Norges Handelshøyskole
Bergen, Våren 2010

Which factors affect the bond spread of Norwegian firms?

The empirical relation of board structure and characteristics of firms

By: Arnstein Gabrielsen

Master of Science in Financial Economics

Supervisor: Dr. Carsten Bienz

Abstract

I intend to analyse to which extent the characteristics of firms and the structure of the board of directors is taken into account by creditors deciding when to invest in a corporate bond issue or not. The perception of creditors is extracted by analyzing how the corporate bonds spread relates to board independence, experience, diversity and size which may be considered to be important determinants of corporate governance and performance of the board. Technically, the results are documented using multiple regression models estimated by ordinary least squares on a dataset consisting of 1341 bonds. My findings include a negative relation of experience and a positive relation of board size to the corporate bond spread, while my findings are inconclusive with respect to board diversity and independence. In sum, these results explain how investors either explicitly or implicitly take into account the structure of the board before investing in corporate bonds. With regard to the firm, I document a relation of size, asset turnover and return volatility, while leverage seems unrelated to the spread.

Acknowledgement

I would like to express my gratitude to my supervisor Dr. Carsten Bienz for planting the seeds of what, from my perspective, proved to be a very interesting problem for a thesis. His constructive criticism throughout the different stages of the writing process was also valuable. Furthermore, this thesis would not have been written had it not been for the Norwegian Trustee offering access to their extensive database of the Norwegian bond market. Lastly, I would like to thank my proofreaders Kjell and Sigve for their help in improving the linguistic aspects of my thesis.

Table of content

Figures

Tables

1. Introduction

The breakdown of corporate governance preceding the failures of WorldCom, Enron and Tycon, sparked an intensive debate of whether the board of directors had been sleeping on duty. This debate suggested a number of changes to boards in order to improve the corporate governance of firms. One contribution is "Back to the drawing board: designing corporate boards for a complex world" by Carter and Lorsch (2004), who argue in favour of a reduction in board size, increased number of independent directors and boards chaired by an independent director. Meanwhile, the Norwegian government has enacted a law, which states that 40 percent of all boards of publicly listed firms shall consist of female directors (The Ministry of Children, Equality and Social Inclusion, 2008), in an effort to increase gender diveristy. A number of articles have been investigating how the board structure affects the performance and market value of firms, still, few have delved into how these reforms and regulation are perceived by creditors.

The perception of creditors can be extracted by analysing how the risk premium of corporate bonds relates to the structure of corporate boards. The risk premium, henceforth the corporate bond spread, is the difference between the required rate of return on a corporate bond and a government bond (Bodie, 2001). Government bonds issued by financially healthy countries, like Norway, are assumed to be free of default risk. For corporate bonds, however, the expected return depends on the risk of default and recovery in case of default, leading to these factors being important determinants of the spread. The spread is accordingly often referred to as the default premium on corporate bonds (Bodie, 2001). I oftentimes refer to the spread as the cost of debt, justified by how the spread measures the cost of borrowing in excess of the risk free interest rate.

The main objective of this thesis is to investigate the relation between the board structure and the corporate bond spread. My contribution is first and foremost to increase the quantity of research in light of the limited number of publications issued investigating the relation between board structure and the cost of debt. Secondly, using a Norwegian dataset enables me to examine the stability of relationships found in articles in other countries. Norwegian

business life has some advantageous distinctive characteristics in this respect, as boards are smaller and more independent compared to the American firms usually studied, which proves to be an interesting board environment when it comes to testing the findings of other authors (explained in part 5.5).

I have collected a comprehensive dataset containing 1341 bonds, which includes most corporate bonds issued after 1997, and coupled them with a wide array of firm and board characteristics. This allows for estimation of the effect of different board characteristics on the spread, holding all other bond, firm and board characteristics constant. It is not only the quantity of measures that set this thesis apart, but also the use of a different measure of board independence from management, which is based on the tenure of the board relative to the CEO. This measure has a number of advantages relative to alternative independence measures, as is discussed in part 2.5, and it is interesting to note how the findings of other authors compares to this alternate measure.

Even though my focus of attention will be on the board structure, I intend to estimate and discuss a rigorous base model on how to control how firm and bond characteristics relate to the spread. A general discussion of factors affecting the spread is interesting in view of the phenomenal growth in outstanding value of bonds and the increased scope of firms and industries issuing bonds (figure 2). This has enhanced the breath and share number of bonds available to researchers, which enables more extensive research on the corporate bond spread of the Norwegian bond market.

I estimate multiple regression models in order to estimate rigorous relations to the individual variables by discovering "ceteris paribus" relationships, i.e. the relation of one variable holding all other relevant factors constant. The multiple regression models are estimated using ordinary least squares (OLS) regression, which is discussed in detail in part 6.

My findings indicate that creditors, either consciously or unconsciously, take into account the structure of the board when deciding to invest in a corporate bond, evident by a negative relation of average tenure and age of the board members and a positive relation of board size to the corporate bond spread. A number of expected relations to the bond spread of firm and bond characteristics are also confirmed, such as a negative issue and firm size and a positive relation of firm risk. Leverage, having a theoretical relation to default risk, proved unrelated

to the corporate bond spread. The interpretation and implications of these findings are discussed in detail as I present my findings.

The thesis is organized in a traditional manner, starting off with a theoretical description, followed by a description of the data collection process and the dataset, before my findings are being presented. In more detail, section 2 offers a theoretical description of how the corporate bond spread relates to bond, firm and board characteristics. I start out with a description of the relationships expected to firm variables using option theory and the relations documented in other papers that investigate the bond spread (part 2.1). I then extend my knowledge by reviewing to which extent default risk can explain the observed bond spreads, in order to anchor my expectations of the importance of firm characteristics.

In section 2.2 I review some of the most important papers investigating bond and bond market characteristics, such as liquidity, maturity and a number of contractual features, before I focus on board qualities by defining the board of directors in section 2.3. Section 2.4 deals with and relates corporate governance to creditors by presenting three governance problems, and proceeds with explaining how a well-equipped board can lower the cost of debt by mitigating these governance problems. Sections 2.5 to 2.8 define board independence, experience, diversity and the number of board members as four important determinants as to the effectiveness of a board, and carry on with a discussion of their theoretical and empirical relation to the performance of the board and the cost of debt.

A general description of the Norwegian bond market, the data collection process and the dataset follows in sections 3, 4, and 5 respectively. Part 6 discusses any econometric pitfalls and the underlying assumptions of the estimation method thought to be important to the analysis of my findings. In section 7 I analyse and discuss my findings. The section is structured similar to the theoretical discussion in part 2, dividing the presentation and discussion of the results into firm, bond and the four board characteristics. Section 8 summarizes on the importance of the different predictors of the cost of debt. Note that the most important regression models will be presented in the main text, while tables related to the robustness sections, variable descriptions and correlation matrices are presented in the appendix.

Two articles serve as sources of inspiration. “Board characteristics, accounting report integrity and the cost of debt” by Anderson et al. (2004) relates a range of board characteristics, focussing on independence, board size and audit committee structure, to the cost of debt. They find, using a sample of 252 S&P500 industrial firms surveyed annually, that the board structure is related to the cost of debt. “Aligned, informed, and decisive: Characteristics of value-creating boards” by Bøhren and Strøm (2007) is a Norwegian cousin of the growing literature on board characteristics and firm performance. Performance is measured as market value of assets divided by book value of assets (Tobin’s Q). Data is collected on all non-financial firms listed on the Oslo stock Exchange from 1989 to 2002, and thus differs relative to my sample with regard to both time and firm composition. Their econometric model of choice is fixed effect estimation. This article serves as a local reference on board characteristics and performance, and is used to compare and discuss my findings relative to the findings of the performance literature. The details of these articles will be discussed in relation to the relevant board characteristics discussed below.

2. Determinants of the corporate bond spread

2.1 Firm characteristics

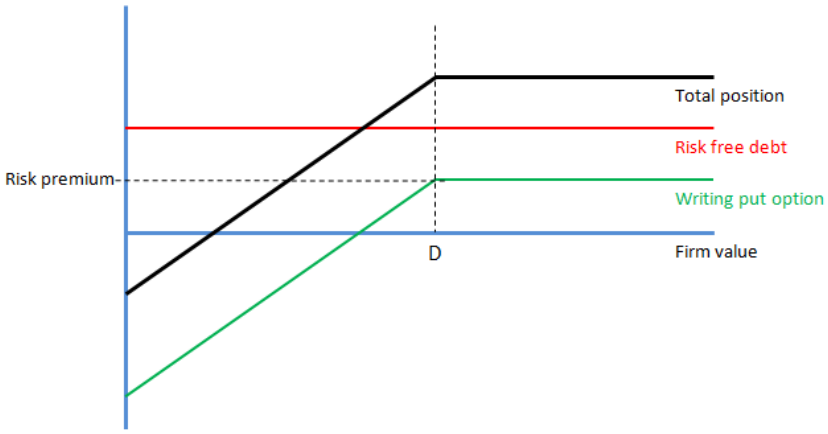
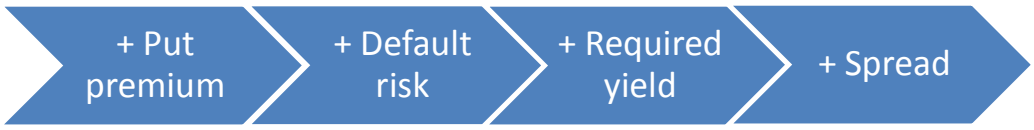


Figure 1: Creditor's position in the debt option framework

I now intend to explore the theoretical relation of firm characteristics to the corporate bond spread by the use of an option model, in order to motivate the inclusion of different firm characteristics in the regression models. Owners of limited companies have the option to declare the company bankrupt, walk away, and hand any remaining assets over to creditors. The resemblance to a position using options is striking, as limited liability can be considered a long position in the firm, held side by side with a put option. Creditors hold an opposite position, illustrated in figure 1, where they have an outstanding risk free debt and have written a put option to the owners of the firm. Generally, a put option grants the holder the right to sell an underlying asset at a predetermined exercise price. The opposite position is held by the option writer, who commits to buy the underlying asset from the option holder, i.e. the option commits the creditors to buy the firm at the face value of the debt. This commitment is put into effect by the owners, who as holders of the option have the right to declare the company bankrupt. They will ask creditors to make good of their commitment if firm value is lower than par value of the debt at maturity. This intuition dates back to Merton (1974) who used

option theory to price corporate debt. Clearly, an increase in the value of the put option implies a rise in default risk resulting in a gain (loss) to the owners (creditors) (Brealey et al., 2006).



What factors determine default risk? This question can be answered by looking at the factors determining the value of the put option sold by creditors. Factors increasing the value of the option imply a rise in default risk, as the value of the option rises when the probability of default increases. The value of the put option will consequently be equal to the theoretical bond spread.

Multiple factors affect the value of a put option (Hull, 2009). All other factors equal, a higher exercise price results in a higher premium, because the underlying asset is sold at a higher price. In the debt option framework, the owners are selling the firm to the creditors at the face value of debt. Increasing the amount of debt will accordingly increase the value of the put option, and thus results in a higher bond spread.

Table 1	ΔSpread
Volatility firm value	+
Value of firm	-
Time to maturity	+
Level of debt	+

Merton's (1974) bond pricing model suggests an initially increasing negative effect of leverage, before the effect dampens at higher levels of debt. Brealey et al., (2006), however, argue, based on outcomes in the market, in favour of an increasing negative effect of leverage over the entire range of possible leverage ratios. This relationship emerges if the probability of default is insignificant at low and moderate levels of debt, but increases at an accelerating phase as the debt ratio reaches high levels.

The effect of increased firm size can be deducted from the option framework in a fashion similar to leverage. Increased value of firm asset for constant debt will reduce the likelihood of the firm ever becoming worth less than the face value of debt. It is accordingly less probable that the owners will find declaring the firm bankrupt profitable, which lowers the value of the limited liability put option. The theoretical finding of a positive relation of

leverage and a negative relation of firm assets points to a positive relation to the bond spread of debt measured relative to total assets.

Firm size may also be negatively related to the spread, even if the debt is increased in tandem with firm assets, because a blow to one activity may have a minor impact on the whole of the firm. The principal reason, which is unrelated to the option model, is their more diversified nature, operating across countries, industries and products (Rajan and Zingales, 1995).

Increased risk of the underlying asset will always work to increase the value of an option. Too see this in relation to the limited liability put option, consider how a very risky firm is more likely to experience a large fall in asset value at the turn of the business cycle. It is accordingly more probable that the owners will find themselves with a firm worth less than the outstanding value of debt, which makes exercise of the limited liability put option profitable. Accordingly, increased volatility will rise the value of the put option making for a larger expected bond spread.

Assuming identical volatility, an option with a longer time to expiration will have more time for which the volatility can cause changes to the underlying asset's value. Accordingly, a long-term loan has a more valuable put option attached, and this explains how the corporate bond spread increases with maturity. It is, in other words, more likely that a firm will go bankrupt during a ten year period compared to a five year period.

Firm volatility cannot be observed directly, and will have to be estimated. Campbell et al. (2003) argue how equity volatility will incorporate all information available in accounting variables and credit rating, and is therefore the most reliable estimator of firm risk. They find empirical support of their claim after having documented a strong relation between the spread and idiosyncratic risk. They also include various accounting variables, like interest coverage ratio, operating income to sales, long-term debt to assets and total debt to market capitalization, but are not able to attach much explanatory power to these variables once credit rating and equity volatility is accounted for in the regression.

The presentation of the option model assumes no costs associated with declaring a firm bankrupt. On the contrary, a real world bankruptcy carries large direct and indirect cost. One important determinant of such value destruction is the marketability of firm assets. A competitive advantage, such as a brand name, has limited value outside the firm and may be

lost in a bankruptcy. The lower marketability of intangible assets can make for a higher spread of firms having very little tangible assets (Brealey et al., 2006).

Some firm characteristics are not related to the option model, but can, nevertheless, have important relations to the spread. Asset turnover represents the ability of assets to generate sales, in other words the amount of sales generated by every kroner invested in the firm. Firms with a high asset turnover have a number of characteristics (Bodie et al., 2001). Firstly, asset turnover can be related to the competitive strategy utilized by a firm. A price leader will have high asset turnover by the means of high sales at a low margin, while a premium brand will have higher margins and lower asset turnover. Altman (1968) argues for a relation between management's ability to face competition and asset turnover and thus argues in favour of using high asset turnover as a predictor of default. An industry's capital intensity, i.e. the relative amount of capital required to generate sales, can also be conveyed by the asset turnover ratio. In sum, these arguments suggest a number of ways in which asset turnover can have an important relation to the spread.

Quarterly financial statements, required by the Oslo Stock Exchange, lead to enhanced timeliness and quality of information released to financial markets. Moreover, a strict set of rules govern insider trading and insider information ensuring all investors trade based on equal information (Oslo Børs/Oslo Stock Exchange, 2010). These rules can affect the spread by easeing enforcement of debt contracts (section 2.4), and by increased liquidity of traded debt (Alexander et al., 2000).

Ownership composition can also be related to the spread. The incentives of smaller shareholders to monitor management are limited by free-riding of other investors, because the individual owner covers the whole cost of monitoring, while receiving only a small share of the gains. In essence, the motivation to monitor is positively related to the individual investor's stake in the firm. However, as shareholders become too dominant they can utilize their dominance to expropriate other stakeholders, creditors included (Hart, 1995). This line of reasoning seems to coincide with a bell-shaped curve, confirmed by Steen and Pedersen (2000) in relation to performance. Anderson et al. (2004) argue that long-term owners, defined as owning a large share of the firm, will champion a longstanding perspective in the treatment of creditors, which may lead to not playing the games discussed in relation to the board of directors in part 2.4. However, this union is not supported by the empirical findings

of Bhorjraj and Sengupta (2003), who document a positive relation between the spread and the concentration of institutional ownership.

Profitability is used by rating agencies as an overall measure of financial health. Return on assets measures the average return earned on the firm's investments. In other words, the ability to put funds invested by creditors to profitable use within the firm, which makes this a highly relevant measure of profitability for creditors (Bodie et al., 2001).

This part has so far related a number of firm characteristics to the default risk of bonds. I now investigate the extent to which default risk can account for the size of the spread, in order to form an opinion of the theoretically largest share of the spread to be captured by firm characteristics. By regressing the corporate spread on variables that should explain changes in default risk and recovery rates over time, Collin-Dufresne et al. (2001) explain a mere 25 percent of changes in the spread. A high degree of cross-correlation, revealed by a closer look at the residuals, suggests a common underlying factor may be missing from their model.

The low explanatory power of default risk is supported by Elton et al. (2001), who find that expected loss from default explains a mere 17.8 percent and tax differences explain an additional 36.1 percent, leaving 46.17 percent of the spread unexplained for 10 year A-rated bonds. The expected default premium is calculated assuming a risk neutral world using observed default probabilities, recovery rates and coupons.

In an attempt to account for the 46 percent left unexplained, they argue that corporate bond spreads vary systematically with the same underlying factors as stocks. A risk premium in excess of expected default is thus required in order to induce investors to hold corporate bonds in a diversified portfolio. This systematic variation will only be captured by the risk premium if government bonds are insensitive to the very same systematic variations. These systematic variations can either be explained by changes in default rates varying with equity returns or some systematic underlying factor determining the compensation for risk in capital markets. Regressing the unexplained portion of the spread against the factors included in the Fama-French three factor model, explains 85 percent of the previously unexplained spread of industrial firms and reports significant relations of the market, size and value factors, which supports the hypothesis of systematic risk factors being priced in corporate bond markets.

Longstaff et al. (2005) describe how credit default swaps are an ideal method for measuring the size of the default premium by trading directly in the probability of default. Credit default swaps offer default protection in exchange for payment of a periodically fixed premium. In a default the protected investor receives par value of the debt in order to cover the loss on the underlying bond. They find that the default premium explains most of the corporate spread across all ratings, and the importance increases for lower rated issues, explaining 51 percent for AAA/AA-rated bonds, 56 percent for A-rated bonds and 71 percent of the spread for BBB-rated bonds.

These figures are much larger than the share attributed to default risk by Elton et al. (2001), but are not directly comparable as the default swap premium will incorporate any systematic risk premium of corporate bonds. The total share of default risk and systematic risk in Elton et al. (2001) accounts for about 57 percent of the spread, and is thus in line with the results by the use of credit default swaps. These results imply that a significant part of the spread is unexplained by default risk, and consequently the firm characteristics discussed in this section. The next section discusses how bond and bond market characteristics can account for parts of the share left unexplained by default risk.

2.2 Bond and bond market characteristics

Bond characteristics, together with firm characteristics, form the backbone of any attempt to estimate a regression model of the bond spread. In an effort to explain the unexplained share of the bond spread, Longstaff et al. (2005) regressed the residuals of their model against several proxies of liquidity and tax effects. In contrast to Elton et al. (2001), they found a weak relation to variables representing the tax burden of bonds. If trading in corporate bonds is less liquid than trading in government bonds, one would expect a liquidity premium to compensate investors for the difficulty of selling corporate bonds. Proxies for liquidity, like the bid ask spread and size of the issue, are found to be important for explaining the residual, which allowed them to conclude that investors are compensated for the cost of low liquidity. Chen et al. (2007) use the bid-ask spread, percentage of days with zero returns and a liquidity measure based on a paper by Lesmond et al. (1999) as proxies for the true liquidity, and find a positive and significant relationship to the bond spread, which increases in importance for

riskier bonds. In conclusion, the commonly used proxies of liquidity favour the view of liquidity being priced in corporate bond markets.

Bonds listen on an organized marketplace are to a large extent subject to the same rules as listed firms with regard to disclosure requirements and insider trading (Oslo Børs/Oslo Stock Exchange, 2008). Being listed can also be related to liquidity as it will be easier to find a trading partner in an organized market (Oslo Alternative Bond Market, 2010). Both factors benefit investors, which may result in a lower spread of listed bonds.

Another issue to consider is the life of the bond, often captured by inclusion of either maturity or duration (definition of duration in section 4.2). The option model points to a rising spread as maturity increases, but these findings are not always reproduced by articles investigating the yield across maturities of corporate bonds (yield curve). For investment grade debt, researchers find an upward sloping yield curve (Fons, 1994)(Sarig and Warga, 1989). Researchers rationalise their findings by explaining how benefits of further increases in credit quality are limited compared to the loss in case of a downgrading. An upward sloping yield curve is thus explained by the aggregate probability of a downgrading increasing with the term of a loan (Helwege and Turner, 1999).

Speculative grade debt has the possibility of increasing its standing with rating agencies, while the risk of further downgrading is limited. A downward sloping yield curve can emerge as the accumulated probability of an upgrading increase with maturity. Firms of lower risk may experience a hump-shaped curve if the short term is dominated by worsening prospects, while improvements prevail in the long-haul (Helwege and Turner, 1999). Empirical research on speculative grade debt has produced varying results. Fons (1994) and Sarig and Warga (1989) find a downward sloping yield curve. In contrast, Helwege and Turner (1999) document an upward sloping curve after isolating the effect of maturity by investigating bonds issued by the same firm on the same date, but with differing maturity. They argue that the studies which conclude with a negative or hump-shaped relationship have fallen prey to changing risk characteristics of issuers across maturities. Basically, safer firms issue long-term bonds, while more risky firms are forced to rely on medium-term bonds. A hump-shaped or strictly downward sloping curve emerges as firms of higher maturity are required to pay a lower default premium.

