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Thesis

The Debt Maturity Structure of Norwegian Limited Liability Firms

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i. Abstract

This thesis sets out to provide key characteristics on Norwegian non-listed firms' debt maturity structure, and to assess how it deviates from that of listed firms. From the large sample provided by the CCGR database, an evaluation of how leading theoretical models on debt maturity structure, initially developed for listed firms, apply to all Norwegian limited liability firms, was performed.

Despite recent advances in the theoretical field on debt maturity structure, numerous autonomous hypotheses and no integrated theoretical framework characterise this field. This thesis is therefore centred on the four different arguments; tax, risk management, signalling, and agency cost, perceived to best reflect the fundamental mechanisms underlying the various hypotheses proposed in the theory. Testable hypotheses are deducted from the leading theoretical models, under each of the four arguments.

Relying on descriptive statistics and panel data analysis, support was found for the agency cost and risk management arguments. No support was found for the tax argument and only mixed results were obtained with respect to the signalling argument. The results further show that the debt maturity structure of listed and non-listed firms does not deviate significantly. The overall conclusion is that the models initially developed for listed firms also apply to Norwegian limited liability firms, of which a majority is non-listed.

ii. Acknowledgements

We would like to express our gratitude to our supervisor, Professor Øyvind Bøhren, for valuable guidance, counselling and flexibility in this thesis project. Our ambitious goal of completing the thesis during the first year of the two-year Master's programme would not have been feasible without his invaluable support.

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1 Introduction

Following Modigliani and Miller's (1958) seminal work on the relevance of capital structure there have been ample research and theoretical developments in the field of capital structure. While research has largely focused on the role of capital structure, or the combination of debt and equity financing of a firm, the field of debt maturity structure, or the combination of short term and long term debt, has not nearly received the same attention. Different theoretical models have been proposed to explain the debt maturity structure decision of firms, including tax-benefit, risk management, liquidity risk, signalling, trade-off and agency cost arguments. However, these theories and models are all centred on firms operating in well functioning capital markets. With the U.S., UK and to some extent the Japanese economy as exceptions, most economies consist of a vast majority of non-listed firms not taking part in such capital markets. According to Berninz, Bøhren and Rydland (2007: 54) private, non-listed Norwegian firms with limited liability comprised 99,8% of the total number of limited liability firms in Norway between 1994 and 2005. Clearly, private firms play a crucial role in the Norwegian economy. Uncovering the debt maturity structure of these firms, and evaluate to what extent their debt maturity structure deviates from that of listed firms, are important to broaden the knowledge of an imperative part of the economy often neglected in financial research.

Issues concerning the debt maturity structure of Norwegian firms have been investigated in earlier theses. However, these are now more than 15 years old and arguably suffer from restrictions on both data availability and data quality. The extensive internationalisation and privatisation observed in the Norwegian economy over the last decades, along with developments in the empirical literature on debt maturity structure, thus calls for an updated study.

The importance of debt and liquidity has recently become extraordinarily apparent. The fall of the banking giant Lehman Brothers by September 2008 in many ways marked the definite start of the financial crisis. Triggered by the subprime-mortgage collapse in the U.S housing market in 2006-2007, the crisis

rapidly spread throughout the global financial system. The subsequent turmoil in the financial markets, lead to a credit squeeze that severely reduced liquidity in the intra-bank market, which in turn affected corporate lending. By the end of 2008 the U.S. and several large European economies entered into a recession, and signs of the financial crisis impacting the real economy emerged. The Norwegian economy has so far not suffered from the full severity of the financial crisis. Nevertheless, an 88% increase in bankruptcies from the 1st quarter of 2008 to 1st quarter of 2009 indicates that the Norwegian economy is also being affected (Statistics Norway 2009). Whereas debt and leverage holds the potential of lowering costs of capital and to reduce certain agency problems, creditors remain the single claimants that can rightfully force a firm into liquidation. Subsequently, leverage and debt maturity policies are vital to firms. The drastic increase in bankruptcies, observed in the Norwegian economy in recent time, adds to this argument.

