

**Abira Mohsin**

# **Capital Structure Determinants**

**Capital structure determinants for large listed Norwegian and  
foreign public firms**

**Masteroppgave i Økonomi og administrasjon  
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## Abstract

The ultimate goal of all the firms in the market is to maximize the firm value and the wealth of shareholders. The empirical data suggests that such goals can be achieved by an optimal combination of debt and equity which may result in a low average weighted cost of capital to the firm. An appropriate choice of capital structure based on firm, industry and country level explanatory factors could influence their path of capital growth.

So far, many empirical studies have been carried out to identify and explain the contributing factors to influence the choice for a particular capital structure suitable to any individual firm or group of firms. Ironically, such studies with particular reference to the firms operating in the capital market of Norway are few and far between. Realising this vacuum, the current study is a humble effort to explore and identify the most significant factors, both at firm and country level, which affect the choice of capital structure of some of the largest domestic and foreign firms listed on Oslo Børs.

Quarterly data of largest 29 domestic and 34 foreign firms for the past five years (2011 to 2015) has been collected from Thomson Reuter's data stream for the purposes of analysis. To maintain uniformity, financial firms including banks and insurance companies have been excluded from the sample. With view to enhance the reliability of the tests, two separate models on the book value of leverage as dependent variables (short term debt and long term debt) are tested over number of independent variables on three different data sets (domestic , foreign firms and their combined data ). An attempt has been made to find out if there is a difference between foreign and local firms in the choice of their respective capital structures. Explanatory factors were derived from previous empirical studies on the same subject. Some additional factors like exchange rate, liquidity and past profitability have been included that are not studied previously on Norwegian data.

The results reveal that for long-term debt ratio (LTD/TA), non-debt tax shield, inflation and exchange rate are the most significant determining factors for adopting a capital structure in both domestic and foreign firms. While, inflation is particular to domestic firms only. The results also show that for short-term debt ratio (STD/TA), non-debt tax shield again is a significant explanatory factor along with tangibility and exchange rate at a lesser scale. Domestic firms prefer short-term debt but foreign firms prefer long-term debt as a source of external financing. Support of trade-off theory for both short term and long term debt in capital structure of listed firms in Norway is an obvious outcome of the results.

## Preface

This paper is being submitted in partial fulfilment of my master degree at Høgskolen I Oslo og Akershus (HIOA) with specialization in finance. The subject of my thesis reflects the current challenges faced by the corporate sector. I would not hesitate to add that, writing this thesis provided me with an ideal opportunity to apply the knowledge I gained during my Master's programme. The process was onerous, but it gives me a great deal of satisfaction that I could come up with some practical recommendations and hope that these will be received well by the academia.

My efforts wouldn't have borne fruits without the valuable help and able guidance of my teachers. My special thanks to all my teachers, Guide, colleagues and friends. Their suggestions have been my guiding lights in completing this paper. I owe a sense of gratitude to my husband also for his support, besides my children who have been very patient through this journey.

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## List of Abbreviations

CGS	Costs of goods sold
D	Market value of debt
E	Market value of equity
EBIT	Earnings before interest and taxes
EPS	Earning per share
GDP	Gross domestic product
GLS	Generalized least square
GLS	Generalized least square
GMM	General Method of moment
H <sub>A</sub>	Alternating hypothesis
H <sub>0</sub>	Null hypothesis
LSDV	least squares dummy variable
LT	Long term
LTD	Long term debt
LTD/TA	Long term debt/Total Assets
LTL	Long term liability
MNCs	Multinational corporations
MSE	Mean-square error
NPV	Net present value
OLS	Ordinary least square
POT	Packing order theory
r <sub>D</sub>	Rate of return demanded by debt investors of the company
r <sub>E</sub>	Rate of return demanded by the equity investors
ROI	Return on investment
Sig	Significance
ST	Short term
STD	Short term debt
STD/TA	Short term debt/Total Assets
STL	Short term liability
TA	Total assets
TOT	Trade off theory
V	Total value of the firm
VIF	variance inflation factor
VIT	Variable Inflation test

## 1 Introduction

*The first chapter provides a summary of the entire research to follow. It summarises the objective, scope, analysis, limitations and finally the main research question or hypothesis that laid the foundation of this research.*

### 1.1 Contributions, Scope and Limitations:

It is a pioneer study of capital structure that is based on only largest listed firms that has been segregated into Norwegian and foreign firms operating in Norway for the past 5 years (2011-2015) and finally the combined data set (foreign + domestic firms). Book value of leverage taken as dependent variable is also studied separately as long-term debt (LTD/TA) and short-term debt (STD/TA). The aim is to identify and compare if there is any difference in capital structure choice between local and foreign firms.

Firms that got unregistered or changed their name during the period of study are also included in the sample in order to account for survivorship bias and to maintain a decent sample level. Data is derived from quarterly reports of the firms included in the sample. Firms with minimum of 10 quarterly observations are considered in order to avoid small finite sample bias (Bryman & Bell, 2007)

Financial and private listed firms are beyond the scope of this study. I had to take out financial sector including banks and insurance companies due to their huge differences in financial reporting from rest of the industry. Extreme values are also taken out from data set in order to maintain normal distribution.

For the theoretical part, although a lot of work has been done over the topic of capital structure previously, I have only included the theories that are most relevant to my scope of work.

### 1.2 Research question:

What are the most significant firm level and country level explanatory variables on long-term and short-term debt ratios as dependent variables in determining capital structure choice of largest listed domestic and foreign firms operating in Norway.

## 2 Literature Review

*This chapter provides an introduction to the topic of capital structure, its importance for business markets and past theoretical work on the subject of capital structure considering the distinction of perfect and imperfect markets.*

### 2.1 Capital Structure:

Capital structure is the mix of financing, required to finance the real time investments. The mix is considered to hold debt, equity and hybrid securities along with internal cash reserves that the company



retains for investment purposes. Debt or leverage is non-equity capital used to fulfil the financing needs of companies by external financing.

The topic of capital Structure is one of the most complex and important issues for company's decision-making process. Since such decisions have strategic and long-term impact on company's survival, performance and profitability in the market (M.A Qureshi-2009).

One of the important questions that has been asked throughout the last century is; how do firms finance their operations and whether there exist an optimal way for firms to finance their operations. Similarly, lot of work has been done to identify the factors that influence a firm's choice of financing. To begin with, Weston & Brigham (1981) inquired whether it was possible to develop a "reasonable theory" that explains these questions. Since then, a large number of theories have been advanced in order to explain these questions.

Myers in his article in 1984 makes a contrast between two influential perspectives on debt, known as trade-off theory and pecking order theory. Though, he presents them as "broad organizing frameworks" only. Further he opined that changes in capital structures convey signals to the company's investors. This will be studied later in the chapter again. These contributing factors can also be seen as a part of a much larger picture that determines a firm's capital structure (Frank & Goyal-2008).

There exists other theories like signalling (Ross-1977) and market timing theory (Baker and Wurgler-2002) which aim to explain the choice of capital structure. The problem we still face today is that, can these theories individually explain important facts about capital structure that a firm face in the real world?

Economists worldwide agree upon the importance of capital structure, but still a comprehensive model of capital structure is lacking that can account for all the empirical findings. All the existing models are able to explain some of the known stylized facts, while contradicting one with others, at times. Coming to the real issue, one has to examine the role of debt and equity to form some reliable opinion.

### *Does debt policy matter?*

A firm's asset generates its cash flow. If the firm is only financed by equity (common stock and retained earnings), this stream of cash flows goes entirely to the shareholders. However when the financing is a mixture of debt and equity, this stream of cash flow is divided into a secure stream to debt holders and a riskier one to shareholders. 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 research on the topic of capital structure is an effort to find out the optimal combination of debt and equity that maximizes a firm's value.

To analyse the issue further, the researchers have studied both perfect and imperfect markets.

## 2.2 Capital structure in a perfect market

The available data suggests that Modigliani & Miller in 1950's rigorously studied capital structure theory. They proposed two propositions for capital structure irrelevance in a perfect market. They suggested that Markets are perfect when there are no transaction and bankruptcy costs and no information asymmetry. Any deviation from the perfect market can be fixed with financial innovation. Their propositions to explain this complex issue are given below.

### A. MM proposition 1:

Modigliani & Miller (1958) came up with the idea that the mix of capital structure perhaps doesn't matter. By using arbitrage arguments, they proved that in a perfect capital market, the source of financing does not have any effect on the availability & cost of financing and ultimately on the value of the firm. The proposition assumes that there are no taxes, no bankruptcy costs involved. According to Modigliani & Miller cost of capital remains unaffected with the choice of financing. The weighted average cost of capital  $r_A$  is a standard tool to measure the cost of overall firm's financing. It is a combination of weighted average cost of debt  $r_D$ , cost of equity  $r_E$ , Market value of debt and market value of equity.

Weighted average cost of capital ( $r_A$ ) =  $r_D * (D / V) + r_E * (E / V)$

$r_D$  = rate of return demanded by debt investors of the company

$r_E$  = rate of return demanded by the equity investors.

Cost of debt is always low as compare to equity since debt holders have claim on company's assets prior to equity holders. This fact neutralises the effect of high equity cost and overall financial mix.

### B. MM proposition 2:

"The cost of capital of levered equity increases with the firm's market value debt-equity ratio." (Berk & DeMarzo-2007, s. 461)

Three years later (1963) Modigliani and Miller modified their proposition 1. They proposed that debt issues have implicit and explicit costs. *Explicit cost* is the interest rate charged for issuing debt and *implicit cost* is the increased financial riskiness of the firm due to increased leverage. These extra costs makes the shareholders to demand increase in rate of equity that is the increased return on their investment. This implicit and explicit costs together makes the choice of debt financing no cheaper than equity and the return demanded by the investors on their investment is unaffected by the choice of capital structure (Brealy, Myers, & Marcus, 2007)

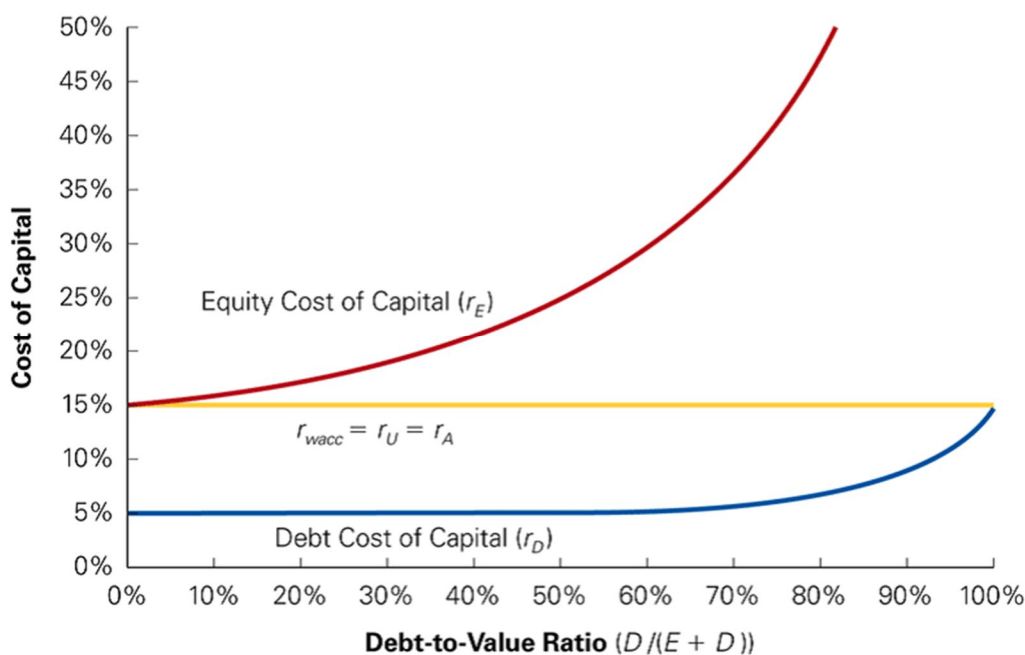


Figure 1: WACC and Leverage with Perfect Capital Markets (Source: Berk & DeMarzo, 2007)

Capital structure does matter!

The selection of optimal combination of debt and equity in capital structure does matter. The reason to understand MM 1 argument and the assumptions it is based on is to understand why one capital structure mix is better than another (Brealey et.al.-2013). It is important to be aware of all the market imperfection that possibly exists. Such imperfections account for corporate taxes (Modigliani and Miller-1963), bankruptcy costs (Stiglitz-1972; Titman-1984), agency costs (Jensen and Meckling-1976; Myers-1977), personal taxes (Miller-1977) and information asymmetries (Myers-1984; Myers and Majluf-1984).

These imperfections lays the foundation for modern thinking on capital structure by relaxing the unrealistic assumptions of MM theorem, that brings forward three basic theories of capital mix- Trade off theory, Pecking order theory and market timings theory. Factors that are assumed to determine capital structure are related to these imperfections.

There are different types of decisions regarding leverage that the companies needs to make including level of leverage, adjustment of leverage overtime, either use book value or market value of debt and short term or long term debt. Few researchers have suggested that debt should not be treated uniformly (Rauh and Sufi-2010). Therefore companies differentiate between long-term debt and short-term liabilities (Eidem, Halvorsen and Vold - 2010).

## 2.3 Capital structure in imperfect markets

Since perfect markets are not a reality in a practical world. There are three basic theories that explain capital structure in imperfect markets including trade-off theory, pecking order theory and market timings theory.

### 2.3.1 Trade-off theory

“...Total value of a levered firm ( $V_L$ ) equals the value of the firm without leverage ( $V_U$ ) plus the present value of the tax savings from debt minus the present value of financial distress costs” (Berk and DeMarzo-2013, p. 574).

$$V_L = V_U + PV(\text{Interest Tax Shield}) - PV(\text{Financial Distress Costs})$$

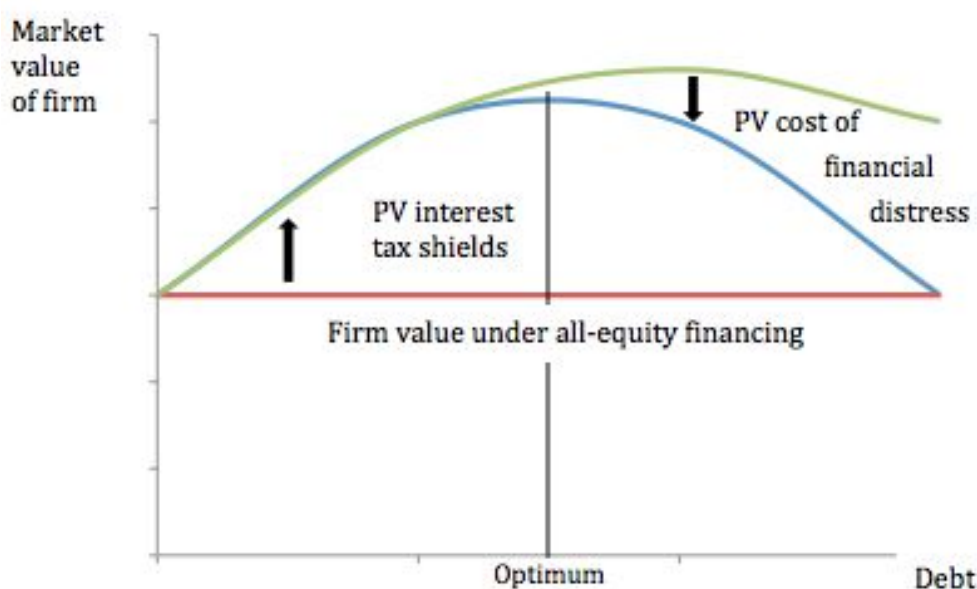


Figure 2: Static trade off theory of capital structure (source: Stewart C. Myers–1984)

To attain maximum firm value, it needs to operate at the top of the curve.

According to Myers (1984), increased leverage leads to the risk of financial distress. With the increased riskiness, the value of the firm decreases and the cost of capital increases.

An optimal capital structure on the other hand is a trade-off between cost of financial distress and tax benefits of debt. Companies should go for optimal debt ratio (Frank and Goyal, 2008) however levels of optimal debt ratios vary across firms and industries depending on their tax levels and bankruptcy costs.

### 2.3.2 Pecking order theory:

Financing behaviour is driven by adverse selection and information asymmetry costs. According to pecking order theory, firms first of all prefer internal financing (depreciation, retained earnings and cash). Adverse selection cost is minimum in this case. When internal financing is exhausted and external financing is required, their second preferred choice is debt financing because of low information &

adverse selection cost and finally their last resort in case of more financing requirements is equity financing as the cost is too high— Myers(1984)

Since equity is subjected to high adverse selection costs, it is considered an extremely risky option from the investor point of view as compare to debt financing which bares fewer information asymmetry costs and fewer risks for the investor. Both financing options offer adverse selection risk premium but equity option being more risky offers higher risk premium than debt financing. So the outside investor demands higher rate of return on equity than on debt.

The concept of *information asymmetry* is that the firm managers have superior information than investors. This concept results into downgrading of equity prices in the market prior to the event of equity floatation. Shares are undervalued so with the issuance of new equity the value transfers from existing investors to new investors. On the other side, if shares are overvalued then the value transfers other way round. Freedenberg (2004) finds strong support for pecking order theory in his study on Norwegian manufacturing firms.

### **2.3.3 Market timing theory**

Firms attempt to time the raising of their capital through external financing. The concept has become more popular in recent years (Baker and Wurgler-2002). At the time of financing, managers evaluate between equity and debt and select the one that is most suitable at that time. The theory also suggests that managers avoid external financing if either of the financing sources is not favorable. Contrary, they may raise capital if the market conditions are favorable, despite no need for external financing.

### 3 Previous Empirical research on Capital Structure

*Followed by the theoretical framework discussed in the previous chapter, this chapter provides an overview of previous empirical research on the topic of capital structure. The findings of both international studies as well as studies based on Norwegian firms are presented below.*

Along with the great amount of theoretical work on the topic of capital structure, a lot of empirical work has been done to support or negate theories of capital structure and to find a perfect framework of capital mix. Though various quantitative analyses have been presented but no theory completely explains the actual practice of capital structure of companies in the market.

