preferred. However Brooks (2008) claims that the random effects model will provide lower volatility and more efficient estimations than the fixed effects model. This is based on the fact that the RE-model utilises the information in the panel data so that the effects of the independent variables on leverage can be illuminated. Another advantage with the RE-model is that less degrees of freedom is lost because there are less parameters to estimate.

3.3 The Regression Model

A regression is an advanced approach to evaluate the relationship between variables and it is the most common tool used in applied economics (Koop, 2013). The main objective of a regression analysis is to investigate how the value of the dependent variable (Y) changes when the value of one of the independent variables (X_1, X_2, X_3,…, X_k) changes by one unit. A simple regression model analyses the linear relationship between two variables, while a multiple regression model take into account that the independent variables can affect each other and jointly affect the dependent variable.

This paper will use two different models, model 1 is given by book value of leverage as the dependent variable, and model 2 will use market value of leverage as the dependent variables. Both models will be used along with the determinants discussed in section X as independent variables. Therefore the following general model applies:

Formula 11: $$blev/mlev = \beta_0 + \beta_1 \times prof_{it} + \beta_2 \times size_{it} + \beta_3 \times tang_{it} + \beta_4 \times grow_{it} + \beta_5 \times liq_{it} + \beta_6 \times ndts_{it} + \varepsilon_{it}$$

The reason for using both book value and market value of leverage is to examine if the chosen independent variables affect them differently. While model 1 is based on historic accounting values, model 2 incorporates the expectations of future cash flows. Table 6 shows the variables and the proxies used in this paper. The proxies have been determined based on previous literature, so that it will be easier to compare the results.

Table 3: Variable proxies

Variable	Proxy
Book Value of Leverage	Total Debt / (Total Debt + Book Value of Equity)
Market Value of Leverage	Total Debt / (Total Debt + Market Value of Equity)
Profitability (P)	EBITDA/Total Assets
Size (S)	Ln (Total Sales)
Tangibility (T)	Fixed Assets/Total Assets
Growth (G)	Market capitalisation/Book value
Liquidity (L)	Tot. Current Assets/Tot. Current Liabilities
Non-Debt Tax Shield (NDTS)	Depreciation/Total Assets

3.4 Hypotheses

Based on the theories presented in chapter 2 and their impact on firms' capital structure, 2 different hypotheses are created and shown in table 7. The first one will be formulated based on the trade-off theory, while the second one will be created on the basis of the pecking order theory. The hypothesis testing will be used in order to examine whether one theory is better than the other in explaining the capital structure of Norwegian listed firms. The null hypothesis will be rejected on the 5% significance level.

Table 4: Hypotheses

Variables	Hypotheses		1: Pecking Order	2: Trade Off
Profitability (P)	**A**	**H_0:** **H_A:**	*P has a positive effect on LEV* *P has a negative effect on LEV*	*P has a negative effect on LEV* *P has a positive effect on LEV*
Size (S)	**B**	**H_0:** **H_A:**	*S has a positive effect on LEV* *S has a negative effect on LEV*	*S has a negative effect on LEV* *S has a positive effect on LEV*
Tangibility (T)	**C**	**H_0:** **H_A:**	*T has a negative effect on LEV* *T has a positive effect on LEV*	*T has a negative effect on LEV* *T has a positive effect on LEV*
Growth (G)	**D**	**H_0:** **H_A:**	*G has a negative effect on LEV* *G has a positive effect on LEV*	*G has a positive effect on LEV* *G has a negative effect on LEV*
Liquidity (L)	**E**	**H_0:** **H_A:**	*L has a negative effect on LEV* *L has a positive effect on LEV*	
NDTS	**F**	**H_0:** **H_A:**		*NDTS has a positive effect on LEV* *NDTS has a negative effect on LEV*

Chapter 4: ANALYSIS

This chapter will begin with a descriptive analysis of the data, then a correlation analysis will be conducted, followed by the choice of estimation model. It will continue presenting the empirical results obtained from analysing the effect different firm-specific determinants may have on capital structure in listed Norwegian firms. The analysis is based on the specifications discussed in the previous chapter. The findings will then be presented before they are compared and contrasted to the established theories and previous empirical research presented in chapter 2.

4.1 Descriptive statistics

Descriptive statistics is used to describe the basic features of the data in an empirical research paper. They provide simple summaries about the sample and the measures. Table 6 presents information for 2007-2013 regarding the number of observations, mean, standard deviation and maximum- and minimum values for the variables.

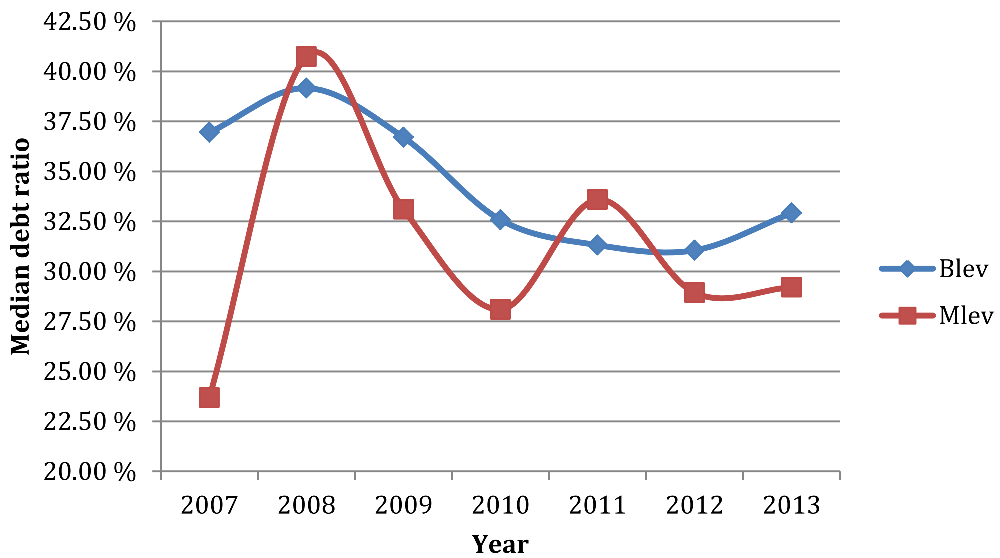
Table 5: Descriptive statistics

Variable	Obs.	Mean	Std. dev	Min.	Max.
Leverage at book value	630	0.3570	0.2219	0	1.6920
Leverage at market value	630	0.3384	0.2329	0	1.3446
Profitability	630	0.0568	0.2298	-2.3457	0.7772
Size	630	14.2257	2.3826	0	20.3747
Tangibility	630	0.3884	0.3033	0	1.5448
Growth	630	1.8478	6.1192	-13.5409	142.639
Liquidity	630	1.9675	3.2724	0.02251	65.3898
No-debt Tax shield	630	0.0548	0.0528	0	0.6750

Looking at the independent variables, some key values stand out from the table. Especially the growth and liability variables have large gaps between the minimum and maximum values accompanied by a large standard deviation. These values may indicate that the dataset should be corrected for extreme values. As the time period studied includes the financial crisis in 2007-08, this may explain some of the outliers, as it does not reflect the true characteristics of firms over time.

The median is the middle observation after the observations have been ranged and is not as sensitive to extreme values as the mean. For book value, the median is 0.336, while it for market value is 0.311 between 2007 and 2013. This suggests that the assets are primarily financed through equity, implying that firms have more equity available to meet their financial obligations. The difference in annual median value for book and market leverage over time is graphically illustrated in figure 5.

Figure 3: Median values of Leverage over time



The above figure show that the median values for book value generally have been larger and less variable than market value over the time period. The explanation lies in market value depending on the market price, which continuously fluctuates and follows the business cycles. Besides, the market value of shares is usually higher than book value, so the difference between the measurements was expected.

4.1.2 Outliers in the data set

An outlier is generally a data point that is far outside the norm for a variable or population. The descriptive statistics suggests that it is appropriate to eliminate some outliers in the data, as it can undermine the results of the analysis. According to Osborne and Overbay (2004) the effect of including outliers in the analysis may involve:

1. Increased error variance and reduced explanatory power of statistical tests
2. Decreased normality
3. Biased estimates that may be of substantive interest

There are several different approaches in how to handle the problem with outliers. One can choose to take a passive approach and keep them; alternatively the outliers can be removed or changed. Based on the descriptive statistics, the most significant outliers are removed from the dataset. The outliers are identified in STATA, and then dropped accordingly.

4.1.3 Descriptive statistics after removing outliers

Table 7 presents the descriptive statistics after removing extreme observations in the dataset. The dataset can now be described as unbalanced as removing some estimations makes for an uneven distribution of N and T. The average value for all the variables remain roughly the same, except for growth and liquidity. These variables had the most significant outliers, so the expected change in mean would therefore also be large. The standard deviation for all the variables have been reduced as the gap between the minimum and maximum values has decreased, but profitability and size also have a slightly more significant change than the other variables.

Table 6: Descriptive statistics after removal of outliers

Variable	Obs.	Mean	Std. dev	Min.	Max.
Leverage at book value	587	0.3556	0.2017	0	0.9719
Leverage at market value	587	0.3459	0.2286	0	1.2029
Profitability	587	0.0655	0.1655	-0.9023	0.4910
Size	587	14.3093	2.0045	6.1312	19.9517
Tangibility	587	0.3951	0.3023	0	1.5448
Growth	587	1.5933	1.6584	-0.6249	15.5413
Liquidity	587	1.7166	1.2821	0.0605	8.8682
No-debt Tax shield	587	0.04918	0.03601	0	0.1967

Leverage at Book Value

In the sample, leverage at book value has a mean of 0.3556. This implies that around 35.5% of the average firm's total assets are financed by debt. Frank and Goyal (2009) got an average leverage at book value of 0.29, which indicates that the companies in this sample are slightly more leveraged than the US companies they researched. However Kouki and Said (2012) got a mean leverage at book value of 0.51 on their study of French firms.

Leverage at Market Value

The average leverage at market value is 0.3459, which indicates that the average company in this sample have a debt level of 34.6% of their market value. In comparison Frank and Goyal (2009) got a mean of 0.28. The standard deviation of 0.22 is larger than for book value of leverage, which implies that the sample variations are larger than for market value.

Profitability

Profitability have a mean of 6.55% which can be considered considerably higher than the mean of 2% found in the research conducted by Frank and Goyal (2009). However, they used EBITDA/sales as a proxy for profitability. Song (2005) got a profitability mean of 8% and a standard deviation of 0.28. Both values a higher than for this sample, indicating that profitability is higher, but with more variability in Swedish firms.

Size

The proxy for size in this sample is the logarithm of sales. As a result, the mean, maximum and minimum statistics makes little economic sense. However a standard deviation of 2.3826 indicates large differences in size between the companies in this sample.

Tangibility

This variable has an average of 0.395. This is slightly higher than the average of 0.35 that Frank and Goyal (2009) discovered in their research. In comparison, Song (2005) got a tangibility ratio mean of 0.288, which is over 0.1 lower than for this sample. Furthermore he got a standard deviation of 0.22, which is significantly lower than the standard deviation of 0.30 from this sample.

Growth

Growth has an average of 1.84, which indicates that the market expects future growth for the companies included in the sample. This is similar to the mean of 1.74 found by Frank and Goyal (2009), but higher than the mean discovered by Song (2005) of 1.07.

