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Debt Heterogeneity

An empirical study of debt structure determinants for the companies in the OSEBX index

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NORWEGIAN SCHOOL OF ECONOMICS

Acknowledgements

This master thesis was written as a conclusive part of the Master of Science in Economics and Business Administration program at the Norwegian School of Economics. The research topic is within the authors' main profile, Financial Economics, and amounts to 30 credits over a semester.

The background for the choice of research topic is our interest in the field of capital structure. Both authors have taken several corporate finance courses during our time at NHH, and we came across the inspiration for this topic during the "Cases in Corporate Finance" course. The work process has been very educational and fascinating, but also complicated and at times, frustrating. We believe that the acquired knowledge about the determinants of debt structure is something that we can bring with us into our future careers.

We wish to extend our gratitude to our supervisor Kyeong Hun Lee who has contributed with valuable insights before and under the process of writing this thesis. Finally, we would like to thank our family and friends for always supporting us.

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Abstract

This thesis aims at investigating how firm-specific characteristics affect the debt structure, debt specialisation and debt priority structure decisions of the firms in the OSEBX index. In the period 2009-2018, we observe 54 individual firms for a total of 445 firm-year observations. The data set is unique, collected manually from the firms' annual reports, and cross-checked with SDC Platinum. The debt outstanding is categorised in detail to provide new insights into the complexities of the debt structure.

We find that while large firms do not use more leverage, they have more diversified borrowings and prefer market debt, which is senior unsecured. Profitable firms use more debt, have specialised borrowings and prefer secured private debt. Firms with high growth opportunities use less debt and avoid restrictive debt types, such as bank debt and mortgages. High growth firms also use less subordinated debt. Tangible firms use more of all debt categories except for bank debt. They have more diversified borrowings and have more access to subordinated debt. Dividend payers use less debt, driven by convertibles and export credit. Further, family-controlled firms use more debt and prefer private debt to public debt. All else equal, family-controlled firms have more diversified borrowings, and they rely on secured debt. Firms with high liquidity rely less on debt, which is mainly driven by less dependence on short term debt sources, such as bank debt. They also have more access to subordinated debt.

By treating debt as heterogeneous, this thesis has analysed and uncovered previously hidden nuances of capital structure. We believe this paper provides further insight into the financing decision of Norwegian public firms.

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1 Introduction

Capital structure is one of the primary disciplines of corporate finance, first introduced by the groundbreaking work of Modigliani and Miller (1959). Despite their findings, capital structure has remained a highly relevant research topic. In fact, capital structure is one of the most crucial decisions of corporate management. With market imperfections like taxes and bankruptcy costs, the choice of capital structure affects the value of the firm. Further, the choice of capital structure affects managerial incentives and could potentially create conflicts of interest between equity holders and debt holders.

Previous literature has often treated debt as a homogeneous entity. However, treating debt as homogeneous impose restrictions on the understanding of the real complexities of the debt structure. Each specific debt type has its unique properties, such as different payoff and priority structures. Ignoring these features omits valuable insight into how management determines the capital structure.

More accessible information and improved databases have paved the way for new directions in capital structure research. This accessibility has made it possible to extract more details about the complexity of outstanding debt obligations. More details make it possible to treat debt as a heterogeneous entity and thereby allow to analyse the effect of each specific type of debt instrument.

Inspired by the work of Rauh and Sufi (2010), this thesis explores capital structure in the Norwegian market from a heterogeneous debt perspective. As a proxy for the Norwegian equity market, we decided to use the companies in the Oslo Stock Exchange Benchmark Index (OSEBX). For these companies, we have obtained detailed information on debt and firm-specific characteristics for the time period 2009-2018. Using this unique data set, we uncover previously ignored nuances in the investigation of the Norwegian capital market. To our knowledge, we are the first to provide such a detailed analysis of the debt structure and debt specialisation of the companies in the OSEBX index.

1.1 Research Problem

This paper examines the determinants that affect the debt structure of the firms in the OSEBX index. The firm-specific characteristics used are in accordance with previous research in the field, but this paper also includes new firm characteristics not commonly applied to debt structure analysis. The results will be interpreted with a basis in established capital structure theories and previous empirical research. This paper seeks to answer the following research problem:

This paper aims to investigate how selected firm-specific characteristics are affecting the debt structure, degree of specialisation and priority structure of the companies in the OSEBX index.

1.2 Contribution

The main contribution of this paper is the unique data set collected manually from the annual reports of the companies in the sample. It provides a detailed view of the composition of debt used by Norwegian public firms as well as their debt specialisation and priority structure. Further, this paper introduces new determinants that are uncommon in the field of capital structure research. We believe this may provide a broader understanding of the diversity of capital structure.

2 Background

2.1 OSEBX and the Oslo Stock Exchange

The Oslo Stock Exchange Benchmark Index consists of the 67 most traded stocks on the Oslo Stock Exchange and is revised semiannually. In table A1 in the appendix, a list of the companies included in the index is presented. The Oslo Stock Exchange is one of the leading market places for oil and gas, shipping and fisheries and aquaculture in the world, which is reflected by the composition of the index. By year-end 2018 the market capitalisation of the Oslo Stock Exchange was approximately 70.8% of GDP (Norges Bank, 2019).

2.2 The Norwegian Bond Market

As of year-end 2018, the market capitalisation of the domestic bond market was approximately 58.6% of GDP (Norges Bank, 2019). According to Nordic Trustee (2019), the Norwegian bond market is among the largest and most active in Europe. At the end of 2018, the Norwegian bond market had 2060 billion NOK outstanding, with 500 billion NOK of these being corporate.

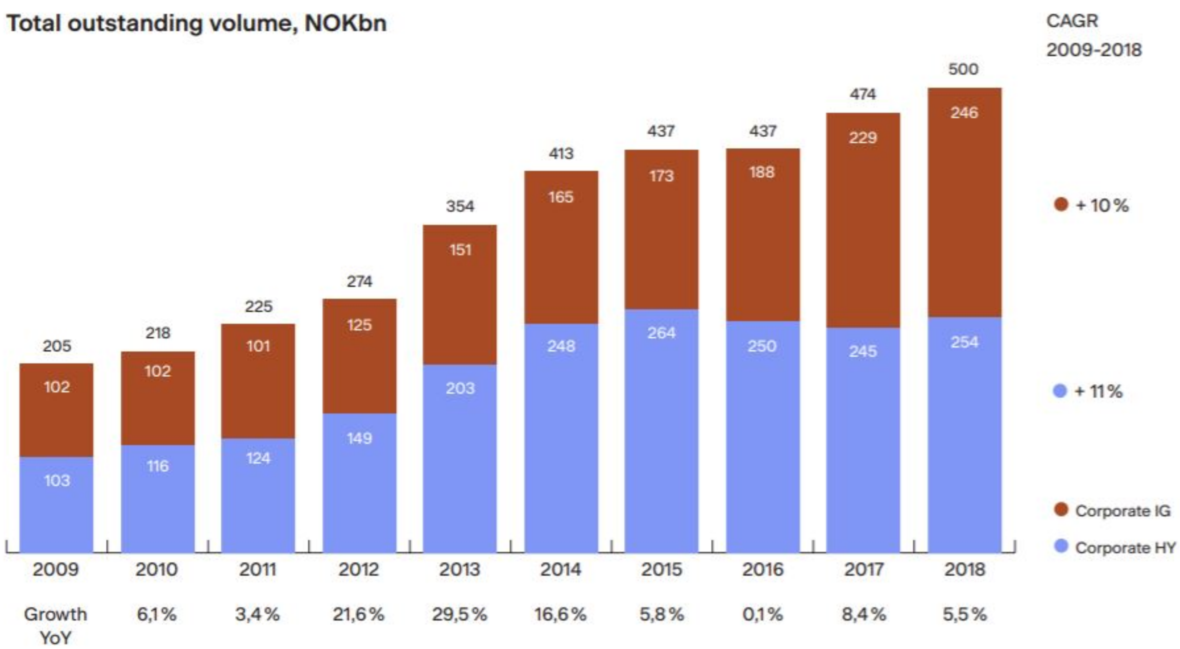

Figure 2.1: Corporate bonds outstanding.
Nordic Trustee (2019)

The corporate bond market has flourished in the last decade, with bonds outstanding more than doubling. The growth is especially strong from 2012 to 2014, strongly driven by the issuance of high yield bonds. The period 2012-2014 was characterised by high oil prices, which drove oil service companies to issue high yield bonds to fuel their growth. From the oil price crisis of autumn 2014, the number of high yield bonds outstanding stagnated. However, investment-grade bonds kept growing and ensured positive growth rates for the entire corporate bond market.

2.2.1 Leader and Laggard

A paradox of the Norwegian bond market is its position as both leader and laggard. The Norwegian bond market has been a pioneer when it comes to the use of high yield bonds, and is one of the most effective high yield markets in the world, together with London and New York (Oslo Børs, 2014). As shown in figure 2.1, the high yield segment has made up more than 50% of the corporate bond market each year for the last decade. A report by Nordic Trustee (2019) shows that oil service and shipping are the most significant users of high yield financing. Despite their decline since the oil price crash of 2014, they still make up 48% of the high yield market.

The reason for Norway being a leader in the high yield market stem from its long tradition in cyclical and capital intensive industries such as oil and gas, shipping and oil service. This combination created a demand for high-risk debt, which was met by high yield bonds provided by innovative financiers. Today, the Norwegian bond market is used widely by foreigners. Although the size of the Norwegian market is relatively large, it mostly remains a niche market catering to maritime industries.

The Norwegian credit market is also a leader in another segment of the bond market, namely green bonds. In January 2015 The Oslo Stock Exchange became the first stock exchange in the world to operate a separate list for green bond issues. Green bonds finance environmentally friendly projects, and the list aims to showcase sustainable investment opportunities.

Despite the status as a leader in specific segments, the Norwegian bond market is also a laggard in other terms. The Norwegian bond market has very few ratings considering the high number of debt issues. Figure 2.2 shows that the majority of issuers are not rated. As the issuer pays for the rating, small companies that are not looking to issue debt internationally often chose to remain unrated. This lead to banks issuing shadow ratings to bond investors. Shadow ratings are conducted with similar methodology as official ratings, but they are not issued by a certified rating agency. The banks issuing shadow ratings were also competing for doing business with the bond issuers. This practice caused the European Securities and Market Authority (ESMA) to crack down on shadow ratings, and in 2016 the practice ceased. Despite this, most issuers are still not rated by a certified agency.

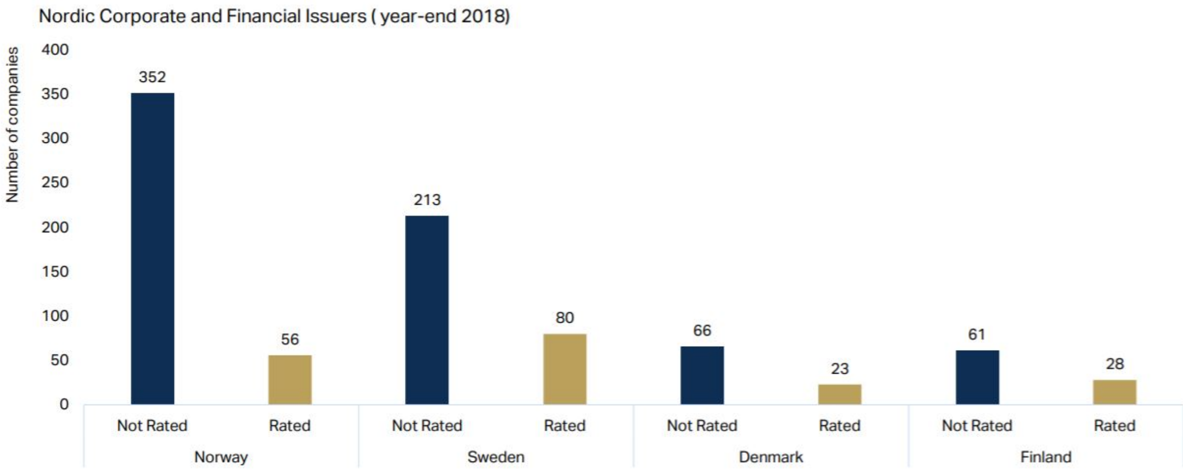

Figure 2.2: Number of rated issuers.
Liedgren (2019)

The Norwegian Bond Market has been developing rapidly in the period this paper sets out to analyse. This development establishes a fascinating backdrop for our research question. The maturation of the debt markets in Norway facilitates the use of a wide range of debt instruments. Therefore, analysing the heterogeneity of debt structure is highly relevant for a thorough understanding of the debt financing of firms.

3 Theory

This chapter examines the main theories of capital structure used in this paper. These theories function as a framework when examining how debt heterogeneity affects the capital structure of the companies in the OSEBX index. Capital structure is an extensively examined theoretical field, but treating debt as heterogeneous instead of just a homogeneous entity is not too common in research. To fully understand the implications of treating debt heterogeneously, one needs to understand the capital structure theories. Starting with the groundbreaking propositions of Modigliani and Miller and expanding this framework with other theories, we hope to provide a sufficient understanding of how debt heterogeneity impacts capital structure.

3.1 Modigliani and Miller Propositions

3.1.1 Modigliani and Miller Proposition I

Modigliani and Miller's propositions on a firm's financing decisions are by many viewed as one of the cornerstones of modern capital structure theories. They argued that a firm's debt to equity ratio does not affect the total value of the firm under the conditions found in a perfect capital market (Berk and DeMarzo, 2014).

Therefore, the following conditions must hold for the proposition to apply:

1. All securities are priced fairly and can be traded by both investors and firms in the market, equal to the present value of future cash flows of the securities.
2. There are no taxes or transaction costs
3. Cash flows do not affect the financing decisions of the firms, and they do not reveal any new information.
4. The law of one price holds as any two securities/commodities that are perfect substitutes must sell at the same price in equilibrium.

If the conditions of the perfect capital market are met, according to MM proposition 1, we have:

> "In a perfect capital market, the total value of a firm is equal to the market value of the total cash flows generated by its assets and is not affected by its choice of capital structure" (Berk and DeMarzo, 2014, p. 483).

This proposition can be written mathematically as:

$$E + D = U = A \tag{3.1}$$

Equation (3.1) highlights how, in a perfect capital market, the value of a firm's equity and debt is equal to the unlevered value, which is equal to the value of the firm's assets. Therefore, the market value of the firm is independent of the choice of capital structure (Berk and DeMarzo, 2014).

In a perfect capital market, the total cash flow generated by the assets of the firm will be equal to cash flow paid to its debt and equity holders. Therefore, the law of one price implies that the value of the firm's equity and liabilities must equal the value of its assets (Berk and DeMarzo, 2014).

Given the conditions of a perfect capital market, having firms trade securities for them create no value for investors. If this was not true, investors could buy and sell securities in the market, exchanging identical cash flows, but selling at a lower price, creating an arbitrage opportunity (Modigliani and Miller, 1959). Consequently, the price of over- and underpriced securities will approach equality. This also implies that the return on a firm's assets is not affected by the leverage ratio of the firm, as shown in (3.2):

$$\frac{E}{E+D}R_E + \frac{D}{E+D}R_D = R_U = R_{WACC} \tag{3.2}$$

Where the firms weighted average cost of capital (WACC) is independent of the firm's capital structure and equal to the unlevered cost of capital.

3.1.2 Modigliani and Miller Proposition II

MM proposition I state that the value of a firm is not affected by its choice of capital structure. However, the cost of capital still differs between securities, even in a perfect capital market. When a firm decides upon its capital structure, they choose between debt and equity. If they decide to finance a potential project exclusively with equity, the respective equity holders will require a higher expected return than the risk-free rate the firm can borrow at. Therefore, debt may seem like a cheaper and more reasonable financing choice (Berk and DeMarzo, 2014).

MM proposition II states that this is not the case since debt increases the financial risk and, consequently, the firm's equity cost of capital by demanding a premium for the additional risk (Modigliani and Miller, 1959).

This can be derived with a baseline in the equation from proposition I:

$$E + D = U = A \tag{3.3}$$

Next, one could replicate the cash flows from a portfolio consisting of the firm's equity and debt by holding unlevered equity, as the weighted average of the returns of the securities in the portfolio is equal to the total return. Restating (3.3) shows us that the equity cost of capital is equal to the risk without leverage plus any additional risk taken on due to leverage as shown in equation (3.4) below, and we therefore have that:

> "The cost of capital of levered equity increases with the firms' market value debt-equity ratio"(Berk and DeMarzo, 2014, p. 489)

$$r_E = r_U + \frac{D}{E} * (r_U - r_D) \tag{3.4}$$

3.2 Trade-off Theory

From the simplistic assumptions used in the Modigliani and Miller propositions, we now move on to models that better reflect the complexities of the real world. The perfect capital markets assumption underlying the Modigliani and Miller propositions does not hold when frictions such as transaction costs, information asymmetry, taxes, bankruptcy costs and agency problems arise. The core of the trade-off theory focuses mainly on taxes and bankruptcy costs.

3.2.1 Taxes

In a perfect capital market, the leverage ratio does not affect the valuation of the firm. That is essentially the conclusion of the Modigliani and Miller propositions. Introducing taxes alter this conclusion. Since debt payments are tax-deductible and dividends are not, the firm has an incentive to prefer debt financing over equity financing. The use of debt financing will increase the free cash flow to the firm, compared to a situation where the firm is all-equity financed. That is, the value of the company increases due to the usage of leverage. This effect is shown in figure 3.1 below.

