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# Determinants of Capital Structure: Empirical evidence from listed firms in Norway

**Masteroppgave i Økonomi og administrasjon**
**Handelshøyskolen ved HiOA**

## Abstract

In this study I have researched on capital structure of Norwegian firms listed on annual statistic over large domestic and foreign firms. This study aims to investigate which variables determine the capital structure of these firms, by using a long list of both firm-specific and macroeconomic variables.

Datastream was the source of data collection. A total of 59 firms and1503 firms were included in this study. By using fixed effects model, the result indicates that there are differences in the determinants of long-term and short-term debt. Non-debt tax shield is the most explanatory variable for short-term debt, while tangibility is the firm characteristic that mostly affects the long-term debt. The most surprisingly result was that the profitability and size were not significant, which is not in accordance with previous research on capital structure. Furthermore, none of the macroeconomics factors seems to affect capital structure of Norwegian firms.

Both types of debt increase with tangibility for domestic firms, on the other hand none observed factors affect short-term and long-term debt for foreign firms.

The results obtained for short-term debt are inconclusive and support both theories and do not point out superiority of any theories. On the other hand long-term debt can be explained by trade-off theory. This indicates that capital structure of large Norwegians listed firms can be explained by the trade-off between the costs and benefits of debt.



Handelshøyskolen ved HiOA
Oslo 2016

# Acknowledgement

Writing this Master thesis has been both learning and difficult. I would like to express the most sincere gratitude to my supervisor Ivar Bredesen for his encouragement, guidance and support throughout the writing process. His remarkable ability to cheer me up when I desperately needed it because everything seemed impossible and fruitless, is the reason I was able to write this master thesis.

A special thanks to Associate Professor Muhammad Azeem Qureshi for his valuable time. I appreciate the help he has provided.

I am thankful to my family and friends for their continuous support throughout the many emotional breakdowns.

Innholdsfortegnelse

# Chapter 1: Introduction

In this chapter, I will present an introduction of the topic capital structure and a brief introduction of objectives of this research.

Throughout the last century, several questions have been asked; how do firms finance their operations and whether there exist an optimal way for firms to finance their operations. Others have also researched on factors that influence a firm's choice of financing. Weston (1955) argued half a century ago, whether it was possible to develop a "reasonable theory" that explains these questions. (Frank & Goyal 2008). Since then, large amounts of theories have been advanced in order to explain these questions. Myers in his article from 1984 makes a contrast between the influential perspectives on debt, known as trade-off theory and pecking order theory. Although Myers (1984) presents them as "broad organizing frameworks", can these also be seen as a part of a much larger picture that determine a firm's capital structure (Frank & Goyal 2008). Myers (1984) discovered that changes in capital structures convey signals to the company's investors. There exist other theories like signalling (Ross 1977) and market timing theory (Baker and Wurgler 2002) that aims to explain the choice of capital structure. The problem we still face today is that none of these theories is capable of separately explaining the important facts about capital structure a firm faces in the real world.

Economists worldwide agree upon the importance of capital structure, but still lack a comprehensive model of capital structure that can enhance all the empirical findings. All the existing models are able to explain some of the known stylized facts, while contradicting on others. Frank and Goyal (2009) express their concern *".., in recent decades the literature has not had a solid empirical basis to distinguish the strengths and the weaknesses of the main theories"* (Frank and Goyal 2009:1). Although Myers (2001) is sceptical to the possibility of a universal theory in future, Frank and Goyal (2008) are more optimistic.

There are two possibilities in the research of capital structure. First, we have a theory that states that financing does not matter, well known as Miller and Modigliani (1958) irrelevance theorem. They proved in their famous article *The cost of Capital, Corporate Finance, and the Theory of Investments* in American economics review (1958) that financing does neither affect the value of the firm nor the cost of capital. The paper was based on strict assumption

about perfect and frictionless markets, where any deviation from the equilibrium point was quickly resolved due to financial innovation.

Another possibility is that capital structure does matter, because of market imperfections like taxes, information asymmetry and agency costs. Here we have numbers of conditional theories, that emphasis on different market imperfections. Trade-off theory states the firm choses the debt level by balancing the tax advantages of additional debt against the cost of financial distress, and therefor predicts moderate level of borrowing from tax paying firms. Trade-off theory considers taxes and deadweight bankruptcy costs as important factors to explain a firm's capital structure. The pecking order theory emphasizes difference in information, and agent costs seem to exist in the background of both theories. Pecking order theory points out that when internal funds are insufficient, firms prefer debt to issuing equity, due to asymmetric information and adverse selection. Therefore, the amount of a firm's debt is an indication of their cumulative need for external funds.

A firm's asset produces its cash flow. If the firm is only financed by equity (common stock and retained earnings), this stream of cash flow goes entirely to the shareholders. However, when the financing is a mixture of debt and equity, it divides this stream of cash flow into a secure stream to debt-holders and a riskier one to the stockholders. Therefore, there might be different cost of capital for debt and equity. And the objectives of managers are to ensure the low cost of capital to maximize the value of the firms. Therefore, it is important to find the determinants of capital structure that affect the cost of capital.

When we know that capital structure does matter and MM three years after their article admitted that they were wrong, why do we devote time to understand their theorem? The reason is if we are unable to understand MM argument and the assumptions their model is based on, we will not completely understand why one capital structure mix is better than another (Brealey et al 2013). It is important to be aware of the kind of market imperfection that exists; such as taxes, cost of bankruptcy and financial distress. Factors that are assumed to determine capital structure are related to these imperfections. Most of theories in the field of capital structure deviates from MM irrelevance theorem by relaxing the unrealistic assumptions.

From a financial perspective, a firm's capital structure has a direct impact on overall risk and the cost of capital. Source of financing affect both the value of firm and shareholders, and is therefore continuously under research. Although debt ought to be the cheapest source of capital, an increase in debt to equity ratio, can increase not only financial risk, but also the volatility of EPS and return on equity (Baker and Martin 2011).

The reason behind my research on the capital structure is to find which firm-specific and macroeconomics factors affect the capital structure of large Norwegian listed firms. As mentioned above, no perfect mix exists yet, that is suitable to the entire market or industry.

## 1.1 Research and objective

The aim of this study is to find out how firm-specific characteristics and macroeconomics variables affect the capital structure of listed largest domestic and foreign firms in Norway. Therefore the research question for this study is:

***What are the determinants of capital structure of large listed domestic and foreign firms in Norway?***

To answer this research question, we may answer these questions:

- Does long-term debt and short-term debt provide different results?
- Are there any differences in capital structure of domestic and foreign firms?
- Are predictions from trade-off theory and Pecking order theory valid for large Norwegian listed firms?

## 1.2 Outline

I will start by presenting capital structure in perfect markets. Thereafter discuss the dominating theories in imperfect markets. Furthermore, I will analyse the selective empirical research before developing the hypothesis that will be tested in this paper. Afterwards will I elaborate methodology and sample before presenting and analysing the findings. In the end, I will summarize the findings and present limitations of the study and recommendation for future research.

# Chapter 2: Literature view

The theory chapter begins with capital structure in perfects markets, by introducing Modigliani and Miller theory about capital structure irrelevance. Accordingly, I will present capital structure in imperfect markets, by using two well-known capital structures theories. Market timing theory is another capital structure theory that has gained popularity in the last decade, but is not reviewed here since it does not fall in scope of this thesis.

## 2.1 Capital structure in perfect markets

Modigliani and Miller (1958) and their new perspective on optimal capital structure is called the birth of modern business finance. They assumes perfect capital markets with no taxation, no transactions costs, no information asymmetry and no costs associated with financial distress, and developed to propositions.

MM proposition 1 is based on law of conservation of value, arbitrage argument and "home leverage". It states that in a perfect capital market a firms value is unaffected by its capital structure. It does not matter whether a firm's chooses to finance with debt or equity, since the market value of the company will remain the same. By changing the capital structure, it is only possible to alter the value of assets divided across securities on balance sheet, and not the market value of firm (Brealey et al 2013). This indicates that debt mix, the choice between short-term debt and long-term debt should have no effect on value of the firm. Furthermore, in a perfect capital market a private investor can replicate any capital composition and will therefore not pay extra for any capital structure.

MM proposition considers risk and return on equity as a result of change in the debt ratio. It states that the expected rate of return on equity in leveraged firms increase proportionally with the debt to equity ratio (Brealey et al 2013).

Economists have by relaxing the restricted assumptions of MM's model and introducing different types of market imperfections, tried to introduce a model that can explain capital structure in imperfect markets.

## 2.2 Capital structure in imperfect markets

### Taxes and Miller and Modigliani

In their paper, Miller and Modigliani (1963) modified their propositions by considering effect of taxes. They argued that a firm could maximize its value by using debt, since taxes exists in real worlds and firms have to pay interest on their debt. Interest are paid before payment of taxes, which makes interest payment tax deductible. This implied full financing since they assumed debt to be risk free and could be held permanently, making the value of tax shield a perpetuity (Brealey et al 2013).

This adjustment gives us average cost of capital where benefits of tax shield is considered. The high amount of leverage will give lower the WACC (the weighted average cost of capital) since the firm can exploit the tax advantages of debt.

### 2.2.1 The trade-off theory

The trade-off theory is one of the most frequently used theories seeking to explain a company's choice of optimal capital structure. This theory is an offspring of the endless debate of MM irrelevance theorem. By introducing the taxes into this theorem, Modigliani and Miller (1963) revealed that debt could be beneficial for the firms. Nevertheless, this implied full debt financing since no cost was associated with debt and firms have a linear objective function.

### Static trade-off theory

Kraus and Litzenberger (1973) introduced bankruptcy costs as one of the costs associated with debt and provided us with the theory known as static trade-off theory. This theory is based on the two propositions of MM.

It is common to distinguish between direct bankruptcy costs and indirect bankruptcy costs. Direct bankruptcy costs are legal fees, administrative expenses and restructuring costs. Indirect bankruptcy costs include loss of employees (lost product innovations), loss of customers (loss in revenue) and less favourable credit terms. The latter can in many cases be substantial and difficult to measure. Bankruptcy costs vary by both industry and firm.

Myers described the static trade-off framework as "*in which the firm is viewed as setting a target debt-to-value ratio and gradually moving towards it…"*(Myers 1984). Frank and Goyal (2008) point out that target adjustment serves better as a separate hypothesis, since it is not necessary that firms balance tax savings versus bankruptcy costs, to make this adjustment. Few of the reasons they presented are; tax being more complex than the theory assumes and the target debt ratio not being observable. Bankruptcy costs must also be deadweight cost and not transferable. Similar to Frank and Goyal (2008), I use the term static trade-off theory in this study "*for the hypothesis that bankruptcy and taxes are the key factors that determine the leverage within a static model"* (Frank & Goyal 2008 p. 137). A single period trade-off without target adjustment.

The static trade-off theory states that companies choose the optimal mixture (substitute debt for equity) by balancing the advantages and disadvantages associated with additional debt, holding the firm's assets and investments plan constant. The benefit of using debt financing is interest tax shield versus the costs of debt, in terms of financial distress and bankruptcy. This is also known as trade-off tax-bankruptcy perspective.

Myers (2001) highlights that financial distress includes both bankruptcy costs and agency costs when there is uncertainty around a firm's creditworthiness. By increasing theirs debt, firms get larger interest expenses and lower taxable profits, and therefore pays a reduced amount in taxes. This makes the debt favourable over equity financing. At the same time, higher level of debt increases the obligations of the firms and consequently the probability of default. The higher the debt ratio, the higher will the probability of default be. Financial distress has a negative effect on a firm's market value (Myers 2001).

When the risk of incurring these costs increases, the value of company decreases and capital becomes more expensive. Since the marginal benefits of debt are diminishing and marginal costs (bankruptcy and financial distress) increasing, the trade-off theory assumes that firms will borrow up to the point where these two offset each other (the point of value maximization), the top of the curve in figure 1. It means that this theory affirms the existence of an optimal debt ratio.

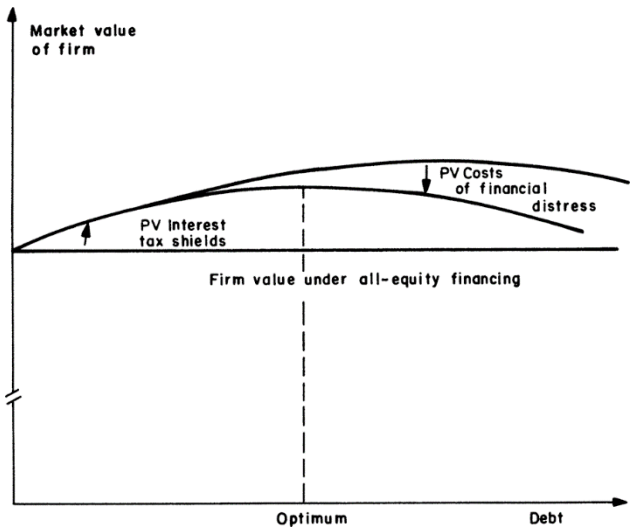

*Figure 1: Market value of a firm and debt, from Myers (1984)*

**Dynamic trade-off theory**

An addition of multiple periods into the original trade-off theory gives us dynamic trade-off theory. Here is the notion of target adjustment well defined and it recognizes that target debt ratios may differ from firm to firm, within the industry and across industries. Companies with tangible assets and a large income, enjoy the benefits from tax shield by having high target debt ratios (Brealey et al 2013). The opposite is true for unprofitable companies with a large amount of intangible assets.

There are costs associated with capital structure adjustment, preventing companies to always lying on its target debt ratio. Unpredictable events and costs of adjustment can delay a company from achieving its target debt ratio, and that is why we observe firms having different debt ratios, although they have the same target debt ratio. A feasible solution is to have a range of debt ratios that firms allow its ratio to float within, instead of bearing the high rebalancing costs (Kane, Marcus and McDonald 1984, cited in Baker and Martin 2011).

Unlike MM's theory stating that a firm should borrow as much as they can, the trade-off theory predicts moderate debt ratios. In the dynamic model with frictions, a firm's debt ratio will always differ from the optimal debt ratio, due to the reasons discussed above. In their studies Henry and White (2005), Leary and Robert (2005) and Strebulaev (2007) found out that shock on leverage is more likely caused by adjustment cost rather than capital structure indifference (Baker and Martin 2011).

#### 2.2.1.1 Agency costs

Beside bankruptcy costs, agency costs should as well be associated with the use of debt. "*Agency concern are often lumped into the trade-off framework broadly interpreted*" (Frank and Goyal 2009 p.1). Furthermore, agency costs can arise due to information asymmetry between mangers and shareholders (Jassim et al 1988). These agency costs arise when managers do not own 100 % of the firm. Agency costs affect the costs of financial distress and are important for the trade of theory. Static trade-off presented above and pecking-order theories are based on assumption that managers and shareholder interests are aligned.

Managers in debt-financed firms, the agents, may have incentives to act in their own interests, and not the shareholders (principles). Jensen and Meckling (1976) direct our attention to the role of agency costs in corporate finance, caused usually by the separation of ownership and control in public firms. They point out two types of potential conflicts; conflict between shareholders and managers (principal agent problems / agency costs of equity) and conflict between shareholders and debt-holders (agency costs of debt).

**The conflict between shareholders and debt-holders**

The conflict appears when firms risks financial distress. If there is a significant probability of default, managers may try to maximize the shareholders' value, instead of total firm value by participating in risk shifting activities (Jensen and Meckling 1976). The reason is that shareholders have much to gain at the expense of debt-holders, since they have residual claim. In case of bankruptcy and liquidation of assets, the debt-holders have the first claim, therefore shareholders gain when value of debt falls. Risk shifting activities such as investment in riskier projects or assets benefits shareholders if succeed, and burden firm's creditors in case of failure.

Free cash flow available, may cause overinvestments problems because managers have an incentive to accept high-risk projects that benefit shareholders if succeed, but burden creditors in case of failure. To protect themselves from these kinds of overinvestments problems, rational bondholders demand higher compensation, making additional debt less attractive or debt-holders may write legal contract that restricts managers from additional borrowing. The opposite, underinvestment problem may occur when managers forgo positive NPV projects that only benefit the debt-holders. Highly leveraged firms are more likely to have these managerial moral hazard problems (overinvestment and underinvestment).

The agency cost due to conflict between equity and debt provides important insight for trade-off theory. By including these costs, we understand that the cost of financial distress is not limited to cost of bankruptcy. The threat of bankruptcy affects firm's investment and operating strategies, and can decrease a firm's value. This explains why firms operate at relatively low debt ratios. Both the bankruptcy costs and agency costs would be considered versus interest tax shield. Agency costs helps us understand why growth firms use equity, and not debt. They have more to lose.

**The conflict between shareholders and managers:**
The conflict between managers and stockholders' interests increases the capital cost of financing and affect the market value of the firm. Shareholders are forced to either develop reward systems to align manager's interests or spend unnecessary resources on monitoring costs. Managers view new equity and debt as costly compared to retained earnings (Jassim et al 1988).

Debt can also be a disciplining mechanism by forcing managers to generate certain cash flows to meet the banks requirements, and this way effecting managers ability to invest in value enhancing activities (Jensen 1986). A firm's commitment to interest payments convey positive signals to the market that this firm is doing well and believes in favourable prospect. To achieve optimal debt ratio, one must evaluate the agency cost of debt (overinvestment and underinvestment) versus agency costs of equity (free cash flow problem).

#### 2.2.1.2 Is trade-off theory able to explain company's capital structure behaviour?
Frank and Goyal (2008) point out that historical data is not in favour of static trade-off theory. According to trade-off theory, the motivation behind use of debt financing is a reduction in tax payment, but the observed level of debt ratios do not match up to the corporate tax rates. Another remark is that taxes are only a century old, but debt financing was a common phenomenon longer before the tax incentive appeared. The biggest flaw in the trade-off theory is constant empirical findings of inverse relation between probability and debt.
Trade-off theory predicts that taxpaying firms cannot operate with conservative debt ratios. If that is true then a value-maximizing firm should never pass up the opportunity of utilizing interest tax shield, especially when costs of financial distress are low. Still, we find profitable firms with superior credit rating operating having low debt ratios (Myers 1977, 2001). In

Graham (2000) sample, around half of the tax paying firms could have doubled their interest payments, to utilize from the effect of doubled interest tax shield.