Two types of options are commonly included in bond contracts. Adding a call option entitles management to redeem the bond prematurely at a specified call price. The bond will be called when the coupon is higher than market rates, which allows the firm to refinance the bond at a lower coupon. Opposite, investors will incur a loss when they are forced to invest at the lower market interest rate. Having the bond called is thus unfavourable to investors who will require compensation in the form of a higher bond spread (Bodie, 2001).

The option to convert grants bondholders the right to exchange a bond into a predetermined amount of shares (conversion ratio). The profitability of exercising the option requires the stock price to increase relative to the conversion ratio. The option to convert enables creditors to take part in the value creation of the firm and accordingly lowers the required yield to maturity (Bodie, 2001).

2.3 The board of directors

A definition of the board of directors is a useful point of entry into a discussion of the relation of board characteristics to the bond spread. According to Fama and Jensen (1983), owners delegate the responsibility of internal control to the board of directors, who then assigns responsibility of the daily running of the firm to the management, but retains the power to hire, fire and compensate top-management and approve and monitor important decision within the firm. This hierarchy is essential to ensure separation of ownership and control. The directors' role is of an agent safeguarding the interest of the owners, and is illustrated by Cadbury (2002) who concludes that directors "owe their duty to their shareholders".

Carter and Lorsch (2004) present three distinct activities common to most board of directors. Firstly, a minimum requirement of any board is to monitor the performance of the firm and its management by keeping a close eye on important business units and the financial reporting process. Secondly, the board is the top-level decision maker in charge of strategic direction, acquisitions, CEO compensation and firing and hiring of top management. Lastly, boards can offer advice to top-management in relation to the daily running of the company. The nature of this role depends on the expertise of the different board members. In any case, top-management is not required to follow the board's advice, still top-management and the board frequently compromise on important business decisions. These distinctive activities require the board to balance their approach, as a CEO kept at a short leash may find it advantageous

play his cards close to his chest, knowing how information shared may be used to oversee his performance (Bøhren and Strøm, 2005).

2.4 Board of directors and corporate governance

A number of definitions of corporate governance exist in business literature. Shleifer and Vishny (1997) define corporate governance as "ways in which the supplier of finance to corporations assure themselves of getting a return on their investments", which focuses on all investors in a firm, thereby including bondholders. Others employ an even wider definition, defining corporate governance as a mechanism for making decisions not specified in an initial contract (Hart, 1995). Tirole (2001) utilises the stakeholder perspective when defining corporate governance as "the design of institutions that induce or force management to internalize the welfare of stakeholders". This definition goes beyond investors, including natural stakeholders like suppliers, employees, customers and communities.

All definitions cited above include creditors in corporate governance. Accordingly, a relation to the corporate bond spread is established as good corporate governance involves safeguarding the interests of bondholders. Board structure can affect the cost of debt by promoting good governance, and consequently reduce the adverse effect of the governance problems discussed below. The board is in charge of maintaining good corporate governance within the firm, illustrated by Cadbury (2002) who defines the board as being in centre of the firm's governance system. The remainder of this sub-section deals with three important governance problems, how they affect creditors and how the board can mitigate these problems.

The first governance problem involves an agency problem as owners cannot fully monitor management controlling the firm on their behalf. This structure allows management to diverge from profit maximization in order to consume expensive perks, reduce effort, lower risk taking, diversify or build a larger than necessary organization (Brealey et al., 2006). These actions all go with benefits to management, but may reduce profits to owners. A board is thus expected to intervene on the owners' behalf in order to reduce the risk of management diverging from profit maximization (Hart, 1995). Lowered profitability reduces the financial health of the firm and can thus by itself cause a loss to creditors (part 2.1). In contrast, lower

risk taking or growth through diversification (part 2.1) may benefit creditors. In sum, the aggregate effect of attuning management and owner incentives is difficult to ascertain.

Writing and monitoring of complicated covenants in order to protect creditor's claim against the firm are costly (Jensen and Meckling, 1976). A financial reporting process of high quality makes for a more hands off monitoring of the firm. However, if financial information cannot be trusted, creditors are forced to take on a more active and costly monitoring role to make sure the firm is in accordance with the lending agreement. An empirical example is offered by DeFond and Jiambalvo (1994), who find evidence of management manipulating the financial statements in order to conform with accounting covenants. Such malpractice allows firms to continue operating when liqudation would have been more profitable to creditors. In addition, the true risk of the firm is unobservable to lenders, and they will therefore incur a loss if the firm proves to be of higher risk than suggested in the information at issue (Lu et al., 2010).

The board of directors is responsible for the accuracy of the financial statement, and are also ultimately responsible for internal reporting and control (Carter and Lorsch, 2004). Easy access to timely and reliable information can affect spread as creditors, being fully aware of these expected costs, will require compensation through the interest rate (Jensen and Meckling, 1976). In summary, the performance of the board can affect the accuracy of information released to the financial market, which are of high importance to the creditors' ability to monitor the lending agreement.

The next governance problem involves the relationship between creditors and management and/or owners. Imagine management of a firm at the brink of bankruptcy having two projects. The first strikes a good balance between risk and reward, but the reward, if successful, is barely enough to cover the claim of creditors. The second project, if successful, covers not only the claim of creditors, but also leaves a handsome profit to the owners. The caveat is the low probability of success making this a negative net present value project. Any financially sound firm would discard the latter project in favour of the first. This is not necessarily the case with a distressed firm, where creditors reap most of the profit from the good project and at the same time covers the initial outlays in case of failure. In summary, choosing the risky project is profitable to the owners, while creditors incur a loss, causing a wealth transfer from creditors to owners (Brealey et al., 2006). More generally, the increased value of the limited liability put option of section 2.1 induces owners to raise firm risk, which reduces the total

value of creditors' claim against the firm (Jensen and Meckling, 1976). Delayed liquidation in case of default, increasing leverage, paying out large dividends and refusing to invest equity in distressed firms are other examples where value creating opportunities are forgone by owners.

Creditors are aware of these incentives, and will include comprehensive covenants and require compensation for the expected loss and monitoring costs through the bond spread (Brealey et al., 2006). Boards are hired to serve the owners, and may have incentives to rubber stamp all proposals with a benefit to owners. Opposite, the directors may take a long term perspective, as this agency cost will be taken into account by future lenders (Brealey et al., 2006). It is, based on these examples, difficult to conclude on the relationship of board structure and risk shifting to the corporate bond spread.

The remainder of this part discusses how board independence, diversity, experience and size can enable the board to mitigate the presented governance problems and improve their performance in relation to their director duties.

2.5 Board Independence

Carter and Lorsch (2004) and Fama and Jensen (1983) argue how a predominantly independent board is essential to achieve proper separation of ownership and control. Drawing a line back to the three main tasks of any board (Dalton et al., 1998), a board dependent on top management will not be able to properly monitor performance and the financial reporting process, which may lower the profitability of the firm and increase the cost of enforcing compliance with debt contracts. Moreover, it is clear that a board, which merely ratify proposals from top management does not fulfil their role as top-level decision maker, and it is unlikely that an insider dominated board will be able to offer independent advice to top-management.

The role of outside and inside directors is discussed in "Separation of ownership and control" by Fama and Jensen (1983). Insider directors have access to information about the performance of different business units and the inner workings of the organization that, if shared, can increase the quality of monitoring and decisions made by the board. Furthermore, Hermalin and Weisbach (1988) find an increased number of inside directors when a CEO

change is imminent. This is a result of the need to screen and expose potential candidates to top level decision making. Outside directors are essential as negotiators in conflicts between management and as impartial decision makers in matters burdened with owner-management agency problems. Cadbury (2002) is of the opinion that outside directors add vitality to the board and are needed for their "critical objectivity". In accordance with this, Carter and Lorsch (2004) suggest balancing an independent board against the knowledge held by company and industry insiders. The optimal balance between knowledge and independence is to a large extent determined by firm and industry characteristics, which implies that a distinct equilibrium exists for every firm.

Beasly (1996) finds support for a relation between share of outside board members and accounting fraud, Klein (2002) identifies a similar association to abnormal accruals and Ajinkya et al. (2005) observe a relation between outside directors and the frequency of management's performance forecasts, which together suggest that board of director independence is an important determinant of financial reporting quality and possibly related to the cost of debt.

Bøhren and Strøm (2005) find no relationship of director independence to market value of Norwegian firms and explain their findings by positing a negative relationship between board monitoring and the CEO's willingness to share information. Intense monitoring of management will lead to management entrenchment as information shared will be utilized by the board to monitor management. They conclude that the costs and benefits of independence are optimally aligned for Norwegian boards, which may explain the absence of a relation to the spread.

Bøhren and Strøm (2005) measure independence as the difference between average director and CEO tenure. A positive value implies that the average director was hired before the current CEO, entailing that these directors will be more independent of the current CEO. The literature investigating the effectiveness of boards usually examines each director to determine their relationship to the firm. An example is provided by Anderson et al. (2004), who define directors employed or retired and directors in an immediate family relation as insiders, while directors with an existing or potential future business relation to the firm are branded as affiliated directors. Classifying directors using detailed qualitative data can make for a more accurate classification. Still, the researcher will encounter missing information and

borderline cases, which require a good sense of judgement in order to reach correct conclusions. Whether a director will have a future relation to the firm, other than the directorship, is entirely subjective and contrasts to the mechanical nature of the measure employed by Bøhren and Strøm (2005).

Hermalin and Weisback's (1998) relation of CEO tenure to nomination of dependent directors

The intuition underlying their measure of independence is based on a model by Hermalin and Weisback (1998). This model advocates a relation between the current CEO's track-record and the ability to nominate dependent directors to the board. The CEO's bargaining power will increase after reporting high performance over time, which enables nomination of directors who are more dependent on the CEO. The model relates time of service to performance by modelling a board that fires CEOs after a period of poor performance assuming that the board is able to find a better candidate. As a consequence, relative tenure of the board and the CEO is related to independence through the CEO's bargaining position (figure above).

More generally, Dalton et al. (1998) explain how a relation between the relative tenure independence measure and board monitoring materializes as directors will feel obligated towards the CEO who hired them in the first place. Factors affecting board monitoring of the financial reporting process is, as argued in section 2.4, the most probable cause of a relation between board structure and the cost of deb. In sum, these arguments present a strong case in favour of tenure independence being a more suitable measure in relation to creditors. Furthermore, Hermalin and Weisback (1998) explain how attempts to enforce a certain ratio of outside directors are bypassed by nominating directors who would easily be controlled by management. This argument short-circuits the logic of classifying directors with no ties to the firm as independent. Together these arguments point to a mechanical measure comparing board and CEO tenure for having beneficial attributes as a measure of independence compared to traditional criterions often employed in the literature.

The importance of director independence is established by Anderson et al. (2004), who find a negative relationship to the corporate bond spread, and Bhojraj and Sengupta (2003), who relate the ratio of non-officers negatively to the bond spread. The relation to financial reporting suggests that this relation may be caused by enhanced quality of the financial reporting process, which again relates to the second governance problem in 2.4.

The CEO who serves a dual role as a board member rises comparable issues. Norwegian CEOs are prohibited by law to serve as chairmen, nevertheless, the CEO can still serve as a regular board member (Bøhren and Strøm, 2005). This is different from most American studies, which often investigates the effects of a CEO when serving as the chairman of the board in addition to his executive duties. Carter and Lorsch (2004) claim that truly independent boards are only accomplished by prohibiting the CEO from serving as a director. Still, this independence comes at the cost of not having direct access to the experience and inside knowledge of the CEO.

2.6 Board experience

The tie between experience and productivity in any occupation, including directors, need no further introduction (Avolio, 1990). However, finding suitable proxies for experience is difficult. I argue that average tenure, average age and average number of board positions of the directors have a relation to the experience of the board and the spread. Tenure is a two edged sword in relation to the corporate bond spread. On the one hand, tenure may proxy for experience. As time of service increases, directors will learn more about the workings of the firm, their duties as directors and they may improve their stance in negotiations and their ability to persuade top-management, which may lead to a lower corporate spread as average tenure increases. Anderson et al. (2004) use tenure as a proxy for experience and the ability to persuade management, but find, to the contrary of their expectations a positive relation to the cost of debt. Beasly (1996) argues in favour of experienced outside directors being more able to prevent accounting fraud through monitoring, after having found a relation between outside director tenure and the likelihood of financial statement fraud.

Opposite, Carter and Lorsch (2004), point out how directors may become more emotionally attached to the firm and top-management as time of service increases and how boards of high

tenure can grow less effective by getting bogged down in the old ways of doing things. The presented arguments can explain the larger corporate bond spread observed by Anderson et al. (2004), and suggest changes are necessary from time to time. Moreover, Golden and Zajac (2001) demonstrate a hump-shaped relation of tenure to strategic change, after suggesting an initially positive relation as younger boards will have "a less rich information base" of which to base their decisions, while longer serving boards will be less inclined to change the established philosophy.

While tenure is used as a proxy of the relationship between the corporate bond spread and firm specific experiences, average age can proxy for the overall experience of a director. Age is correlated with the number of years spent working, which may cause a relation between age and overall knowledge and business experience of directors (Anderson et al., 2004). Similarly, Golden and Zajac (2001) explain how the strong leadership skills required by complex organizations are developed with age. In spite of this, Carter and Lorsch (2004) argue that many directors of high age will experience business knowledge becoming dated and network of contacts becoming smaller, which can result in a negative relation to board efficiency.

Average number of directorships held by the board members is a different measure of experience, relying on characteristics of the typical director having numerous directorships. Several arguments support the notion of number of directorships being a proxy for experience. Similarly to the arguments presented for tenure, different directorships may improve one's knowledge about the industry and duties as a director. In other words, it is not only the time spent on a particular board, but also the total time spent serving as a board member. Secondly, many positions can be a consequence of directors having important qualities and experiences, which are advocated by Fama and Jensen (1983), who propose serving on multiple boards can be a result of superior performance on past directorships. Outside directors' reputation and thus attractiveness in the market for directors depends on their performance as board members. Therefore, good directors, who should have a positive impact on the firm, are characterized by many directorships as a consequence of their high esteem.

Unrelated to experience, the number of directorships may also proxy for the size of the director's network. According to Bøhren and Strøm (2005), a director's network functions as

a source of direct and indirect information from other organizations, and thus enables him to make better decisions and offer superior advice to management.

Ferris et al. (2003) examined the opposite relation, by arguing in favour of such directors being overcommitted, which may reduce their effort and lower their monitoring quality. However, no evidence was found after regressing number of positions against performance and examining abnormal stock returns after appointing a director with many directorships. On the contrary, they found evidence of the alleged overcommitted directors being more likely to serve on board committees. Such thorough testing, together with the finding of a positive relation to performance by Bøhren and Strøm (2005), contradicts the overcommitted hypothesis.

This section has established a relation of director tenure, age and number of positions to board experience. Nevertheless, it is important to keep in mind how the relation of these variables may be very different in the sample, evident by the alternative hypotheses relating these variables, both positively and negatively, to the spread.

2.7 Board diversity

Board diversity is argued by Cadbury (2002) to be an important quality of an effective board, and he accordingly argues in favour of balancing the different attributes and experiences of directors appointed to corporate boards. Bøhren and Strøm (2007) interpret gender mix, number of board members, employee directors and age dispersion as being important for board diversity, and argue in favour of a relation between diversity and the board's capability as a decision maker. In practise, however, they find an inconclusive relation of age dispersion and a negative relation of the remaining diversity proxies.

A number of variables can indicate the level of diversity within a board. Age variation signifies directors who are in different stages of their careers or have a different life experience which may cause distinct values and beliefs (Ireland et al. 1987). Carter and Lorsch (2004) stress the importance of asking long-serving directors to retire in order to make room for new members, by explaining how young directors are more in touch with current and developing consumer trends as well as having fresh ideas and perspectives important to the firm. The difference in seniority of board members can therefore indicate firms replacing

board members bringing in new blood to the board. Variation between board members can be captured by the use of standard deviation of age and tenure (Bøhren and Strøm, 2005).

According to Campbell and Minguez-Vera (2008), gender diversity allows boards to examine a wider set of alternatives in order to solve difficult problems, which may lead to higher performance by expanding the perspective of the board (Bøhren and Strøm, 2007). In addition, boards mirroring the customers and employees enhance understanding of the market place (Campbell and Minguez-Vera, 2008). The Norwegian Parliament enacted a law in 2005 enforcing 40 percent share of female directors on boards of public companies. At the same time, the publicly listed firms of my sample had 13 percent female directors. If there is a limited pool of qualified candidates, as is argued by Carter and Lorsch (2004), limiting this pool further by enforcing a certain gender mix can have an adverse effect on the effectiveness of the board. This argument is strengthened further as a great many firms tapped the limited pool to raise their share of female directors after the law was enforced. To the contrary, an enforced ratio of female directors may also increase the pool of candidates considered for a directorship (Campbell and Minguez-Vera, 2008).

Using panel-data techniques on a director dataset from Spain, Campbell and Minguez-Vera (2008) find that a higher ratio of female board members increases the value of the firm higher. In contrast, Bøhren and Strøm (2007) identify a negative relationship to firm performance of Norwegian firms. Such differing results are common in the empirical literature analysing gender diversity, and explain the lack of consensus among researchers.

In sum, I expected a negative relation to the diversity of tenure and age, while the presented arguments in relation to gender composition are more conflicting. No articles have to my knowledge investigated the relation of board diversity to the cost of debt, which makes it interesting to note the relevance of gender equality to the bond spread.

2.8 Board size

Various conflicting hypotheses have been raised regarding the relationship between board size and board monitoring. Cadbury (2002) argues in favour of a board sufficiently large to bring in a wide variety of knowledge and experience, while still being small enough to allow “true

discussion and debate between members". Jensen (1993) explains how reprisals by CEOs of firms with larger boards may cause individual directors to be less likely to speak freely and naturally lead to boards more easily controlled by management

Group dynamics from organizational behaviour research raises the possibility of a hump-shaped relationship to board performance. Initially, adding a member increases work capacity and the ability to gather information. Larger groups, however, suffer from free-riding of individual members and less effective communication and interaction, accordingly lowering the incremental effect of appointing an additional director to the board. The organizational behaviour literature suggests every group has an optimal size depending on the objectives at hand. A decision making unit, for instance a board, will typically reach its optimal size at a lower head-count, than a group whose goal is pure information gathering (Busch and Vanebo, 2003).

This is supported by Golden and Zajac (2001), who found evidence of a hump-shaped relation of board size to strategic changes of American hospitals. In his study of accounting fraud, Beasly (1996) also analysed the effect of board size finding a positive relationship to the likelihood of accounting fraud, which supports the view that board size can affect the cost of debt through the quality of financial reporting. A number of papers investigate the relationship between market value and board size. Yermack (1996) finds a negative relationship to Tobin's Q (market value to book value of assets). He relates his result to the execution of several board duties by finding evidence of smaller boards being more likely to fire the CEO after a period of poor performance and implementing performance related compensation packages. His results relate board size to the board's ability to monitor management and thus establish a potential relation to the corporate bond spread. While Yermack studied large Fortune 500 companies, Eisenberg et al. (1998) confirmed the negative relationship on small and medium sized Finnish firms. This negative dependency is also confirmed by Bøhren and Strøm (2005) in their study of Norwegian firms.

Regarding the corporate spread, Anderson et al. (2004) identify a negative relationship of board size to the spread, and interpret this as a link between board size and the quality of the financial reporting process. In conclusion, the results in relation to the spread seem to suggest a negative relation to board size. While both the performance literature and a study of

accounting fraud, which is argued to be highly relevant for the cost of debt, suggests an adverse effect of increased board size.

3. The Norwegian bond market

It is beneficial to start off with a general description of the Norwegian bond market to get a picture of the size as well as sector composition of issuers and investors over time. All bonds and certificates issued in the Norwegian market have been included in the discussion, in order to account for changing characteristics of all sectors and return types in the Norwegian market.

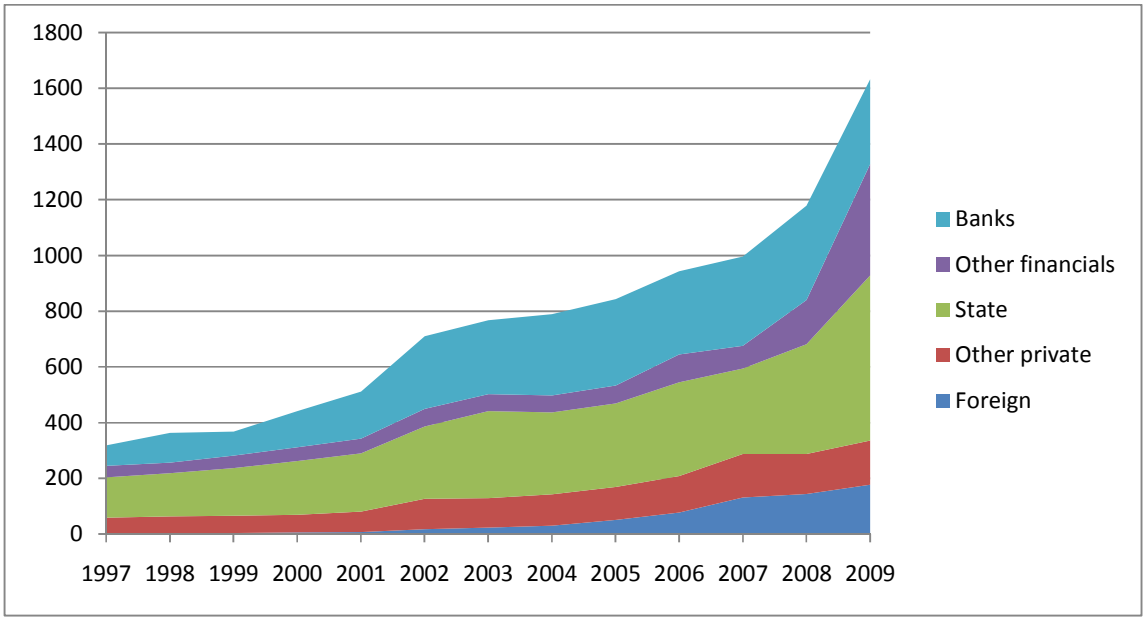


Figure 2: End year par value of outstanding Norwegian bonds and certificates in billion 2009 kroner. Source: Stamdata

Figure 2 highlights the almost fourfold increase in volume outstanding during the last ten years. Even so, the Norwegian bond market is small compared to comparable countries. A comparison to Sweden is illustrative as the Swedish bond market is more than twice the size of the Norwegian market, evident by the par value of outstanding bonds and certificates in December 2009 of 3884 billion NOK.