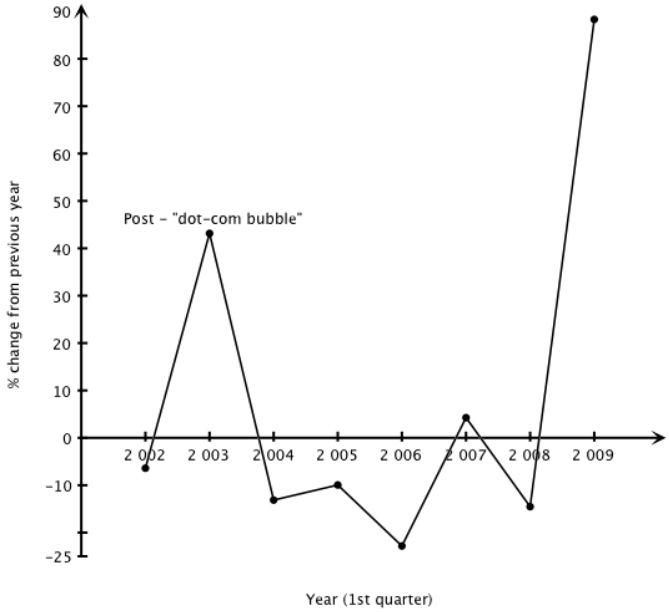

Figure 1-a Percentage change in bankruptcies

Centre for Corporate Governance Research (CCGR), under the Institute of Financial Economics at the Norwegian School of Management BI, have built a well-specified, high quality database on both listed and non-listed Norwegian firms. The inclusion of ownership, family relations and other governance related variables along with highly detailed, over-time-consistent, accounting data for a large number of limited liability firms make the database particularly well suited for studies of debt structure characteristics, and for testing related models and theories. A key feature of the database is that it enables testing of the extent to which predictions of leading theories and models, initially developed for publicly traded firms, also applies to non-listed firms.

1.1 Research question and objectives

The research question raised in this thesis reads as:

What are the key characteristics of Norwegian non-listed firms' debt maturity structure and how does it deviate from that of listed firms?

Answering this research question implies reaching the following three objectives. Firstly, provide updated characteristics on the debt maturity structure of Norwegian limited liability firms (i.e. listed and non-listed). Secondly, compare debt maturity structure characteristics across listed and non-listed firms. Thirdly, evaluate how leading theoretical models of debt maturity structure, initially developed for analysing listed firms, apply to Norwegian limited liability firms.

1.2 Thesis Outline

The following is organised into four main sections. Chapter two introduces the theoretical field of capital structure, in the context of corporate finance, followed by an overview of the theoretical and empirical research within the field of debt maturity structure. The set of hypotheses deducted from the extensive theoretical and empirical review concludes chapter two.

Chapter three outlines the methodological approach adopted in this thesis, including the research approach and research design employed A discussion concerning the econometric approach chosen follows next, along with the model specification and precise definition, or operationalisation, of the variables used.

Chapter four presents the empirical results obtained in this thesis. Descriptive statistics providing updated characteristics on the debt maturity structure of Norwegian limited liability firms are presented first, followed by the results derived from the panel data regression analysis.

The fifth and final chapter summarises and presents the main conclusions drawn. Additional remarks, evaluation of results obtained, and recommendations for further research within the field of debt maturity structure, completes this chapter and the thesis.

2 Theory and Empirical Research

This chapter introduces the theoretical field of capital structure and provides an extensive overview of the theoretical and empirical research within the field of debt maturity structure. From the extensive theoretical and empirical review, a set of testable implications formulated as hypotheses are deducted.

2.1 Introduction: Capital Structure and Debt Maturity Structure

In order to provide a general introduction to the topics of capital and debt maturity structure, a brief summary of the field of corporate finance is presented. Corporate finance covers any decisions made by a firm that have financial implications, and seeks to provide normative guidelines on how to maximize the value of a firm through management decisions. Generally, these decisions include investment decisions, financing decisions and finally dividend decisions (Ross, Jaffe, and Westerfield 2005). The investment decisions are net present value decisions concerned with project risks, cash flows and the cost of capital. The dividend decisions deal with the amount and forms in which cash that cannot profitably be put into use by the firm are returned to the owners. The financing decisions, under which capital structure constitute a major branch, are concerned with both the mix of financing sources, such as debt and equity, and the maturity structure of financing. The latter decisions further influence both investment decisions, through changes in cost of capital, and dividend decisions through its impact on free cash flow. The financing decisions thus include identifying both the optimal capital structure, i.e. optimal mix of financing sources, and the optimal debt maturity structure, i.e. optimal duration of debt. Due to the existence of market imperfections, the decisions concerning capital and debt maturity structure holds the potential to influence the value of the firm.