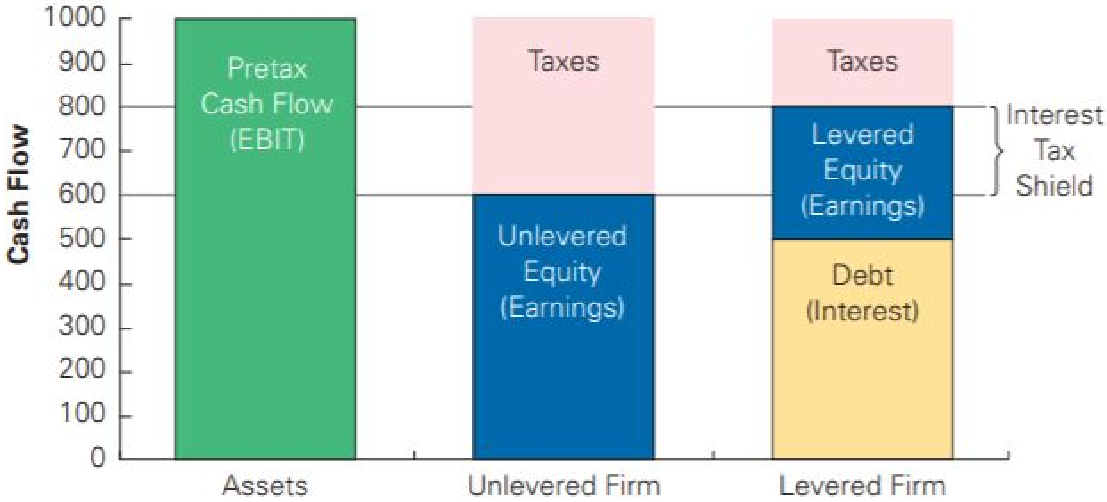

Figure 3.1: Debt tax shield.
(Berk and DeMarzo, 2014, p. 511)

The interest tax shield represents extra value to the equity holders of the firm. The introduction of personal taxes may reduce the effect of the tax shield (Berk and DeMarzo, 2014). To illustrate this, consider the following equation.

$$V^L = V^U + \tau^* D \tag{3.5}$$

V^L is the value of the firm in a levered state, and V^U is the value of the firm if financed only with equity capital. τ^*D is the marginal combined tax rate multiplied with the permanent debt level. This is equivalent to the present value of the tax shield of debt. If there are no personal taxes or the tax rates of personal debt and equity income are the same, then the τ^* is the same as the marginal corporate tax rate. This is shown in (3.6). τ_c is the corporate tax rate, τ_i is the tax rate to debt holders and τ_e is the personal tax rate to equity holders.

$$\tau^* = \frac{(1-\tau_i) - (1-\tau_c)(1-\tau_e)}{(1-\tau_i)} = 1 - \frac{(1-\tau_c)(1-\tau_e)}{(1-\tau_i)} \tag{3.6}$$

If the firm increases its value by issuing debt, then what sets the limit for optimal use? One thing to consider is the firm's earnings. To take advantage of the debt tax shield, the firm needs earnings it can offset. Therefore, the trade-off theory states that leverage should increase with profitability. This prediction is, as we shall see, the opposite of the prediction made by the pecking order theory. When Fama and French (2002) compared the two theories, they found a negative relationship between debt and profitability, exposing a weakness in the trade-off theory. The other effect limiting the amount of optimal debt issued is bankruptcy costs.

3.2.2 Bankruptcy Costs

We now introduce the second market friction, which is bankruptcy costs. Bankruptcy costs can be both the cost associated with actual bankruptcy (direct) but also the cost of being close to bankruptcy (indirect). Weiss (1990) studied 37 American bankruptcies finding an average direct cost of 3.1% of total capital with a range of 1% to 6.6%. The direct costs of bankruptcy are mainly, but not limited to, legal and advisory fees. These fees are more severe for small companies due to the lack of proportionality with assets, as Warner (1977) argues in his paper. These transaction fees are not accounted for in the

Modigliani and Miller world of perfect capital markets and would impose a cost of issuing excessive amounts of debt as this increases the probability of default.

The indirect cost of bankruptcy is more difficult to measure, but often more severe than the direct costs of bankruptcy. Berk and DeMarzo (2014) mention the following as the most common types of indirect bankruptcy costs: loss of customers, loss of suppliers, loss of employees, loss of receivables and fire sale of assets. In essence, counterparties of the distressed firm will observe the weak bargaining position and take advantage of it. Further, customers and suppliers will be reluctant to do business if the firm is too close to the edge of bankruptcy. Altman (1984) finds average indirect bankruptcy costs ranging from 11% to 17% of assets. He also found evidence of indirect bankruptcy costs up till three years before the bankruptcy, suggesting that this cost is imposed early at signs of weakness.

3.2.3 Trade-off

The simple trade-off model balances the interest tax shield versus the sum of the direct and indirect bankruptcy costs as shown in (3.7).

$$V^L = V^U + PV(\text{Interest Tax Shield}) - PV(\text{Financial Distress Costs}) \tag{3.7}$$

The value of the levered firm is equal to the value of the unlevered firm plus the present value of the interest tax shield minus the present value of the financial distress costs (Berk and DeMarzo, 2014). From this equation, the value of the firm can be maximised by borrowing until the marginal debt tax shield is equal to the marginal rate of the financial distress costs. This effect is shown in figure 3.2. The deriving of an optimal leverage ratio has an important implication, and the existence of leverage ratios is thoroughly researched. Papers by Taggart Jr. (1977), Marsh (1982), Auerbach (1983) and Jalilvand and Harris (1984) all confirms that firms are converging towards optimal leverage ratios.

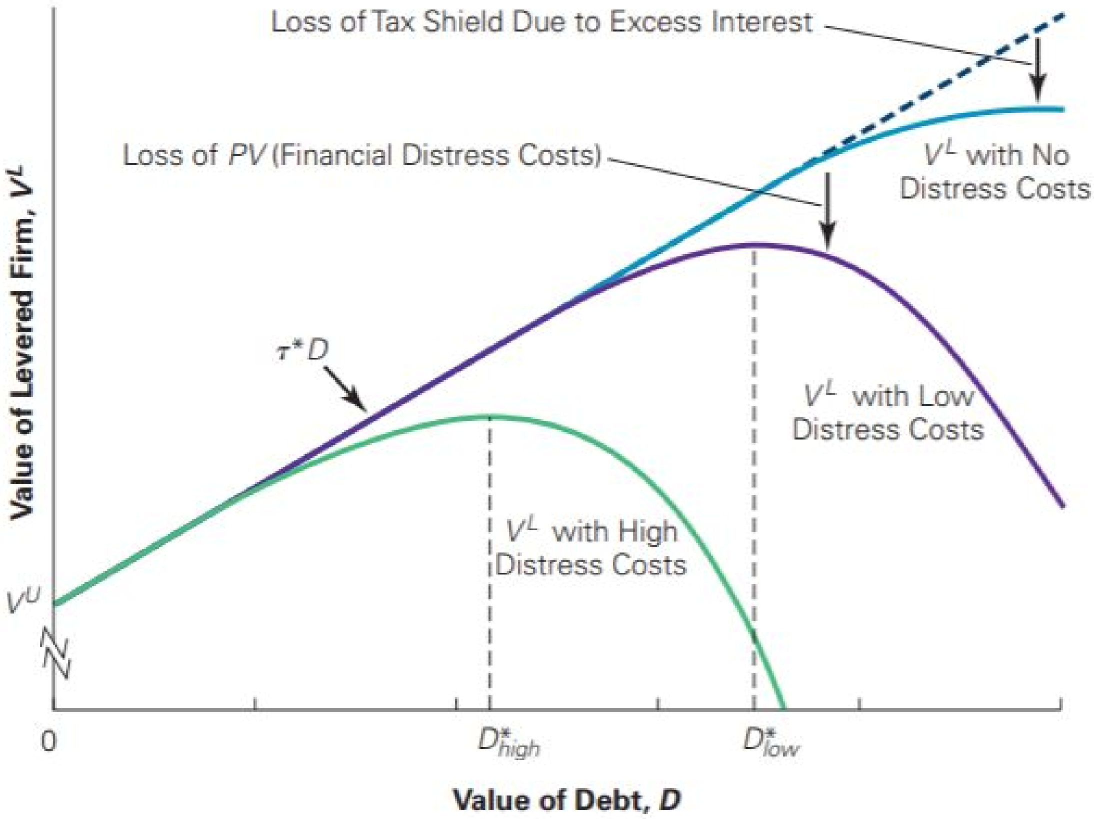

Figure 3.2: Debt tax shield.
(Berk and DeMarzo, 2014, p. 551)

3.2.4 Debt and Agency Theory

Another essential aspect of the issuance of debt is agency theory, which is present in several debt theories. However, since it is a central element in more sophisticated trade-off models, we decided to include agency theory in this section. Jensen and Meckling (1976) defines agency theory as a situation where the principal hires an agent to undertake tasks on behalf of the principal while receiving decision making authority. In our case, the agent is the management of the firm, and the principal is the firm's shareholders. Equation (3.8) shows the trade-off model when including the agency costs and benefits of debt. In some instances, the self-interest of the agent may not align with the best interest of the principal. If the principal cannot perfectly monitor and discipline the agent, agency cost issues will arise.

Jensen (1986) introduces the theory of the free cash flow problem. He argues that managers of firms with substantial free cash flows and few profitable investment opportunities may engage in empire-building activities, and thereby impose an agency cost on the shareholders. Further, he argues that the issuance of debt can reduce the agency costs as it binds the management to the promise of paying out some of the free cash flow to the owners of the firm. Another agency benefit of debt is put forward by Harris and Raviv (1990), who argues that the debtholders will monitor the actions of the management and thereby reduce the agency costs. In practice, this could be done by having covenants to the debt.

There may also be agency costs related to issuing debt. Jensen and Meckling (1976) puts forward what is known as the asset substitution problem. Imagine the equity of the firm as a call option on the firm's assets with a strike price equal to the debt outstanding. After issuing debt, the management will have an incentive to exchange the firm's assets with more volatile assets, as this increases the equity value of the firm. However, this reduces the value of the debt holders' claim and thereby impose a conflict of interest between equity holders and debt holders (Jensen and Meckling, 1976).

The other agency cost we want to highlight is debt overhang, which was formalized by Myers (1977). Imagine a highly levered firm that will default on its debt if no action is taken. The value of the firm's assets will then be lower than the debt outstanding. If the firm has positive NPV projects, it cannot necessarily raise the equity capital to undertake the investment as the equity holders may receive less than their investment when the claim of the debt holders is redeemed. This situation is an underinvestment problem as the firm forgoes positive NPV projects that would increase the total value of the firm, as this is not in the best interest of equity holders.

$$\begin{aligned} V^L = V^U &+ PV(\text{Interest Tax Shield}) - PV(\text{Financial Distress Costs}) \\ &- PV(\text{Agency Costs of Debt}) + PV(\text{Agency Benefits of Debt}) \end{aligned} \tag{3.8}$$

Even though the trade-off theory is a valuable framework, it does not consider the different types of debt and their characteristics as it treats debt as homogeneous. In the search for what drives debt structure decisions, we further consult the pecking order theory.

3.3 Pecking Order Theory

Another theory in the capital structure literature is the pecking order framework. According to this theory, firms prefer internal financing to external financing and debt to equity in security issues. The pecking order theory consists of four components (Myers, 1984):

1. Firms prefer internal financing sources over external financing.
2. Firms adjust their target dividend pay-out ratio to their investment opportunities.
3. Fluctuating profitability and opportunities in addition to a sticky dividend policy may result in situations where the cash flows from internal activities, may not cover the cost of potential investment opportunities. In this case, firms first spend retained earnings or profitable securities.
4. If retained earnings are not sufficient, the firm requires external financing, starting with the safest option first. If possible, firms start with regular debt. The next step is different types of hybrid financing options, such as convertible bonds. Lastly, if necessary, firms issue equity.

Myers (1984) argues that the costs that arise from the information asymmetry between management and potential investors on the value of the firm and its risky securities are one of the main drivers of the pecking order theory. Because of these costs, firms will prefer to first finance new investments with retained earnings before using ordinary debt, risky debt and eventually, equity. Therefore, cash earnings net investments decide the leverage ratio of the firm.

In the classical pecking order theory, leverage increases when the need for investments exceeds the firms retained earnings and subsequently falls when retained earnings exceed the need for investments. In a stable world where a firm experiences constant profitability and investment opportunities, more profitable firms will have lower leverage, and firms with superior investment outlays will experience higher leverage (Fama and French, 2000).

According to Myers (1984), firms balance between future and current financing costs, and firms that expect future investment opportunities adapt to lower current leverage levels. By implementing a forward view on future investments, firms can adapt their low-risk debt capacity so that future investment opportunities are financed by retained earnings instead of issuing new risky debt or abandoning the investment opportunity.

3.4 Market Timing Theory

A third framework in the capital structure literature is the market timing theory. According to Huang and Ritter (2004), evidence from the United States shows that firms use equity issues on a larger scale than what the pecking order theory predicts. Furthermore, Fama and French (2002) showed how the frequency of equity issues had risen even when firms could go for retained earnings or standard debt.

In the market timing theory, the relative cost of equity is the primary driver when a firm chooses between equity and debt for its investment opportunities. When firms perceive the relative cost of equity as sufficiently low compared to debt, issuing equity will be the first choice when seeking outside financing. If the relative cost of equity is sufficiently low, firms will also prefer issuing equity over their retained earnings, which is in sharp conflict with the pecking order theory (Huang and Ritter, 2004). When a firm has a high market value compared to its book value, corporate executives will attempt to time the market and issue shares at high prices and repurchase at a later stage when the prices are lower as a means of financing the firm (Baker and Wurgler, 2002).

Baker and Wurgler (2002) found that market timing has substantial effects on the capital structure of firms. Their studies showed that low leveraged firms issued equity when their market value was high compared to book value and that highly leveraged firms issued equity at low market values. Furthermore, they showed how variations in a firm's market value impact its capital structure in the long-run because capital structure is the result of executives trying to time the equity market over time. The reasoning behind this, according to Baker and Wurgler (2002), is how executives perceive the firm's market valuation. If they believe that the market is misvaluing the firm, they will raise equity since they believe the cost of equity to be sufficiently low.

3.5 Asymmetric Information

In both the trade-off and the pecking order theory, asymmetric information is viewed as an essential part through adverse selection and moral hazard when deciding on the type of financing. Especially Myers and Majluf (1984) argues that asymmetric information is one of the main drivers for a firm's capital structure when deriving the pecking order theory.

When presenting the pecking order theory, Myers (1984) claims that the market punishes firms issuing equity because of information asymmetry between managers and the market, consequently leading to reduced potential pay-offs for the issuing firm. Because of this, as highlighted in the pecking order theory, firms should only issue equity as a last resort.

Naturally, the insiders of a firm have superior knowledge about the financial outlook of a firm, especially regarding its assets and future potential investment outlays and therefore, the true value of their risky securities. Thus, the market should lean towards policies that prefer internal over external financing and debt over equity (Bharath et al., 2008). A reason for this is the asymmetric information between the management and the market, and they discount the price they are willing to pay due to adverse selection (Berk and DeMarzo, 2014).

Issuing equity is by many investors perceived as a signal that the firm's equity might be overpriced. Consequently, investors withhold from investing at the issuing price, which leads to a decline in the share price. Asquith and Mullins (1986) showed that this is the case, with US firms experiencing a price fall of 2.7% when announcing an equity issue. On the other side, prior to announcing an equity issue, firms experience an increase in their share price. Lucas and McDonald (1990) showed that shares from firms issuing equity vastly outperformed the market with close to 50% in the 18 months prior to the announcement. Furthermore, they argue that undervalued firms will wait to issue equity until the perceived undervaluation from the market ceases to exist.

The implication of undervaluation forces managers to seek alternative sources of financing for their firms, and they will prefer using retained earnings or debt instead of equity (Berk and DeMarzo, 2014). One reason for this is that the issues surrounding adverse selection are smaller when firms issue debt. The superior information of managers about their firms does not influence the value of low-risk debt, which is mainly set by interest rates. Therefore, underpricing is generally smaller concerning debt (Berk and DeMarzo, 2014). Next, the management of a firm can use debt as a way of signaling to the market. A firm that has discovered a future competitive advantage but is not yet ready to be introduced to the market can make use of the credibility principle, which are actions the management only would take if their intentions were true. One way to appear credible to investors is committing to substantial future debt payments, showing the market that the future project will deliver cash flows allowing them to pay back the debt. Furthermore, distress costs can be detrimental for a firm, so taking up debt could be a strong signal to investors that the firm believes they will grow in the near future (Berk and DeMarzo, 2014).

3.6 Previous Research on Debt Heterogeneity

Now that we have visited the fundamentals of capital structure, it is time to enter the core of our question: debt heterogeneity. Of the fundamental theories, it is mainly the pecking order theory, asymmetric information and agency theory that has predictions for debt heterogeneity. This section will focus on the research dedicated to shedding light upon the choice of different sources of debt and priority structures. Rauh and Sufi (2010) shows that even though the leverage ratios are relatively stable, firms regularly change their underlying debt structure. This shows that ignoring debt heterogeneity results in missing information that could provide further insight. Although linked, common research areas with a focus on debt heterogeneity are maturity structures, debt specialization, priority structures, the impact of bank relations and the determinants for debt structure. Our paper focuses on the determinants of debt structure, debt specialization and priority structure, and we will therefore concentrate on these sides of debt structure research.

One important implication of the pecking order theory is the negative correlation between debt and profitability. Rauh and Sufi (2010) finds that the negative correlation is stronger between profitability and the more information sensitive types of debt and weaker or not significant for the less information-sensitive types of debt. As a possible explanation, they state that the more profitable firms can avoid issuing equity and types of debt that are information sensitive like convertibles. To further elaborate on the understanding of debt structure, we consult the model created by Cantillo and Wright (2000). They argue that private debt has advantages in the event of restructuring and that public debt has advantages when the firm has a low probability of default as it minimizes the use of costly intermediaries. Therefore, features that reduce the probability of default, like profitability, or reduce the cost in the event of default, like size and tangibility, will increase the use of market financing (Cantillo and Wright, 2000).