Liquidity

This variable has a mean of 1.71 and it can be interpreted as how much the average company is able to pay off its obligations. Thus for every 1 of current liabilities, firms have 1.71 of current assets to cover their short-term liabilities. Ozkan (2001) achieved a liquidity ratio of 1.64, which indicates that Norwegian firms are slightly better at meeting their short-term obligations. If the ratio is under 1, firms should be concerned, as the current liabilities will outweigh their current asset. The variable has a standard deviation of 1.28, which is reasonable. The value of the ratio is therefore relatively close around the mean.

Non-Debt tax Shield

Non-debt tax shield has a mean of 0.49. This result is slightly lower compared to a mean of 0.055 obtained from Song (2005). The same applies to the standard deviation from his research, which is 0.048 and about 0.012 higher than what can be detected in this sample.

4.2 Correlation analysis

A correlation analysis presents the pair wise correlation between all the variables that are included in the regression analysis. The null-hypothesis is that there is no correlation between the variables. Table 9 presents the correlation matrix and gives an overview of the correlation coefficient of the variables.

Table 7: Correlation matrix

	Blev	Mlev	Prof	Size	Tang	Grow	Liq	Ndts
Blev	1.0000							
Mlev	0.9029	1.0000						
Prof	-0.0001	-0.0433	1.0000					
Size	-0.0387	-0.0133	0.2125	1.0000				
Tang	0.6666	0.6658	0.1409	0.0232	1.0000			
Grow	-0.1573	-0.4283	-0.0167	-0.0616	-0.1915	1.0000		
Liq	-0.3003	-0.3220	-0.1652	-0.2382	-0.3133	0.1250	1.0000	
Ndts	0.0043	-0.0116	0.0399	0.0154	0.1279	0.0806	-0.1256	1.0000

Using panel data for the regression analysis eliminates most of the effect of collinearity between variables. However this will still cause problems if one or more variables are close to perfect collinearity. Table 9 shows that this is not a concern as the correlation between most of the variables are relatively low. The correlation between tangibility and the debt measures are moderately correlated, which means that there is a linear relationship between them. As expected, there is strong correlation between book value of leverage and market value of leverage because of the similar definitions.

4.3 Evaluation of Estimation Model

This section will evaluate what estimation model is the most appropriate to use. Firstly a pooled OLS regression analysis will be conducted and the data will be examined to see if it fulfils the assumptions of the discussed estimation models from the previous chapter. Then the sample will be tested for panel data effects to see if panel data estimation methods are more appropriate. All the assumptions will be tested and discussed before the estimation model is chosen.

4.3.1 OLS regression Analysis

An OLS regression analysis was conducted on the two models, one with book value of leverage as the dependent variable and the other with market value of leverage.

$$\text{Blev} = \beta_0 + \beta_1 \times \text{prof}_{it} + \beta_2 \times \text{size}_{it} + \beta_3 \times \text{tang}_{it} + \beta_4 \times \text{grow}_{it} + \beta_5 \times \text{liq}_{it} + \beta_6 \times \text{ndts}_{it} + \varepsilon_{it}$$

$$\text{Mlev} = \beta_0 + \beta_1 \times \text{prof}_{it} + \beta_2 \times \text{size}_{it} + \beta_3 \times \text{tang}_{it} + \beta_4 \times \text{grow}_{it} + \beta_5 \times \text{liq}_{it} + \beta_6 \times \text{ndts}_{it} + \varepsilon_{it}$$

Table 8: Pooled OLS regression results

Variables	1: Book-value of leverage	2: Market value of leverage
profitability	-0.1185557**	-0.1945976***
size	-0.0065745*	-0.0054111
tangibility	0.431606***	0.4482379***
growth	-0.0016718	-0.0403105
liquidity	-0.0226829***	-0.0253397***
Non-debt tax shield	-0.5019125**	-0.4728972**
_cons	0.3531473	0.3891353
Where P > |t|: $p < 0.05$ = *, $p < 0.01$ = ** *and* $p < 0.001$ = ***		
Observations	587	586

F	88.30	131.49
Prob > F	0.0000	0.0000
R-squared	0.4774	0.5767
Adjusted R-squared	0.4720	0.5724

4.2.1.1 ANOVA results

The values for F and Prob > F indicates whether or not the regression model is significant. Specifically, they test the null hypothesis that all of the regression coefficients are equal to zero. For both models, Prob > F is equal to 0.000, which means that we can reject H_0 and conclude that the model is significant. The F-value is the explained variability divided by the unexplained variability. In these models the F-value is 88.30 and 131.49, respectively. The higher the F-value, the more of the total variability is accounted for in the model.

R-squared measures the explanatory power of the model and indicates how the variance in the dependent variable (Y) can be explained by the independent variables (X) (Koop, 2013). The results show that the model with book value as the dependent variable is equal to 0.4720, while using market value gives a significantly higher R-squared of 0.5724. This means that for model 1, 47.20% of the variation in leverage at book value can be explained by the significant independent variables. For model 2, 57.24% of the variation in market value can be explained by the significant independent variables.

4.2.1.2 Interpretation of coefficients

The table shows that there are some differences in the magnitude of the coefficients between having book value as the independent variable compared market value. When interpreting the coefficients, all other variables are kept constant (ceteris paribus).

Profitability

Model 1: Book Value of Leverage

There is a negative relationship between book value of leverage and profit. When EBITDA/Total assets increases by 1 percentage point, book-leverage decreases by 0.11 percentage points. The coefficient is significant at the 1% significance level.

Model 2: Market Value of Leverage

The regression obtained a negative relationship between market value of leverage and profitability. The results indicate that when profitability increases with 1 percentage point, market value of leverage decreases with 0.19 percentage points.

Size

Model 1: Book Value of Leverage

There is a negative relationship between size and book value of leverage. When size increases by 1 percentage point, book value of leverage decreases by 0.006 percentage points. The coefficient is significantly different from zero at the 5% significance level.

Model 2: Market Value of Leverage

There is a negative relationship between size and market value of leverage. When size increases by 1 percentage point, market value of leverage decreases by 0.005 percentage points. However, the results suggest that the variable is not significantly different from zero at the 5%, 1% or the 0.1% significance level.

Tangibility

Model 1: Book Value of Leverage

There is a positive relationship between book value of leverage and tangibility. The results indicate that when the ratio fixed assets/total assets increases with 1 percentage point, book value of leverage increases by 0.43 percentage point. Economically, this is a strong positive relationship between the variables. Tangibility is significantly different from zero at the 0.1% significance level.

Model 2: Market Value of Leverage

There is a positive relationship between market value of leverage and tangibility. The results indicate that when the tangibility ratio increases with 1 percentage point, book value of leverage increases by 0.44 percentage points. Tangibility is significantly different from zero at the 0.1% significance level.

Growth

Model 1: Book Value of Leverage

There is a negative relationship between growth and book value of leverage and a 1% percentage point increase will result in a 0.0016 decrease in book value of leverage. Growth is not significantly different from zero at the 5%, 1% or 0.1% significance level

Model 2: Market Value of Leverage

There is a negative relationship between growth and market value of leverage. The results indicate that a 1 percentage point increase in the growth variable will cause a 0.04 decrease in market value of leverage. However, the coefficient is not significantly different from zero at the 5%, 1% or 0.1% significance level

Liquidity

Model 1: Book Value of Leverage

There is a negative relationship between book value of leverage and liquidity. The results suggest that a 1 percentage point increase in the liquidity ratio will lead to a decrease in book value of leverage of 0.022 percentage points.

Model 2: Market Value of Leverage

There is a negative relationship between liquidity and market value of leverage. A 1 percentage point increase in the liquidity ratio will result in a 0.025 decrease in the market value of leverage

Non-Debt Tax Shield

Model 1: Book Value of Leverage

There is a negative relationship between non-debt tax shield and the book value of leverage. A one percentage point increase in the ratio depreciation/total assets may lead to a 0.5 percentage point decrease in the book value of leverage. This can be considered an economically strong negative relationship. The variable is significant at the 1% significance level

Model 2: Market Value of Leverage

There is a negative relationship between non-debt tax shield and the market value of leverage. The results suggest that a 1 percentage point increase in the ratio depreciation/total assets causes a 0.5 percentage point decrease in the book value of leverage. The variable is significant at the 1% significance level

4.2.2 Test of assumptions

Because this study uses a panel dataset, the assumptions for OLS will be tested in order to determine if the regression results are reliable. If not, further analysis should be conducted using either a FE-model or a RE-model.

Linearity

The estimation model assumes that the relationship between the dependent and independent variables is linear. If a linear regression model is fitted to variables that do not have a linear relationship with the dependent variable, the results can be flawed. Perfect linearity is rarely existent in empirical research, but non-linearity should be examined and detected as it can indicate that variables should have a different functional form. Appendix B1 provides scatter plot of the variables against the residuals. Some outliers are detected in the linear relationships, but all the variables provide a satisfactory degree of linearity.

Normality

Normality in the residuals is necessary in order to conduct valid hypothesis testing because is assures us that the p-values for the t-statistics and the F-test is reliable. The two most common ways to test the assumption of normality is by conducting a skewness/kurtosis test or creating a kernel density estimate followed by pnorm and qnorm plots. The first test is numerically, while the latter tests illustrate the issue graphically.

The skewness/kurtosis test (sktest) test measures skewness and excess kurtosis to test for normality. The null hypothesis states that there is no significant departure from normality in the data. Table 11 shows that we can accept the null hypothesis at the 5% significance level and conclude that the data fits the normal distribution

Table 9: Skewness/Kurtosis test for Normality

Variable	obs	Skewness	Kurtosis	chi2(2)	Prob>chi2
Residuals (r)	586	0.8957	0.1655	1.94	0.3783

The Kernel density estimate tests for normality in the residuals for the regression model. The Kernel density plot in appendix B2 shows that the residuals are approximately normally distributed.

In addition to the Kernel density estimate, a standard normal probability plot (pnorm) and a quantile normal distribution plot (qnorm) are used to further examine the assumption of normality. While pnorm is sensitive to non-normality in the middle range of the data, the qnorm is sensitive to non-normality near the tails. The results are presented in appendix E, and show that pnorm provides no evidence of non-normality. However qnorm shows a slight deviation from normality in the upper tail. This deviation is considered small, so the conclusion is that the assumption of normality holds in the model.

Heteroscedasticity

Presence of heteroscedasticity can have massive implications for the model as it can lead to wrong computation of the standard errors in the analysis and thus the wrong conclusion about the results. The model is first tested for heteroscedasticity by using the Breusch-Pagan test, where we test the null hypothesis that there is homoscedasticity of errors.

Table 10: Breusch-Pagan test

Model	chi2 (1)	Prob > chi2
Book value	1.25	**0.2634**
Market value	1.22	**0.2695**

Both models have values above 0.05, thus we accept the null hypothesis at the 5% significance level and we conclude that we do not have heteroscedasticity in either model. It is common do also conduct a Cameron and Trivedi test, as this takes into account certain factors that the Breusch-Pagan test ignores.

Table 11: Cameron and Trivedi test

	Book value			Market value		
Source	**Chi2**	**df**	**p**	**Chi2**	**df**	**p**
Heteroscedasticity	58.38	27	0.0004	148.03	27	0.0000
Skewness	24.80	6	0.0004	99.12	6	0.0000
Kurtosis	10.02	1	0.3118	1.20	1	0.2741
Total	82.49	34	**0.000**	248.35	34	**0.000**

Based on these test results, we have to reject the null hypothesis at the 5% level and conclude that there are elements of heteroscedasticity present.