In an extensive quantitative survey, Graham and Harvey (2001) found that managers are less likely to follow the theoretical recommendations of optimal capital structure; rather they opt for flexible to somewhat tight debt equity ratio. It was found that managers follow informal criteria like financial flexibility and credit ratings as most important factors while deciding debt policy. On the other hand while deciding for equity issuance, earnings per share and share price appreciations are considered most important. A similar kind of survey has been performed by Henriksen and Stjern (2008) on Norwegian listed firms. They found results similar to the results of Graham and Harvey (2001)

One of the empirical contributions is to perform cross sectional tests among variables to discover important determinants of capital structure (CS). Proxies for the variables are influenced by the theories of capital structure (CS). A number of internal (firm level) and external (industry and country level) variables influence the capital structure choice of companies (Titman and Wessels, 1988; Harris and Raviv, 1991; Frank and Goyal, 2009; Antoniou et al, 2002)

Titman and Wessels (1988) introduced a model to present determinants of capital structure in US listed industrial firms from 1974-1982 and found that firm past profitability and uniqueness are negatively related to debt, while firm size positively related to long term debt and inversely correlated with short term debt. They did not find any significant relationship between debt and growth, non-debt tax shield and tangibility.

Frank & Goyal (2004) in their comprehensive analysis of determining statistically significant factors on publicly traded US firms from 1950- 2000 presented negative relation of profitability and dividend, while tangibility, size and inflation are positive with respect to leverage. Their results did not support pecking order theory.

A similar kind of study on panel data of Canadian non-financial companies by Nunkoo & Boateng (2009) found profitability and tangibility have positive effect, while size and growth have negative effect on leverage.

### 3.1 Multinational corporations versus domestic corporations

Most of the empirical literature has ignored additional international factors that can affect choice of capital structure for multinational and domestic corporations (Burgman-1996). A firm is multinational when it operates in multiple countries and it has opportunity to obtain finances through domestic and international sources. Multinational corporations (MNCs) operate in perfectly correlated economies so they are high in diversification (Burgman-1996). They are diversified in terms of nature of business, customer base and labour etc.

Studies on the comparison of financial policies of multinational firms with domestic firms believe that global factors influence financial leverage (Burgman-1996; Chen; Mansi; Reeb-2002; Desai et al.-2004)

Traditional paradigm of trade-off between tax shield and bankruptcy cost suggest MNCs have low bankruptcy cost and ultimately high level of debt. International activity increases firm leverage (Mansi and Reeb-2002). Contrarily empirical evidence suggests the opposite (Lee-1986; Fatemi-1988; Lee and Kwok-1988). Multinational companies have usually low leverage ratio as compare to domestic firms. The possible explanation is high cost of capital due to agency problems, political risk, differences in applied taxes and exchange rate risk (Lee and Kwok -1988, Burgman -1996 and Chen et al. -1997). This is called “cost of foreignness” .Some studies also suggest that MNCs use more short term financing (Fatemi-1988).

International factors like foreign exchange and political risk; diversification and agency costs have not been tested on Norwegian market so far. I would address the factors of agency cost and exchange rate for MNCs operating in Norwegian market and on local Norwegian firms to test their effect on capital structure.

### 3.2 Role of countries on financing policies

Country specific factors may also influence the capital Structure of companies (Booth et al., 2001; Bancel and Mittoo-2004; Antoniou et al.-2008; Beck et al.-2008; de Jong et al.-2008, Rajan and Zingales-1995).

Bancel and Mittoo, (2004) surveyed CFO’s (chief financial officers) of 16 European countries to study their choice of capital structure. Interestingly they found a clear difference of capital structure preferences between Scandinavian and non-Scandinavian countries. They found that managers in European countries have unconventional determinants for capital structure selection. The most significant factor is financial flexibility and earning per share values are primary concerns.

Using panel data from 1969-2000 on French, British and German companies, Antoniou et al. (2002) found positive relation between size and leverage. It means that financing through leverage increases with the increase in size of the firm, whereas leverage decreases with growth of the companies.

Macroeconomic factors also have influence on leverage. Factors like, GDP growth rate, Inflation,



exchange rate risk, bonds and equity market development. Stronger the bond market of a country, higher the leverage ratio of the companies as issuing and trading bonds is easier. And stronger the equity market, lower is the leverage ratio De Jong et al. (2008)

### 3.3 Empirical studies on firms operating in Norway

A modest number of empirical studies have been carried out on Norwegian private and public firms. Study by Eduardo K. Kayo and Herbert Kimura (2010) showed mean and standard deviation of leverage (LTD/TA) for different countries. As a mean debt statistic of Norway they reported long term debt ratio of 18% with respect to total assets.

Empirical work of Frydenberg (2004) on capital structure of Norwegian manufacturing industry from 1990-2000 finds significant support for pecking order theory. He reported ratio of ST debt to total debt (STD/TD) as 58% and LT debt to total debt (LTD/TD) as 50%. The study provides interesting and relevant results, which are in line with my research. He has also applied same definition of leverage as short and long term. His findings suggest that Norwegian companies opt to have more short term than long-term debt. He suggests that large firms tend to decrease their debt with high current profitability whereas; they increase their LT debt and decrease ST debt with large amount of fixed assets. Like tangibility (large fixed assets) same are the findings for non-debt tax shield.

Mjøs (2007) is the first to present detailed description of capital structure in large Norwegian private and public companies for the period 1992-2005. His definition of leverage is also in line with Frydenberg and mine, by segregating data into local Norwegian and foreign firms. He reports that firms are heterogeneous and show variability in the choice of capital structure. Big Listed firms generally have better access to outside capital mainly due to lower information asymmetry. From listed companies he found that leverage increase with size and tangibility. It decreases with profitability and interest rate levels. Listed foreign companies rely on equity markets for outside financing.

In one of the recent studies on capital structure of Norwegian firms by I.G De Olalla (2016), he divides firms into three groups depending on their total equity from the period 2000 to 2011. He also uses the same definition of leverage as long-term debt to total assets like previous studies of Myøs and Frydenberg. In order to find the core model containing only significant explanatory variables, he passes a series of filters by excluding factors with lowest t-statistics. According to his findings; risk of sales, tangibility and firm size (log of assets) are the core determining factors for leverage (LTD/TA) in capital structure of large listed firms. Most of his results comply with the results of previous empirical findings on significant determinants of capital structure, except for profitability. Leverage is always reported to decrease with the increase in profitability both for Norwegian and American listed firms, however I.G De Olalla reports the coefficient of profitability to be positively related to leverage.



Findings by Mjøs, Frydenberg and I.G De Olalla are most relevant for my research during this project. Following de Jong et al. (2008), I include GDP per capita growth rate in my study to check the effect of countries economic conditions on leverage rate.

## 4 Chosen variables

*After analysis of past empirical studies on determinants of capital structure in international and Norwegian corporations, I have selected a number of variables that are most suitable for the current study. This chapter would discuss all the chosen dependent and independent variables separately.*

I intend to examine the capital structure among domestic and foreign firms by regressing the effect of selected determining independent variables on two dependent variables separately. Depending on expected economical relevance and inspired by the findings of past literature, I have selected 15 Characterizing variables. To get results that are comparable to earlier studies, I limit the analysis to the more conventional measures found in the literature. Information on selected dependent and independent variables is presented in Table 1

### 4.1 Dependent variable

The given definition of dependent variables are in line with the previous empirical studies of Fredenberg (2004), Mjøs (2007) and I.G De Olalla (2016) on Norwegian listed firms. These variables are:

#### 4.1.1 Long term debt

It is the ratio of interest bearing long-term debt to total assets of the firm (LTD/TA).

#### 4.1.2 Short term debt

The type of interest bearing debt that is usually returned within a year. It is a kind of temporary debt that is used to meet short-term needs. It is the ratio between short-term debt and total assets (STD/TA).

### 4.2 Independent variables

After detailed study of past empirical research I choose to proceed with selected independent variables that are most common in past empirical studies of capital structure and most relevant to Norwegian market. External factors include exchange rate, inflation rate and GDP growth rate. Internal factors include firm level factors. There are a total of 12 independent firm level factors including tax shield, probability of bankruptcy, business risk, non debt tax shield, agency cost, growth, current and past profitability, liquidity, tangibility, firm size and dividend pay-out ratio.

## *Hypothesis*

Each variable below would be followed by 4 hypotheses for STD and LTD with further distinction for domestic and foreign firms. Hypothesis is based on the theories and past empirical studies presented in chapter 2 and 3 on firms' capital structure. It is not based on the conventional method of relating the signs of the coefficients with theories of POT and TOT, since different writers of past empirical studies have interpreted signs of the coefficients differently to POT and TOT, which makes the interpretation of the results confusing. Therefore, I have based my hypothesis on the expected signs from previous empirical results of mainly Norwegian studies and also international studies. It would be finally accepted or rejected after the final results of regression presented in chapter 7.

**Table 1: Independent variables, parameter name and proxy**

<b>Variable</b>	<b>Variable name</b>	<b>Parameter</b>	<b>Proxy</b>
Firm level			
Independent variables	Tax shield	TS	Tax payments gross profit
	Probability of bankruptcy	Z	Altman's Z-score
	Business risk	BR	%Change in (net profit before tax/total assets)
	Non debt tax shield	ND	Depreciation expenses/Total assets
	Agency cost	AC	Operating expenses/sales
	Growth	G	%Change in total assets
	Current profitability	CP	Net profit before tax /total assets
	Past profitability	PP	Retained earnings/total assets
	Liquidity	L	Current assets/current liabilities
	Tangibility	TAN	Net fixed assets/total assets
	Firm size	S	Ln(total assets)
	Dividend payout ratio	DPR	Dividend paid/total equity
	Market to book ratio		
Country level	Inflation rate	INF	Annual inflation (consumer prices) rate
Independent variables	Exchange rate	EXR	Ln (yearly average exchange rate)
	Economic growth	EGR	Annual per capita GDP growth rate
Dependent variables	Long term Liability ratio	LTD/TA	Ratio of long-term debt to total assets
	Short term Liability ratio	STD/TA	Ratio of short-term debt to total assets

### 4.2.1 Firm level Variables

These are the internal factors that are controllable by managers to some extent. Twelve firm level independent variables are discussed below.

#### 4.2.1.1 Agency Cost (AC)

In 1776 Adam Smith expressed in his book “The wealth of nations”, how one can better take care of his own finances than someone else does. This concept laid the foundation for Agency theory. The “principal agent theory” by Jensen and Meckling in 1976 is the land mark for the formation of today’s modern agency theory.

Separation of principal (owners) and agent (managers) create the value bias for the firm particularly when they have varying interests concerning financing and investment decisions related to the firm and maximizing profit for owner is not in the primary interest of the manager. These decisions affect Principal differently than the agent. (Berle and Means-1932)

There are three components of agency costs (Goergen-2012):

- *Monitoring costs*: These are the costs incurred to keep check and balance on the managers and to avoid their unwanted behaviour.
- *Bonding costs*: These costs are incurred to make sure that managers are acting in the best interest to the owners.
- *Residual loss*: Costs due to lost opportunities when managers may not invest in the best possible way that can maximise benefit for the owners. It also includes over and under investments that managers do on behalf of shareholders but these investments are not made with intention to maximize owner’s profitability.

Firm transparency also has effects on agency costs. Firms that are less transparent, face the problems of more agency costs. Information asymmetry is another factor that contributes to agency costs when there is information gap between owners and managers. The free cash flow theory further explains how managers for their own interests can exploit the free availability of finances. Especially when the incentives and interests of managers contradict with the owners to transfer free available cash to the owners in the form of dividends rather use it for their own personal gains (Michael Jensen-1986). For this reason it is suggested that minimum possible free cash flow should be available in the hands of managers.

Looking closely into the relationship of agency costs to leverage, studies reveals positive relationship between the two. It means higher the agency costs, more the shareholders would opt to source finances through debt financing. It is used as a governance mechanism for managers. It is a way to discipline managers by restricting free available cash flow at the disposal of managers. In the case of debt financing,

the company is liable to pay interest to creditors prior to any other expenses. It prevents the available resources from being exploited in the hands of managers either for their personal use or by over investing in unfavourable projects. Jensen (1986) Financing through Debt should be set at a level where managers are encouraged to invest in feasible projects with positive net present value (NPV) in addition to finance existing ones. (Tirole, 2006).

In the perspective of DCs and MNCs, agency cost is a significant factor while selecting optimal debt level. Higher the agency cost, lower are debt ratios (Lee and Kwok-1988) Costs includes monitoring, labour market imperfections, advertisement and marketing, higher auditing costs, cultural & language differences and higher costs of information asymmetry.

### ***Hypotheses***

1. H<sub>0</sub>: AC has a negative effect on LTD in foreign firms.
2. H<sub>0</sub>: AC has a positive effect on LTD in domestic firms.
3. H<sub>0</sub>: AC has a negative effect on STD in foreign firms.
4. H<sub>0</sub>: AC has a positive effect on STD in domestic firms.

#### ***4.2.1.2 Business Risk (BR)***

Volatility in EBIT (Earnings before interest and taxes) increases the risk factor so therefore lenders demand higher premiums that make debt option less attractive for firms.

Risks have various forms. One of them is political and exchange rate risk for foreign companies operating in a risky company. When theories are suggesting negative relationship between risk and leverage, empirical evidence suggest the opposite for MNCs (Burgman, Todd A.-1996)

### ***Hypotheses***

1. H<sub>0</sub>: BR has a positive effect on LTD in foreign firms.
2. H<sub>0</sub>: BR has a negative effect on LTD in domestic firms.
3. H<sub>0</sub>: BR has a positive effect on STD in foreign firms.
4. H<sub>0</sub>: BR has a negative effect on STD in domestic firms

#### ***4.2.1.3 Probability of bankruptcy (Z)***

Altman Z score is the formula for predicting probability of bankruptcy for a firm. A form of credit strength test developed specially for publically traded manufacturing companies. The formula is comprised of five ratios that can be calculated by data fetched from company's annual financial statement.

$$Z\text{-Score} = 1.2A + 1.4B + 3.3C + 0.6D + 1.0E$$

A = Working Capital/Total Assets

$B = \text{Retained Earnings/Total Assets}$

$C = \text{Earnings Before Interest \& Tax/Total Assets}$

$D = \text{Market Value of Equity/Total Liabilities}$

$E = \text{Sales/Total Assets}$

It is helpful for investors to evaluate company's strength when they are interested to invest in its equity. If the score is below 1.8, the probability for bankruptcy is high. While score above 3.0 indicates low risk of bankruptcy.

### ***Hypotheses***

1.  $H_0$ : Z has a negative effect on LTD in foreign firms.
2.  $H_0$ : Z has a negative effect on LTD in domestic firms.
3.  $H_0$ : Z has a negative effect on STD in foreign firms.
4.  $H_0$ : Z has a negative effect on STD in domestic firms

#### *4.2.1.4 Current profitability (CP) and Past profitability (PP):*

Profitability and debt financing have negative relationship (Titman and Wessels 1988; Rajan and Zingals, 1995; Fama and French 2002; Hovakimian et al 2004) Profitable Companies generate enough cash that can be used as internal financing prior to looking for external sources of finance. This is in accordance to POT.

The models of Myers and Majluf (1984) predicts that companies have tendency to rely on internal sources and increase external financing if required, they prefer debt over equity in order to finance positive NPV projects. Their model further predicts negative relationship between Current and past profitability with leverage.

According to the theory of optimal capital structure, more profitable firms have more supporting income. They are exposed to high tax rates and the rate of bankruptcy is low. The book value of debt ratio is positively correlated with EBIT value. This type of firm formation highly supports POT (Baskin-1989)

The published statistical studies show strong support for negative relationship between firm's current and past profitability with leverage. Regression of leverage with profitability provides significant negative coefficient (Arditti, Hall and Weiss, Gale, and Baker)

Toy, et al. performed an empirical study on the data of five different countries USA, Norway, Holland, Japan and France. In the regression of liabilities to total assets as dependent variable and profitability as independent variable (EBIT/TA). In all the countries except France coefficient of profitability is significantly negative.

However on the *contrary* according to Trade-off theory a positive relationship exists between profitability

and leverage ratio. (Shyam-Sunder and Myers-1999; MacKay and Phillips-2001) Profitable companies generate excess cash that can lead to high agency costs. When managers use that cash inefficiently and ineffectively, debt financing helps to combat this issue (Jensen-1986)

### ***Hypotheses***

1. H0: CP has a negative effect on LTD in foreign firms.
  2. H0: CP has a negative effect on LTD in domestic firms.
  3. H0: CP has a negative effect on STD in foreign firms.
  4. H0: CP has a negative effect on STD in domestic firms
- 
1. H0: PP has a negative effect on LTD in foreign firms.
  2. H0: PP has a negative effect on LTD in domestic firms.
  3. H0: PP has a negative effect on STD in foreign firms.
  4. H0: PP has a negative effect on STD in domestic firms

#### ***4.2.1.5 Tangibility (TAN)***

The capital structure of the firm in many ways is affected by the type of assets it owns. It is beneficial for the firms to sell secured debt (Myers and Majluf-1984). The empirical studies bring forth positive relationship between firm's net fixed assets and amount of leverage for financing beneficial projects. Information cost incurred by the issuance of securities can be avoided by issuing debt secured by the property whose value is known (Firms that have fixed assets in hands that can work as collateral tends to issue more debt as compare to equity in order to take advantage of this opportunity (If the debt is collateralized then the borrower is bound to invest in positive projects (Galai and Masulis-1976, Jensen and Meckling-1976, and Myers-1984). This is in accordance to TOT. POT makes the opposite prediction. More tangible assets reduce the information asymmetry level and equity becomes cheaper (Harris and Raviv, 1991).

### ***Hypotheses***

1. H0: TAN has a positive effect on LTD in foreign firms.
2. H0: TAN has a positive effect on LTD in domestic firms.
3. H0: TAN has a positive effect on STD in foreign firms.
4. H0: TAN has a positive effect on STD in domestic firms

#### 4.2.1.6 *Dividend pay out ratio (DPR)*

There exists a strong positive relationship between past dividend rate and current leverage that supports POT. Empirical studies reveal a positive relationship of past dividend with leverage in developing countries (M.A Azeem)

The hypothesis that Payment of past dividends indicates the funding burden on the corporation and increase future cash needs with ultimately leads to greater borrowing and high debt ratios. It was empirically tested and confirmed by Baskin-1989.

However TOT supports either negative or insignificant relationship between the two (Baskin-1989).