Over the last half of century the theoretical evolution within the field of capital structure has been substantial. The seminal works of Modigliani and Miller (1958, 1963) in many ways constitute a starting point and a benchmark for the research on capital structure. Their models were founded on the principle that under certain conditions (i.e. perfect markets) a firm's financial structure (defined by dividend

policy and choice of leverage) remains irrelevant. Modigliani and Millers' models in turn sparked a comprehensive effort within the empirical research on capital structure.

The field was further advanced by the agency problem-theory, most notably introduced by Jensen's et al. (1976) seminal paper on the theory of the firm and agency problems caused by the separation of ownership and control. Applying agency theory and assuming information asymmetries, Ross (1977) argues that, contrary to Modigliani and Miller's irrelevance theorem, management incentive schemes and leverage decisions act as signals to investors, leading to higher average valuations of leveraged firms.

Applying real-option theory and building on Ross' (1977) signalling idea, Myers (1977) developed a theory on corporate borrowing behaviour, thus providing one of the first benchmark papers on debt maturity structure. Myers and Majulf (1984) extended the work of both Ross (1977) and Myers (1977), and developed the Peking Order Theory on the role of asymmetric information between investors and firms' financing decisions. Their seminal work, modelling the optimal order of capital sources used by firms, constitutes yet another important benchmark in the field of capital structure research.

Although primarily a sub-field of corporate finance, the relevance of capital and debt maturity structure for agency costs implies that these decisions cannot be held separate from corporate governance considerations. Following 1997 there has been an extensive focus on corporate governance, following worldwide privatization, accumulation of pension fund ownership, the 1998 Russia/East Asia/Brazil crises and extensive governance scandals like Enron, Tyco and Worldcom.

While the theory of optimal capital structure has received extensive attention over the last half of century, the sub-field of debt maturity structure remains less developed; particularly in the context of non-listed firms. The following paragraphs outlines, in greater detail, major theories and models within the field of dept maturity structure. However, the theoretical field is characterised by

numerous autonomous hypotheses and no integrated theoretical framework. The presentation is therefore organised according to four different arguments, perceived to reflect the fundamental mechanism that these theories and models are founded on.

The first strain of arguments is related to the market imperfections brought about by taxation and the subsequent deductibility of interest expenses, and is referred to as the 'tax' argument.

The second strain of arguments relate to the field of risk management. The maturity structure of debt influences the risk of inefficient liquidation, and the exposure to exchange and interest rate risks. A trade-off exists between these risks and the costs of both raising and serving debt. Arguments in this category are referred to as 'risk management' arguments.

The third strain of arguments parallels those of the Peking Order Theory, in that outside investors can draw inferences on firm quality and the potential of positive or negative private information being present, through the maturities of the debt issued by firms. These arguments are referred to as 'signalling' arguments.

The fourth and final strain is related to agency problems arising from the conflicting interest of managers, owners and creditors. According to theory, the maturity structure of debt will affect these conflicts. Subsequently, these arguments are referred to as 'agency cost' arguments.

The dominating theoretical models under each of these arguments are presented first, followed by key empirical findings related to these models.

2.2 The Tax argument

The existence of market imperfections, such as taxes, result in debt financing to attain an advantage over equity due to the tax deductibility of interest expenses. This in turn will influence decisions concerning optimal capital structure. Relaxing the assumptions of perfect capital markets in their earlier work,

Modigliani and Miller (1963) incorporates the effect of taxes on capital structure in their revised model, and hence models the impact of taxes on optimal capital structure.