Another interesting paper on the topic is written by Denis and Mihov (2003). They investigate the choice between public, private non-bank and bank debt in a large sample of new debt issues. They conclude that firms with high credit quality use public debt, firms with medium credit quality use bank debt and firms with low credit quality use private non-bank debt. Although generalising, as firms usually use multiple sources of debt, we interpret this result as firms preferring public debt to private if they can obtain it at reasonable costs.

Our second focus area is debt specialization. Here our primary source is a paper by Colla et al. (2013). They investigate a large sample of public US firms finding that 85% of the firms concentrate their borrowings to one particular source. Further, they find that the larger firms with credit ratings are more diversified in their sources of finance and that small firms without credit are more specialised in their debt composition. They also argue that the benefits of specialisation are lower bankruptcy costs and increased incentive for creditor monitoring. Finally, they find that some firms are not able to reach their desired debt structure as they are excluded from some parts of the debt market or find the cost of certain debt types unbearable (Colla et al., 2013).

Next, we turn to the topic of priority structure. Rauh and Sufi (2010) finds that firms with low credit quality use multiple layers of priority structure and that firms with deteriorating credit ratings introduce more layers in their debt priority structure. Other determinants for priority structure are offered by Barclay and Smith (1995) who find that larger firms and firms with many profitable growth opportunities use less secured debt. The explanation they offer for large firms using less secured debt is that they have an advantage in issuing public debt, which more often is not secured. A recent paper by Benmelech et al. (2019) argues that the negative correlation between growth and secured debt could be driven by firms avoiding debt types that impose restrictions on investment policies. They also find that the share of debt that is secured is declining and that it is countercyclical. That is, firms issue less secured debt in good times to ensure financial flexibility and issue more secured debt in times of difficulty (Benmelech et al., 2019).

4 Data

4.1 Data and Data Treatment

The data set applied in this thesis is obtained manually from the annual reports of the companies in the OSEBX index. Furthermore, we cross-checked the debt issued by the companies with the SDC Platinum database. The annual reports are either obtained from the companies own web pages or from Newsweb, the official news provider of the Oslo Stock Exchange.

Our analysis is limited to the companies included in the OSEBX index as of autumn 2019. In the analysis, we use two sets of data, where one is a subset of the other. The first data set is used for the analysis of debt type determinants while the second data set is used for the analysis of debt specialisation and priority structure. We start with the total number of firms in the OSEBX index, which is 67. We have excluded all financial firms from the study, as their capital structure is usually highly regulated by law. After excluding the financial firms, we end up with 60 companies. The excluded companies are Axactor, B2 Holding, DNB, Gjensidige Forsikring, Norwegian Finance Holding, SpareBank 1 SR-Bank and Storebrand.

In order to use common econometric methods for panel data, we also excluded any company with less than two year observations, which are companies listed in either 2018 or 2019. This excludes Adevinta, Elkem, MPC Container Ships and PCI Biotech Holding. Further, Schibsted A and Schibsted B are shares in the same company, but with different voting rights. Adevinta was also a part of Schibsted as of the last available annual report (demerged and listed in 2019), so the effect of Adevinta's capital structure is therefore technically included. We also exclude BerGenBio as the firm has a zero value observation of sales. Including this firm would give an error in the logarithmic sales variable used to proxy for firm size. The total number of companies in the first sample used in this thesis is 54. For these companies, we have obtained observations for the last ten years, which is 2009 to 2018. Not all the companies in the final sample have been listed for the full ten-year period, so the panel is unbalanced. In total, we have 445 observations for the first sample.

For the second sample, we exclude all observations with zero debt, but we have made no other adjustments. The second sample is applied in the debt specialisation and priority structure analysis, and therefore it makes no sense to include observations that have no debt as firms cannot specialise or prioritise debt that is not existent. Idex Biometrics, Next Biometrics, Nordic Nanovector, Nordic Semiconductor, Photocure and TGS-NOPEC are removed from the second sample as these firms have zero debt observations for at least some of the ten years analysed. This leaves 398 observations for the second sample.

Some companies have annual reports that state the accounts in USD, EUR, SEK or DKK. To overcome this problem, we have converted all obtained values from the financial statements to NOK by multiplying with the exchange rate on the 31st of December each year. The exchange rates are found with the currency calculator from Norges Bank. Most share prices are obtained from the annual reports, but in the instances where they are missing, the share prices are obtained from Yahoo Finance. As of the 23rd of September 2019, the OSEBX index market capitalisation represents 90.3% of the total market capitalisation of the Oslo Stock Exchange, while our first sample represents 73.87% of the total market capitalisation of the Oslo Stock Exchange. The companies in the sample can be found in table A1 in the appendix.

4.2 Sample Summary

This subsection will give a brief presentation of the summary statistics of the companies included in the sample. Figure 4.1 display the industry distribution relative to the market capitalisation. The classification is based on the primary business area of the company, as stated in the companies' annual reports. The largest sectors by market capitalisation are oil and gas, industry, fisheries and aquaculture and communication services. In table A2.1 in the appendix, we show the distribution of the number of firms per sector as well as the total market capitalisation of each sector. The largest sectors by the number of firms are industry, IT, shipping and fisheries and aquaculture.

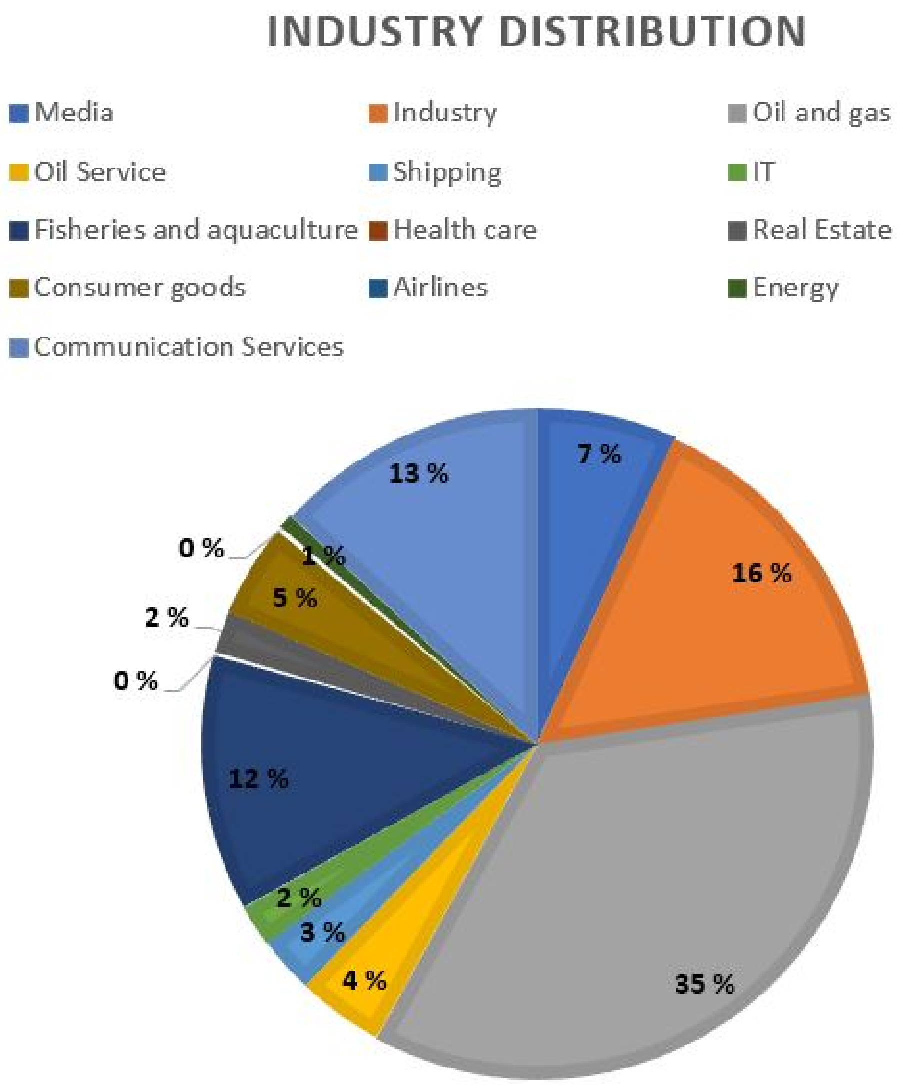

Figure 4.1: Industry distribution by market cap

Because our sample originates from the OSEBX index, it includes many of the largest firms in Norway. The average of the total assets is approximately 44.7 billion, while the median is 14.4 billion. An explanation for the considerable difference in mean and median is that some of the largest companies are substantially larger than the rest of the companies. Companies like Equinor, Telenor, Hydro, Yara and Aker all breach the 100 billion asset line for some or most of the observations. Naturally, we find the same trend in total capital with the mean and median being 30 billion and 9.3 billion, respectively.

The first surprise appears with the profitability rate. The average profitability, defined as EBIT divided by total assets, is 1.78%. Such low profitability is quite poor but does not tell the full story. In this case, the average is affected severely by small companies running substantial deficits. When calculating the average profitability, each observation is given equal weight. Therefore, some small companies running large deficits will negatively affect the mean of the entire sample, although the vast majority of assets in place produce respectable rates of return. If we divide the total EBIT for the period by the total assets in place, we get a rate of 9.72%. This imbalance is backed further by the mean profitability being below the 25th percentile at 2.16%. The sample contains several firms in industries such as biotech and IT. Many of these companies are in the early phase and are spending large sums on research and development. In extreme cases, they lose more money than they have assets and survive by issuing new equity capital regularly.

These companies also affect the Market to Book ratio. The average Market to Book ratio is 2.6, and the median is 1.84. Especially the biotech companies have high growth expectations and low book values of equity. When it comes to the tangibility of the assets, the mean and median are 34% and 24%, respectively. Some of the firms in the sample have very tangible assets, with the maximum being 95%. Towards the higher end, the shipping, real estate and airline companies are present. On the other side of the extreme, we again have the biotech companies, some of which have tangibility as low as 0%. The sample also exhibits quite good liquidity represented by an average current ratio of 2.17. Further, the average leverage ratio, defined as total debt divided by total capital, has a mean of 0.35 and a median of 0.34. The summary statistics of the sample can be found in table 4.1. For a more thorough explanation of the variables, see the chapter on regression variables.

Table 4.1: Descriptive Statistics

Variable	Mean	Median	Quantile 25	Quantile 75	Min	Max
Total Assets	44,698	14,438	5,458	31,919	16	986,400
Total capital	30,092	9,270	3,864	24,917	10	639,500
Profitability	1.78%	5.67%	2.16%	10.80%	-179.87%	40.83%
MTB	2.60	1.84	0.95	3.06	-2.15	42.43
Tangibility	0.34	0.24	0.12	0.53	0.00	0.95
Liquidity	2.17	1.63	1.05	2.51	0.12	16.68
Leverage	0.35	0.34	0.17	0.49	0.00	1.09

Total assets and total capital is stated in million NOK

4.3 Classification of Debt Types

The classification of debt types is done by studying the notes to the financial statements and cross-checking with the debt issues we find in the SDC Platinum database. The classification of debt types is inspired by the classification done by Rauh and Sufi (2010), but we have also added new debt categories to describe the observed sample better.

1. Bank Loans: Bank loans consist mainly of two categories: i) revolving credit and ii) term loans. Revolving credit is a form of bank debt that lets the borrower draw on a credit line up until a pre-specified amount. There are usually no regular down payments, and the principal can be redeemed at any time prior to the maturity date. The borrower could also borrow amounts that are previously redeemed, that is, the full line of credit is available until the date of maturity. A term loan is a bank loan for a specific amount that is due at a specific date. The term loan usually has regular down payments, and the borrower can not draw on credit that is previously redeemed. In general, revolving credit is more short-term, while a term loan is more of a long-term financing instrument.

2. Bonds: A bond is a publicly traded debt instrument that lets the corporation borrow a fixed amount. It has a pre-specified date of maturity (unless callable) and in Europe normally pays interest annually. The principal is usually redeemed at maturity.

3. Convertible Bonds: Just like a bond, but the investor has the option to convert the bond to equity at a pre-specified price. Due to the option value, it all else equal, often has lower coupons than similar bonds. It also usually ranks junior to most other debts due to the option of converting to equity.

4. Program Debt: Program debt consists of i) commercial paper and ii) medium term notes. Commercial paper is a short term debt instrument with maturity usually shorter than 270 days. It is not backed by collateral and is therefore mostly used by the highest quality of companies as the investors would require high credit risk premiums for poor quality companies. Medium term notes are registered under the shelf registration rule and typically have maturities ranging between 5 and 10 years. The difference between medium term notes and bonds is somewhat arbitrary, and

only loans that are specified explicitly as medium term notes in the notes of the annual reports or the SDC Platinum database are classified in this category.

5. Mortgage and Equipment: A mortgage is a loan that is secured in a specific asset. Like a term loan, it has fixed loan amount and maturity and a pre-specified repayment schedule. The difference between a regular secured term loan and a mortgage loan is sometimes marginal, and we therefore only classify a loan as a mortgage if the word mortgage is stated explicitly in the notes of the annual reports or the SDC Platinum database.

6. Financial Lease: Financial lease or capital lease is a long-term leasing situation that resembles a purchase financed through a loan. The lessee pays the lessor interest and principal in order to control the asset. If the lessee defaults on its payments, the lessor can usually take control of the asset.

7. Export Credit: Export credit is loans offered or guaranteed by some export credit institutions. These are government or quasi-government institutions set up to aid domestic exporters by lending to said exporters' international customers. The loans are usually either term loans (secured or unsecured) or mortgages. Only loans made or guaranteed by an export credit institution is classified as export credit.

8. Other: This category is debt stated as other in the notes of the annual report, loans that do not fit any of the categories above or loans that we could not manage to classify.

5 Regression Variables

This chapter will present the various dependent and independent variables used in the analysis section of this thesis. A brief summary of the variables can be found in table A2.2 in the appendix.

5.1 Dependent Variables

5.1.1 Debt to Total Capital

To define this variable, we first need to define debt and draw the line between debt and other types of liabilities. Colla et al. (2013) defines debt as long term debt plus obligations under capital leases. The term debt refers to the capital borrowed to finance the firm. The distinction between debt and other liabilities is crucial as we are interested in the financing choice of the firm. Other liabilities, such as regular payables, tax payable and pension liabilities are not a financing choice, but rather a function of the firm‘s business. Furthermore, these liabilities are self-financing as long as the firm is operating. The choice of management is therefore how to finance the residual needed in order to operate the firm, which is the decision of interest in this paper. This variable is book debt divided by the sum of book equity and book debt. We prefer to use the book values as a survey by Graham and Harvey (2001) shows that corporate managers do not rebalance their leverage ratios to compensate for fluctuations in market equity values.

5.1.2 Various Debt Types to Total Capital

In the analysis of debt heterogeneity, we use bank debt, bonds, convertibles, program debt, mortgages, financial lease, export credit and other divided by total capital as dependent variables. All values are book values with the same argument used in the previous section.

5.1.3 HHI

The Herfindahl-Hirschman index (HHI) is typically used to compute market concentration, but as in Colla et al. (2013), we use it to compute the concentration of debt used by each company. The calculation of the index starts with the calculation of equation (5.1).

$$SS_{i,t} = \sum_{i=1}^{n} (\frac{\text{Debt Type}_{i,t}}{\text{Total Capital}_{i,t}})^2 \tag{5.1}$$

The equation above is the squared sum of each debt type divided by the total capital of the firm for each period. Then, the SS_{it} is used in the calculation of the HHI:

$$HHI_{i,t} = \frac{SS_{i,t} - 1/8}{1 - 1/8} \tag{5.2}$$

The number 8 is the number of debt types used in the analysis. If the firm uses only one type of debt, the HHI index will be equal to one. If, however, the firm uses all eight types of debt in equal proportion, the index would be zero. The HHI then becomes a measure to check whether the company specialises its debt or whether it diversifies its external sources of financing.

5.1.4 Secured Debt

The secured debt variable is debt that is pledged or backed by some assets. Following the approach of Rauh and Sufi (2010), this categorisation is done based on information from the firm's annual reports. Any debt stated in the annual report, as backed by an asset and debt stated as mortgage debt are both categorised as secured debt in this thesis. Furthermore, according to Barclay and Smith (1995), finance leases are categorised as secured debt as the lessee will have the right to repossess the assets in case of a default. Lastly, the variable has been scaled by total debt.

5.1.5 Senior Unsecured Debt

The senior unsecured debt variable consists of senior unsecured or unsecured debt, as stated in the annual reports of the companies in the OSEBX. Senior unsecured debt is the most common type of debt and is often preferred by those firms able to choose between different types of debt. Furthermore, any unclassified debt is categorised as senior unsecured in accordance with the work of Rauh and Sufi (2010). Unclassified debt is mainly related to the debt type Other and make up about 1.5% of the debt outstanding. Lastly, the variable has been scaled by total debt.

5.1.6 Subordinated Debt

The subordinated debt variables consist of subordinated, junior subordinated and senior subordinated, as stated in the annual reports. Convertible bonds and private placement are also classified as subordinated debt (Rauh and Sufi, 2010). Convertible bonds, because of the option to convert the bonds into equity and private placements because of different regulations than other types of debt. Furthermore, both these types of debt have lower priority than ordinary subordinated debt in default and thereby included in this category. Lastly, the variable has been scaled by total debt.

5.2 Independent Variables

The four standard independent variables in capital structure research were put forward in a paper by Rajan and Zingales (1994). These are sales, profitability, market-to-book and tangibility. In addition to these variables, we have added liquidity, a dummy for family-controlled and a dummy for dividend payer.

5.2.1 Sales

The natural logarithm of total revenues is used as a proxy for the size of the company. The idea is that large companies exhibit different borrowing preferences than smaller firms. In addition to this, large companies are a lot harder to bankrupt. A large number of people, suppliers and customers may be dependent on a large company, which makes the threshold for bankruptcy higher. In extreme circumstances, the government may intervene to secure the continuation of the company. Rajan and Zingales (1994) points out that large firms are less likely to go bankrupt, as they also are more diversified. This diversification decreases the risk of lending to such companies and increases the supply of debt. They also argue that size could be a proxy for the information outsiders possesses. In such a case, large firms may experience less information asymmetry and therefore have a competitive advantage in issuing equity relative to debt. However, it has consistently been found that larger companies usually have higher leverage ratios than small companies

(Krushev and Strebulaev, 2005).