#### ***Hypotheses***

1. H<sub>0</sub>: DPR has a positive effect on LTD in foreign firms.
2. H<sub>0</sub>: DPR has a positive effect on LTD in domestic firms.
3. H<sub>0</sub>: DPR has a positive effect on STD in foreign firms.
4. H<sub>0</sub>: DPR has a positive effect on STD in domestic firms

#### 4.2.1.7 *Firm Size (S)*

Large firms are more diversified; more stable with stable capacity to payback debt therefore probability of bankruptcy is low (Titman and Wessels, 1988). TOT predicts a positive relation between leverage and size.

Pot predicts the opposite relation. Large firms are followed by analysts when the market value of equity is high (I.G De Olalla, 2016). Large firms also have less problems of information asymmetry. That makes equity financing more attractive option for firms to raise funds.

#### ***Hypotheses***

1. H<sub>0</sub>: S has a positive effect on LTD in foreign firms.
2. H<sub>0</sub>: S has a positive effect on LTD in domestic firms.
3. H<sub>0</sub>: S has a positive effect on STD in foreign firms.
4. H<sub>0</sub>: S has a positive effect on STD in domestic firms

#### 4.2.1.8 *Growth (G)*

According to TOT, negative relation between leverage and high growth firms are predicted by previous studies (Frank & Goyal-2005-2009) In case of bankruptcy, high growth firms loose more of their value as compare to mature firms.

POT suggests opposite. High growth firms have greater needs for funding positive investment opportunities therefore the debt level is higher for high growth firms (Chen-2004; Booth et al.-2001)

### ***Hypotheses***

1. H<sub>0</sub>: G has a positive effect on LTD in foreign firms.
2. H<sub>0</sub>: G has a positive effect on LTD in domestic firms.
3. H<sub>0</sub>: G has a positive effect on STD in foreign firms.
4. H<sub>0</sub>: G has a positive effect on STD in domestic firms

#### ***4.2.1.9 Liquidity (L)***

Liquidity is defined as availability of current assets. These assets can be used to cover current liabilities. It shows that firm has ability to meet short-term obligations. Therefore POT suggests negative relation between liquidity and leverage. Assets that are liquid or can be easily converted into cash reduces risk for investors that allows firms to take long-term debt.

### ***Hypotheses***

1. H<sub>0</sub>: L has a negative effect on LTD in foreign firms.
2. H<sub>0</sub>: L has a negative effect on LTD in domestic firms.
3. H<sub>0</sub>: L has a negative effect on STD in foreign firms.
4. H<sub>0</sub>: L has a negative effect on STD in domestic firms

#### ***4.2.1.10 Non debt tax shield***

TOT predicts leverage to be negatively related to non-debt tax shield i.e. depreciation. When depreciation costs are high, they can be used to reduce tax therefore debt option is less attractive (Titman & Wessels-1988). On the contrary, positive relationship points out towards company's efforts to reduce tax as much as possible.

### ***Hypotheses***

1. H<sub>0</sub>: ND has a negative effect on LTD in foreign firms.
2. H<sub>0</sub>: ND has a negative effect on LTD in domestic firms.
3. H<sub>0</sub>: ND has a negative effect on STD in foreign firms.
4. H<sub>0</sub>: ND has a negative effect on STD in domestic firms

#### ***4.2.1.11 Tax shield***

With the increase in effective tax rate, external borrowing of the firm increases. Firms would finance through leverage because of tax deduction of interest payments Mayers and Majluf (1963). Therefore a positive relation exists between tax shield and leverage according to TOT. This factor laid the foundation for capital structure theory.



## ***Hypotheses***

1. H<sub>0</sub>: TS has a positive effect on LTD in foreign firms.
2. H<sub>0</sub>: TS has a positive effect on LTD in domestic firms.
3. H<sub>0</sub>: TS has a positive effect on STD in foreign firms.
4. H<sub>0</sub>: TS has a positive effect on STD in domestic firms

### ***4.2.2 Country level variables***

These are the external factors that are not controllable by managers. I have selected three external country level variables explained below.

#### ***4.2.2.1 Economic growth (EGR)***

Under TOT, economic growth i.e. per capita GDP growth rate should affect leverage ratio positively. Companies borrow more when the economy has a growing trend because the probability of bankruptcy decreases, taxable income increases. Derived from the study of I.G. De Olalla, positive relation is expected from the current study.

POT argues negative relationship. Under economic growth, firms have high profitability that allows availability of more internal funds. According to POT, firm prefer internal funds.

## ***Hypotheses***

1. H<sub>0</sub>: EGR has a positive effect on LTD in foreign firms.
2. H<sub>0</sub>: EGR has a positive effect on LTD in domestic firms.
3. H<sub>0</sub>: EGR has a positive effect on STD in foreign firms.
4. H<sub>0</sub>: EGR has a positive effect on STD in domestic firms

#### ***4.2.2.2 Inflation rate (INF)***

According to TOT, higher inflation rate has positive effect on leverage. With the increase in inflation, companies opt to finance through leverage. The real value of tax deductions is higher when the inflation is higher. This is in compliance to Market Timings Theory, when inflation is high relative to interest rates, managers issue more debt since the payments would have lower real values. Again derived from the study of I.G. De Olalla, positive relation is expected from the current study.

## ***Hypotheses***

1. H<sub>0</sub>: INF has a positive effect on LTD in foreign firms.
2. H<sub>0</sub>: INF has a positive effect on LTD in domestic firms.
3. H<sub>0</sub>: INF has a positive effect on STD in foreign firms.
4. H<sub>0</sub>: INF has a positive effect on STD in domestic firms

#### 4.2.2.3 Exchange rate risk (EXR)

The traditional concept is that more sensitive the firm is to exchange rate fluctuations, the greater the expected cost of bankruptcy, which results into lower debt level. But on the contrary argument MNCs may opt for more debt ratios in order to hedge its transaction exposure to exchange rate fluctuations.

Another school of thought is that domestic corporations are more exposed to exchange rate fluctuations as compare to MNCs. For example if Norwegian kroner strengthens, MNCs can decrease their price of products and can still manage to maintain profits in their home currency. On the contrary if rate weakens, Norwegian companies that import foreign products loses their profit margins due to increase in cost of goods (Burgman, Todd A.-1996)

#### ***Hypotheses***

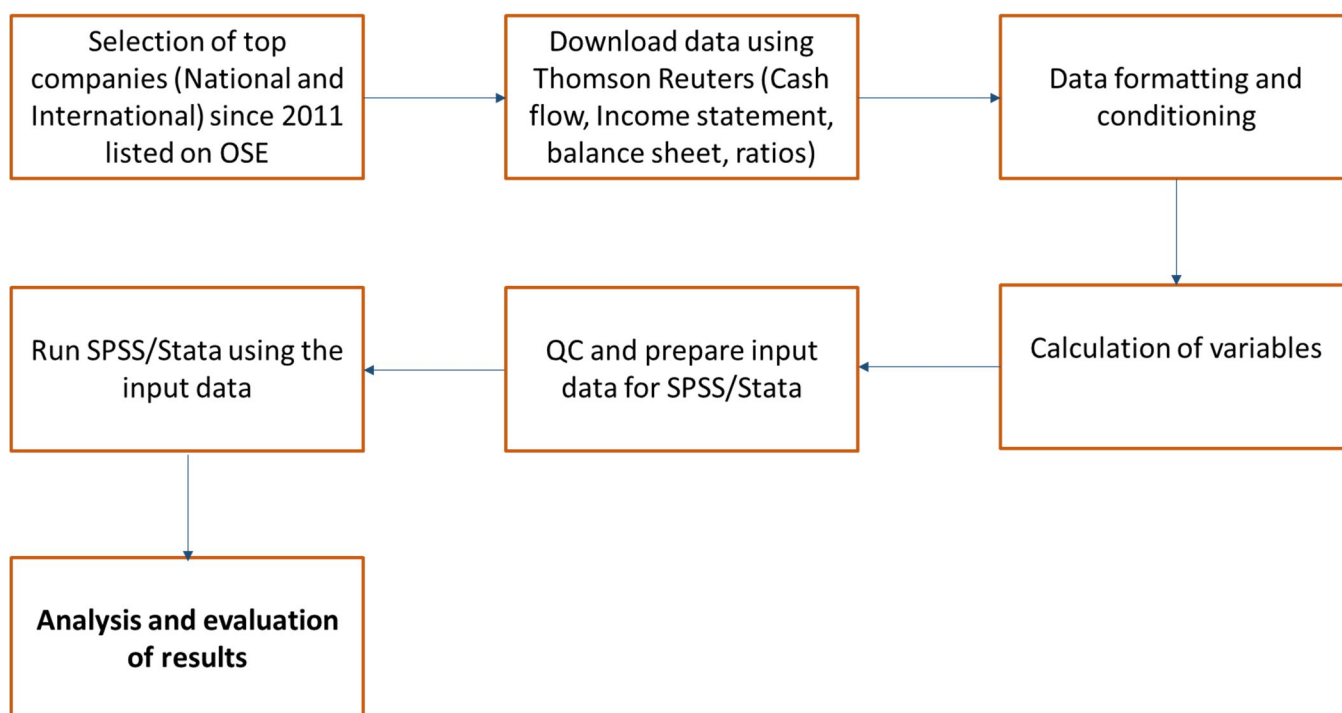
1. H<sub>0</sub>: EXR has a positive effect on LTD in foreign firms.
2. H<sub>0</sub>: EXR has a negative effect on LTD in domestic firms.
3. H<sub>0</sub>: EXR has a positive effect on STD in foreign firms.
4. H<sub>0</sub>: EXR has a negative effect on STD in domestic firms

## 5 Data

*The discussion of all the chosen dependent and independent variables leads to the discussion of collected data. This chapter would present information about sample data on which the whole analysis is based, the main steps involved and the quality of data. Information on missing data is also presented in detail.*

Data is the most critical part of any research as all the results depends on the authenticity and validity of data. Mainly seven steps have been followed in the process of handling data. Starting from collection, formatting, quality check and finally evaluation of results. Flow diagram showing all the steps is presented below.

### 5.1 Flow diagram



**Figure 3: Flow diagram demonstrating data flow and steps performed**

### 5.2 Selection of Data set

In order to carry out research, the first and most important step is to decide on data set and its time frame. There are basically three types of data sets widely classified for regression purposes. Cross sectional data, time series data and panel data. Cross-sectional data contains information of number of units at a certain time or time period. Time series data holds data of a unit for certain successive time periods. However, Panel data is a combination of both these. It contains data for multiple units for a multiple time intervals. I have chosen to conduct my research on panel data set.

### 5.3 Selection of Companies and corresponding data

In compliance to the empirical work of Graham and Harvey (2001) I would restrict my study of capital structure choice and its effective determinants with respect to largest 25 Norwegian and 25 foreign companies by market value of assets listed on Oslo stock exchange during the past five years from 2011 to 2015. Every year the ranking of the largest firms vary according to their total listed assets. Therefore it makes a total of 29 local Norwegian listed firms and 35 foreign firms that were ranked within top 25 listed companies from the start of year 2011 till the end 2015. The list of companies can be found in Appendix F.

The Study is performed on their reported quarterly financial data starting from the time the firm was registered on Oslo stock exchange. Some of the companies were delisted, bankrupted, acquired or merged during our sample period. Data of such companies included in the study is restricted to the years they were independently listed. Private companies are also not part of the sample. Fourth quarter financial results of 2015 for some companies were still due when the data was collected.

Firms quarterly financial quantitative data is taken from Thomson Reuters Data Stream. It is a secondary source of data that holds information, news and financial data of Norwegian and international firms operating in Norway. The system is accessible from computer lab at Høgskolen I Oslo og Akershus (HIOA).

The data collected from annual reports mainly contains income statement, balance sheet, cash flow statement and ratios of all the selected companies during selected sample years (2011-2015). For the purpose of this study, data has been downloaded, compiled, processed and organized in order to calculate the effect of selected determining dependent and independent variables on the capital structure. Data on these calculated variables is then run in two programs called SPSS and STATA to achieve statistical results.

Largest companies that holds minimum of ten quarterly observations are selected during my study sample years. Some companies have missing data of one or more than one factor, for more than two quarters at the beginning when they initially got listed. Such observations are kept blank instead of deleting all the values in those quarters, remaining values are preserved. The downloaded data further had some individual missing values and some extreme outliers. Such values are dealt with the method of winsorization at the top and bottom 1 percent of my sample to maintain the essence of data.

Initially financial firms including banks and insurance companies were taken as part of the sample but later they were removed because of large differences in their financial calculations and reporting methodology.

## 5.4 Missing Data

In the process of data collection it was observed that some data was missing and not reported in the annual statements of the firms. Especially a large amount of tax information was not reported by foreign firms. The missing information creates a challenge for the researcher in order to maintain the validity of research results. Here is an overview of missing values as per combined, domestic and foreign data sets separately.

### 5.4.1 Combined data set

Summary of missing values for the complete data set, including foreign and domestic firms is presented in a sequence of 3 pie charts. It represents the number and percentage of missing values.

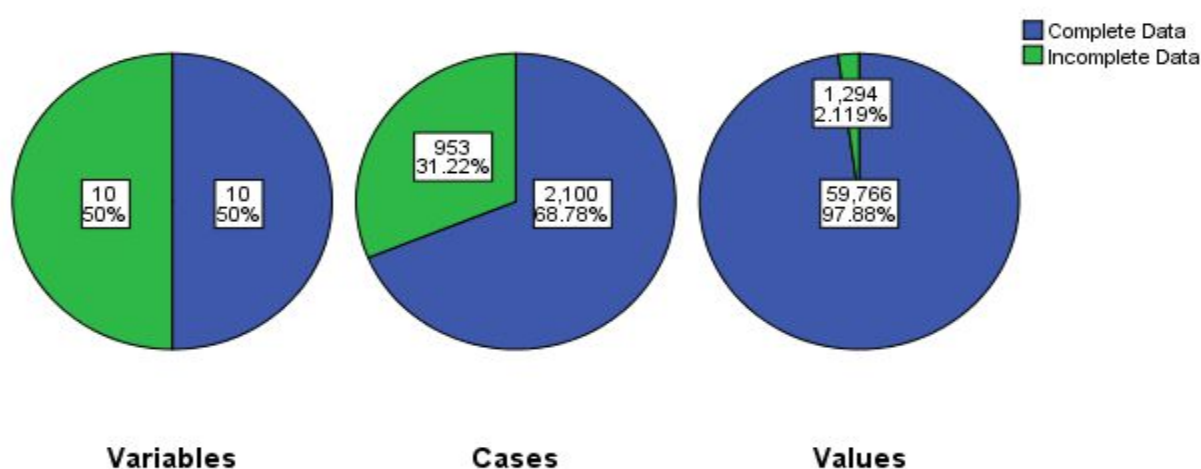


Figure 4: Summary of missing values - Combined data

The first chart shows that 50% of the variables have at least one missing value. The second chart shows the number of cases that have at least one missing value. In our middle chart around 31% cases have missing values. There are 3053 total cases or quarterly observations in which 2100 are complete cases with no missing values that makes around 68% of the whole sample. For the purpose of regression only those 2100 cases would be considered.

However as per the right hand pie chart, out of the total number of observations in the whole dataset, around 2% of values are missing. In empirical studies, 5% or less missing data is considered as normal. My data set is therefore normal with only 2% missing values.

The summary of missing values is presented in viation.

Table 2. Tax shield has the maximum number of values missing. Out of 3053 total tax shield quarterly observations, 597 are missing i.e. 19%. The basic reason is that most of the foreign firms did not report for taxes in their financial statement and some domestic firms too.

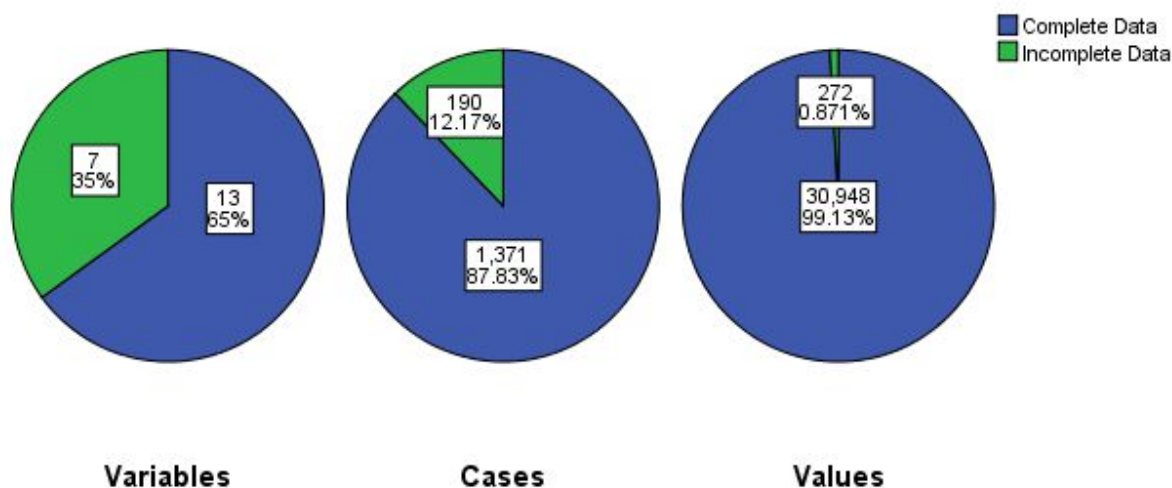
The three tables below Table 1 through 3 show the number of missing values, their percentage to the whole data set, remaining number of valid values, their mean and standard deviation.

**Table 2: Descriptive statistics for missing values of explanatory variables – Combined data set**

	Missing		Valid N	Mean	Std. Deviation
	N	Percent			
Tax shield	597	19.6%	2456	.159155	.8693355
Agency Cost	130	4.3%	2923	1.239292	5.2666670
Inflation Rate	128	4.2%	2925	.018906	.0096599
Economic Growth	90	2.9%	2963	-.001681	.0869731
Business risk	66	2.2%	2987	-.112312	5.5072433
Growth	63	2.1%	2990	-.010433	.4744587
Probability of Bankruptcy	35	1.1%	3018	1.693089	6.7688510
Dividend payout ratio	1	.0%	3052	230.011096	1705.8729189

### 5.4.2 Domestic

In the case when only domestic firms are considered, only 7 variables have some missing data which makes about 12% cases (quarterly observations). Overall less than 1% values are missing as a whole. So for the domestic firms, significant amount of data is available for calculations.