Furthermore, the figure illustrates how different sectors' share changes over time. It is interesting to note the dominance of state, banks and other financials in the primary bond

market, accounting for 25, 20 and 31 percent of the total par value of outstanding at the end of 2009. In 2002 these figures were 37, 37 and 9 percent respectively, illustrating the large increase in bond market activity by financials. Investigated further, the increase can primarily be attributed to the popularity of mortgage companies after the new covered bond regulation was introduced in 2007. The new regulation allowed banks to remove mortgages from their balance sheets, and establish covered bond companies to finance these mortgages in the bond market using the very same bonds as security (Norwegian government, 2007).

The smaller share issued by the state is a clear sign of the increased scope of firms using the bond market to satisfy their financial needs. The increased attractiveness of the Norwegian bond market is also evident by noting the increased volumes by foreign organizations. The sector labelled "other private" includes industries such as oil and gas, manufacturing, fishery and shipping, and has remained relatively stable in the period from 2001 to 2010 compared to other sectors, increasing from 53 to 159 billion in nominal amounts and decreasing from 14 to 10 percent measured as share of total par value of bonds outstanding.

The term structure reveals a small number of long-term bonds, which exposes investors having long term liabilities to a maturity mismatch between assets and liabilities (International Monetary Fund, 2005). This also makes calculation of a duration equivalent synthetic government bond in part 4.2 impossible at high maturities, which causes a measurement error to the bond spread if the yield curve is positively or negatively sloped at long maturities. The International Monetary Fund thus recommends issuance of long-term government bonds in order to create a liquid market for safe long-term investments.

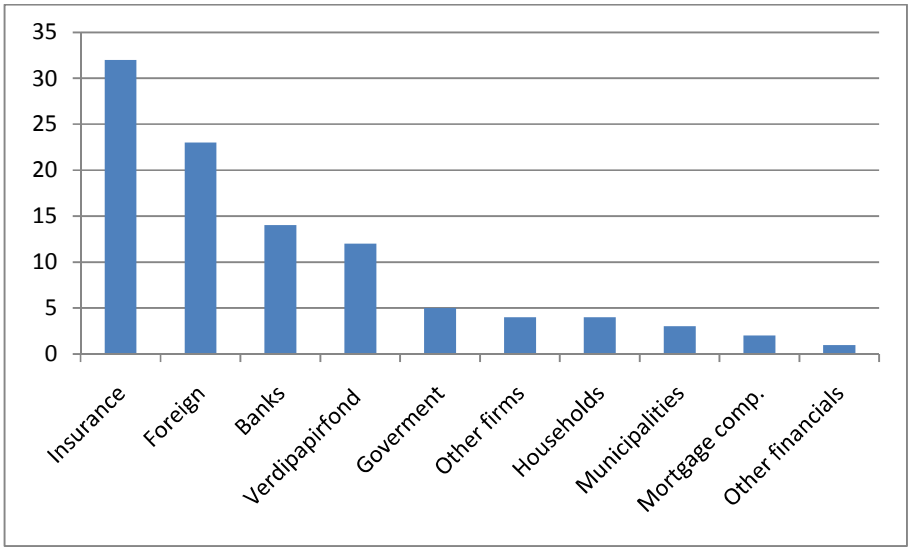


Figure 3: Share of bonds owned based on market value Source: Finance Norway (2007)

The Norwegian corporate bond market is dominated by large institutional investors who hold the bonds until maturity. Examples include insurance companies and pension funds holding 32 and 14 percent of the outstanding bonds, respectively, in 2007. Insurance companies invest in bonds because they have long-term liabilities more easily matched by investing in long-term bonds (Finance Norway, 2007). Banks primarily invest in bonds to satisfy their liquidity needs by using the safer spectre of bonds as collateral in transactions with the central bank (Finance Norway, 2007). Moreover, a sizeable 23 percent of bonds are held by foreign investors.

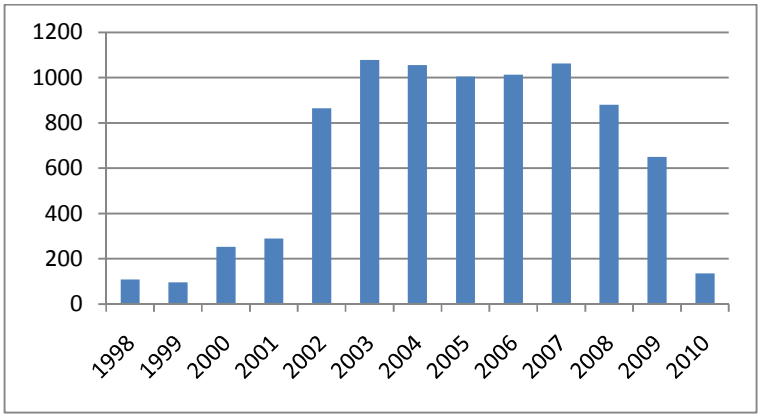


Figure 4: Number of corporate bonds issued in the Norwegian market across time

According to figure 4 the number of bonds issued per year was relatively low prior to 2002. In 2002, the number of bonds increased abruptly and stabilized at about 1000 new bonds issued per year in the following 5 years. The increase in 2002 was mainly due to a sharp increase in fixed coupon bonds, while floating rate notes remained relatively stable. The financial crisis in 2008 and 2009 led to a sharp decline, which crippled this relatively stable pattern. A continuation of this downward trend could result in about 530 new issues in 2010, which is substantially lower than in 2009, and would as such prolong the negative trend. The figure indicates how a relatively small share of bonds included in my sample was issued prior to 2002, while a relatively large portion was issued between 2003 and 2007.

The Norwegian government has a net financial surplus and is for this reason a net investor in the financial markets. Nevertheless, government bonds are issued every second year to maintain a risk free reference rate in the Norwegian financial market (The Norwegian Central Bank, 2004). A reference rate is important to enable market participants to gauge the risk premium offered on corporate bonds. This is commonly expected to enhance the efficiency of financial markets. Nevertheless, borrowings of the Norwegian government are small measured relative to other countries (The Norwegian Central Bank, 2004). The low liquidity and volumes outstanding may cause the balance of demand and supply to affect the yield in a way that is unrelated to the level of risk free lending in the economy (Rakkestad and Hein, 2004), and can thus lower the suitability of using the yield of Norwegian government bonds as a risk free reference rate for corporate bonds. A measurement error in a dependent variable has to be correlated with the independent variables to cause undesired results in an OLS-regression model (Wooldridge, 2009). It is difficult to argue in favour of systematic

correlation between the error and the independent variables, which makes it highly unlikely that this problem, if it exists at all, affects the estimated relationships in section 7.

The use of Norwegian government bonds as a reference rate has two advantages relative to American bonds used in most studies of corporate bonds. First, the American dollar is a global reserve currency, which may affect the yield of US government bonds as central banks around the world hold large amounts of dollar (Reisen, 2009). One illustrative example is the large holdings of American government bonds by the People's Republic of China (Helmut, 2009). Second, the spread of American bond markets includes a tax wedge as government bonds are tax exempt at the federal level, while corporate bonds are taxable at all levels (Elton et al., 2001). In comparison, the tax effect is removed from the Norwegian corporate bond spread as all Norwegian bonds are taxed at the same rate.

4. Data collection

4.1 Sample size

Norwegian trustee (Stamdata) maintains a comprehensive database from which all data on bonds, such as date of issue, maturity, return type, issue size and whether the bond is listed on an organized market, is collected. Stamdata contained 13463 bonds at the beginning of 2010, and table 2 describes how the sample ended up at 1341 viable bonds.

Table 2		Removed	Sample size
	Bonds in Stamdata		13463
-	Before 1998	977	12486
-	Government related	4048	8438
-	Savings banks	4253	4185
-	Foreign firms	851	3334
-	"Exotic" return types	432	2902
-	Maturity < 0.5 years	1164	1738
-	Missing coupon	71	1667
-	Various issues with data	73	1594
-	Mortgage companies	253	1341
=	Total bonds in sample		1341

According to the table, bonds issued prior to 1998 and bonds issued by foreign enterprises are removed as the corresponding firm and board data proved difficult to collect. Bonds issued or guaranteed by the government are risk free. These bonds are removed from the sample due to the irrelevance of estimating a risk premium.

As shown, the initial sample included 4218 bonds issued by savings banks, which would have dominated the sample of bonds if included. Furthermore savings banks are either independent institutions or issuers of primary capital certificates, which limit the influence of investors and give them a very different organizational structure compared to other firms included in the sample (The Norwegian Savings Banks Association, 2010).

Mortgage companies and covered bond companies issue bonds to finance portfolios of household and commercial mortgages. Many of these firms are shell companies growing assets by approximately 1000 percent annually from 2006 to 2008, as banks have been eager to transfer mortgages off their balance sheets. These large changes cause extreme values that may adversely affect the estimated coefficients of the regression models (Wooldridge, 2009). Further concern is caused by how default risk may be solely determined by the riskiness of the underlying mortgages, which leaves no place to the firm variables employed by my

models (Campbell and Taklser, 2003). I thus remove mortgage companies from the regressions in order to improve the estimated relations to important characteristics of the firm.

Other bonds, labelled exotic return types in table 2, have special features making calculation of the spread difficult. To be specific, the return of linked notes is tied to equity returns which make calculation of the spread unachievable at issue, and information about the discount at issue of zero coupon bonds is unavailable through the data sources at my disposal.

Intuitively, the probability of default in the case of very short-term bonds is low (Bodie et al., 2001) and may reduce these bonds' sensitivity to any factors used to explain the cost of debt. A large share of the bonds is considered to be within in this category, and would, if included, have a large say in determining the estimated relations. Motivated by this, bonds with maturity of less than 6 months are removed from the sample. Finally, after removing all deadwood, the sample contains 1341 floating and fixed rate bonds with a maturity of more than or equal to 6 months.

4.2 Calculation of the spread

It is useful to start out with a description of duration and yield to maturity, which are important concepts to investors in debt instruments and play a crucial part in determining the spread.

$$P_0 = \sum_{t=1}^{T} \frac{C_t}{(1+y)^t} + \frac{D}{(1+y)^T}$$

The yield to maturity, often abbreviated to yield, is the return earned by investors if the bond is bought today and held until maturity. Technically, the calculation involves finding the discount rate equalizing future cash flows received to the current price paid for the bond, which is the result of solving for y in the above equation. The probability of bankruptcy will be incorporated into the yield to compensate the investors for the risk of default (Bodie et al. 2001).

Yield to maturity assumes the bond is held until maturity. Bonds with a call option attached can be redeemed prematurely, which may invalidate the yield to maturity as a measure of the

return over the bond's life. Yield to call is an alternate measure taking into account the possibility of early redemption by replacing the life of the bond with the time to the first call date. The yield to call is a more suitable measure if low market interest rates make early redemption profitable to the firm (Bodie et al. 2001).

$$D = \sum_{t=1}^{T} t * \frac{\frac{CF_t}{(i+y)^t}}{P_0}$$

Duration measures the effective maturity of a bond by taking coupon payments into account (Bodie et al. 2001), and is calculated as the weighted average time to each bond payment. According to the formula above, the weights are determined by the ratio of discounted cash flows at time t relative to the price of the bond today. Expected duration is lower for callable bonds as they risk being redeemed prior to the due date.

Modified duration is measured as the above duration discounted by the yield to maturity of the underlying bond, and measures the approximate change in the bond price in relation to a one percentage point change to the market interest rates. A bond with a larger modified duration will for this reason respond more negatively to changes in interest rates (Bodie et al. 2001).

Duration is determined by several factors (Bodie et al. 2001). A lengthened maturity will naturally increase duration as repayment is more distant in time, while a higher coupon rate will lower duration because of a reduced average maturity of the cash flows, and thus reduce duration. Lastly, duration is negatively related to the current yield to maturity.

My sample consists of two return types. For floating rate notes, interest is calculated based on the sum of a market interest rate and a spread. Since the interest rate will move according to market rates, these instruments are free of any risk of market rates changing relative to the coupon rate. Fixed rate bonds pay a fixed coupon, exposing investors to interest rate risk, as market rates change relative to the promised coupons. The different exposures to interest rate changes will not in theory affect the spread, because fixed rate notes are matched to a duration equivalent bond meaning they will have the same exposure to interest rate changes (assuming equal convexity). Investors in both types of bonds will experience a loss (gain) as default risk increases (decreases) (Bodie et al. 2001).

The spread on fixed and floating rate notes are calculated using different methods. The former is estimated by subtracting the yield on a synthetic duration equivalent government bond, calculated using linear interpolation of the yield curve, from the corporate bond coupon. Using linear interpolation assumes the yield curve is linear between the two closest matching bonds. The government bond yield is calculated as the average yield during the 30 days prior to the bond issue. The use of the coupon rate in place of the yield to maturity is justifiable as no bonds in a comprehensive spot check were found to be issued at a discount from par value.

The spread on floating rate notes relative to the Norwegian Inter Bank Offered Rate (NIBOR), which is a money market interest rate for lending among Norwegian banks (The Norwegian Central Bank, 2010), is available directly from Stamdata. The Stamdata spread measures the risk premium in excess of risky interbank lending (Hull, 2009), which would make direct comparison of floating and fixed coupon bonds impossible. The Stamdata spread was made compatible with the fixed coupon spread by adding to it the difference between NIBOR and Norwegian treasury bills. Ideally, I would have preferred to measure the floating rate note spread relative to an equal floating rate government bond. However, this is a purely hypothetical issue as no such bonds are issued by the Norwegian government.

Yield to call is often the most relevant measure of the yield on callable bonds. Disregarding yield to call can cause a measurement error of the spread on callable bonds. However, this measurement error is reduced as call options are commonly out of the money at issue (Bodie, 2001). Still, it is useful to keep in mind that any systematic measurement error will be captured by any callable bond dummy variable included.

The yield to maturity and modified duration of government bonds and treasury bills are collected from Datastream and the Norwegian central bank, respectively. The spread of bonds denominated in foreign currencies are calculated against the yield on government bonds issued by the respective countries. For the sake of simplicity, I matched bonds issued in Swedish krona and USD by maturity, while bonds denominated in Euro are duration matched to German bonds. The yield to maturity of these bonds is collected from the web-pages of the respective central banks.

Extracting the yield to maturity from secondary bond markets is the predominant method of analysing the corporate bond spread. Sadly, the number of observations through time are

limited by the average bond being traded a low 10 times a year (Oslo Stock Exchange, 2009). This figure is sure to overstate actual liquidity as trades are not evenly spread across either bonds or time. Secondly, a lion's share of bonds is not listed causing a 60 percent reduction to the number of viable bonds. The sample being cut in more than half will severely reduce the power of the hypothesis tests (Wooldridge, 2009). One can, moreover, argue that the yield at issue is the cost at which the company raised the debt to begin with, and therefore better measures the cost of debt (Gabbi and Sironi, 2002).

Still, the use of primary market spreads introduces problems of its own. As presented above, estimates of how the spread relates to firm characteristics over time for the same bond are made impossible. Further problems, discussed in part 6, are caused by estimating a model using cross-sectional variation among bonds. Moreover, the primary market spread will also absorb any under- or miss-pricing of bonds at issue. However, Datta et al. (1997) find that next day abnormal return of straight bond IPOs are positive, but insignificant and conclude that underpricing in corporate debt markets is weaker than what is observed in equity IPOs.

4.3 Firm characteristics

This sub-section presents the way which the characteristics of a firm discussed in section 2.1 are measured, collected and matched to the bonds, in order to attain a better understanding of the nature of the variables included in the estimated regression models. A comprehensive list of all variables and how they are measured is included in table A4.

Annual financial accounting data is collected from RavnInfo, and is matched to bonds based on year of issue. Financial statements are usually released some time into the next year, which means investors would not have had access to the actual financial statement at the time of issue. This problem, however, is minor as information about the state of the firm would have been partially available through other sources. The financial statements of 2009 and 2010 are not available, and many bonds issued in this period are accordingly matched to the financial statement of 2008. Variables measured in kroner are reported in December 2009 kroner.

The magnitude of change over time of variables based on the financial statement causes a number of problems. When variables, such as sales or total assets, grow by a factor of 1000

annually, past accounting data is made irrelevant within a year. Extreme values are also common among the accounting based variables, as a negative return on assets of -3 or a positive return on assets of 1 can attest to. Overall, the effect of extreme values is uncertain, as they can have a very large impact on the estimated coefficients, but may also enhance my ability to estimate significant results through increased variation of the independent variables (Wooldridge, 2009).

$$ROA = \frac{Net\ income}{Total\ Assets}$$

Return on assets was chosen as the preferable measure of firm profitability, because of the lower degree of extreme values in my sample and by being a highly relevant measure of profitable for investors (section 2.1). The numerator is defined as net income before minority interests and extraordinary items, and the denominator as total assets at year end. The calculations of the other financial ratios, presented below, are self-explanatory.

$$Intangible\ ratio = \frac{Intangible\ asset}{Total\ fixed\ assets}$$

$$Asset\ turnover = \frac{Total\ Sales}{Total\ assets}$$

$$Leverage\ ratio = \frac{LT\ debt\ outgoing\ balance + LT\ debt\ incoming\ balance}{Total\ assets\ outgoing\ balance + Total\ asset\ incoming\ balance}$$

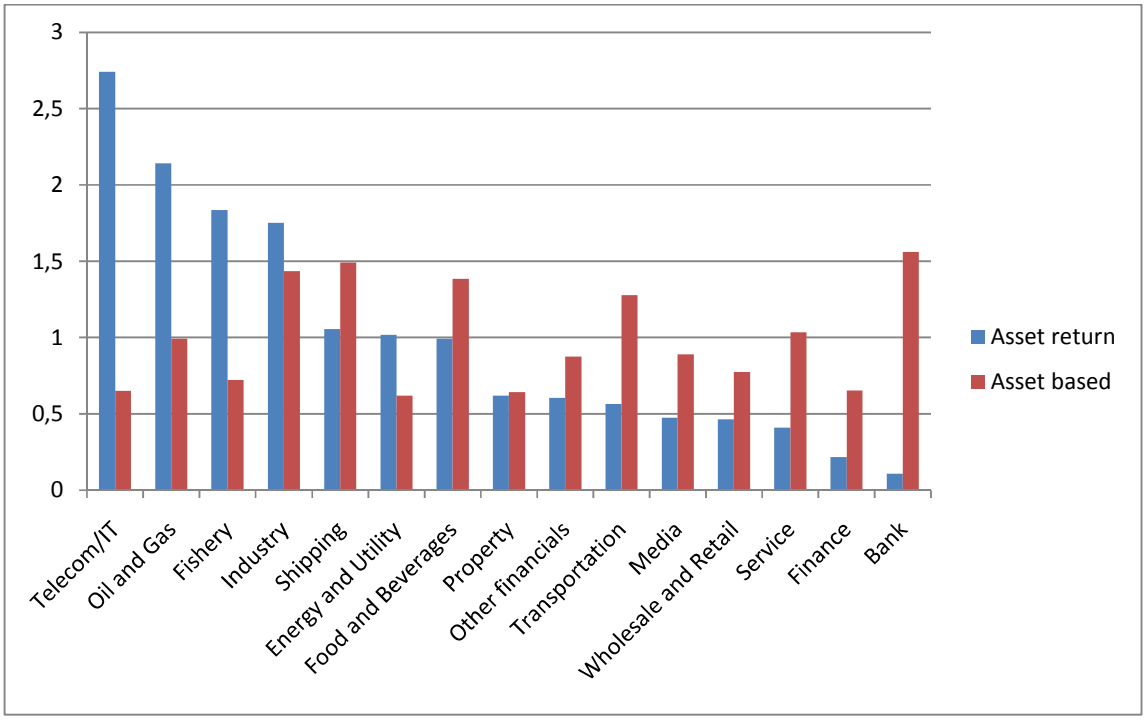


Figure 5: Volatility of the individual industries measured relative to average sample volatility

According to Campbell and Taksler (2003), equity volatility is the preferable measure of risk. However, I am forced to rely on accounting based measure of risk because the removal of bonds issued by private firms would cut my sample in more than half, which would hamper with my ability to estimate significant relations to other variables (Wooldridge, 2009), thus forcing me to rely on accounting based measures of risk. Figure 5 plots how asset based volatility would rank banks as the most risky industry. My sample banks have experienced high growth in assets, and derived from this a high standard deviation of total assets unrelated to firm risk. Asset return volatility leads to a more reasonable distribution of risk among firms, and is consequently the preferred measure of risk in my sample. Return on assets varies substantially from period to period, which suggests using all available financial statements to estimate a more stable measure of risk.