Autocorrelation

Autocorrelation in the regression can be detected by using a Breusch-Godfrey/Wooldridge test. The null hypothesis is that there is no first-order autocorrelation.

Table 12: Breusch-Godfrey/Wooldridge test

Model	F (1, 85)	Prob > F
Book value	27.264	**0.0000**
Market value	17.211	**0.0001**

Both models have a probability below 0.05, this means that we reject the null hypothesis at the 5% significance level and conclude that we have a presence of autocorrelation.

Multicollinearity

According to Brooks (2008), the presence of multicollinearity usually does not have a significant effect on the overall result because a small degree of correlation will not significantly influence the estimation. Even thought section 7.4.1 did not indicate a strong correlation between any of the independent variables, a variable inflation test (VIF) is conducted in order to make sure that there is no multicollinearity in the data.

Table 13: VIF-test

Variable	VIF
Liquidity	1.20
Tangibility	1.17
Size	1.10
Profitability	1.08
Growth	1.06
No-debt tax shield	1.04
Mean VIF	**1.11**

As a general rule, multicollinearity may be a problem if the mean VIF is above 10. In this case, the mean VIF is 1.11 and we can conclude that there is no multicollinearity in the model.

4.2.3 Panel data effects

As the two models violate the assumptions of heteroscedasticity and autocorrelation, it is necessary to test for panel data effects.

The Lagrange multiplier test

The Lagrange multiplier (LM) test helps decide if a simple OLS regression can be used for analysis of panel data. The null hypothesis tested is that the cross-sectional variance across all components is zero, i.e. that there is no significant difference across units and thus no panel effects.

Table 14: Lagrange Multiplier Test

Model	Chi2 (1)	Prob > Chi2
Book value	663.43	**0.0000**
Market value	579.80	**0.0000**

For both book value of leverage and market value of leverage, the probability is below 0.05. Hence the null hypothesis is rejected at the 5% significance level and there is significant evidence of differences across entities. This indicates that an effects model should be used instead of OLS.

Hausman test

In order to decide between the fixed or the random effects model, a Hausman test is conducted where the null hypothesis is that the preferred model is random effect. That means that the unique errors (u_i) are not correlated with the regressors.

Table 15: Hausman Test

Model	Chi2 (6)	Prob > Chi2
Book value	6.18	**0.4038**
Market value	11.25	**0.0810**

For both book value and market value of leverage the probability is above 0.05 (not significant). Hence we accept the null hypothesis at the 5% significant level and conclude that the random effects model should be applied.

4.2.4 Diagnostics results

The dataset fulfils the assumptions of linearity, normality and no multicollinearity, while autocorrelation and indications of heteroscedasticity are identified. Based on the discussion in section 3.2, the model has been examined for panel data effects. Significant panel data effects where discovered, which indicates that either a fixed effects model or a random effects model should be used.

The decision between which one to use was decided after conducting a Hausman test. This test examines whether the coefficients from the fixed effects estimation or the random effects estimation are the most statistically significant. With both book value and market value as the dependent variable, no significant correlation between the individual specific residual term and independent variables where found. This suggested that the random effects model was more appropriate to use. Results from the OLS regression and the fixed effects regression along with a comparison can be found in appendix F. Following the discussion on the RE-model from section 3.2.4, the GLS-estimator will be used in the preceding analysis.

4.3 Random Effects Regression

This analysis will explore how firm-specific factors affects firms' level of leverage by using a random effect model. Interpreting the coefficients in a RE model is slightly different from the basic OLS because the coefficients include both the within-entity and the between-entity effects. When interpreting the results, the coefficient will represent the average effect of the independent variables ($x_{i, 1,2,,k}$)
over leverage, when x changes across time and between firms by one percentage point. This means that the random effects regression does not only predict change over time, but will also take into account the difference between units.

A cluster robust regression has to be conducted because of the presence of heteroscedasticity and autocorrelation detected in the dataset. Because this dataset contains relatively small time-variables (T) compared to unit-variables (N), clustering will effectively make standard errors robust to any kind of serial correlation and heteroscedasticity. Furthermore it is determined that coefficients would be analysed at the 5% significance level. Results from the RE regression is presented below in table 16.

Table 16: Robust Random Effects regression

Variables		1: Book-value of leverage	2: Market value of leverage
profitability		-0.1390454* (0.0568)	-0.169078*** (0.0482)
size		-0.0038564 (0.0038)	-0.0013304 (0.0039)
tangibility		0.4587378*** (0.0502)	0.4501003*** (0.0419)
growth		0.0090431 (0.0069)	-0.0261529*** (0.0076)
liquidity		-0.0163805** (0.0061)	-0.0247853*** (0.0070)
Non-debt tax shield		-0.4880205 (0.3075)	-0.3496479 (0.3048)
_cons		0.2755688 (0.0668)	0.29749 (0.0700)
Where: p < 0.05 = *, p < 0.01 = ** *and p < 0.001 = ***, cluster robust std.errors in ( )*			
	within	0.2942	0.3672
R-sq	**between**	0.5428	0.6418
	overall	0.4681	0.5659
Obs		586	586
Wald chi2 (6)		144.58	241.45
Prob > chi2		0.000	0.000
Sigma_u		0.11776774	0.11531709
Sigma_e		0.08818594	0.09212662
Rho		0.64072996	0.61041179

The values for chi2 and Prob > chi2 indicates whether or not the regression model is significant. It is an F-test that tests the null hypothesis that all of the regression coefficients are equal to zero. For both models, Prob > chi2 is equal to 0.000, which means that we can reject H_0 and conclude that the model is significant and all coefficients are different fro zero.

Sigma_u and sigma_e in table 16 respectively represents the standard deviation of random effects and random errors. The former is slightly higher for book value, while the latter is higher for market value. Rho represents the intraclass correlation in the models. For model 1, 64% of the fraction of variance is caused by random effects, while random effects for model 2 cause 61% of variance.

4.3.1 Differences Between Book- and Market Value of Leverage

R-squared measures the explanatory power of the model. The GLS estimator is a weighted average of between and within estimators, thus the overall R-squared tells us how much the variance in capital structure can be explained by firm-specific characteristic. The R-squared values in table 16, indicates that the variation in market value of leverage is better explained by the independent variables than for book value of leverage. The regression gives an R^2 of 0.468 for model 1, which means that 46.8% of the variation in book value of leverage can be explained by the independent variables. In comparison, model 2 reports an R^2 of 0.566, implying that 56.6% of the variation in market value of leverage can be explained by the independent variables. This shows that it is a large difference between the models and the independent variables' ability to explain variation across firms. Conclusively the independent variables are able to explain 10% more of the variation in market value of leverage than for book value.

4.3.2 Firm-specific Effect on Capital Structure

In this section, the results from the coefficients will be analysed and discussed in order to determine the effect of the chosen firm-specific factors on capital structure.

4.3.2.1 Profitability

The profitability-variable is significant at the 5% significance level for book value of leverage as the independent variable, while it is significant at the 0.1% level for market value. For both models, profitability is negative, which indicates that firms with higher returns tend to have lower levels of leverage. The results suggest that a 1 percentage point increase in profitability will lead to a 0.139 percentage point decrease in book value of leverage. For model 2, a one percent percentage point increase in profitability will result in a 0.169 percentage point decrease in the market value of leverage.

The two theories provide different views on the effect profitability have on leverage. The pecking order theory assumes an inverse relationship between profitability and leverage. Hence more profitable firms will use less leverage because they will use retained earnings as funding instead of external debt. In contrast, the trade off theory believes that profitable companies will shield their profits from tax, and thus borrow more than less profitable firms. The fact that both theories suggest a negative relationship between leverage and profitability is consistent with the results from Titman and Wessels (1988), Rajan and Zingales (1995) Song (2005), Frank and Goyal (2004) among others. A positive relationship is rarely supported by recent empirical studies.

4.3.2.2 Size

For both models, size is not significantly different from zero at the 5% significance level. This implies that size is not a factor when firms determine their capital structure in Norwegian companies. This result deviate from previous empirical research from Frank and Goyal (2004) who provide results suggesting that size is significant, indicating that larger firms tend to have higher debt levels.

The insignificance of this factor stands in contrast to the Trade-off theory that claims that size matters, as larger firms tend to add more debt because of a lower probability of default. The pecking order theory justifies the expectation of a positive relationship between size and leverage with a lower degree of information asymmetry, as this will give companies better opportunities and conditions to gain access to credit.

4.3.2.3 Tangibility

Tangibility is the most explanatory factor for both models. The coefficient is significantly different from zero at the 0.1% level and it has a positive relationship with firm leverage. The results indicate that a 1 percentage point increase in the tangibility ratio will result in a 0.458 increase in book value of leverage and a 0.450 increase in the market value of leverage respectively.

The result is supported by both theories, which expects a positive relationship between tangibility and leverage. The pecking order theory explains that information asymmetry will be lower for firms with more tangible assets, resulting in more debt. However Harris and Raviv (1991) argue that the pecking order theory indicate a negative relationship between tangibility and debt. They state that firms with few tangible assets will have greater asymmetry problems, and as a result, the coefficient should not be significantly different form zero. The trade off theory expects a positive relationship between tangibility and debt because a higher degree of asset tangibility leads to lower bankruptcy costs.

The results and the views of the theories are supported by a large amount of empirical research. Song (2005) found that tangibility is positively related to total debt ratio at the 0.1% significance level. Noulas & Genimakis (2011) and Nunkoo & Boateng (200) also found a significantly positive effect of tangibility on leverage.

4.3.2.4 Growth

Growth has a negative relationship with book value of leverage and a positive relationship with market value of leverage. The variable is not significantly different from zero when using book value of leverage as the dependent variable, but the opposite is the case for market value of leverage, where the coefficient is significant at the 0.1% significance level. A 1 percentage point increase in the growth ratio will result in a 0.026 percentage point decrease in market value of leverage.

If a company has a lot of growth opportunities, the cost of bankruptcy and financial distress will be considerably higher (Titman & Wessels, 1988). With this in mind, the trade-off theory suggests a negative relationship between growth and leverage. This is mainly because firms with prospects of growth are likely to have lower earnings before tax, and they are therefore not be able to take advantage of the interest tax shield associated with a high debt ratio. In addition, growing firms are likely to appreciate financial flexibility, and thus preferably a lower debt ratio.

Ozkan (2001) achieved a negative effect of growth on leverage. He concludes that growing firms often have a large proportion of intangible assets, and may therefore not be able to support a high leverage ratio. Furthermore firms with growth opportunities tend to have lower debt levels because debt holders fear that the firm might pass up on investment opportunities. The results are also consistent with other empirical studies including Frank & Goyal (2007), Rajan & Zingales (1995), Shah & Khan (2007) and Nunkoo & Boateng (2011). In comparison, Noulas & Genimakis (2011) find a positive relationship with growth and leverage explaining that firms choose to issue equity when their market performance is high. Song (2005) discovers that growth is not related to total debt ratio.