**Figure 5: Summary of missing values - Domestic data**

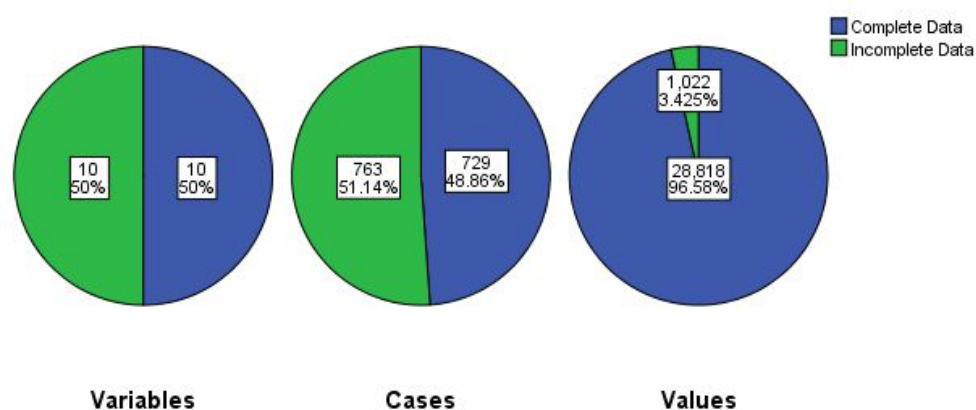
The table below reports individual variables with number and percent of missing values.

**Table 3: Descriptive statistics Domestic firms**

	Missing		Valid N	Mean	Std. Deviation
	N	Percent			
Inflation Rate	68 <sup>1</sup>	4.4%	1493	.018883	.0096659
Tax shield	52	3.3%	1509	.222184	.8816706
Agency Cost	32	2.0%	1529	.923306	.7524117
Business risk	31	2.0%	1530	-.040152	3.3726076
Growth	29	1.9%	1532	.025681	.1306366
Economic Growth	24	1.5%	1537	.003659	.1081111

### 5.4.3 Foreign

Foreign firms have the highest amount of missing data reported in their financial statements. 50% of variables reported quarterly have one or more missing values. All and all it is about 3.5% missing data which is still within the limit of 5% being considered so the data is considered valid. Overall there are 28,818 values available for calculations



**Figure 6: Summary of missing values - Foreign data**

As reported in the overall data, it is the reported taxes for foreign companies that have the maximum of missing values.

<sup>1</sup> Quarterly Inflation rate derived from ycharts.com is only available from 1997

Report for individual variables with missing values is presented in the table below.

**Table 4: Descriptive statistics foreign firms**

	Missing		Valid N	Mean	Std. Deviation
	N	Percent			
Tax shield	545	36.5%	947	.058721	.8400465
Agency Cost	98	6.6%	1394	1.585880	7.5718450
Economic Growth	66	4.4%	1426	-.007437	.0553247
Inflation Rate	60 <sup>2</sup>	4.0%	1432	.018929	.0096570
Business risk	35	2.3%	1457	-.188087	7.0883676
Probability of Bankruptcy	35	2.3%	1457	1.664975	9.4133272
Growth	34	2.3%	1458	-.048379	.6641271
Dividend payout ratio	1	.1%	1491	89.995973	461.7624170

## 5.5 Data Quality

Immense focus has been placed on the quality of data. I have performed various quality checks. It involves matching downloaded data from the source data stream to make sure that all the publicly available data is gathered correctly. All the values are taken in Norwegian kroners. Values available in any other currency form are converted to the standard according to the Norwegian conversion rate at that point in time. For example if a value on 31.12.2014 was in dollars, it is converted into Norwegian kroners according to the exchange rate on that date. The calculation of variables has also been checked at various occasions during calculations to maintain data quality. Listing dates of companies both domestic and foreign have been crosschecked from data stream Thomson Reuters and from the website of Oslo stock exchange. The compiled data holds only correct, reasonable and up to date information according to my knowledge and efforts.

After all these adjustments, the final data set holds 59,766 total observations, 2100 common quarterly cases without any missing value for the combined data set. These cases are finally taken as input for regression purpose. Domestic firms have 1371 and foreign have 729 cases as input for regression. There are 63 total firms, 34 foreign firms and 29 domestic firms. This is the complete data to be finally scrutinized in SPSS and STATA for statistical results.

<sup>2</sup> Quarterly Inflation rate derived from ycharts.com was only available from 1997



## 6 Methodology

*After proper collection and handling of data, the next step is to use statistical methodologies that are used to study and evaluate the characteristics of selected variables. This chapter presents different statistical techniques included are correlation, linear panel regression, pooled ordinary least square and two forms of effect models. For the selection of final model, several tests are performed to study data characteristics. In order to select the perfect model suitable on the given data, linearity and model tests are also performed.*

### 6.1 Correlation

Correlation of individual variable with other variables individually presents numerically quantifying association between them, the direction and strength of relationship between them and with leverage measures. The correlation coefficient always exists between -1 to +1 where -1 means perfect negative correlation and +1 means perfect positive correlation. 0 means there exists no linear relationship between the variables. The null hypothesis ( $H_0$ ) states that there is no correlation between the variables.

**Table 5: Correlation coefficients (own contribution based on Koop 2013)**

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

Three correlation matrices presented below in Table 6, Table 7 and Table 8, give an overview of correlation coefficient of the variables each for combined data set, domestic data and foreign data respectively. There are slight differences in correlations between variables in three different sets of data. Tangibility and long-term debt are moderately correlated in all three tables. It means there exists positive linear relation between the two. Use of panel data eliminates most of the collinearity between variables. But as the tables indicate, it is not a matter of concern for the current data set as collienarity between most of the variables is low.

It is worthy to note the negative relationship between firm size and probability of bankruptcy (Atman's Z score) for both domestic and foreign firms. This indicates that as the size of the firm (total assets) increases, the Z score decreases. When the score is low, probability of bankruptcy is high. Firms becomes riskier with respect to bankruptcy as they grow in size.

**Table 6: Correlation Matrix - Combined data set**

	Short term debt ratio	Long term debt ratio	Tax shield	Past Profitability	Probability of Bankruptcy	Growth	Current Profit	Business risk	Non debt tax shield	Agency Cost	Liquidity	Tangibility	Firm size	Exchange Rate	Inflation Rate	Dividend payout ratio	Economic Growth
Short term debt ratio	1,00																
Long term debt ratio	-,23	1,00															
Tax shield	,01	-,02	1,00														
Past Profitability	-,26	,02	,03	1,00													
Probability of Bankruptcy	-,23	-,26	-,03	,42	1,00												
Growth	,05	,02	,02	-,06	-,03	1,00											
Current Profit	-,16	-,04	,04	,40	,33	,05	1,00										
Business risk	,04	-,02	,02	-,01	,04	,00	,17	1,00									
Non debt tax shield	,10	-,04	-,01	-,05	-,04	-,08	-,26	,05	1,00								
Agency Cost	-,02	-,06	,00	,00	-,01	-,15	-,35	,00	,62	1,00							
Liquidity	-,23	-,15	-,01	,02	,47	,00	,07	,03	-,05	,01	1,00						
Tangibility	-,20	,55	-,04	,08	-,22	-,01	,00	-,07	,01	-,02	-,28	1,00					
Firm size	-,18	,17	,05	,36	-,10	-,01	,17	-,01	-,11	-,07	-,31	,28	1,00				
Exchange Rate	-,01	,10	-,03	-,05	-,05	-,01	-,07	-,04	,00	-,02	-,09	,06	-,01	1,00			
Inflation Rate	-,02	,03	-,02	,01	,00	,05	,02	-,02	,00	,02	-,03	,01	,03	,18	1,00		
Dividend payout ratio	-,03	-,03	,02	,03	,00	,01	,06	,01	,03	-,01	-,04	,06	,24	,02	,01	1,00	
Economic Growth	,00	,03	-,05	-,03	-,04	-,04	-,07	,02	,01	,02	-,03	,03	,01	,11	,13	,06	1,00

**Table 7: Correlation Matrix – Domestic data set**

	Short term debt ratio	Long term debt ratio	Tax shield	Past Profitability	Probability of Bankruptcy	Growth	Current Profit	Business risk	Non debt tax shield	Agency Cost	Liquidity	Tangibility	Firm size	Exchange Rate	Inflation Rate	Dividend payout ratio	Economic Growth
Short term debt ratio	1,00																
Long term debt ratio	-,26	1,00															
Tax shield	,01	-,04	1,00														
Past Profitability	-,35	-,16	,02	1,00													
Probability of Bankruptcy	-,14	-,30	,01	,16	1,00												
Growth	-,02	-,01	,03	-,05	,05	1,00											
Current Profit	-,13	-,12	,04	,20	,21	,04	1,00										
Business risk	,04	-,03	,01	,04	-,04	,00	,05	1,00									
Non debt tax shield	,02	,08	,00	-,14	-,01	-,01	,01	-,07	1,00								
Agency Cost	,12	-,13	,03	-,15	-,06	,03	-,47	,01	,04	1,00							
Liquidity	-,28	-,15	,01	,16	,42	,04	,08	-,03	-,17	,03	1,00						
Tangibility	-,16	,45	-,01	-,12	-,26	-,02	-,04	-,06	,35	,05	-,24	1,00					
Firm size	-,21	,15	,01	,18	-,18	-,14	,07	,02	,31	-,06	-,31	,38	1,00				
Exchange Rate	,03	,18	-,05	-,16	,04	-,05	-,12	-,04	,07	-,02	-,09	,12	-,10	1,00			
Inflation Rate	-,01	,04	-,01	-,03	,02	,07	-,01	-,01	-,01	,02	-,02	,00	,00	,18	1,00		
Dividend payout ratio	-,07	-,04	,02	,04	-,01	,00	,08	,01	,16	-,02	-,05	,12	,29	,03	,02	1,00	
Economic Growth	-,01	,00	-,07	,02	-,01	-,09	-,06	,01	,00	,02	-,03	,00	,03	,12	,16	,09	1,00

**Table 8: Correlation Matrix – Foreign data set**

	Short term debt ratio	Long term debt ratio	Tax shield	Past Profitability	Probability of Bankruptcy	Growth	Current Profit	Business risk	Non debt tax shield	Agency Cost	Liquidity	Tangibility	Firm size	Exchange Rate	Inflation Rate	Dividend payout ratio	Economic Growth
Short term debt ratio	1,00																
Long term debt ratio	-,19	1,00															
Tax shield	,00	,03	1,00														
Past Profitability	-,29	,11	,00	1,00													
Probability of Bankruptcy	-,28	-,23	-,08	,49	1,00												
Growth	,07	,06	,01	-,08	-,06	1,00											
Current Profit	-,19	,03	,02	,43	,36	,04	1,00										
Business risk	,04	-,02	,02	-,02	,07	,00	,21	1,00									
Non debt tax shield	,13	-,10	-,01	-,02	-,05	-,09	-,30	,07	1,00								
Agency Cost	-,03	-,06	,00	,01	,00	-,17	-,34	,00	,66	1,00							
Liquidity	-,22	-,14	-,05	-,03	,57	-,04	,07	,08	-,02	,02	1,00						
Tangibility	-,20	,59	,01	,33	-,18	,06	,13	-,08	-,14	-,09	-,37	1,00					
Firm size	-,22	,32	,06	,45	-,08	,03	,19	-,05	-,24	-,08	-,37	,53	1,00				
Exchange Rate	-,07	,06	-,01	-,06	-,14	,00	-,06	-,06	-,02	-,01	-,09	,06	,09	1,00			
Inflation Rate	-,04	,03	-,06	,03	-,02	,04	,04	-,04	,00	,02	-,05	,03	,06	,18	1,00		
Dividend payout ratio	,00	,06	,01	,04	-,02	,02	,06	,01	-,03	-,03	-,07	,10	,21	-,06	-,03	1,00	
Economic Growth	,01	,03	-,01	-,04	-,06	-,02	-,08	,03	,01	,03	-,04	,03	,01	,12	,11	,04	1,00

## 6.2 Linear panel Regression:

Regression analysis is the advance technique to evaluate the type, intensity and validity of relationship between two variables. The concept is to investigate how the value of one variable (dependent “Y”) is affected by one unit change in the other variable (independent “X”). A simple regression is a linear relationship between two variables. However when more independent variables are taken into account, it becomes a multiple regression model where independent variables jointly effect each other as well as dependent variable.

$$Y_{it} = \alpha + \beta_{1it}X_{1it} + \beta_{2it}X_{2it} + \dots + \beta_{kit}X_{kit} + v_{it} \quad i = 1, 2, \dots, N$$

Y= Dependent variable

X= Independent variable

$\beta$ = Coefficient of relationship between two variables

$\alpha$ = Constant. It is the value of Y when all independent variables are zero.

i=is the number of events, k=number of parameters

Linear regression method has a further special types called Pooled ordinary least square For panel data.

## 6.3 Pooled ordinary least square

This method provides consistent and valid estimates on panel data when there exists no cross sectional or time specific effects, which means there is no individual heterogeneity (Park-2011)

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

Where,

$Y_{it}$ = Dependent variable

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

$\beta_0$ = Intercept

$\beta$ = Vector of the independent variables coefficient

$\varepsilon_{it}$ = Error term where  $u_i = 0$

The error term,  $\varepsilon_{it}$  is expected to be independent and identically distributed. In a case where there is a presence of heteroscedasticity and autocorrelation in the residuals and the correlation between residuals and explanatory variables, this method provides biased results. This problem applies to a situation when it involves the study of capital structure with its vast number of variables. This brings us to make a choice between the other two most suitable models, fixed effect model and random effect model.

## 6.4 Fixed effect model

Fixed effect enables to account for any changes in variables over time within each firm. This model takes into account unobserved heterogeneity and decomposes residuals into two components. One accounts for the variation between different firms involved ( $u_i$ ) and second accounts for the remaining disturbance ( $e_{it}$ ).

$$Y_{it} = (\alpha + u_i) + \beta X_{it} + e_{it}$$

Where  $u_i$  ( $i=1..n$ ) is the fixed effect to be estimated

If there exists any correlation between independent variables and omitted variables, fixed effect model controls for it by treating  $u_i$  as fixed effect.

The unobserved effect is brought into the model by using least squares dummy variable (LSDV) estimation. These are the common estimators of fixed effect model. This technique involves a dummy variable that is responsible to provide fixed effect thus providing solution for the problem of omitted variables.

## 6.5 Random effect model

This model assumes that unobserved error terms are not correlated with independent variables and error variance estimated are specific to firms. Therefore  $u_i$  is a part of error term  $e_{it}$

$$Y_{it} = \alpha + \beta X_{it} + (e_{it} + u_i)$$

This means that difference between firms rather lie in their individual error term instead of intercept. This model is estimated by using Generalized Least Square (GLS).

## 6.6 Selection of model

For the current study, two types of models are considered differentiating on dependent variable that is ratio of Long-term debt to total assets (LTD/TA) and short-term debt to total assets (STD/TA). The data is further divided into three sets.

1. Combined (foreign + domestic firms)
2. Domestic firms
3. Foreign firms

First both models of STD ratio and LTD ratio are studied for overall data set, then these models are studied on local firms data and finally on foreign firms. The reason for this distribution is to check if there is any difference in explanatory variables that leads to the variance in the capital structure.

### 6.6.1 General regression model

General regression models that applies to three types of data sets including combined (domestic+ foreign), domestic and foreign data sets. There are 12 firm level independent variables and 3 country level independent variables. Variable names with their parameters and proxies are given in table 1.

#### **Model 1**

$$\text{STD/TA} = \alpha + \beta_1 \text{TS}_{it} + \beta_2 \text{Z}_{it} + \beta_3 \text{BR}_{it} + \beta_4 \text{ND}_{it} + \beta_5 \text{AC}_{it} + \beta_6 \text{G}_{it} + \beta_7 \text{CP}_{it} + \beta_8 \text{PP}_{it} + \beta_9 \text{L}_{it} + \beta_{10} \text{TAN}_{it} + \beta_{11} \text{S}_{it} + \beta_{13} \text{DPR}_{it} + \beta_{15} \text{INF}_t + \beta_{16} \text{EXR}_t + \beta_{17} \text{EGR}_t + \varepsilon_{it}$$

#### **Model 2**

$$\text{LTD/TA} = \alpha + \beta_1 \text{TS}_{it} + \beta_2 \text{Z}_{it} + \beta_3 \text{BR}_{it} + \beta_4 \text{ND}_{it} + \beta_5 \text{AC}_{it} + \beta_6 \text{G}_{it} + \beta_7 \text{CP}_{it} + \beta_8 \text{PP}_{it} + \beta_9 \text{L}_{it} + \beta_{10} \text{TAN}_{it} + \beta_{11} \text{S}_{it} + \beta_{13} \text{DPR}_{it} + \beta_{15} \text{INF}_t + \beta_{16} \text{EXR}_t + \beta_{17} \text{EGR}_t + \varepsilon_{it}$$

In order to decide the model discussed above that fits best on the collected data, the characteristics of the data are studied. First the data is examined for linear regression assumptions that involve tests for normality, autocorrelation, heteroscedasticity and multicollinearity. Results for simple linear regression of LTD and STD on all independent variables for three data sets are available in Appendix B through D

#### 6.6.1.1 Linearity test

The OLS model assumes linear relationship between dependent and independent variables. If variables do not have linear relationship and a linear model is fitted to them, it can produce biased results.

Individual plots for all the independent variables against residuals are created with both LTD and STD simultaneously for all the three sets of models including combined data set, domestic firms data and foreign firms data. Sample of two scatter plots are available in Appendix G

Some of the scatter plots show linearity but some variables do not suggest perfect linearity. Linear regression has been performed among chosen variables, in order to sort out the existence and magnitude of causal effects of one or more independent variables upon a dependent variable of interest. Perfect linearity rarely exists between dependent and independent variables in empirical research.

#### 6.6.1.2 Normality

The charts for distribution of residuals on long-term debt and short-term debt for all three data sets are shown in Appendix H. There is an approximately normal distribution of residuals that confirms OLS normality assumption and allows reliability of P-values for statistical F-test and t-statistics. The results on the data shows acceptance of null hypothesis at 5% significance level. Hence concluded there is no significant deviation from normality in data.