Listed large companies have the possibility of adjusting their capital structure at relative low cost and a broader range of financing sources, which may lead to use of debt (Myers 2001). MacKie-Manson (1990) finds empirical result aligned with trade-off theory, showing that taxpaying firms favour debt (Myers 2001). At the same time, his finding support Millers (1977) equilibrium, where gain from debt is offset by low effective tax rate on capital gains. In situations like this, a firm will benefit from using equity since low tax rates force investors to pay more tax on debt, than they would have done on equity income. Graham (1996) found that a firm's marginal tax rate and changes in long-term debt was positively related, although Fama and French (1998) could not find any evidence indicating that interest tax shield affect market value of the firm (Myers 2001).

Debt ratios differ from industry to industry. Small and growing firms relay mainly on issuing equity, while large oil firms tends to use debt as external financing source. Myers (2001) point outs that utility, chemical, telecommunication and transportation industry rely heavily on high debt ratios, while pharmaceutical companies operate with negative debt ratios. He observed low or negative debt ratios for growth companies.

A number of studies such as Leary and Roberts (2005), Alti (2006), Flannery and Rangan (2006), Kayhan and Titman (2007), Huang and Ritter (2009) have tested the target adjustment models empirically and ended up with finding in favour of dynamic trade-off theory (Baker et al 2011). Findings from these studies about firms' capital structures support the existence of leverage in the long run, although the adjustment speed toward the target is very slow.

### 2.2.2 Pecking order theory

Another important theory in the capital structure literature is pecking order theory. Based on Akerholfs (1970) model, Myers & Majluf (1984) and Myers (1984) proposed this theory as a different perspective on capital structure. This theory draws our attention to adverse selection problem caused by asymmetric information between a firm's management and its new investors. Managers are more likely to have superior information regarding the market value of their firm's assets and future growth opportunities. The new investors closely observe

managers financing decision since they convey information about firm's prospects. Managers are reluctant to issue new equity when it is undervalued since it adds equity to the firm at the expense of old shareholders. Issuance of new equity is only acceptable when it is overvalued, since Myers and Majluf (1984) assumed that mangers takes action in favour of existing shareholders. Doing so, managers send signals to the market of equity being too expensive and consequently it observe a drop in its share price on announcement date, due to adverse selection costs. Asquith and Mullins (1980) is one of the several studies that confirm this prediction of pecking order theory (Myers 2001). With large information asymmetry, the expected fall in price at announcement is greater. Announcement of debt may cause a small drop in stock prices.

The pecking order theory considers information asymmetry as an important factor to choose financing source. The optimal financing source is that least affected by information asymmetry, therefore internal funds (retained earnings) is preferred over external financing. Furthermore, short-term debt is preferred over long-term debt (Fama and French 2012). If internal funds were insufficient, a firm would first issue debts than hybrid securities, since they serve as a fixed claim and therefore less effected by information asymmetry. This theory considers dividend as "sticky", therefore dividend cuts are not an option for financing capital expenditures. It means we can observe changes in external financing by looking at changes in net cash flows. As a last resort, a firm will turn to issuing new equity, due to residual claims and high adverse selection costs associated with it. Debt reduces information asymmetry, and issuing equity when debt is available will convey investors that managers are pessimistic and believe that shares of their firm are overpriced. Therefore issue of equity is only an alternative when the firm already has high debt ratio and additional debt is more costly than equity.

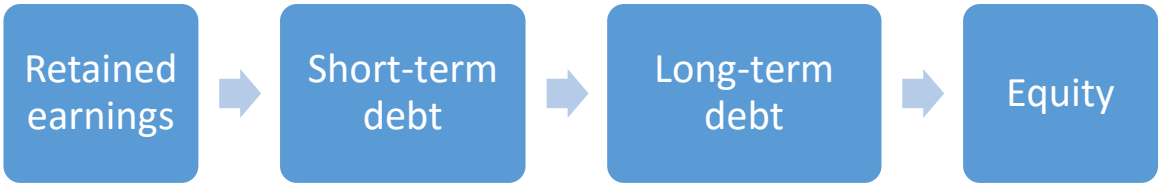


*Figure 2: Financial hierarchy of pecking order theory (oun contribution)*

Pecking order theory predicts a firm's capital structure being result of both its financial requirements over time and minimizing the adverse selection costs, rather than aiming for an optimal debt ratio.

#### 2.2.2.1 Is pecking order theory able to explain company's capital structure behaviour?

Pecking order theory explains why most firms use debt as a source of external financing. Myers and Majluf (1984) state that managers will try to avoid issuance of equity to maximize value, as long as they feel they have better information than outsiders do. Shyam-Sunder and Myers (1999) test the pecking order theory by regressing the net debt issuance of a firm against its net financial deficit. By finding a coefficient of financial deficit close to 1, they find empirical support for pecking order theory. However, their sample included only 157 firms over a period of 1971 to 1989. Frank and Goyal (2003) examined the financial behaviour of American firms in the same context as Shyam-Sunder and Myers (1999) and found that none of theirs predictions hold when a longer series of time or broader set of firms is used. Furthermore, pecking order theory does a poor job in explaining small- high growth firms with large information asymmetry, the type of firms that it should perform best on (Frank and Goyal 2003).

Pecking order theory cannot explain why firms with surplus of retained earnings issue debt (Frank and Goyal 2008). This theory does well in predicting the relation between profitability and leverage, but it does not provide any help in explaining many other factors that affect a firm's financing decisions. Pecking order theory did well in explaining the capital structure behaviour until 1980 (Fama and French 2012, Frank and Goyal 2009)

### 2.2.3 Taxes

The benefit with debt financing is that under a corporate tax system, the interest expense is tax deductible. In a country as Norway, with corporation tax rate lying on 28% until 2013, 27 % for the last two years and 25% for fiscal year 2016, the firms have much to gain by taking additional debt (KPMG). The interest tax shield is a valuable asset, since it increases the income for both bondholders and shareholders and this make tax favourable over equity. Although according to Frydenberg (2004) Norwegian tax system treats debt and equity equally.

Taxes are favourable from trade-off theory perspective. Debt financing was a source of financing, long before the introduction of corporate taxes and has been used in USA when corporate tax rate was only 1% in 1909 (Frank and Goyal 2009). Miller (1977) did not observe large difference in the debt to assets ratios of non-financial firms when the tax rate was increased form 11% in 1920 to 52 % in 1950.

Another thing to remember is that debt is not fixed or permanent as Miller and Modigliani (1963) assumed. If it was, we would be able to calculate the effect of present value of the interest tax shield. Firstly, a firm's debt capacity is highly dependable on its future profitability and market value. A profitable firm has the alternative of borrowing more, but a firm that is not doing well, may find itself being forced to pay down the remaining debt. Investors may consider future interest tax shields as risky, since they do not know the size or the duration of interest tax shield with certainty. Secondly, firms are not always profitable, and may face years with financial losses. In that case, the average future tax rate will be lower than effective future rate. Furthermore, the tax advantages of debt a firm enjoys on corporate level, may be less valuable, due to the tax advantages of equity to investors at individual level.

# Chapter 3: Empirical Research

There is no consensus regarding determinant of the capital structure in previous research. Researchers give importance to different factors in different studies. However profitability, firm sixe, growth and tangibility seem to be consistent. In this paper, I have extract a long list of variables with a majority of firm-specific variables and macroeconomic factors based on previous research.

## 3.1 International empirical research

### 3.1.1 Titman and Wessels

Titman and Wessels (1988) tested the explanatory power of a broad range of theoretical determinants suggested by theories of capital structure, on various types of debt. They distinguish between three types of debt; short term, long term and convertible debt, instead of using a single aggregated measure of total debt. Their sample was 469 American firms in the period 1974 to 1982. "Linear structural modelling" (factor analysis) is used to account for the measurement problems. Determinants in their research were asset structure, non-debt tax shields, growth, uniqueness of business (measured by number of product line and advertising expenses), industry classification, size, earnings volatility and profitability.

The most important discovery in this study was prediction of a negative relation between a firm's uniqueness and debt. In contrast with the prediction made by capital structure theories, they did not find support for any significant relation between debt and volatility, collateral value of assets, non-debt tax shield and growth of a firm. They do however provide support for small firms having significantly higher short-term debt ratios than large firms. A possible indication of high transaction costs small firms' face while issuing long-term debt and equity. They argue thereby that transaction costs might be an important determinant of capital structure particularly for small US firms. This result provides useful insight about possible risk factors a firm faces. By having low long-term debt ratios, large firms are less likely to be affected by economic downturns. Their findings suggest a negative relationship between past profitability and current debt, providing support for implications of Pecking order theory by Myer and Majluf (1984). Size is related to long-term debt over book value of equity, but not the market value of equity. This suggest that the findings are reasonable since firms with high market values relative to book values, have more capacity to borrow and therefore high debt ratio over their book value.

### 3.1.2 Harris and Raviv (1991)

They do not actually perform an empirical research, but gather the literature on theories and empirical research on capital structure till 1991. In the search for firm-specific characteristic that determine leverage, they found a few similarities in the previous research. Most of the previous studies are in consensus about that fixed assets, non-debt tax shield, growth and firm size increase with debt. Nevertheless, volatility, bankruptcy probability, profitability, R&D and advertising expenditures share a negative relationship with debt. They find the theories to be complementary and incapable of answering which factor was important in various contexts.

Empirical findings of Titman and Wessel (1988) contradict survey by Harris and Raviv (1991) on basic facts and create a serious empirical problem. This gives advocates of different theories choice of deliberately oppose two well-known previous researches.

### 3.1.3 Rajan and Zingales (1995)

Most of the empirical research was on firms located in United States. **Rajan and Zingales (1995)** conduct their research on public firms from highly industrialized G7 countries (United States, Japan, Germany, France, Italy, United Kingdom and Canada), in period 1987 - 1991. The number of American firms was 2500, while firms from rest of G7 countries was 2000.

The objectives in their study were to examine whether evidence from US firms are valid for the capital structure of firms in other countries, and how do the determinants relate to existing capital structure theory. By studying different markets they try to find factors that truly influence capital structure, and are not "merely spurious correlations". They used Tobit regression model on four determinants of capital structure, such as tangibility of assets (fixed assets over total assets), Growth (market to book ratio), firm size (logarithm of net sales) and profitability (EBIDITA over total assets). Both book leverage and market leverage is used as measure of debt. At highest, model was able to explain 30% of variance in total market leverage for Canada. The observed average of explanation power was 19 %, while the range was 5 – 30 %. The observed R2 was between 0,05-0,29 for book leverage, while market leverage had better R2 between 0,12-0,30.

Instead of presenting each country separately, the authors focuses on "broad pattern" across countries and discuss exceptions. The same level of debt was observed across G7 countries,

except United States and Germany, which seem to be less leveraged. Their result indicates a positive relationship between leverage and size (except Germany, where the correlation is negative). Profitability has an inverse relationship with leverage (as observed by Titman and Wessel 1988) in all G7 countries, but Germany. Overall tangibility is positive correlated with debt, while market to book ratio is negatively correlated with debt[1]. Their findings indicate at best a week relation between the theory of capital structure and the empirical proxies tested.

### 3.1.4 Frank and Goyal (2009)

Frank and Goyal (2009) studied the significance of a long list of factors (15 to start with) that affect firms' capital structure to find out which factors are reliably important. The research was conducted on 270 000 firm years observation of American public firms in period 1950-2003. Four different leverage measures was used; long term and total debt over both book and market value of assets, in multiple regression models.

Using marked based definition of leverage, they find industry median, tangibility, profits, firm size, market to book assets ratio and expected inflation account for 27 % of variation in total debt, and rest of factors only account for 2%. These six "Core factors" are statically significant and have consistent signs. By using book-based definition of leverage, firm size, market to book ratio and expected inflation are no longer significant.

They discover that profitable firms and firms with high market to book ratio have less debt. While firms with huge amount of tangible assets and larger firms tend to have high debt ratios. The importance of profitability as a determinant of leverage has been declining over the past decades. Their findings indicate that debt level of industry has an influence on the firm's capability of borrowing. Inflation and debt are positively correlated, meaning firms operate with high debt ratios when they suspect high inflation rate. Furthermore, payment of dividend is associated with debt, since dividend paying firms in their study have less leverage, compared to non-divided payer.

[1] All the result presented here uses book leverage as the dependent variable, since my study only uses book leverage as dependent variable. The authors have also presented results for market leverage as dependent variable.

Their findings are in favour of static trade-off theory since five of the core factors had the same signs as predicted by this theory. According to Frank and Goyal (2009), while the sign of profitability was in line with pecking order theory[2]

### 3.1.5 Antoniou et al (2008):

Antoniou et al (2008) tried to elaborate the importance of different economies (market oriented versus bank oriented) on capital structure decisions, because they have direct implications on availability of funds to firms operating in certain economies. By using a two-step system GMM procedure on panel data, they analyse the determinants of capital structure for G-5 countries (United States, Japan, Germany, France and United Kingdom). They found a positive relation with tangibility and size, profitability, growth opportunities and share prices effects debt ration negatively in both capital market-oriented and bank-oriented institutions.

## 3.2 Review of empirical research including Norway

### 3.2.1 Fan et al (2012)

Fan et al (2012) devote their research to find the influence of institutional environment (tax policies, legal systems and regulation of financial institutions) along with firm characteristics (tangibility, profitability, firm size and market to book ratio), on the capital structure on firm and debt maturity. Their sample consist of firms from 39 developed and developing economies from 1991 - 2006 (272 092 firms-years), in which Norway is included[3]. Generalized method of moments (GMM) is used for regression analysis to address the heteroscedasticity in residuals and serial correlation across both firm and country level observations.

Their findings indicate that country level determinants are more important than industry classification. Contradicting Booth et al (2001), the outcome of their regression confirms the much-anticipated result that firm in countries with greater tax gains, uses more debt. Norway is considered a “dividend imputation tax system” where the corporate profit is taxed only once, and the tax shield from leverage is 0. The median leverage ratio for Norway was around

[2] Frank and Goyal (2009) argue that the negative sign of probability is inconsistent with the static version of theory, but is in line with the dynamic version of trade of theory proposed by Fischer, Heinkel and Zencher (1989).

[3] 266 Norwegian firms (1826 firm years observation) were included in study.

0.36 (compared to 0.20 for others developed countries) and Norway had the second highest long term debt ratio (0.84), than other developed countries (0.61). They observe low debt ratios and a higher proportion of long-term debt in developing countries and in countries with low level of corruption. They did not find a significant relation between leverage and inflation. Their findings are consistent with Titman and Wessels (1988), Rajan and Zingales (1995) and De Jong et al (2008), where tangibility and firm size increase debt, and profitability and market to book ratio decrease debt.

On maturity structure of debt, they found long-term debt to be positively associated with tangibility, size and profitability, while market to book ratio had an insignificant affect. Overall findings suggest high long-term debt in developed countries.

### 3.2.2 Frydenberg (2004)

Frydenberg (2004) is one of the few studies, based on Norwegian data, for period 1990 - 2000. By using panel data techniques, he tested eight variables such as return on assets, dividend, size, non-debt tax shield, industry code, fixed assets, growth and uniqueness. He found fixed assets, size, growth, taxes, return on assets and industry category, to be the determinants of the capital structure for Norwegian non-listed manufacturing firms. Total debt over total asset of book values was selected as a measure of leverage, while he also report long-term and short-term ratios as maturity structure of debt are part of capital structure puzzle. Frydenberg finds the tax effect of debt financing controversial, due to equal treatment of equity and debt by the Norwegian tax systems. He observed a negative significant non-debt tax shield relation, indicating that taxes effects debt positively and significantly.

His data indicates that growth firms have more short-term debt. He found that large Norwegian manufacturing firms have more debt. Dividend increases the short-term debt, while decreasing both long-term and total debt. Fixed-assets were the most important explanatory variable in his research for explaining the maturity structure of debt. With a coefficient of 0.40 for long-term debt, firms with substantial amount of fixed assets ought to have more long-term debt, than short-term debt. Furthermore, his finding shows that return on assets decreases all type of debt ratios. He found an insignificant effect of uniqueness variable on debt, non-debt tax shield was negative related to short-term debt and total debt and

positively related to long-term debt[4]. His finding shows that four variables (size, assets structure, return on asset and volatility) affect the maturity structure of debt. Overall, his findings is in line with pecking order theory because it "*dominates the others factors that are implicit in a trade of theory*" (Frydenberg 2004 p. 27)

### 3.2.3 Nilssen (2014)

Nilssen (2014) in her master thesis about capital structure of listed Norwegian firms found tangibility to be the most important variable in explaining the capital structure. Profitability and liquidity was negative related to book value of debt, while tangibility was positively related to debt. Book value of leverage supports pecking order theory, while for market value of leverage result was mixed. None of the theories were able to explain the capital structure in Norwegian firms.

## 3.3 Determinants of capital structure

In this section, I will look into relevant factors that have impact on capital structure and are relative to market frictions and capital structures theories presented above, that deviates from MM capital irrelevance theory. The literature presents several different determinants of the capital structure. In this study, determinants on both firm and country level are analysed. I will focus on how these factors affect maturity structure of debt.

### 3.3.1 Firm specific determinants of capital structure

**Tax shield**

In trade-off theory, debt is preferable because it provides firms with the valuable interest tax shield and increases the income after taxes, since the interest is deductible. The higher the tax rate, the more advantage a firm has from additional borrowing. A firm borrows to the point where tax shield benefits intercept with costs of debt (bankruptcy costs, financial distress and agency cost), thus the relation between interest tax shield and debt can be described as u-shaped (Miller 1977; Qureshi et al 2012). Therefore, the trade-off theory assumes that taxes and debt are positive correlated. The effect of taxation on debt is although more significant for large firms, than small firms. The evidence from previous studies is ambiguous. Mayer (1990) cited in Rajan and Zingales (1995) stated that taxes do not have any explanatory power.

[4] All these results are from fixed effects estimation. Frydenberg (2004) does report result obtained by OLS regression as well in his article.

Graham (2000) findings suggest that firm do not exploit tax benefits, as predicted by trade-off theory. MacKie-Mason (1990) argues that most studies fail to find significant tax effects due to "*the fact that tax shield have a negligible effect on the marginal tax rate for most firms"* (MacKie- Mason 1990 p.1).
H 1a: Trade-offtheory suggests positive relationship between interest tax shield and debt.

**Probability of Bankruptcy**

This determinant relates more closely to the trade-off theory than pecking order theory. The probability of bankruptcy increases the bankruptcy costs, while tax benefits are unaffected, making the optimal debt ratio fall. In order to reduce bankruptcy cost, firms will reduce their borrowing. Thus, trade-off theory predicts that bankruptcy is negatively associated with the firm's level of debt. Firms that shift from long-term to short-term financing increase the probability of bankruptcy, and hence the expected costs associated with bankruptcy (Fama and French 2012).

H 2a: Trade-offtheory forecast a negative relation between probability of bankruptcy and debt.