4.3.2.5 Liquidity

Liquidity is significantly different from zero at the 1% significance level for book value of leverage and at the 0.1% significance level for market value of leverage. Both results indicate a negative relationship between liquidity and leverage, so that a 1 percentage point increase in the liquidity ratio will lead to a 0.016 decrease in book value of leverage and a 0.024 decrease in market value of leverage. In the pecking order theory, firms prefer internal to external financing, as a result they would create liquid reserves from retained earnings. If the liquid assets were sufficient in financing a firm's investments, the firm would have no incentive to raise funds externally. Ozkan (2001) made the same discovery and suggested that the inverse relationship could be a result of potential conflicts between shareholders and debt holders of the company. Sbeiti (2010) also found the liquidity coefficient to be negative, while Olayinka (2011)'s results suggest a positive relation between leverage and liquidity.

4.3.2.6 Non-debt tax shield

The results show that there is a negative relationship between non-debt tax shield and leverage for both models. However, the variable is not significantly different from zero at the 5% significance level. Despite that the variable is not a determining factor for Norwegian companies in defining their capital structure, the negative relationship is consistent with the trade-off theory. Mazur (2007) got the same results for Polish companies, while Heshmati (2001) and Ozkan (2001) found non-debt tax shield to be significant and inversely related to debt.

4.3.3 How well do the pecking order and the trade off theory explain the findings?

The last research objective was to determine if the capital structure of the firms included in this study can be explained by established theories of capital structure. In order to decide which theory provide the most accurate predictions, the nature of the relationship between the dependent and independent variables where examined. Table 17 provides a summary of the theoretical hypothesis mentioned in section 3.4 and is based on the regression analysis from table 16.

Table 17: Test of Hypothesis

Variable	Trade-off	Pecking Order	Results: BLEV	Results: MLEV
Profitability	(+)	(-)	(-)*	(-)***
Size	(+)	(-)	(-)	(-)
Tangibility	(+)	(+)	(+)***	(+)***
Growth	(-)	(+)	(+)	(-)***
Liquidity	/	(-)	(-)**	(-)***
NDTS	(-)	/	(-)	(-)

For book value of leverage, four of the independent variables predicts a negative relationship, while tangibility and growth reports a positive relationship with book value of leverage. When using market value of leverage as the dependent variable, all the variables except from tangibility predict a negative relationship. Hence, how growth is affecting leverage is differing between the models.

The results obtained for book value of leverage supports the pecking order theory. This implies that the Norwegian firms in the sample prefer internal financing to finance investments rather than debt. In terms of the trade-off theory, there is a positive relationship with tangibility and a negative relationship with non-debt tax shield. As a result, the trade-off theory does not get much support, which implies that firms do not consider the trade off between the costs and benefits of using debt financing.

For market value of leverage, the relationship with four of the variables can be explained by the pecking order theory, while three is the case for the trade off theory. This implies that both theories too some degree can explain how firm-characteristics affect the market value of leverage.

Based on the random effects regression analysis, three of the independent variables are significant for book value of leverage, while four is significant for the market value of leverage. The relationships that are not statistically significant are size and non-debt tax shield for both models and growth for book value of leverage. Although these coefficients are not significant in the models, the nature of these relationships may still provide insight into which theory is better at explaining capital structure for the sample. Taking this into account, the pecking order theory gains support in model 1, while none of the theories are fully able to predict the obtained results for model 2. The latter is the case for most previous studies that have questioned the explanatory power of the theories, suggesting that one is not superior to the other.

Chapter 5: CONCLUSION

This chapter will provide a conclusion for this paper by presenting the most important findings together with results regarding the research objectives. Then the limitations of this study will be discussed before some recommendations for future research is presented

5.1. Summary

Ever since Miller and Modigliani (1958) proposed the irrelevance of capital structure for firm value, several theories explaining the opposite have been developed. The two most prominent being, the trade off theory and the pecking order theory. The trade off theory stresses that the choice of capital structure is a result of a trade off between the benefits and costs of debt. The debt tax shield represent an advantage, while the costs of debt include financial distress and bankruptcy costs. In contrast, the pecking order theory advances that firms follow a pecking order of financing. Because of information asymmetry, firms will prefer internal to external funding and debt over equity. A variety of studies on this topic have been conducted for different countries and with different determinants. However few has focused on the capital structure decision in Norwegian firms. The main purpose of this study was therefore to try and fill the gap in the existing literature and hopefully provide some useful information about the determinants of capital structure of Norwegian firms.

Based on the overall aim of this study, the following objectives where formulated:

- Analyse whether firm-specific characteristics can explain the variation in capital structure across Norwegian firms.

- Determine if book value of leverage and market value of leverage produce different results.
- Look at the dominant theories of capital structure and examine if the trade-off theory and the pecking order theory can explain the observed capital structure of Norwegian firms.

Based on previous empirical research, six firm-specific determinants of capital structure where identified; profitability, size, growth, tangibility, liquidity and non-debt tax shield. While the first four factors can be linked to both the pecking order and the trade off theory, liquidity is significant for the pecking order theory, while the non-debt tax shield is given special attention in the trade off theory. This study comprises firms listed on the Oslo Stock Exchange over a time period of 7 years from 2007-2013. The data was collected from DataStream and firms had to have reported financial data for the entire time period. As a result, the data set included a total of 90 firms representing 587 complete observations for firm characteristics.

Firstly, a preliminary analysis was conducted, starting with descriptive statistics of the data. This uncovered that the data set contained outliers that could possibly bias the results and the significance of the regression model. After removing some extreme values, different descriptive measurements were analysed, including mean, standard deviation and range. The descriptive statistics were followed by correlation analysis, before the estimation models where analysed. As the data set can be characterised as panel data, basic OLS regression may not predict reasonable results and either Random effects or fixed effects should be used. After testing the OLS assumptions and testing for panel data effects, it was concluded that a random effects estimation model would be the most appropriate way to analyse the data. After conducting and analysing the regression, there was made an attempt to answer the identified research objectives.

5.2 Main findings, implications and concluding remarks

This section will provide the conclusions and implications in relations to the overall aim of this paper and the identified research objectives.

5.2.1 The effect of firm characteristics on capital structure

The R^2 values for both models yielded reasonably high values. The results predicted that the independent variables are able to explain 46.8% of the variance for model 1 (book value) and 56.6% for model 2 (market value).

The significant variables for book value of leverage were profitability, tangibility and liquidity. Profitability and liquidity had a negative relationship with leverage. This indicates that firms with higher returns and the capability of converting their assets into cash have reduced need for leverage. Tangibility got a positive relationship with leverage, presumably because tangible assets can serve as collateral for debt. The model using market value of leverage produced four significant variables, including profitability, tangibility, growth and liquidity. The relationship with the three common variables are the same, however, the values of the coefficients are larger and have a stronger statistical significance than for book value of leverage. In fact, the four variables are all significantly different from zero at the 0.1% significance level. The growth variable has a negative relationship with leverage, indicating that growing firms have less debt than mature ones.

From the result, it may be concluded that tangibility is the most important firm characteristic to consider when making financing decisions, followed by profitability and liquidity.

5.2.2 The difference between book value and market value of leverage

In this research, the debt to equity ratio is the dependent variable and it is used to quantify capital structure. This measurement can be based on book values or market values. As there has been continuous discussion in the literature over what the most preferable measurement is, this study has used both in order to examine whether or not there is a difference between them.

The R^2 obtained from the regression analysis reported that the variation in market value of leverage is better explained by the independent variables, than book value of leverage. The variation in the independent variables explains 56.6% of the variation in market value as opposed to only 46.8% of book value of equity, a variation of over 10%. Additionally, there are more significant variables for market value than for book value. Hence, the results indicate that there are differences between the two measurements of leverage. This may imply that Norwegian firms should focus more on market value, as this provided a significantly stronger result.

5.2.3 How well does established theories explain capital structure in Norwegian firms

The results obtained from using book value of leverage as the independent variable, can fully be explained by the pecking order theory. This implies that listed Norwegian firms prefer internal over external leverage and that variations in capital structure can be explained by a firms' cash flow, rather than the trade off between the costs and benefits of debt. Market value of leverage on the other hand, did not produce the same results. The regression estimations did not lead to a conclusion on the superiority of one of the theories, but included predictions from both.

5.3 Limitations to the study

The time period covered in this study and the sample size could be a limitation, especially considering that some of the estimators may suffer from small finite sample biases (Bryman & Bell, 2007). However, validating the results by performing different tests has mitigated this problem. There was an option to increase the time period covered in this study, but as companies may change their behaviour over longer time periods, this could also potentially bias the results.

The data sample in this study consisted of a total of 90 firms listed on the Oslo stock exchange. By focusing solely on listed firms for the time period of the study, the research may have been exposed to survivorship bias (Bryman & Bell, 2007). In order to reduce the possibility of this type of bias, the study should have included firms that where delisted during the selected period.

For this research, six firm-specific determinant of capital were identified and analysed. However, there is a large set of possible variables that may influence the capital structure decisions made by firms. For practical reasons it is difficult, if not impossible to identify them all, especially as some of them are hard to measure, such as management style.

5.4 Recommendations for future research

In this research the focus have been on firm-specific determinants of capital structure. For the future it may be interesting to examine the effect of macroeconomic factors including GDP growth, interest rates and other measures of market condition. If the market is struggling, investors may not give firms access to capital and the interest rate on debt may be higher that what the firm is willing to pay. These factors may also have an affect on the firm-specific determinants. Furthermore a cross-industry study could examine how capital structure varies across different industries. How it differs between the top industries in Norway, such as the energy, petroleum and shipping sector would be of particular importance.

According to the trade-off theory, an optimal capital structure exists which reflects the costs and benefits of debt. As a result, firms should set a target debt ratio and continuously adjust their capital structure to meet the target. Future research on Norwegian firms can examine how firms set their target leverage ratios and how fast they are able to adjust their capital structure to the target. Ozkan (2011) among others researched this by creating a dynamic capital structure model.

The results from this study show that the identified firm characteristics have an effect on capital structure. A recommendation for future research to survey the CFO's of the firms included in the sample. This may provide an indication of why these specific factors affect capital structure and it may give an understanding of what managers consider when making capital structure decisions. Are they the same as the ones included in this study or are there other relevant factors they take into account when deciding on how the firm should be financed.

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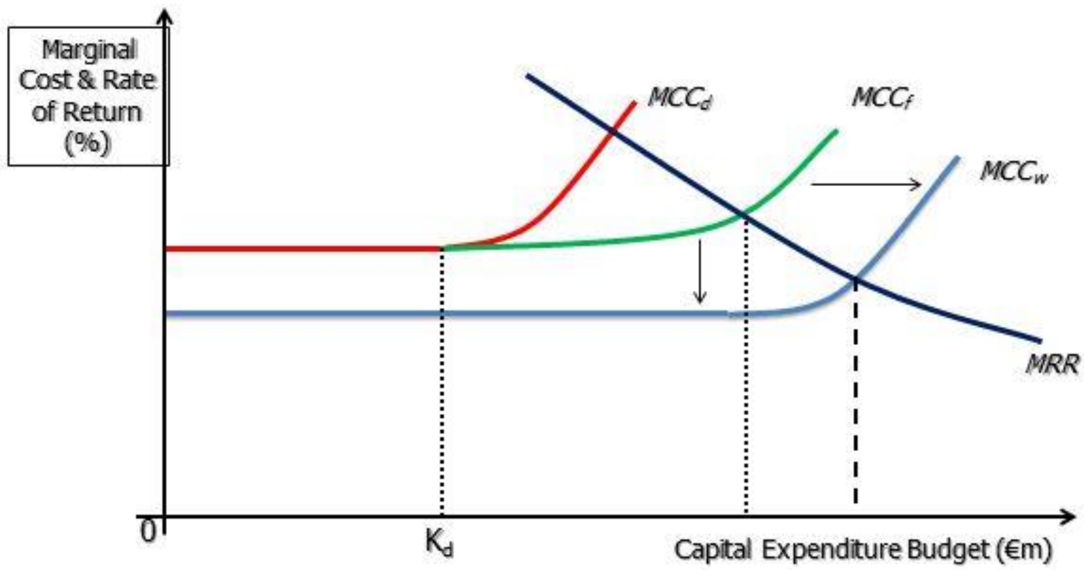
7. APPENDICES

Appendix A: Cost of Capital

A1: Cost of capital under imperfect capital markets

The figure below is from Eiteman et al. (2013) and provides an illustration of the transition from a domestic to a global marginal cost of capital.