### 6.6.1.3 Homoscedasticity

It is an assumption that residuals have same variance on each observation but when it is violated it is called heteroscedasticity. Heteroscedasticity can be tested by Breusch Pagan / Cook-Weisberg test.

**Table 9: Breusch-Pagan / Cook-Weisberg test for heteroskedasticity**

	Combined		Domestic		Foreign	
	chi2(15)	Prob > chi2	chi2(15)	Prob > chi2	chi2(15)	Prob > chi2
<b>ST</b>	14254.75	0.0000	288.73	0.0000	5965.74	246.76
<b>LT</b>	363.16	0.0000	386.62	0.0000	0.0000	0.0000

The Breusch Pagan / Cook-Weisberg test gives significance value below 0.05 that allows us to reject the null hypothesis of homoscedasticity not present. The results of the test show heteroscedasticity in both long term and short-term debt in three data sets. So it is concluded that the data holds heteroscedasticity.

With the presence of heteroscedasticity, coefficients of linearity are inefficient but still unbiased. Standard errors are biased which can lead to wrong conclusions about the significance of regression coefficients. In this case weighted least square regression is more appropriate. General Method of moment estimation (GMM) is a method to deal with heteroscedasticity while running panel data regression.

### 6.6.1.4 Autocorrelation

Autocorrelation in the data can be detected by using Durbin Watson test. The values are always between 0 and 4. Value of 2 means that there is no autocorrelation. Values approaching 0 means positive auto correlation and values near to 4 means negative auto correlation.

The results of the data sets is presented in Table 12

**Table 10: Durbin Watson test**

	Combined	Domestic	Foreign
<b>LTD</b>	0.462	0.424	0.599
<b>STD</b>	0.716	0.307	0.947

Hence positive auto correlation for both LTD and STD is detected in all three data sets.

Autocorrelations generally exist because of the dynamic causality of capital structure or due to omitted variables. Auto correlation can be handled by GLS estimator Brooks (2008) or another way is to introduce lagged variables.



### 6.6.1.5 *Multicollinearity*

Correlation matrix presents the robustness of the variables included in the regression model. For the variables to be valid the correlation between them should not exceed 0.8 (Kennedy, 2011, p. 196). Practically the assumption of no multicollinearity usually never holds. A small degree of correlation will not affect the results in a significance manner (Brooks, 2008).

Three tests are performed individually for overall firms data, domestic firms and then foreign firms. Results are presented in table 7, 8 and 9

#### Overall Data (domestic + foreign)

The correlation matrix between variables for overall data shows acceptable levels of correlation between variables. The highest level of correlation is observed between agency cost and non-debt tax shield (0.62) however it is below the maximum acceptable level therefore all the variables are considered valid. No correlation is found between dividend pay out ratio and market to book ratio (0.00), cash from operating activity and market to book ratio (0.00). Growth and liquidity also has a very minor correlation (0.001).

#### Domestic firms

For the data of domestic firms, highest correlation exists between firm size and cash from operating activity (0.564) but still it is below the maximum acceptable level of 0.8 so the variables are valid. No correlation exists between inflation rate and cash from operating activity (0.00).

#### Foreign Firms

From the data of foreign firms, highest correlation exists between non-debt tax shield and agency cost (0.688) that is an acceptable level since its below 0.8 so the reliability of explanatory variables is still valid.

Another way to check multicollinearity is by Variable Inflation test (VIT). As a rule, if VIF is above 10 then there exists multicollinearity. The results of the data shows values of VIF are either 1 or 2 which is far below the limit of 10. Hence concludes there is no multicollinearity in the model.

The table for VIF results are available in Appendix A

## 6.7 Panel data effects

To decide if simple linear regression can be performed for the analysis on panel data, Lagrange Multiplier test is useful.

$H_0$ : Zero cross sectional variance across all components.

$H_A$ : Panel effect exists

**Table 11: Lagrange Multiplier test on the combined data**

<b>Model</b>	<b>Chi<sup>2</sup> (1)</b>	<b>Prob &gt; Chi<sup>2</sup></b>
STD	624.87	0.0000
LTD	593.80	0.0000

Probability is below 0.05 for Both LTD and STD in all the three sets of data. So alternative hypothesis  $H_A$  is accepted that is serial correlation exists in the data. Hence an effect model is used instead of simple linear regression. Result for combined data set is presented in table 13

## 6.8 Diagnostics

The data under consideration fulfils the assumptions of linearity for normality, linearity and multicollinearity.

But violates the assumptions of non-autocorrelation and homoscedasticity. To control for these violations, GLS estimator is used. Data is further tested for panel data effects.

The results shows existence of panel effect, therefore least square model cannot be used. This leads towards the selection between fixed effect model and random effect model to account for time-invariant changes of the variables over the years (Kennedy 2011, p. 282-284)

### 6.8.1 Effect test

The selection depends upon the correlation between independent variables and unobserved effect variables. The standard test for this selection is Hausman Specification test. According to the test  $H_0$ : Unique errors are correlated with regressors. If the null hypothesis can be rejected, there is a reason to believe that fixed effect model is appropriate.

**Table 12: Hausman Test results**

	<b><u>Domestic</u></b>		<b><u>Foreign</u></b>	
	LTD	STD	LTD	STD
chi2(15)	355.56	2.19	-23.10	11.28
Prob>chi2	0.0000	0.0000	<0	0.7322

Although the results of Hausman test are mixed. Both random effect regression and fixed effect regressions are suggests for different data sets only fixed effect regression will be performed.

### 6.8.2 *Finally selected model*

I intend to examine firm level fixed effects and it is intended to control the potential correlation between company's error terms and estimator variables over the years by imposing a time independent effect for each company, therefore fixed effect model is applied and its results will be further analysed to identify the sign and magnitude of the determining variables on capital structure of Local and foreign companies. The analysis also highlights the essence of the results to the choice of variables depending on their significance. I intend to achieve results comparable to earlier studies

All the suitable variables are included in the regression to attain their coefficients, possible effects on leverage (positive or negative), their magnitude, significance level and resulting  $R^2$ .

## 7 Results and Analysis

*After the final model is decided, this chapter includes descriptive statistics of the sample data, results of regression and discussion of results for each explanatory variable with acceptance and rejection of hypothesis.*

### 7.1 Descriptive statistics:

Descriptive statistics summarizes the statistics of dependent and independent variables included in the study. It provides summary of samples and measures.

#### Combine Data (domestic + foreign)

**Error! Reference source not found.** presents average indicators of variables. The important findings are

- For combined data set, short-term and long-term debt ratios each are approximately 50% with respect to total debt combined. That is 22% of short-term and 21% of long-term debt with respect to total assets. Short-term debt ratio is a measure of short-term debt to total assets, whereas long-term debt ratio is a measure of long-term debt to total assets of all the domestic and foreign firms included in the study.
- Growth has a mean of -0.01. It means growth in assets assets of all firms combined has decreased by 1% overall.
- Tangibility has a mean of 0.43. It means 43% of firms assets are comprised of fixed assets.
- No debt tax shield has a mean of 0.01. Meaning 1% earnings from the assets are subjected to depreciation.
- Tax shield accounts for the mean of 0.13. It means 13% income comes as tax shield.

Table 13: Data characteristics described as total number of observations, mean, standard deviation and median values of the complete data set before excluding cases with missing values.

	<b>Total Revenue</b>	<b>Total Assets</b>	<b>Total Current Liabilities</b>	<b>Total Long Term Debt</b>	<b>Total Equity</b>
<b>All firms combined</b>					
Number of observations	3053	3053	3053	3053	3053
Mean Value	5210	30252	6799 22%	6536 21%	11829 39%
St.dev	17955	86775	19493	17097	33266
Median	893	8097	1518	1900	2936
<b>Domestic firms</b>					
Number of observations	1561	1561	1561	1561	1561
Mean Value	8500	44243	10347 23%	8367 19%	17455 39%
St.dev	24478	116539	26206	21173	44516
Median	1742	10030	2392	2132	4088
<b>Foreign firms</b>					
Number of observations	1492	1492	1492	1492	1492
Mean Value	1767	15614	3087 20%	5556 36%	5943 38%
St.dev	3127	28002	5682	11191	11134
Median	385	5124	605	1491	1835

**Table 14: Variable information along with mean and standard deviation of variables for domestic, foreign and combined data sets.**

The ratios are derived from the complete data set before excluding cases with missing values.

	Variable name	Parameter	Proxy	Mean			Standard deviation		
				Domestic	Foreign	Combined	Domestic	Foreign	Combined
<b>Firm level</b>	Tax shield	TS	Tax payments/gross profit	0.21	0.04	0.13	0.87	0.67	0.78
	Probability of bankruptcy	Z	Altman's Z-score	1.7	1.7	1.7	2.4	9.4	6.8
	Business risk	BR	%Change in (net profit before tax/total assets)	-0.04	-0.19	-0.11	3.37	7.09	5.51
	Non debt tax shield	ND	Depreciation expenses/Total assets	0.01	0.01	0.01	0.01	0.05	0.03
	Agency cost	AC	Operating expenses/sales	0.92	1.59	1.24	0.75	7.57	5.27
	Growth	G	%Change in total assets	0.03	-0.05	-0.01	0.13	0.66	0.47
	Current profitability	CP	Net profit before tax /total assets	0.01	-0.01	0.00	0.07	0.25	0.18
	Past profitability	PP	Retained earnings/total assets	0.16	-0.54	-0.18	0.37	3.22	2.29
	Liquidity	L	Current assets/current liabilities	1.94	2.35	2.14	2.05	4.04	3.19
	Tangibility	TAN	Net fixed assets/total assets	0.28	0.59	0.43	0.23	0.29	0.30
	Firm size	S	Ln (total assets)	9.34	8.25	8.81	1.63	2.02	1.91
<b>Country level</b>	Dividend payout ratio	DPR	Dividend paid/total equity	364	90	230	2335	462	1706
	Inflation rate	INF	Annual inflation (consumer prices) rate	0.02	0.02	0.02	0.01	0.01	0.01
	Exchange rate	EXR	Ln (yearly average exchange rate)	1.87	1.86	1.86	0.15	0.14	0.14
	Economic growth	EGR	Annual per capita GDP growth rate	0.00	-0.01	0.00	0.11	0.06	0.09

### Domestic firms and Foreign Firms

For the data comprised of only domestic firms, 23% of the total assets of domestic firms on average is comprised of short term debt and 19% of assets is comprised of long term debt on average. It means domestic firms rely more on STD as compare to LTD. For foreign, total assets on average are comprised of 20% STD and 36% of LTD. Here the foreign firms reliance on LTD is higher as compare to STD (figure 14)

From figure 15, it is interesting to note that tax shield ratio for domestic firms is quite high 21% as compare to foreign firms 4%. It means domestic firms gain higher payback in the form of reductions in taxes by paying interest on debt as compare to foreign. It can be interpreted that since domestic firms rely more on STD that comes with high interest costs that the borrowers have to pay to lenders as compare to LTD. Therefore they have high interest expenses and in return high tax shield benefits.

Foreign firms have negative growth ratio, current and past profitability (-0.05, -0.01, -0.54) respectively. However domestic firms have positive figures (0.03, 0.01, 0.16). This depicts that domestic firms are doing better with respect to growth and profitability.

Another important figure is dividend payout ratio. There is a huge difference in value between domestic (364) and foreign firms (90). It means domestic firms are more generous in terms of paying debt.

## **7.2 Regression**

After the discussion of informative values from descriptive statistics, I intend to test determinant variables for the ratio of LTD and STD in largest 29 local Norwegian and largest 34 foreign firms listed on Oslo stock exchange from 2011 to 2015. Regression for both LTD and STD is run on chosen independent variables for all three data sets.

Book-leverage ratio acquired from balance sheet, both for long term and short-term debt has been chosen to further proceed with regression. They are taken as ratio of book value of short term liabilities with total assets (STD/TA) and book value of long term debt ratio with total assets (LTD/TA).

In the analysis of determinants of leverage, fixed effect panel data regression of STD and LTD on firm level and country level determinant variables for combined data set gets meaningful coefficients with significance that allows for further regression of subsamples that is individually for local and foreign firms on long term and short term debt as dependent variable.

For independent variables, firm level variables are Tax shield, Past Profitability, Probability of Bankruptcy, Growth, Current Profitability, Business risk, Non debt tax shield, Agency Cost, Liquidity, Tangibility, Firm size and Dividend payout ratio. Exchange Rate, Inflation Rate, Economic Growth are taken as country level independent variables.

The intention is to compare the results of these attempts of regressions in order to check the sign, magnitude and effect of determinant variables on short term and long-term leverage ratio for domestic and foreign firms

### 7.2.1 *Models of regression*

Two models of fixed effect regression of STD and LTD for three data sets combined, domestic and foreign are presented below.

#### Fixed effect regression models

##### Model 1

$$\text{STD}/\text{TA} = \alpha + \beta_1 \text{TS}_{it} + \beta_2 \text{Z}_{it} + \beta_3 \text{BR}_{it} + \beta_4 \text{ND}_{it} + \beta_5 \text{AC}_{it} + \beta_6 \text{G}_{it} + \beta_7 \text{CP}_{it} + \beta_8 \text{PP}_{it} + \beta_9 \text{L}_{it} + \beta_{10} \text{TAN}_{it} + \beta_{11} \text{S}_{it} + \beta_{12} \text{A}_{it} + \beta_{13} \text{DPR}_{it} + \beta_{14} \text{COA}_{it} + \beta_{15} \text{INF}_t + \beta_{16} \text{Exp}_t + \beta_{17} \text{EGR}_t + \epsilon_{it}$$

##### Model 2

$$\text{LTD}/\text{TA} = \alpha + \beta_1 \text{TS}_{it} + \beta_2 \text{Z}_{it} + \beta_3 \text{BR}_{it} + \beta_4 \text{ND}_{it} + \beta_5 \text{AC}_{it} + \beta_6 \text{G}_{it} + \beta_7 \text{CP}_{it} + \beta_8 \text{PP}_{it} + \beta_9 \text{L}_{it} + \beta_{10} \text{TAN}_{it} + \beta_{11} \text{S}_{it} + \beta_{12} \text{A}_{it} + \beta_{13} \text{DPR}_{it} + \beta_{14} \text{COA}_{it} + \beta_{15} \text{INF}_t + \beta_{16} \text{Exp}_t + \beta_{17} \text{EGR}_t + \epsilon_{it}$$

**Table 15: Capital structure determinants LTD**

Coefficient values for explanatory variables on long-term debt (LTD) as dependent variable from fixed effect regression for each data set including combined, domestic and foreign. Positive/negative signs indicate the relationship of variable with leverage. Significance P-value is marked with star \* where:  $P \leq 0.10$  \*,  $P \leq 0.05$  \*\* and  $P \leq 0.01$  \*\*\*

	Long term debt (LTD)		
	Combined	Domestic	Foreign
Tax shield	0.0037	0.0029	0.0067
Past Profitability	0.0060*	-0.0480***	0.0119*
Probability of Bankruptcy	-0.0090***	-0.0127***	-0.0118***
Growth	0.0075	-0.0029	0.0099
Current Profitability	-0.0834**	-0.1805***	-0.0713
Business risk	0.0010*	0.0000	0.0014*
Non debt tax shield	-0.3274**	1.2894***	-0.4500*
Agency Cost	0.0025*	-0.0122**	0.0041*
Liquidity	0.0104***	0.0065***	0.0267***
Tangibility	0.2817***	0.2561***	0.3640***
Firm size	-0.0041	-0.0053*	-0.0037
Dividend payout ratio	0.0000	0.0000	0.0000**
Inflation Rate	0.0330	0.3201*	-0.4356
Exchange Rate	0.1259***	0.1064***	0.1255***
Economic Growth	-0.0233	-0.0381	-0.0084
_cons <sup>iii</sup>	-0.0619	0.0041	-0.1084

<sup>iii</sup> Constant is the regression. It is the expected mean value of LTL if all the independent variables have value=0



**Table 16: Capital structure determinants STD**

Coefficient values for explanatory variables on short-term debt (STD) as dependent variable from fixed effect regression for each data set including combined, domestic and foreign. Positive/negative signs indicate the relationship of variable with leverage. . Significance P-value is marked with star \* where:  $P \leq 0.10$  \*,  $P \leq 0.05$  \*\* and  $P \leq 0.01$  \*\*\*

	Short term debt (STD)		
	Combined	Domestic	Foreign
Tax shield	-0.0010	0.0008	-0.0034
Past Profitability	-0.0052	-0.0953***	0.0047
Probability of Bankruptcy	-0.0099***	-0.0050***	-0.0123***
Growth	0.0088	-0.0687***	0.0236
Current Profit	-0.0872*	0.0124	-0.1182*
Business risk	0.0020***	0.0015**	0.0024**
Non debt tax shield	1.0132***	0.4501	0.8908***
Agency Cost	-0.0089***	0.0031	-0.0087***
Liquidity	-0.0293***	-0.0249***	-0.0325***
Tangibility	-0.1050***	-0.1847***	0.0121
Firm size	-0.0510***	-0.0293***	-0.0699***
Dividend payout ratio	0.0000	0.0000	0.0000
Exchange Rate	-0.0955***	0.0055	-0.2735***
Inflation Rate	-0.1782	-0.0753	-0.3077
Economic Growth	-0.0075	-0.0220	-0.0074
_cons <sup>iv</sup>	0.9416***	0.5892***	1.3430***

<sup>iv</sup> Constant is the regression. It is the expected mean value of STL if all the independent variables have value=0

**Table 17: Fixed effect regression model various parameters**

	Long term debt (LTD)		
	Combined	Domestic	Foreign
Number of obs	2256	1396	860
Number of groups	59	29	30
R-sq: within	0.1185	0.238	0.0948
between	0.4091	0.2228	0.4757
overall	0.3313	0.2695	0.3732
Obs per group: min	1	4	1
avg	38.2	48.1	28.7
max	70	69	70
	F(15,2182) =19.55	F(15,1352) =28.15	F(15,815) =5.69
corr(u <sub>i</sub> , Xb)	0.2733	0.0486	0.3742
Prob > F	0.000	0.000	0.000
sigma <sub>u</sub>	0.134	0.115	0.147
sigma <sub>e</sub>	0.120	0.082	0.163
rho	0.553	0.661	0.448
F test that all u <sub>i</sub> =0:	F(58, 2182) = 33.83	F(28, 1352) = 72.39	F(29, 815) = 13.74

	Short term debt (STD)		
	Combined	Domestic	Foreign
Number of obs	2256	1396	860
Number of groups	59	29	30
R-sq: within	0.1763	0.2359	0.1972
between	0.2682	0.231	0.2737
overall	0.1698	0.2402	0.1726
Obs per group: min	1	4	1
avg	38.2	48.1	28.7
max	70	69	70
	F(15,2182) =31.14	F(15,1352) =27.83	F(15,815)=13.35
corr(u <sub>i</sub> , Xb)	-0.1958	-0.0786	-0.2182
Prob > F	0.000	0.000	0.000
sigma <sub>u</sub>	0.168	0.096	0.219
sigma <sub>e</sub>	0.149	0.085	0.213
rho	0.559	0.557	0.514
F test that all u <sub>i</sub> =0:	F(58, 2182) = 18.76	F(28, 1352) = 51.19	F(29, 815) = 9.01

The probability F-test is used to check the null hypothesis ( $H_0$ ) that the coefficients of all the explanatory variables are equal to zero. Since the result for F-test is 0.00 for both leverages, which means null hypothesis can be rejected, and alternative hypothesis ( $H_A$ ) is accepted that all the coefficients are different from zero. This can be concluded that the model is significant.