**Business risk**

Business risk, also referred to as operating risk, is associated with the volatility of firm's earnings. Debt involves a commitment of periodic payments, which a firm may default due to high volatility in their earnings. These firms meet unfavourable conditions from creditors as well and borrow at relatively higher interest rates. Furthermore, they face higher costs of financial distress, forcing them to operate with lower debt ratios. From a trade-off perspective, variable cash flow decreases the value of interest tax shield since it cannot be constantly exploited to its potential. Hence, there should be an inverse relationship between debt and business risk according to trade-off theory (Titman and Wessels 1988). Frydenberg (2004) agrees and points out those firms with high business risk should have low debt ratios, to avoid falling in financial distress due to the higher volatility in their earnings. The predictions based on agency costs are somewhat ambiguous. According to Myers (1977) "*The impact of risky debt on the market value of the firm is less for firms holding investment options on assets that are risky relative to the firms' present assets. In this sense we may observe risky firms borrowing more than safe ones"* (Myers 1977 p. 167). The agency cost perspective postulates positive relationship, while pecking order theory predicts negative relation. High earnings

volatility increase the information asymmetry between firm's insiders and outsiders, and as a result capital markets claims a higher premium on debt (De Angelo and Masulis 1980).
H 3a: Trade-off theory forecast a negative relation between business risk and debt.
H 3b: Pecking order theory suggests a negative relation between business risk and debt

**Non-debt tax shield**

It takes into account tax deductions for depreciation and investment tax credits, and is a substitute for the interest tax shield of debt financing. The non-debt tax shield decreases the incentive of using debt financing for the purpose of tax shield exploitation. In trade-off theory the optimal ratio is to be found at interaction between marginal tax benefit and marginal expected bankruptcy costs. This theory predicts an inverse relation between non-debt tax shield and debt, since it captures the substation effect between interest tax shield and other tax-deductible entities. Firms that have large non-debt tax shield relative to their cash flow, have small debt ratios (DeAngelo and Masulis 1980). Titman and Wessels (1988) found that non-debt tax shield had an insignificant effect on debt. Frydenberg (2004) found a significant negative relation between this variable and leverage for Norwegian manufacturing firms. However in Norway, the tax deduction incentive is low, since the tax system is presumed to be neutral towards both debt and equity. The pecking order theory is indistinct about the non-debt tax shield.

H 4a: Trade-off theory predicts a negative relation between non-debt tax shield and debt.

**Agency cost**

Agency cost is a variable that captures the effects of conflicts between shareholders and managers. Managers may have a non-productive use of firm's resources and an increase in debt may reduce amount of free cash available. Therefore, trade-off theory predicts a positive relation between debt and agency costs. High agency cost may increase the information asymmetry between firm and outsiders, which makes equity more costly and debt becomes more attractive for additional financing. Hence, pecking order theory assumes a positive relation between debt and agency cost.

H 5a: Trade-off theory predicts a positive relation between agency costs and debt.
H 5b: pecking order theory predicts a positive relation between agency costs and debt.

**Growth**

Growth as an independent variable is representative of both pecking order theory and trade-off theory. Myers (1977) argues growth firms should use more equity financing, since highly leveraged firms may pass up positive NPV opportunities (Rajan and Zingales 1995). According to trade-off theory, growth is negative related to leverage of the firm. Growth firms lose more of their market value, if they fall into financial distress (Myers 1977). They borrow more to support their growth opportunities, and increase the cost and probability of financial distress. Any increase in cost of financial distress lowers the optimal debt ratio, hence restricting firms from borrowing as much as before. Agency costs expect an inverse relation between growth and leverage, due to underinvestment, overinvestment and asset substitution problems (Frank and Goyal 2008). Firms with risky debt may underinvest in positive NPV projects since the shareholders bear the entire cost, but get only a part of the increase in market value of the firm. An increase in growth opportunities also causes asset substitution problems and makes debt more costly since creditors anticipate this kind of behaviour. In order to retain agency conflicts, firms with greater growth opportunities should borrow less.

To minimize overinvestment problems shareholders can use debt as a disciplinary device to prevent negative NPV investment. This problem only occurs when firms have few investment opportunities; nevertheless, growth firms do not lack possible NPV projects. Therefore, disciplinary role of debt is less valuable for growth firms (Frank and Goyal 2008, Jensen 1986). Most of the empirical studies conclude with a negative relationship between growth and debt. Rajan and Zingales (1995) confirms that this is also true for the G7 countries.

In contrast, pecking order predicts a positive relation between growth and debt. The internal fund may not be sufficient to finance investments opportunities; hence, the firm should increase its borrowing in growth periods.

H 6a: Trade-off theory depicts a negative relation between growth and debt.
H 6b: Pecking order theory predicts a positive relation between growth and debt.

**Current profitability**

Profitability is one of the most significant independent variable in previous research on capital structure. It measures how the available total assets are utilized to generate income. Profitability is representative for both trade-off theory and pecking order theory. As

mentioned above, in static trade-off theory identifies the target debt ratio by a comparison of benefits and cost of debt. For profitable firm's cost of financial distress such as bankruptcy costs are low, due to frequent cash flows. Frank and Goyal (2009) claims that expected cost of financial distress are low for profitable firms, making the tax shield more valuable. Thus, profitable firms should borrow more to shield the higher taxable income, especially since they have to opportunity to use more debt without increasing the possibility of financial distress. In addition, the debt markets are inclined to lend more to the profitable firms, due to low risk of bankruptcy. This reflects that trade-off theory predicts a positive relation between profitability and debt. Agency cost perspective finds the disciplinary role of debt valuable and predicts that profitable firms should borrow more since these are more likely to face free cash flow problems (Jensen 1986).

In comparison, pecking order theory predicts a negative relation between profitability and leverage. Reason behind profitable firms having low debt ratios is the access of sufficient internal funds, and not low target debt ratios set by firms because in pecking order theory the concept of target debt does not exist. Less profitable firms borrow more because of insufficient internal financing. Profitable firms borrow less because when investments and dividend are fixed, the firm uses the internal funds, and over time become less levered.

The empirical studies usually find a negative relationship between profitability and leverage. Wald (1999) in cross-sectional test of United States, United Kingdom, Germany, France and japan, found strong evidence for profitable firms having low debt ratios (Myers 2001). The trade-off theory has problems with explaining the negative relation between high profitability and low debt ratios. If manager's was truly able to exploit the tax advantages as the trade-off theory predicts, we should observe the opposite. Frank & Goyal (2009) and Fama and French (2002) confirm that profitable firms tend to have lower debt ratios. In addition, Frydenberg (2004) empirical study provides the evidence that this relationship is also true for the Norwegian manufacturing firms.

H 7a: Trade-off theory suggests positive relationship between profitability and debt.
H 7b: Pecking order theory suggests negative relationship between profitability and debt.

**Past profitability**

According to pecking order theory, firms prefer raising capital internal, and use external capital when internal funds are exhausted. Thus, they will first use retained earnings, then short-term debt and long-term debt, and as the last alternative issue new equity. Myers (1984) argues that this behaviour is due to costs associated with issuing new equity. These costs can be either transaction costs or costs of asymmetric information. In both cases, the past profitability of a firm, and hence the amount of retained earnings, should be an important determinant of firms capital structure (Titman and Wessel 1988). Therefore, according to pecking order theory we should expect negative relationship between past profitability and leverage.

H 8a: Trade-off theory suggests positive relationship between past profitability and debt.
H 8b: Pecking order theory expects negative relationship between past profitability and debt.

**Liquidity**

According to trade-off theory, firms with high liquidity should have high debt ratios, due to the ability of their assets to generate high cash flows and are thereby capable of meeting their financial obligations on time (Ross 1977). Hence, trade-off theory expects a positive relation between liquidity and leverage. According to Pecking order high liquid firm will prefer to use internal funds (reserve of retained earnings) instead of debt, for financing investment opportunities (Myer 1984). Titman and Wessels (1988) and Rajan and Zingales (1995) observe an inverse relationship between liquidity and leverage.

H 9a: Trade-off theory forecast positive relationship between liquidity and debt.
H 9b: Pecking order theory forecasts negative relationship between liquidity and debt.

**Tangibility**

The type of assets a firm owns, have an impact on its capital structure. Tangible assets are easier to collateralize, and suffer small loss in case of financial distress, compared to intangible assets. Thus, intangible assets and leverage is negatively correlated and vice versa (Myers 2001). Trade-off theory predicts a positive relation between tangible assets and debt ratios. It is logical that companies with large frictions of relatively safe, tangible assets borrows more since they face low cost of debt, compared to companies with risky intangible assets. In case of liquidation, tangible assets should retain most of their value, especially when firms are valued based on underlying substantial fixed assets (Baker and Martin 2011, Frank

and Goyal 2009). Tangibility diminish the risk of accruing agency costs by making it difficult for shareholders participating in risk shifting activities to steal wealth from bondholders, or changing dividends policies (Stulz and Johnson 1985). Secured debt do not only lowers the asset substitution and wealth transfer problem, but also prevent suboptimal problems, because it lowers the risk premium on debt and decreases the financial constraints of firms with high fixed assets. Therefore, firms with low agency costs can increase their debt ratios, according to both bankruptcy costs-tax perspective and agency costs-tax perspective. Frydenberg (2004) findings indicate that Norwegian firms with high ratio of fixed assets to intangible assets ought to have more long-term debt than short-term debt. Frank and Goyal (2009), Rajan and Zingales (1995) and Titman and Wessels (1988) found a positive relation between these two variables.

Myers and Majluf (1984) indicate that there exists asymmetric information costs associated to issuing securities, and these could be avoided by the use of secured debt (Titman and Wessel 1988). Secured debt may be less expensive than both unsecured debt and equity, since investors require a premium for invest in unsecured debts. However, Harris and Raviv (1995) argue that tangible assets lower the cost of equity, due to low information asymmetry associated with them. Secured debt reduces the adverse selection, because lenders can sell the collateral and obtain some of the loss in case of bankruptcy. Thus, we should expect negative correlation between tangibility and leverage, according to pecking order theory. Booth et al (2001) finds a negative relation.

H 10a: Trade-off theory predicts positive relationship between tangibility and debt.
H 10b: Pecking order theory forecasts negative relationship between tangibility and debt.

**Size**

Size is related to many aspects in capital structure theory, such as asymmetric information, transaction costs, access to financial markets and financial distress. Thus, there exist contradicting interpretations about the relationship between size and debt. Size is mostly affected by financial distress costs (Baker and Martin 2011). Default risk is lower for large firms because they are more diversified and have steady cash flows. Thus, Rajan and Zingales claims that size may be an inverse proxy for the probability of bankruptcy. Titman and Wessels (1988) argues that size reflect diversity of a firm earning, and thus large firms bear low risk of bankruptcy, and should have more debt compared to smaller firms. Furthermore,

debt-related agency costs are less for firms with respectable reputation in debt markets because they receive higher credit ratings due to low risk of default. This implies that the trade-off theory predicts that large, diversified firms will operate with relatively high debt ratios. Warner (1977) found the empirical support for diversified being less disposed to bankruptcy. Frank and Goyal (2009) concluded that larger firms operate with a higher level of debt, compared to smaller firms. Frydenberg (2004) also found a positive coefficient for size variable, which confirms the role of size as an inverse proxy of bankruptcy risks of firms[5].

The Pecking order theory predicts an inverse relationship between size and debt. This prediction rest on the fact the larger firms are more transparent (well known) since they have been more around. Hence, larger firms have less asymmetric information costs, which reduces the chance of issuing undervalued equity and increase the possibility of larger firms issuing equity. Frank and Goyal (2009) agrees, and suggest that larger firm may have easier access to the capital market, compared to small firms. Titman and Wessels (1988) found a negative relation between a firm's size and its short-term debt, indicating existence of transaction costs for small firms. This indicates that size is also related to the maturity of debt. Larger firms tend to issue more long-term debt, while smaller firm faces higher cost than larger firms do, in order to issue both equity and long-term debt (ibid). Rajan and Zingales (1995) observed a positive relation between size and all the G-7 countries, expect Germany.

H 11a: Trade-off theory expects positive relationship between size and debt.
H 11b: Pecking order theory assumes negative relationship between size and debt.

**Age of business**

Age is an important determinant of capital structure, given that the firms with long history have the reputation of fulfilling the debt repayment and enjoys advantageous terms in obtaining debt. The older the firm is, the lower cost of debt it faces, as long as market does not fear that firms will undertake project that will engage in suboptimal investment. Therefore, both bankruptcy and agency costs perspectives of trade-off theory consider age as an indicator of a firm's credibility and assumes positive correlation. The pecking order theory assumes that firms retain their earning over time. Thus, older firms have a severe resort of

[5] The positive (significant) coefficient is from fixed-effects estimation. For OLS he got a negative coefficient, which he explains by that OLS estimates must be taking unwanted firm heterogeneity into the model.

retained accumulated earnings, and relies less on external financing to meet their financial obligations, than younger firms.

H 12a: Trade-off theory predicts positive relationship between age and debt.

H 12b: Pecking order theory forecasts negative relationship between age and debt.

**Dividend payout ratio**

Many studies argue the importance of using dividend as costly signal of earnings. Dividend signals a firm's financial health, and belief in their future earnings (Bhaduri 2002). If firms can use dividends to signal information about their credibility, it can reduce information asymmetry and easily access equity markets. In pecking order theory, firms use external funds only when the internal funds are insufficient. Constant dividend payments reduce the amount of internal funds (low retention ratio), and increase the need for issuing debt. Hence, we should expect a positive relation between dividend payout ratio and debt (Ali 2011). If a firm faces high growth opportunities, than we should observe a low dividend payout ratio, according to pecking order theory. If dividend payments actually convey signals about a firm's good financial health and its capacity to use more debt, we should expect a positive correlation. Positive effects on debt could also be a result of firms with high debt pays out dividends to be in the capital market, since monitoring of management is less costly.

"*Agency models envisage dividend payment and debt issue as a substitute in mitigating agency problems*" (Bhaduri 2002 p. 660). Paying large sums in dividend reduces only the free cash flow problems, while an increase in debt ratios, forces firms to make periodic payment. Thereby both reducing agency costs associated with free cash flow and benefiting from interest tax shield. Thus, by borrowing more a firm will have less amount to make dividend payments. From the trade-off theory, a negative relation between leverage and dividend payout is expected. According to Frydenberg (2004) this relationship should also hold from signalling point of view, because firms paying large sum in dividends, signal the belief in their ability to finance future investments without consuming more debt. Frank and Goyal (2009) found the dividend paying firms tend to have low debt ratios, than non-dividend payers. Frydenberg (2004) found a positive relation between short-term debt and dividend, since promised dividend payments increase firm's liabilities, while a negative effect was found on the long-term debt and total debt.

H 13a: Trade-off theory predicts a negative relation between dividend and debt.

H 13b: Pecking order theory assumes a positive relation between dividend and debt.

### 3.3.2 Macroeconomics determinants of capital structure

Antonios et al (2008) elaborate that previous empirical research only focuses on identifying the firm specific factors that managers should be aware of while making capital structure decisions, and keep ignoring the macroeconomic conditions that could possibly affect a firms choice of capital structure.

**Inflation**

Inflation is a variable that drives from trade-off theories, which have an impact on the cost of debt and equity. When inflation increases, funding gets more costly. Market demands a higher interest rate on their investments, to neutralise the effect of a decrease in the purchasing power of the currency. This indicates a positive correlation between cost of debt and inflation. According to Frank and Goyal (2009), although inflation is a proxy of decrease in the value of investments, simultaneously it also affects the real value of the tax deduction. The real value of tax deduction is higher, when inflation is high. Based on this, we should expect a positive relation between inflation and debt. Frank & Goyal (2009) established a positive correlation between inflation and leverage, based on the fact that leverage in US was higher when the inflation rate was high.

H 14a: Trade-off theory predicts a positive relation between expected inflation and debt.

**Economic growth**

Firms tend to borrow more during the period of economic growth since stock prices, taxable income and cash reserves increase, and bankruptcy costs decrease (Gertler and Gilchrist 1993 cited in Frank and Goyal 2009). From the trade-off bankruptcy perspective, we should expect a positive relationship between GDP per capita growth rate and debt, since a decrease in bankruptcy costs allows firms to rebalance debt ratios to a higher level. Nevertheless, Frank and Goyal (2009) argues that firms face more agency problems during recessions, and if debt has the disciplinary role (Jensen 1986), we should rather expect an inverse relation in during expansions. This makes predictions from Trade-off theory ambiguous. Pecking order theory suggests a negative relation between economic growth and debt, due to the increase in cash reserves during expansions, firms should have sufficient internal funds.

H 15a: Trade-off theory predicts a positive relation between economic growth and debt.

H 15a: Pecking order theory predicts a negative relation between economic growth and debt.

# Chapter 4. Methodology

## 4.1 Data collection and data sample

Each year under the annual statistics, Oslo Børs publishes the list over the largest domestic and foreign firms by their market value. This statistics is available from 2003-2015. My population consists of all firms that are in the list over 25 largest domestic and foreign companies, published by Oslo Børs (OSEBX). These firms are either listed on Oslo Børs or been listed during any point of the sample period. A time span of six years seemed reasonable. The sample in consideration is all firms on the list over largest domestic and foreign firms, in period 2010-2015 and I have used quarterly observations. I collected the financial data for firms that are published on list from 2010, but the financial data for some firms goes as back as 1992 and the latest observation is either third or fourth quarter of 2015, depending on whether data for fourth quarter of 2015 was available at the time of data collection. Therefore, dataset may include anomalies due to financial crises (2007-2008). By including recent years, it is possible to observe lately trends in capital structure for Norwegian firms. Some firms were repeated over the several years, after examining the list I ended up with 37 domestic firms and 44 foreign firms.

First, firms that have either changed name or merged with another firm, where the financial data in not available are excluded. Secondly, firms with less than five observations was not included since to see a trend in a firm's capital structure require data over some time. Firms delisted during the research period are included until the time of delisting. A firm in the sample declared bankruptcy, and is still included in the research. There should not exist survival bias since no firms are left out for the convenience purpose. Sector qualification from Oslo Børs is used to decide which firm are financial firms. Following (Frank and Goyal 2009), all the firms belonging to the financial industry (banks, insurance firms) was excluded, due to their different operations and regulatory requirement that makes their capital structure of different nature. I ended up with a total of 26 domestic and 33 foreign firms (a dataset of 2944 firm year observations) before removing missing values and calculating the proxies for determinants of capital structure, see appendix A1.