Source: Eiteman et al (2013), p. 38

The figure shows that a multinational company has a given marginal return of capital at different budget levels, represented by the line MRR. Even if the firm expands it capital budget, it maintains its debt ratio so that financial risk does not change. If the firm is limited to raising its capital in the domestic market, the line MCCd shows the marginal domestic cost of capital at different budget levels. The optimal budget in the domestic case is where MCCd meets MRR. If the firm gets access to addition funds outside its domestic capital market, the marginal cost of capital will shift to MCCf. As MCCf meets MRR at a lower point, the firm will get a lower marginal cost of capital, while having increased its capital budget. As a result of the combined effects of greater availability of capital and international pricing of the firms securities, the marginal cost declines and the capital expenditure budget gets extended even further where MCCW crosses MRR.

Appendix B: Past Studies

B.1 Past Empirical Research

Below is a table over some previous empirical studies that have been analysed in order to decide on which determinants of capital structure would be used in this paper.

Table 1: Previous Empirical Research

Author(s)	Data Period	Focus	Sample Size	Determinants of Capital Structure
Ozkan (2001)	1984-1996	Non-Financial UK firms	390	Profitability (-), Liquidity (-), Growth (-), Non-debt tax shield, Size (/)
Heshmati (2001)	1993-1998	Small Swedish firms	2261	Profitability, Tangibility, Growth, Non-debt tax shield, Size, Age
Bhaduri (2002)	1989-1995	Indian firms in manufacturing	363	Growth, Cash Flow, Size, Uniqueness, Industry
Voulgaris et al. (2004)	1989-1996	Greek firms in manufacturing	218	Profitability, Size, Growth,
Chen (2004)	1995-2000	Chinese-listed companies	88	Profitability, Size, Growth, Tangibility
Akhtar (2005)	1992-2001	Australian companies	835	Profitability, Growth, Size, Tangibility
Shah & Khan (2007)	1993-2002	Non-Financial Pakistani firms	286	Profitability, Tangibility, Size, Growth, Volatility, Non-debt tax shield
Mazur (2007)	2000-2004	Polish companies	238	Profitability, Growth, Size, Uniqueness, Asset structure, Non-debt tax shield.
Nunkoo & Boateng (2009)	1996-2004	Non-Financial Canadian companies	7098	Profitability, Tangibility, Size, Growth
Sbeiti (2010)	1998-2005	GCC country companies	142	Profitability, Liquidity, Tangibility, Size, Growth
Noulas & Genimakis (2011)	1998-2006	Greek listed companies	259	Profitability, Size, Growth, Tangibility, Volatility
Olayinka (2011)	1999-2007	Nigerian Companies	66	Profitability, Growth, Liquidity, Tangibility, Size
Gonzáles & Gonsáles (2012)	1995-2003	Spanish Companies	3439	Profitability, Tangibility, Growth, Non-debt tax shield,

Source: Own contribution

Appendix C: Data Sample

C.1 Companies included in the sample

Table 18: Firm Sample

AF GR. ASA	ELECTROMAGNETIC	ORKLA ASA
AGR GROUP ASA	ELTEK ASA	PETROLEUM GEO-SVCS
AKER PHILADELPHIA	EVRY ASA	PETROLIA SE
AKER SOLUTIONS ASA	FARSTAD SHIPPING ASA	PROSAFE SE
AKVA GROUP ASA	FRED. OLSEN ENERGY	PSI GROUP ASA
AMERICAN SHIPPING CO	GANGER ROLF ASA	Q-FREE ASA
APPTIX ASA	GC RIEBER SHIPPING	REACH SUBSEA ASA
AQUA BIO TECHNOLOGY	GOODTECH ASA	REC SILICON ASA
ARENDALS FOSSEKOMP.	GRIEG SEAFOOD ASA	REM OFFSHORE ASA
ATEA ASA	GYLDENDAL ASA	REPANT ASA
AUSTEVOLL SEAFOOD	HAFSLUND ASA	ROCKSOURCE ASA
BELSHIPS ASA	HAVFISK ASA	SALMAR ASA
BERGEN GROUP ASA	HAVILA SHIPPING ASA	SCANA INDUSTRIER ASA
BIONOR PHARMA ASA	HEXAGON COMPOSITES	SCHIBSTED ASA
BLOM ASA	HURTIGRUTEN ASA	SEABIRD EXP
BONHEUR ASA	I.M. SKAUGEN ASA	SEVAN MARINE
BW OFFSHORE LTD	INTEROIL EXPLORATION	SIEM SHIP
BYGGMA ASA	KITRON ASA	SOLSTAD OFFSHORE ASA
CECON ASA	KONGSBERG AUTOMOTIV	SOLVANG ASA
CERMAQ ASA	KONGSBERG GRUPPEN	STATOIL ASA
COMROD COMMUNICA	LEROY SEAFOOD GROUP	TELENOR GROUP
DEEP SEA SUPPLY PLC	MARINE HARVEST ASA	TELIO HOLDING
DET NORSKE	NORSK HYDRO ASA	TGS-NOPEC GEOPHYSIC
DIAGENIC ASA	NORSKE SKOGINDUST.	TIDE ASA
DNO ASA	NORTHERN OFFSHORE	TOMRA SYSTEMS ASA
DOF ASA	NORWEGIAN AIR	TTS GROUP ASA
DOLPHIN INTER	NORWEGIAN ENERGY	VEIDEKKE ASA
DOMSTEIN ASA	NTS ASA	WILH WILHELMSEN
EIDESVIK OFFSHORE	OCEANTEAM ASA.	WILSON ASA
EITZEN CHEMICAL ASA	ODFJELL ASA	YARA

Appendix D: Model Assumptions

D.1 OLS Assumptions

OLS assumptions collected from Koop (2013) and Kleinbaum et al. (2008):

1. **Linearity:**

   This assumption states that the model can be written as: $Y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_{ik} x_{ik} + \varepsilon_I$ and it specifies a lineat relationship between y and $x_1, \ldots, x_k$. This implies that a one unit change in the explanatory variable will have the same effect in the dependent variable regardless of the explanatory variable's initial value. If there exists a non-linear relationship between variables, they should be changed to a proper functional form.

2. **Exogenity:**

   This assumption can be expressed as: $E[\varepsilon_i | x_{j1}, x_{j2}, \ldots, x_{jk}] = 0$. This states that the expected value of error at observation I in the sample is not a function of the independent variables observed at any observation, including this one. This means that the independent variables will not have any useful information for prediction of the error term.

3. **Homoscedastic:**

   This assumption states that the variance of y is the same for any fixed combination of the explanatory variables. It can be expressed as: $VAR(y | x_{i1}, x_{i2}, \ldots, x_{ik}) = \sigma^2$. If this assumption is not met, we cannot fully rely on the p-values of the regression coefficients.

4. **Nonautocorrelation**

This assumption states that $cov(\varepsilon_t, \varepsilon_s) = 0$, where $t \neq s$. This means that the error terms from two different periods must be linearly unrelated.

5. **Not Stochastic**

This assumption states that observations on independent variables are fixed in repeated samples. This implies no measurement error in x and no serial correlation where a lagged value of y would be used as an independent variable. Finally there should be no simultaneity or endogenous independent variables.

6. **No Multicollinearity:**

This assumption states that none of the independent variables in the sample ($x_{i1}, x_{i2}, ..., x_{ik}$) are constant and that there does not exist a perfect linear relationship between any of them. The problem with multicollinearity arises when some or all of the independent variables are highly correlated with one another. It reveals itself through low t-statistics and high p-values. If multicollinearity is present, the regression model has difficulty telling which explanatory variables are influencing the dependent variables.

D.2 FE Assumptions

1. The model should be linear in parameters and can be written as:

   $Y_{it} = (\beta_0 + u_i) + \beta X_{it} + v_{it}$

2. There should be a random sample in the cross section
3. The independent variables should not be constant over time: $\Delta x_{i,\ 1,2,...,k} \neq 0$
4. There should not be a perfect linear relationship between the explanatory variables: $Corr(x_{itj,}\ x_{its}) < 1$, where $s \neq t$.
5. The independent variables must be exogenous on the unobserved effect:

$E(v_{it} | u_i, x_{itj}) = 0$. Hence we control for the unobserved fixed parameter u_i, so that $Corr(x_{itj}, u_{it}) = 0$

6. The variance of the residuals on all explanatory variables should be constant: $VAR(\Delta v_{it} | x_{itj}) = \sigma^2$.
7. For all $s \neq t$, the difference in idiosyncratic errors are uncorrelated, so that: $Cov(\Delta v_{it,} \Delta v_{is} | x_{itj})$
8. Conditional on x_{itj}, the Δv_{it} is independent and identically distributed normal random variables. However this is not a necessary assumption, only a preferable one.