Sigma-u represents standard deviation of fixed effects and sigma-e respectively represents standard deviation of errors.

R-squared represents the explanatory power of the model. It depicts the extent to which the variance in the capital structure that can be determined by explanatory variables. The overall R-sq. for model 1 is 0.1649 which means 16% of the variation in the short term debt ratio can be explained by independent variables and overall R<sup>2</sup> for model 2 is 0.3574 which means 35% of the variation in long term debt ratio can be explained by independent variables. There is huge difference in explanatory power between two models. The later is higher than the former showing that the model 2 has better fit. It can be concluded that independent variables are 19% better able to explain variation in long-term debt ratio as compare to short-term debt ratio.

### 7.3 Effect of explanatory variables on capital structure

In Table 15 and 16, the fixed effect regressions for leverage ratios (STD/TA & LTD/TA) on each of the characterizing variables provides coefficients that represent the average effect of these determining variables ( $x_i, 1, 2 \dots n$ ). Since the total debt ratio and the equity-ratio necessarily must sum to unity, the coefficients and significance levels may also be interpreted as explanations of the debt ratio. Results of individual explanatory variables are presented below along with the acceptance or rejection of hypothesis presented in chapter 4 for expected relationship and significance of individual variables with leverage.

### 7.4 Firm Level explanatory variables

#### 7.4.1 Current profitability (CP) and past profitability (PP)

		Combined	Domestic	Foreign
CP	LTD	-0.0834**	-0.1805***	-0.0713
	STD	-0.0872*	0.0124	-0.1182*
PP	LTD	0.0060*	-0.0480***	0.0119*
	STD	-0.0052	-0.0953***	0.0047

The variable is significant with negative relationship for long-term debt (-0,083\*\*, -0,180\*\*\*, -0,071) in foreign and combine data. For ST debt (-0,087\*, 0,012, -0,118\*) the results suggests negative relation of current profitability variable with debt ratios. All the top listed firms with higher current profitability tend to have less LTD. And foreign firms also tend to have less short-term debt with increased current profitability.

Negative relationship between profitability and leverage is in consistence with the past empirical results from the study of Mjøs (2007) on Norwegian data. Studies of Titman and Wessels, Harris and Raviv, Frank and Goyal, Rajan and Zingales also found negative relationship. It suggests the compliance of packing order theory. Packing order theory suggests a negative relationship between leverage and

profitability. It argues that when the firm has high profitability, it would prefer to use its earnings for financing investments and to payoff debt.

However findings of I.G De Olalla (2016) on capital structure of private and listed firms in Norway suggests positive relation for LTD/TA. Nunkoo & Boateng also proved the same. This is in contrast suggested by trade-off theory. More the firm is profitable, it should opt to borrow more to shield their profits from tax and exploit the benefits of tax advantages. Another argument is that with increase profitability, firm ability to payback loan and goodwill in the market increases.

Current profitability is not significant in Short-term debt ratio for domestic firms (0,012) and for LT debt in foreign firms with negative relation to debt (-0,071).

Past profitability variable has positive relationship with long term leverage for foreign firms and combine data (0,006\*, 0,011\*). It suggests foreign firms tend to have more debt with increased retained earnings. The possible explanation is that they tend to shield their profits from tax or they may have problem of agency cost with increased retained earnings. A positive relation is rarely supported by recent empirical studies. It is interesting to find that foreign companies in Norway support positive relation. However results suggests that local firms significantly tend to reduce both ST and LT debt (-0,095\*\*\*, -0,047\*\*\*) with increased retained earnings.

### ***Result of Hypothesis***

1. H<sub>0</sub>: CP has a negative effect on LTD in foreign firms (accepted)
  2. H<sub>0</sub>: CP has a negative effect on LTD in domestic firms. (accepted)
  3. H<sub>0</sub>: CP has a negative effect on STD in foreign firms (accepted)
  4. H<sub>0</sub>: CP has a negative effect on STD in domestic firms (Non significant)
- 
1. H<sub>0</sub>: PP has a negative effect on LTD in foreign firms. (rejected)
  2. H<sub>0</sub>: PP has a negative effect on LTD in domestic firms.(accepted)
  3. H<sub>0</sub>: PP has a negative effect on STD in foreign firms (Non significant)
  4. H<sub>0</sub>: PP has a negative effect on STD in domestic firms (accepted)

### ***7.4.2 Firm size (S)***

The explanatory variable size has significant negative relationship with STD for combined, domestic and foreign data sets and with LTD it is only significant for domestic data with negative relation. It means with 1 percent point increase in firm size, ST & LT debt ratio decreases. The fall in short term leverage with increase in firm size is sharper in foreign firms (-0.07\*\*\*) as compare to local (-0.03\*\*\*) showing trend of foreign firms to avoid ST leverage.

For LTD, though the change is relatively stable, the result is only significant for domestic firms. It indicates that large domestic Norwegian firms avoid external financing. They have less information asymmetry thus better access to credit. Interestingly, results are contrary to the previous findings of Frydenberg (2004) for size (log total revenue) and results of I.G De Olalla (2016) for size as (log total assets), similar proxy as mine. Findings of Mjøs (2007) on Norwegian data however support my findings for ST debt.

Negative relationship between firm size and leverage suggests compliance to POT. Large size firms have more free cash and accumulated earnings so therefore they do not need external financing. They prefer to payoff loans and finance investment opportunities with cash and retained earnings. Another explanation is that the large sized firms generally have good reputation in the market with access cash flow. The market has positive expectations from such firms for increase in value. These expectations can lead to overvaluation of equity of the firm. The firm can exploit this overvaluation by issuing new equity.

Large firms usually also do not have problems of agency cost and information asymmetry that can facilitate the choice of equity.

### **Result of Hypothesis**

1. H<sub>0</sub>: S has a positive effect on LTD in foreign firms. (Non significant)
2. H<sub>0</sub>: S has a positive effect on LTD in domestic firms. (rejected)
3. H<sub>0</sub>: S has a positive effect on STD in foreign firms. (rejected)
4. H<sub>0</sub>: S has a positive effect on STD in domestic firms (rejected)

### **7.4.3 Non debt tax shield (ND)**

	Combined	Domestic	Foreign
LTD	-0.3274**	1.2894***	-0.4500*
STD	1.0132***	0.4501	0.8908***

This explanatory variable has highest coefficient value and is also significant for both leverages. With every 1 percent point increase in tax benefit from depreciation, STD increases. The argument for positive relationship is to reduce tax payments. By reporting aggregated costs of goods sold (CGS) and depreciations along leverage costs, income before tax is reduced which leads to reduced tax payments. It also suggests that foreign companies in Norway raise more short-term debt.

Since only largest firms are considered as sample of the study, largest domestic firms are highly capitalized, their tangibility is high that results into high cash inflow with depreciation expense as fixed assets depreciates with time. Domestic companies raise LTD (1.289\*\*\*) along with the reserves obtained from reported depreciation to raise cash for further expansion and growth. It points out that Norwegian

companies have more growth opportunities. The results from Frydenberg (2004) also suggest positive relationship in LTD on Norwegian data.

For LTD, the negative relationship of foreign firms (-0.45\*) is consistent with TOT. It shows that foreign firms prefer to pay down debt as liquidity increases.

### **Result of Hypothesis**

1. H<sub>0</sub>: ND has a negative effect on LTD in foreign firms. (accepted)
2. H<sub>0</sub>: ND has a negative effect on LTD in domestic firms. (rejected)
3. H<sub>0</sub>: ND has a negative effect on STD in foreign firms. (rejected)
4. H<sub>0</sub>: ND has a negative effect on STD in domestic firms (insignificant)

#### **7.4.4 Tangibility (TAN)**

	Combined	Domestic	Foreign
LTD	0.2817***	0.2561***	0.3640***
STD	-0.1050***	-0.1847***	0.0121

It is one of the highest explanatory variable for LTD (0.28\*\*\*, 0.25\*\*\*, 0.36\*\*\*) and for STD (-0.1\*\*\*, -0.18\*\*\*, 0.01) respectively for combined, domestic and foreign data. The results indicates that 1 percentage point increase in tangibility would lead to increase in LTD whereas decrease in STD.

The positive relationship for LTD is in compliance to TOT. Asset tangibility reflects the security available for lenders and is unsurprisingly positively related to leverage across all firms. Firms with large fixed assets have higher investment demands for further growth. They can keep assets as collateral while taking loans or tangible assets are on mortgage, as a result leverage ratio increases. Collateral reduces the chances of default. In case of default, the lender can sell collaterals to get back their loan. With reduced risk, cost of debt is also reduced which makes LTD an attractive choice.

Norwegian firms are highly capitalized with high tangibility i.e. availability of fixed assets is high, For example the biggest company included in the sample are Veidekke, Statoil, Telenor and shipping companies. All are heavily capital intensive. They have high reliance on both tangible and intangible assets, which requires large amount of financing.

The negative relationship is in compliance to POT. A negative relationship of tangability to STD may suggest that firms with high fixed assets are better equipped to meet their short term financing needs but for the long run they rely on LTD.

The positive relationship is in compliance to previous empirical studies, both on Norwegian data as well as international studies. Mjøs (2007) and I.G De Olalla (2016) both report a positive relation of LT

leverage with tangibility. Harris and Raviv (1991), Frank and Goyal (2008), Rajan and Zingal (1995) also report the same results.

**Result of Hypothesis**

1. H0: TAN has a positive effect on LTD in foreign firms. (accepted)
2. H0: TAN has a positive effect on LTD in domestic firms. (accepted)
3. H0: TAN has a positive effect on STD in foreign firms. (insignificant)
4. H0: TAN has a positive effect on STD in domestic firms (rejected)

**7.4.5 Growth (G)**

Results for growth variable are not that significant overall. It means its not a strong explanatory variable in terms of defining capital structure for listed firms in Norway. However the factor is significant for STD in domestic firms with a negative sign (-0.068\*\*\*). As discussed in tangibility variable, large firms have enough profitability with growth and thus reserves to meet their short-term expenses and investment demands, therefor they do not opt for short-term leverage.

The results are in compliance to the findings of Frank and Goyal (2008), Rajan and Zingals (1995), who found negative relationship between growth and leverage. However contrary with the studies of Frydenberg (2004) on Norwegian data for both STD and LTD as a positive relation with leverage. Harris and Raviv found the same.

**Result of Hypothesis**

1. H0: G has a positive effect on LTD in foreign firms. (insignificant)
2. H0: G has a positive effect on LTD in domestic firms. (insignificant)
3. H0: G has a positive effect on STD in foreign firms. (insignificant)
4. H0: G has a positive effect on STD in domestic firms (rejected)

**7.4.6 Liquidity (L)**

	Combined	Domestic	Foreign
LTD	0.01043***	0.0065***	0.0267***
STD	-0.0292***	-0.0249***	-0.0325***

Liquidity variable is one of the highly significant variables for both LTD and STD (0,0104356\*\*\*, 0,0065008\*\*\*, 0,0267198\*\*\*) and (-0,0292646\*\*\*, -0,0249408\*\*\*, -0,0325312\*\*\*) for combined, domestic and foreign data respectively.

It means large firms in Norway avoid short-term loans when they have high level of liquidity internally available. In POT, firms prefer internal financing before looking for external options. If they have enough internal liquid reserves, they have no incentive to go for external financing.

A positive relationship with long-term loan may point out towards agency cost. To avoid this problem, firms opt to take loan. With the compulsion to pay interest, problem of agency cost can be reduced. According to TOT the more liquid firm would use external financing due to their ability of paying back liabilities and to get benefit of tax-shields (Ahmed, Nasir, Ali - 2011)

Liquidity variable is not frequently a part of previous studies.

### ***Result of Hypothesis***

1. H<sub>0</sub>: L has a negative effect on LTD in foreign firms. (rejected)
2. H<sub>0</sub>: L has a negative effect on LTD in domestic firms. (rejected)
3. H<sub>0</sub>: L has a negative effect on STD in foreign firms. (accepted)
4. H<sub>0</sub>: L has a negative effect on STD in domestic firms (accepted)

### ***7.4.7 Tax shield (TS)***

Tax shield is non-significant for both long term and short-term debt. The variable is not a determining factor for capital structure of firms listed in Norway.

However, the positive relationship for LTD is in compliance to TOT. Although tax benefit is one of the bases for the development of capital structure theory, in most of the empirical studies the variable turns out to non-significant.

In my data, one of the reasons for the variable to be non-significance is the unavailability of publicly available tax information mostly in foreign firms income statements.

The previous studies on Norwegian data by Frydenberg suggest positive relationship. Other studies like Harris and Raviv (1991) also concludes positive relationship between tax shield and leverage.

### ***Result of Hypothesis***

1. H<sub>0</sub>: TS has a positive effect on LTD in foreign firms. (insignificant)
2. H<sub>0</sub>: TS has a positive effect on LTD in domestic firms. (insignificant)
3. H<sub>0</sub>: TS has a positive effect on STD in foreign firms. (insignificant)
4. H<sub>0</sub>: TS has a positive effect on STD in domestic firms (insignificant)



### 7.4.8 Dividend Payout ratio (DPR)

Dividend payout ratio is only significant for LTD in foreign firms (-0,0000259\*\*) Though the variable is not a determining factor for the capital structure of big listed companies, it has a negative relationship with LTD overall for domestic and foreign companies. The negative relationship is in compliance to previous empirical studies like Frank & Goyal(2008). It means when the dividend payout ratio goes up by 1 percent point, long term debt goes down.

When companies have excess cash after spending on possible investment opportunities, they pay-out dividend. In a situation with the excess cash in hand, companies do not need external financing. Dividend paying companies are more attractive for equity investors. Companies in Norway have a trend to pay dividends. For example, Statoil’s earnings have remarkably reduced due to fall in oil prices. Still the company is paying dividend to its equity holders. Dividend paying companies signals that they are confident about their future earnings, such firms do not face under pricing while issuing equity. (Frydenberg -2004) Mjøs says “healthy firms pay dividends”. He also found negative relation.

#### Result of Hypothesis

1. H0: DPR has a positive effect on LTD in foreign firms. (rejected)
2. H0: DPR has a positive effect on LTD in domestic firms. (insignificant)
3. H0: DPR has a positive effect on STD in foreign firms. (insignificant)
4. H0: DPR has a positive effect on STD in domestic firms (insignificant)

### 7.4.9 Business Risk (BR)

	Combined	Domestic	Foreign
LTD	0.000987*	0.000046	0.001399*
STD	0.0020***	0.0015**	0.0023**

I found significant positive relation of business risk with both LTD and STD (0,0009876\*, 0,0000458, 0,0013989\*)and (0.0020\*\*\*, 0.0015\*\*, 0.0023\*\*) respectively for combined, domestic and foreign data. I.G De Olalla (2016) also reports positive relation of business risk (standard deviation of growth in sales) with LT leverage.

The results are interesting since leverage is expected to decrease with increase in risk. With increased risk, Equity holders’ for companies in Norway would want to load more risk onto lenders through increased leverage. Another explanation is that there is a law of return “more risk more return”. The volatility in EBIT (earnings before interest and taxes) encourages firms to take loans to make sure that reasonable reserves are available for the purposes of hedging in case of risk

### ***Result of Hypothesis***

1. H<sub>0</sub>: BR has a positive effect on LTD in foreign firms. (accepted)
2. H<sub>0</sub>: BR has a negative effect on LTD in domestic firms. (insignificant)
3. H<sub>0</sub>: BR has a positive effect on STD in foreign firms. (accepted)
4. H<sub>0</sub>: BR has a negative effect on STD in domestic firms (rejected)

#### ***7.4.10 Probability of bankruptcy (Z)***

	Combined	Domestic	Foreign
LTD	-0.0090***	-0.0127***	-0.0118***
STD	-0.0099***	-0.0050***	-0.0123***

The variable has negative sign proved from past empirical studies. My results are also in accordance to past studies. It is a highly significant variable with P-value 0 throughout all the regression attempts. When there is a risk of bankruptcy, firms avoid taking more debt since debt is the debt that has to be paid first in case of bankruptcy. Atman's Z-score predicts the probability that firm will go into bankruptcy within two to three years. Firms with low credit rating give a signal of riskiness, therefore investors demand high returns. For this reason, leverage is a costly option of financing for such firms. Thus it is avoided as much as possible.

### ***Result of Hypothesis***

1. H<sub>0</sub>: Z has a negative effect on LTD in foreign firms. (accepted)
2. H<sub>0</sub>: Z has a negative effect on LTD in domestic firms. (accepted)
3. H<sub>0</sub>: Z has a negative effect on STD in foreign firms. (accepted)
4. H<sub>0</sub>: Z has a negative effect on STD in domestic firms (accepted)

#### ***7.4.11 Agency cost (AC)***

	Combined	Domestic	Foreign
LTD	0.0025*	-0.0122**	0.0041*
STD	-0.0089***	0.0031	-0.0087***

For LTD, agency cost has negative relation for domestic firms and positive relation for foreign firms (-0.0122\*\*, 0.0041\*) respectively. It suggests that foreign firms may face the problem of dealing with local management maybe due to cultural difference so they try to combat the problem of agency cost with increased leverage. Less availability of free cash would restrict managers to misuse resources. It can also

point out that foreign firms have less investment opportunities where they can utilise these excess available cash instead of paying out as interest.