To answer the research question, secondary data in form of financial information (income statement, balance sheet, cash flows and market value of firms) is collected using Thomson Reuters Datastream. Datastream is a financial database that contains financial information

about both companies and markets, and is considered a quality database. All data in this study is provided in standardized million NOK. Complementary macroeconomic data, needed to answer the research question, is then provided from various public data source. The GDP data is from Statistisk Sentralbyrå (SSB), inflation rate from OECD, listing and sector from Oslo Børs.

An issue with cross sectional studies of leverage is how to deal with missing information. There are two ways to handle this problem. The first way is to use available data to predict the value of missing data, called "multiple imputation" (Frank and Goyal 2008). The second is to drop the firm years with missing value. By using the second approach all the observations with missing values on the variables are excluded, from the dataset. For instance if the value of retained earnings was missing for a firm for one quarter, all the observations on other firms from the same quarter are dropped accordingly. Furthermore, some observations was deleted due to a value of zero for total sales or total assets, since some of the proxies are scaled by these. I excluded firm observations with inconsistent accounting information like negative equity, because it would have given a negative value for MB ratio. This resulted in a total of 1503 firm years observations.

## 4.2 Regression analysis

A regression analysis is the most common approach to examine the relationship between a dependent variable (Y) and one or several independent variables ($X_1 + X_2 + X_n$). Multiple regression (with several independent variables) lets us control for many independent variables that simultaneously effect the dependent variables (Wooldridge 2009). The objective is to investigate how does the value of dependent variable change when value of one of the independent variables changes. A multiple regression will be used in this study and can be described as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \mu$$

Where Y: dependent variable, n: number of independent variables, $\beta_0$: intercept, $\beta_1$: regression coefficients, $X_n$: independent variables and $\mu$: error term (Wooldridge 2009).

### 4.2.1 Panel data

Panel data consists of both the time series and cross-sectional dimensions. *"To collect panel data—sometimes called longitudinal data—we follow (or attempt to follow) the same*

*individuals, families, firms, cities, states, or whatever, across time*" (Wooldridge 2009 p. 444). The nature of data in this study is panel data since it uses multiple variables (independent variables) over multiple periods to paint the true picture of relationship between variables.

Panel data can be either balanced or unbalanced. In a balanced panel, all individuals (in our case firms) are observed in all periods Ti = T for all i (i=time). However, in an unbalanced panel all information is not available for all individuals (firms) in all time periods, meaning that all firms are not observed for the same time period (Ti≠T). The dataset in this study is highly unbalanced, since the oldest firms have financial data from 1992, while the youngest firm have data from 2010.

### 4.2.2 Panel data estimations method

There are several advantages of using panel data model, over both cross section and time series method. According to Brooks (2008) panel data utilize more information in dataset and therefore can address a wide spectre of issues and is used on more complex problems than simple time series or cross-sectional methods alone. Panel data is ideal to study dynamics of change. By using panel data degrees of freedom are increased, and hence the power of the test. Panel data reduces the multicollinearity problems that may exist between independent variables. Furthermore, by using the appropriate effect model, it is possible to remove certain type of omitted variables bias and control for individual unobserved heterogeneity that may exist between firms.

For panel data, we have three types of model: pooled model, fixed effects model and random effects model.

**Pooled OLS model**

This is the simplest model one can use in panel data analysis. Pooled OLS do not distinguish between the cross sectional and times series properties of data. The OLS estimates the regression coefficient so the sum of squared residuals is as smallest as possible (Wooldridge 2009). In order to give best linear unbiased estimates (BLUE), the OLS model have to fulfil Gauss-Markov Theorem assumptions (ibid). The OLS assumptions are as following: Linear in parameters, random sampling, no perfect collinearity (multicollinearity), zero conditional mean, homoscedasticity and no autocorrelation (no correlation between error terms over time) (Wooldridge 2009).

In the absence of individual heterogeneity (no cross-sectional or time specific effect), Pooled OLS model will provide consistent and efficient estimates using panel data and can be described as:

$Y_{it} = \beta_0 + \beta X_{it} + \varepsilon_{it}$ ,

Where i: the cross sectional dimension, t: the time series dimension, $Y_{it}$ is the dependent variable, $\beta_0$ is the intercept, β is the vector of independent coefficients, $X_{it}$ is the vector of independent coefficients and $\varepsilon_{it}$ is the error term where cross-sectional and time effects are zero (Park 2011).

**Random effects model**

A random effects model assumes that individual or group effects (heterogeneity) are uncorrelated with independent variables. The variation across entities is assumed to be random and this variation should not be correlated with the dependent and independent variables. Generally, if we expect the difference across entities will effect dependent variable, the random effects will be suitable. In random effects model, the intercept and slope of regressors are the same across individuals, and differences among individual are captured by individual specific error and not their intercepts (Park 2011). Since the error term is not correlated with the independent variables, one can use time-invariant variables as the explanatory variables. A random effects model can be described as:

$Y_{it} = \beta X_{it} + \alpha + \mu_{it} + \varepsilon_{it}$

Where $Y_{it}$: dependent variable, $\beta$: coefficient for an independent variable, $X_{it}$: an independent variable, $\alpha$: intercept for each entity, $\mu_{it}$: between entity error term and $\varepsilon_{it}$: within entity error term (Torres- Reyna 2007).

**Fixed effects model**

Fixed effect model is most suitable for analysing time-variant variables and changes within entities. It takes into account the individuality of each firm by allowing the intercept to vary across firms, while holding the slope coefficients constant across firms. It explores the relationship between independent variables and dependent variables within an entity (in our case firms) and allows entities to have its own individual characteristics. At the sae time it removes the time-invariant characteristics to let us access the net effect of independent variables on the dependent variable (Torres-Reyna 2007).

Using fixed effects, one assumes that something within each firm may bias dependent or the independent variables. Fixed effects assume correlation between entity's error term and independent variables (presence of heterogeneity) and remove the effect of time-invariant variables. Furthermore, fixed effects consider the time-invariant characteristics to be unique for each firm and therefore do not allow entity's error term and constant to correlate with other firm's characteristics (Torres-Reyna 2007).

$Y_{it} = \beta_1 X_{it} + \alpha_i + \mu_{it}$ , i = firm and t = time

Where $Y_{it}$: dependent variable, $\beta_1$ : coefficient for an independent variable, $X_{it}$: an independent variable, $\alpha_i$: the unknown intercept for each firm and $\mu_{it}$: the error term (Torres-Reyna 2007).

4.3 Proxies and their definition

Dependent variable

A firm's capital structure or debt is the dependent variable in this study. The simplest and most used proxy is the firms average debt ratio over the relevant sample period. In previous research, several definitions for level of debt are available. Measures differ in whether long-term, short-term or total debt is used. Both Rajan & Zingales (1995) and Harris & Raviv (1991) use total liabilities over total assets as the definition of debt ratio.

Another key issue is whether to use book value or market value of debt. There is no consensus between researchers and both measures have their advocates. Myers (1977) favours book value of debt because managers focus on this value since debt is supported by *"assets in place"*, rather than growth opportunities, which he explains are *"assets not yet in place"* (Myers 1977 p 150). Due to constant fluctuation in financial markets, managers perceive market value as an unreliable guide for capital structure policy. Graham and Harveys (2001) well-known survey support this view.

Opponents of book value argue that this value only represent a "pluged number" to satisfy the balance sheets requirement, and thereby it is not a relevant value. Book value is presumed to be "backward looking" and market value "forward looking", there is no reason that these values should correlate (Barclay, Morellec and Smith 2006 cited in Frank and Goyal 2009). Nevertheless, many studies show that regression results are the same whether one uses book or market values of equity; a good example is the study of Titman and Wessel (1988).

In this study, instead of using an aggregate debt measure I distinguish between short term and long-term debt, over total book assets, in line with Frydenberg (2004). According to Rajan and Zingales (1995) short-term and long-term debt ratio is "more appropriate" definition of leverage, than total liabilities over total assets. Total debt ratios fail to incorporate the probability of default in near future and may overestimate the amount of leverage, if account payable is included as total liabilities.

I distinguish between short-term debt and long-term debt to see how these two measures of capital structures are affected by determinants in this study. It is important since these two represent different aspects of corporate claims and therefore might be affected differently.

Defining independent variables

A list of dependent and independent variables and their definitions are provided in the table 1. Most of the proxies' measures are determined by previous research reviewed in the section 3. Definition for agency cost is taken from Singh and Davidson (2003) and tax shield is taken from Qureshi et al (2012). For bankruptcy risk I am using Altmaz z-score. I find it necessary to elaborate tax shield variable and agency cost since they can be ambiguous.

Booth et al (2001) argue that it is difficult to define a proxy for tax variable for individual firms, since the marginal value of the tax shield should be either zero or positive for all firms. Therefore this proxy should serve as average tax rate since it is defined as the tax payments over earnings before taxes. Advantage of this proxy is that "*it includes the impact of tax loss carry forwards*" (Booth et al 2001).

Proxy for agency cost is asset turnover, which is defined as sales divided by total assets. It is an asset utilization ratio that measures the effectiveness and the ability of firm's management to productively use a company's assets. Therefore, it is an inverse proxy for agency cost and a low ratio will indicate existence of high agency cost between manager and shareholders and ineffective asset utilization.

4.4 The regression model

In this paper, I will analyse the determinants of capital structure using two different models. Model 1 will use short-term leverage ($STL_{it}$), while model 2 has long-term leverage ($LTL_{it}$) as the dependent variable. Both of these debt ratios are in book value, as mentioned

before. These models will be used separately with the selected determinants of capital structure, discussed in section 3.3. The following fixed effects model will be used in further analysis:

$$STL_{it}/LTL_{it} = \beta_{0i} + \beta_1 TS_{it} + \beta_2 Z_{it} + \beta_3 BR_{it} + \beta_4 ND_{it} + \beta_5 AC_{it} + \beta_6 G_{it} + \beta_7 CP_{it} + \beta_8 PP_{it} + \beta_9 L_{it} + \beta_{10} TAN_{it} + \beta_{11} S_{it} + \beta_{12} A_{it} + \beta_{13} D_{it} + \beta_{14} INF_t + \beta_{15} GDP_t + \mu_{it}$$

*Table 1**: Proxies of dependent and independent variables***

This table show all the dependent and independent variables included in this study. The model names will be used in in STATA and the printout from STATA. The expected sign are drawn from hypothesis development in Section 3.3. TOT stands for trade-off theory and POT stands for pecking order theory.

***The depend variables***

| *Variable name* | Model name | Proxy |
|---|---|---|
| *Short-term debt ratio* | STL | STL*/TA , STL* = STL -(account payable + payable accrued) |
| *Long-term debt ratio* | LTL | LTL*/TA, LTL*= Total Liabilities- Total short-term liabilities |

***Firm specific independent variables***

| *Variable name* | Model name | Proxy | Expected sign | |
|---|---|---|---|---|
| | | | TOT | POT |
| *Tax shield* | $TS_{it}$ | Tax payment/Net profit before taxes | + | |
| *Probability of bankruptcy* | $Z_{it}$ | Altzman's Z Score = 1.2A + 1.4B + 3.3C + 0.6D + 1.0E | - | |
| *Business risk* | $BR_{it}$ | Change in current profitability | - | - |
| *Non-debt tax shield* | $ND_{it}$ | Depreciation expenses/Total assets | - | |
| *Agency cost* | $AC_{it}$ | Sales/Total assets | + | + |
| *Growth* | $G_{it}$ | Market to book ratio | - | + |
| *Current profitability* | $CP_{it}$ | Net profit before tax/Total assets | + | - |
| *Past profitability* | $PP_{it}$ | Retained earnings /Total assets | + | - |
| *Liquidity* | $L_{it}$ | Current assets/Current liabilities | + | - |
| *Tangibility* | $TAN_{it}$ | Net fixed assets/Total assets | | |
| *Firm Size* | $S_{it}$ | Ln (Total assets) | + | - |
| *Age of business* | $A_{it}$ | Ln (Number of year since listing) | + | - |
| *Dividend pay-out ratio* | $D_{it}$ | Dividends / Net income before taxes | - | + |
| *Dummy Ownership structure* | O | Dummy; 0 for domestic firm and 1 for foreign | | |
| ***Country level (macroeconomic) independent variable*** | | | | |
| *Inflation rate* | $INF_t$ | Quarterly inflation (consumer prices) rate | + | |
| *Economic growth* | $GDP_t$ | Quarterly per capita GDP growth rate | + | - |

# Chapter 5: Results and analysis

In this chapter I will begin with a descriptive analysis of dataset, followed by correlation analysis and the choice of estimation model. Thereafter, present the empirical results from regression model and analyse the effect different frim-specific and macroeconomics variables. At last, I will present the findings before comparing these to hypothesis, established theories and previous empirical research discussed in chapter 2 and 3.

## 5.1 Descriptive statistics

*Table 2: Descriptive statistics for firms in sample*

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| STLit | 1,503 | .1624798 | .1315917 | 0 | .8496732 |
| LTLit | 1,503 | .3078444 | .1811478 | 0 | .8728731 |
| TSit | 1,503 | -.195537 | 14.18217 | -546 | 29.05263 |
| Zit | 1,503 | 2.199881 | 3.266715 | -11.8172 | 38.69013 |
| BRit | 1,503 | -.0049361 | .1018352 | -2.684487 | 1.019161 |
| NDit | 1,503 | .011426 | .0241893 | -.0807792 | .7912656 |
| ACit | 1,503 | .1775479 | .1509368 | -.1491653 | 1.046075 |
| Git | 1,503 | 3.298847 | 21.0753 | .0002499 | 692.6538 |
| CPit | 1,503 | .0134725 | .0565683 | -1.028378 | .6272224 |
| PPit | 1,503 | .1512371 | .5939294 | -11.13171 | .8509434 |
| Lit | 1,503 | 2.043033 | 2.168315 | .0548714 | 25.76699 |
| TANit | 1,503 | .439166 | .3102709 | 0 | 1.475617 |
| Sit | 1,503 | 9.164707 | 1.80985 | 2.727853 | 13.81591 |
| Ait | 1,503 | 2.586043 | .8516656 | 0 | 7.606387 |
| Dit | 1,503 | .4608497 | 5.663342 | -35.88 | 198.7079 |
| INFt | 1,503 | .0180526 | .0095116 | .001 | .048 |
| GDPt | 1,503 | .0099536 | .0455623 | -.1108399 | .119539 |

The descriptive statistics is a good starting point in any type of analysis since it gives useful information about data. It contains information about numbers of observations (obs), mean value (mean), standard deviation (Std. Dev.), minimum (Min) and maximum (Max) values observed for all factors. Detailed summary statistics is also produced in STATA, and I will comment the median for short-term and long-term debt, from these statistics (see appendix ).

As we can see in table 2, some observations stand out. Variables TSit, Zit, Git and Dit have large difference between the minimum and maximum values, along with large standard deviation (> 2). This might be a result of anomalies faced by a single firm, or effects of

financial crises (2007-2008). This indicates existence of outliers in dataset, which should be corrected. Before further analysis, I will clean my data for outliers.

### 5.1.1 Outliers

A common problem in the studies of capital structure is existence of outliers in dataset. Outliers may influence the descriptive statistics and analysis. Choosing a passive way to deal with outliers may result in increased error variance and low explanatory power of statistical tests and biased estimates (Osborne and Overbay 2004, cited in Nilsen 2007). There are no objective way to deal with outliers. Frank and Goyal (2008) argues that both trimming and winsorization have been used to deal with outliers. Trimming is the procedure where the outliers are excluded, while in winsorization the "*most extremes tails of distribution are replaced by the most extreme value that has not been remove*" (Frank and Goyal 2008 p.173).

First, the outliers in the dataset have been identified in STATA by using different approaches such as: drawing boxplot, using extremes command and predicting the residuals and Cook's distance[6]. Consequently, the selected variables have been winsorized at 1 % level at the right tail (except Git that is winsorized at 1% level on both sides), to prevent more loss in degree of freedom. All the variables that have been winsorized, are labelled as_w hereafter.

[6] Cook's distance measures the influence of observation on the overall model. A value > 1 indicates problem with high influential outlier (Torres-Reyna 2007)

*Table 3: Descriptive statistics for firms in sample after winsorization*

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| STLit | 1,503 | .1624798 | .1315917 | 0 | .8496732 |
| LTLit | 1,503 | .3078444 | .1811478 | 0 | .8728731 |
| TSit_w | 1,503 | .2155053 | 1.159366 | -2.024691 | 29.05263 |
| Zit_w | 1,503 | 2.220045 | 3.222201 | -2.568567 | 38.69013 |
| BRit_w | 1,503 | -.0012968 | .0592556 | -.2490566 | 1.019161 |
| NDit_w | 1,503 | .0114899 | .0240673 | .0000943 | .7912656 |
| ACit_w | 1,503 | .177724 | .1506625 | 0 | 1.046075 |
| Git_w | 1,503 | 2.446438 | 4.107758 | .1419541 | 30.83012 |
| CPit_w | 1,503 | .0151869 | .0432052 | -.153711 | .6272224 |
| PPit_w | 1,503 | .1674331 | .4464972 | -2.503942 | .8509434 |
| Lit_w | 1,503 | 2.043638 | 2.167791 | .217833 | 25.76699 |
| TANit | 1,503 | .439166 | .3102709 | 0 | 1.475617 |
| Sit | 1,503 | 9.164707 | 1.80985 | 2.727853 | 13.81591 |
| Ait | 1,503 | 2.586043 | .8516656 | 0 | 7.606387 |
| Dit_w | 1,503 | .5454986 | 5.48344 | -2.404372 | 198.7079 |
| INFt | 1,503 | .0180526 | .0095116 | .001 | .048 |
| GDPt | 1,503 | .0099536 | .0455623 | -.1108399 | .119539 |

The difference between range of short-term liabilities ratio and long-terms liabilities ratio is not very large. Average short-term debt ratio lies on 0.1625 (median 0.1358), which implies that around 16.25% of the firms' total assets are financed by short-term debt. Frydenberg (2004) got a mean of 43.96 % for the Norwegian manufacturing firms. This indicates that firms in our sample use less short-term leverage than companies included in his research. Maximum and minimum values indicate a large gap between the short-term debt ratios of the firms.