D.3 RE Assumptions

1. The model should be linear in parameters and can be written as: $Y_{it} = \beta_0 + \beta X_{it} + (u_i + v_{it})$
2. There should be a random sample in the cross section
3. There should not be a perfect linear relationship between the explanatory variables.
4. The independent variables must be exogenous on the unobserved effect: $E(v_{it} | u_i, x_{itj}) = 0$, and the expected value for all u_i given all explanatory varibles is constant. This means that $E(u_{it}, x_{itj},) = \beta_0$
5. The variance of the residuals on all explanatory variables should be constant: $VAR(v_{it} | u_i\ x_{itj}) = \sigma^2$, and the variance of u_i given all explanatory variables is constant: $VAR(u_i | x_{itj}) = \sigma^{2.}$
6. For all $s \neq t$, the difference in idiosyncratic errors are uncorrelated, so that: $Corr(\ v_{it,} v_{is} | u_i, x_{itj})$

D.4 Fixed vs. Random Effects Model

The table below shows the main difference between the fixed and the random effect model (Park, 2011)

Table 20: Fixed vs. Random Effects Model

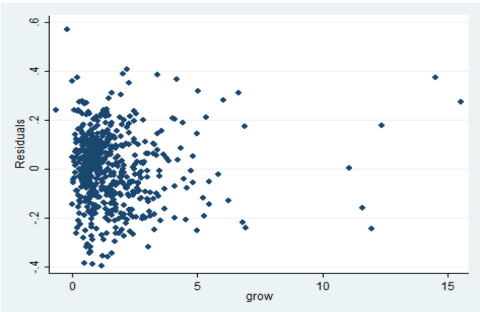
	Fixed Effect Model	**Random Effect Model**
Functional form	$Y_{it} = (\beta_0 + u_i) + \beta X_{it} + v_{it}$	$Y_{it} = \beta_0 + \beta X_{it} + (u_i + v_{it})$
Intercepts	Varying across groups and/ or time	Constant
Error variances	Constant	Randomly distributed across groups and/or time
Slopes	Constant	Constant
Estimation	LSDV, within effects estimation	GLS, FGLS

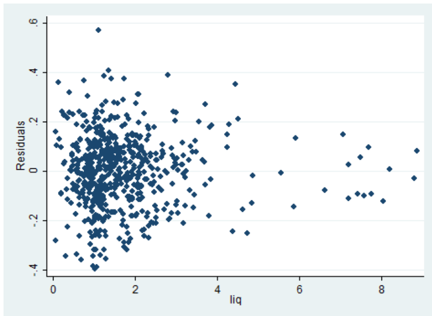
Source: Park (2011)

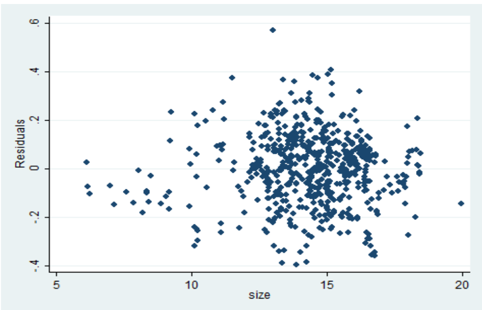
Appendix E: Evaluation of Assumptions

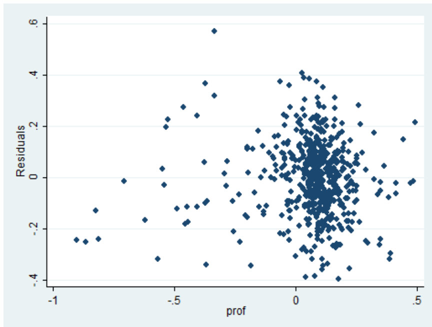
E.1: Test for Linearity

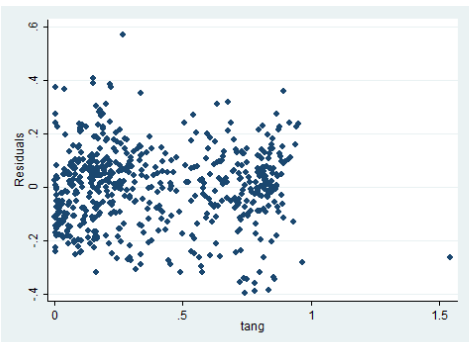
The most frequently used method to test the assumption of linearity is to create a plot showing residuals versus fitted values. If the residuals are plotted randomly around a horizontal line from 0 on the y-axis, the assumption that the relationship is linear is reasonable. There are some indications of non-linearity. However, as a whole the degree of linearity is considered reasonable.

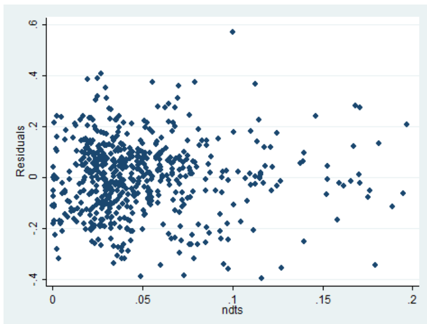








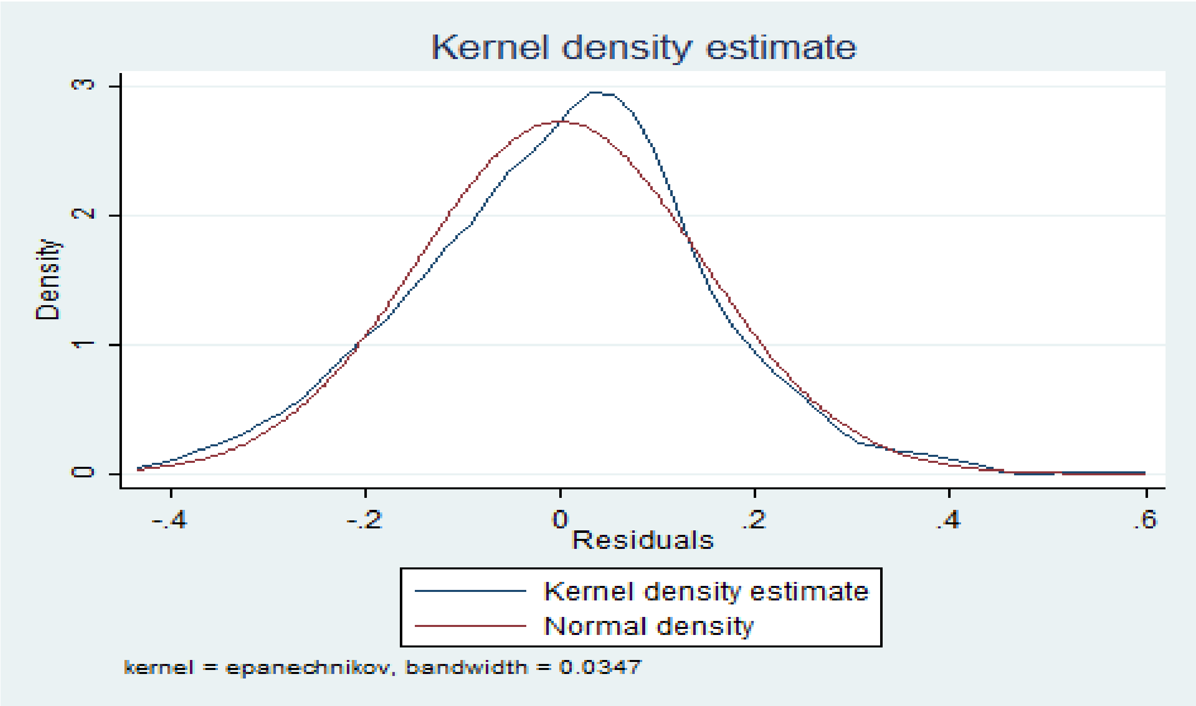




E.2: Test for Normality

A kernel density estimate is used to test the assumption of normality in the models. This tests the error term in the regression models. Figure 11 shows the kernel density estimate (the residuals) with the blue line and the normal distribution with the red line.

Figure 11: Kernel density estimate for normality

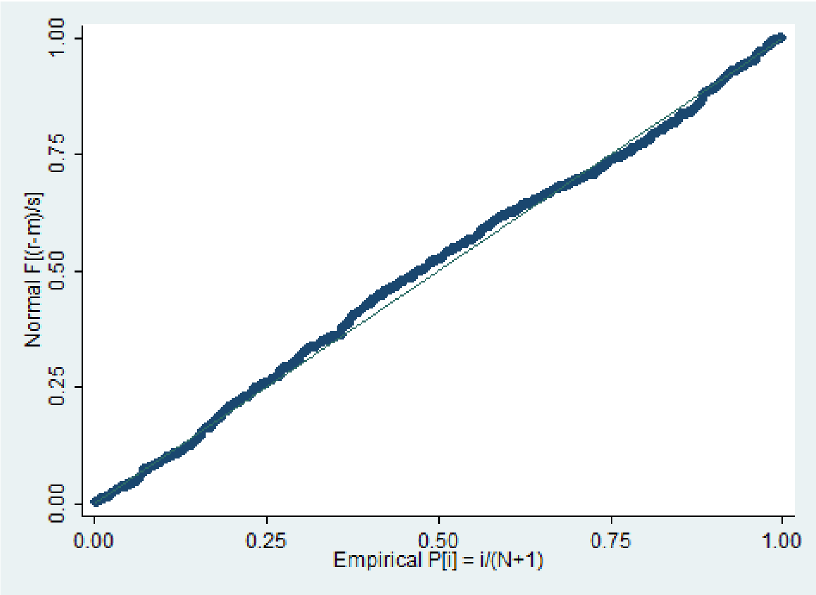


The above figure illustrates that the residuals are close to normally distributed. Hence the assumption of normality holds.

In addition to the kernel density estimate, a standardised normal probability plot (pnorm) and a plot showing the quantiles of a variable against the quantiles of normal distribution (qnorm) is created to further examine the normality assumption.

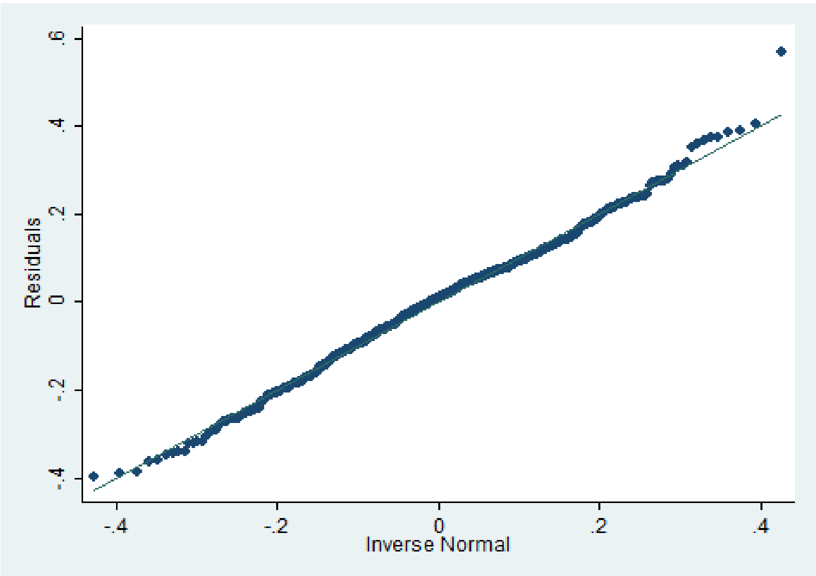
For pnorm, the data is plotted against a straight line normal distribution. The data points are then plotted around this line. If the data deviates from the straight line, this indicates a violation of the normality assumption.

Figure 12: Standardised normal probability plot



There is a slight deviation from the normality line in the figure. However, pnorm is very sensitive to non-normality in the middle range of the data. Overall it s concluded that the observations satisfy the assumption of normality.

Figure 13: Quantiles of variable against quantiles of normal distribution plot



Qnorm is sensitive to non-normality near the tails. The above figure shows that there are some small deviations from normality in the upper tail, but this is considered a small discrepancy. It is therefore decided that the residuals are close to a normal distribution.