For domestic data set, the results are contrary. Here the variable has significant negative relation with LTD (-0.0122\*\*) Domestic firms tend to reduce LTD with increase in agency cost. This suggests that domestic firms use their excess available cash to payoff their LT debt. Big domestic Norwegian firms are perhaps more transparent than foreign firms with lesser problems of information asymmetry, therefore companies prefer equity financing over debt when they face problems like agency cost. It is important to mention that these findings are contrary to the theory and previous empirical findings

### ***Result of Hypothesis***

1. H<sub>0</sub>: AC has a negative effect on LTD in foreign firms. (rejected)
2. H<sub>0</sub>: AC has a positive effect on LTD in domestic firms. (rejected)
3. H<sub>0</sub>: AC has a negative effect on STD in foreign firms. (accepted)
4. H<sub>0</sub>: AC has a positive effect on STD in domestic firms. (insignificant)

## **7.5 Country Level variables**

### ***7.5.1 Inflation rate***

Inflation has significant positive relation with LTD for domestic data set only (0,320\*). TOT suggests that high inflation leads to high level of leverage because real value of tax deduction is higher when inflation is high.

### ***Result of Hypothesis***

1. H<sub>0</sub>: INF has a positive effect on LTD in foreign firms. (insignificant)
2. H<sub>0</sub>: INF has a positive effect on LTD in domestic firms. (accepted)
3. H<sub>0</sub>: INF has a positive effect on STD in foreign firms. (insignificant)
4. H<sub>0</sub>: INF has a positive effect on STD in domestic firms (insignificant)

### ***7.5.2 Exchange rate***

	Combined	Domestic	Foreign
LTD	0.1258***	0.1064***	0.1254***
STD	-0.0954***	0.0055	-0.2734***

It is a highly significant country level determining factor but with opposite signs for both ST and LT leverage (0.1258\*\*\*, 0.1064\*\*\*, 0.1254\*\*\*) & (-0.0954\*\*\*, 0.0055, -0.2734\*\*\*) respectively for combined, domestic and foreign data. When Norwegian kroner weakens with respect to dollar, revenues

fall, which result into less cash inflow. Weaker currency means that more money is required to buy from abroad. Therefore companies require more external financing.

### ***Result of Hypothesis***

1. H<sub>0</sub>: EXR has a positive effect on LTD in foreign firms. (accepted)
2. H<sub>0</sub>: EXR has a negative effect on LTD in domestic firms.(rejected)
3. H<sub>0</sub>: EXR has a positive effect on STD in foreign firms. (rejected)
4. H<sub>0</sub>: EXR has a negative effect on STD in domestic firms (insignificant)

### ***7.5.3 Economic growth***

The factor is not significant to predict the capital structure of listed companies operating in Norway. However the sign is constantly negative throughout regression attempts, which suggests compliance to POT. According to POT, under high economic growth, companies generate good profit therefore they do not need external financing. Another reason might be that companies are not optimistic with economic growth of the country, so they payout loans.

### ***Result of Hypothesis***

1. H<sub>0</sub>: EGR has a positive effect on LTD in foreign firms. (insignificant)
2. H<sub>0</sub>: EGR has a positive effect on LTD in domestic firms. (insignificant)
3. H<sub>0</sub>: EGR has a positive effect on STD in foreign firms. (insignificant)
4. H<sub>0</sub>: EGR has a positive effect on STD in domestic firms (insignificant)

**Table 18: Relationship of explanatory variables with debt depicted with signs (+/-).**

Comparing results of past international empirical studies with current study

	Nunkoo & Boateng	Antoniou	Lee and Kwok	Reeb	Mansi	Chen	Burgman	Titman and Wessels	Harris and Raviv (1991)	Frank and Goyal (2008)	Rajan and Zingales (1995)	My Findings						
												LTD/TA			STD/TA			
												C	D	F	C	D	F	
Firm Level	Firm size	+	+					+	+	+	+	-	-	-	-	-	-	
	Tangibility	+						0	+	+	+	+	+	+	+	+	+	
	Tax shields								+				+	+	+	-	+	-
	Prob. of bankruptcy												-	-	-	-	-	-
	Business Risk								-				+	+	+	+	+	+
	Agency cost												+	-	+	-	+	-
	Growth	-	-					0	+	-	-	-	+	-	+	+	-	+
	Non-Debt tax shield							0					-	+	-	+	+	+
	Past Profitability												+	-	+	-	-	+
	Current Profitability	+							-	-	-	-	-	-	-	-	+	-
	Liquidity												+	+	+	-	-	-
	Country Level	Dividend payout ratio									-	-	-	-	-	-	+	-
Inflation										+			+	+	-	-	-	-
Exchange rate													+	+	+	-	+	-
Economic growth													-	-	-	-	-	-
Ownership	Local firm																	
	Foreign firm			-	+	+	-	-										

**Table 19: Relationship of explanatory variables with debt depicted with signs (+/-).**

Comparing results from past empirical studies on Norwegian data with current study

	Frydenberg (2004)		Mjøøs (2008)		I.G De Olalla	My Findings						
	LTD/TA	STD/TA	LTD/TA	STD/TA	LTD/TA	LTD/TA			STD/TA			
						C	D	F	C	D	F	
Firm Level	Firm size	+	+	+	-	+	-	-	-	-	-	-
	Tangibility			+		+	+	+	+	+	+	+
	Tax shields						+	+	+	-	+	-
	Probability of bankruptcy						-	-	-	-	-	-
	Business Risk					+	+	+	+	+	+	+
	Agency cost						+	-	+	-	+	-
	Growth	+	+				+	-	+	+	-	+
	Non-Debt tax shield	+	-				-	+	-	+	+	+
	Past Profitability						+	-	+	-	-	+
	Current Profitability			-		+	-	-	-	-	+	-
	Liquidity						+	+	+	-	-	-
	Country Level	Dividend payout ratio	-	+	-			-	-	-	+	-
Inflation						+	+-	+	-	-	-	-
Exchange rate							+	+	+	-	+	-
Economic growth						+	-	-	-	-	-	-
Owners hip	Local firm											
	Foreign firm											

## 8 Conclusion

### 8.1 Main Findings

The study examined the explanatory factors of capital structure choice for largest domestic 29 and largest 35 foreign companies (log assets) in total, operating and listed in Norway for the past 5 years (2011-2015). Two separate models for book values of long term debt (LTD) and short term debt (STD) are tested for three different data sets including domestic firms data, foreign firms data and overall combined data set including both domestic and foreign firms.

The result indicates that most of the variables related to profit (current & past profitability, firm size, liquidity) are significantly negatively related to either short term or long term debt ratio, signalling that profits are used to pay-out debt.

It can be concluded that big companies in Norway prefer to pay out debts whenever it is feasibly possible with liquid reserves internally available. More transparency and less information asymmetry makes equity the more preferred option to approach external financing for big companies. Most of the domestic companies pay regular dividends that make their equity more attractive for investors. Support of trade-off theory for both short term and long term debt is obvious.

Companies operating in Norway usually have good reserves to support their short term needs therefore all the explanatory variables except business risk have negative relation to STD for both domestic and foreign companies showing that companies have lower target debt ratio.

**Non-debt tax shield** is the most important explanatory variable with highest coefficient value with respect to determine capital structure of both foreign and domestic listed firms in Norway. Firms are capital intensive, depreciation of this capital becomes a source of income for the firms. Domestic firms raise more debt with income from non-debt tax shield to avoid taxes. Foreign firms, on the contrary payout their long-term debt with income from non-debt tax shield.

**Tangibility** is the second most significant explanatory variable with high coefficient value. Since the sample is comprised of only largest firms, such firms are capital intensive. Therefore tangibility plays an important role as companies opt long-term loans to finance their fixed assets. This result is in compliance to previous empirical findings from studies on Norwegian listed companies.

**Firm size** with its high significance, negatively related to short-term and long-term debt. The result is contrary to the previous findings of Frydenberg (2004), I.G De Olalla (2016) and Mjøs (2007) from data of Norwegian listed companies.

Leverage is found to be positively related to **inflation** and **exchange rate risk**. These findings are consistent with the use of capital structure as a tool to hedge economic exchange rate risk.

R<sup>2</sup> value of both the models is reasonably well. For LT debt, R<sup>2</sup> value (33 %, 27%, 37%) and for ST debt, R<sup>2</sup> value (17%, 24%, 17%) for three data sets combined, domestic and foreign respectively. Results are given in Table 17

.Significant variables with their coefficient values and resulted relationship (+/-) with LT and ST debt is shown in Figure 7 and

Figure 8

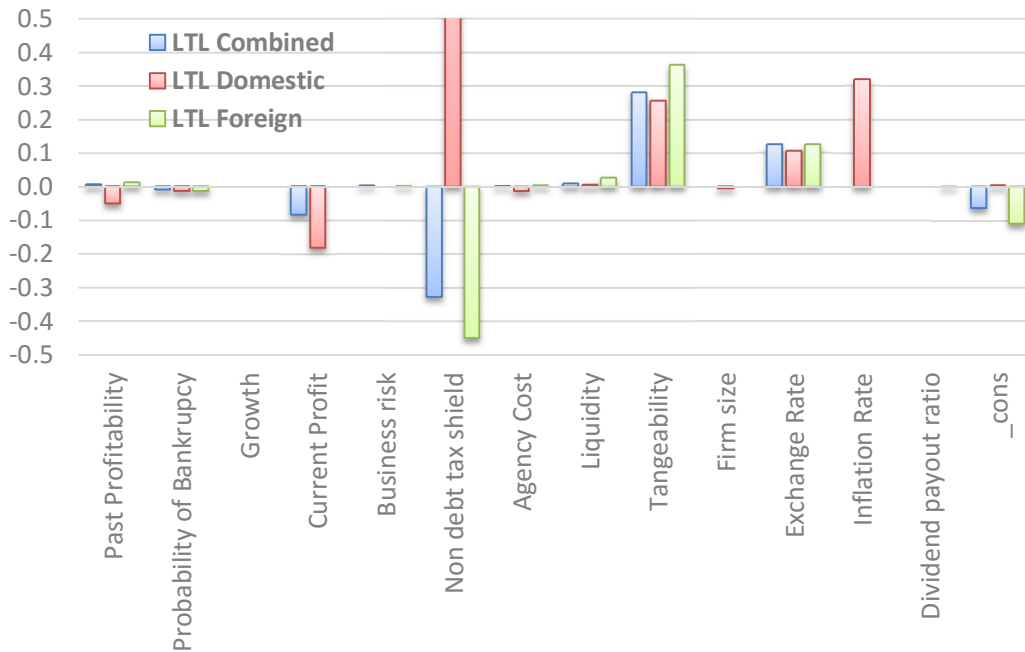


Figure 7: Significant variables with sign and magnitude of resulted relationship with leverage LTD

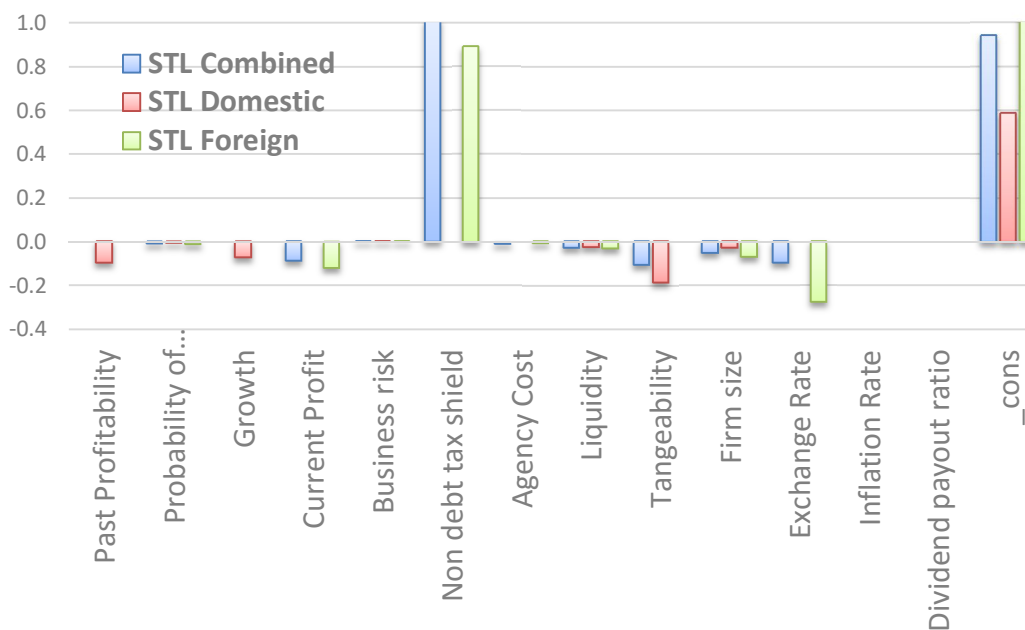


Figure 8: Significant variables with sign and magnitude of resulted relationship with leverage STD



## 8.2 Difference between domestic and foreign firms

There are three variables that shows significant results but coefficients with different signs for domestic and foreign firms in long term debt ratio.

- i. Non debt tax shield (saving from depreciation) has positive sign for domestic firms and negative sign for foreign firms. Positive relation means that with the gains from depreciation, domestic companies increase their long-term debt. The possible reason is that domestic companies try to avoid tax payment as much as possible by paying interest. Negative sign for foreign firms indicates that companies try to avoid external financing when they have enough internal reserves available and try to pay back if possible.
- ii. Agency Cost has negative sign for domestic firms and positive sign for foreign firms. The positive relation with LTD indicates that foreign firms try to discipline managers by increasing leverage if they face the problems of misuse of revenues internally. Negative sign for domestic firms can be justified by considering that domestic firms use their earnings to pay back LT loans if they are afraid of miss use. It signals their trend to avoid external leverage.
- iii. Past profitability shows negative sign for domestic firms and positive for foreign. The negative relation again points out towards trend of domestic firms to avoid and reduce long term debt whenever they have enough reserves to pay back loans. A positive relation again points out towards the trend of foreign firms that they try to avoid tax by taking more loans. When they pay interest, so the tax payments are ultimately reduced.

## 8.3 Suggestions and recommendations

Initially the idea was to include all potential explanatory variables to perform regressions and omitting those variables from the regression that were not significant. This process was to be repeated multiple times until the core model of only significant variables is obtained. Later the conventional method was decided as to depict both significant and no-significant variables in the results. I recommend researchers to adopt the methodology of finding core model on the given data for further research.

In addition, it is suggested to include also private firms and small firms with the segregation of domestic and foreign, so that more authentic results can be obtained with large sample size.

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## Appendix A

### Multicollinearity Table

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Taxshield		2	2	1	2	1	2	2	1	1	2	1	1	1	1	1	2	
Past Profitability	1		2	1	1	1	2	2	1	1	2	1	1	1	1	1	2	
Probability of Bankruptcy	1	1		1	2	1	2	2	1	1	2	1	1	1	1	1	2	
Growth	1	2	2		2	1	2	2	1	1	2	1	1	1	1	1	2	
Current Profit	1	2	2	1		1	2	2	1	1	2	1	1	1	1	1	2	
Business risk	1	2	2	1	2		2	2	1	1	2	1	1	1	1	1	2	
Non debt tax shield	1	2	2	1	2	1		1	1	1	2	1	1	1	1	1	2	
Agency Cost	1	2	2	1	1	1	1		1	1	2	1	1	1	1	1	2	
Liquidity	1	2	1	1	2	1	2	2		1	2	1	1	1	1	1	2	
Tangeability	1	2	2	1	2	1	2	2	1		2	1	1	1	1	1	2	
Firm size	1	1	2	1	2	1	2	2	1	1		1	1	1	1	1	1	
Age of business	1	2	2	1	2	1	2	2	1	1	2		1	1	1	1	2	
Market to Book ratio	1	2	2	1	2	1	2	2	1	1	2	1		1	1	1	2	
Exchange Rate	1	2	2	1	2	1	2	2	1	1	2	1	1		1	1	2	
Inflation Rate	1	2	2	1	2	1	2	2	1	1	2	1	1	1		1	2	
Dividend payout ratio	1	2	2	1	2	1	2	2	1	1	2	1	1	1	1		1	
Economic Growth	1	2	2	1	2	1	2	2	1	1	2	1	1	1	1	1		2
Cash from Operating Activities	1	2	2	1	2	1	2	2	1	1	2	1	1	1	1	1	1	

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## Appendix B OLS Regression (Combined)

### Dependent Variable: Short term debt ratio

Number of obs	2256
F( 15, 2240)	42.11
Prob > F	0
R-squared	0.22
Adj R-squared	0.2147
Root MSE	0.1802

### Dependent Variable: Long term debt ratio

Number of obs	2256
F( 15, 2240)	80.29
Prob > F	0
R-squared	0.3497
Adj R-squared	0.3453
Root MSE	0.16376

STD	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TS	0.0019909	0.0044356	0.45	0.654	-0.0067075	0.0106893
PP	-0.0220983	0.0054378	-4.06	0	-0.0327619	-0.0114348
Z	-0.0070475	0.0017907	-3.94	0	-0.010559	-0.003536
G	0.034833	0.0180965	1.92	0.054	-0.0006545	0.0703206
CP	-0.1668143	0.0573086	-2.91	0.004	-0.2791978	-0.0544309
BR	0.0014494	0.0008233	1.76	0.078	-0.000165	0.0030639
ND	1.023011	0.2033322	5.03	0	0.6242715	1.42175
AC	-0.0105504	0.0021348	-4.94	0	-0.0147368	-0.0063641
L	-0.0364786	0.0028628	-12.74	0	-0.0420926	-0.0308646
TAN	-0.1809777	0.0148812	-12.16	0	-0.2101601	-0.1517954
S	-0.0198679	0.0028209	-7.04	0	-0.0253998	-0.0143361
EXR	-0.052118	0.0273641	-1.9	0.057	-0.1057797	0.0015438
INF	-0.3213235	0.4019255	-0.8	0.424	-1.109509	0.4668619
DPR	1.25E-06	2.01E-06	0.62	0.532	-2.68E-06	5.19E-06
EGR	-0.0198128	0.0757817	-0.26	0.794	-0.1684225	0.1287969
_cons	0.6177474	0.058042	10.64	0	0.5039257	0.7315692