While Modigliani and Miller model the effect of taxes on optimal capital structure, Brick and Ravid (1985) develops a theoretical model for the relevance of taxes on debt maturity structure. By leaving the leverage ratio constant they state an irrelevance theorem under strict assumptions and subsequently, by relaxing these assumptions, they show that debt maturity is positively related to the term structure of interest rates.

Brick and Ravid's (1985) model is also consistent with Modigliani and Millers' irrelevance proposition, under identical assumptions. Based on the assumption of equal after-tax payments to bondholders, independent of debt maturity strategies, an increasing term structure will cause long term debt to accelerate the tax-benefits from debt. This argument holds when long term debt pays more in interest during the first period and less in the second, compared to interest payments on short term debt. Equally, if the term structure is decreasing, short term debt maturity is optimal. Brick and Ravid (1985) evaluate their hypothesis through simulations, as opposed to conducting empirical tests.

Although commenting on the effect of agency costs and the likely existence of an optimal debt maturity structure, Brick and Ravid (1985) does not incorporate this feature into their model. Based on the propositions of Brick and Ravid, one should expect to find a positive relationship between the term structure of interest rates and the use of long term debt.

Brick and Ravid (1991) extend their initial tax-argument from 1985 by allowing for stochastic and thus uncertain interest rates. Brick and Ravid (1991) analyse the debt maturity decision and conclude that under interest rate uncertainty a specific debt capacity factor induces more long term debt. Brick and Ravid (1991) interpret their results as to indicate that the term premium (the difference between the implied forward interest rate and the future expected spot rate) may act as a predicator to determine the optimal debt maturity.

2.2.1 Empirics

The empirical literature testing Brick and Ravid's (1985, 1991) proposed models generally find little support for their hypotheses. (See for example MacKie-Mason (1990: 1471) for a brief listing of studies unable to find significant tax effects on financing decisions). Moreover, MacKie-Mason (1990) find that taxes do influence the financing decision of firms (i.e. capital structure), however without relating these findings to debt maturity structure.

Guedes and Opler (1996) empirically tests the liquidity risk, agency costs, asymmetric information, and tax-benefit hypotheses. With regards to the tax-benefit hypothesis, their findings partly support the notion that firms with high expected future tax bills will issue more long term debt in the form of straight debt instruments. They further find that firms issuing long term debt are less likely to have net operating loss carryforwards, and that, on average, issuers of debt with maturity of 30 years or more tend to pay more taxes. However, Guedes and Opler argue that these findings are inconclusive with respect to the tax-benefit hypothesis, as firms with net operating loss carryforwards and low taxes have lower cash flows by definition, and thus may be screened out of the long bond market for other reasons (Guedes and Opler 1996: 1823).

Guedes and Opler find a negative and statistically significant correlation between the term premium and debt maturity (contrary to Brik and Ravid's (1991) predictions) and offer four different explanations for this finding.

1. firms have difficulties borrowing long term in high interest rate environments as the required rate of return creates an incentive to shift to risky projects.
2. ***(irrational managers, rational market)*** managers think they can "ride the yield curve" by avoiding the long end of the maturity spectrum when the term premium is high.
3. (***rational managers, irrational market)*** managers issue short-term debt when the term premium is high as the expectations hypothesis does not hold.

4. ***(rational managers, rational market)*** in a general equilibrium the sample firms may be inframarginal borrowers and gravitate toward the short end of the yield curve when it steepens. (Guedes and Opler 1996: 1826)

However, the authors have no strong evidence for any of these explanations. In general, Guedes and Opler (1996: 1831) find little support for the tax-benefit hypothesis.

Although provided only partially support by empirical studies, the tax-benefit hypotheses claim that debt maturity is influenced by the term premium. A positive term premium should therefore be positively correlated with more long term debt, while a negative term premium should correlate with more short term debt.

2.3 The Risk Management argument

The risk management argument is centred on the ideas of immunisation; a hedging strategy intended to reduce or eliminate interest rate risks by matching assets and debt maturities, and liquidation risk (i.e. the risk of inefficient liquidation). A common feature among the two ideas is the concept of maturity matching, which implies that the debt maturity structure of a firm is determined by its asset structure.