APPENDIX F: STATA OUTPUT

Table of Contents

1. Descriptive Analysis

1.1. Descriptive Statistics

```
describe id Year blev mlev prof size tang grow liq ndts

                storage  display     value
variable name    type    format      label      variable label
----------------------------------------------------------------------------
-----------------------------
id               byte    %9.0g
Year             int     %8.0g
blev             float   %8.0g
mlev             float   %8.0g
prof             float   %8.0g
size             float   %8.0g
tang             float   %8.0g
grow             float   %8.0g
liq              float   %8.0g
ndts             float   %8.0g


summarize blev mlev prof size tang grow liq ndts

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        blev |        630      .35706    .2219021          0      1.692
        mlev |        630    .3384241    .2328915          0   1.344664
        prof |        630    .0568626    .2298811   -2.34577   .7772421
        size |        630    14.22577    2.382636          0    20.3747
        tang |        630    .3883797    .3033154          0   1.544874
-------------+---------------------------------------------------------
        grow |        630    1.847847     6.11922  -13.54092    142.639
         liq |        630    1.967522    3.272405   .0225177   65.38978
        ndts |        630    .0548151    .0528267          0   .6750109
```

1.2 Removing Extreme Outliers

```
. graph box blev
. drop if blev >1
(5 observations deleted)
. graph box mlev
. drop if mlev >1
(1 observation deleted)
. graph box prof
. drop if prof <-1
(4 observations deleted)
. graph box size
. drop if size <5
(6 observations deleted)
. drop if size >20
(6 observations deleted)

. graph box tang
. graph box grow
. drop if grow >20
(3 observations deleted)
. drop if grow <-2
(5 observations deleted)
. graph box liq
. drop if liq >10
(7 observations deleted)
. graph box ndts
. drop if ndts >0.2
(7 observations deleted)

. summarize blev mlev prof size tang grow liq ndts Year id

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
```

```
        blev |       586    .3552613    .2018068          0   .9719132
        mlev |       586    .3444474    .2260944          0   .9403544
        prof |       586    .0654489     .165628  -.9023686   .4910574
        size |       586    14.31304    2.004264   6.131227   19.95171
        tang |       586    .3936484    .3002437          0   1.544874
-------------+--------------------------------------------------------
        grow |       586    1.595904    1.658692  -.6249995   15.54134
         liq |       586    1.710944    1.275764   .0605558   8.868263
        ndts |       586     .049194    .0360434          0   .1967844
        Year |       586    2009.971    1.998507       2007       2013
          id |       586    45.37884    25.93957          1         90
```

1.3 Correlation Matrix

```
. corr blev mlev prof size tang grow liq ndts
(obs=586)

             |     blev     mlev     prof     size     tang     grow      liq     ndts
-------------+------------------------------------------------------------------------
        blev |   1.0000
        mlev |   0.9029   1.0000
        prof |  -0.0001  -0.0433   1.0000
        size |  -0.0387  -0.0133   0.2125   1.0000
        tang |   0.6666   0.6658   0.1409   0.0232   1.0000
        grow |  -0.1573  -0.4283  -0.0167  -0.0616  -0.1915   1.0000
         liq |  -0.3003  -0.3220  -0.1652  -0.2382  -0.3133   0.1250   1.0000
        ndts |   0.0043  -0.0116   0.0399   0.0154   0.1279   0.0806  -0.1256   1.0000
```

1. Pooled OLS Regression

2.1 Model 1 – Book Value of Leverage

```
. reg blev prof size tang grow liq ndts

      Source |       SS       df       MS              Number of obs =     586
-------------+------------------------------           F(  6,   579) =   88.17
       Model |  11.3752586     6  1.89587644           Prob > F      =  0.0000
    Residual |  12.4494473   579  .021501636           R-squared     =  0.4775
-------------+------------------------------           Adj R-squared =  0.4720
       Total |  23.8247059   585  .040725993           Root MSE      =  .14663

------------------------------------------------------------------------------
        blev |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        prof |  -.1180871   .0379707    -3.11   0.002    -.1926641   -.0435101
        size |  -.0066148   .0031791    -2.08   0.038    -.0128588   -.0003708
        tang |   .4349388   .0218522    19.90   0.000     .3920196    .4778581
        grow |  -.0017614   .0037627    -0.47   0.640    -.0091515    .0056288
         liq |   -.021932   .0052098    -4.21   0.000    -.0321644   -.0116997
        ndts |  -.5027592   .1714481    -2.93   0.003    -.8394951   -.1660232
       _cons |   .3515232   .0513821     6.84   0.000     .2506053    .4524412
------------------------------------------------------------------------------

. estimate store olsblev
```

2.2 Testing OLS Assumptions

2.2.1 Linearity

```
. rvpplot prof
. rvpplot size
. rvpplot tang
. rvpplot grow
. rvpplot liq
. rvpplot ndts
```

2.2.2 Normality

```
. sktest r

                    Skewness/Kurtosis tests for Normality
                                                          ------- joint -----
-
    Variable |     Obs   Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)   
Prob>chi2
-------------+------------------------------------------------------------
-
           r |     586      0.8957         0.1655         1.94         0.3783

. kdensity r, normal

. pnorm r

. qnorm r
```

2.2.3 Multicollinearity

```
. vif

    Variable |       VIF       1/VIF  
-------------+----------------------
         liq |      1.20    0.832029
        tang |      1.17    0.853842
        size |      1.10    0.905295
        prof |      1.08    0.929292
        grow |      1.06    0.943599
        ndts |      1.04    0.962498
-------------+----------------------
    Mean VIF |      1.11
```

2.2.4 Testing for Heteroscedasticity

```
. rvfplot, yline (0)

. **// White test \\**
. estat imtest

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |      58.38     27    0.0004
            Skewness |      24.80      6    0.0004
            Kurtosis |       1.02      1    0.3118
---------------------+-----------------------------
               Total |      84.20     34    0.0000
---------------------------------------------------


. **// Breusch-Pagan test \\**
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity 
         Ho: Constant variance
         Variables: fitted values of blev

         chi2(1)      =     1.25
         Prob > chi2  =   0.2634
```

2.2.5 Testing for Autocorrelation

```
. xtserial blev prof size tang grow liq ndts

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      85) =     29.865
           Prob > F =      0.0000
```

2.3 Model 2 – Market Value of Leverage

```
. reg mlev prof size tang grow liq ndts

      Source |       SS       df       MS              Number of obs =     586
-------------+------------------------------           F(  6,   579) =  131.49
       Model |  17.2470562     6  2.87450937           Prob > F      =  0.0000
    Residual |  12.6573788   579  .021860758           R-squared     =  0.5767
-------------+------------------------------           Adj R-squared =  0.5724
       Total |   29.904435   585  .051118692           Root MSE      =  .14785

------------------------------------------------------------------------------
        mlev |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        prof |  -.1945976   .0382864    -5.08   0.000    -.2697949   -.1194004
        size |  -.0054111   .0032056    -1.69   0.092    -.0117071    .0008848
        tang |   .4482379   .0220339    20.34   0.000     .4049617     .491514
        grow |  -.0403105    .003794   -10.62   0.000    -.0477621   -.0328588
         liq |  -.0253397   .0052531    -4.82   0.000    -.0356571   -.0150222
        ndts |  -.4728972   .1728739    -2.74   0.006    -.8124337   -.1333608
       _cons |   .3891353   .0518094     7.51   0.000      .287378    .4908925
------------------------------------------------------------------------------

. estimate store olsmlev
```

2.4 Testing OLS Assumptions

2.4.1 Heteroscedasticity

```
. **// White test \\**
. stat imtest
Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |     142.51     27    0.0000
            Skewness |     116.55      6    0.0000
            Kurtosis |       0.44      1    0.5048
---------------------+-----------------------------
               Total |     259.50     34    0.0000
---------------------------------------------------

.
. **// Breusch-Pagan test \\**
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of mlev

         chi2(1)      =     0.49
         Prob > chi2  =   0.4844
```

2.4.2 Autocorrelation

```
. xtserial mlev prof size tang grow liq ndts

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      85) =     18.282
           Prob > F =      0.0000
```

2.5 Comparing Pooled OLS for the two models

```
. estimates table olsblev olsmlev
```

Variable	olsblev	olsmlev
prof	-.11808707	-.19459765
size	-.00661481	-.00541113
tang	.43493884	.44823785
grow	-.00176136	-.04031047
liq	-.02193204	-.02533965
ndts	-.50275915	-.47289724
_cons	.35152322	.38913527

3. Evaluating Panel Data Estimation Methods

3.1 Descriptive Statistics for Panel Data

```
. sort id Year
. tsset id Year
       panel variable:  id (unbalanced)
        time variable:  Year, 2007 to 2013, but with gaps
                delta:  1 unit

.
. xtsum blev mlev prof size tang grow liq ndts

Variable         |      Mean   Std. Dev.       Min        Max |    Observations
-----------------+--------------------------------------------+----------------
blev     overall |  .3552613   .2018068          0   .9719132 |     N =     586
         between |             .1813131   .0271872   .8005603 |     n =      90
         within  |             .0961268  -.1227003   .8041916 | T-bar = 6.51111
                 |                                            |
mlev     overall |  .3444474   .2260944          0   .9403544 |     N =     586
         between |             .2040186   .0135325   .7836719 |     n =      90
         within  |             .1060605  -.1805433   .7554036 | T-bar = 6.51111
                 |                                            |
prof     overall |  .0654489    .165628  -.9023686   .4910574 |     N =     586
         between |             .1441238  -.6886512   .3782189 |     n =      90
         within  |             .1051651  -.6321375   .4951032 | T-bar = 6.51111
                 |                                            |
size     overall |  14.31304   2.004264   6.131227   19.95171 |     N =     586
         between |             1.918281   8.344688   19.20593 |     n =      90
         within  |             .8948678   6.460872   19.23701 | T-bar = 6.51111
                 |                                            |
tang     overall |  .3936484   .3002437          0   1.544874 |     N =     586
         between |             .2872676    .003679   .9076724 |     n =      90
         within  |             .0979028  -.2531918   1.036285 | T-bar = 6.51111
                 |                                            |
grow     overall |  1.595904   1.658692  -.6249995   15.54134 |     N =     586
         between |             1.225009   .2475393   6.578539 |     n =      90
         within  |             1.221715  -4.258824   10.67818 | T-bar = 6.51111
                 |                                            |
liq      overall |  1.710944   1.275764   .0605558   8.868263 |     N =     586
         between |             1.101435    .318166   7.677907 |     n =      90
         within  |             .8036921  -.7862038   6.353968 | T-bar = 6.51111
                 |                                            |
ndts     overall |   .049194   .0360434          0   .1967844 |     N =     586
         between |             .0341203   .0010025   .1753201 |     n =      90
         within  |             .0179038  -.0308673   .1435742 | T-bar = 6.51111
```

3.2 Model 1: Book value of Leverage

3.2.1 Fixed Effect estimation

```
. xtreg blev prof size tang grow liq ndts, fe i(id)

Fixed-effects (within) regression               Number of obs      =       586
Group variable: id                              Number of groups   =        90

R-sq:  within  = 0.2951                         Obs per group: min =         2
       between = 0.5357                                        avg =       6.5
       overall = 0.4635                                        max =         7

                                                F(6,490)           =     34.18
corr(u_i, Xb)  = -0.0265                        Prob > F           =    0.0000

------------------------------------------------------------------------------
        blev |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        prof |  -.1499056   .0358561    -4.18   0.000    -.2203562    -.079455
        size |  -.0041351   .0041152    -1.00   0.315    -.0122207    .0039506
        tang |   .4648519   .0406494    11.44   0.000     .3849834    .5447205
        grow |   .0109849   .0030554     3.60   0.000     .0049816    .0169883
         liq |  -.0139587   .0050339    -2.77   0.006    -.0238495    -.004068
        ndts |  -.4497298   .2126567    -2.11   0.035    -.8675613   -.0318983
       _cons |   .2697453   .0616452     4.38   0.000     .1486239    .3908668
-------------+----------------------------------------------------------------
     sigma_u |  .12355539
     sigma_e |  .08818594
         rho |  .66250649   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(89, 490) =    12.48             Prob > F = 0.0000
estimate store fixedblev
```