One challenge is the difference between group and parent company accounts brought about by the fact that group accounts are unavailable prior to 2004. The integration of subsidiaries into group accounts causes total asset to be larger than what is reported in the parent company accounts (Kvaal and Johnsen, 1999). A shift from parent company to group accounts over time may make it seem like the firm experienced very high growth, despite being artificially

caused by including the assets of subsidiaries. Even though I would like to utilize the additional information provided by subsidiaries, consistency over time requires me to use total assets of the parent companies accounts. This is not the case for ratios, as both the nominator and denominator will increase as subsidiaries are included. Ratios, such as return on asset, asset return volatility and asset turnover, are accordingly calculated based on group accounts whenever available, in order to get an overall picture of the state of all firms controlled by the issuer.

My ownership data comes from Proff.no, which has the most comprehensive source of current ownership data on Norwegian firms. Under the assumption of current ownership patterns being representative of the past, I generated a variable representing the share held by block holders, who are owners' holding more than 5 percent of the firm.

The division into different industries is based on the industry classification reported in the bond dataset from Stamdata. A number of industries, such as shipping, property and banking, include firms operating in relatively similar markets. Others are more heterogeneous, like the industry category, which includes firms ranging from shipyards to pharmaceuticals, or oil and gas, which includes extraction of oil, drilling companies and firms offering seismic services. An effort was made to create as homogenous industries as possible. To be specific, I reclassified several firms from the diverse service category to more appropriate industries, and included the two bonds issued by insurance companies in the financial sector.

I constructed a dummy variable representing the five industries having the highest level of risk, ranked by the asset return volatility of figure 5, for use in the descriptive analysis of section 5. The high risk industry dummy is 1 for firms in fishery, industry, oil and gas, shipping and telecom/it and 0 for the remaining industries. Many firms within these sectors are export based and therefore exposed to international competition and price fluctuations, while the low risk sectors contains many firms serving domestic markets.

4.4 Board structure

The discussion of the four board characteristics produced a number of proxies of the board structure. The collection of data and the choices made with regard to the estimation of these variables are all presented in the following paragraphs.

I collected information on name, date of taking office and type of position of the directors from the firm's public notices announcing changes to board composition, which are accessible from the Brønnøysund Register Centre dating back to 1999. Combining the data from the public notices with data on date of birth and other positions in official business life, available from RavnInfo and Proff.no, enabled me to generate variables representing the number of directors, share of female directors, average and the standard deviation of age and tenure of the directors and average number of directorships held by the members of the board. Alternate directors are excluded from these calculations as they are assumed to be of less importance to the structure of the board. For the sake of consistency, I follow Anderson et al. (2001) by using the natural logarithm of board size. For the about 100 bonds issued by firms having filed no public notice of board composition at the time of issue, I used the next available observation by assuming the board was the same at issue, but calculation of tenure was made impossible without information on the time of taking office.

Indentifying the correct director in the Proff.no database proved challenging, and there are bound to be errors where I found the wrong person. Both data sources are also limited to current positions, which force me to assume that a director's positions today are representative of the positions held in the past. The Proff.no database contains information on all current directors. Directors missing in the database are consequently recorded as having no current positions. Moreover, I was prevented from indentifying the correct person whenever the database returned many viable persons. These directors are missing data on age and positions in business life, and are thus removed from the calculation of average age and positions of the board.

Not having had access to information on directors who served prior to my bond sample causes all directors to start at zero tenure regardless of having served prior to 1999. The end result is

a measurement error that is more pronounced for bonds issued during the first half of the sample and materializes as a steady increase in tenure with time before stabilizing after 2004. Luckily, this problem is reduced by a lion's share of bonds being issued during this latter period.

$$Independence = \frac{1}{N}\sum_{i=1}^{N} DirectorTenure_i - CEO\ Tenure$$

I calculated two variables to represent the independence of a board. The first variable measures independence as director tenure relative to CEO tenure as shown in the formula above, and has been analysed in the theoretical discussion of independence. An alternative measure calculates the ratio of directors hired before the current CEO, where a larger ratio means a more independent board. I also computed a dummy variable representing whether or not the CEO serves as a director. The information about the CEOs required to compute these variables are available from the firm's public notice announcements. However, this piece of information is missing for about half of my sample, which causes the removal of these bonds from all models with the independence variables.

5. Descriptive statistics

I next review the spread in light of several important bond characteristics, such as time, maturity and return type, in order to offer a preliminary discussion of the structure and the expected relations of the regression model. At the end I present a descriptive analysis of the different explanatory variables and their correlations to other variables.

5.1 The distribution of bonds

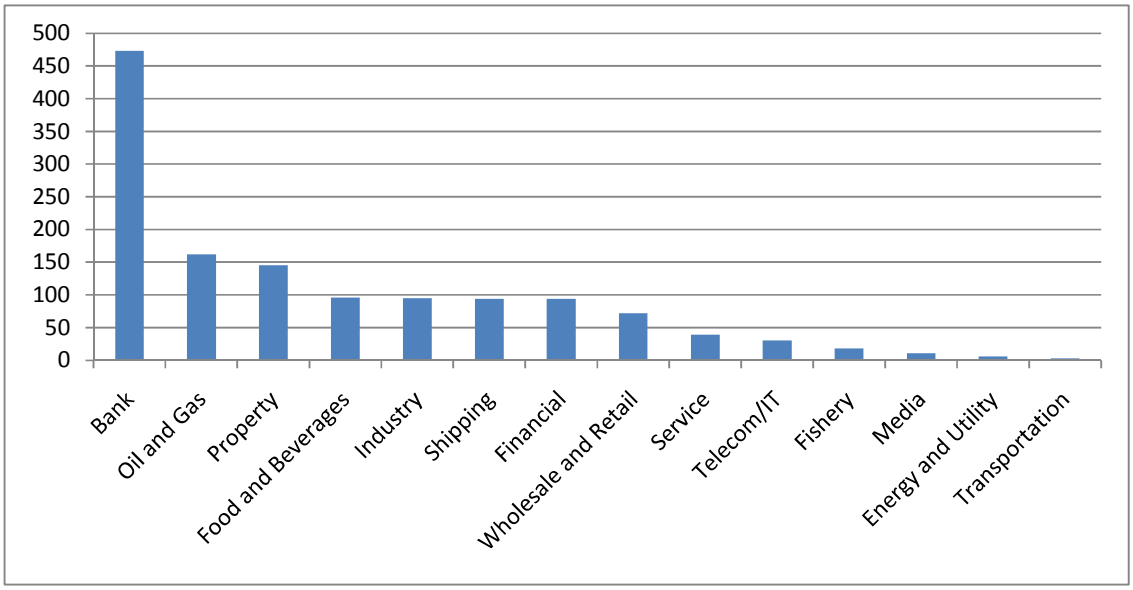


Figure 6: Number of bonds issued by industry in sample

Investigating the distribution across industries, my sample is dominated by banks and oil and gas, issuing about 35 and 12 percent of bonds, respectively. Industries dominating the sample can affect the estimated relations to the spread and distort my overall inference. The banking sector is an illustrative example, by having a median firm size of 29 billion compared to the sample median of 6.56, which can affect the estimated relation to firm size in the complete sample.

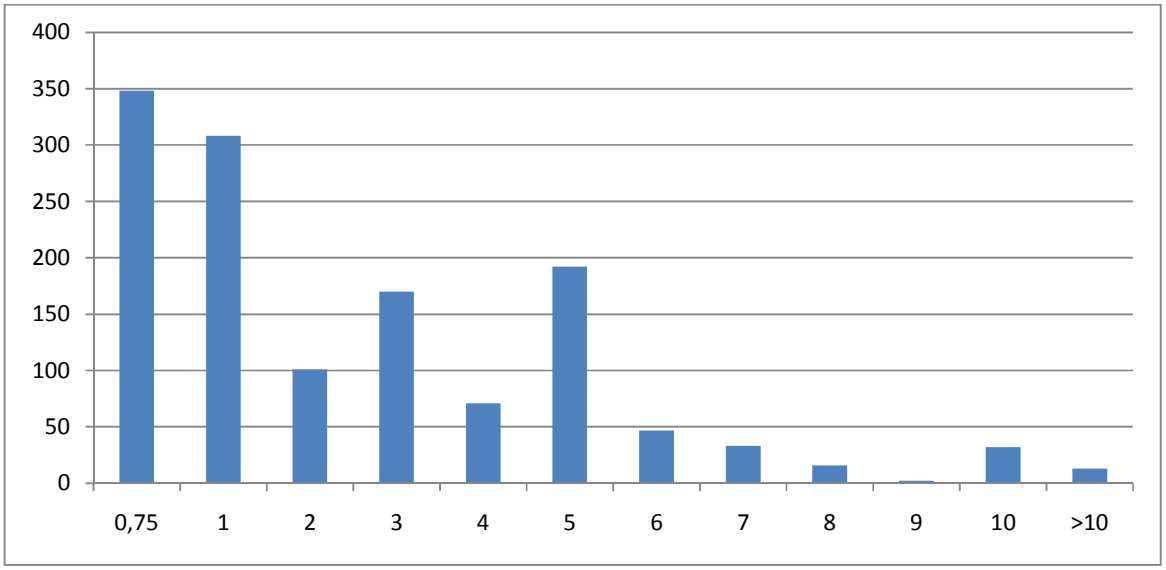


Figure 7: Number of bonds in the sample issued at different maturities (less than)

Figure 7 illustrates the importance of estimating separate regression for short- and medium-term bonds in order to investigate how the large share of short-term bonds may influence the estimated coefficients. Visual inspection of the graph also portrays the criticism forwarded by the International Monetary Fund as only 12 bonds are have a maturity of more than 10 years. The remainder of bonds have a maturity of between 1 and 5 years.

5.2 The corporate bond spread

As shown in table A5, the average spread is 189 basis points, while the median is 94 basis points. This wedge between the median and the average is caused by some very risky firms required by markets to pay a spread of more than 1000 basis points. The standard deviation of 243 is an indication of variation in the spread beyond the extremes reported above, which is advantageous when estimating relations to the spread using OLS-regression (Wooldridge, 2009).

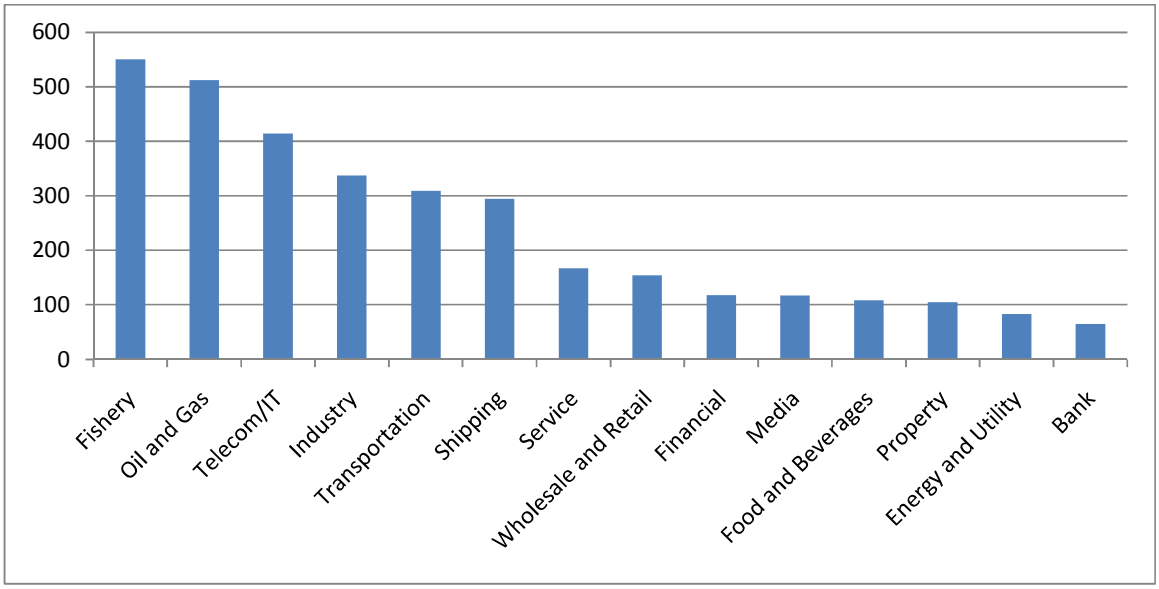


Figure 8: Spread in basis points across industries

The overview of the average spread across industries, in figure 8, offers no surprises. The high spread industries are dominated by the export sector, whose profitability is tied to changing prices of commodities in global markets. It is also interesting to note the similar sequencing of firms whether they are ordered by the bond spread in figure 8 or return volatility in figure 5. The banking sector, being heavily regulated, commands the lowest spread in the sample. Energy and utility and food and beverages serve basic needs in domestic markets and are thus awarded with a low spread. In conclusion, the large sector differences highlight the importance of controlling for the distinctive attributes of the industries in the estimated models.

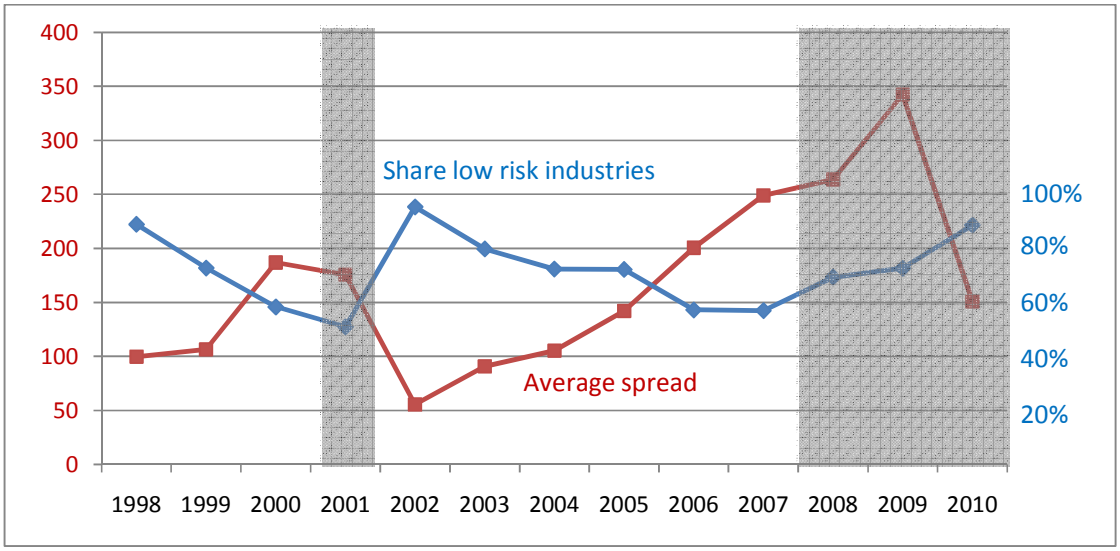


Figure 9: Bond spread (basis points) over time (left) and share of low risk industries share off bonds (right). Shaded areas represent recessions as defined by the National Bureau of Economic Research (2010).

Over time the blue line, representing the spread, seems to follow the business cycle, falling in downturns and rising sharply when the economy is booming. This is opposite of what I would expect if the spread is determined by default risk (Bodie, 2001). The natural explanation is one of shifts to the risk composition of firms issuing bonds, where riskier firms issue bonds in good times, while avoiding the bond market in downturns. Thus, reducing the spread as the compositions of bonds is tilted in favour of safer bonds.

To strengthen my theory I added the share issued by firms from low risk industries (blue line), based on the high risk industry dummy variable defined in section 4.3. By visual inspection one can see the share of low risk issues following the business cycle, and as the percentage of safer issues fall the average spread rises. In sum, the dynamics of this graph supports the hypothesis of riskier firms withdrawing from the bond market in downturns.

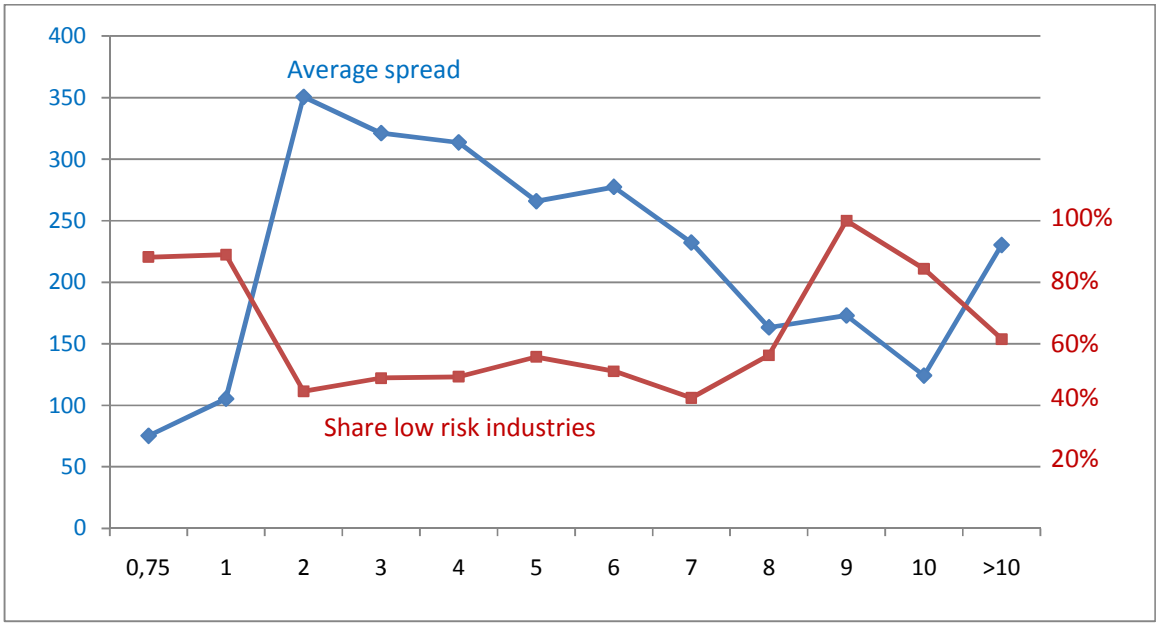


Figure 10: Bond spread (basis points) across maturities (left) and the share of low risk industries (right)

Motivated by the discussion in part 2.2, I expect long-term bonds to be dominated by safer firms. In turn, this may result in a decreasing or hump-shaped curve across maturity. The blue line exhibits a clear hump-shape, initially increasing, before falling almost linearly for maturities of more than 2 years. The shape of the curve emphasises the estimation of a non-linear relation, by the use of a quadratic term, to best capture changes in the spread.

In order to account for the behaviour of the spread over maturities, I added the share of bonds issued by firms in low risk industries (red line). Maturities of less than one year are dominated by safer firms evident by their 90 percent share of bonds issued. Intuitively, only firms in safer industries are able to rely on short-term bonds to satisfy their liquidity needs. Risky firm's share is higher for maturities ranging from 2 till about 5 years, but slides downwards as maturity increases. This can be explained by only safer firms being able to issue long term bonds at good terms, while more risky firms are forced to rely on medium-term bonds (Helwege and Turner, 1999). Looking back at the changes in the average spread across maturities, one can see how changes to the composition of issues explain a substantial portion of the variation in figure 10.

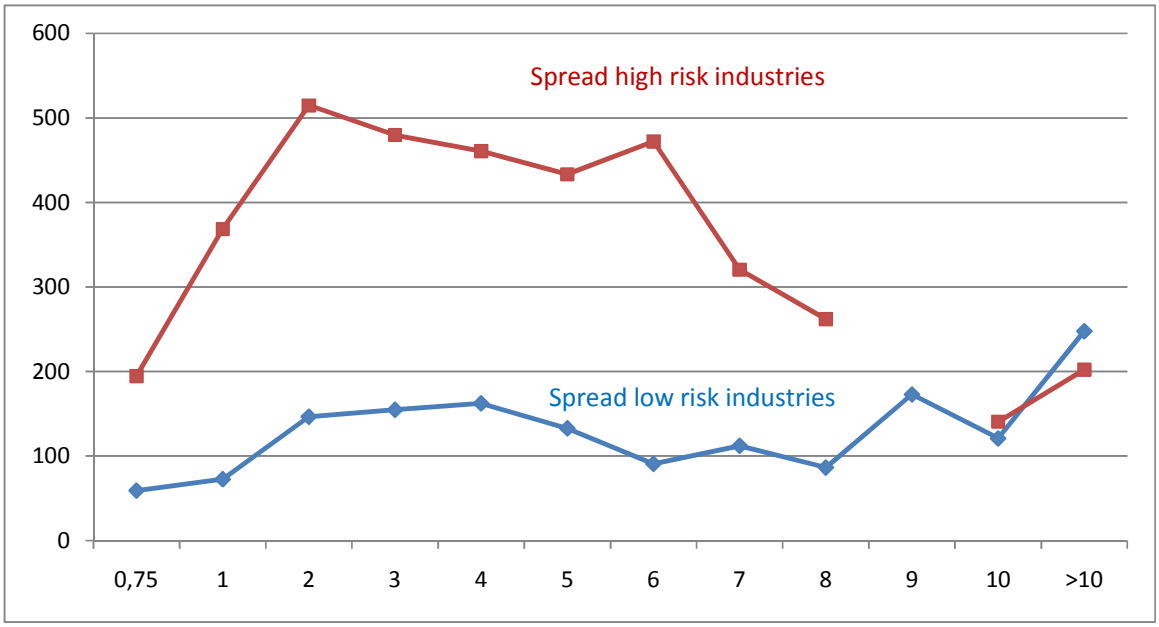


Figure 11: Spreads across maturity for high and low risk industries

Figure 11 plots the average spread separately for high and low risk industries across maturities. The curves show how the bond spread expands for both groups as maturity is lengthened from less than a year to about three years. At longer maturities the red curve depicts a falling spread, creating a hump-shape over time, while the low risk curve depicts a flatter relation. Even after dividing the sample by risk, the firms within the high risk industries segment themselves into different maturities based on risk characteristics. Alternatively, the low number of observations for long-term high risk industry bonds may add to the hump-shape by causing these average spreads to be less accurately calculated. This pattern does not transfer to the low risk industries and may be accounted for by the more homogenous nature of the markets served by banks and property firms.