Morris (1976) explore risks associated with various debt maturity structures. The model presented by Morris analyses the effect of bond maturity (short vs. long) and how this affects the variance of net income, which in turn affects a firm's cost of equity. Morris assumes that firms face two types of maturity policies to decide upon, long term versus short term. A long term policy involves maturity matching, where the maturity of assets are matched to the maturity of debt. A key advantage of matching these maturities is increased predictability in terms of cost of financing assets. Furthermore, by holding debt with shorter maturities than the maturities of assets, the firm runs the risk of not being able to meet its commitments, as the assets in place have not yet generated sufficient cash flows to service the debt. In the opposite case, the firm runs the risk of having no assets in

place that can generate the cash flows necessary to service the debt, as the assets are retired prior to the debt maturing.

Nevertheless, the increased predictability may in fact be sub-optimal for equity holders, implying that breaking the maturity matching principle can be beneficial under certain circumstances. Morris argues that the covariance between net operating income and future interest rates determine when breaking this principle, by financing long term assets with short term debt rolled over, is beneficial to equity holders. According to Morris, whenever this covariance is positive the uncertainty regarding future interest costs are countered by a lower volatility in net income, resulting in both net income and subsequently cost of equity being less variable, and hence increases the value of the firm. This as in recessionary periods both net operating income and interest rates are assumed to drop. The reduction in net income will consequently not be as severe when financing with short term debt as opposed to long term debt. Long term debt involves fixed interest payments and therefore a drop in interest costs will not counter a drop in net operating income. In effect, net income becomes more volatile with a long term borrowing policy. However, this result only holds when the covariance is positive. Following a short term borrowing policy when the covariance between net operating income and interest rates are zero or negative will effectively increase the volatility in net income compared to a long term policy.

Stulz (1996) explores the area of corporate risk management and focuses on the divergence observed between theory and current practice. Academic theory claims that firms can increase their market value through implementing systematic minimum variance hedging schemes that eliminate exposures toward e.g. interest and exchange rates. In practice however, it is observed that firms tend to conduct more of a selective hedging strategy. Besides hedging against various known exposures, such as those mentioned above, firms also use corporate risk management to exploit information asymmetries in situations where managers are convinced that they hold private information that enables them to predict future price movements better than the market in total.

To bridge this gap, Stulz present a modified goal for corporate risk management, which merges academic theory with that observed in practice, stating that firms should only hedge against costly downside outcomes. Stulz therefore regard this modified goal of risk management as corresponding to purchasing an out of the money put option that limits downside risk while leaving potential upside outcomes unhedged. However, the extent to which firms can benefit from these unhedged upper tail outcomes depend on their financial strength and their ability to withstand situations where the potential upper tail outcomes manifest as negative lower tail outcomes without having notable effects on firm value. The intuition underlying this argument refers to the relation between financial strength and the cost of financial distress; unhedged positions introduce greater variability in cash flows, which increases the probability of default and hence the present value of costs of financial distress increases, causing firm value to drop.

In addition to reducing the costs of financial distress, Stulz (1996) argues that corporate risk management can contribute to reduce two other costs related to increased variability in cash flows; increased required return of stakeholders and increased tax-payments. Firstly, the increase in required return of stakeholders is particularly apparent in closely held firms where owners have large fractions of their wealth tied up in the firm. Corporate risk management efforts that hedge the financial exposure of such stakeholders will reduce their required return by lowering stakeholders' risk. In effect, the present value of the firm will increase as a result of lower return constraints. Secondly, predictability of income is crucial in order to lower tax payments. Most countries have progressive taxation systems, which imply that firms can minimise tax payments across business cycles by maintaining taxable income within optimal ranges. Stulz (1996) concludes that the managers able to utilise corporate risk management measures to reduce the net effect of these three costs will increase the value of their firm.

To summarize, Stulz (1996) provides general implications of corporate risk management and arguments emphasising its importance. Furthermore, Stulz claim that corporate risk management is key to ensure the future existence and prosperity of a firm, by reducing the likelihood of financial distress and in parallel

maintaining the financial flexibility to undertake replacement and value creating investments.