Mean long-term debt ratio lies on 0.3078 (median .3291), implying that a larger part of average total assets are financed through long-term liabilities, than short-term liabilities. This difference is anticipated since in developed countries, such as Norway, companies uses more long-term financing compared to developing countries. Furthermore, large listed corporations have easier access to both other financing sources (equity, venture capital) and long-term debt financing, and therefore expected to rely more on long-term financing. This observation is in line with predictions made by Titman and Wessels (1988) that large companies have more long-term debt. In comparison, Frydenberg (2004) observed a mean of 0.2326, which is lower

than 0.30. It shows that there has been an increase in the use of long-term debt in Norwegian firms, or that manufacturing firms use less debt.
Mean for these two variables indicate that an average Norwegian firms uses the double amount of long-term debt, compared to the short-term debt. Standard deviation for short-term debt is 13%, while long-term debt ratio deviates by 18% from the mean value of the sample of Norwegian large listed firms. In Frydenberg (2004), these ratios had a standard deviation of 19.05% (short-term debt) and 18.49 % (long-term debt).

Tax shield is an estimate of a company's effective tax rate. The average tax rate is 21.55 %, with a range from -2.02 to 29.05. We can see that the average has increased from – 19.6 % before winsorization, and the gap between the maximum and minimum values has decreased. Probability of bankruptcy represented by Altman's Z score has a mean value of 2.22. There is a huge gap between the business risks of companies in this sample, ranging from -2.57 to 38.59. A score <1.8 indicates that firms are likely to go bankrupt, while a score between 1.8 and 3.0 is considered a grey area, where companies should take precautions since they are still in likelihood of bankruptcy (Investopedia).

Business risk represents variation in a company's current profitability. This variable has an average of -0.13 %, with a standard deviation of 6 %. Business risks faced by firms varies lot, with a range of -0.25 to 1.02. Non-debt tax shield has a mean value of 0.011 and deviates from this value by 0.024. Frydenberg (2004) found a mean of 0.0009 with a standard deviation of 0.06, but he used another definition of this variable.

Proxy for agency cost is assets turnover ratio, which measures sales generating ability of the firm's assets. This is a inverse proxy for agency cost, therefore a low assets turnover ratio indicates that firms experience high agency costs between managers and shareholder (Singh and Davidson 2003). The average agency cost for the firms included in this study is 0.17, with a standard deviation of 0.15 and a maximum of 1.04. The higher this ratio is the better.

Growth has a mean of 2.45, which implies that market expects high future growth for the firms in this sample. Fluctuation in growth is significant, from 0.14 to 30.83. Frydenberg (2004) found average growth of 0.007 but he measures growth as revenue this year divided by revenue last year. Frank and Goyal found an average of 1.76 using market to book ratio as the measure of growth and a standard deviation of 2.87, with is lower than 4.11 observed in table

3. The standard deviation indicates large difference in growth between Norwegians firms in this sample.

Current profitability is a type of return on assets (ROA). The mean value of profitability is 0.015, which implies that on average Norwegian listed firms enjoy 1.5% of profit before taxes on every NOK of total assets. Standard deviation is 4.3%, where the lowest observed profitability is -15.37% and the highest is 62.72 %.

Past profitability is a measure of cumulative profitability over time. The average past profitability is 16.7 %, with a standard deviation of 0.45. On average 16.7 % of a company's total assets are funded by retained earnings, which indicates that a significant part of total assets in Norwegian listed firms are composed by borrowing or equity.

Liquidity has an average value of 2.04 and a standard deviation of 2.17. This ratio measures whether firms are able to cover their short-term obligations with the current assets they own. Mean value of 2.04 indicates that firms in this sample on average have sufficient assets, compared to the liabilities they face. An alternative interpretation is for single unit current liabilities the firm has; it has on average 2.04 in assets to pay for those short-term liabilities. The standard deviation does not deviate a lot from mean for this variable. Looking at the range of this proxy, the minimum value is 0.22, while the maximum value is 25.77, which is a huge difference.

Tangibility has a mean value of 0.44, which means that 44% of total assets for the average firm in this sample are fixed assets and can be used as collateral. Compared to Frydenberg (2004), the average is 0.07 higher than his research (0.3676). Furthermore, sample in this study deviates more from the mean value, than a standard deviation of 0.20 reported by him. Size is the natural logarithm of total assets, while age is the natural logarithm of number of years since listing on the Oslo Børs. Therefore, there is no intuitive explanation of mean values of these two proxies. The standard deviation of size is 1.81, which indicates differences between the sizes of the Norwegian listed companies in the study. Age has a standard deviation of 0.85 in this study, which is small compared to a standard deviation of 16.12 reported by Frydenberg (2004).

Average firm pays a dividend of 0.55 of its net income, which deviates by 5.48 of the mean value of the sample firms. Furthermore, large gap between minimum and maximum value indicates huge difference between dividend payments of Norwegian listed large firms. Inflation in Norway fluctuated between 0.001 and 0.048, while quarterly GDP growth rate per capita fluctuates between -0.11 and 0.12.

## 5.2 Evaluation of estimation model

First, I will perform a pooled OLS regression on both dependent variables and then run the Lagrange multiplier (LM) test to decide whether Pooled OLS model or random effects model is appropriate to use. If the panel effects model is appropriate, the dataset will further be tested for the multicollinearity and heteroscedasticity since the existence of these will result in unreliable hypothesis testing and coefficients that are difficult to interpret. A Hausman test model will be performed to check whether random effects model or fixed effects model will be suitable.

### 5.2.1 The Lagrange multiplier (LM) test

We have a panel dataset and it is very common for panel effects to exist in the dataset. In that case, Pooled OLS may give unreliable result. The Lagrange multiplier (LM) test helps us in deciding whether a simple OLS regression or random effects model should be used for the analysis of panel data. The null hypothesis tested is that variance across entities is zero, meaning that there is no panel effect in data (Torres-Reyna 2007).

The Lagrange multiplier (LM) test for short-term debt (to the left) and long-term debt

```
STLit[id,t] = Xb + u[id] + e[id,t]

Estimated results:
                    |       Var     sd = sqrt(Var)
--------------------+------------------------------
              STLit |    .0173164       .1315917
                  e |    .0039525       .0628687
                  u |     .008045        .089694

Test:   Var(u) = 0
                     chibar2(01) =  7219.36
                   Prob > chibar2 =   0.0000
```

```
LTLit[id,t] = Xb + u[id] + e[id,t]

Estimated results:
                    |       Var     sd = sqrt(Var)
--------------------+------------------------------
              LTLit |    .0328145       .1811478
                  e |    .0075556       .0869227
                  u |    .0094342       .0971298

Test:   Var(u) = 0
                     chibar2(01) =  4380.99
                   Prob > chibar2 =   0.0000
```

The Lagrange multiplier test for short-term and long-term debt shows that the p-value is less than 0.05 for both. Hence, we can reject the null hypothesis and conclude that there are

significant cross sectional variance across firms. This indicates that an effect model (random effects model) should be used, instead of pooled OLS.
Although the pooled OLS model is not preferred, I still have to test for the multicollinearity and heteroscedasticity. The reasons for testing these two assumptions will be discussed under their tests.

### 5.2.2 Testing for multicollinearity

There are two ways to investigate whether variables are subject to multicollinearity. First is to calculate the Pearson correlation matrix, and the second is to perform a variable inflation test (VIF) to make sure that there is no multicollinearity between independent variables. If there is high correlation between explanatory variables (X), it may cause problem in distinguishing which explanatory variable is explaining the dependent variable. In other words, multicollinearity makes regression coefficient of independent variables both unstable and difficult to interpret, by increasing the variance of these coefficient.

**Correlation matrix**

*Table 4: Pearson pairwise correlation matrix at significant level 0.05*

| | STLit | LTLit | TSit_w | Zit_w | BRit_w | NDit_w | ACit_w | Git_w | CPit_w | PPit_w | Lit_w | TANit | Sit | Ait | Dit_w | INFt | GDPt | Oitdum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STLit | 1.0000 | | | | | | | | | | | | | | | | | |
| LTLit | -0.2567* | 1.0000 | | | | | | | | | | | | | | | | |
| TSit_w | -0.0127 | -0.0028 | 1.0000 | | | | | | | | | | | | | | | |
| Zit_w | -0.1643* | -0.3750* | 0.0830* | 1.0000 | | | | | | | | | | | | | | |
| BRit_w | 0.0551* | 0.0015 | -0.0137 | -0.0581* | 1.0000 | | | | | | | | | | | | | |
| NDit_w | 0.1180* | 0.0080 | -0.0073 | -0.0398 | 0.4560* | 1.0000 | | | | | | | | | | | | |
| ACit_w | **0.5038*** | -0.3636* | 0.0160 | -0.0423 | -0.0094 | -0.0147 | 1.0000 | | | | | | | | | | | |
| Git_w | 0.1781* | 0.0538* | 0.0012 | 0.3059* | 0.0469 | 0.1598* | 0.0912* | 1.0000 | | | | | | | | | | |
| CPit_w | -0.0260 | -0.0562* | 0.0300 | 0.1062* | -0.3871* | -0.1542* | 0.1898* | -0.0283 | 1.0000 | | | | | | | | | |
| PPit_w | -0.0357 | 0.0559* | 0.0396 | 0.0417 | -0.0219 | 0.0227 | 0.0537* | -0.1527* | 0.2729* | 1.0000 | | | | | | | | |
| Lit_w | -0.3007* | -0.2101* | 0.0222 | **0.5160*** | -0.0387 | -0.0804* | -0.1912* | -0.0300 | 0.0039 | -0.1107* | 1.0000 | | | | | | | |
| TANit | -0.3473* | **0.5203*** | -0.0659* | -0.3506* | -0.0106 | 0.0082 | **-0.5018*** | -0.1666* | -0.0778* | -0.1460* | -0.2391* | 1.0000 | | | | | | |
| Sit | -0.0149 | 0.4016* | 0.0457 | -0.2825* | -0.0216 | -0.0419 | -0.0561* | -0.1462* | 0.1707* | 0.3470* | -0.3439* | 0.1863* | 1.0000 | | | | | |
| Ait | 0.2335* | -0.1778* | 0.0164 | 0.0157 | 0.0008 | -0.0461 | 0.2235* | 0.0487 | -0.0345 | 0.1576* | -0.1163* | -0.3622* | 0.1039* | 1.0000 | | | | |
| Dit_w | 0.0245 | 0.0120 | 0.0203 | -0.0157 | 0.0093 | -0.0080 | 0.0012 | -0.0064 | 0.0055 | 0.0118 | -0.0190 | 0.0098 | 0.0635* | 0.0091 | 1.0000 | | | |
| INFt | 0.0080 | -0.0064 | 0.0055 | -0.0118 | -0.0784* | -0.0430 | 0.0181 | 0.0413 | 0.0355 | 0.0059 | -0.0150 | -0.0070 | 0.0237 | 0.0054 | -0.0239 | 1.0000 | | |
| GDPt | 0.0101 | -0.0124 | 0.0414 | 0.0510* | -0.0812* | -0.0375 | 0.0066 | 0.0300 | 0.0593* | -0.0023 | 0.0281 | -0.0073 | -0.0331 | 0.0151 | -0.0606* | -0.1295* | 1.0000 | |
| Oitdum | -0.2206* | 0.2136* | -0.1135* | -0.1254* | -0.0149 | 0.0777* | -0.4107* | -0.1631* | -0.1778* | -0.2284* | -0.0607* | **0.6809*** | -0.2433* | -0.4238* | 0.0007 | -0.0197 | -0.0079 | 1.0000 |

ρ >|0.5| = **Highligheted**
* = significant at 0.05 level

The correlations analysis is carried out to check whether it exists multicollinearity among the independent variables in the study. Multicollinearity exists when there is high (close to 1) correlation between the independent variables (Wooldridge 2009). According to Wooldridge (2009) low degree of correlation between explanatory variables is preferred. Using panel data do already eliminates the effect of collinearity among variables, but collinearity can still cause problems if the variables in the regression are perfectly correlated. The correlation between any variable with its self is always one. Correlation in the table measures both the strength and the direction of linear relation between variables (UCLAa). The range of correlation

coefficients is ±1, where -1 represents perfect negative correlation, and 1 represents perfect positive correlation. A correlation of 0, represent no linear relationship between variables. Generally, a correlation around 0.8 is considered high.

Table 4 presents pairwise correlation between all the variables in the regression. From this table, we can see that the overall correlation between variables is relatively low. Tangibility and long-term debt shows a moderate significant positive linear relation. The two dependent variables share an inverse linear relation, as expected. There is a negative moderate relation between agency costs and tangibility (-0.5008), while liquidity and probability of default shows a positive significant linear relation.

**VIF test**

Even though the correlation matrix does not indicate high correlation between explanatory variables, the variable inflation test (VIF) is performed to test the severity of multicollinearity. VIF is widely used to check for multicollinearity, where a value of mean VIF above 10 or (1/VIF <0.10), indicate existence of multicollinearity in the model (Torres-Reyna 2007).

| Variable | VIF | 1/VIF |
|---|---|---|
| TANit | 3.25 | 0.307540 |
| Oitdum | 2.93 | 0.340734 |
| Zit_w | 1.85 | 0.541113 |
| Lit_w | 1.82 | 0.549022 |
| Sit | 1.80 | 0.554194 |
| ACit_w | 1.70 | 0.587741 |
| BRit_w | 1.51 | 0.663750 |
| CPit_w | 1.44 | 0.695066 |
| PPit_w | 1.36 | 0.736279 |
| Git_w | 1.36 | 0.737376 |
| NDit_w | 1.35 | 0.741139 |
| Ait | 1.32 | 0.755828 |
| GDPt | 1.04 | 0.964124 |
| INFt | 1.03 | 0.969872 |
| TSit_w | 1.03 | 0.973604 |
| Dit_w | 1.01 | 0.989461 |
| Mean VIF | 1.61 | |

The mean value is 1.61, which is less than 10, hence there is no multicollinearity present in the model.

### 5.2.3 Testing for heteroscedasticity

An assumption of OLS is constant variance in error term, known as presence of homoscedasticity in the dataset. A violation of the assumption indicates existence of heteroscedasticity. It causes upward bias in our standard errors that are used to calculate the t-values for hypothesis testing, while regression coefficients are still unbiased. A result of heteroscedasticity is unreliable hypothesis testing. As we know, the t-values are affected by standard error and the coefficients and when our standard errors are biased, it affects our t-values and significant test by giving us incorrect values. The opposite may also be true. This may result in some estimates that actually are significant may incorrectly appear to be insignificant.

By performing two tests, Breuch-Pagan /Cook-Weisberg`s test and Cameron & Trivedis IM, I will test whether this assumption holds. I need to run tests for both models separately.

Breuch Pegan test runs a regression of explanatory variables against the squared variance and tests for the constant variance in error term (the linear form for heteroscedasticity). The null hypothesis is homoscedasticity (Torres-Reyna 2007). As we can see we have a significant p-value (0.000), hence we reject the null hypothesis and conclude that heteroscedasticity may be present for short-term debt model. For long-term debt model the p-value is 0.8553 > 0.05, and therefore we cannot reject the null hypothesis and conclude that the errors are homoscedastic.

Since Brench Pegan test gave conflicting results, we perform Carmeron and Trivedi test. This is a more sensitive test for heteroscedasticity and takes into account non-linear form of heteroscedasticity. It has the same null hypothesis as Breuch Pegan test. Based on the significant result for both models, we reject the null hypothesis at 5% level ($p<0.05$) and conclude that there may exist elements of heteroscedasticity in both models.

For short-term debt

Cameron & Trivedi's decomposition of IM-test

| Source | chi2 | df | p |
|---|---|---|---|
| Heteroskedasticity | 864.04 | 135 | 0.0000 |
| Skewness | 81.88 | 15 | 0.0000 |
| Kurtosis | 24.28 | 1 | 0.0000 |
| Total | 970.20 | 151 | 0.0000 |

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

         chi2(1)      =   583.27
         Prob > chi2  =   0.0000
```

For long-term debt

```
. estat imtest

Cameron & Trivedi's decomposition of IM-test
```

| Source | chi2 | df | p |
|---|---|---|---|
| Heteroskedasticity | 583.08 | 135 | 0.0000 |
| Skewness | 86.70 | 15 | 0.0000 |
| Kurtosis | 23.88 | 1 | 0.0000 |
| Total | 693.67 | 151 | 0.0000 |