5.2.2 Profitability

Profitability is defined as operating profit divided by the total assets of the firm. It is therefore a measure of how profitable the company can operate its assets. In cases where the annual reports do not state operating profit, we have used the EBIT as a proxy. One advantage of using operating profit is that it is not dependent on the choice of financing. Researchers such as Colla et al. (2013) and Rajan and Zingales (1994) use the operating profit before depreciation, whereas Rauh and Sufi (2010) uses operating profit after depreciation. We acknowledge the advantage of using operating profit before depreciation due to reduced dependence on accounting standards. However, we have chosen the operating profit after depreciation, as it is more commonly used in the annual reports.

The pecking order theory predicts that the company would prefer to rely on internal sources of capital rather than external (Myers and Majluf, 1984). This implies that it should be a negative relationship between profitability and the level of debt issued. This relationship between profitability and leverage was largely confirmed in the meta-study by Harris and Raviv (1991). On the other hand, the trade-off theory predicts the opposite. That is, companies with higher profitability will be more able to carry the advantages of debt financing and will thus use more of it. In addition to this inconsistency in the theories, Frank and Goyal (2009) argues that the importance of profitability has decreased over time as equity markets have become more willing to finance firms that are not yet profitable but have substantial growth opportunities.

5.2.3 Growth

Market to Book is defined as the market value of equity divided by the book value of equity. This variable is used regularly as a proxy for the growth opportunities of the company. One critique for using the market to book ratio as a proxy for growth opportunities is that firms with assets that have increased in value since purchase will have a high market to book ratio without necessarily having substantial growth opportunities (Harris and Raviv, 1991). This might be a concern if the sample contains many firms that operate in industries with high asset volatility, such as shipping. However, Adam and Goyal (2008) finds the market to book ratio to be the best proxy for future growth opportunities. Further, Smith and Watts (1992) finds a negative correlation between firm leverage and growth options.

One reason for the negative relationship between the market to book ratio and leverage is that the companies are looking to avoid debt overhang (Myers, 1977). Therefore, companies with substantial profitable growth opportunities are less likely to take on large amounts of debt compared to companies with low amounts of profitable growth opportunities. Rajan and Zingales (1994) comes up with another possible explanation for the negative relation between high market to book ratio and leverage ratio. In their paper, they find that the correlation is driven by large equity issues. The alternative explanation could then be that managers are timing the market. That is, they perceive the market value of equity as “expensive” and exploits this to issue new equity instead of borrowing.

5.2.4 Tangibility

Tangibility is defined as total Property, Plant and Equipment (PPE) divided by total assets. It gives a measure of how tangible a firm’s assets are, which is important because it determines how much collateral the firm can pledge in order to obtain loans. Frank and Goyal (2009) argues that more tangible assets are simpler to value and therefore reduce the expected bankruptcy costs. Rauh and Sufi (2010) finds no significant correlation between tangibility and bank debt. However, they find significant correlations between tangibility and the other debt types tested for in their paper. They argue that bank relations can compensate for the lack of tangible assets. One issue with this variable is that there are differences among the PPE in terms of suitability as collateral. A paper by Campello and Giambina (2010) highlights how the redeployability of an asset is decisive for the amounts of debt it can support.

5.2.5 Liquidity

Liquidity is defined as current assets divided on current liabilities, usually named "current ratio". This ratio is a measure commonly used in analyzing a firm’s liquidity status. Ozkan (2001) uses this definition of liquidity and finds that the liquidity ratio has a negative effect on the debt level of the company. On the one hand, a high liquidity ratio would allow the company to carry larger amounts of short-term debt. However, a high liquidity ratio also implies that the company can finance a larger part of the investments internally (Ozkan, 2001). The empirical result and the latter argument are consistent with the pecking order theory.

5.2.6 Family-controlled

The family-controlled dummy is equal to 1 if the firm is family-controlled and 0 if not. This variable is added to test if family-controlled firms have different lending behaviour than other firms. In our sample, 94 of the total of 445 observations are family-controlled. Our definition of a family-controlled firm is that at least 50.1% of the firm's shares need to be owned either by a high net worth individual or by several high net worth individuals in a family relation. The phenomenon of large public companies being family-controlled is not that common in market-based financial systems, but we find some research on the topic.

A paper by Ampenberger et al. (2013) conducts an analysis of debt structure with a focus on family-owned public firms in Germany. They find a significant negative correlation between being family-controlled and leverage. This result somewhat contradicts what we expect to find. We would expect family-controlled firms to have higher leverage ratios. The reason for our assumption is that family-controlled firms may be reluctant to issue equity if the family owners are not able to participate relative to their share in the issue, as this would lead to a dilution of the voting power. The controlling families usually have very concentrated wealth as most of their net worth is tied up in the company. Thereby, family owners have stronger incentives to implement a more hands-on approach and active monitoring. This is often achieved by keeping the majority of the voting rights and thereby controlling the company board.

Research by Baek et al. (2016), on the other hand, find that there is a positive correlation between being family-controlled and leverage. They also argue that family-controlled firms avoid dilution through issuing debt, which is more in line with our reasoning. Ampenberger et al. (2013) points out that the German financial system is bank-based and that this may affect the correlation since papers that find a positive relationship are conducted in market-based financial systems. Further, they argue that the amount of leverage may depend on the degree of risk aversion. Our view is that the Norwegian financial system is more market based than the German financial system, and we therefore expect our results to be more in line with Baek et al. (2016).

5.2.7 Dividend Payer

This variable is a dummy variable that is equal to 1 if the company pays dividends and 0 if the company does not pay a dividend. Frank and Goyal (2009) finds that the firms that are dividend payers have lower leverage ratios than firms that do not pay dividends. From the pecking orders point of view, dividends can be seen as a sign of excess free cash flow. The firm would then be able to finance a greater portion of its projects internally. Drobetz et al. (2013) points out that the reduced information asymmetry from paying dividends may be another cause of the negative correlation between dividends and leverage. The dividend payments are then seen as a sign of quality and thereby reduces the cost of issuing equity relative to the cost of issuing debt. This is supported by Gropp and Heider (2009), who also finds this negative correlation.

6 Methodology

6.1 Types of Data Sets

The three main types of data sets are cross-sectional data, time-series data and panel data. This section will give a brief presentation of the types of data sets and implications for the analysis. Cross-sectional data is data on multiple entities collected at a specific point of time. It is the simplest type of data set and, if collected by random sampling, offers few problems when conducting econometric analysis.

Time series data is observations of variables collected over time. A typical example is the development of a stock market index. One challenge with time-series data is that in economics, they are rarely independent across time as they suffer from serial correlation (Wooldridge, 2018). A panel data set is a combination of the cross-sectional data set and the time series data set. Our data set is a panel data set as it follows the development of debt for the same companies over time. In fact, it is an unbalanced panel data set as we do not have the same number of observations for all companies. The use of panel data yields both advantages and challenges.

6.2 Advantages and Challenges with Panel Data

The first advantage of panel data sets is that it allows controlling for individual heterogeneity. Contrary to cross-sectional data and time-series data, panel data controls for variables that are time- or entity-invariant (Baltagi, 2005). The next advantage is that panel data contains more information than other data types. More information leads to less collinearity and more degrees of freedom (Baltagi, 2005). Panel data is also better at studying the dynamics of change and uncovering effects that are not detectable in other types of data sets (Baltagi, 2005). Despite its many advantages, there are also some challenges with panel data. Although panel data allows for controlling the individual heterogeneity, Hsiao (2006) states that it is methodological challenging to do so in order to obtain valid inference. The following sections will present the methods used in econometric analyses of panel data and how they are derived.

6.3 Simple Regression

To uncover how the characteristics of the company affect the debt structure, we use regression analysis. In order to understand the more advanced regression methods, it is beneficial to start with the simple regression model. The formula of the simple regression is shown in (6.1). Simple regression is suited for deriving the relationship between two variables. The dependent variable is labelled y, and the independent variable is labelled x. The β_0 is the constant and is usually not put much emphasis on. The β_1 is the slope of the regression and shows how much y changes per extra unit of x. The u is the error term and represents the omitted variables that affect y. The most common method to estimate the coefficients of the model is the ordinary least squares (OLS) method (Wooldridge, 2018). The use of this model rests on several assumptions, which will be presented later in this chapter.

$$y = \beta_0 + \beta_1 x + u \tag{6.1}$$

6.4 Multiple Regression

The multiple regression model is, like the simple regression model, a tool for uncovering the relationship between the dependent and independent variables. However, because the multiple regression model has multiple independent variables, the interpretation of the coefficients change slightly. The coefficient β_1 is how much the y change for a one unit change in x_1, all else equal. That is, the effect of x_1 on y while holding all other $x_2, ..., x_k$ constant (Wooldridge, 2018). The multiple regression model is presented in (6.2).

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_k x_k + u \tag{6.2}$$

An additional feature of the multiple regression analysis is the possibility to include dummy variables, also called binary variables. A dummy variable allows us to separate the effect of belonging to one specific group. For instance, we could separate the effect of paying dividends on the level of bonds issued. The β_3 coefficient is the effect on the dependent variable of, all else equal, belonging to the chosen group (Wooldridge, 2018). The multiple regression model with a dummy variable is presented in (6.3).

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 D_1 + ... + \beta_k x_k + u \tag{6.3}$$

6.5 Ordinary Least Square

The Ordinary Least Square method is a way of estimating the regression coefficients of the population. The OLS estimate is formed by minimizing the sum of squared residuals. This is expressed mathematically in equations (6.4) and (6.5). For an OLS regression to be unbiased, consistent and effective, five main assumptions must be satisfied, known as the Gauss-Markov assumptions. The following sections will present the Gauss-Markov assumptions, the tests for these assumptions, and the implications if violated (Wooldridge, 2018).

$$\hat{u}_i = y_i - \hat{y}_i = y_i - \hat{\beta}_0 - \hat{\beta}_1 x_{1i} - \hat{\beta}_2 x_{2i} - ... - \hat{\beta}_k x_{ki} \tag{6.4}$$

$$min \sum_{i=1}^{n} \hat{u_i^2} \rightarrow \beta_0, \beta_1, \beta_2, ..., \beta_k \tag{6.5}$$

6.5.1 Linear in Parameters

The first assumption of the OLS defines the multiple linear regression. It states that when the dependent variable is a linear function of the independent variable, the model is linear in its parameters. However, the model is quite flexible as the dependent variable, and the independent variables can be functions of natural logarithms and squares. Violating this assumption gives biased and inconsistent estimates of the coefficients (Wooldridge, 2018). This model can be expressed as shown in equation (6.6).

$$y = \beta_0 + \beta_1 x + u \tag{6.6}$$

6.5.2 Random Sampling

The second assumption of OLS states that the sample for the multiple linear regression must be drawn from a sample of n random observations. The random sample is mathematically described in (6.7). The error term must also be random for the dependent variable to be random. As with the assumption of linearity in parameters, violating the assumption of random sampling gives biased and inconsistent estimates (Wooldridge, 2018).

$$\{(x_{i1}, x_{i2}, ..., x_{ik}, y_i) : i = 1, 2, ...n\} \tag{6.7}$$

6.5.3 No Perfect Collinearity

The third assumption states that none of the independent variables are constant, and there is no perfect linear relationship between the independent variables. If perfect collinearity is present, OLS cannot be used to estimate the model (Wooldridge, 2018). The assumption allows for the independent variables to be correlated, but they cannot be perfectly correlated. A test of this assumption is checking the correlation amongst the independent variables in a correlation matrix.

6.5.4 Zero Conditional Mean

The fourth assumption states that the error u has an expected value of zero given any value of the independent variables. This assumption is shown mathematically in equation (6.8). Omitting an important factor that is correlated with any of the independent variables, the assumption is violated. If the first four assumptions are satisfied, then the model is unbiased and consistent (Wooldridge, 2018).

$$E(u|x_1, x_2, ..., x_k) \tag{6.8}$$

6.5.5 Homoskedasticity

The variance of the error u is independent of the dependent variables. That is, the variance of the error u is the same given any value of the independent variables. This assumption is expressed mathematically in equation (6.9). If this assumption is violated, the model suffers from heteroskedasticity. The estimated coefficients are still unbiased and consistent, but the standard errors are wrong. Due to issues with the standard error, one cannot rely on inferences drawn on the sample. One way of correcting for this is with heteroskedasticity robust standard errors. If the Gauss-Markov assumptions 1-5 are all satisfied, the coefficient estimates are efficient and asymptotically normal, and OLS is the best linear unbiased estimator (BLUE) (Wooldridge, 2018). The standard test for the presence of heteroskedasticity is the Breusch-Pagan test with homoskedasticity as the null hypothesis.

$$Var(u|x_1, x_2, ..., x_k) = \sigma^2 \tag{6.9}$$

6.5.6 Autocorrelation

Because we are dealing with a panel data set, which includes time-series data, we also need to consider autocorrelation. This assumption states that the error term, conditional on the independent variable, should be uncorrelated for different time periods (Wooldridge, 2018). Equation (6.10) shows the mathematical notation of this assumption. Autocorrelation is quite common when dealing with panel data because we observe the same entities over time. In our case, the types of debt issued by a company will likely not change much from year to year as several types of outstanding debt usually have long term maturities. The levels of different types of debt will probably vary little from one year to the other. Thus, we might suffer from autocorrelation problems. In the case of panel data, a Breusch-Pagan/Wooldridge test for serial correlation is the standard method for detecting the presence of autocorrelation (Wooldridge, 2018).

$$Corr(u_t, u_s) = 0 \text{ for all t} \neq s \tag{6.10}$$

6.5.7 Normality

The normality assumption states that the error terms are independent of the independent variables and normally distributed, as shown in (6.11) (Wooldridge, 2018).

$$u_i \sim Normal(0, \sigma^2) \tag{6.11}$$

The error term u_i represents the effect on the dependent variable from omitted variables from the regression model. With a large number of independent and identically distributed random variables, one can rely on the Central Limit Theorem (CLT). The CLT states that with a sufficient number of observations, the distribution of the independent variables is assumed to be normal despite the variables themselves not being normally distributed (Gujarati, 2004). Violating the assumption of normality will lead to an inability to run inference testing. To check for normality, one creates Normal Quantile plots where one investigates how the residuals coincide with the normal distribution.

6.6 Outliers

An OLS estimate is sensitive to outliers in the sample, and this needs to be addressed when conducting an econometric analysis. Outliers may not be representative of the population and thus give us the wrong coefficients. Wooldridge (2018) define an influential observation as an observation that if dropped, would change the OLS estimates by a large amount. The two most common ways of dealing with outliers are i) dropping the observations and ii) winsorizing the observations. The outliers need to be carefully inspected if one is to drop the observation, as dropping an observation could have a considerable influence on the regression. Draper and Smith (1998) states that as a general rule, one should only reject an outlier if it is caused by erroneous recording. When winsorizing the observation, one defines a percentile of observations for treatment. For instance, one could choose to treat the 2.5% most extreme observations at each side of the distribution. The 2.5% most extreme observations at each end of the distribution would then be constrained to the 2.5th and 97.5th percentile. Winzorising reduces the influence of extreme observations without omitting them. A way of analysing the outliers would be to conduct regressions on samples with and without the outliers. These regressions give an overview of how influential the outliers are and if one should take further actions.

6.7 Panel Data Econometrics

Due to the multiple observations of each unit over time, regular OLS is not suited for panel data. Regular OLS treats each observation as unique and does not catch effects that are constant for a unit or constant over time. We cannot assume independently distributed observations over time. Therefore, the next section will present the three main methods used for regressions on panel data. Further, it will elaborate on the tests conducted to decide which method is appropriate to use for a specific data set.

6.7.1 Pooled OLS

The simplest estimation method used on panel data is the pooled OLS method, which is essentially a regular OLS model used on a panel data set. This approach has its limitations as it treats each observation equally. That is, it does not catch effects that are fixed over time or for the entity. To use this method, we cannot have serial correlation in the error term. Further, the differenced errors must be serially uncorrelated in order to use the standard t and F test statistics (Wooldridge, 2018). The model is shown in equation (6.12). Here we have that a_i is the unobserved individual effect and u_{it} is the error term of the regression.

$$y_{it} = \beta_0 + \beta_i x_{it} + \alpha_i + u_{it} \tag{6.12}$$

Where a_i is the unobserved individual effect and u_{it} is the error term of the regression.

6.7.2 Fixed Effects

Fixed effects estimation is another way of estimating the model. In the fixed effects estimation, one accounts for the individuality of each entity in the sample by letting the intercept vary for each entity, while simultaneously assuming a constant slope of the coefficients across the entities. By having the intercept of each entity vary, while keeping the slope constant, we get a time-invariant model (Gujarati, 2004).

The Fixed Effects model is a bit complex, so we will spend some time deriving the transformation of the model. We start with equation (6.13) with one independent variable.

$$y_{it} = \beta_1 x_{it} + \alpha_i + u_{it}, \quad t = 1, 2, ..., T \tag{6.13}$$

This is averaged out over time in equation (6.14) for each entity i.

$$\overline{y}_i = \beta_1 \overline{x}_i + \alpha_i + \overline{u} \tag{6.14}$$

The α_i is fixed over time and therefore appears in both equation (6.13) and (6.14). The next step is to subtract equation (6.14) from (6.13). The result is then equation (6.15), where $\ddot{y}_{it} = y_{it} - \overline{y}_i$ is the time-demeaned data on y, and equivalently for $\ddot{x}_{it}$ and $\ddot{u}_{it}$. By executing this transformation, the unobserved effect α_i has disappeared. This is also called the within estimator as it uses the time variation within y and x for cross-sectional observations (Wooldridge, 2018).

$$\ddot{y}_{it} = \beta_1 \ddot{x}_{it} + \ddot{u}_{it}, \quad t = 1, 2, ..., T \tag{6.15}$$

The fixed effects estimator is unbiased if the error term u_{it} is uncorrelated with each independent variable over the whole time period. Furthermore, the correlation between α_i and the independent variables are allowed and as a consequence of this, the time constant independent variables gets erased by the fixed effects transformation $\ddot{x}_{it}$ as shown when deriving the fixed effects estimation (Wooldridge, 2018).