While the implications presented by Stulz (1996) are general in nature and not directly testable, Morris (1976) offers specific predictions on firm characteristics assumed to be reflected in the debt maturity structure. It is expected that firms with a positive covariance between net operating income and interest rates to exhibit low variability in net income and larger fractions of short term debt, compared to those with a zero or negative covariance. Firms in the latter two situations are thus assumed to exhibit a greater level of maturity matching and consequently an overweight in long term over short term debt. However, Morris' (1976) predictions can also be formulated and tested in an alternative way. Following Morris (1976) it is expected that firms with an overweight of long term debt to try to match the maturities of debt and assets.

2.3.1 Empirics

Guedes and Opler (1996) find that larger firms on average issue debt of shorter maturities. This is consistent with the liquidity risk hypothesis as larger firms are more likely to default. Furthermore, firms in industries with more volatile earnings prefer debt with longer maturities which is also consistent with the liquidity risk hypothesis.

Consistent with the hypothesis that firms lengthen their debt maturities to offset the higher probability of a liquidity crisis due to leverage, Stohs and Mauer (1996) find a positive relation between debt maturity and leverage.

Jun and Jen (2005) find that firms with a high degree of maturity matching are more likely to stabilise equity values and to exhibit lower stock return volatility. Subsequently, asset maturity is seen as an important determinant of debt maturity.

The effect of earnings volatility on debt maturity where found to be positive for French firms, negative for British firms, and insignificant for German firms, by

Antoniou et al. (2006). The positive relation found for French firms suggest that firms with volatile earnings issue long term debt to avoid liquidation. The negative relation found for British firms indicate a possible aversion for long term commitment.

According to the theory on maturity matching, firms seek liquidity immunisation by matching the maturities of assets and liabilities. In line with expectations, Körner (2007) find asset maturity to represent a significant predictor of debt maturity. Theory on the effect of leverage on debt maturity offer different predictions across theoretical perspectives. While the liquidity risk hypothesis predicts that firms lengthen the debt maturity to avoid exposure to bankruptcy risk, the agency cost and tax arguments predict an opposite relation. In Körner's (2007) study of Czech firms, leverage is found to be positively related to debt maturity.

2.4 The Signalling argument

The signalling argument arises due to the existence of private information, or information asymmetries, between firm insiders and firm outsiders. Building on the logics underlying the Peking-order theory, outsiders perceive the issuance of debt as signals revealing information regarding the quality of firms. Given that the debt maturity structure serves as an indicator on the quality of a firm (credit worthiness and the existence of positive private information), managers will take this into account when issuing debt. The preceding argument can therefore be considered as the analogous to the Pecking Order Theory of capital structure decisions.

Flannery (1986) explores to what extent the debt maturity structure can be used by insiders to signal the quality of a firm to less informed outsiders. Flannery presents a model where high quality firms and low quality firms signals their inherent quality through their decisions concerning the debt maturity structure. The signalling of quality is necessary due to the information asymmetry that exists between insiders (e.g. management) and outsiders (lenders). Outsiders cannot distinguish high quality firms from low quality firms as the true quality of a firm

remains private for each firm and cannot be credibly communicated to the market. Lenders therefore take this, coupled with the fact that low quality firms have a higher probability of defaulting compared to high quality firms, into account when setting their default premiums on long term debt. The premiums are charged to borrowers of long term debt as the probability of default increases with time to maturity. In Flannery's model lenders set their default premiums on long term debt at a level where the expected loss from their entire portfolio of long term loans, supplied to all firms (i.e. both high quality and low quality firms) is zero. Lenders therefore treat all firms equal based on their average perception of the entire distribution of firms. As a result, the default premiums paid by high quality firms on long term debt are too high, while the reverse holds for low quality firms. High quality firms will therefore suffer when borrowing long term, as the market value of their firm will be well below the intrinsic value, due to the excessive discounting rate. The market value of low quality firms, on the other hand, is driven above its intrinsic value.

In Flannery's model, high quality firms are aware of the excessive default premiums charged on long term debt and will therefore prefer to borrow short term. Low quality firms, on the other hand, holding the same information will consequently borrow long term. Low quality firms may also be prevented from borrowing short term, as this requires the debt to be refinanced, or rolled over. The refinancing of short term debt will reveal new information about borrowers to lenders, which may prevent low quality firms from rolling over short term debt.