```
. estat hettest

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

         chi2(1)      =     0.03
         Prob > chi2  =   0.8553
```

### 5.2.4 Pooled OLS, heterogeneity and Lagrange multiplier (LM) test

This is the simplest approach to estimate model using panel data. Pooled OLS assumes fixed intercept, meaning all firms in the study have common capital structure coefficients. It does not distinguish between the various companies we have in this dataset. By pooling the companies together, we deny the heterogeneity that may exist between companies in this sample. The advantage of using Pooled OLS is that it takes into account all the variations in the dataset, both between entities, within entities and over time. The main disadvantage is that it gives inconsistent and biased estimates if the assumption of uncorrelated error term is violated.

It is difficult and unlikely for researchers to produce capital structure models that are fully specified (Booth et al 2001). In other words we can never be certain that all the relevant variables are included in the regression model. Omitted variables may correlate with both the determinants of capital structure and the proxies (independent variables). Omitted variables for capital structure can be industry code, which measures the effect of differences in capital structure related to the industry. A majority of the previous empirical study have concluded with a significant industry differences (Frydenberg 2004). With Pooled OLS the unobservable factors will always cause problems and result in omitted variable bias. Furthermore, when the dataset is unbalanced, a restrictive pooled OLS model may give inefficient and biased parameters estimates. Although pooled OLS will not be used in further analysis, the regression results are presented in appendix C.

### 5.2.5 Hausmans specification test

To find out whether a fixed or random effects model is appropriate to use, the Hausman (1978) specification test is conducted, with the null hypothesis that the random effects model is preferred. It tests whether the unique error (ui) is correlated with the regressors. According

to the null hypothesis (random effect is efficient), it is not correlated with the regressors. This means that both random effects model and fixed effects model will provide consistent estimates, but random effects model is efficient, and fixed effects model will provide inefficient estimates, if the null hypothesis cannot be rejected (Baum 2006).

For short-term debt we are getting a p-value (0.1095)>0.05 (see appendix B2), hence we cannot reject the null hypothesis that there is no systematic difference between the coefficient of both the fixed effects model and the efficient model. For long-term debt we get a p-value (0.0018) that is significant (<0,05), indicating that fixed effects model is preferred (see appendix B3). Suggesting that there are significant systematic different between fixed effects model and the efficient coefficient estimates (random model). We are getting conflicting results.

### 5.2.6 Which model to use?

LM test suggested use of panel effects model while Hausman test gave conflicting result and therefore the selection of the estimation model will be based on theoretical background.
In this study the firm specifics characteristics are being tested and therefore, from a theoretical point of view, we should use a fixed effects model. Due to the individual effects, there are reasons to believe that some explanatory variables may correlate with the error term and to adjust for this, a fixed effects model may be more suitable. "*If the measurement error is constant, throughout the sample period, the error is then flashed out in fixed effects transformation. If, in contrast the measurement error varies randomly around the mean value of the variable, the fixed effects transformation will cancel out the errors*" (Frydenberg 2004). Furthermore, Bevan and Danbolt (2004) point out that result of the traditional capital structure studies based on pooled OLS may be bias since they fail to control for firm specific, time-invariant heterogeneity.

Unobserved effects are variables that vary between firms, but are time-invariant. Fixed effects omits the time-invariants effects (where value does not change over time) and uses only the within variation between firms. All the variables in this study vary over time (except inflation and GDP) and we aim to observe the firms specific characteristic to say something about capital structure of the firm (debt ratios used as proxies), hence a fixed effects model is suitable for this purpose.

Since we observe the same entity, across time, we are most likely to have autocorrelation in the error term. Autocorrelation affects both variance and p-value in hypothesis testing, by underestimating the variance; it may result in overestimates significance and thereby give untrustworthy hypothesis testing. A way to handle both heteroscedasticity and autocorrelation in error term is to cluster standard errors by the panel id (firms in our dataset).
Based on the discussion above, I will now perform a fixed effects model clustered standard error by the panel id[7].

### 5.3 Fixed effects regression – Result and discussion

Different models are used to test which variables are important in determining the capital structure of large Norwegian listed firms. In the first model all the independent variable are investigated against short-term debt, while in model 2 all the explanatory variables are regressed against long-term debt. The differences in determinants of capital structure in domestic and foreign firms are tested against short-term debt (model 3 and model 4) and long-term debt (model 5 and model 6).

The result of multivariate fixed effects regression is presented in this table 5, for whole sample. It shows how the firm-specific and macroeconomics variables affect the dependent variables. I will call result for fixed effects model for short-term debt for sample, model 1, and result for fixed effects model for long-term debt for sample, model 2. Model 1 is column (1) in table 5 and model 2 is column (2).

In this analysis, we are going to explore how both firm-specific characteristics and the macroeconomic factors explain the short-term and long-term leverage of large Norwegian listed firms, by using a fixed effects model with clustered standard errors by firms. Coefficients in a fixed effects model have the same interpretation as an OLS and indicate changes in Y (dependent variable) as the X (independent variable) increases by one unit. At the same time result from stepwise fixed effects regression for short-term debt and long-term debt will be commented.

[7] Although I am not using random effects model, the STATA output for random effects regression is presented in appendix D.

*Table 5: Comparison of fixed effects regression for short-term debt and long-term debt*

This model represents the results form fixed effects regression clustered standard errors by id. Column (1) reports results for short-term debt and will be referred to model 1. Column (2) reports results for long-term debt and will be referred to as model 2.

| | (1) STLit | (2) LTLit |
|---|---|---|
| TSit_w | -0.000384 | 0.00112 |
| | (0.000856) | (0.00154) |
| Zit_w | -0.00502* | -0.0112** |
| | (0.00245) | (0.00373) |
| BRit_w | -0.0326 | -0.0252 |
| | (0.0702) | (0.0904) |
| NDit_w | 0.414*** | -0.0461 |
| | (0.0960) | (0.139) |
| ACit_w | 0.0788 | 0.0169 |
| | (0.150) | (0.0770) |
| Git_w | 0.00574* | 0.00788** |
| | (0.00277) | (0.00161) |
| CPit_w | 0.0370 | -0.0633 |
| | (0.115) | (0.161) |
| PPit_w | -0.0351 | -0.000394 |
| | (0.0235) | (0.0522) |
| Lit_w | -0.0123*** | 0.00714 |
| | (0.00255) | (0.00471) |
| TANit | -0.170* | 0.238** |
| | (0.0761) | (0.0750) |
| Sit | -0.00671 | 0.0325 |
| | (0.0132) | (0.0166) |
| Ait | 0.00225 | 0.00944** |
| | (0.00190) | (0.00237) |
| Dit_w | 0.000362 | -0.000475 |
| | (0.000253) | (0.000493) |
| INFt | -0.0253 | -0.195 |
| | (0.252) | (0.293) |
| GDPt | 0.0154 | 0.0289 |
| | (0.0316) | (0.0310) |
| _cons | 0.302* | -0.126 |
| | (0.140) | (0.139) |
| R-sq | 0.302 | 0.191 |
| adj. R-sq | 0.295 | 0.183 |
| N | 1503 | 1503 |

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

R-squared is the measure of explanatory power of model, and shows the amount of variance in dependent variable (Y) that can be explained by the independent variables (x) (Torres-Reyna 2007). R-squared for short-term debt is 0.2953, while long-term debt has the value of 0.1825. This indicates that 29.53 % of the shot-term debt can be explained by the significant independent variables in model 1.In model 2, the significant independent variables only explain the 18.25 % of variance in long-term debt. We detect a large difference in independent variables ability to explain short-term debt ratio and long-term debt ratio. It seems like the same independent variables are able to explain around 11% more variance in short-term debt, than long-term debt.

It is common that to get low r-squared values in studies on capital structure. Rajan and Zingales (1995) reported r-squared from 5 % to 29 % for book leverage for different countries (se section 3), while Frank and Goyal (2009) core factor model explains 27 % of variation in total debt to market assets (18 % for total debt to book assets). Frydenberg (2004) fixed effects model had overall explanatory power of 22.33% for short-term debt and 30.6% for long-term debt.

Now I will interpret the coefficients, and report coefficients form both models under the variables. This way it is easier the see how maturity structure is effected by the explanatory variables. I will start by commenting the coefficients of the variables, since they tell us the direction of relationship between the explanatory variables and the dependent variables (short-term and long-term debt). Another thing to notice is the p-values of these coefficients. In the table the asterisk reference marks ***, ** and * represent the statistical significance at 0.1%, 1% and 5% level respectively. N reports the number of observations included in the regression.

### 5.3.1 Firm-specific determinants and capital structure

**Tax shield**

Model 1 shows negative relationship between tax shield and short-term debt ratio (- 0.0004), but the relationship is not significant at 5 % significance level. It is a very small change and indicates that firms with higher value of tax shield ought to have less short-term debt.
A positive coefficient is reported in model 2 for long-term debt. This indicates the higher the tax shield is, the higher is the long-term debt. Nevertheless, the relationship is still

insignificant at 5 % significance level. This means that tax shield is not significantly different from zero at this level, for both models.

The negative relation between tax shield and short-term debt is in contrast with prediction made by static trade-off theory and hypothesis 1a. Static trade-off theory relies on the fact that interest tax shield makes debt more favourable over equity and the higher tax rate is, the more additional debt a firm should have to take advantage of interest tax shield. An explanation of this finding can be that the predicted relation only holds for long-term debt or total debt. However, for long-term debt, the predicted sign is in line with static trade-off theory. Both models shows insignificant results, which indicates that tax is not an important determinant of capital structure in large Norwegian listed firms.

Frydenberg (2004) who argues that Norwegian tax system is neutral and therefore it is "peculiar" to expect taxes to be a significant variable in search for determinants of capital structure for Norwegian firms, supports the insignificance. This result gains further support by Fan et al (2012) who say that the value of tax shield should be 0, since Norway has a "dividend imputation tax system". Furthermore, Frank and Goyal (2009) found tax factors to be poor determinants of capital structure for American firms in their sample, and taxes were not included in the core model. The results of this study gains further support by Graham (2000) who found that large firms operate with conservative debt ratios, although they have the possibility to utilise tax shield without increasing cost of financial distress.

**Probability of bankruptcy**

The probability of bankruptcy is significant at 5 % significant level for short-term debt, while it is significant at 1 % level for long-term debt. As we can see, table !1 shows negative coefficients for both models, but the coefficient for long-term model is twice as large. If probability of bankruptcy increases by 1%, short-term debt ratio decreases by only 0.005 percentage points, while long-term debt ratio decreases by 0.011 percentage points. Significant positive coefficients for both models indicate that probability of bankruptcy is related positively to the debt ratio of a firm, no matter the maturity structure of debt. This implies that probability of bankruptcy is an important variable in determining the capital structure of large Norwegian listed firms.

Results for both models are in line with predictions made by trade-off theory and hypothesis 2a. This indicates that firms in this study choose the optimal structure by balancing the marginal benefits and costs of additional debt. When the probability of bankruptcy increases, while benefits are unaffected, firms have to reduce theirs debt level to prevent them from falling in financial distress. The reason long-term debt is more affected by probability of bankruptcy can be that short-term debt fluctuates much, and is easier to increase or decrease in time of financial distress. If the probability of default is high, firms may reduce their long-term debt in order to reduce total debt or creditor may not be willing to lend money to corporations that may fail on periodic debt payments.

**Business risk**

There is a negative insignificant relationship between business risk and the structure of debt (short-term and long-term debt). In model 1, an increase of 1 percentage point in change of net profit before tax over total assets from one year to another, will decrease the short-term debt ratio by 0.03 percentage points. A 1-percentage point increase in business risk ratio decreases the value of long-term debt by 0.025 percentage points.
The insignificance in both models suggests that business risk is not a crucial variable in determining the capital structure of large Norwegian listed firms in this study. Hence, we reject the hypothesis 3a and 3b. This result is in line with Titman and Wessels (1988) and Frydenberg (2004).

However, the sign of coefficients in both models are consistent with hypothesis 3a and 3b, and arguments based on both static trade-off theory and pecking order theory about a negative relation between debt and business risk. These results imply that the firms in this study face high costs of financial distress due to the volatile changes in theirs profitability, which force them to operate with lower debt ratios. On the other hand, high information asymmetry caused by volatility in profitability makes pecking order theory predict an inverse relation between business risk and debt. From the trade-off "tax-bankruptcy" perspective, we expect low debt ratios. Volatility in earnings (change in current profitability in this study) creates uncertainty around utilization of tax shield and decreases the expected value of tax shield. However, the trade-off agency costs perspective postulates a positive relation between business risk and debt since risky debt does not affect market value of high risky firms according to Myers (1977).

**Non-debt Tax shield**

Non-debt tax shield is one of the most explanatory variables for short-term debt in model 1. With a significance level at 0.1%, we can be sure that this variable is significantly different from zero at 0.1 % level. Furthermore, with a coefficient of 0.41 this variable has the largest effect on short-term debt and appears to be the most important variable in determining short-term debt for large Norwegian listed firms. The positive relation implies that short-term debt tends to increase with non-debt tax shield. An increase of 1 percentage point in non-debt tax shield will result in a 0.41 % rise in short-term debt ratio.

In model 2, we notice the negative insignificant relation between non-debt tax shield and long-term debt ratio. Therefore, this variable in not significantly different from zero at 5 % significance level. These results indicate that non-debt tax shield is not a factor in determining the long-term debt (however the predicted sign is consistent with general assumptions about these two being inversely correlated), but plays a crucial role in determining the short-term debt ratio.

It is a highly unexpected relation between short-term debt and non-debt tax shield, because this variable takes in to account tax deductions for depreciation and investment tax credits and therefore, should rather be related to long-term debt.

The positive significant coefficient in model 1 is in contrast with trade-off theory and hence hypothesis 4a, which predict a negative relation between non-debt tax shield and debt ratio. Neither does it support DeAngelo and Masulis (1980) substitution hypothesis. Furthermore, this result is also in contrast with previous research of Frydenberg (2004) who found the opposite relationship for Norwegian manufacturing firm. A possible justification for this result can be that non-debt tax shield is actually a proxy for the collateral value of assets. In model 2, the insignificant relation between non-debt tax shield is consistent with trade-off theory since non-debt tax shield is a substitute for interest tax shield, it predicts an inverse relationship. However, empirical founding of Titman and Wessels (1988) supports a nonsignificant result and the fact that non-debt tax shield does not explain long-term debt ratio.

**Agency costs**

Agency costs have positive coefficients in both models, suggesting that an increase in agency cost variable will also increase both short-term and long-term debt. Nevertheless, this variable is not significantly different form zero, even at 5 % significance level in both models. The measure for agency cost is the asset turnovers ratio, which is an asset utilization ratio. This is an inverse proxy for the agency costs faced by firms and therefore the results suggest that decrease in agency costs will increase both types of debt, which contradicts predictions made by both theories. This implies that agency problems are not the main concerns in capital structure decisions. Results do no t provide any support for the disciplinary role of debt (Jensen 1986) or the fact that the debt has an important influence on agency costs. A possible reason behind this result might be that my measure sales over total assets, does not be a good proxy for agency costs. Another reason could be that cash flow generated by sales are being exploited by management.

**Growth**

Table 5 confirms the positive relation between growth and the types of debt. Short-term debt and growth shares a positive significance relation at 5 % significance level, while coefficient for long-term debt is significant at 0.1% level. One percentage point increase in the growth of firm (market to book ratio) will increase the short-term debt ratio by 0.0057 percentage point, while the long-term debt rise by 0.0079 percentage points respectively. The effect on short-term debt is slightly smaller than long-term debt. Growth seems to be a central variable in determining the capital structure of large listed Norwegians firms.

Pecking order theory and trade-off theory predicts mutually exclusive outcome about the relationship between growth and leverage. The result indicates that an increase in the market to book ratio will increase both short-term and long-term debt. Hence, these results confirm that the hypothesis 6b is consistent with pecking order theory. This indicates that listed Norwegian large firms in this study do not have sufficient internal funds to finance their operations and investment opportunities and therefore rely on both short-term and long-term debt. These results are partially supported by Frydenberg (2004) since he observed a positive significant relation between short-term debt and growth at 5% significance level.

These findings are in contrast with Myers (1977) assumptions about high leveraged firms passing positive NPV opportunities. Trade-off theory predicts that growth firms will borrow

less since high level of debt increase the probability of financial distress. Furthermore, growth firms have less earnings before taxes and therefore are not able to take advantage of tax shield related to high debt ratio. Agency cost perspective suggests growth firms should borrow less to prevent underinvestment, overinvestment and assets substitution problems. These findings do not support any of these two predictions. A possible justification for this result from agency costs perspective can be that the disciplinary role of debt are more valuable than anticipated by Frank and Goyal (2008) and Jensen (1986) for large Norwegian listed growth firms in this study. However, this justification will be peculiar since the results do not indicate significant existence of agency costs in this sample.

The empirical research has been ambiguous. Rajan and Zingales (1995) found a negative relation between growth and leverage in G7 countries, while Titman and Wessels (1988) could not find a significant relationship between these two variables. The result is in contrast with finding of Fan et al (2012) about an insignificant effect of market to book ratio on maturity structure of debt.

**Current profitability**

Current profitability shares a positive relation with short-term debt and a negative relation with long-term debt. However, these variables are not significantly different from zero for both models.

The results suggest that profitability is not a determinant in explaining the capital structure of firms in this study. This deviates from prediction made by pecking order theory about a negative significant relationship between debt and profitability, due to sufficient internal funds in profitable firms. The result is in contrast with previous empirical research that support pecking order prediction, such as; Wald (1999), Frank & Goyal (2009), Fama and French (2002), Rajan and Zingales (1995) and Titman and Wessels (1988) and Frydenberg (2004).

**Past profitability**

Both models report insignificant negative impact on past profitability variable on the respective debt ratios. These result deviates from Titman and Wessels (1988) who consider past profitability to be an important determinants of capital structure according to pecking order theory. Past profitability or cumulative profits measures how the proportion of retained

earnings compared to total debt effects leverage. The regression coefficients are consistent with implications of pecking order theory suggesting that firms finance their investment with retained earnings. However, this variable does not have any economic significance. This implies that past profitability is not one of the key factors in explaining the capital structure of large Norwegian listed firms. This result is supported by Frank and Goyal (2009) who found the explanatory power of this variable to decrease over the last decades.

**Liquidity**

This variable has a negative relation with short-term debt at a significance level of 0.1 %. A 10-percentage points increase in liquidity will decrease the short-term debt ratio by 0.12 percentage points. The higher current assets over current liabilities a firm has, the smaller will short-term debt ratio be. Model 2 reports insignificant, but positive relationship between liquidity and long-term debt of a firm.

Liquidity is more closely related to short-term debt, than long-term debt, since we are measuring it by taking current assets scaled by current liabilities. This ratio shows the firms' ability to deal with theirs short-term liabilities. Furthermore, the large impact on short-term debt indicates that liquidity is the second most important variable in determining short-term debt for listed Norwegian large firms. Our findings show a significant negative relation between liquidity and short-term debt, indicating that liquid firms tend to have low short-term debt. This confirms hypothesis 9b and indicates that firms in this study finance their activities following the financial hierarchy identified by pecking order theory. This theory implies that liquid firms build reserve of retain earnings, which means they maintain high cash inflow and therefore have no incentive to use short-term debt if these internal funds are sufficient to cover daily operations and investment opportunities. The high inflow indirectly indicates that these firms are generating high inflow of cash. The inverse relationship conveys positive signals to the capital market indicating the firm's ability to meet its short-term obligations and faces low threat of default. My findings are supported by Titman and Wessels (1988) and Rajan and Zingales (1995) who found an inverse relation between liquidity and debt.

The relation between long-term debt and liquidity is in line with trade-off theory. However, this relation is insignificant, indicating that tangibility does not contribute in explaining the long-term debt ratio of firms included in this study. These results are in line with the maturity mechanism, which states that non-fixed assets are financed by short-term debt, while fixed

assets are financed by long-term debt. This confirms that the relationship between liquidity and gearing depends on maturity structure of debt.

**Tangibility**

The significant coefficient of -0.17 of tangibility indicates a negative relation between short-term debt and amount of fixed asset compared to total assets a firm owns. A 1-percentage increase in the tangibility ratio will decrease the short-term debt by 0.1689 percentage points, and this relation is significantly different from zero at a significance level of 5 %. On the other hand, a positive relation is reported between long-term debt and tangibility, at a 1 % significance level. A 1-percentage increase in tangibility will increase the long-term debt ratio by 0.238. Tangibility is the most explanatory variable for explaining long-term debt, due to the large value of the coefficient.

These results are consistent with previous empirical findings, where tangibility share a positive relation with long-term debt and the opposite is true for short-term debt. A negative relationship between short-term debt and tangibility can be due to the fact that firms prefer long-term debt when they have sufficient amount of tangible assets to use as collateral. Furthermore, these results are also consistent with the maturity matching principle where firms match duration of assets with liabilities. Frydenberg (2004) found the same relation between maturity structure and tangibility.

An increase in tangibility ratio decreases the short-term debt, therefore we accept hypotheses 10b consistent with pecking order theory. This indicates that large Norwegian listed firms with high proportion of fixed assets employ less short-term debt. Secured debt decreases the information asymmetry and lowers the cost of equity, therefore a negative relation is expected between tangibility and debt (Harris and Raviv 1991).

We accept hypotheses 10a (trade-off theory and agency cost), since tangibility increases the long-term debt. Tangibility is the most explanatory factor for long-term debt. From the trade-off perspective, firms with substantial amount of tangible assets suffer less in case of financial distress, since they retain most of their value in case of bankruptcy. In addition, trade-off framework also predicts low agency costs are associated with high tangibility ratio. This result is supported by a large amount of empirical results such as Frank and Goyal (2009),

Rajan and Zingales (1995) and Titman and Wessels (1988) who found a positive relation between these two variables.

**Size**

Model 1 indicates a negative relation between size and short-term debt, while model 2 reports a positive relation between the long-term debt and size. However, for both models size is not significantly different from zero at 5 % significance level.

The results reveal that there is no relationship between size and maturity structure of any economic significance, and therefore size is not a determinant of capital structure for large Norwegian listed firms. This result is in contrast with Titman and Wessels (1988) findings that suggest size is related to long-term debt, Frydenberg (2004) who provide results suggesting that size is an inverse proxy of bankruptcy cost. Furthermore, it deviates from Frank and Goyal (2009) suggestion about larger firms having more debt.