3.2.2 Random Effect Estimation

```
Random-effects GLS regression                   Number of obs      =
586
Group variable: id                              Number of groups   =        90

R-sq:  within  = 0.2942                         Obs per group: min =         2
       between = 0.5428                                        avg =       6.5
       overall = 0.4681                                        max =         7

                                                Wald chi2(6)       =    308.32
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
        blev |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        prof |  -.1390454   .0332319    -4.18   0.000    -.2041786   -.0739121
        size |  -.0038564   .0035378    -1.09   0.276    -.0107904    .0030776
        tang |   .4587378   .0311623    14.72   0.000     .3976608    .5198149
        grow |   .0090431   .0029161     3.10   0.002     .0033276    .0147586
         liq |  -.0163805   .0046029    -3.56   0.000     -.025402    -.007359
        ndts |  -.4880205   .1850666    -2.64   0.008    -.8507444   -.1252966
       _cons |   .2755688   .0555092     4.96   0.000     .1667727    .3843649
-------------+----------------------------------------------------------------
     sigma_u |  .11776774
     sigma_e |  .08818594
         rho |  .64072996   (fraction of variance due to u_i)
------------------------------------------------------------------------------

 . estimate store randomblev
```

3.2.3 RE vs. FE

```
. estimates table fixedblev randomblev

----------------------------------------
    Variable | fixedblev    randomblev
-------------+--------------------------
        prof | -.14990557   -.13904538
        size | -.00413507   -.00385638
```

```
        tang |  .46485193    .45873781
        grow |  .01098495    .00904309
         liq | -.01395872   -.01638051
        ndts | -.44972981   -.48802048
       _cons |  .26974532    .27556878
----------------------------------------
```

3.2.4 Breusch Pagan LM – Test

```
Breusch and Pagan Lagrangian multiplier test for random effects

        blev[id,t] = Xb + u[id] + e[id,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                    blev |    .040726       .2018068
                       e |   .0077768       .0881859
                       u |   .0138692       .1177677

        Test:   Var(u) = 0
                             chibar2(01) =   663.43
                          Prob > chibar2 =   0.0000
```

3.2.5 Hausman Test

```
. hausman fixedblev randomblev

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-
V_B))
             |   fixedblev    randomblev     Difference          S.E.
-------------+------------------------------------------------------------
--
        prof |   -.1499056    -.1390454       -.0108602         .0134648
        size |   -.0041351    -.0038564       -.0002787         .0021021
        tang |    .4648519     .4587378        .0061141         .0261013
        grow |    .0109849     .0090431        .0019419          .000912
         liq |   -.0139587    -.0163805        .0024218         .0020381
        ndts |   -.4497298    -.4880205        .0382907         .1047531
--------------------------------------------------------------------------
--
                           b = consistent under Ho and Ha; obtained from
xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from
xtreg
    Test:  Ho:  difference in coefficients not systematic

                  chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        6.18
                Prob>chi2 =      0.4038
```

3.3 Model 2: Market Value of Leverage

3.3.1 Fixed Effects Estimation

```
.xtreg mlev prof size tang grow liq ndts, fe i(id)

Fixed-effects (within) regression               Number of obs      =       586
Group variable: id                              Number of groups   =        90

R-sq:  within  = 0.3680                         Obs per group: min =         2
       between = 0.6352                                        avg =       6.5
       overall = 0.5610                                        max =         7

                                                F(6,490)           =     47.56
corr(u_i, Xb)  = 0.1268                         Prob > F           =    0.0000

------------------------------------------------------------------------------
        mlev |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        prof |  -.1632551   .0374583    -4.36   0.000    -.2368539   -.0896564
        size |   -.000119   .0042991    -0.03   0.978    -.0085659     .008328
        tang |   .4340189   .0424658    10.22   0.000     .3505813    .5174564
        grow |  -.0236681    .003192    -7.41   0.000    -.0299397   -.0173965
         liq |  -.0246893   .0052589    -4.69   0.000    -.0350221   -.0143566
        ndts |  -.2298814   .2221595    -1.03   0.301    -.6663842    .2066214
       _cons |    .277307   .0643998     4.31   0.000     .1507731    .4038409
-------------+----------------------------------------------------------------
     sigma_u |  .12481067
     sigma_e |  .09212662
         rho |  .64731735   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(89, 490) =    11.25             Prob > F = 0.0000
. estimate store fixedmlev
```

3.3.2 Random Effects Estimation

```
. xtreg mlev prof size tang grow liq ndts, re i(id)

Random-effects GLS regression                   Number of obs      =       586
Group variable: id                              Number of groups   =        90

R-sq:  within  = 0.3672                         Obs per group: min =         2
       between = 0.6418                                        avg =       6.5
       overall = 0.5659                                        max =         7

                                                Wald chi2(6)       =    440.90
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
        mlev |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        prof |   -.169078   .0345463    -4.89   0.000    -.2367875   -.1013684
        size |  -.0013304   .0036519    -0.36   0.716    -.0084881    .0058272
        tang |   .4501003   .0318536    14.13   0.000     .3876683    .5125323
        grow |  -.0261529   .0030414    -8.60   0.000    -.0321139   -.0201919
         liq |  -.0247853   .0047811    -5.18   0.000    -.0341561   -.0154144
        ndts |  -.3496479   .1911873    -1.83   0.067    -.7243682    .0250724
       _cons |     .29749   .0572763     5.19   0.000     .1852305    .4097496
-------------+----------------------------------------------------------------
     sigma_u |  .11531709
     sigma_e |  .09212662
         rho |  .61041179   (fraction of variance due to u_i)
------------------------------------------------------------------------------
. estimate store randommlev
```

3.3.3 RE vs. FE

```
. estimates table fixedmlev randommlev

----------------------------------------
    Variable | fixedmlev    randommlev
-------------+--------------------------
        prof | -.16325515   -.16907796
        size | -.00011896   -.00133041
        tang |  .43401887    .45010032
        grow | -.02366806   -.02615288
```

```
        liq | -.02468934   -.02478526
       ndts | -.22988138   -.34964788
      _cons |  .27730698    .29749003
----------------------------------------
```

3.3.4 Breusch Pagan LM – Test

```
Breusch and Pagan Lagrangian multiplier test for random effects

        mlev[id,t] = Xb + u[id] + e[id,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                    mlev |   .0511187       .2260944
                       e |   .0084873       .0921266
                       u |    .013298       .1153171

        Test:   Var(u) = 0
                             chibar2(01) =   579.80
                          Prob > chibar2 =   0.0000
```

3.3.5 Hausman Test

```
. hausman fixedmlev randommlev

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-
V_B))
             |   fixedmlev    randommlev     Difference          S.E.
-------------+------------------------------------------------------------
--
        prof |   -.1632551     -.169078        .0058228        .0144802
        size |    -.000119    -.0013304        .0012114        .0022684
        tang |    .4340189     .4501003       -.0160814        .0280837
        grow |   -.0236681    -.0261529        .0024848        .0009688
         liq |   -.0246893    -.0247853        .0000959        .0021901
        ndts |   -.2298814    -.3496479        .1197665         .113147
---------------------------------------------------------------------------
--
                           b = consistent under Ho and Ha; obtained from
xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from
xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       11.25
                Prob>chi2 =      0.0810
```

3.4 OLS vs RE vs FE

```
. estimate table olsblev olsmlev fixedblev fixedmlev randomblev randommlev

---------------------------------------------------------------------------------------
    Variable |  olsblev      olsmlev      fixedblev     fixedmlev    randomblev    randommlev
-------------+-------------------------------------------------------------------------
        prof | -.11808707   -.19459765   -.14990557   -.16325515   -.13904538   -.16907796
        size | -.00661481   -.00541113   -.00413507   -.00011896   -.00385638   -.00133041
        tang |  .43493884    .44823785    .46485193    .43401887    .45873781    .45010032
        grow | -.00176136   -.04031047    .01098495   -.02366806    .00904309   -.02615288
         liq | -.02193204   -.02533965   -.01395872   -.02468934   -.01638051   -.02478526
        ndts | -.50275915   -.47289724   -.44972981   -.22988138   -.48802048   -.34964788
       _cons |  .35152322    .38913527    .26974532    .27730698    .27556878    .29749003
---------------------------------------------------------------------------------------
```

3.5 Random Effects Cluster Robust Regression

3.5.1 Book Value of Leverage

```
. xtreg blev prof size tang grow liq ndts, re cluster(id)

Random-effects GLS regression                   Number of obs      =       586
Group variable: id                              Number of groups   =        90

R-sq:  within  = 0.2942                         Obs per group: min =         2
       between = 0.5428                                        avg =       6.5
       overall = 0.4681                                        max =         7

                                                Wald chi2(6)       =    144.58
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

                                     (Std. Err. adjusted for 90 clusters in id)
------------------------------------------------------------------------------
             |               Robust
        blev |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        prof |  -.1390454   .0568761    -2.44   0.014    -.2505205   -.0275702
        size |  -.0038564   .0038552    -1.00   0.317    -.0114124    .0036996
        tang |   .4587378   .0502777     9.12   0.000     .3601954    .5572802
        grow |   .0090431   .0069247     1.31   0.192     -.004529    .0226152
         liq |  -.0163805   .0061101    -2.68   0.007    -.0283562   -.0044048
        ndts |  -.4880205   .3075745    -1.59   0.113    -1.090855    .1148144
       _cons |   .2755688   .0668995     4.12   0.000     .1444481    .4066895
-------------+----------------------------------------------------------------
     sigma_u |  .11776774
     sigma_e |  .08818594
         rho |  .64072996   (fraction of variance due to u_i)
```

3.5.2 Market Value of Leverage

```
. xtreg mlev prof size tang grow liq ndts, re cluster(id)

Random-effects GLS regression                   Number of obs      =       586
Group variable: id                              Number of groups   =        90

R-sq:  within  = 0.3672                         Obs per group: min =         2
       between = 0.6418                                        avg =       6.5
       overall = 0.5659                                        max =         7

                                                Wald chi2(6)       =    241.45
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

                                     (Std. Err. adjusted for 90 clusters in id)
------------------------------------------------------------------------------
             |               Robust
        mlev |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        prof |   -.169078   .0482686    -3.50   0.000    -.2636827   -.0744733
        size |  -.0013304   .0039313    -0.34   0.735    -.0090357    .0063749
        tang |   .4501003   .0419777    10.72   0.000     .3678256     .532375
        grow |  -.0261529   .0076855    -3.40   0.001    -.0412161   -.0110896
         liq |  -.0247853   .0070538    -3.51   0.000    -.0386105   -.0109601
        ndts |  -.3496479   .3048941    -1.15   0.251    -.9472294    .2479337
       _cons |     .29749   .0700742     4.25   0.000     .1601471    .4348329
-------------+----------------------------------------------------------------
     sigma_u |  .11531709
     sigma_e |  .09212662
         rho |  .61041179   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

3.5.3 Comparing the Models

```
. . estimate table robustblev robustmlev

----------------------------------------
    Variable | robustblev   robustmlev
-------------+--------------------------
        prof | -.13904538   -.16907796
        size | -.00385638   -.00133041
        tang |  .45873781    .45010032
        grow |  .00904309   -.02615288
         liq | -.01638051   -.02478526
        ndts | -.48802048   -.34964788
       _cons |  .27556878    .29749003
----------------------------------------
```