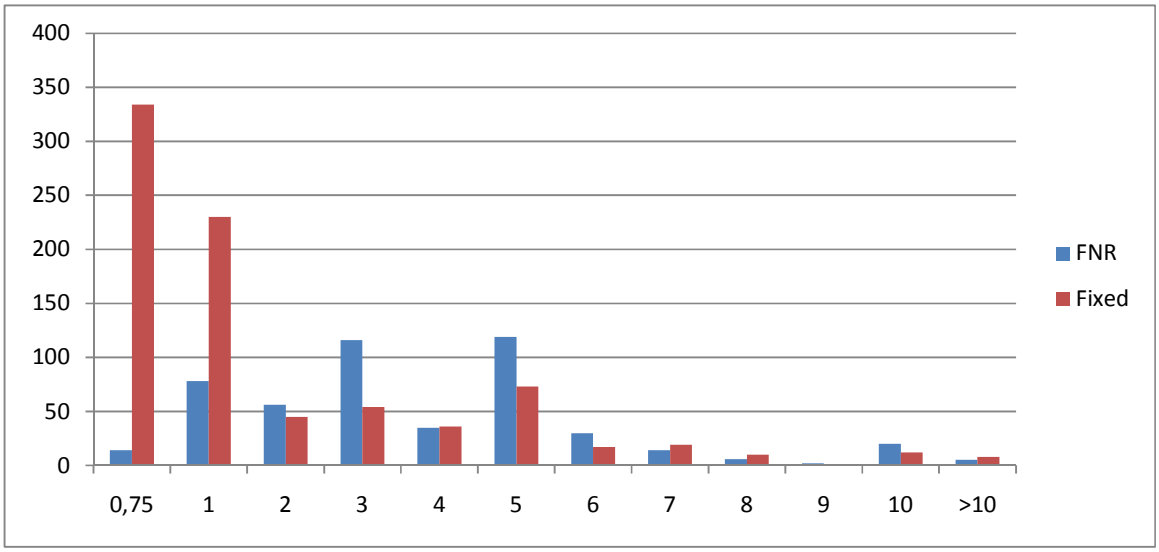


Figure 12: Number of bonds issued of return types across maturity

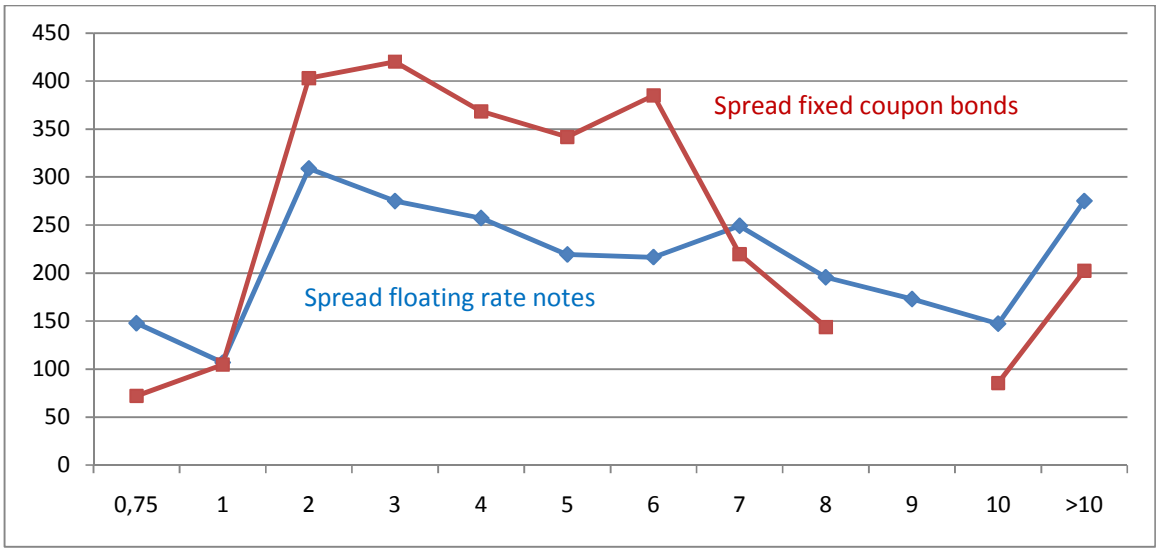


Figure 13: Spread of return types across maturity

There are few differences between floating rate notes and fixed coupon bonds over industries and time. However, a slight difference materializes over maturities as illustrated in figure 12 and 13. Short term bonds are usually fixed, which is perfectly logical given the low interest rate risk for short-term bonds, while medium-term bonds have a slight over representation of floating rate notes. The average spread also differs across maturity, as the spread increase in figure 12 of medium-term bonds is higher for fixed rate bonds. This can, in a fashion similar

to the changes over time and maturities, be explained by a higher share of fixed coupon bonds issued by firms from high risk industries. Some of the difference over maturity will inevitably be captured by the firm characteristics controlled for in the regression, but these graphs still propose including return type in the regression model.

5.3 Bond characteristics

As shown in table A5, the average amount borrowed is 297 million kroner, while the median is 201 million kroner. Some bonds are very large, for instance the eight largest bonds all have a face value of more than 2 billion NOK, and the largest has a par value of 15 billion kroner. Still, most issues are much smaller, illustrated by 50 percent of bonds being in the range of 108 and 337 million kroner.

The median maturity is 1.2 years and 25 percent of the bonds have a maturity of less than 9 months, which illustrates how a large share of bonds is relatively short-termed. The distribution of return types consists of 37 percent floating rate notes and 63 percent fixed coupon bonds. Furthermore, 5 percent are convertibles, 18 percent of the bonds are callable and about 41 percent of the bonds are listed.

5.4 Firm characteristics

The sample characteristics are to a large extent determined by the industries documented to dominate the sample at the beginning of this section. The firms of these industries issue many bonds annually causing them to have large say when the sample statistics are determined. This problem is illustrated as the bonds issued by the largest firms are all banks. The median firm size is 6.8 billion NOK, while the average is 29.8, which demonstrates how the banks' large balance sheets cause the average to be more than 4 times the size of the median.

The average firm is able to generate 0.38 kroner of sales per 1 kroner invested in the firm. Grocery trade and producers of food dominate at the higher end of the scale, while banks and financial institutions are found to have lower asset turnover. The large differences across industries support the notion presented in 2.1 of asset turnover representing industry

characteristics. The low median profitability of 1 percent may be an indication of how my sample firms are either start-ups running at a temporary loss or mature unprofitable firms.

Variation in the estimated coefficients is an advantage in order to estimate significant coefficients in regression models (Wooldridge, 2009). The low degree of variation of leverage and intangible asset is thus a cause of concern, evident by 26 percent and 48 percent of bonds having insignificant levels of the ratios, respectively. Still, a handful bonds sparks a high ratio of both variables alleviating some of this concern. Nevertheless, low variation can be an explanation of a weak relation of these variables to the spread.

5.5 Board structure

The average age of 51.4 years illustrates how people are appointed to the board at a late stage of their careers. As for tenure, the average board has served as directors for 2.7 years. However, the average of 3 years after 2004 is due to the measurement error of board tenure (part 4.3) a more representative description of my sample directors.

My median board, being 7 directors, is much smaller than what is analysed in most studies of corporate boards, and can lead to a disparate relation of board size compared to other studies. This is evident by the median board size of 12 directors in Anderson et al.'s (2004) study of S&P 500 firms, which makes my third quartile board of 8 members seems small in comparison.

Approximately 60 percent of CEOs of large American industrials serve as chairmen of the board (Boone et al. 2007). In my sample only 35 percent of CEOs serve a dual role as directors, which is an indication of a higher degree of independence in Norwegian boardrooms. This may provide for a very different board environment to test the alleged benefits independent directors. The seniority of directors and CEOs are about the same as the average of relative tenure independence is -0.09 years. Still, a lot of variation is present among the different bonds, which the maximum and minimum of 8.63 and -6.41, respectively, can attest to. Investigating the share of independent directors reveals that many boards have either all or no independent directors, while a smaller sub sample has a mix of independent and dependent directors.

5.5 Correlation

Studying the correlation matrices, in table A6 and A7 in the appendix, is useful in order to determine the relationships between the corporate spread and important variables, and may as such give an indication to what variables should be included in the regression model. The former table shows firm and bond characteristics, while the latter reports the correlation of firm and board variables. The corporate bond spread is significantly and positively correlated to maturity, intangible asset ratio, volatility and leverage, inferring that these variables should be included in a regression model. In contrast, return on assets, block-holders and total assets are negatively correlated. Of the dummy variables callable, convertible, floating rate notes, listed bond and firm are all significantly related to the spread. Amount issued and asset turnover, however, have an insignificant correlation coefficient to the spread at the 5 percent level, but can nevertheless have an important role once other factors are controlled for.

Of the board variables, average tenure, average age, number of board members and CEO serving as a director, all have a significant negative correlation to the spread, while average number of directorships, tenure dispersion, independence and share of female directors have an insignificant coefficient. These results highlight some relevant relationships between cost of debt and board characteristics, but correcting for bond and firm variables is necessary before a conclusion can be made.

It is also useful to study the relationship between some of the independent variables more closely. A positive correlation of maturity indicates that the correlation coefficient captures the rise in the spread from short- to medium-term bonds depicted in figure 10. Furthermore, high leverage is associated with higher return on assets and smaller firms. For bond characteristics, the correlation matrix indicates a tendency for larger firms to be less likely to issue callable, convertible and listed bonds, and riskier firms are more likely to add a call option and the ability to convert a bond into stocks.

For board characteristics, the matrix shows that members of larger boards keep their seats over a longer period. Moreover, the correlation coefficients indicate how large boards appoint directors with a lower number of directorships. Equally enlightening is the correlation between board and firm characteristics. A high average tenure seems to go hand in hand with more profitable and less risky firms. The correlation matrix also reports a negative association between board size and leverage and return volatility, while an opposite association is found

to firm profitability. High levels of independence and the share hired before the current CEO seems to be characteristics of lower levels of debt.

The correlations documented above emphasise the importance of controlling for firm variables, because dropping these variables from the regression may lead to biased estimates of the board coefficients, as discussed in the next part (Wooldridge, 2009).

6. Empirical methodology

I now consider the statistical properties of OLS-regression in relation to my sample of bonds, as a prelude to the estimation and analysis of the multiple regression models in the next part. "Introductory econometrics a modern approach" by Wooldridge (2009) is used as a reference throughout this discussion.

My data set, having surveyed multiple bonds issued by the same firm over time, has some features of a panel data set. However, a perfect panel data set would involve observations of each firm periodically. Bond issues, however, are not a periodical event. Some firms routinely issue bonds at an annual basis, while others use bond markets at a more sporadic basis. These latter firms can thus have large gaps in the time dimension of the data set.

The limitation of my dataset forces me to disregards the time-dimension by adding all bonds into one large cross-sectional sample. This method is called the pooled cross-sectional approach, and is not without flaws. To be specific, the same factors may affect bonds issued by the same firm over time, and consequently violate the assumption of different bonds being independently distributed. Researchers routinely solve this problem by the inclusion of time dummy variables in order to incorporate systematic relations of the spread over time.

The discussion of the correlation matrices documented substantial correlation between the individual proxies of the board structure and firm characteristics, and stresses the need to control for other factors related to the spread in order to uncover the true relation of board structure. This requirement promotes the use of multiple regression models, which enables the estimation of board structure coefficients holding all other relevant factors constant. The most viable estimation method is ordinary least square (OLS), because this is the best linear

unbiased estimator (BLUE). More technically, BLUE means that the estimates will have an expected value equal to the true value in the population (unbiased) and have the smallest variance (best) of any linear estimator

OLS is BLUE if the five Gauss-Markov assumptions are satisfied. The assumption of constant expected error given any values of the independent variables (fourth Gauss-Markov assumption) fails when one or more of the explanatory variables are correlated with the error term of the regression. Failure of this assumption is called endogeneity or endogenous explanatory variable in relation to a specific variable, and often occurs when an important unobserved variable is missing from the model. Important missing variables will be contained within the error term, and do not by themselves violate the BLUE characteristics of OLS. However, if the missing factor is correlated with the independent variables the result is biased estimates as parts of this variable will be captured by the independent variables. This correlation between the error term and independent variables violates the constant expected error assumption and thus leads to an endogeneity problem.

An illustration of this problem is offered by Kale and Shahrur (2007), who find evidence of the bargaining power of customers being positively related to debt levels. Bargaining power of customers is not accounted for by the dataset and may be reflected in the bond spread by creditors. If this is the case, the effect of bargaining power will be partially captured by the leverage coefficient and partially by the error term, and thus mislead me to assume an artificially high importance of leverage. The problem arises even after including industry dummies, because they represent broad industry characteristics, and will not be able to capture the finer distinctive features of the numerous sub-markets within the assigned industry classifications.

An endogeneity problem can also originate by the use of the wrong specification of independent variables, such as using book values of assets in place of market value or asset return volatility in place of equity volatility. This will cause the relation of firm size to differ from the true relation, and can, assuming true firm value is correlated with the other independent variables, lead to biased estimates of all included coefficients.

Simultaneity, a special kind of endogeneity, may cause problems in regression models when one or more of the independent variables are jointly determined with the dependent variable.

For instance, a two way relationship may exist between the amount of leverage and the spread. A high spread will reduce the attractiveness of using debt as a mean of finance and will accordingly lower the leverage ratio. At the same time, a higher amount of debt may increase the risk of the firm, and consequently affect the spread. This example is best described as a simultaneously determined equilibrium.

Will OLS be an unbiased estimator if the explanatory variables are jointly determined with the dependent variable? According to Wooldridge, a simultaneously determined dependent variable may cause an endogeneity problem by being correlated with the error term. An equally serious problem is caused by the difficulty of separating the effect of leverage on the cost of debt, which we are interested in, from the effect of the spread on leverage. The well know dilemma "which came first, the chicken or the egg", is a suitable description of this problem. The remedy is to estimate simultaneous equation models, where the co-determined variables are estimated together. However, these models will be biased if one or more of the equations are miss-specified consequently requiring a more rigorous theoretical description of the nature of the simultaneity than what is available in the relation between firm, bond, board characteristics and the spread.

Missing observations result in the removal of approximately 100 bonds from the regression models. Missing data causes no problem if the observations are missing at random. However, a violation of the random sampling assumption (second Gauss-Markov) may occur if the missing bonds have a systematic cause. The bonds missing one or more variables are caused by no previous accounting records or missing information about the board in the company registers. The latter is common for start-ups and may cause problems if these firms are perceived to be more risky by investors. The problem is partially solved by making an effort to fill in the blanks, whenever possible.

The fifth Gauss-Markov assumption requires the same variance of the error given any values of the explanatory variables. This assumption is, in addition to being required for OLS to be BLUE, important in order to calculate the standard errors of the estimated coefficients. Violation of this assumption is called heteroskedasticity and causes a bias to the estimator of the variance of the coefficients. Violation thus invalidates hypothesis testing and causes the t-statistics to no longer conform to an exact t-distribution.

A second assumption in order to test hypotheses requires knowledge of the full distribution of the coefficients, which is made possible by assuming the unobservable error is normally distributed. This assumption is valid if all independent variables are normally distributed. Total assets and issue size are both log-transformed in order to more closely match the bell-shape of the normal distribution. Most ratios deviates substantially from this requirement, but can be overlooked by using the central limit theory. This loophole causes the OLS-estimator to be approximately normally distributed regardless of the distribution of the individual variables, and is only viable in large samples, commonly defined as consisting of more than 30 observations.

It is problematic to assume independence of multiple bonds issued by the same firms. This problem is aggravated by the frequent bond issues carried out by a small minority of firms. This may result in correlated residuals, which can invalidate the regular OLS standard errors. The problem is solved by estimating standard errors that relax the assumption of the independence of individual bonds. All reported hypothesis tests on the coefficients have been adjusted for this problem by estimating firm clustered standard errors (Petersen, 2006).

Standardizing the coefficients is a useful tool to judge the relative importance of different variables included in a regression. This is done by standardizing each variable by subtracting its mean and dividing by its standard deviation, which results in each variable having a mean of 0 and standard deviation of 1. The new coefficients are interpreted as the change in standard deviations to the spread by an increase to the independent variable by one standard deviation.

7. Results and analysis

7.1 Introduction

The remainder of my thesis discusses the estimated relations of bond, firm and the four board characteristics to the corporate bond spread. The models in table 3 include firm and bond variables from section 2.1 and 2.2 found to have a significant relationship to the corporate bond spread. Insignificant variables, except the convertible dummy variable, are removed in order to estimate a parsimonious base model as a building block for investigating relations to the board structure. The variables found to be insignificant are included in table A9 of the

appendix, and are discussed at the end of section 7.1 and 7.2. Board variables, found to be insignificant are included in the models and discussed in the main text, as an inconclusive result is important when documenting the hypotheses presented in part 2.

Even thought my sample consists of bonds issued after 1997, a number of important accounting variables are missing from RavnInfo in 1998 and 1999. The 40 bonds issued before 2000 are thus removed from the regressions. As discussed earlier, I control for the effect of time and industries by the use of dummy variables. Industries containing few bonds or firms having few common characteristics are included in the base category.

Firms related to the Norwegian businessman Olav Thon are removed from regression 4 to estimate the relation of the number of directorships held by the board. Olav Thon born in 1923, has more than 100 positions in different firms and owns a number of firms having issued 89 bonds in the sample. These factors will produce extreme outliers of average age, age dispersion and number of positions, which may make estimation of relations to the spread difficult.

Table 3 reports four regressions in order to test different proxies and maximize the effective sample size. The latter is important in order to take into account the fact that the independence variables are missing for a relatively large share of the sample. Including these variables in all regressions would impair on my ability to estimate significant relations to other variables (Wooldridge, 2009). Regression 1 includes diversity measured relative to tenure and experienced measured using average tenure, while regression number 2 measures diversity as dispersion in age and experience as average age. Regression 3 adds the independence variable and the dummy variable of whether the CEO is a director. The inclusion of these variables reduces the sample to 979 observations. The last regression removes the 89 bonds issued by firms related to Olav Thon, and is used to estimate a relation to number of board positions and as a robustness check of the coefficients representing average age and age dispersion. Coefficients are reported with cluster corrected t-statistics below them in parentheses, and the stars represent the significance level at which one can reject the null hypothesis of no relationship to the bond spread.

7.2 Hypotheses and expected relationships

$$Spread = \beta_0 + \beta_1 Asset\ return\ volatility + \beta_2 \ln(Assets) + \beta_3 \ln(AmountIssued) + \beta_4 Maturity + \beta_5 Maturity^2 + \beta_6 AssetTurnover + \beta_7 Callable + \beta_8 Convertibles + Board\ characteristics + \varepsilon$$

I hypothesis, based on the discussion in part two, that board independence will have a positive effect on the monitoring of the board, which points to a negative relation to the bond spread. Next, I expect increased experience to have a positive impact on the quality of the board, and consequently anticipate a negative relation of average board tenure, age and number of directorships held in business life. The discussion with regard to diversity left me with the expectation of a negative relation of tenure and age dispersion, while the relation to gender dispersion is more vague. Conflicting results of board size on performance, financial accounting quality and the cost of debt makes pinpointing an expected relationship difficult. The correlation matrix seems to point to a negative relation of board size, tenure and age diversity, but controlling for other variables is necessary before a conclusion can be made.

The relation of the firm characteristics is more straightforward. I expect a negative relation of leverage and firm size and a positive relation of profitability. I was unable to find sources enabling me to pinpoint the relation of asset turnover, which prevents me from concluding on the expected sign. The theoretical discussion and description of the spread over maturities, strongly suggest a hump-shaped relation of maturity to the spread. Furthermore, I expect a negative relation of issue size, listed bonds and bonds being convertible, while a positive relation is expected to callable bonds.