6.7.3 Random Effects

A problem with the fixed effects estimator is the consumption of degrees of freedom, especially in large data panels. This problem is solved by the random effects estimator where the error term u_{it} express the lack of knowledge about the true model instead of adding unnecessary independent variables (Gujarati, 2004).

The derivation of the random effects estimator starts with equation (6.16). The equation has the same unobserved effects as the fixed effect model.

$$y_{it} = \beta_0 + \beta_1 x_{it1} + ... + \beta_k x_{itk} + \alpha_i + u_{it} \tag{6.16}$$

Contrary to the Fixed Effects model, the α_i is uncorrelated with the independent variables in the Random Effects model. The next step of deriving the Random Effects model is to define the composite error term $v_{it} = \alpha_i + u_{it}$. Equation 6.16 can then be rewritten to equation 6.17.

$$y_{it} = \beta_0 + \beta_1 x_{it1} + ... + \beta_k x_{itk} + v_{it} \tag{6.17}$$

The composite error term contains α_i in every period and is therefore serially correlated. If the Random Effects model assumptions hold:

$$Corr(v_{it}, v_{is}) = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_u^2}, \quad t \neq s \tag{6.18}$$

To cope with the serial correlation in the composite error term we could use the General Least Squares method. We define $\theta = 1 - [\frac{\sigma_u^2}{\sigma_u^2 + T\sigma_u^2}]^{1/2}$ and transforms into (6.19).

$$y_it - \theta\overline{y}_i = \beta_0(1-\theta) + \beta_1(x_{it1} - \theta\overline{x}_{i1}) + ... + \beta_k(x_{itk} - \theta\overline{x}_{ik}) + (v_{it} - \theta v_i) \tag{6.19}$$

The transformation subtracts a fraction of the time average depending on the variance of the error terms and the time period and thereby fixing the serial correlation problem (Wooldridge, 2018).

Contrary to the fixed effects model, constant independent variables across time are allowed in the random effects model. The reason for this is an underlying assumption in the random effects model. Here, the unobserved effect is uncorrelated with the total sum of independent variables and is not affected by time fixed effects (Wooldridge, 2018).

6.7.4 Fixed Effects vs Random Effects

If the main independent variable is constant over time, we cannot use fixed effects to estimate its effect on the dependent variable. However, we can only use random effects if we assume that the unobserved effect is uncorrelated with the independent variables. One test designed to choose between fixed effects and random effects is the Hausman (1978) test. The procedure states that random effect method is applied if the Hausman test does not reject the null hypothesis. If the test does not reject the null hypothesis, the fixed effects and the random effects estimates either are close enough that a distinction between the two does not matter or that the fixed effect sampling variation is so large that practically significant differences are not concluded as statistically significant (Wooldridge, 2018).

If the Hausman test leads to rejection of the null hypothesis, then the key random effects assumptions are false, and the fixed effects estimates are used. In the end, the choice between fixed effects and random effects is decided by whether we can assume that α_i is uncorrelated with all x_{itk} (Wooldridge, 2018). An overview of the assumptions for both estimators is provided in table 6.1 below.

Table 6.1: Main Assumptions FE vs RE

Assumption	Model	Notation	Meaning
Linearity	Fixed Effect Random Effect		The dependent variables are a linear function of the independent variable
Normality	Fixed Effect Random Effect	$u_{it} \sim N(0, \sigma^2)$ $v_{it} \sim N(0, \sigma^2)$	Error term is normally distributed
No Perfect Collinearity	Fixed Effect Random Effect		Correlation between the independent variables are not equal to +/- 1
Zero Conditional Mean	Fixed Effect Random Effect	$E(u_{it}\|x_{it}) = 0$ $E(v_{it}\|x_{it}) = 0$	The idiosyncratic error is uncorrelated with the independent variables

6.7.5 Random Effects vs Pooled OLS

In order to test whether to use the random effects or the pooled OLS estimate, one can use the Breusch-Pagan Lagrange Multiplier test (Breusch and Pagan, 1980). The null hypothesis is that the variance of the unobserved fixed effect is zero. This is shown mathematically in equation (6.20). If the null hypothesis is rejected, it is better to use the random effects than the pooled OLS estimates.

However, this test has some limitations. The fact that we have α_i, indicated by $\sigma_\alpha^2 > 0$, has nothing to do with whether the α_i is correlated with the independent variables. If the unobserved fixed effect is correlated with the independent variables, then both random effect and pooled OLS estimates are inconsistent (Wooldridge, 2018). In general, the random effects estimator is preferable over pooled OLS as it both removes parts of the α_i error term and removes some of the autocorrelation.

$$H : \sigma_\alpha^2 = 0 \tag{6.20}$$

7 Analysis

7.1 Tests and Choice of Method

When running the analysis of debt structure, we need to make sure that the underlying assumptions of our methods are satisfied. Therefore, we run several tests to investigate whether this is the case.

7.1.1 Multicollinearity

One of the OLS assumptions, which is also valid for panel data, is the assumption of no perfect collinearity. Ideally, the correlation between the two independent variables is equal to zero, but we allow for some correlation between variables as long as the correlation coefficients are not equal to +/- 1.

Table 7.1: Correlation Coefficients

Positive/Negative	Correlation Coefficient	Strength of Correlation
$+/-$	1	Perfect Positive/Negative
$+/-$	0.99 - 0.75	Strong Positive/Negative
$+/-$	0.74 - 0.5	Moderate Strong Positive/Negative
$+/-$	0.49 - 0.25	Moderate Weak Positive/Negative
$+/-$	0.24 - 0.01	Weak Positive/Negative
$+/-$	0	No Correlation

In table 7.1 above, the relationship between correlation coefficients and their strength are highlighted. A moderate weak or weak relationship between two independent variables is generally accepted.

For the analysis, a correlation matrix between all independent variables has been constructed. Based on the results from the correlation matrix in table 7.2, none of the independent variables in the sample has perfect collinearity. Sales and the variables Liquidity and Profitability are the strongest correlated variables in the sample with a negative correlation of 0.59 and a positive correlation of 0.58, respectively. The assumption of no perfect collinearity therefore seems to be satisfied. Furthermore, none of the independent variables used for analysis purposes is strongly correlated.

Table 7.2: Correlation Matrix

	Family	Dividend	Sales	Profitability	Growth	Tangibility	Liquidity
Family	1						
Dividend	0.28***	1					
Sales	0.09	0.52***	1				
Profitability	0.15**	0.50***	0.58***	1			
Growth	-0.32***	-0.19***	-0.42***	-0.27***	1		
Tangibility	0.19***	0.02	0.16***	0.10*	-0.46***	1	
Liquidity	-0.07	-0.30***	-0.59***	-0.34***	0.30***	-0.35***	1

*Note: ***, ** and * denote significance at the 0.1, 1 and 5% levels, respectively.*

7.1.2 Panel Effects

Since this paper conducts an analysis of 54 companies over a ten year period, panel data is the desired statistical method as it captures unobserved individual effects that can have a considerable impact on the analysis. Therefore, the Breusch-Pagan Lagrange Multiplier test is used to test if the data set contains significant panel effects and thereby conduct the analysis using estimators based on panel data (Baltagi, 2005). These tests are presented in table A3.1 and A3.2 in the appendix. Based on the results from the test, the null hypothesis of no panel effects is rejected. Further tests are therefore conducted based on using panel data estimators in the analysis.

7.1.3 Hausman Test

Panel data estimators are used in this analysis since the null hypothesis of no panel effects were rejected. The fixed effects and random effects estimators described in the theory chapter are commonly used for analysis. When choosing between the two estimators, the underlying assumptions need to be investigated. For the random effects estimator, one needs the correlation between the idiosyncratic error term u_{it} and the independent variables x_{it} to be equal zero. Furthermore, one need that the correlation between the time-invariant unobserved specific individual effects a_i and the independent variables x_{it} is equal to zero. For the fixed effects estimator only the first assumption of no correlation between the idiosyncratic error term u_{it} and the independent variables x_{it} need to be true. This is because the unobserved individual effect a_i is removed during the transformation of the fixed effects estimator.

The Hausman test is conducted to choose between the two estimators. Here we test for significant differences in the results of the two estimators, and the null hypothesis is that there are no significant differences between them. If we cannot reject the null hypothesis, we prefer the random estimator as it is deemed more efficient. If the second assumption of no correlation between the unobserved individual effects and the independent variables is violated, the estimators will give significantly different results, and the random effects estimator is deemed inconsistent, and we reject the null hypothesis. In this case, the fixed effects estimator is the preferable choice.

The null hypothesis is rejected for the HHI models analysing the debt specialisation, which is shown in table A3.3 in the appendix. The random effects estimator is therefore deemed as inconsistent, and the fixed effects estimator is preferred. In table A3.4 in the appendix, the null hypothesis for the different debt types are rejected for all models except for Mortgage Debt and Export Credit. Still, since the null hypothesis are rejected for the remaining seven models, the fixed effects estimator is chosen for further analysis for all models to ensure consistency.

7.1.4 Test for Autocorrelation

Analysing multiple companies over several years means that one must test for the presence of serial correlation in the idiosyncratic error term for the model as time-series are part of the data. Here, the Breusch-Godfrey/Wooldridge test for serial correlation is used to test for the presence of serial correlation.

Based on the results in table A3.6 and A3.7 in the appendix, we reject the null hypothesis of no serial correlation in our models. Serial correlation is present in all models, for both debt specialisation and different types of debt.

7.1.5 Test for Heteroskedasticity

Another crucial assumption is homoskedasticity in the models. It is essential to test if the variance in the error term is constant to ensure that inference based on the models is both unbiased and efficient. If this is not the case, and the variance in the error terms are no longer constant, the model will suffer from heteroskedasticity, which means that the error term is no longer constant. The standard error will also be less efficient.

The studentized Breusch-Pagan test is used to test for the presence of heteroskedasticity.

Here, the null hypothesis is homoskedasticity in the error term. In table A3.7 in the appendix, we test the models used to analyse debt specialisation. The results from the Breusch-Pagan tests are ambiguous. For HHI1 and HHI2, we cannot reject the null hypothesis of homoskedasticity. However, as we add more independent variables to the model, the conclusion shifts and the null hypothesis is rejected, and heteroskedasticity is present. In table A3.8, the models for debt heterogeneity and priority structure are tested for heteroskedasticity. Here, we reject the null hypothesis of homoskedasticity for all models except for other debt types.

Based on these results, most of the models used for analysis have presence of heteroskedasticity, and as stated earlier, the models also suffer from serial correlation in the error terms. Therefore, robust standard errors are included to make the models withstand these issues and make them unbiased and efficient.

7.2 Debt Summary

This section will present a summary to provide a deeper understanding of the debt of the sample. To give the best presentation of the debt, we decided to use the value-weighted average. That is, the total value of a specific debt type outstanding, divided by the total value of debt outstanding. This approach gives less weight to the small observations in the sample but gives a better understanding of the debt market in total. The debt composition by year is displayed in figure 7.1.

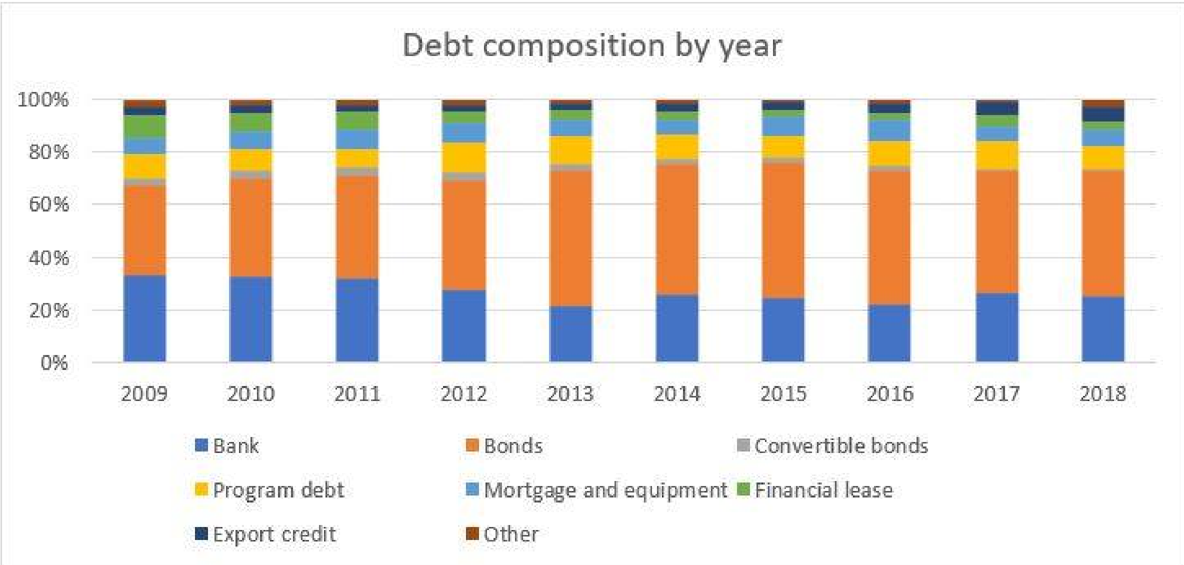

Figure 7.1: Debt composition by year

The graph shows that bonds are the dominating source of funding with bank debt in second place and program debt on third. We also see that the importance of bank financing is declining from the first observed year. The relative importance of bonds increases throughout the period and peaks in 2015, while program debt is reasonably stable throughout the period. Financial lease decrease throughout the period and export credit has the opposite effect. The use of convertibles almost disappeared towards the end of the period and was mostly used between 2010 and 2012. One possible explanation for this may be that convertibles were used in the restructuring process in the aftermath of the financial crisis.

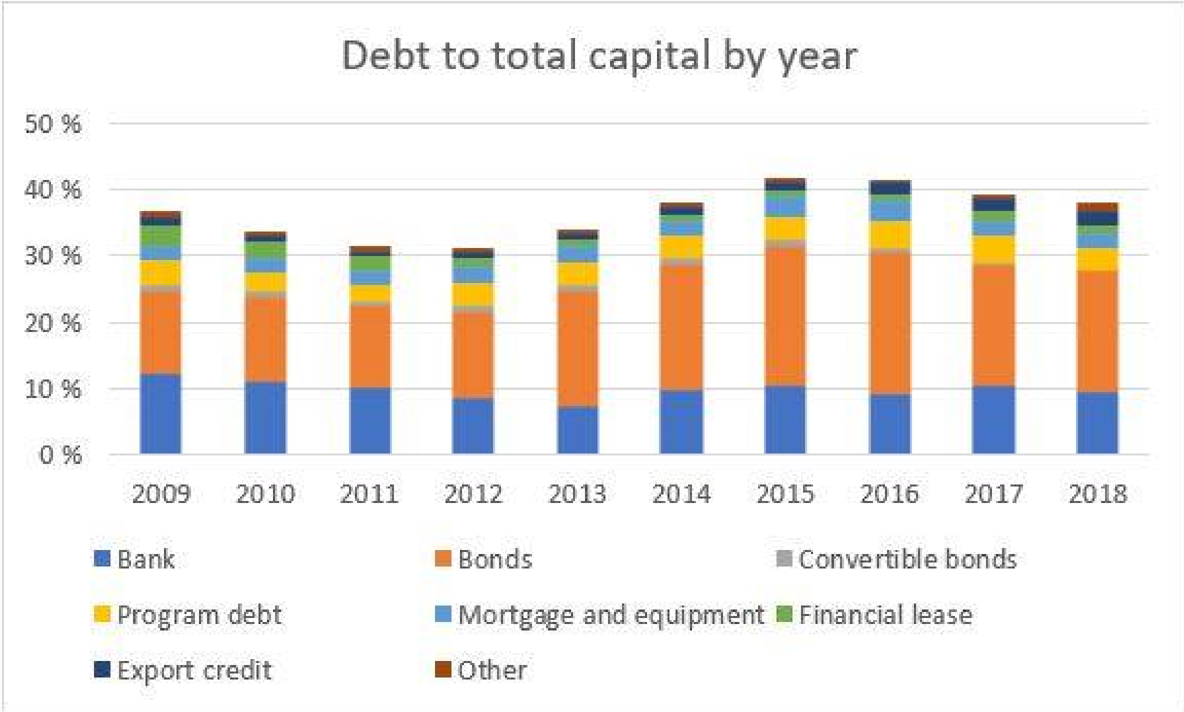

Figure 7.2: Debt to total capital by year

Figure 7.2 shows the debt to total capital by year. The average leverage ratio for the period is 36.6% but varies from 31.2% to 41.7%. The leverage ratio decreases in the first years of the period and bottoms out in 2012. From then it increased to a peak in 2015. After that, the decrease in debt is marginal. We do not have a causal explanation for the changes in the leverage ratio. However, one possible reason for the development could be restructurings after the financial crisis and then increased leverage towards the oil crisis of 2014. We also note that the increasing leverage ratios from 2012 and onward may partially be driven by the low interest rates post the financial crisis. Next, we look at how many percents of the sample observations that use the different categories of debt. These observations are exhibited in table 7.3.

Table 7.3: % of observations using

	Bank	Bonds	Convertibles	Program	Mortgage and Equipment	Financial Lease	Export	Other
% using	77.8%	50.4%	9.4%	10.3%	16.4%	45.5%	13.2%	50.7%

We observe that the most common debt type to have is bank debt, with 77.8% of the sample observations using it. The other dominant types of debt by the number of observations are bonds at 50.4% and financial lease at 45.5%. While bank debt is the most commonly used in numbers, it is not used proportionally by value. The use of bonds is approximately proportional, while the use of financial leases is highly overrepresented in numbers compared to value. The next on our menu is to look at the debt specialisation of our sample.