Firms can thereby signal their inherent quality to outsiders on the back of their debt maturity structure decisions. Flannery concludes that high quality firms will reduce the default premium paid by signalling their quality through issuing short term debt. Low quality firms, on the other hand, reveal their quality as they are forced to issue long term debt. From Flannery's model it is expected that financially strong firms will on average have a debt maturity structure with an overweight of short term debt, relative to long term debt.

Diamond (1991) analyses debt maturity structure decisions made by firms who hold private information regarding their credit ratings. Diamonds model

incorporates several features of Flannery's (1986) model such as the information asymmetry between borrowers and lenders, the high quality versus low quality firm separation, and the signalling effect of issuing short term versus long term debt. Furthermore, borrowing short term is less costly than borrowing long term as longer maturities generates more uncertainty for lenders, with respect to repayment, since the probability of firms defaulting increases with time. Diamond's model, however, focuses on credit rating as opposed to firm quality. Firms are also divided across three groups according to their initial credit rating (high, medium or low). While firms either borrow short term or long term in Flannery's (1986) model, firms now issue both short and long term debt and the optimal mixture is a trade-off between exploiting private information and the liquidity risk of short term financing. The exploitation of private information is relevant for firms with high credit ratings who borrow short term. When short term debt is refinanced private information is revealed to lenders, information which in turn may allow firms with high credit ratings to improve their borrowing terms. The liquidity risk of short term financing, on the other hand, refers to the probability of being prevented from refinancing when the information revealed is negative.

In Flannery's model, lenders set the default premiums based on their average consideration of all firms and consequently does not categorise firms prior to their debt issue. In Diamonds model, on the other hand, firms receive an initial credit rating prior to their initial debt issue, based on the market broad view of lenders. This initial credit rating will further impact firms' future credit ratings when lenders either upgrade or downgrade firms. Firms with high initial credit ratings can therefore increase the probability of reducing their cost of borrowing by releasing private information that underpins their true position as a high quality firm.

The ability of firms to maximise the potential benefits of holding private information and to minimise the liquidity risk therefore depends on their initial credit rating and how prospects regarding future investment projects will affect their future credit ratings, and consequently their ability to refinance and exploit short term borrowing. The advantages of borrowing short term, over long term,

stems from the fact that creditors exhibits less risk from short term lending as the potential information asymmetry between borrowers and lenders is reduced. Shorter maturities also increase the probability of lenders being repaid as the shorter time frame reduces the risk of distant extreme events taking place. Extreme events such as those experienced over the last two years in the world economy. The predictions drawn from Diamond's model are similar to those of Flannery, in the sense that firms with high credit ratings, or high quality firms, borrow short term and firms with lower credit ratings, or low quality firms, borrow long term. However, a key difference exists between the two models due to the categorisation of firms. Diamond refines Flannery's categorisation of low quality firms into firms with medium and low credit ratings. Diamond argues that only firms holding a medium credit rating will borrow long term as opposed to Flannery who argues that all low quality firms will borrow long term. Firms that are initially assigned a low credit rating, on the other hand, are forced to borrow short term due to the larger probability of these firms defaulting.

In summary, the signalling argument states that due to the existence of information asymmetries outsiders draw inferences based on the maturity of the debt issued by firms. Firms holding positive private information are more likely to issue short term debt to benefit from this information. Firms holding negative private information on the other hand will prefer debt with longer maturities to avoid both costly renegotiations and the possibility of failing to roll over short-term debt (liquidation). Following Diamonds categorisation of firms (and adopting a modified version of Flannery's naming convention) it is expected that firms with high credit ratings (i.e. high quality firms) to have an overweight of short term