Table 3 - OLS-regression of bond spread (bp)

		Sign	1	2	3	4
Firm char.	Asset return volatility	+	186.92***	173.53***	203.53***	180.25***
			2.91	2.6	3.27	2.72
	Asset Turnover	?	-70.91***	-77.67***	-76.27***	-81.87***
			-3.13	-3.66	-3.07	-3.54
	ln(Total Assets)	-	-18.22**	-22.24***	-20.24*	-20.06**
			-1.97	-2.6	-1.78	-2.37
Bond characteristics	Maturity	+	35.54***	36.47***	35.37***	35.96***
			4.69	4.94	3.93	4.77
	Maturity^2	-	-3.13***	-3.16***	-3.17***	-3.07***
			-4.12	-4.44	-3.21	-4.39
	Callable	+	121.75***	118.13***	120.48***	112.84***
			5.75	5.32	4.70	5.10
	Convertible	-	-61.04	-56.15	-95.01**	-54.94
			-1.61	-1.49	-2.00	-1.47
	ln(Amount Issued)	-	-28.38**	-24.72**	-31.38**	-26.52**
			-2.46	-2.13	-2.52	-2.21
Board characteristics	ln(Board Size)	?	46.05	58.52**	51.1	61.25*
			1.6	1.99	1.44	1.91
	Average Tenure	-	-25.21***		-23.45***	
			-3.55		-2.75	
	Average Age	-		-4.51***		-4.21***
				-2.88		-2.65
	Multiple Directorships	-	-0.22	1.88	-1.01	4.51***
			-0.22	1.51	-0.9	2.93
	Average share female	?	-49.13	-31.13	-78.3	-49.97
			-1.07	-0.79	-1.46	-1.17
	Std Tenure	?	16.98		23.59	
			1.34		1.64	
	Std Age	?		-1.6		2.36
				-1.12		1.09
	Independence	-			3.79	
					0.88	
	Dual pos CEO	?			-14.15	
					-0.6	
	Adjusted R^2		0.6485	0.6471	0.6653	0.6493
	N		1170	1206	979	1118

Bond spread in basis points. Asset volatility and asset turnover as fractions

Callable, convertible and Dual pos CEO as dummy variables

Sign represents the relationships discussed in section 2.

Constant, year and industry dummy variables are included, but not reported in this table

*, ** and *** denotes significance at the 10%, 5% and 1% levels, respectively

Reported t-values and significance levels are estimated using firm clustered standard errors

7.2 Firm characteristics

Long term debt to total assets, argued to be important in part 2.1, is not significant at the 10 percent level in table A9. The lack of significance means it is very likely to observe such a coefficient, even if leverage is irrelevant. The result is robust to alternative measures of leverage, such as total debt to total assets and total debt to equity.

The trade of theory and the pecking order of finance offer two distinct explanations of the weak relation of leverage. According to the trade of theory of the capital structure, firms will choose an optimal mix of debt and equity by weighting the positive and negative effects of debt on equity value (Brealey et al., 2006). Benefits of debt include tax deductibility of interest payments and the disciplinary effect of fixed interest payments on management. Opposite, direct and indirect costs of default cause firms to prefer lower leverage. These costs and benefits are taken into account by management when they decide upon an optimal ratio of debt. In the model, however, many of these factors are left unexplained and thus reside within the error term. Specifically, a firm, whose assets are easily marketable in a distress sale may settle on a higher ratio of debt than a similar firm relying on its valuable brand name, and may at the same time be required to pay a higher cost of debt (Brealey et al., 2006). Another example relies on how true firm risk is negatively related to leverage levels and positively related to the spread (Brealey et al., 2006). External observers are confined to use estimates of risk based on externally available data, while management on the other hand can rely on detailed inside knowledge as they choose an optimal level of debt. These examples are at the heart of the problem as they show how marketability of assets in distress or true firm risk will be partially captured by the error term and partially captured by leverage. This causes an endogeneity problem, and may, in both cases, bias the expected positive relation towards zero.

The pecking order of finance describes how asymmetric information of investors and management causes firms to prefer internal to external sources of finance and debt to equity (Brealey et al., 2006). These preferences lead to the leverage ratio being determined by the firm's external need of finance, which in turn is determined by access to internal funds and the investment opportunities available. This causes firms to settle on a low level of leverage regardless of their underlying business risk. Low levels of debt are often assumed to have a small effect on default risk (Brealey et al., 2006), and can thus explain the weak relation of

leverage. The pecking order and the trade of theory are not compatible, as the latter involves an optimal level of debt. Alternatively, the weak relation can also be due to a miss specification of the leverage ratio. It is probable that the true relationship involves debt measured relative to market capital (section 5).

Adding an interactive relationship of leverage and return volatility, in order to investigate alternative leverage specifications, resulted in a positive coefficient of 478 basis points. Coefficients on interactions terms are more difficult to interpret, and will also affect the standalone interpretation of return volatility and leverage.

The interaction term in table A8 is estimated relative to the average level of return volatility and leverage (Wooldridge, 2006). The estimated relation indicates how higher leverage makes for a more negative relation of firm risk. This is in line with the empirical findings of Campbell and Taksler (2003), who rationalise their findings by explaining how risky firms with small amount of debt are less likely to go bankrupt, while high leverage and risk makes for an especially destructive combination. Testing the significance of volatility under the new specification involves using an F-test of joint significance of the interaction and the regular coefficient. This test signifies that both factors are strongly significantly different from zero (F-test 3 in table A16). However, the interaction term do not seem to augment the statistical importance of leverage, evident by the insignificant F-test at the 10 percent level (F-test 4 in table A17).

Even though this interaction term has an intuitive explanation, the benefit has to be weighed against the cost of a more complicated interpretation of the model. Furthermore, the interaction term proved to be a dead-end in relation to the chief motivation of trying out an alternative specification of leverage. I thus decided to leave out this interaction term of the final model. The discussion of leverage has introduced two theories of the capital structure in order to explain the absent relation of leverage. Still, to reach a conclusion on the most appropriate explanation is difficult, except to note that both explanations are plausible.

Turning to the significant firm variables, the importance of the coefficients can be judged by comparing the standardized coefficients. The standardized coefficients indicate how a one standard deviation change in asset turnover, total assets and return volatility results in a change of -0.19, -0.12 and 0.1 standard deviations, respectively, to the spread.

Asset turnover is the most important firm variable, judged by the size of the standardized coefficients and by the highly statistically significant coefficient. It is, however, difficult to trace the negative sign to specific characteristics of firms, such as capital intensity or marketing strategy. Firm size, measured as log-transformed total assets, is the second most important firm predictor of the spread, and is significant at the 5 percent level in model 1, which supports the argument of larger firms being more robust in times of crisis.

Asset return volatility has the expected positive sign and is highly statistically significant. However, the variable seems to be of relatively low importance being ranked last of all by the standardized coefficients. This rank is caused by a very low practical significance, exemplified by a low 6.9 basis points increase to the spread as return risk is increased from the first to the third quartile. Furthermore, the practical importance is not heightened by the interaction term of leverage and volatility. This is not in accordance with the findings of Campbell et al. (2003) in relation to equity volatility, and may suggest that return volatility is an inferior measure of firm risk. Campbell et al.'s (2003) argument is based on the way which equity volatility incorporates information continuously. In contrast, new information is taken into account by the financial statement at an annual basis. Even so, the low share of bonds issued by publicly listed firms force me to make do with return volatility (4.3).

Leverage is not the only insignificant firm variable. Table A9 indicates how return on asset has a non significant relation to the spread. Looking back at the large share of firms that report a low or negative return on assets may provide a rational for this weak relation (part 5.4). Investors who believe in the future potential of a firm may perceive a current negative return on assets as irrelevant when they decide whether or not to invest in a bond. In other word, return on assets may not represent an adequate measure of the financial health of many firms.

The intangibles assets ratio proved insignificant. This can be attributed to the artificially low levels of intangibles assets in the sample caused by the shortcomings of financial accounting measures of intangible assets. Specifically, the financial statement leaves out important intangible assets, such as brand name and the human capital of employees, severely biasing the estimated ratio downwards (Kvaal and Johnsen, 1999). Lastly, the share of the firms held by block-holders proved unable to explain the corporate bond spread.

The accounting based variables surprised me with their low importance as measures of default risk. These findings are not as surprising when one look back at the 17.8 and 56 percent of the spread related to default risk, respectively, in the articles by Elton et al. (2001) and Longstaff et al. (2005). These figures leave a significant share of the spread to other factors than default risk. I investigate further by comparing my estimated coefficients to studies conducted on American data. Using leverage as an example, Anderson et al. (2004) find only a weakly significant relation of leverage to the spread. In relation to total assets, Anderson et al. (2004) and Klock et al. (2005) report coefficients of 10 to 22.5 (depending on the model specification) and 30 respectively, which are relatively similar to my coefficients of between 18 and 22. In conclusion, my estimated coefficients seem to be relatively similar in size to the results of other authors.

7.3 Bond characteristics

Considering bond characteristics, investors require a sizeable addition to the spread for bonds being callable. This is as anticipated in light of the expected loss to investors when a bond is called by the firm. Alternatively, Crabbe and Helwege (1994) review three agency theories and find empirical evidence explaining how more risky firms are more likely to include a call-provision. The coefficient will thus capture unobservable risk characteristics important to management when they decide whether or not to include the option to call a bond. These characteristics may be captured by the callable dummy variable, which in turn would lead to an upward bias to the size of coefficient. The significant relation of issue size is in line with the argument that larger bonds have more potential buyers and sellers, which increases liquidity.

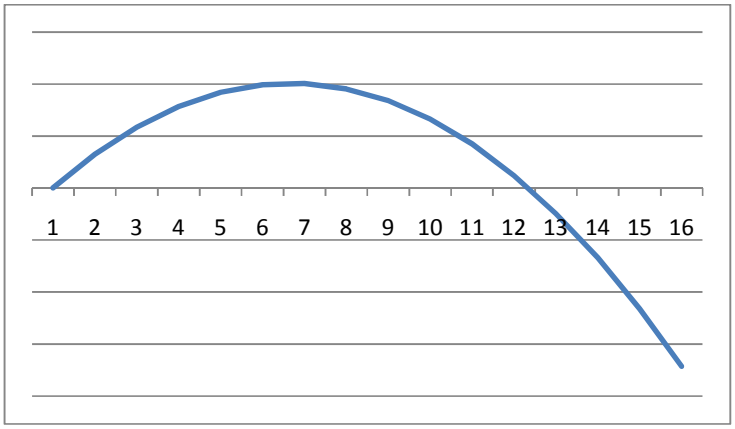


Figure 14: Shape of the curve relating maturity to the spread in regression 1 in table 3

The decision to use a non-linear relationship of maturity complicates the interpretation of the coefficients, because the effect of a one year increase in maturity depends on the initial maturity (Wooldridge, 2009). Figure 14 shows the diminishing effect of maturity to the corporate spread brought about by the coefficients of regression 1. The diminishing nature of the curve illustrates how a one year increase to the term of a short-term bond increases the spread to a lesser extent than a comparable one year increase of a medium-term bond. The diminishing effect of including a squared term to the regression will dominate at some point, and will eventually cause a negative effect of a one year increase to the term of the loan. The former happens at a maturity of about 6 years, while the latter occurs at approximately 12 years. However, most bonds are within the range of a positive marginal effect of a lengthened maturity. In conclusion, the emerging hump-shaped relation is in accordance with the finding of many studies, and can be attributed to risk characteristics not controlled for by the other firm variables (Helwege and Turner, 1999).

A predicted negative coefficient is estimated in table 3 to bonds with a convertibility option. However, the estimated p-value is not small enough to warrant a conclusion in favour of a lower spread. Nevertheless, the theoretical justification of a lower spread on convertibles bonds is strong enough to warrant inclusion in the base model. The model is also incapable of documenting a systematic spread difference of floating rate notes and fixed coupon bonds in table A9.

It is interesting to note how a listing on a stock exchange of both the firm and the bond do not significantly affect the spread. The arguments in 2.1 and 2.2 theorized how increased quality

and equal information of investors would work to lower the spread. The long-term perspective and dominance among investors by pension funds and insurance companies may help to explain my inconclusive result (part 3). Planning to hold the bonds until maturity, these important investors are less sensitive to the benefits cited above. More generally, it is also possible that the value to all investors of higher quality information is severely reduced as low liquidity makes trading more difficult (part 4.2).

7.4 Board independence

The remainder of this thesis discusses the relation found to variables representing the board structure. The relation of board independence, measured as the difference of average director and CEO tenure, is not able to predict the level of the corporate bond spread (regression 3). Moreover, an identical conclusion is obtained after the inclusion of the dummy variable representing CEOs who serve a dual role as board members. These results indicate that the conclusion of Bøhren and Strøm (2005) is applicable to bond markets as well as equity markets.

The above independence measure contains information of relative tenure of the board and the CEO, which if irrelevant, complicates the interpretation of independence. In comparison, the ratio of independent directors is simpler, being determined by whether or not the directors were hired before the current CEO. However, my conclusion remains the same, justified by the equally insignificant coefficient of table A8.

My results contrast to the findings of a number of articles investigating the effect of board independence on board effectiveness, cost of debt and firm performance. In the following I present two possible explanations of my findings.

Firstly, comparing the tenure of directors and the CEO may be a poor method to account for director independence. Directors hired by former CEOs may be close personal friends of top-management, while directors hired under the reign of the current CEO may have no prior relationship to the firm. Another example involves how poor performance may force a change of CEO (James and Soref, 1981), which substantially changes the measure of independence, and simultaneously may cause a change to the corporate bond spread. In other words, independence may capture the underlying causes of a CEO dismissal.

Secondly, the discussion of part 2.5 revealed how the structure of Norwegian boards is by nature more independent from management than comparable American boards. The inconclusive results can thus be attributed to an optimal level of independence of Norwegian boards, while the boards studied in Anderson et al. (2004) would benefit from becoming less dependent on management. Bøhren and Strøm (2005) concluded in favour of the latter explanations after estimating a similar relation to performance. Still, I find it difficult to reject the former hypothesis, and will thus limit myself to note how both hypotheses are plausible explanations of the inconclusive relation of director independence.

7.5 Board experience

The theoretical discussion promotes director tenure, age and number of directorships as proxies of board experience. The case for tenure is supported by the strongly negative coefficient of regression 1. Part 5.5 discussed how average tenure is artificially low and increases steadily during the first half of the sample, before stabilizing after 2005. This may influence the estimated relation cited above. I thus include a separate regression of bonds issued after 2005 in table A11, which confirms the findings of table 3.

It is natural to add a quadratic term in order to investigate the hypotheses forwarded in favour of a stronger initial benefit of tenure and a negative relation of high seniority boards (part 2.5). The quadratic term is reported in table A8 and is judged to be highly significant by the F-test in table A16. A positive squared term supports the argument of a decreasing importance of tenure at higher seniority. Still, the small size of the squared term limits the deviation from a non-linear relation within the range of tenure observations in my sample.

On the other hand, infrequent changes to the board can be related to mature firms. If mature firms can raise debt at better conditions, the mature firm effect will be contained within the tenure coefficient, seemingly increasing the importance of tenure. This view is supported by Boone et al. (2007), who studied the determinants of board characteristics and found evidence of changes to board composition and size as firm characteristics evolved. The referred to changes will lower average tenure as directors are replaced and may also be related to the spread, which, together, may induce a negative effect of low tenure.

My conclusion contrasts to Anderson et al. (2004), and supports their initial argument of tenure having a negative relation to the cost of debt through experience. These results need not contradict each other if boards at the average tenure of my sample of 3 years (2004-2010) are able to harness the benefits of experience, while boards having served for 9.2 years, as is the case of Anderson et al.'s(2004) sample, are dominated by the adverse effects of tenure discussed in part 2.6.

Age, representing life long experience, is included in regression 2. The coefficient gives an account of a positive dependency of strong statistical properties. However, some may argue that this result alone is not strong support of the experience hypothesis, as people appointed to the board are already relatively old, justified by the median director being about 51 years old. Even though people learn throughout their lifetime, the effect of the 26th working year can be argued to be less than that of the 5th year (Avolio, 1990). Still, the result is more compelling once paired with the negative relation of tenure.

Age and tenure have been argued to cause higher experience. Number of directorships, however, is argued to be an indicator of directors who have qualities and experiences related to their performance as directors. Model 4 is estimated after removal of firms affiliated with Olav Thon and documents a significantly positive connection to the bond spread of average number of board positions. This result favours the over-committed hypothesis to the hypothesis of board positions representing positive qualities of the individual directors. My finding is the opposite of Ferris et al. (2003) and Bøhren and Strøm (2005) relative to firm performance, and implies a somewhat different relation to the cost of debt.

Part 4.4 explained how the number of directorships of bonds issued during the late part of the sample is more accurately measured, as only data as of February 2010 was available through Proff.no and RavnInfo. Using this variable, I assume the average director who has many positions today also had multiple positions at issue. The validity of this assumption is examined by dividing the sample into two sub-samples by time (regression 4 in table A11). The relation is highly significant in the sub-sample including 2005, which is most prone to this measurement error, while an insignificant coefficient is reported for more recent bonds. By itself, this can invalidate the assumption and point to oddities in the sample as explanations of the positive relation. However, observed over time the number of directorships fluctuates around the sample average, which points to no systematic changes

caused by the measurement error. Still, the relationship being determined by the sub-sample most affected by the measurement error suggests a cautious approach when interpreting the positive coefficient of average number of directorships.

The similar coefficients on average age and tenure signal the value and importance of experience. The opposite sign on average number of positions do not by itself discredit this hypothesis as it is likely that other factors than experience form this relation. These variables are only used as proxies of experience, and the relationships found can consequently not be tied directly to increased experience. They do, however, together present a sound argument for the experience hypothesis.

7.6 Board diversity

The few articles which discusses board diversity presents dispersion in gender composition, tenure and age as possible aspects of diversity. The presented models in columns 1 and 2 convey little evidence of these coefficients being different from zero. My results are accordingly not consistent with the argument that replacing directors bring new vigour to the board nor the claim of directors of different age having complementary knowledge and experience. My weak results can be caused by the standard deviation of tenure and age being poor proxies of diversity. A shakeup of the board may occur after a change to corporate control or a period of poor performance (Denis and Sarin, 1998), which by themselves may affect the spread. Large changes to the board will by definition cause a reduction in the calculated standard deviation of tenure, and this shows how the standard deviation of tenure may capture other aspects of the firm than diversity.

I presented two conflicting hypotheses of the relation to the share of female directors. One relates female directors positively to the bond spread by arguing how limiting the pool of viable candidates may affect director quality. The other presents an opposite relation by arguing how female directors expand the perspective of the board. Neither is supported by the negative, but insignificant coefficient reported in both models. My results are estimated in a period when firms hired female directors to comply with the new law. This variation in the sample makes a good environment to investigate the relation of female directors, and thus

supports the notion of female directors being no different from male directors in the eyes of creditors.

7.7 Board size

As motivated in part 2.8, the number of directors can represent a number of characteristics of a board. Both work capacity and diversity increases with the number of directors, while a negative relation to the board's effectiveness and influence is argued for large boards.

Log-transformed board size is positive in all reported models in table 3. However, the strength of this relationship is sensitive to the choice of model specification. Model 2 reports a significant coefficient at the five percent level, which is support of board size having an adverse effect on the bond spread. Opposite, a p-value of 0.111 in model 1 do not qualify to reject the hypothesis of the true coefficient being equal to zero. It is interesting to note how the coefficient of model 1 is significant once estimated on the sub-sample of fixed coupon bonds and weakly significant on non-financial industries and after removal of multiple bonds issued by the same firm annually. These results indicate a stronger relation of board size within the sub-samples than in the sample as a whole.

An alternative model specification involves a quadratic term in order to test the hump-shaped relationship presented in organizational psychology research. Regression 1 in table A8 in the appendix reports insignificant coefficients on both number of directors and number of directors squared. However, an F-test is required to maintain the joint irrelevance of two coefficients. The reported F-test in table A16 is not able to reject the null of both coefficients being different from zero. Moreover, the quadratic model is one of diminishing increases to the corporate bond spread when new directors are added to the board. In other words, an increase from 2 to 3 directors is more negative to creditors than an expansion from 9 to 10 members. This is the opposite of the arguments presented in the literature, and it is accordingly hard to base a logical explanation on this result. It is clearly not hump-shaped within the interval of board sizes found in my sample, which strongly supports discarding the non-linear model.

Explaining the mixed results is difficult. For one, it is possible that the true relationship is one of increasing spread for larger boards, where my mixed results can be attributed to low

variation in the sample or a miss-specification of model 1. The former has some substance as my sample firms usually keep their board size constant through time. Although my sample consists of many bonds, the variation of firms issuing bonds is not equally large. A larger and more varied sample may have enabled me to conclude with statistical certainty on the relation of board size (Wooldridge, 2009). Moreover, correlation of board size to a number of variables in the models may also be a cause of the mixed results (part 5.5) (Wooldridge, 2009). Still, there is the possibility of a non-existent or weak relation, either due to board size being irrelevant to creditors or many boards having an optimal number of board members. The last has some weight in light of my median and third quartile board being 6 and 8 members, respectively, which means most board are smaller than the maximum effective board size stipulated by Lipton and Lorsch (1992).

The negative to the spread of Anderson et al.'s (2004) contradicts the estimated coefficient of model 2. Their study is conducted on larger American firms, and it is therefore questionable how their results compare to my smaller Norwegian firms. The negative relation to performance in Bøhren and Strøm's (2005) study of Norwegian firms makes for a more relevant assessment of my findings. More generally, arguments presented by organizational behaviour research and participants in the governance debate makes for a compelling case in favour of board size having a negative relation to board performance. These arguments solve the deadlock between the two models by providing a theoretical explanation of my results and evidence of a positive relation to performance of Norwegian firms. I thus adopt the significant coefficient of model 2, and accordingly concludes in favour of an adverse relation of board size to the cost of debt.