Table 7.4: Number of debt types used

Number of types	0	1	2	3	4	5	6	7	8
Observations	38	41	114	116	90	39	7	1	0
Percent	8.5%	9.2%	25.6%	26%	20.2%	8.7%	1.6%	0.2%	0%
Using at least this many	100%	91.5%	82.3%	56.7%	30.7%	10.5%	1.8%	0.2%	0%

Table 7.4 display how many observations that uses a certain number of debt types. It is most common to use 2-4 types of debt simultaneously, showing a moderate specialisation of the debt structure. 38 of the observations use no debt at all while Aker one year uses 7 types of debt simultaneously. The average HHI is 0.52, which further shows that the specialisation is moderate. A more thorough analysis of the debt specialisation will be presented later in the analysis.

7.3 Debt Structure Decision

For the analysis of debt structure, we have run two sets of regressions. In panel A, the standard explanatory variables are run on each type of debt. Then in panel B, the other explanatory variables are also included. Both panels can be found below the interpretation of the independent variables. To improve the understanding of the debt structure choice, we decided to divide the interpretation by explanatory variables.

7.3.1 Sales

Surprisingly, we find no significant correlation between sales and the total leverage ratio in either panel A or panel B. We would have expected the variable to be significant and positive as large firms have a lower probability of bankruptcy (Rajan and Zingales, 1994). Therefore, larger firms should be able to bear more debt than small companies. Further, we observe that the size variable has negative and significant correlations to bank debt and mortgage debt. Bank debt and mortgages are two of the least information sensitive debt types as they are often either secured or monitored through covenants. Larger companies are more thoroughly analysed, and they therefore suffer less from the asymmetric information issue (Rajan and Zingales, 1994). Thus, they should have an advantage in obtaining information sensitive market financing relative to less information sensitive bank financing. This advantage is also backed by the significant positive relationship between size and market debt such as bonds and program debt.

Interestingly we find a positive and strongly significant correlation to both convertibles and export credit. Convertibles are the most information sensitive debt type so it should be more available to large firms, all else equal, according to the previous argument. The export credit coefficient is likely to be related to the size of the projects financed by export credit. The correlation to financial lease and other debt is not significant, and we also have in mind that the debt type other is a residual and that the interpretation would not necessarily make economic sense if significant. The differences in estimates between panel A and panel B are minor but largest for bank debt.

7.3.2 Profitability

Some surprises also arise when it comes to profitability. We find a positive but non-significant correlation between profitability and leverage ratio in panel A. This correlation becomes strongly significant and a bit larger when testing for extra variables in panel B. This is not consistent with the pecking-order theory, as it predicts that firms with high earnings would prefer internal to external financing. However, it is consistent with the trade-off theory, as firms with larger earnings could better exploit the debt tax shield. Further, this result is inconsistent with the results in research by Fama and French (2002). One explanation for this result could be the composition of companies in the sample that we have discussed earlier. The 38 observations of zero leverage have average profitability of -36%. The low profitability is mainly related to the biotech companies that survive by frequently issuing equity capital. These companies are effectively excluded from the debt market due to substantial information asymmetries and they negatively affect the coefficients. The interpretation is then that the companies using leverage are those profitable enough to obtain debt financing at reasonable prices. Further, Frank and Goyal (2009) argue that the importance of profitability has decreased as the market is now more willing to finance unprofitable firms with growth opportunities.

We find that bank debt and mortgages have significant and positive correlations, while convertibles and program debt have significant and negative correlations. This result is consistent with the findings of Rauh and Sufi (2010). The other debt types do not have significant correlations, and the significance of export credit disappears when including more explanatory variables in panel B. These findings show that more profitable firms prefer private debt to public debt. This result is, to some extent, consistent with the pecking order theory, as firms would prefer the least information sensitive types of debt to more information sensitive debt types. However, we would have expected the correlation to all debt types to be negative and the coefficients of the most information sensitive debt types to be most negative.

7.3.3 Growth

Growth opportunities are negatively correlated with the leverage ratio and significant. This result is in line with Myers (1977), who argues that firms with high growth opportunities are more vulnerable to debt overhang issues. An alternative explanation could be that firms with a high market to book ratios exploits this to time the market. That is, if management perceives the firms stock to be overpriced, they could exploit that overpricing by issuing equity instead of debt when raising new capital.

Further, growth is significantly negatively correlated to bank debt and mortgages. For bank debt, the results are consistent with Rauh and Sufi (2010), but they do not test on mortgages. Benmelech et al. (2019) offers one possible explanation for this result. They argue that high growth firms will tend to avoid secured debt types as these impose restrictions on investments opportunities the firm can pursue. We also find significant and positive correlations with program debt and export credit. Program debt may be preferred as it imposes fewer restrictions than other debt types. Alternatively, it may be more available to firms with better investment opportunities. We suspect that the correlation to export credit stems from high growth firms using export credit to fuel their growth. The correlations to other debt types are not significant, but this is not surprising. The coefficients are almost unchanged by introducing the additional regression variables.

7.3.4 Tangibility

Tangibility is not only strongly significant and positively correlated to leverage ratio but it also has the highest coefficient of all explanatory variables. This result is highly consistent with the trade-off theory and asymmetric information as tangible assets are easier to value and therefore reduce the perceived risk of debt holders. This is supported empirically by the findings of for instance Frank and Goyal (2009) and Rajan and Zingales (1994). Tangibility is positive and significant for all explanatory variables both in panel A and B except for bank financing in panel B. Further, the coefficients are reduced slightly by introducing other regression variables. The reason for tangibility not being significant to bank debt may be that the effect of a bank relationship may substitute for collateral (Berger and Udell, 1995).

The coefficients are largest for bonds and mortgages. Mortgages are positively correlated to tangibility as more tangible firms can offer more collateral. While for bonds, it is probably related to reduced bankruptcy costs. A paper by Cantor and Varma (2005) shows that firms with a high percentage of tangible assets have higher recovery rates, and this reduces the risk lenders face. The coefficients are also not surprising when it comes to financial lease and export credit financing. A financial lease is almost per definition financing of tangible assets such as equipment and vehicles, whereas the use of export credit in our sample is most common in asset heavy industries such as shipping, fisheries and aquaculture and airlines.

7.3.5 Dividend

The dividend payer dummy variable is negative and strongly significant to total debt. This result is consistent with the findings of Frank and Goyal (2009) and may be interpreted as the company having free cash flow and therefore being able to finance more projects internally as stated in the pecking order theory. We find no significant correlation between dividend payments and issuing bank and bond debt. The dividend dummy is the only explanatory variable with no correlation to either of the two largest types of debt. Dividends are strongly significant and negatively correlated to convertibles, supporting the pecking order hierarchy. We struggle to find a theoretically anchored explanation for the significant correlation to export credit, and it may be as simple as companies using export credit not having free cash flows to pay dividends. As mentioned previously, export credit financing is positively related to growth opportunities and substantial investments may eat up the cash that would otherwise go to dividends.

7.3.6 Family

The family-controlled dummy is strongly significant and positive for total leverage. This result is consistent with research by Baek et al. (2016) and with our previous assumptions stated in chapter 5.2.6. It indicates that family-controlled firms use more leverage as the controlling families are not willing to give up control by issuing equity. We also observe that the coefficient is negative and strongly significant for convertibles. Family-controlled firms do not like convertibles as this debt instrument could threaten their controlling status if the option to convert to equity is exercised.

The coefficients for mortgage debt and bank debt are also positive and significant, while the coefficient for program debt is negative and significant. The coefficient for bonds is not significant. These results show that family firms prefer private debt to public debt. One reason for this could be that having public debt leaves them more exposed in a potential restructuring as it needs the debt holders approval. Conflicting interests may make it difficult to retain control of the assets as some debt holders might prefer to take control of the assets instead of doing a corporate workout. The other coefficients are not significant except for the category other debt. As other debt is just a residual, we do not lay much emphasis on that result.

7.3.7 Liquidity

The liquidity, or the current ratio, is strongly significant and negatively correlated to the leverage ratio. As the current ratio is a measure of short term liquidity and contains, for instance, cash holdings and short term financial investments, this comes as no surprise. If we look at the pecking order theory, it predicts that firms with good liquidity need less external financing. Liquidity is also negatively correlated to bank financing. This result is also expected as bank loans, and drawn revolvers in particular, are the primary source of short term financing. Thus, if firms have liquid funds at hand, it reduces their need for managing the short term liquidity with bank debt. The coefficient for bank debt is also the largest, suggesting that the negative correlation to leverage ratio is primarily driven by the lack of the shorter term financial sources. Further, mortgages and export credit are both significant and negative, which could be explained by a decrease in the need for external financing as liquidity increases.

Program debt is significant and negatively correlated with liquidity. Since program debt mainly consists of short-term notes, firms with better liquidity will have less need for these debt instruments. Surprisingly, we find a strong significant and positive correlation to convertibles. This result is not consistent with the pecking order theory as convertibles are the least attractive source of debt in the hierarchy. Lastly, bonds and financial leases are not significant at the 5% level.

Table 7.5: Panel A: Debt type

Panel A display fixed effect regression results with a sample of 54 publicly listed companies on the OSEBX index in the period 2009-2018 for four explanatory variables. Standard errors are clustered and robust. Year Fe means that time fixed effects are included in the regressions.

	Dependent variable:								
	Total Debt	Bank	Bonds	Convertibles	Program	Mortgage	Financial Leases	Export Credit	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sales	0.005	-0.011^{***}	0.010^{***}	0.003^{***}	0.008^{***}	-0.016^{***}	0.0002	0.011^{***}	-0.0004
	(0.007)	(0.003)	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.000)
Profitability	0.048	0.179^{***}	-0.040	-0.042^{***}	-0.032^{***}	0.088^{***}	-0.021	-0.090^{***}	0.007^{*}
	(0.028)	(0.038)	(0.041)	(0.012)	(0.007)	(0.019)	(0.024)	(0.024)	(0.003)
Growth	-0.014^{*}	-0.017^{**}	0.006	-0.001	0.006^{***}	-0.015^{***}	-0.001	0.007^{**}	0.0002
	(0.006)	(0.006)	(0.005)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
Tangibility	0.473^{***}	0.064^{*}	0.129^{***}	0.019^{***}	0.033^{***}	0.125^{***}	0.046^{**}	0.053^{***}	0.003
	(0.027)	(0.030)	(0.019)	(0.003)	(0.004)	(0.021)	(0.015)	(0.011)	(0.007)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	445	445	445	445	445	445	445	445	445
R^2	0.408	0.070	0.113	0.046	0.084	0.200	0.031	0.051	0.004
Adjusted R^2	0.390	0.042	0.087	0.018	0.056	0.176	0.002	0.023	-0.026
F Statistic (df = 4; 431)	74.221^{***}	8.091^{***}	13.764^{***}	5.232^{***}	9.832^{***}	26.919^{***}	3.478^{***}	5.812^{***}	0.454

Note: ***, ** and * denote significance at the 0.1, 1 and 5% levels, respectively

Table 7.6: Panel B: Debt Type

Panel B display fixed effect regression results with a sample of 54 publicly listed companies on the OSEBX index in the period 2009-2018 for all explanatory variables. Standard errors are clustered and robust. Year Fe means that time fixed effects are included in the regressions.

	Dependent variable:								
	Total Debt	Bank	Bonds	Convertibles	Program	Mortgage	Financial Lease	Export Credit	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sales	-0.008	-0.023^{***}	0.009^{***}	0.005^{***}	0.008^{***}	-0.020^{***}	0.001	0.014^{***}	-0.001^{*}
	(0.006)	(0.005)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)
Profitability	0.103^{***}	0.168^{***}	-0.021	-0.029^{*}	-0.033^{***}	0.059^{*}	-0.019	-0.029	0.007
	(0.027)	(0.035)	(0.042)	(0.012)	(0.007)	(0.026)	(0.001)	(0.021)	(0.004)
Growth	-0.013^{*}	-0.018^{**}	0.004	-0.001	0.006^{***}	-0.012^{***}	-0.0001	0.008^{***}	-0.0002
	(0.006)	(0.006)	(0.005)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Tangibility	0.385^{***}	0.016	0.123^{***}	0.026^{***}	0.033^{***}	0.107^{***}	0.046^{**}	0.033^{*}	0.002
	(0.028)	(0.033)	(0.019)	(0.004)	(0.004)	(0.016)	(0.001)	(0.016)	(0.008)
Dividend	-0.073^{***}	0.010	-0.015	-0.009^{***}	0.003	0.015	-0.006	-0.073^{***}	0.002
	(0.014)	(0.026)	(0.012)	(0.002)	(0.004)	(0.008)	(0.001)	(0.012)	(0.002)
Family	0.056^{***}	0.023^{*}	-0.014	-0.015^{***}	-0.007^{***}	0.051^{***}	0.010	0.013^{**}	-0.005^{***}
	(0.009)	(0.012)	(0.010)	(0.002)	(0.001)	(0.009)	(0.001)	(0.004)	(0.001)
Liquidity	-0.044^{***}	-0.027^{***}	-0.003	0.004^{***}	-0.001^{**}	-0.009^{*}	0.001	-0.007^{***}	-0.001
	(0.006)	(0.003)	(0.003)	(0.001)	(0.0002)	(0.004)	(0.001)	(0.001)	(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	445	445	445	445	445	445	445	445	445
R^2	0.476	0.107	0.121	0.105	0.086	0.245	0.034	0.143	0.021
Adjusted R^2	0.456	0.073	0.088	0.072	0.052	0.216	-0.002	0.111	-0.016
F Statistic (df = 7; 428)	55.477^{***}	7.289^{***}	8.443^{***}	7.201^{***}	5.754^{***}	19.794^{***}	2.163^{**}	10.190^{***}	1.299

Note: ***, ** and * denote significance at the 0.1, 1 and 5% levels, respectively

7.4 Debt Specialisation

For the analysis of debt specialisation, all firms with zero debt observations are removed from the original sample. The reason is that it does not make sense to analyse the specialisation if the firm does not use debt financing at all. Table 7.7 shows the regressions run with the HHI as the dependent variable and the seven firm-specific variables as independent variables. Although some of the variables used are different, a similar analysis is conducted by Colla et al. (2013), and we can therefore compare the results. We run four separate regressions for debt specialisation.

The first column in table 7.7 includes the standard firm-specific characteristics used in debt research: Sales (Size), profitability, growth (M/B) and tangibility. Our results suggest a slightly negative but strongly significant relationship between size and debt specialisation. This result shows that larger firms diversify their borrowings, which is consistent with the results of Colla et al. (2013). They argue that the cost of monitoring should result in less transparent firms specialising their debt structure. As larger firms are monitored more thoroughly, the information cost should be smaller, and they should be able to obtain a more diversified debt structure.

Next, there is a strongly significant and positive correlation between profitability and specialisation. This result is different from the findings of Colla et al. (2013), who finds a significant negative relationship in their first regressions and then finds no significance as they add regression variables. The reason for profitability to be positively related to specialisation may be that the more profitable firms to a larger degree are able to choose their optimal debt structure and thus concentrate on fewer preferred sources. Further, we find a significant and positive correlation between growth opportunities and debt specialisation. This result indicates that companies with higher growth opportunities have more concentrated debt structures. This is consistent with the findings in Rauh and Sufi (2010). The tangibility variable is significant and negative. A reason could be that firms with tangible assets have lower expected bankruptcy costs and thereby are able to diversify their debt portfolio.

For the second column, we add the dividend payer dummy variable. We find this variable to be significant and negative, suggesting that dividend payers have more diversified debt structures, all else equal. The remaining variable coefficients are mostly unchanged, but the profitability coefficient is substantially larger than in column one and still strongly significant.

In the third column, we add the dummy variable for family-controlled firms. We find this to be negative and strongly significant. Family-owned firms tend to diversify their borrowings more than comparable firms that are not family-owned. One explanation could be that they are more levered, as we saw in table 7.6, and therefore they need to use more types of debt to achieve their desired leverage ratios. As we have mentioned previously, family-controlled firms will prefer debt financing to issuing equity if the equity issue dilutes the ownership share of the controlling family. Thus, they might need to issue several types of debt to avoid issuing equity, leading to less debt specialisation in family-controlled companies. Except for the increase in the profitability coefficient, the other variables do not change much. However, the dividend payer dummy ceases to be significant when including the family control dummy in the regression. In column number four, we also added the liquidity variable, but the variable is not significant and has almost no effect on the other regression variables. We also observe that the adjusted r-squared increase until regression number three and then does not improve in regression number four.

Table 7.7: Evidence on Debt Specialisation

The table display fixed effect regression results on the degree of debt specialisation with a sample of 48 publicly listed companies on the OSEBX index in the period 2009-2018. Standard errors are clustered and robust. Year Fe means that time fixed effects are included in the regressions.

	Dependent variable:			
	HHI			
	(1)	(2)	(3)	(4)
LnSales	-0.037^{***}	-0.030^{***}	-0.040^{***}	-0.037^{***}
	(0.007)	(0.008)	(0.008)	(0.008)
Profitability	0.408^{***}	0.603^{***}	0.695^{***}	0.668^{***}
	(0.106)	(0.105)	(0.106)	(0.103)
Growth	0.015^{*}	0.013	-0.006	-0.004
	(0.006)	(0.007)	(0.007)	(0.007)
Tangibility	-0.146^{**}	-0.156^{**}	-0.160^{**}	-0.143^{**}
	(0.053)	(0.053)	(0.048)	(0.044)
Dividend		-0.085^{**}	-0.040	-0.038
		(0.026)	(0.028)	(0.026)
Family			-0.163^{***}	-0.165^{***}
			(0.015)	(0.015)
Liquidity				0.013
				(0.008)
Year FE	Yes	Yes	Yes	Yes
Observations	398	398	398	398
R^2	0.097	0.112	0.173	0.175
Adjusted R^2	0.066	0.080	0.140	0.140
F Statistic	10.307^{***} (df = 4; 384)	9.658^{***} (df = 5; 383)	13.277^{***} (df = 6; 382)	11.525^{***} (df = 7; 381)

*Note: ***, ** and * denote significance at the 0.1, 1 and 5% levels, respectively*

7.5 Priority Structure

In this section, we have analysed the effect of the firm-specific characteristics on the priority structure. Three separate analyses have been conducted to investigate how the secured debt, senior unsecured debt and subordinated debt of a firm are correlated with these characteristics.