LTD	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TS	-0.0010279	0.004031	-0.26	0.799	-0.0089327	0.0068769
PP	0.0138816	0.0049416	2.81	0.005	0.0041909	0.0235723
Z	-0.0150519	0.0016273	-9.25	0	-0.018243	-0.0118607
G	0.015439	0.0164454	0.94	0.348	-0.0168108	0.0476889
CP	-0.0600879	0.05208	-1.15	0.249	-0.1622181	0.0420422
BR	0.0012266	0.0007482	1.64	0.101	-0.0002405	0.0026938
ND	-0.2772506	0.1847812	-1.5	0.134	-0.6396109	0.0851097
AC	-0.0024062	0.00194	-1.24	0.215	-0.0062106	0.0013982
L	0.0137684	0.0026016	5.29	0	0.0086666	0.0188702
TAN	0.3863936	0.0135235	28.57	0	0.3598737	0.4129135
S	0.0036258	0.0025635	1.41	0.157	-0.0014013	0.008653
EXR	0.1001048	0.0248676	4.03	0	0.0513389	0.1488707
INF	0.314402	0.3652558	0.86	0.389	-0.4018733	1.030677
DPR	-6.68E-06	1.83E-06	-3.66	0	-0.0000103	-3.10E-06
EGR	0.0011408	0.0688677	0.02	0.987	-0.1339104	0.1361921
_cons	-0.1210958	0.0527465	-2.3	0.022	-0.2245331	-0.0176586

## Appendix C OLS Regression (Domestic)

Dependent Variable: Short term debt ratio

Number of obs	1396
F( 15, 2240)	36.59
Prob > F	0
R-squared	0.2846
Adj R-squared	0.2768
Root MSE	0.12141

STD	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TS	0.0023231	0.0036482	0.64	0.524	-0.004834	0.0094798
PP	-0.1567949	0.0146245	-10.72	0	-0.185484	-0.128106
Z	-0.0034716	0.0019127	-1.82	0.07	-0.007224	0.0002804
G	-0.0617844	0.0270534	-2.28	0.023	-0.114855	-0.008714
CP	-0.0286213	0.0787967	-0.36	0.716	-0.183196	0.1259529
BR	0.0014799	0.0010012	1.48	0.14	-0.000484	0.0034438
ND	1.228398	0.4445863	2.76	0.006	0.3562604	2.100537
AC	0.0150723	0.0051633	2.92	0.004	0.0049434	0.0252011
L	-0.0276679	0.0023138	-11.96	0	-0.032207	-0.023129
TAN	-0.1441914	0.0166245	-8.67	0	-0.176804	-0.111579
S	-0.0199142	0.0027545	-7.23	0	-0.025318	-0.014511
EXR	-0.0309793	0.0240547	-1.29	0.198	-0.078167	0.0162086
INF	-0.1480934	0.3445493	-0.43	0.667	-0.82399	0.5278037
DPR	4.40E-07	1.40E-06	0.31	0.753	-2.31E-06	3.19E-06
EGR	-0.0362101	0.0751263	-0.48	0.63	-0.183584	0.1111639
_cons	0.554835	0.0549866	10.09	0	0.4469687	0.6627014

Dependent Variable: Long term debt ratio

Number of obs	1396
F( 15, 2240)	44.81
Prob > F	0
R-squared	0.3275
Adj R-squared	0.3202
Root MSE	0.12868

LTD	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TS	-0.001343	0.003867	-0.35	0.728	-0.0089274	0.0062423
PP	-0.061407	0.0155	-3.96	0	-0.0918123	-0.031002
Z	-0.014391	0.002027	-7.1	0	-0.0183673	-0.0104142
G	0.0313616	0.028672	1.09	0.274	-0.0248841	0.0876072
CP	-0.473428	0.083511	-5.67	0	-0.6372505	-0.3096045
BR	0.0004068	0.001061	0.38	0.702	-0.0016747	0.0024883
ND	-1.298995	0.471188	-2.76	0.006	-2.223316	-0.3746737
AC	-0.052705	0.005472	-9.63	0	-0.0634397	-0.0419699
L	0.0066367	0.002452	2.71	0.007	0.0018262	0.0114471
TAN	0.2833667	0.017619	16.08	0	0.2488033	0.3179301
S	0.0059371	0.002919	2.03	0.042	0.0002104	0.0116637
EXR	0.1223174	0.025494	4.8	0	0.0723061	0.1723286
INF	0.3803201	0.365165	1.04	0.298	-0.3360183	1.096659
DPR	-5.32E-06	1.48E-06	-3.58	0	-8.23E-06	-2.40E-06
EGR	-0.013343	0.079621	-0.17	0.867	-0.1695349	0.142849
_cons	-0.067537	0.058277	-1.16	0.247	-0.1818569	0.0467839

## Appendix D OLS Regression (Foreign)

Dependent Variable: Short term debt ratio

Number of obs	860
F( 15, 2240)	17.82
Prob > F	0
R-squared	0.2405
Adj R-squared	0.227
Root MSE	0.24036

Dependent Variable: Long term debt ratio

Number of obs	860
F( 15, 2240)	38.33
Prob > F	0
R-squared	0.3275
Adj R-squared	0.3946
Root MSE	0.12868

STD	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TS	-0.0031735	0.0104653	-0.3	0.762	-0.0237146	0.0173676
PP	-0.0153288	0.0091524	-1.67	0.094	-0.033293	0.0026353
Z	-0.0069385	0.0035423	-1.96	0.05	-0.0138912	0.0000142
G	0.0455357	0.0274501	1.66	0.098	-0.0083429	0.0994142
CP	-0.1899024	0.0907378	-2.09	0.037	-0.3680005	-0.0118042
BR	0.0018084	0.0013389	1.35	0.177	-0.0008196	0.0044365
ND	0.9934096	0.3096706	3.21	0.001	0.3855948	1.601224
AC	-0.0121096	0.003063	-3.95	0	-0.0181215	-0.0060977
L	-0.0529389	0.0074551	-7.1	0	-0.0675716	-0.0383063
TAN	-0.2033365	0.0373952	-5.44	0	-0.2767351	-0.129938
S	-0.023934	0.006593	-3.63	0	-0.0368745	-0.0109934
EXR	-0.1692175	0.0619409	-2.73	0.006	-0.2907938	-0.0476413
INF	-0.5467621	0.8757319	-0.62	0.533	-2.26563	1.172106
DPR	0.0000144	0.0000146	0.99	0.324	-0.0000143	0.0000431
EGR	0.0311098	0.1386833	0.22	0.823	-0.2410948	0.3033144
_cons	0.8992641	0.1238041	7.26	0	0.656264	1.142264

LTD	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TS	0.0040688	0.0085027	0.48	0.632	-0.01262	
PP	0.0068631	0.007436	0.92	0.356	-0.0077321	
Z	-0.0188667	0.002878	-6.56	0	-0.0245156	
G	0.0109451	0.0223022	0.49	0.624	-0.0328293	
CP	0.0165299	0.0737211	0.22	0.823	-0.1281683	
BR	0.0011739	0.0010878	1.08	0.281	-0.0009613	
ND	-0.0548291	0.2515958	-0.22	0.828	-0.548656	
AC	0.0000419	0.0024885	0.02	0.987	-0.0048425	
L	0.0431403	0.006057	7.12	0	0.0312519	
TAN	0.5450228	0.0303822	17.94	0	0.4853892	
S	0.0079465	0.0053565	1.48	0.138	-0.0025672	
EXR	0.0117783	0.0503247	0.23	0.815	-0.0869979	
INF	0.2084929	0.7114995	0.29	0.77	-1.188023	
DPR	-2.92E-06	0.0000119	-0.25	0.805	-0.0000262	
EGR	0.0069019	0.112675	0.06	0.951	-0.2142542	
_cons	-0.1305021	0.1005863	-1.3	0.195	-0.3279307	

## Appendix E List of Companies - Domestic

	Firm name	Ticker name	from	to
1	Statoil ASA	STD.OL	q1 2000	q4 2015
2	Telenor ASA	TEL.OL	q1 2000	q4 2015
3	Yara International ASA	YAR.OL	q2 2004	q4 2015
4	Orkla ASA	ORK.OL	q1 2000	q4 2015
5	Norsk Hydro ASA	NHY.OL	q1 2006	q3 2015
6	Marine Harvest ASA	MHG.OL	q1 2000	q3 2015
7	Schibsted ASA	SBSTB.OL	q3 2000	q3 2015
8	Leroy Seafood Group ASA	LSG.OL	q1 2001	q3 2015
9	Salmar ASA	SALM.OL	q1 2006	q3 2012
10	Kongsberg Gruppen ASA	KOG.OL	q1 2000	q4 2015
11	Olav Thon Eiendomsselskap ASA	OLT.OL	q1 2000	q3 2015
12	Veidekke ASA	VEI.OL	q1 2000	q4 2015
13	TGS NOPEC Geophysical Company ASA	TGS.OL	q3 2000	q4 2015
14	Tomra Systems ASA	TOM.OL	q3 2000	q4 2015
15	Entra ASA	ENTRA.OL	q1 2013	q3 2015
16	Af Gruppen ASA	AFGRA.OL	q1 2004	q3 2015
17	Aker ASA	AKER.OL	q1 2004	q3 2015
18	Norwegian Air Shuttle ASA	NWC.OL	q1 2003	q4 2015
19	Det Norske Oljeselskap ASA	DETNOR.OL	q2 2006	q3 2015
20	Austevoll Seafood ASA	AUSS.OL	q1 2005	q3 2015
21	Hafslund ASA	HNA.OL	q1 1999	q4 2015
22	Atea ASA	ATEA.OL	q1 2000	q4 2015
23	Fred Olsen Energy ASA	FOE.OL	q4 2000	q3 2015
24	Algeta ASA	ALGZF.PK)	q1 2005	q4 2013
25	Petroleum Geo Services ASA	PGS.OL	q1 1992	q3 2015
26	Cermaq Group AS	CRMQF.PK)	q1 2003	q3 2014
27	DNO ASA	DNO.OL	q1 2000	q4 2015
28	Opera Software ASA	OPERA.OL	q1 2002	q4 2015
29	Wilh Wilhelmsen ASA	WWASA.OL	q1 2009	q4 2015

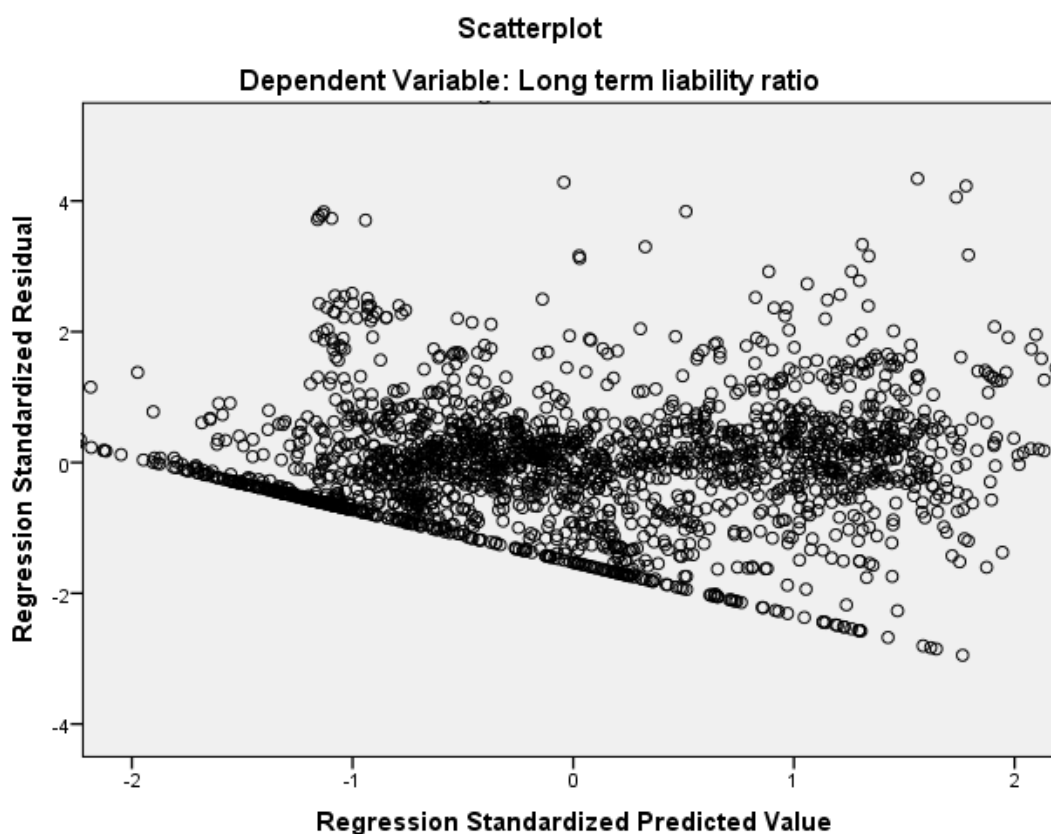
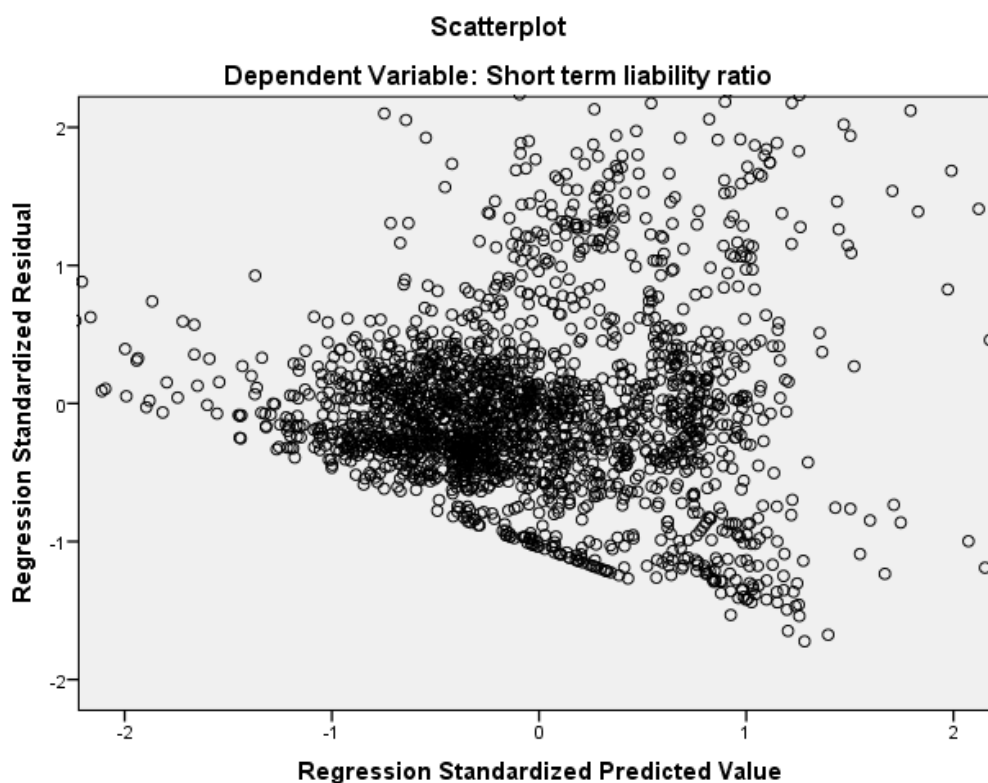


## Appendix F List of Companies - Foreign

	Firm name	Ticker name	From	To
1	Royal Caribbean Cruises Ltd	RCL.OL	q1 1992	q4 2015
2	Subsea 7 SA	SUBC.OL	q1 1999	q4 2015
3	Frontline Ltd	FRO.OL	q1 1998	q3 2015
4	P/F Bakkafrøst	BAKKA.OL	q2 2009	q3 2015
5	Hoegh LNG Holdings Ltd	HLNGH.OL	q2 2010	q3 2015
6	Stolt-Nielsen Ltd	SNI.OL	q1 1998	q4 2015
7	Seadrill Ltd	SDRL.OL	q2 2005	q3 2015
8	Prosafē SE	PRSO.OL	q1 2000	q4 2015
9	Tanker Investments Ltd	TANIL.OL	q4 2013	q3 2015
10	BW Offshore Ltd	BWO.OL	q1 2005	q4 2015
11	SAS AB	SASNOK.OL	q1 2000	q4 2015
12	Golden Ocean Group Ltd	GOGL.Tr.OL	q4 1999	q3 2015
13	Siem Offshore Inc	SIOFF.OL	q3 2005	q3 2015
14	Odfjell Drilling Ltd	ODLL.OL	q2 2012	q3 2015
15	Gaming Innovation Group Inc formally NIO inc)	GAMIG.OL	q1 2004	q3 2015
16	Songa Offshore SE	SONG.OL	q3 2005	q3 2015
17	Wentworth Resources Ltd	WRLT.OL	q2 2005	q3 2015
18	Jinhui Shipping and Transportation Ltd	JINS.OL	q2 2000	q3 2015
19	Siem Shipping Inc	SSIP.OL	q1 2001	q3 2015
20	Asetek A/S	ASETEK.OL	q4 2011	q3 2015
21	Vizrt Ltd Delisted	VIZ.OL^C15	q2 2000	q4 2014
22	Archer Ltd	ARCHER.OL	q1 2008	q2 2015
23	Deep Sea Supply PLC	DESSC.OL	q3 2005	q3 2015
24	EMAS Offshore Ltd (formally known as EOC)	EMASL.OL	q3 2006	q4 2015
25	Northern Offshore Ltd Delisted	NFSHF.PK)	q1 2000	q1 2015
26	Polarcus Ltd	PLCS.OL	q2 2008	q3 2015
27	Northland Resources SE Delisted	NAUR.OL^A15	q2 2004	q3 2014
28	Questerre Energy Corp	QEC.OL	q1 2004	q3 2015
29	VERIPOS INC	VPOS.OL^C14	q1 2011	q4 2013
30	Avocet Mining	AVM.OL	q2 2010	q3 2015
31	Funcom	Funcom	q4 2004	q4 2015
32	Dockwise		q4 2012	q4 2006
33	Fairstar Heavy Transport		q1 2006	q2 2012
34	Axactor publ AB (Nickel Mountain Group)	AXA	q3 2015	q1 2001

## Appendix G

## Scatter Plots Linear Regression



## Appendix H

## Skewness and kurtosis