7.8 Robustness in sub-samples

Dividing the sample into different sub-samples assesses the stability of relations found in the models of table 3. This is made important as my sample includes a large share of banks and is collected during a time of high growth of the domestic bond market. As discussed earlier, the size of the t-statistics depend on the sample size (Wooldridge, 2009), which reduces the power of the hypothesis tests in these sub-sample regressions. Coefficients not being significant in the sub-samples are therefore not very disturbing. In contrast, significant changes of sign are more problematic, as they violate the interpretations of my results and

indicate a relation sensitive to the characteristics of the different sub-samples. The sub-sample regressions are included in tables A11 to A15 of the appendix. I will start out by a discussion of bond and firm variables, before I comment on the behaviour of some important board variables.

Tables A11 to A13 present sub-samples over time, maturity and floating rate notes and fixed rate notes, and do not reveal any significant changes of sign by the firm and bond variables. Some variables are not significant over sub-samples, like asset return volatility and convertibility being only significant for longer term bonds or convertibility, asset turnover and issue size being only significant for more recently issued bonds.

How the relations are affected by rerunning the regressions on the sub-samples of the financial sector and the non-financial industries are important in order to test whether the different balance sheets or the extent of government regulation of the former sector affects the estimated coefficients (The Norwegian Central Bank, 2004). Some coefficients change sign, but only asset turnover experiences a significant change of sign. The relationship for financials is positive, while the relationship to the remainder of industries is negative. This need not discredit the inclusion of asset turnover in the model, as it is possible that asset turnover represents the variation across industries of firm characteristics. Consequently a positive relation within the financial sector does not necessarily contrast with a negative relation for the sample as a whole. The rest of the firm characteristics are not consistently significant across industries, while callable bonds and maturity maintains their significant relations.

An equally important robustness check involves randomly removing multiple bonds issued by a firm in the same year. Firms in banking and real estate will, owing to their frequent bonds issues, experience a sharp decline in their share of bonds. The characteristics of these firms may have a larger influence in determining the coefficients of the regression due to the constant nature of firm characteristics of bonds issued in the same year. Table A15 reports the models after removal of multiple issues per year by the same firm. The sample size of 475 bonds illustrates the extent to which some firms issue many bonds annually. All firm and bond variables are at least significant at the 10 percent level and of equal sign, which means my concern was uncalled-for.

Of the board variables, tenure is significantly negative over time, maturities and return-types, and has the right sign for other industries than banking and finance and after removing multiple issuers per year by the same firm. The consistently significant nature of tenure supports the conclusion of experience as an important characteristic of the board. Age is weakly significant over time and strongly significant after removing multiple issues by the same firm. The latter robustness model also reveals show a higher ratio of female directors lead to a lower spread and how enhanced diversity of tenure increases the spread.

8. Summary

The principal goal of this thesis is to investigate the relation of factors that represent the structure of corporate boards to the bond spread required by creditors as compensation for risk. The primary lesson learned is of creditors who take into account the structure of the board in their investment decisions. Whether the board structure is taken explicitly or implicitly into account, through other variables such as the board structure affecting the quality of financial reporting or performance, is difficult to discern. My findings are, regardless of the cause, a valuable contribution to the debate regarding optimal board structure and corporate governance in the aftermath of recent governance scandals. Many high profiled participants argue in favour of smaller and more independent boards. My results show how a reduced board size will be positively perceived by creditors, who require a smaller risk premium for bonds issued by smaller boards. The arguments presented in favour of increased independence, however, are not supported by the investors in my sample bonds, which seems, judging by the relation between independence, CEOs serving on the board and the cost of debt, to attach little value to the independence of a board.

Using age and tenure as proxies of experience, I find support for the hypothesis of increased experience being beneficial to the board. The practical implications are that Norwegian board members can stay in their position for longer periods to harness the benefits of tenure and that older board members' business experience contributes positively to the efficacy of the board. Opposite, my models are inconclusive with regard to the benefits to creditors of gender equality and diversity with respect to tenure and age.

Of the firm characteristics I was unable to estimate a significant relation to leverage, and present two explanations of this result. Firstly, an endogeneity problem can be the result of firms choosing an optimal level of leverage in accordance with the trade of theory of the capital structure. Alternatively, Norwegian firms may maintain a too low level of leverage as described by the pecking order of finance. The other firm characteristics are more straightforward, such as a negative relation of firm size and a positive relation of risk. While investigating the characteristics of the individual bonds, I documented a negative relation of issue size, which is argued to be a proxy for liquidity. I furthermore indentified a yield curve shaped by firms segmenting themselves into different maturities based on firm risk.

The process of writing this thesis has highlighted some interesting extensions of my results. My measure of independence has both advantages and disadvantages. It would be interesting to investigate how the relation to the spread and performance changes if the affiliation of each director is determined based on qualitative information describing his relation to the firm. Moreover, future increased size and breath of the Norwegian bond market may bring about a more varied sample of bonds for estimation of relation to board and firm variables. Furthermore, enlarged liquidity of secondary market data may also enable researcher to estimate the yield to maturity of the same bond over time, and possibly enables proper estimation of fixed effects models. Fixed effect estimation can control for the endogeneity problems, which have been the culprit of much uncertainty regarding the interpretation of my findings. Lastly, my results point to a low importance of asset return volatility and leverage. These variables are based on accounting measures, and the use of data from equity markets may provide a much stronger relation to the spread.

9. References

Proff.no. http://www.proff.no/

Ravninfo.no. https://www.ravninfo.com/

Ajinkya, B., Bhojraj, S., & Sengupta, P. (2005). The Association between Outside Directors, Institutional Investors and the Properties of Management Earnings Forecasts. *Journal of Accounting Research , 43*, pp. 343-376.

Amir, B., A., H. R., & W., S. L. (1980). A Rationale for Debt Maturity Structure and Call Provisions in the Agency Theoretic. *The Journal of Finance , 35*, pp. 1223-1234.

Anderson, R. C., Mansi, S. A., & Reeb, D. M. (2004). Board characteristics, accounting report integrity and the cost of debt. *Journal of Accounting and Economics , 37*, pp. 315-342.

Avolio, B. J., Waldman, D. A., & McDaniel, M. A. (1990). Age and Work Performance in Nonmanagerial Jobs: The Effects of Experience and Occupational Type. *Academy of Management , 33*, pp. 407-422.

Barnea, A., Haugen, R. A., & Senbet, L. W. (n.d.). A Rationale for Debt Maturity Structure and Call Provisions in the Agency Theoretic Framework. *The Journal of Finance , 35*, pp. 1223-1234.

Beasley, M. (1996). An empirical analysis of the relation between the board of director composition and financial statement fraud. *Accounting Review , 71*, pp. 443-465.

Bhojraj, S., & Sengupta, P. (2003). Effect of corporate governance on bond ratings and yields: The role of institutional investors and outside directors. *Journal of Business , 76*, pp. 455-475.

Board of Governors of the Federal Reserve System http://www.federalreserve.gov

Bodie, Z., Kane, A., & Marcus, A. J. (2001). *Investments* (5 ed.). McGraw-Hill.

Boone, A. L., Field, L. C., Karpoff, J. M., & Raheja, C. G. (2007). The determinants of corporate board size and composition: An empirical analysis. *Journal of Financial Economics , 85*, pp. 66-101.

Brealey, R. A., Myers, S. C., & Allen, F. (2006). *Corporate Finance.* McGraw-Hill Irwin.

Busch, T., & Vanebo, J. O. (2003). *Organisasjon og ledelse Et integrert perspektiv* (5 ed.). Universitetsforlaget.

Bøhren, Ø., & Strøm, Ø. (2007). Aligned, informed, and decisive: Characteristics of value-creating boards.

Cadbury, A. (2002). *Corporate governance and chairmanship. A personal view* (1 ed.). New York: Oxford University Press.

Campbell, J. Y., & Taksler, G. B. (2003). Equity volatility and corporate bond yields. *Journal of Finance , 58*, pp. 2321-2349.

Campbell, K., & Minguez-Vera, A. (2008). Gender Diversity in the Boardroom. *Journal of Business Ethics , 83*, pp. 435–451.

Carter, C. B., & Lorsch, J. W. (2004). *Back to the drawin corporate board.* Harvard Business School Press.

Chen, L., Lesmond, D. A., & Wei, J. (2007). Corporate Yield Spreads and Bond Liquidity. *Journal of Finance , 62*, pp. 119-149.

Collin-Dufresne, P., Goldstein, R., & Martin, S. (2001). The determinants of credit spread changes. *Journal of Finance , 56*, pp. 2177-2207.

Crabbe, L. E., & Helwege, J. (1994). Alternative Tests of Agency Theories of Callable Corporate Bonds. *Financial Management , 23*, pp. 3-20.

Dalton, D. R., Daily, C. M., Ellstrand, A. E., & Johnson, J. L. (1998). Meta-Analytic Reviews of Board Composition, Leadership Structure, and Financial. *Strategic Management Journal , 19*, pp. 269-290.

Datta, S., Iskandar-Datta, M., & Patel, A. (1997). The Pricing of Initial Public Offers of Corporate Straight Debt. *The Journal of Finance , 52*, pp. 379-396.

DeFond, M. L., & Jiambalvo, J. (1994). Debt covenant violation and manipulation. *Journal of Accounting and Economics , 17*, pp. 145-176.

Eisenberg, T., Sundgren, S., & Wells, M. T. (1998). Larger board size and decreasing firm value in small firms. *Journal of Financial Economics , 48*, pp. 35-54.

Elton, E. J., Gruber, M. J., Agrawal, D., & Mann, C. (2001). Explaining the rate spread on corporate bonds. *Journal of Finance , 56*, pp. 247-277.

Fama, E., & Jensen, M. (1983). Separation of ownership and control. *Journal of Law and Economics , 26*, pp. 301-326.

Ferris, S. P., Jagannathan, M., & Pritchard, A. C. (2003). Too busy to mind the business? Monitoring by directors with multiple board appointments. *Journal of Finance , 58*, pp. 1087-1112.

Finance Norway. (2007). *Det norske obligasjonsmarkedet - hva kan gjøres for å skape et mer velfungerende marked?*

Fons, J. S. (1994). Using default rates to model the term structure of credit risk. *Financial Analysts Journal , 50*, pp. 25-32.

Gabbi, G., & Sironi, A. (2002). Which factors affect corporate bond pricing? Empirical evidence from the Eurobonds primary market spread. *Bocconi U, Newfin Research Center Working Paper* .

Golden, B. R., & Zaja, E. J. (2001). When Will Boards Influence Strategy? Inclination x Power = Strategic Change. *Strategic Management Journal , 22*, pp. 1087-1111.

Gordon J., A., Edwards, A. K., & Ferri, M. G. (2000). The determinants of trading volume of high-yield corporate bonds. *Journal of Financial Markets* , pp. 177-204.

Hart, O. (1995). Corporate governance: Some theory and implications. *The Economic Journal , 105*, pp. 678-689.

Helmut, R. (2009/9/7). *Towards a new reserve currency system?* Retrieved 2009/15/5, from http://www.oecdobserver.org/news/fullstory.php/aid/3075/Towards_a_new_reserve_currency_system_.html

Helwege, J., & Turner, C. M. (1999). The slope of the credit yield curve for speculative-grade issuers. *Journal of Finance , 54*, pp. 1869-1884.

Hermalin, B. E., & Weisbach, M. S. (1998). Endogenously chosen boards of directors and their monitoring of the CEO. *American Economic Review , 88*, pp. 96-118.

Hermalin, B. E., & Weisbach, M. S. (1988). The determinants of board composition. *The RAND Journal of Economics , 19*, pp. 589-606.

Hull, J. (2009). *Options, Futures and Other Derivatives* (7 ed.). Pearson Prentice Hall.

International Monetary Fund. (2005). *Norway: Financial System Stability Assessment.* International Monetary Fund.

Ireland, R. D., Hitt, M. A., Bettis, R. A., & de Porras, A. D. (1987). Strategy Formulation Processes: Differences in Perceptions of Strength and Weaknesses Indicators and Environmental Uncertainty by Mangerial Level. *Strategic Management Journal , 8*, pp. 469-485.

James, D. R., & Soref, M. (1981). Profit Constraints on Managerial Autonomy: Managerial Theory and the Unmaking of the Corporation President. *American Sociological Review , 46*, pp. 1-18.

Jensen, M. C. (1993). The Modern Industrial Revolution, Exit, and the Failure of Internal Control Systems. *Journal of Finance , 48*, pp. 831-880.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency cost and ownership structure. *Journal of Financial Economics , 3*, pp. 305-360.

Kale, J. R., & Shahrur, H. (2007). Corporate capital structure and the characteristics of suppliers and customers. *Journal of Financial Economics , 83*, pp. 321–365.

Klein, A. (2002). Audit committe, board of director characteristics, and earnings management. *Journal of Accounting and Economics , 33*, pp. 375-400.

Klock, M. S., Mansi, S. A., & Maxwell, W. F. (2005). Does corporate governance matter to bondholders? *Journal of Financial and Quantitative Analysis , 40*, pp. 693-719.

Kvaal, E., & Johnsen, A. (1999). *Regnskapsloven.* Cappelen Akademisk.

Lesmond, D. A., Ogden, J., & Trzcinka, C. (1999). A new estimate of transaction costs. *Review of Financial Studies , 12*, pp. 1113-1141.

Lipton, M., & Lorsch, J. W. (1992). A Modest Proposal for Improved Corporate Governance. *The Business Lawyer , 48*, pp. 59-77.

Longstaff, F. A., Mithal, S., & Neis, E. (2005). Corporate Yield Spreads: Default Risk or Liquidity? New Evidence from the Credit Default Swap Market. *Journal of Finance , 60*, pp. 2213-2253.

Lu, C.-W., Chen, T.-K., & Liao, H.-H. (n.d.). Information uncertainty, information asymmetry and corporate bond yield spreads. *Journal of Banking & Finance Accepted Manuscript* .

Merton, R. C. (1974). On the pricing of corporate debt: The risk stucture of interest rates. *The Journal of Finance , 29*, pp. 449-470.

Norwegian goverment. (2007/5/25). *New Norwegian legislation on covered bonds*. Retrieved 2010/20/4, from http://www.regjeringen.no/en/dep/fin/press-center/Press-releases/2007/New-Norwegian-legislation-on-covered-bon.html?id=467946

Stamdata http://www.stamdata.no

Oslo Alternative Bond Market. (2010). *Listing*. Retrieved 05 30, 2010, from http://www.oslobors.no/ob_eng/Oslo-ABM/Listing

Oslo Børs/Oslo Stock Exchange. (2008). *Informasjonsplikt for obligasjonstustedere på markedsplassene Oslo Børs og Aslo ABM.*

Oslo Stock Exchange. (2010). *Løpende forpliktelser for børsnoterte selskaper.*

Oslo Stock Exchange. (2009). *Monthly Statistics.*

Petersen, M. A. (2006). Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches. *Kellogg Finance Dept. Working Paper* .

Raheja, C. G. (2005). Determinants of board size and composition: a theory of corporate boards. *Journal of Financial and Quantitative Analysis , 40*, pp. 283-306.

Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *Journal of Finance , 50*, pp. 1421-1460.

Rakkestad, K. J., & Hein, J. B. (2004). Om langsiktige referanserenter i det norske obligasjonsmarkedet. *Penger og Kreditt , 32*, pp. 151-158.

Reisen, H. (2009, 10). Towards a new reserve currency system? *OECD Observer* .

Sarig, O., & Warga, A. (1989). Some empirical estimates of the risk structure of interest rates. *Journal of Finance , 44*, pp. 1351-1360.

Sveriges Riksbank http://www.riksbank.com/

The Brønnøysund Register Centre http://www.brreg.no/

The Ministry of Children, Equality and Social Inclusion. (2008). *Kjønn og lønn*. Retrieved 2010/5/30, from http://www.regjeringen.no/nb/dep/bld/dok/nouer/2008/nou-2008-6/15/5/4.html?id=501233

the National Bureau of Economic Research. (2010). *the National Bureau of Economic Research*. Retrieved 2010/13/6, from http://www.nber.org

The Norwegian Banks' Guarantee Fund. (2005). *Innskuddsgarantiens dekningsområde.* The Norwegian Banks' Guarantee Fund.

The Norwegian Central Bank www.norges-bank.no/

The Norwegian Central Bank. (2004). Norske finansmarkeder - pengepolitikk og finansiell stabilitet. *Norges Bank skriftserie , 34*.

The Norwegian Central Bank. (2010/1/22). *Ord og uttrykk*. Retrieved 2010/6/8, from http://www.norges-bank.no/templates/article____11598.aspx#nibor

The Norwegian Savings Banks Association. (2010). *About equity certificates*. Retrieved 2010/03/04, from http://www.sparebankforeningen.no/id/17042.0

Thomsen, S., & Pedersen, T. (2000). Ownership Structure and Economic Performance in the Largest European Companies. *Strategic Management Journa , 21*, pp. 689-705.

Thomson Reuters.*Datastream*.

Wooldridge, J. M. (2009). *Introductory Econometrics A Modern Approach* (4 ed.). South-Western.

Yermack, D. (1996). Higher market valuation of companies with a small board of directors. *Jornal of Financial Economics , 40*, pp. 185-211.

Table A4 - Description of variables

		Type	Description
Firm characteristics	Asset Return Volatility	Fraction	Standard deviation of return on assets over time
	Leverage	Fraction	Longterm debt to total assets. Average incoming and closing balances
	Intangible Assets Ratio	Fraction	Total intangible assets to total fixed assets
	Asset Turnover	Fraction	Total sales to total assets
	Return on assets	Fraction	Income before extraordinary items to total assets
	ln(Total Assets)	Log-trans.	Total assets (of parent company) in Dec 2009 kroner
	Block holders	Fraction	Share of equity held by owners holding blocks of more than 5 percent
	Firm listed	Dummy	Equal to one if firm is listed
Bond char.	Maturity	Quantitative	Maturity of the bond
	ln(Amount issued)	Log-trans.	Amount issued in the first tranche in Dec 2009 kroner
	Callable	Dummy	Equal to 1 if the bond is callable
	Bond Listed	Dummy	Equal to 1 if the bond is listed or will be listed in the future
	FRN	Dummy	Equal to 1 if the bond is a floating rate note
	Convertibles	Dummy	Equal to 1 if the bond is convertible.
Board characteristics	Avg Age	Quantitative	Average age of directors
	Avg Tenure	Quantitative	Average tenure of directors
	Avg Female	Fraction	Average share of female directors
	Board Size	Quantitative	Number of directors
	Avg directorships	Quantitative	Average directorships held by the directors of a firm
	Std Tenure	Fraction	Tenure dispersion of the directors measured as the standard deviation
	Std Age	Fraction	Age dispersion of the directors measured as the standard deviation
	CEO dual position	Dummy	Equal to 1 if CEO serves a as director
	Independence	Quantitative	Average difference in tenure of directors and the CEO
	Share Independent	Fraction	Share of directors hired before the current CEO

Table A5 - Descriptive statistics

		Mean	Median	StDev	Min	Max	Q1	Q3	Missing obs
Firm characteristics	Corporate bond spread	189	94	243	-83	2445	33	245	5
	Block holders	0,40	0,00	0,49	1,00	0,00	0,00	1,00	0
	Asset return volatility	0,05	0,02	0,13	0,00	1,93	0,00	0,04	58
	Leverage	0,32	0,34	0,24	0,00	1,03	0,07	0,53	61
	Intangible asset ratio	0,14	0,05	0,21	-0,07	1,00	0,00	0,24	81
	Asset Turnover	0,38	0,09	0,64	0,00	3,03	0,03	0,38	55
	Return on assets	0,00	0,01	0,09	-1,31	0,40	-0,01	0,04	52
	Total Assets	29,8	6,8	72,2	0,0	550,2	2,0	30,1	17
	Firm-listed	0,49							0
Bond char.	Maturity	2,59	1,18	2,48	0,50	20,00	0,75	4,17	0
	Amount issued	297	201	513	0,1	15315	108	337	0
	Callable	0,18							0
	Bond Listed	0,41							0
	Foreign Currency	0,06577							0
	FRN	0,37							0
	Convertibles	0,05							0
Board characteristics	Avg Age	51,44	50,37	5,42	34,00	67,81	47,90	54,50	9
	Avg Tenure	2,71	2,47	1,71	0,00	9,77	1,40	3,76	93
	Avg Female	0,22	0,25	0,17	0,00	1,00	0,00	0,38	8
	Board Size	7	7	2	1	14	5	8	4
	Avg directorships	9,85	5,88	11,13	0,00	57,67	4,00	11,40	6
	Std Tenure	1,35	1,16	0,98	0,00	4,55	0,54	2,09	106
	Std Age	10,04	8,16	8,30	0,00	44,64	5,90	10,59	28
	Independence	-0,09	-0,03	1,99	-6,41	8,63	-1,02	1,14	314
	Share Independent	0,35	0,29	0,35	1,00	0,00	0,00	0,67	415
	CEO dual position	0,35							276

Convertibles, Callable, Bond listed, Sinking fund, FRN, Firm listed and CEO dual position are dummy variables

Total assets is in billion NOK and Amount issued is in million NOK. Both in Dec 2009 kroner

Table A6 - Correlation matrix of firm and bond characteristics

Variable pairs in bold represent correlation coefficients significant at the 5 percent level