7.5.1 Secured Debt

Based on the analysis conducted in table 7.8, the size variable has negative correlations with secured debt that are strongly significant for all four regressions. As mentioned earlier, both mortgage debt and bank debt are less information sensitive and often have covenants included to ensure that the firms fulfil all requirements of the loan contract. Large, publicly listed companies are heavily monitored by market analysts, the exchange they are listed on and their banking connections. Therefore, the asymmetric information issue is less of a concern for these companies (Rajan and Zingales, 1994). Thus, larger firms will often have access to more information sensitive types of debt. These results are in line with the findings of (Barclay and Smith, 1995), who states that larger firms issues less secured debt compared to other types available as they have a comparative advantage in public issues of debt.

The profitability variable is positive and significant for all for regressions, but including more explanatory variables decreases the coefficient estimates. This is consistent with the results found in Benmelech et al. (2019). One explanation for this could be that the use of secured debt in certain situations mitigates the underinvestment problem and thereby lets the firm undertake profitable projects it otherwise would not have been able to (Stulz and Johnson, 1985). Further, we find a significant and negative relationship between growth opportunities and secured debt. Benmelech et al. (2019) argues that the use of secured debt may restrict investment and thereby impose a restriction on growth. However, growth is not significant when we introduce additional regression variables.

The effect of tangibility is not significant for any of the regressions. This result is surprising, as the degree of tangibility should imply how much potential collateral the firm has. In table 7.6 we found that tangibility is positive for the total debt level and in table 7.7 we found that tangibility is negative for specialisation. So while tangible firms are more levered, their borrowings are also more diversified, and they do not use more secured debt. Benmelech et al. (2019) find that the effect of tangibility on the use of secured debt has been declining over time. They argue that firms now can pledge a greater variety of assets as collateral and shows that intangibles have a positive correlation to secured debt. This could be a reason why we find no significance for the tangibility variable. The dividend dummy is significant and positive for the second regression but is not significant for the third and fourth regression.

The family-controlled dummy is positive and strongly significant for both regressions. This result is consistent with what we found in 7.6. We showed that family-controlled firms prefer to use private debt to public debt. As private debt is secured more often than public debt, the preference of private debt is likely to drive the correlation to secured debt. The introduction of liquidity adds no significance to the analysis.

Table 7.8: Analysis of Secured Debt

The table display fixed effect regression results with a sample of 54 publicly listed companies on the OSEBX index in the period 2009-2018. Standard errors are clustered and robust. Year Fe means that time fixed effects are included in the regressions.

	Dependent variable:			
	Secured Debt			
	(1)	(2)	(3)	(4)
Sales	-0.117^{***}	-0.124^{***}	-0.103^{***}	-0.106^{***}
	(0.016)	(0.018)	(0.016)	(0.016)
Profitability	0.720^{**}	0.542^{*}	0.358^{*}	0.391^{*}
	(0.218)	(0.237)	(0.163)	(0.164)
Growth	-0.062^{*}	-0.060^{*}	-0.022	-0.024
	(0.256)	(0.025)	(0.026)	(0.027)
Tangibility	0.137	0.146	0.154	0.134
	(0.099)	(0.093)	(0.098)	(0.104)
Dividend		0.077^{*}	-0.013	-0.016
		(0.039)	(0.038)	(0.039)
Family			0.326^{***}	0.328^{***}
			(0.039)	(0.040)
Liquidity				-0.016
				(0.014)
Year FE	Yes	Yes	Yes	Yes
Observations	398	398	398	398
R^2	0.207	0.212	0.301	0.303
Adjusted R^2	0.180	0.183	0.274	0.273
F Statistic	25.076^{***} (df = 4; 384)	20.569^{***} (df = 5; 383)	27.469^{***} (df = 6; 382)	23.618^{***} (df = 7; 381)

Note: ***, ** and * denote significance at the 0.1, 1 and 5% levels, respectively

7.5.2 Senior Unsecured Debt

The analysis in table 7.9 highlights how senior unsecured debt is affected by the specific firm characteristics. As we argued in the section above, asymmetric information issues are less problematic for larger firms (Rajan and Zingales, 1994). Here, the sales variable is positive and strongly significant, which translates into larger firms having more senior unsecured debt, which is consistent with the results found by Chen et al. (1998). Being heavily monitored, lets these firms use more public debt and less private debt, as shown in 7.6. Public debt is more often unsecured as opposed to private, and this is probably the driver of the correlation between sales and senior unsecured debt.

We find no significant correlation between profitability and unsecured debt. This result is surprising given the positive and significant correlation to secured debt. However, we can look at the results in table 7.6 for an explanation. We previously found that profitability had no significant correlation to bonds, which is the primary source of unsecured financing. The correlation to program debt is admittedly significant and negative, but the amount of program debt issued is dwarfed by the amount of bond debt.

As for growth, the relationship is positive and significant for the first two regressions. This mirrors the result from table 7.8, and we could implement the same argument used there. Companies with high growth options prefer to use debt that does not restrict their investment opportunities (Benmelech et al., 2019). The significance disappears in regression three and four when including more explanatory variables. Including the dividend payer dummy does not provide significance in any of the regressions.

The family-controlled dummy is negative and strongly significant. This is mirroring the results from the secured debt analysis, and we use the same argument for uncovering the reason. Family-controlled firms prefer private debt to public debt, which is more often secured. The liquidity variable is not significant and ads very little explanatory power to the regression.

Table 7.9: Senior Unsecured Debt

The table display fixed effect regression results with a sample of 54 publicly listed companies on the OSEBX index in the period 2009-2018. Standard errors are clustered and robust. Year Fe means that time fixed effects are included in the regressions.

	Dependent variable:			
	SeniorUnsecured			
	(1)	(2)	(3)	(4)
LnSales	0.102***	0.105***	0.088***	0.086***
	(0.016)	(0.017)	(0.016)	(0.016)
Profitability	−0.438	−0.375	−0.228	−0.206
	(0.230)	(0.278)	(0.213)	(0.213)
Growth	0.067*	0.067*	0.037	0.036
	(0.028)	(0.027)	(0.030)	(0.030)
Tangibility	−0.165	−0.169	−0.175	−0.189
	(0.105)	(0.101)	(0.105)	(0.107)
Dividend		−0.027	0.044	0.042
		(0.035)	(0.038)	(0.037)
Family			−0.260***	−0.258***
			(0.044)	(0.044)
Liquidity				−0.011
				(0.009)
Year FE	Yes	Yes	Yes	Yes
Observations	398	398	398	398
R^2	0.193	0.194	0.251	0.252
Adjusted R^2	0.166	0.164	0.222	0.221
F Statistic	22.977*** (df = 4; 384)	18.402*** (df = 5; 383)	21.388*** (df = 6; 382)	18.339*** (df = 7; 381)

Note: ***, ** and * denote significance at the 0.1, 1 and 5% levels, respectively

7.5.3 Subordinated Debt

From the analysis in table 7.10, we see that sales are positive and strongly significant across all regressions. These findings are in line with the findings of Barclay and Smith (1995), who shows that larger firms issues more subordinated debt. We suspect that the reduced information asymmetry related to larger firms give them a comparative advantage when issuing subordinated debt. Profitability is negative and significant for all regressions. Some of the subordinated debt consists of convertibles, which we previously showed to have a negative correlation with profitability. Furthermore, subordinated debt is often more costly, and companies who are able to attain other, cheaper, sources of financing might want to avoid subordinated debt when possible.

Growth is negative and significant for the last two regressions. In our analyses of debt types in table 7.6, convertibles are negatively correlated with growth. This relationship might be a driver behind growing firms having less subordinated debt. Another reason may be that the use of risky debt, like subordinated debt, may reduce the value of growth options due to implementing an inferior investment strategy (1977).

Tangibility is positive and significant for three of the four regressions conducted. A reason for this could be that an increase in tangibility increases the recovery rates at default (Cantor and Varma, 2005). As the holders of subordinated debt are last in line in a bankruptcy process, we expect them to be sensitive to increases in expected recovery rates. Liquidity also has a positive and strongly significant relationship with subordinated debt. Popularised by Ohlson (1980), liquidity is often used as a component in predicting the probability of bankruptcy, and we therefore argue that this result is expected. Because the subordinated debt has the lowest recovery rates, it will also be most sensitive to changes in default probability. Lower default probability will drive down the relative cost of issuing subordinated debt and give firms with good liquidity a comparative advantage in issuing it.

Family-controlled firms are strongly significant and negatively correlated with subordinated, while the dividend dummy is only significant for column two. In general, the results from column four are mostly consistent with the results of convertible debt in 7.6. This suggests that the main driver of subordinated debt in our sample is convertibles.

Table 7.10: Subordinated Debt

The table display fixed effect regression results with a sample of 54 publicly listed companies on the OSEBX index in the period 2009-2018. Standard errors are clustered and robust. Year Fe means that time fixed effects are included in the regressions.

	Dependent variable:			
	Subordinated			
	(1)	(2)	(3)	(4)
LnSales	0.015***	0.019***	0.015**	0.020***
	(0.004)	(0.005)	(0.005)	(0.006)
Profitability	−0.282***	−0.168**	−0.130*	−0.185**
	(0.043)	(0.052)	(0.065)	(0.069)
Growth	−0.006	−0.007	−0.015**	−0.012*
	(0.004)	(0.004)	(0.005)	(0.005)
Tangibility	0.029**	0.023*	0.021	0.055***
	(0.009)	(0.011)	(0.012)	(0.014)
Dividend		−0.050*	−0.032	−0.027
		(0.022)	(0.023)	(0.022)
Family			−0.066***	−0.070***
			(0.011)	(0.011)
Liquidity				0.027***
				(0.005)
Year FE	Yes	Yes	Yes	Yes
Observations	398	398	398	398
R^2	0.039	0.051	0.075	0.097
Adjusted R^2	0.007	0.017	0.039	0.059
F Statistic	3.925*** (df = 4; 384)	4.157*** (df = 5; 383)	5.162*** (df = 6; 382)	5.824*** (df = 7; 381)

Note: ***, ** and * denote significance at the 0.1, 1 and 5% levels, respectively

8 Conclusion

This thesis aims at providing new insights to the firm-specific characteristics driving debt structure decisions of the companies in the OSEBX index. In the period 2009-2018, we observe 54 individual firms for a total of 445 firm-year observations. The data set is unique, collected manually from the firms' annual reports and cross-checked with the SDC Platinum database. We conduct three individual analysis testing the firm-specific characteristics on debt structure, debt specialisation and debt priority structure.

We find that size has no implications for the total leverage ratio, but that larger firms prefer market financing to private financing. Further, large firms have more diversified borrowings and issue more senior unsecured and subordinated debt and less secured debt. For profitability, we surprisingly find a positive effect on total leverage and a preference for private debt over public debt. Profitable firms have more specialised debt structures and use more secured debt. There is no significant correlation to senior unsecured debt and a negative and significant correlation to subordinated debt. Next, firms with considerable growth opportunities use less debt and tend to avoid debt types which impose restrictions, such as bank debt and mortgages. We find little indication of debt specialisation based on growth opportunities. The correlation to secured and senior unsecured is not significant when controlling for family ownership, but is negative and significant for subordinated debt. Tangible firms have more debt and the correlation to all debt types except for bank debt and other debt is significant. They also have a more diversified debt structure. We find no correlation to secured and senior unsecured debt, but a positive relationship between tangibility and subordinated debt.

Firms that pay dividends use less debt, and this effect is driven by convertibles and export credit. We find no significant effect on debt specialisation and priority structure. Family-controlled firms use more leverage and prefer private debt to public debt. They also have more diversified debt structures. Further, they use more secured debt and less senior unsecured and subordinated debt. Firms with good liquidity use less debt than comparable firms, which is mainly driven by less use of short term sources of financing like bank debt. Liquidity has no impact on debt specialisation, secured debt and senior unsecured. However, it is strongly significant and positive for subordinated debt, which is primarily driven by the use of convertibles.

While the majority of our results can be explained by theory and previous empirical findings, no single model is sufficient to understand the capital structure decisions of our sample. We also venture into the impact of family control and liquidity on debt structure, specialisation and priority. We find little previous empirical evidence on the effect of these variables and believe our paper has provided further insight into the debt structure decisions of Norwegian public firms.

9 Limitations and Further Research

9.1 Limitations

The first limitations of the thesis are related to the data sample. We have used an extensive amount of time getting the data set as good as possible, but we are subject to the information we find in the annual reports. The annual reports differ in term of detail and also in term of accounting standards. For instance, there may be small differences separating certain debt types. Still, we believe that we present a fair and objective picture of the debt structure of our chosen sample. The sample also offers limitations in term of size. Due to the time demanding task of collecting the data, we decided to focus on the OSEBX index as a proxy for the Norwegian stock market. Although the OSEBX index represents the majority of the market cap of the Norwegian stock market, it only contains approximately one third of the public companies. Inclusion of more companies would have given a broader and more diversified sample, which might have affected the results. The companies in the OSEBX index are also the most traded stocks on the Oslo Stock Exchange. This makes them the most analysed companies in Norway, and they thus should have a relative advantage in issuing equity compared to the other Norwegian public companies. This advantage may make them less dependent on debt than companies outside the OSEBX.

Further, the paper does not include macroeconomic variables such as interest rates or oil price development. In the OSEBX index, we find many firms that are exposed to cyclical sectors and macroeconomic changes. Therefore, it is reasonable to believe that these variables will affect the debt composition of such firms. Some firms also have parts of their debt issued in other currencies. As we have converted all debt outstanding to NOK for comparability, some firms' leverage ratios will fluctuate due to currency exchange rates.

The explanatory power for some of our models is low, especially when analysing debt as heterogeneous. This suggests that there are many factors not included in this paper that affect the debt composition. Still, other researchers on debt heterogeneity, such as Colla et al. (2013) and Rauh and Sufi (2010) have achieved similar explanatory power which we believe strengthens our analysis.

9.2 Further Research

One possible direction for further research could be to investigate the effect of the implementation of IFRS 16 from 2019 on debt structure. Not including operating leases in the balance sheets, leads to an underestimation of the total leverage ratio as well as the leasing obligations. IFRS 16 will especially impact companies that are reliant on vehicles and manufacturing equipment, such as airlines, shipping companies and construction companies. Another possible direction for research could be to implement credit ratings in the study of debt heterogeneity, specialisation and priority structure. We expect more Norwegian firms to obtain a rating in the years to come, and such an analysis could therefore be more relevant. Lastly, including macroeconomic variables in future research could prove valuable insights into debt structure and its composition.

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Appendix

A1 Company Overview

Table A1.1: OSEBX

Adevinta**/***	AF Gruppen	Aker
Aker BP	Aker Solutions	American Shipping Company
Asetek	Atea	Austevoll Seafood
Axactor*	B2 Holding*	Bakkefrost
BerGenBio	Borr Drilling	BW LPG
BW Offshore	DNB*	DNO
Elkem**	Entra	Equinor
Europris	Evry	Fjord1
Fjordkraft Holding**	Frontline	Gaming Innovation Group
Gjensidige Forsikring*	Golden Ocean Group	Grieg Seafood
Hexagon Composites	IDEX Biometrix	Kitron
Kongsberg Automotive	Kongsberg Gruppen	Lerøy Seafood Group
Mowi	MPC Container Ships**	NEL
Next Biometrics Group	Nordic Nanovector	Nordic Semiconductor
Norsk Hydro	Norwegian Air Shuttle	Norwegian Finans Holding*
Olav Thon Eiendomsselskap	Orkla	PCI Biotech Holding**
PGS	Photocure	REC Silicon
Salmar	Scatec Solar	Schibsted A
Schibsted B***	Sparebank 1 SR-Bank*	Stolt-Nielsen
Storebrand*	Subsea 7	Telenor
TGS-NOPEC Geophysical Company	Tomra Systems	Veidekke
Wallenius Wilhelmsen	Wilh. Wilhelmsen Holding A	XXL
Yara		

**Financial company excluded from our sample*
***Listed in 2018 or 2019. Excluded from our sample*
****A part of Schibsted. Indirectly represented in our sample.*

A2 Market Description and Numbers

Table A2.1: Market Numbers

	Total Market Cap	Share	Number of firms
Media	133.418	6.7%	1
Industry	316.572	15.9%	10
Oil and gas	703.434	34.5%	3
Oil service	83.404	4.2%	6
Shipping	54.989	2.8%	8
IT	39.691	2.0%	9
Fisheries and aquaculture	245.347	12.3%	6
Health Care	3.764	0.2%	3
Real Estate	39.911	2.0%	2
Consumer goods	88.908	4.5%	3
Airlines	5.069	0.3%	1
Energy	13.810	0.7%	1
Communication Services	261.172	13.1%	1
Total	1989.489	100%	54

Note: Total market cap in billion NOK

Table A2.2: Description of firm specific variables

Independent Variables	Description
Sales	Ln(Sales) - Size of the company
Profitability	EBIT/Total Assets - Return on assets
Growth	Market value of equity / Book Value of equity - Growth opportunities
Tangibility	PPE/Total Assets - Measure of tangible assets
Liquidity	Current assets/Current Liabilities - Internal financing ability
Dummy Variables	Description
Family	Dummy = 1 if at least 50.1% of the firm is controlled by one individual or family.
Dividends	Dummy = 1 if the firms share dividend is positive

A3 Statistical Tests

A3.1 Linearity

Figure A3.1 and A3.2 displays the linearity plots between the dependent variable total debt and the independent variables for specific firm characteristics for both data sets. We choose to use total debt as the dependent variable when performing this test as it consists of all debt types. Based on these plots, linearity between some of the variables seems weak. Still, perfect linear relationships are rarely found, and empirical research suggests that the functional form of the variables is correct and that dependencies hold. Therefore, we assume that the assumption of linearity is satisfied.