The insignificance of this variable is in contrast with predictions made by both trade-off theory and pecking order theory. Trade-off theory claims that size should be a determinant in this study since large firms are more diversified and less prone to bankruptcy or the bankruptcy costs are a smaller proportion of the total market value of large firms. Hence, a positive relationship between debt and size is expected. Pecking order theory on the other hand, predicts an inverse relationship since large firms face less information asymmetry costs that increase the probability of issuing equity that is not under-priced.

**Age**

Age is not an important determinant of short-term debt in this study, since table rapport a positive, however insignificant relation at 5 % significance level between these two variables. For model 2, one percentage increase in a firm's age, will increase the long-term debt by 0.009, and this relation is significantly different from zero at 0.1% significance level.
The two theories predict different views about age and leverage. The result indicates the mature companies prefer long-term debt. This prediction is in line with trade-off theory; hence, we accept the hypothesis 12a. A reason to employ more long-term leverage is that mature firms meet beneficial terms that lower the cost of capital. Therefore, they can increase the level of debt, which seems to be true for the firms in this study.

**Dividend pay-out ratio**

The results show that there is a positive relationship between dividend payout ratio and short-term leverage, and a negative relationship between this variable and long-term leverage. However, for both models these relations are insignificant at 5 % significance level.
These results suggest the dividend payout ratio is not a determinant of capital structure for large Norwegian listed firms; therefore, the hypothesis 13a and 13b are rejected. Despite the fact that these results are insignificant, the positive relation is in line with trade-off theory and negative relation is as predicted by pecking order theory. I cannot find the significant support for signalling effect of the dividends but the negative relation with long-term might be explained by that the constant dividend payments reduce the amount of internal funds, forcing firms to issue more long-term debt. My results deviate from previous empirical research of

Frydenberg (2004) who found a positive significant relation between dividend and short-term debt and opposite relation for long-term debt. At the same time, the negative relationship with long-term debt is in line with that dividend paying firms have less leverages (Frank and Goyal 2009).

**Inflation**

The results show a negative relationship between inflation and leverage for both models. Coefficient in model 2 is much larger (-0.195) than coefficient in model 1 (-0.0253), implying that inflation affects long-term debt more. Nevertheless, the variable is not significantly different from zero at the 5% significance level, in both models.

The results insinuate that inflation is not a key variable in determining the capital structure of large Norwegian listed firms in this study. However, the negative relationship is also in contrast with predictions made by trade-off theory and empirical findings of Frank and Goyal (2009). On the other hand, the insignificant result is consistent with Fan et al (2012).

**GDP**

GDP has positive relationship with both types of debt. However, the variable is not significantly different from zero at the 5% significance level, in both models.
These results suggest that economic growth measured by GDP growth rate per capita is not a factor that managers consider while taking the financing decisions in large Norwegian listed firms. The sign of coefficient are in line with trade-off theory that predicts a positive relation

since during economic growth taxable income and cash reserve increase, while bankruptcy costs decreases and this should result in higher debt ratios.

### 5.3.2 Are there any differences in capital structure of foreign and domestics firms?

*Table 6: A comparison between results for fixed effects regression for domestic and foreign firms, using short-term debt as dependent variable*

This model represents the results form fixed effects regression clustered for standard errors by firms, for short-term debt. Column (1) reports results for total sample and is referred to as model 1. Column (2) reports results for domestic firms, referred as model 3. Column (3) reports results foreign firms and will be referred to as model 5.

| | (1) STLit | (2) STLit | (3) STLit |
|---|---|---|---|
| TSit_w | -0.000384 | 0.000405 | -0.00128*** |
| | (0.000856) | (0.00159) | (0.000335) |
| Zit_w | -0.00502* | -0.000816 | -0.00433* |
| | (0.00245) | (0.00418) | (0.00180) |
| BRit_w | -0.0326 | 0.0693 | -0.0339 |
| | (0.0702) | (0.114) | (0.0748) |
| NDit_w | 0.414*** | 0.154 | 0.194 |
| | (0.0960) | (0.557) | (0.129) |
| ACit_w | 0.0788 | 0.200* | -0.115 |
| | (0.150) | (0.0729) | (0.189) |
| Git_w | 0.00574* | 0.00232 | 0.0152** |
| | (0.00277) | (0.00116) | (0.00498) |
| CPit_w | 0.0370 | 0.136 | -0.0101 |
| | (0.115) | (0.112) | (0.128) |
| PPit_w | -0.0351 | -0.0980*** | -0.0180 |
| | (0.0235) | (0.0239) | (0.00959) |
| Lit_w | -0.0123*** | -0.0127*** | -0.0111* |
| | (0.00255) | (0.00246) | (0.00422) |
| TANit | -0.170* | -0.314* | -0.0423 |
| | (0.0761) | (0.124) | (0.0337) |
| Sit | -0.00671 | 0.00854 | -0.00121 |
| | (0.0132) | (0.0117) | (0.0115) |
| Ait | 0.00225 | 0 | 0.000995 |
| | (0.00190) | (.) | (0.00172) |
| Dit_w | 0.000362 | 0.00137 | 0.0000834 |
| | (0.000253) | (0.00109) | (0.0000481) |
| INFt | -0.0253 | 0.0488 | 0.117 |
| | (0.252) | (0.270) | (0.301) |
| GDPt | 0.0154 | 0.0533 | -0.0280 |
| | (0.0316) | (0.0365) | (0.0395) |
| _cons | 0.302* | 0.182 | 0.177 |
| | (0.140) | (0.117) | (0.115) |
| R-sq | 0.302 | 0.361 | 0.451 |
| adj. R-sq | 0.295 | 0.351 | 0.438 |
| N | 1503 | 872 | 631 |

*Table 7: A comparison between results for fixed effects regression for domestic and foreign firms, using long-term debt as dependent variable*

This model represents the results form fixed effects regression clustered for standard errors by firms, for long-term debt. Column (1) reports results for total sample and is referred to as model 2. Column (2) reports results for domestic firms, referred as model 5. Column (3) reports results foreign firms and will be referred to as model 6.

| | (1) LTLit | (2) LTLit | (3) LTLit |
|---|---|---|---|
| TSit_w | 0.00112 | 0.00111 | -0.000728 |
| | (0.00154) | (0.00224) | (0.00150) |
| Zit_w | -0.0112** | -0.0208*** | -0.00713 |
| | (0.00373) | (0.00391) | (0.00381) |
| BRit_w | -0.0252 | -0.123 | 0.0677 |
| | (0.0904) | (0.0658) | (0.138) |
| NDit_w | -0.0461 | 3.126*** | -0.229 |
| | (0.139) | (0.718) | (0.207) |
| ACit_w | 0.0169 | -0.0115 | 0.0582 |
| | (0.0770) | (0.0964) | (0.158) |
| Git_w | 0.00788*** | 0.00967*** | 0.00993* |
| | (0.00161) | (0.00131) | (0.00438) |
| CPit_w | -0.0633 | -0.0837 | -0.0131 |
| | (0.161) | (0.149) | (0.218) |
| PPit_w | -0.000394 | 0.0110 | 0.0146 |
| | (0.0522) | (0.0430) | (0.0649) |
| Lit_w | 0.00714 | 0.0107 | 0.00587 |
| | (0.00471) | (0.00694) | (0.00608) |
| TANit | 0.238** | 0.296* | 0.209** |
| | (0.0750) | (0.107) | (0.0681) |
| Sit | 0.0325 | 0.0232 | 0.0546* |
| | (0.0166) | (0.0198) | (0.0208) |
| Ait | 0.00944*** | 0 | 0.00616 |
| | (0.00237) | (.) | (0.00323) |
| Dit_w | -0.000475 | -0.00276** | -0.000108 |
| | (0.000493) | (0.000821) | (0.000166) |
| INFt | -0.195 | -0.167 | -0.457 |
| | (0.293) | (0.260) | (0.575) |
| GDPt | 0.0289 | 0.0370 | 0.0167 |
| | (0.0310) | (0.0375) | (0.0643) |
| _cons | -0.126 | -0.0480 | -0.286 |
| | (0.139) | (0.197) | (0.164) |
| R-sq | 0.191 | 0.367 | 0.152 |
| adj. R-sq | 0.183 | 0.356 | 0.131 |
| N | 1503 | 872 | 631 |

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 6 and table 7 provide the fixed effects regression (clustered for standard error by firms) when we divide our sample in to subgroups by the ownership structure (foreign and domestic firms). This is to check whether ownership structure affects the relationship between the determinants of capital structure and maturity structure of debt, and is a part of research question (see section 1.1).

*Table 8: A comparison between hypothesis and results divided by ownership structure*

This table present hypothesis developed in section 3.3 and the result from regression. All the results with * represent significant result and seems to be determinants of capital structure for foreign and domestic firms.

| | *Predicted sign Hypothesis* | | *Res: Short term debt* | | *Res: Long-term debt* | |
|---|---|---|---|---|---|---|
| *Firm specific variables* | Trade-off | Pecking order | Domestic | Foreign | Domestic | Foreign |
| *Tax shield* | + | / | + | -*** | + | - |
| *Probability of bankruptcy* | - | / | - | -* | -*** | - |
| *Business risk* | - | - | + | - | - | + |
| *Non-debt tax shield* | - | / | + | + | +*** | - |
| *Agency cost* | + | + | +* | - | - | + |
| *Growth (market to book ratio)* | - | + | + | +** | +*** | +* |
| *Current profitability* | + | - | + | - | - | - |
| *Past profitability* | + | - | -*** | - | + | + |
| *Liquidity* | + | - | -*** | -* | + | + |
| *Tangibility* | + | - | -* | - | +* | +** |
| *Firm Size* | + | - | + | - | + | +* |
| *Age of business* | + | - | / | + | / | + |
| *Dividend payout ratio* | - | + | + | + | -** | - |
| *Inflation* | + | / | + | + | - | - |
| *GDP* | + | - | + | - | + | + |

Myers (2001) classifies these theories of capital structure as conditional, and by distinguish between to different aspect of corporate claims and dividing sample into subgroups, it will be interesting to se whether this is true for Norwegian firms.

**Short-term debt**

Model 3 is capable of explaining 35 % of variance in short-term debt for domestic firms, while model 4 can explain 43.8 % of variance between determinants of capital structure for foreign firms. Explanatory power for both of these models is higher than model 1 where the regression was conducted on the whole sample. To answer the question I find it appropriate to only look at the statically significant differences between foreign and domestic firms and the short-term and long-term debt.

As we can see from table 4 for domestic firms result of variables past probability (-), liquidity (-), tangibility (-) and agency costs (+) are significant at 5 % level. For foreign firms tax shield (-), growth (+), probability of bankruptcy (-) and liquidity (-) are statically significant at 5 % level. It is clear that there is difference in factor that determines the capital structure of these two groups. Significance of these variables indicates that these factors are the determinants of capital structure of these firms. Liquidity is the only common factor among foreign and domestic firms that affect the capital structure measured as short-term debt.

Liquidity in both groups shares a negative relationship with short-term debt. This indicates that foreign and domestic firms with high liquidity ratio in this study tend to have less short-term debt. This relation is justified by pecking order theory that assumes liquid firms will have high inflow of cash and will therefore cover their short-term liabilities with these inflows or reserve of retained earnings, before turning to the capital markets.

Domestic firms with high agency costs variable (high asset utilization ratio implying low agency costs for firms) seem to increase their short-term debt. On the other hand, short-term debt decrease with past profitability, tangibility and liquidity. Results for agency costs contradict both theories, while negative past profitability, tangibility and liquidity variables provide support for pecking order hypothesis (8b, 9b, 10b).

Result shows that foreign firms with high tax shield, high probability of bankruptcy and high liquidity ratios tend to have less short-term debt. Short-term debt in foreign firms only increases with growth. Negative relation for probability of bankruptcy is consistent with trade-off theory (hypothesis 2a), while negative liquidity variable and positive growth variable is in line with pecking order hypothesis (10b, 6b).

A noticeable result is that tax shield variable for foreign firms shows a negative significant relationship, indicating firms with high tax shield tend to have less short-term debt. This result contradicts the prediction made by static trade-off theory (hypothesis 1a) where especially large firms with high income will try to shield their income from taxes by operating with high debt ratios and taking advantage of interest tax shield. This result is supported by Antoniou et al (2008) where they found a negative relationship between effective tax rate and leverage.

The inverse causality might cause a negative relation indicating that firms with low leverage pay high effective tax. Another reason for a negative relation in this study can be that this tax shield proxy does not measure the effective tax rate as we assume or the predictions made by trade-off theory is for long-term or total debt, not short-term debt.

**Long-term debt**

Model 5 can explain 35.6 % of variance in long-term debt for domestic firms, while model 6 can explain only 13.1 % of variance between determinants of capital structure for foreign firms long-term debt.

For domestic firms' variables probability of bankruptcy (-), non-debt tax shield (+), growth (+), tangibility (+) and dividend pay-out ratio (-) is significant at 5 % level. In comparison, tangibility (+), size (+) and growth (+) are significant at 5 % level for foreign firm. The significance suggests these variables effects the capital structure of foreign and domestic listed firms in Norway, when I use long-term debt as proxy for leverage. Both growth and tangibility increases the long-term debt, unaffected by ownership structure.

Firms with high market to book ratio seem to finance their growth with long-term debt. This result indicates the firms are following financing hierarchy proposed by pecking order theory, and do not have sufficient internal funds to investment in growth opportunities and therefore turns to external market for additional funding. However, previous empirical studies (Rajan and Zingales (1995), Frank and Goyal (2009)) concluded with a negative relation. Frydenberg (2004) found that long-term debt increases with growth opportunities, but this result was barely significant at 10 % level. The negative relation can be due to the fact that valuable growth opportunities increase the firms' value and respectively increase the potential use of debt (Titman and Wessels 1988).

A positive relationship between tangibility ratio and long-term debt for both types of firms, indicates that long-term debt increases with proportion of fixed asset owned by the firms. This finding is in favour of trade-off theory where firms with sufficient amount of fixed assets can increase their debt without increasing the probability of bankruptcy and financial distress. The positive relationship indirectly indicates that firms in this study might have low agency costs since tangibility diminish the risk of participating in risk shifting activities.

Domestic firms with high probability of bankruptcy and high dividend ratio prefer to have long-term debt. An increase in non-debt tax shield, growth opportunities and tangibility seem to decrease the amount of long-term debt these firms use. The positive variable of probability of bankruptcy, dividend ratio and negative tangibility are consistent with predicted relationship by trade-off theory. Negative coefficient of non-debt tax shield contradicts trade-off theory, while a negative growth variable support pecking order theory.
Growth, tangibility and firm size; all of these variables tend to increase long-term debt. The positive predicted sign of the growth variable is in line with pecking-order theory, while tangibility and firm size support predictions made by trade-off theory.

#### *5.3.2.2 Determinants of long-term and short-term debt ratios*

**Domestic firms**

Agency cost, past probability, liquidity and tangibility are the determinants of the short-tem debt while probability of bankruptcy, non-debt tax shield, growth tangibility and dividend payout ratio are the factors that significantly can affect long-term debt. Only tangibility seems to be determinant of both type of debt but shares different relationship with debt maturity structure. Negative relationship with short-term debt and positive relationship with long-term debt indicates that maturity mechanism is in place.

**Foreign firms**

Tax shield, probability of bankruptcy, growth and liquidity seem to have significantly effect on short-term debt. While growth, tangibility and firm size are the determinants of capital structure for long-term debt. None of the factors are unaffected by maturity structure for foreign firms.

### 5.3.3 Are predictions by trade-off theory and pecking order theory valid?

Last research objective was to determine whether predictions made by trade-off theory and pecking-order theory are valid for firms included in this study. In order to provide an answer for this question, the hypothesis was developed in section 3.3 and now I will compare it to the result from the regression in model 1 and 2. Table 9 provides a summary of hypothesis and result based on regression analysis.

The negative results for variables probability of bankruptcy and inflation, and positive results for current profitability, age of business and GDP, are consistent with predictions made by trade-off theory. Negative results for tax shield and inflation, and positive results for non-debt tax shield contradict trade-off theory and pecking-order theory is indistinct about effect on these factors. Furthermore, business risks support both theories while the variable agency costs (inverse proxy for agency costs in firms) contradict both theories. Growth, past profitability, liquidity, tangibility, firm size, dividend pay-out ratio indicate that firms in this study follow pecking-order theory. The results obtained for ***short-term leverage*** are ***ambiguous*** and support both theories. Since five of the variables can be explained by trade-off theory and six variables follow pecking order theory, where these theories have contradicting predictions. This implies that to some extent both theories are capable of explaining how firm characteristics and macroeconomics factors affect a firm's capital structure. However throughout all regression models, we have not obtained any significant results for macroeconomics variables, GDP and inflation.

For ***long-term debt*** the results are clearly ***in support of trade-off theory***. Which indicates that large Norwegian listed firms do consider the trade-off between benefits and costs of debt for long-term financing. The positive relation with tax shield, liquidity, tangibility, firm size, age business risk and GDP are in favour of trade-off theory. The negative relationship with probability of bankruptcy, non-debt tax shield and dividend pay-out ratio further support trade-off theory. According to pecking-order theory we observe a positive relationship with growth and age of business.

*Table 9: A comparison between hypothesis and results for sample*

This table present hypothesis developed in section 3.3 and the result from regression. All the results with * represent significant result and seems to be determinants of capital structure for foreign and domestic firms.

| | *Predicted sign* | | *Results* | |
|---|---|---|---|---|
| *Firm specific variables* | Trade-off | Pecking order | Short-term debt | Long-term debt |
| *Tax shield* | + | / | - | + |
| *Probability of bankruptcy* | - | / | -* | -** |
| *Business risk* | - | - | - | - |
| *Non-debt tax shield* | - | / | +*** | - |
| *Agency cost* | + | + | + | + |
| *Growth (market to book ratio)* | - | + | +* | +*** |
| *Current profitability* | + | - | + | - |
| *Past profitability* | + | - | - | - |
| *Liquidity* | + | - | -*** | + |
| *Tangibility* | + | - | -* | +** |
| *Firm Size* | + | - | - | + |
| *Age of business* | + | - | + | + *** |
| *Dividend payout ratio* | - | + | + | - |
| *Inflation* | + | / | - | - |
| *GDP* | + | - | + | + |

The result of fixed affects regression shows five independent significant variables for short-term debt compared to only four independent significant variables for long-term debt. This indicates that majority of independent variables yield statistically insignificant results. However the relationship with these variables may still provide useful insight about which capital structure theory is best suited to explain capital structure of the large Norwegians listed firms in this study.

Based on the relationship with both significant and insignificant variables in model 1 for short-term debt the results are inconclusive about which theory is better at explaining the capital structure of large Norwegians listed firms. For long-term debt in model 2 the results are clearly in favour of static trade-off theory. The difference might be due to the fact that short-term and long-term debt represents different aspect of the firms' claims and therefore might not have the same relation with all capital structure determinants.

# Chapter 6: Conclusion

The study investigated both the firm-specific and macroeconomics determinants of capital structure using panel data analysis for a sample contained by large Norwegian listed firms. This sample consist both foreign and domestic firms characterized by Oslo Børs. Two different measures; short-term and long-term debt were used as dependants variables to quantify capital structure of large listed Norwegian firms. It is possible to use either book value or market value of debt. Since previous empirical studies show that regression results are the same whether one uses book or market value (see section 4.3).

The empirical evidences obtained in my study show that there exist significant differences in determinants of these two measures of debt. R-squared for short-term debt was much higher, which indicates that variation in short-term debt is better explained by the independent variables in this study than long-term debt. Furthermore, regression results report more significant determinants for short-term debt versus long-term debt. This indicates a difference between maturity structure of debt.

Both form of debt ratios are significantly related to probability of bankruptcy, growth and tangibility. Probability of bankruptcy tends to reduce both types of debts, while growth has the opposite effect. Tangibility, amount of fixed assets decrease with short-term debt, while increasing with long-term debt. This confirms the existence of maturity matching mechanism. Non-debt tax shield and liquidity are only significantly related to short-term debt, while only age is significantly related to long-term debt. All the other independent variables are unrelated both measures of debt.

Both types of debt increase with tangibility for domestic firms, on the other hand none observed factors affect short-term and long-term debt for foreign firms.

The results obtained for short-term debt are inconclusive and support both theories and do not point out superiority of any theories. On the other hand long-term debt can be explained by trade-off theory. This indicates that capital structure of large Norwegians listed firms can be explained by the trade-off between the costs and benefits of debt.

The interesting finding in this study is that none of the macroeconomics variables, GDP and inflation are able to explain the capital structure in any models. This study suggests that when analysing capital structure, both short-term and long-term debt should be used instead of an aggregate debt ratio.

## 6.1 Limitations of the study

One of the limitations of this study could be loss of degrees of freedom due to missing value on financial statements. Although the financial data was collected form Datastream, which is a reliable financial database used all over the world to obtain financial information.

The data was highly unbalanced and the estimates may suffer from due to this limitation. This types of limitations are quite usual, and can easily be handled by statistical programmes, such as STATA used in this study.

My data sample in this study consisted of 26 domestic and 33 foreign firms listed on annual statistic at Oslo Børs on the list of the largest foreign and domestic firms by their market value. All the firms on these lists between 2010-2015 were included as the sample. Increasing the time span of the list by for instance starting from 2007 could have made a possible improvement by including several firms to increase the sample.

For this research a total of 15 determinants of capital structure (whereas 13 firm-specific and 2 macroeconomic) were analysed. Most of them yield insignificant results. A large set of possible determinants effects capital structure of the firm and it is extremely difficult to identify variables best suited for the dataset.

## 6.2 Future research

In this study, I researched on a large set of firm-specific and few macroeconomic determinants of capital structure. It is recommendable to examine the effect of other macroeconomic variables, such as interest rate, market condition, supply factors and regulation of financial institutions.

Another possibility is to observe how maturity structure of debt affects the market value of the firm. Since the reason behind all the research and capital structure is to see how financing effects the capital cost of financing and the market value of the firm.

There is still a gap in empirical research about capital structure for both listed and private firms in Norway, at the academic level. Therefore, a possible direction for future research might be to analyse which variables do actually effects the capital structure of Norwegian firms, both small and large. This will provide a base line for future researches about where to begin when researching of capital structure of Norwegian firms. Different measures of debt, such as total debt, short-term debt and long-term debt should be used to observe whether there exist significant differences in the determinants of these leverage measures.

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Apprendix A: Data sample

A1: Firm sample

| | ***Domestic firms*** | | ***Foreign firms*** |
|---|---|---|---|
| *1* | Statoil ASA | 1 | Royal Caribbean Cruises Ltd |
| *2* | Telenor ASA | 2 | Subsea 7 SA |
| *3* | Yara International ASA | 3 | Frontline Ltd |
| *4* | Orkla ASA | 4 | P/F Bakkafrost |
| *5* | Norsk Hydro ASA | 5 | Hoegh LNG Holdings Ltd |
| *6* | Marine Harvest ASA | 6 | Stolt-Nielsen Ltd |
| *7* | Schibsted ser.B ASA | 7 | Seadrill Ltd |
| *8* | Leroy Seafood Group ASA | 8 | Prosafe SE |
| *9* | Salmar ASA | 9 | Team Tankers International Ltd |
| *10* | Kongsberg Gruppen ASA | 10 | BW Offshore Ltd |
| *11* | Veidekke ASA | 11 | SAS AB |
| *12* | TGS NOPEC Geophysical Company ASA | 12 | Golden Ocean Group Ltd |
| *13* | Tomra Systems ASA | 13 | Siem Offshore Inc |
| *14* | Af Gruppen ASA | 14 | Odfjell Drilling Ltd |
| *15* | Norwegian Air Shuttle ASA | 15 | Gaming Innovation Group Inc |
| *16* | Det Norske Oljeselskap ASA | 16 | Songa Offshore SE |
| *17* | Austevoll Seafood ASA | 17 | Wentworth Resources Ltd |
| *18* | Hafslund ASA | 18 | Jinhui Shipping and Transportation Ltd |
| *19* | Atea ASA | 19 | Siem Shipping Inc |
| *20* | Fred Olsen Energy ASA | 20 | Asetek A/S |
| *21* | Algeta ASA | 21 | Vizrt Ltd Delisted |
| *22* | Petroleum Geo Services ASA | 22 | Archer Ltd |
| *23* | Cermaq Group AS | 23 | Deep Sea Supply PLC |
| *24* | DNO ASA | 24 | EMAS Offshore Ltd (EOC) |
| *25* | Opera Software ASA | 25 | Northern Offshore Ltd |
| *26* | Wilh Wilhelmsen ASA | 26 | Polarcus Ltd |
| | | 27 | Northland Resources SE |
| | | 28 | Questerre Energy Corp |
| | | 29 | VERIPOS INC |
| | | 30 | Avocet Mining PLC |
| | | 31 | Funcom NV |
| | | 32 | Dockwise Ltd |
| | | 33 | Fairstar Heavy Transport NV |

Apprendix B:

B1: Detailed summary statistics for Short-term and long-term debt

STLit

| Percentiles | | Smallest | | |
|---|---|---|---|---|
| 1% | 0 | 0 | | |
| 5% | .0092293 | 0 | | |
| 10% | .0407413 | 0 | Obs | 1,503 |
| 25% | .0750189 | 0 | Sum of Wgt. | 1,503 |
| 50% | .1353886 | | Mean | .1624798 |
| | | Largest | Std. Dev. | .1315917 |
| 75% | .2004185 | .7557118 | | |
| 90% | .3282551 | .806591 | Variance | .0173164 |
| 95% | .4542746 | .8159509 | Skewness | 1.784657 |
| 99% | .6763173 | .8496732 | Kurtosis | 7.081349 |

LTLit

| Percentiles | | Smallest | | |
|---|---|---|---|---|
| 1% | 0 | 0 | | |
| 5% | .0005147 | 0 | | |
| 10% | .034189 | 0 | Obs | 1,503 |
| 25% | .1716653 | 0 | Sum of Wgt. | 1,503 |
| 50% | .3294139 | | Mean | .3078444 |
| | | Largest | Std. Dev. | .1811478 |
| 75% | .4245492 | .8106575 | | |
| 90% | .5220758 | .8273557 | Variance | .0328145 |
| 95% | .6015364 | .8576985 | Skewness | .0866492 |
| 99% | .7418696 | .8728731 | Kurtosis | 2.615736 |

## B2: Hausmans test for short-term debt