	Maturity	Bond-listed	Callable	Amount issued	FRN	Convertibles	Block holders	Firm-listed	Leverage	Intangible ratio	Asset Turnover	Return on assets	Total Assets	Return volatility
Bond-listed	**0,49**													
Callable	**0,29**	**0,08**												
Amount issued	**0,143**	**0,15**	**0,074**											
FRN	**0,33**	**0,38**	**0,21**	**0,126**										
Convertibles	**0,11**	**-0,07**	**0,06**	-0,03	**-0,16**									
Block holders	**-0,16**	**-0,15**	**-0,07**	-0,06	**-0,08**	**-0,12**								
Firm-listed	0,04	**0,09**	-0,02	0,012	-0,01	0,03	**-0,44**							
Leverage	0,04	0,01	**0,16**	-0,02	0,01	0,02	**-0,15**	**0,10**						
Intangible ratio	0,05	0,04	**0,11**	**-0,06**	-0,03	**0,29**	**-0,27**	**0,06**	0,04					
Asset Turnover	**-0,09**	0,01	**-0,11**	**-0,08**	**-0,11**	0,02	**-0,15**	**-0,12**	-0,02	**0,28**				
Return on assets	-0,02	**0,10**	**-0,12**	0,05	0,05	**-0,32**	0,00	0,01	**0,07**	**-0,31**	0,04			
Total Assets	-0,04	**-0,1**	**-0,11**	**0,271**	-0,04	**-0,09**	**0,106**	**-0,12**	**-0,31**	0,033	**-0,16**	0,029		
Return volatility	**0,09**	0,05	**0,27**	-0,01	0,02	**0,18**	**-0,18**	0,06	**0,06**	**0,20**	0,00	**-0,17**	**-0,13**	
Spread	**0,20**	**0,12**	**0,46**	0,024	**0,11**	**0,20**	**-0,28**	**0,10**	**0,21**	**0,32**	0,01	**-0,27**	**-0,2**	**0,36**

Table A7 - Correlation matrix of firm and board characteristics

Variable pairs in bold represent correlation coefficients significant at the 5 percent level

	Firm-listed	Leverage	Intangible ratio	Asset Turnover	Return on assets	Total Assets	Return volatility	Board Size	Avg Age	Avg Tenure	Avg directorships	Std Tenure	Std Age	Independence	Share Independent	CEO dual position	Avg Female
Leverage	**0,10**																
Intangible ratio	0,00	**-0,08**															
Asset Turnover	**0,12**	0,02	**0,07**														
Return on assets	0,01	**0,07**	0,04	0,04													
Total Assets	**-0,12**	**-0,31**	0,033	**-0,16**	0,029												
Return volatility	0,05	**0,06**	-0,04	0,00	**-0,17**	**-0,13**											
Board Size	**-0,08**	**-0,37**	0,04	**0,45**	**0,08**	**0,204**	**-0,21**										
Avg Age	**0,23**	**0,24**	0,03	0,03	**0,09**	**0,14**	**0,11**	**0,15**									
Avg Tenure	-0,03	-0,01	**-0,21**	**0,34**	**0,14**	0,036	**-0,17**	**0,20**	**0,41**								
Avg directorships	0,05	**0,41**	0,03	**-0,08**	**0,11**	**-0,1**	-0,02	**-0,43**	**0,45**	**0,10**							
Std Tenure	-0,01	-0,04	**-0,24**	**0,31**	0,04	0,058	**-0,14**	**0,32**	0,05	**0,62**	**-0,13**						
Std Age	**0,08**	**0,31**	0,03	**-0,09**	**0,11**	**-0,1**	**-0,08**	**-0,34**	**0,57**	**0,14**	**0,80**	-0,04					
Independence	0,05	**0,21**	0,03	**0,09**	0,02	0,045	0,05	**0,17**	**0,16**	**0,16**	**0,21**	**0,12**	**0,31**				
Share Independent	**0,20**	**-0,11**	-0,06	**0,17**	-0,01	**-0,05**	-0,02	**0,23**	**-0,10**	**0,18**	**-0,26**	**0,26**	**-0,30**	**0,75**			
CEO dual position	0,01	-0,04	**0,21**	**-0,30**	-0,01	0,031	**-0,12**	**-0,10**	0,03	**-0,19**	**0,15**	**-0,20**	**0,18**	**-0,08**	**-0,21**		
Avg Female	**0,09**	**-0,10**	**-0,24**	0,05	0,00	0,045	-0,01	**0,11**	-0,04	**0,29**	**-0,25**	**0,46**	**-0,14**	**0,14**	**0,17**	**-0,32**	
Spread	**0,10**	**0,21**	**-0,13**	0,01	**-0,27**	**-0,2**	**0,36**	**-0,29**	**-0,08**	**-0,13**	-0,02	-0,03	**-0,13**	-0,02	0,01	**-0,23**	0,00

Table A8 - Alternative OLS-regression models of bond spread (bp)

		1	2	3	4
Firm characteristics	Asset return volatility	186.68***	198.12***	166.16***	186.63***
		2.9	3.15	2.84	2.89
	Asset Turnover	-70.48***	-76.79***	-66.85***	-71***
		-3.1	-3.08	-3.10	-3.13
	ln(Total Assets)	-18.48**	-20.66*	-17.95**	-18.23**
		-1.99	-1.81	-2.27	-1.97
	Leverage			-2.71	
				-0.08	
	Leverage*Volatility			478.46	
				0.98	
Bond characteristics	Maturity	35.51***	35.47***	36.31***	35.55***
		4.67	3.9	4.79	4.69
	Maturity^2	-3.13***	-3.19***	-3.29***	-3.13***
		-4.1	-3.18	-4.47	-4.11
	Callable	121.66***	119.59***	128.55***	121.66***
		5.75	4.66	6.05	5.71
	Convertible	-61.25	-96.09**	-67.7*	-61.2
		-1.61	-2.02	-1.84	-1.60
	ln(Amount Issued)	-28.38**	-31.6**	-22.11**	-28.43**
		-2.47	-2.54	-2.13	-2.47
Board characteristics	ln(Board Size)		47.4		46.27
			1.35		1.61
	Board Size	14.71			
		1.02			
	Board Size^2	-0.51			
		-0.59			
	Average Tenure	-25.25***	-22.16***		-26.79
		-3.5	-2.6		-1.55
	Average Tenure^2				0.21
					0.10
	Multiple Directorships	-0.22	-1.07		-0.22
		-0.22	-0.94		-0.23
	Average share female	-49.24	-68.82		-48.56
		-1.08	-1.28		-1.06
	Std Tenure	17.07	22.6		17.42
		1.35	1.55		1.36
	Share independent		0.85		
			0.03		
	Dual pos CEO		-14.23		
			-0.6		
	Adjusted R^2	0.6486	0.6646	0.6457	0.6485
	N	1170	979	1220	1170

Bond spread in basis points. Asset volatility and asset turnover as fractions

Callable, convertible and Dual pos CEO as dummy variables

Sign represents the relationships discussed in section 2.

Constant, year and industry dummy variables are included, but not reported in this table

*, ** and *** denotes signifiance at the 10%, 5% and 1% levels, respectively

Reported t-values and signficance levels are estimated using firm clustered standard errors

Table A9 - OLS-regression of all firm and bond variables

		Sign	1
Firm characteristics	Return on assets	-	-181.98
			-1.22
	Leverage	+	17.26
			0.41
	Asset return volatility	+	137.64**
			2.00
	Asset Turnover	?	-68.16**
			-2.38
	ln(Total Assets)	-	-24.9**
			-2.42
	Firm listed	-	8.83
			0.45
	Block-holders	?	-12.78
			-0.24
Bond characteristics	Maturity	+	47.01***
			4.25
	Maturity^2	-	-3.89***
			-3.86
	Callable	+	107.09***
			4.78
	Convertible	-	-99.28**
			-2.21
	Bond listed	-	-18.48
			-0.92
	Floating rate notes	?	-25.54
			-1.60
	ln(Amount Issued)	-	-15.24
			-1.38
	Adjusted R^2		0.6432
	N		955

Bond spread in basis points. Asset volatility and asset turnover as fractions

Callable and convertible as dummy variables

Sign represents the relationships discussed in section 2.

Constant, year and industry dummy variables are included, but not reported in this table

*, ** and *** denotes signifiance at the 10%, 5% and 1% levels, respectively

Reported t-values and signficance levels are estimated using firm clustered standard errors

Table A10 - Standardized coefficients of bond spread

		Sign	1	2	3	4
Firm char.	Asset return volatility	+	0.1***	0.09***	0.11***	0.1***
			2.91	2.6	3.27	2.72
	Asset Turnover	?	-0.19***	-0.2***	-0.21***	-0.22***
			-3.13	-3.66	-3.07	-3.54
	ln(Total Assets)	-	-0.12**	-0.16***	-0.13*	-0.14**
			-1.97	-2.6	-1.78	-2.37
Bond characteristics	Maturity	+	0.34***	0.36***	0.33***	0.35***
			4.69	4.94	3.93	4.77
	Maturity^2	-	-0.29***	-0.29***	-0.28***	-0.29***
			-4.12	-4.44	-3.21	-4.39
	Callable	+	0.18***	0.18***	0.17***	0.17***
			5.75	5.32	4.70	5.10
	Convertible	-	-0.06	-0.05	-0.08**	-0.05
			-1.61	-1.49	-2.00	-1.47
	ln(Amount Issued)	-	-0.11**	-0.1**	-0.12**	-0.1**
			-2.46	-2.13	-2.52	-2.21
Board characteristics	ln(Board Size)	?	0.07	0.09**	0.08	0.08*
			1.6	1.99	1.44	1.91
	Average Tenure	-	-0.17***		-0.15***	
			-3.55		-2.75	
	Average Age	-		-0.1***		-0.07***
				-2.88		-2.65
	Multiple Directorships	-	-0.01	0.09	-0.05	0.1***
			-0.22	1.51	-0.9	2.93
	Average share female	?	-0.03	-0.02	-0.05	-0.03
			-1.07	-0.79	-1.46	-1.17
	Std Tenure	?	0.07		0.09	
			1.34		1.64	
	Std Age	?		-0.06		0.03
				-1.12		1.09
	Independence	-			0.03	
					0.88	
	Dual pos CEO	?			-0.03	
					-0.6	
	Adjusted R^2		0.6485	0.6471	0.6653	0.6493
	N		1170	1206	979	1118

Bond spread in basis points. Asset volatility and asset turnover as fractions

Callable, convertible and Dual pos CEO as dummy variables

Sign represents the relationships discussed in section 2.

Constant, year and industry dummy variables are included, but not reported in this table

*, ** and *** denotes significance at the 10%, 5% and 1% levels, respectively

Reported t-values and significance levels are estimated using firm clustered standard errors

Table A11 - Robustness over time

			Regression 1		Regression 4	
	Estimated sign		**<=2005**	**>2005**	**<=2005**	**>2005**
Firm char.	Asset return volatility	+	329.99***	176.65**	215.27***	196.57***
			3.65	2.52	2.64	2.73
	Asset Turnover	-	-14.51	-115.3***	-22.18	-121.8***
			-0.64	-3.48	-1.24	-3.61
	ln(Total Assets)	-	-16.31*	-17.77	-17.85**	-17.71
			-1.89	-1.37	-2.33	-1.36
Bond characteristics	Maturity	+	24.35***	44.72***	23.81***	47.46***
			3.34	4.2	3.18	4.36
	Maturity^2	-	-2.09***	-4.12***	-1.96**	-4.33***
			-2.66	-3.88	-2.56	-4.15
	Callable	+	107.77***	131***	73.66***	137.74***
			3.83	4.38	3.21	4.38
	Convertible	-	34.89	-118.48**	40.18	-113.96**
			0.79	-2.09	0.92	-1.98
	ln(Amount Issued)	-	1.53	-51.77***	-1.08	-49.97***
			0.12	-3.12	-0.08	-2.93
Board characteristics	ln(Board Size)	+	35.63	59.91	25.25	81.2*
			0.71	1.47	0.55	1.87
	Average Tenure	-	-29.62**	-24.51***		
			-2.45	-2.87		
	Average Age	-			-3.12*	-4.36**
					-1.96	-2.18
	Multiple Directorships	-	0.88	-1.96	6.74***	1.13
			0.89	-1.38	3.21	0.66
	Average share female	?	-66.37	-31.07	-102.21**	-33.27
			-1.01	-0.44	-2.08	-0.52
	Std Tenure	?	3.54	21.6*		
			0.15	1.66		
	Std Age	?			3.58	1.72
					1.28	0.68
	Adjusted R^2		0.6552	0.6505	0.6690	0.6426
	N		529	641	515	603

Bond spread in basis points. Asset volatility and asset turnover as fractions

Callable, convertible and Dual pos CEO as dummy variables

Sign represents the relationships discussed in section 2.

Constant, year and industry dummy variables are included, but not reported in this table

*, ** and *** denotes significance at the 10%, 5% and 1% levels, respectively

Reported t-values and significance levels are estimated using firm clustered standard errors

Table A12 - Robustness across return types

			Regression 1		Regression 4	
	Estimated sign		**Fixed**	**FRN**	**Fixed**	**FRN**
Firm char.	Asset return volatility	+	225.5***	194.94*	228.82***	200.61*
			3.03	1.79	3.11	1.74
	Asset Turnover	-	-80.79***	-6.23	-89.2***	-32.82
			-3.13	-0.22	-3.20	-1.18
	ln(Total Assets)	-	-27.65***	1.85	-29.02***	-3.44
			-2.95	0.14	-3.31	-0.29
Bond characteristics	Maturity	+	43.39***	23.46**	44.54***	17.81**
			4.64	2.58	4.37	2.32
	Maturity^2	-	-3.74***	-2.04***	-3.76***	-1.66***
			-4.59	-2.61	-4.27	-2.81
	Callable	+	149.51***	131.39***	129.81***	133.39***
			5.1	5.67	4.28	5.42
	Convertible	-	-51.31	-489.14***	-51.19	-428.06***
			-1.31	-4.38	-1.32	-3.23
	ln(Amount Issued)	-	-36.2***	-41.81***	-33.64**	-35.98**
			-2.77	-2.65	-2.44	-2.32
Board characteristics	ln(Board Size)	+	81.83**	5.48	101.75**	30.55
			2.07	0.15	2.33	0.79
	Average Tenure	-	-18.53**	-30.82***		
			-2.1	-3.15		
	Average Age	-			-4.35**	-2.48
					-2.27	-1.32
	Multiple Directorships	-	-0.1	-0.21	3.89**	4.31**
			-0.11	-0.13	2.01	2.39
	Average share female	?	9.11	-50.11	20.09	-81.32
			0.17	-0.8	0.39	-1.39
	Std Tenure	?	14.45	15.61		
			0.92	1.02		
	Std Age	?			1.81	2.12
					0.64	0.99
	Adjusted R^2		0.6738	0.6864	0.6752	0.6985
	N		749	421	693	425

Bond spread in basis points. Asset volatility and asset turnover as fractions

Callable, convertible and Dual pos CEO as dummy variables

Sign represents the relationships discussed in section 2.

Constant, year and industry dummy variables are included, but not reported in this table

*, ** and *** denotes significance at the 10%, 5% and 1% levels, respectively

Reported t-values and significance levels are estimated using firm clustered standard errors

Table A13 - Robustness over maturity

			Regression 1		Regression 4	
	Estimated sign		**<=1**	**>1**	**<=1**	**>1**
Firm char.	Asset return volatility	+	-56.91	180.7**	73.48	170.51**
			-0.14	2.45	0.16	2.29
	Asset Turnover	-	-43.87*	-96.54***	-56.94	-100.66***
			-1.74	-2.98	-1.66	-3.32
	ln(Total Assets)	-	-13.42	-9.35	-17.97	-12.08
			-1.13	-0.83	-1.37	-1.13
Bond characteristics	Maturity	+	123.08*	-9.65	144.57*	-2.06
			1.67	-0.91	1.68	-0.20
	Maturity^2	-	-34.84	0.27	-48.19	-0.25
			-1.09	0.35	-1.28	-0.34
	Callable	+	274.86***	96.53***	270.75***	90.22***
			3.61	4.61	3.31	4.25
	Convertible	-	-9.49	-88.52**	-40.72	-82.14**
			-0.06	-2.46	-0.22	-2.32
	ln(Amount Issued)	-	-30.4*	-37.47**	-23.38	-35.74**
			-1.73	-2.55	-1.38	-2.42
Board characteristics	ln(Board Size)	+	58.81	38.93	65.66	42.5
			1.01	1.07	1	1.13
	Average Tenure	-	-20.95*	-27.06***		
			-1.86	-2.99		
	Average Age	-			-4.92	-1.29
					-1.52	-0.68
	Multiple Directorships	-	-0.87	1.4	2.45	5.07***
			-1.13	0.94	1.21	3.16
	Average share female	?	-17.24	-85.98	-25.06	-76.84
			-0.24	-1.41	-0.42	-1.37
	Std Tenure	?	-0.37	21.15		
			-0.02	1.24		
	Std Age	?			5.78	1.02
					1.36	0.45
	Adjusted R^2		0.5105	0.6812	0.5123	0.6791
	N		596	574	541	577

Bond spread in basis points. Asset volatility and asset turnover as fractions

Callable, convertible and Dual pos CEO as dummy variables

Sign represents the relationships discussed in section 2.

Constant, year and industry dummy variables are included, but not reported in this table

*, ** and *** denotes significance at the 10%, 5% and 1% levels, respectively

Reported t-values and significance levels are estimated using firm clustered standard errors

Table A14 - Robustness of the financial sector and other industries

			Regression 1		Regression 4	
		Estimated sign	**Other sectors**	**Financials**	**Other sectors**	**Financials**
Firm char.	Asset return volatility	+	190.22***	58.67	172.62***	69.45
			3.12	0.29	2.59	0.36
	Asset Turnover	-	-105.83***	142.26***	-108.84***	135.48***
			-3.8	3.34	-3.88	3.12
	ln(Total Assets)	-	-47.88***	-3.17	-47.11***	-3.45
			-3.88	-0.79	-3.57	-0.72
Bond characteristics	Maturity	+	35.26***	18.8***	42.67***	18.44***
			3.64	2.94	4.32	2.92
	Maturity^2	-	-2.69***	-1.14	-3.17***	-1.13
			-3.14	-1.59	-3.80	-1.60
	Callable	+	123.85***	60.02***	123.6***	60.45***
			4.25	3.42	4.12	3.30
	Convertible	-	-84.6**	-20.37	-76.44*	-20.75
			-2.1	-0.22	-1.91	-0.23
	ln(Amount Issued)	-	-26.85*	-7.85	-28.73*	-6.57
			-1.8	-1.23	-1.72	-1.11
Board characteristics	ln(Board Size)	+	65.99*	-5.03	60.01	-0.32
			1.82	-0.18	1.58	-0.01
	Average Tenure	-	-31.03***	-5.47		
			-3.33	-1.44		
	Average Age	-			-5.66***	-0.73
					-2.70	-1.02
	Multiple Directorships	-	-0.42	1.03	4.44***	0.83
			-0.44	0.8	2.63	0.66
	Average share female	?	-100.88	-6.87	-48.51	-16.02
			-1.37	-0.28	-0.67	-0.67
	Std Tenure	?	20.38	1.41		
			1.15	0.18		
	Std Age	?			4.96*	-1.19
					1.68	-0.59
	Adjusted R^2		0.6428	0.6089	0.6176	0.6149
	N		704	466	626	492

Bond spread in basis points. Asset volatility and asset turnover as fractions

Callable, convertible and Dual pos CEO as dummy variables

Sign represents the relationships discussed in section 2.

Constant, year and industry dummy variables are included, but not reported in this table

*, ** and *** denotes significance at the 10%, 5% and 1% levels, respectively

Reported t-values and significance levels are estimated using firm clustered standard errors

Table A15 - Robustness after removing multiple bonds per year per firm

		Estimated sign	Regression 1	Regression 4
Firm char.	Asset return volatility	+	190.3***	170.21**
			3	2.52
	Asset Turnover	-	-137.06***	-135.26***
			-4.09	-3.86
	ln(Total Assets)	-	-22.93**	-24.27**
			-2.18	-2.29
Bond characteristics	Maturity	+	33.96***	40.04***
			3.26	3.95
	Maturity^2	-	-2.84***	-3.2***
			-3.13	-3.82
	Callable	+	118.78***	111.16***
			4.84	4.37
	Convertible	-	-78.89*	-80.36*
			-1.73	-1.75
	ln(Amount Issued)	-	-34.52**	-32.5**
			-2.22	-2.01
Board characteristics	ln(Board Size)	+	59.83*	68.66*
			1.8	1.91
	Average Tenure	-	-36.41***	
			-4.08	
	Average Age	-		-4.92**
				-2.39
	Multiple Directorships	-	-0.71	3.43**
			-0.5	2.07
	Average share female	?	-113.53*	-67.35
			-1.77	-1.06
	Std Tenure	?	29.73**	
			1.98	
	Std Age	?		2.54
				0.94
	Adjusted R^2		0.6128	0.5974
	N		475	468

Bond spread in basis points. Asset volatility and asset turnover as fractions

Callable, convertible and Dual pos CEO as dummy variables

Sign represents the relationships discussed in section 2.

Constant, year and industry dummy variables are included, but not reported in this table

*, ** and *** denotes significance at the 10%, 5% and 1% levels, respectively

Reported t-values and significance levels are estimated using firm clustered standard errors

Table A16 – F-tests of joint significance of coefficients

#	Relationship	Regression	F-value	P-value
1	Squared board size	A8-1	1.41	0.2457
2	Squared maturity	3-1	11.28	0.0000
3	Interaction volatility	A8-3	7.04	0.0011
4	Interaction leverage	A8-3	0.53	0.5873
5	Squared Tenure	A8-4	6.39	0.0020