Figure A3.1: Sample 1

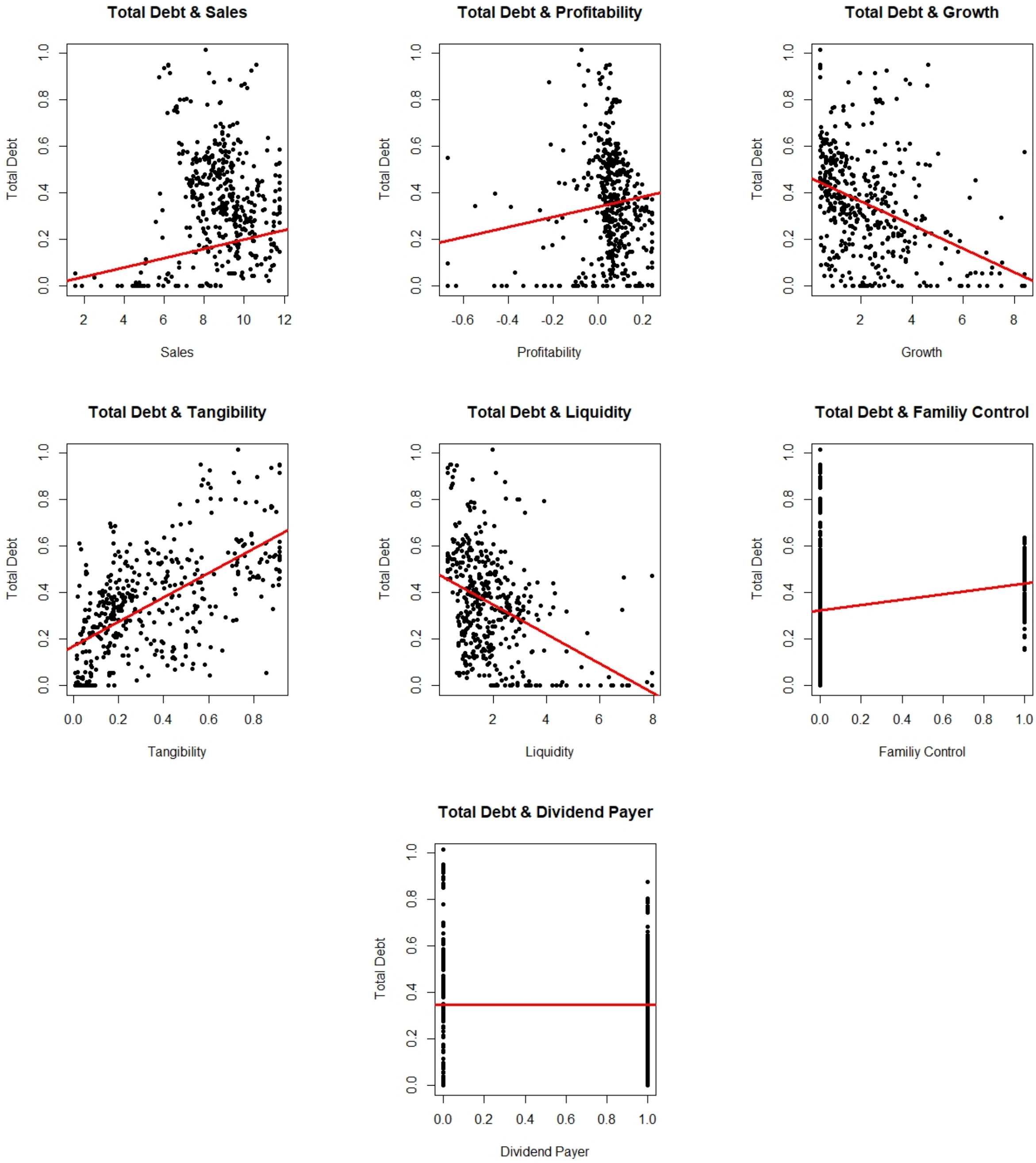
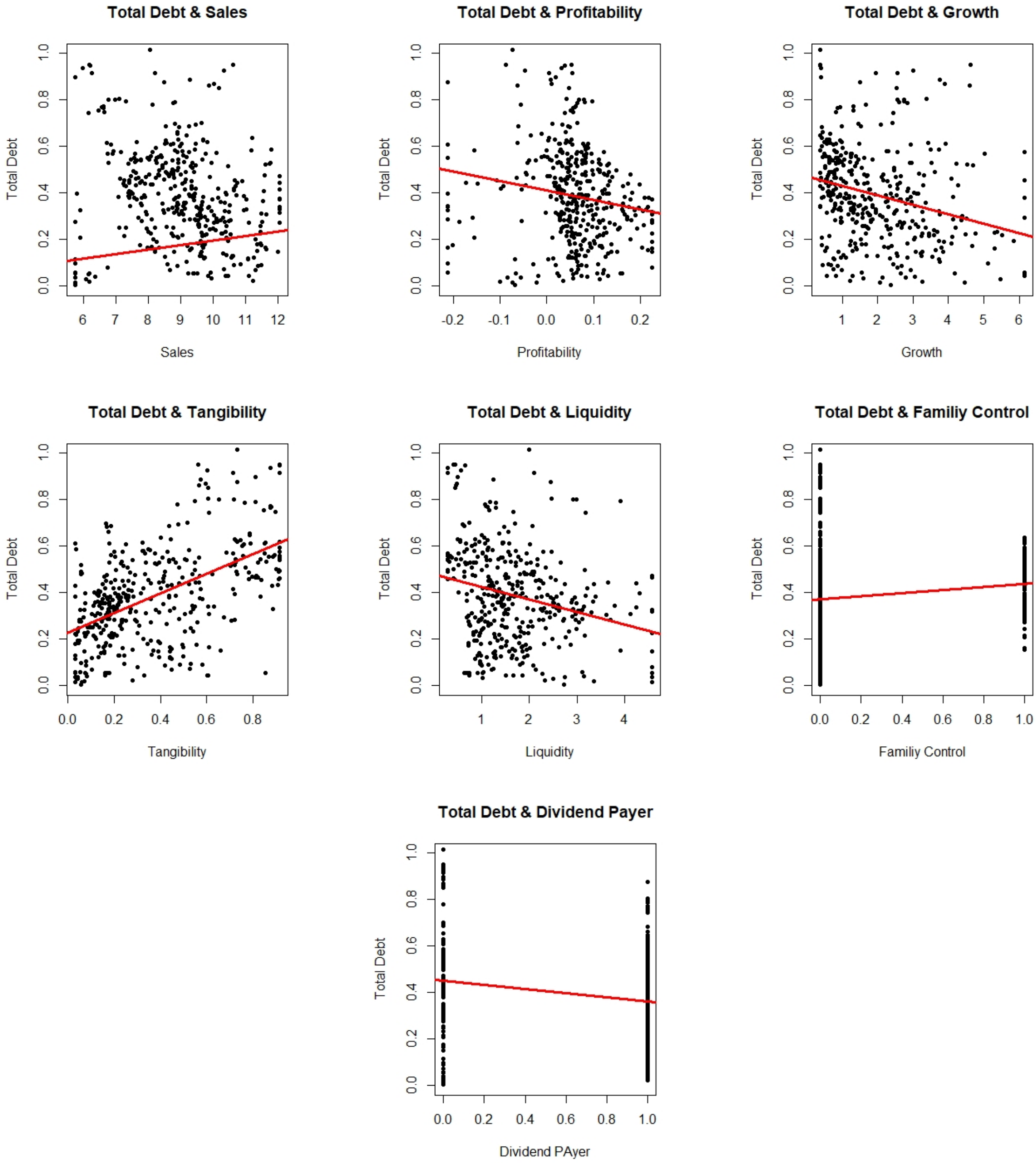


Figure A3.2: Sample 2



A3.2 Normality

Figure A3.3 display the normal distribution of specific firm characteristics. We see that most of the observations fall in between the 95% confidence interval. Therefore, we conclude that the assumption of normality is satisfied.

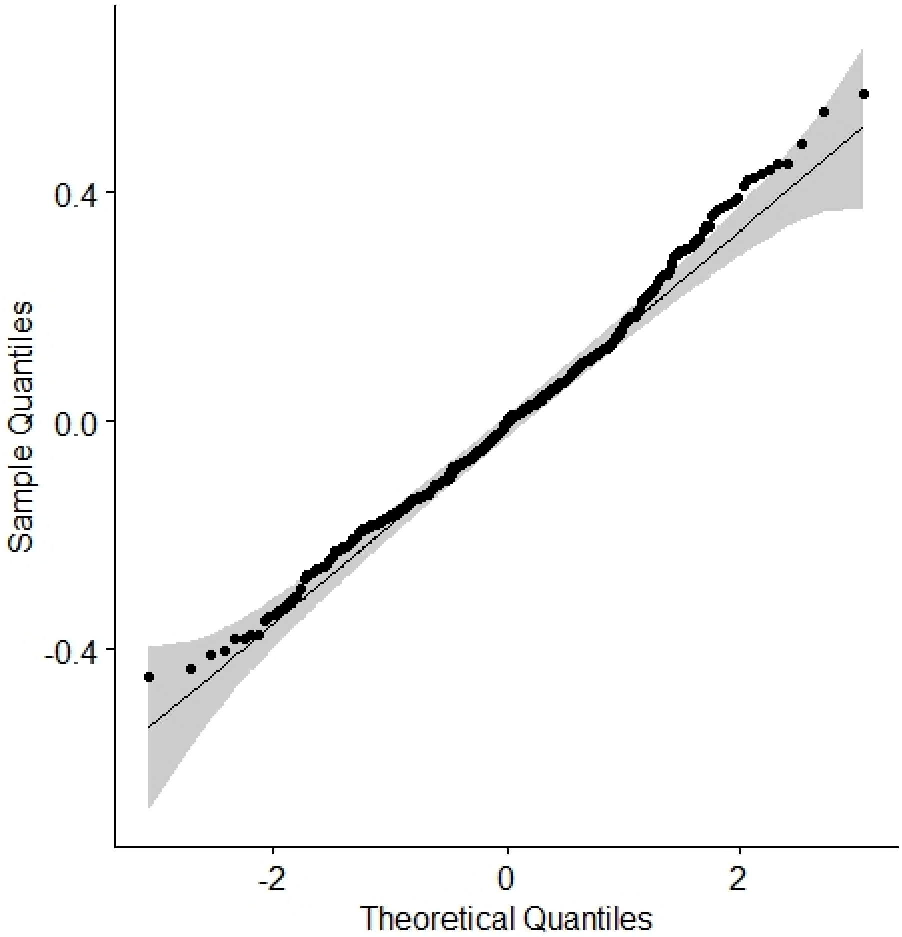


Figure A3.3: Normality Firm Characteristics

A3.3 Panel Effects

Table A3.1 and A3.2 exhibit the Breusch-Pagan Multiplier test for panel effects. All models used for analysis purposes in this paper demonstrate that significant panel effects are present. Therefore, we apply panel data regression methods for further analysis.

Table A3.1: Breusch-Pagan Lagrange Multiplier for Panel Effects - Debt Specialisation

Dependent Variable	Chisq	Df	P-value	Conclusion
HHI1	548.44	1	2.2e-16	Significant Panel Effects
HHI2	505.59	1	2.2e-16	Significant Panel Effects
HHI3	461.99	1	2.2e-16	Significant Panel Effects
HHI4	459.95	1	2.2e-16	Significant Panel Effects

H_0: *No panel effects*
H_1: *Significant panel effects*

Table A3.2: Breusch-Pagan/Lagrange Multiplier for Panel Effects - Types of Debt

Dependent Variable	Chisq	Df	P-value	Conclusion
Total Debt	634.94	1	2.2e-16	Significant Panel Effects
Bank Debt	702.35	1	2.2e-16	Significant Panel Effects
Bonds	596.67	1	2.2e-16	Significant Panel Effects
Convertibles	464.97	1	2.2e-16	Significant Panel Effects
Program Debt	1356.8	1	2.2e-16	Significant Panel Effects
Mortgage Debt	1361.2	1	2.2e-16	Significant Panel Effects
Financial Lease	840.79	1	2.2e-16	Significant Panel Effects
Export Credit	1136.6	1	2.2e-16	Significant Panel Effects
Other	120.75	1	2.2e-16	Significant Panel Effects
Secured	762.24	1	2.2e-16	Significant Panel Effects
Senior Unsecured	919.77	1	2.2e-16	Significant Panel Effects
Subordinated	792.07	1	2.2e-16	Significant Panel Effects

H_0: *No panel effects*
H_1: *Significant panel effects*

A3.4 Hausman Test

Table A3.3 and A3.4 highlights the results from the Hausman test performed on the models used for analysis purposes. Most of the results show that the random model is inconsistent, and the fixed effects model was therefore chosen for further analysis.

Table A3.3: Hausman Test - Debt Specialisation

Dependent Variable	Chisq	Df	P-value	Conclusion
HHI1	37.184	4	1.651e-07	Inconsistent
HHI2	45.785	5	1.004e-08	Inconsistent
HHI3	78.440	6	7.501e-15	Inconsistent
HHI4	77.477	7	4.499e-14	inconsistent

H_0: *No significant difference between models*
H_1: *One model is inconsistent*

Table A3.4: Hausman Test - Types of Debt

Dependent Variable	Chisq	Df	P-value	Conclusion
Total Debt	268.81	7	2.2e-16	Inconsistent
Bank Debt	98.913	7	2.2e-16	Inconsistent
Bonds	56.274	7	8.333e-10	Inconsistent
Convertibles	83.34	7	2.866e-15	Inconsistent
Program Debt	22.659	7	0.001954	Inconsistent
Mortgage Debt	5.7754	7	0.5662	Consistent
Financial Lease	364.18	7	2.2e-16	Inconsistent
Export Credit	11.012	7	0.1381	Consistent
Other	49.668	7	1.678e-08	Inconsistent
Secured	255.38	7	2.2e-16	Inconsistent
Senior Unsecured	310.96	7	2.2e-16	Inconsistent
Subordinated	462.02	7	2.2e-16	Inconsistent

H_0: *No significant difference between models*
H_1: *One model is inconsistent*

A3.5 Serial Correlation

Table A3.5 and A3.6 displays the results from the Breusch-Godfrey/Woolridge Test for serial correlation. Based on these tests, all models have serial correlation in the idiosyncratic error terms. Therefore, we include clustered robust standard errors to control for serial correlation when performing the analysis.

Table A3.5: Breusch-Godfrey/Wooldridge Test for Serial Correlation - Debt Specialisation

Dependent Variable	Chisq	Df	P-value	Conclusion
HHI1	224.96	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
HHI2	213.87	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
HHI3	219.85	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
HHI4	221.56	2	2.2e-16	Serial Correlation in Idiosyncratic Errors

H_0: *No serial-correlation in idiosyncratic errors*
H_1: *Significant serial-correlation in idiosyncratic errors*

Table A3.6: Breusch-Godfrey/Wooldridge Test for Serial Correlation - Types of Debt

Dependent Variable	Chisq	Df	P-value	Conclusion
Total Debt	250.83	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
Bank Debt	255.33	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
Bonds	186.36	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
Convertibles	225.33	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
Program Debt	318.18	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
Mortgage Debt	334.13	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
Financial Lease	294.24	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
Export Credit	296.87	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
Other	73.914	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
Secured	219.78	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
Senior Unsecured	236.55	2	2.2e-16	Serial Correlation in Idiosyncratic Errors
Subordinated	261.73	2	2.2e-16	Serial Correlation in Idiosyncratic Errors

H_0: *No serial-correlation in idiosyncratic errors*
H_1: *Significant serial-correlation in idiosyncratic errors*

A3.6 Heteroskedasticity

Table A3.7 and A3.8 exhibit the results from the studentized Breusch-Pagan test for homoskedasticity. Based on the results, the majority of the models display heteroskedasticity. We include robust standard errors when performing the analysis.

Table A3.7: Studentized Breusch-Pagan Test - Debt Specialisation

Dependent Variable	BP	Df	P-value	Conclusion
HHI1	3.7492	7	0.441	Homoskedasticity
HHI2	4.2428	7	0.515	Homoskedasticity
HHI3	19.904	7	0.00281	Heteroskedasticity
HHI4	24.585	7	0.0008988	Heteroskedasticity

H_0: Homoskedasticity, constant variance in standard errors
H_1: Heteroskedasticity, non constant variance in standard errors

Table A3.8: Studentized Breusch-Pagan Test - Types of Debt

Dependent Variable	BP	Df	P-value	Conclusion
Total Debt	55.812	7	1.029e-09	Heteroskedasticity
Bank Debt	43.742	7	2.397e-07	Heteroskedasticity
Bonds	32.222	7	3.694e-05	Heteroskedasticity
Convertibles	14.420	7	0.04419	Heteroskedasticity
Program Debt	39.195	7	6.659e-06	Heteroskedasticity
Mortgage Debt	129.26	7	2.2e-16	Heteroskedasticity
Financial Lease	17.346	7	0.0153	Heteroskedasticity
Export Credit	60.649	7	1.12e-10	Heteroskedasticity
Other	7.5444	7	0.3745	Homoskedasticity
Secured	83.645	7	2.482e-15	Heteroskedasticity
Senior Unsecured	78.161	7	3.264e-14	Heteroskedasticity
Subordinated	17.851	7	0.01266	Heteroskedasticity

H_0: Homoskedasticity, constant variance in standard errors
H_1: Heteroskedasticity, non constant variance in standard errors