```
. hausman fixedSTL randomSTL, sigmamore
```

| | Coefficients | | | |
|---|---|---|---|---|
| | (b) fixedSTL | (B) randomSTL | (b-B) Difference | sqrt(diag(V_b-V_B)) S.E. |
| TSit_w | -.0003837 | -.0003653 | -.0000184 | .0000562 |
| Zit_w | -.0050195 | -.0052644 | .0002449 | .0001366 |
| BRit_w | -.032569 | -.0309644 | -.0016046 | .0029841 |
| NDit_w | .4144559 | .4074285 | .0070274 | .0077961 |
| ACit_w | .0787874 | .1018058 | -.0230184 | .0079097 |
| Git_w | .0057397 | .0056843 | .0000554 | .0000592 |
| CPit_w | .0370474 | .0278066 | .0092408 | .0074507 |
| PPit_w | -.035064 | -.0350169 | -.0000471 | .0011758 |
| Lit_w | -.012251 | -.012095 | -.000156 | .0001819 |
| TANit | -.1698745 | -.1667567 | -.0031178 | .0092379 |
| Sit | -.0067143 | -.0038152 | -.0028992 | .0015549 |
| Ait | .0022525 | .0053208 | -.0030683 | .0070151 |
| Dit_w | .0003617 | .0003531 | 8.57e-06 | 7.39e-06 |
| INFt | -.0252883 | -.0245825 | -.0007058 | .0068204 |
| GDPt | .015437 | .0207574 | -.0053204 | .0018967 |

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(15) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 21.93
Prob>chi2 = 0.1095

## B3: Hausmans test for Long-term debt

```
. hausman fixedSTL randomSTL, sigmamore
```

| | Coefficients | | | |
|---|---|---|---|---|
| | (b) fixedSTL | (B) randomSTL | (b-B) Difference | sqrt(diag(V_b-V_B)) S.E. |
| TSit_w | -.0003837 | -.0003653 | -.0000184 | .0000562 |
| Zit_w | -.0050195 | -.0052644 | .0002449 | .0001366 |
| BRit_w | -.032569 | -.0309644 | -.0016046 | .0029841 |
| NDit_w | .4144559 | .4074285 | .0070274 | .0077961 |
| ACit_w | .0787874 | .1018058 | -.0230184 | .0079097 |
| Git_w | .0057397 | .0056843 | .0000554 | .0000592 |
| CPit_w | .0370474 | .0278066 | .0092408 | .0074507 |
| PPit_w | -.035064 | -.0350169 | -.0000471 | .0011758 |
| Lit_w | -.012251 | -.012095 | -.000156 | .0001819 |
| TANit | -.1698745 | -.1667567 | -.0031178 | .0092379 |
| Sit | -.0067143 | -.0038152 | -.0028992 | .0015549 |
| Ait | .0022525 | .0053208 | -.0030683 | .0070151 |
| Dit_w | .0003617 | .0003531 | 8.57e-06 | 7.39e-06 |
| INFt | -.0252883 | -.0245825 | -.0007058 | .0068204 |
| GDPt | .015437 | .0207574 | -.0053204 | .0018967 |

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(15) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 21.93
Prob>chi2 = 0.1095

## Appendix C: Pooled regression

### C1: Regression output for Pooled OLS using short-term debt

| Source | SS | df | MS | Number of obs | = | 1,503 |
|---|---|---|---|---|---|---|
| | | | | F(15, 1487) | = | 64.36 |
| Model | 10.2382202 | 15 | .682548016 | Prob > F | = | 0.0000 |
| Residual | 15.770972 | 1,487 | .010605899 | R-squared | = | 0.3936 |
| | | | | Adj R-squared | = | 0.3875 |
| Total | 26.0091923 | 1,502 | .017316373 | Root MSE | = | .10298 |

| STLit | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| TSit_w | -.0016118 | .0023123 | -0.70 | 0.486 | -.0061476 | .002924 |
| Zit_w | -.0066467 | .0011087 | -6.00 | 0.000 | -.0088215 | -.004472 |
| BRit_w | -.0760012 | .0546339 | -1.39 | 0.164 | -.183169 | .0311665 |
| NDit_w | .5101027 | .127022 | 4.02 | 0.000 | .2609413 | .7592641 |
| ACit_w | .2669744 | .0229259 | 11.65 | 0.000 | .2220038 | .3119451 |
| Git_w | .0036277 | .0007348 | 4.94 | 0.000 | .0021863 | .005069 |
| CPit_w | -.1746625 | .0731164 | -2.39 | 0.017 | -.3180847 | -.0312403 |
| PPit_w | -.0247325 | .0069358 | -3.57 | 0.000 | -.0383375 | -.0111274 |
| Lit_w | -.0136471 | .0016348 | -8.35 | 0.000 | -.0168538 | -.0104404 |
| TANit | -.1203823 | .0122927 | -9.79 | 0.000 | -.1444951 | -.0962694 |
| Sit | -.0010888 | .0017508 | -0.62 | 0.534 | -.0045232 | .0023455 |
| Ait | .0077423 | .0035009 | 2.21 | 0.027 | .0008751 | .0146094 |
| Dit_w | .0006064 | .0004869 | 1.25 | 0.213 | -.0003486 | .0015615 |
| INFt | -.0279808 | .2836777 | -0.10 | 0.921 | -.5844318 | .5284702 |
| GDPt | .0629278 | .0593952 | 1.06 | 0.290 | -.0535795 | .179435 |
| _cons | .1923572 | .0226658 | 8.49 | 0.000 | .1478968 | .2368176 |

### C2: Regression output for Pooled OLS model using long-term leverage

| Source | SS | df | MS | Number of obs | = | 1,503 |
|---|---|---|---|---|---|---|
| | | | | F(15, 1487) | = | 96.81 |
| Model | 24.3512084 | 15 | 1.6234139 | Prob > F | = | 0.0000 |
| Residual | 24.9361836 | 1,487 | .016769458 | R-squared | = | 0.4941 |
| | | | | Adj R-squared | = | 0.4890 |
| Total | 49.2873921 | 1,502 | .032814509 | Root MSE | = | .1295 |

| LTLit | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| TSit_w | .004916 | .0029076 | 1.69 | 0.091 | -.0007875 | .0106194 |
| Zit_w | -.019488 | .0013941 | -13.98 | 0.000 | -.0222227 | -.0167533 |
| BRit_w | -.0520991 | .0686986 | -0.76 | 0.448 | -.1868557 | .0826574 |
| NDit_w | -.3275855 | .159722 | -2.05 | 0.040 | -.6408899 | -.014281 |
| ACit_w | -.2299647 | .0288279 | -7.98 | 0.000 | -.2865124 | -.1734171 |
| Git_w | .013379 | .000924 | 14.48 | 0.000 | .0115666 | .0151915 |
| CPit_w | -.1903551 | .0919391 | -2.07 | 0.039 | -.3706992 | -.0100109 |
| PPit_w | .0432829 | .0087213 | 4.96 | 0.000 | .0261754 | .0603903 |
| Lit_w | .0097526 | .0020556 | 4.74 | 0.000 | .0057203 | .0137848 |
| TANit | .1846558 | .0154573 | 11.95 | 0.000 | .1543355 | .2149761 |
| Sit | .0294377 | .0022015 | 13.37 | 0.000 | .0251193 | .0337561 |
| Ait | -.0143485 | .0044021 | -3.26 | 0.001 | -.0229835 | -.0057134 |
| Dit_w | -.0004146 | .0006122 | -0.68 | 0.498 | -.0016155 | .0007863 |
| INFt | -.4686477 | .3567064 | -1.31 | 0.189 | -1.168349 | .2310536 |
| GDPt | .0074609 | .0746856 | 0.10 | 0.920 | -.1390395 | .1539612 |
| _cons | .0324333 | .0285008 | 1.14 | 0.255 | -.0234727 | .0883394 |

Appendix D: Random effects model

comparison between short-term debt and long-term debt clustered on id.

| | (1) STLit | (2) LTLit |
|---|---|---|
| TSit_w | -0.000365 | 0.00129 |
| | (0.000861) | (0.00153) |
| Zit_w | -0.00526* | -0.0115** |
| | (0.00246) | (0.00374) |
| BRit_w | -0.0310 | -0.0234 |
| | (0.0678) | (0.0901) |
| NDit_w | 0.407*** | -0.0608 |
| | (0.0933) | (0.140) |
| ACit_w | 0.102 | -0.00580 |
| | (0.143) | (0.0639) |
| Git_w | 0.00568* | 0.00813*** |
| | (0.00276) | (0.00156) |
| CPit_w | 0.0278 | -0.0742 |
| | (0.114) | (0.154) |
| PPit_w | -0.0350 | 0.00244 |
| | (0.0236) | (0.0505) |
| Lit_w | -0.0121*** | 0.00753 |
| | (0.00248) | (0.00473) |
| TANit | -0.167* | 0.241*** |
| | (0.0655) | (0.0592) |
| Sit | -0.00382 | 0.0333** |
| | (0.0107) | (0.0129) |
| Ait | 0.00532 | 0.00568 |
| | (0.00667) | (0.0106) |
| Dit_w | 0.000353 | -0.000476 |
| | (0.000250) | (0.000496) |
| INFt | -0.0246 | -0.204 |
| | (0.251) | (0.295) |
| GDPt | 0.0208 | 0.0293 |
| | (0.0310) | (0.0308) |
| _cons | 0.261* | -0.115 |
| | (0.115) | (0.104) |
| N | 1503 | 1503 |

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001