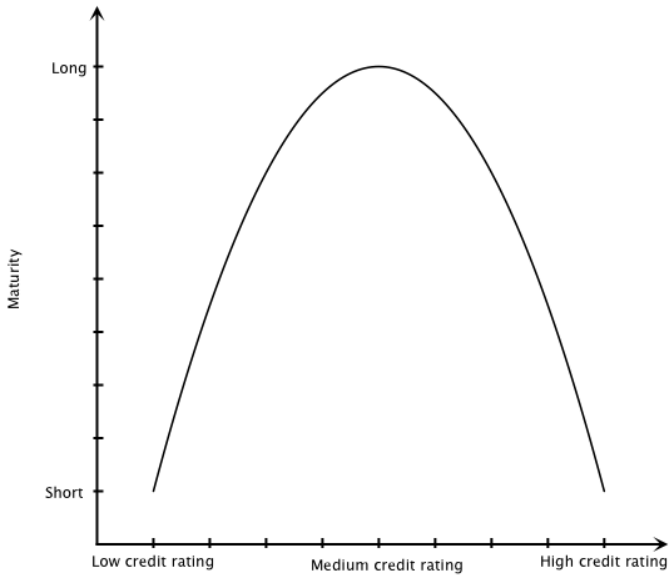

Figure 2-A The non-monotonic relation between debt maturity and credit rating

debt. Similarly, it is expected that firms with medium and low credit ratings (i.e. medium and low quality firms) to have an overweight of long and short term debt, respectively. This non-monotonic relation between debt maturity and credit ratings, or firm quality, can thus be illustrated as follows.

2.4.1 Empirics

Stohs and Mauer (1996) find support for both Flannery's (1986) and Diamond's (1991) predictions in their examination of empirical determinants of debt maturity structure. In consistence with the signalling argument, they find that firms with larger earnings surprises tend to hold more short term debt. In accordance with the predictions of Diamond, they also find strong evidence for a non-monotonic relation between the debt maturity structure and the quality of firms with public debt ratings. Lastly, Stohs and Mauer find that firms with intermediate credit ratings rely more heavily on bank financing for short term financing needs, and that firms with higher credit ratings tend to rely more on directly placed debt.

Finding that firm size and bond ratings remain important determinants of a firm's choice of debt maturity, Guedes and Opler (1996) provide strong support for Diamond's (1991) model of debt maturity choice where firms can be screened out of the long term bond market due to moral hazard problems. However, Guedes and Opler (1996) do not find support for the implied signalling hypothesis as they do not find any relation between debt maturity choices and future stock price performance.

Berger et al. (2005) test the implications of Flannery's (1986) and Diamond's (1991) models and find consistency with both models for low risk firms (i.e. high quality firms), but conflicting findings for high risk firms (i.e. low quality firms) with regards to Diamond's model and other empirical findings. Low risk firms are found to have significantly shorter maturities, compared to other firms, and these maturities tend to increase significantly when information asymmetries are reduced, thus suggesting a strong quantitative role of asymmetric information in determining the debt maturity. For high risk firms Berger et al. (2005) do not find

significant differences in debt maturity from that of intermediate risk firms (i.e. medium quality firms). The lack of significant differences for high risk firms is explained by the potential advantage held by banks over public debt markets in gathering information, renegotiating loans, and enforcing loan contract terms, like collateral and restrictive covenants.

Highfield (2008) find, using a incremental debt issue approach and a negative binominal estimation method, no support for firms using shorter maturities as a signal of quality. No evidence supporting the notion that low quality firms emulate high quality firms with respect to debt maturity choices were found. Lastly, no evidence supporting the hypothesis that both high and low quality firms issue debt with shorter maturities was found. However, credit ratings demonstrated a direct relation between debt maturity and firm quality, subsequently supporting the theory that risky firms (i.e. low quality firms) are screened out of the long term debt market.

2.5 The Agency Cost argument

A major advance in the literature on corporate finance was brought about by the inclusion of agency cost theories. Based on the assumption of conflicting interests between different claimants, such as owners, managers and creditors, agency theory enabled a better understanding of corporate financial behaviour. The presence of stakeholders with deviating interests, who do not internalise the wealth and utility of others, might lead to expropriating behaviour, which again reduce the overall value of the firm. The costs accrued on the back of these conflicting interests are commonly referred to as agency costs (Jensen et al. 1976; Shleifer and Vishny 1997; Becht et al. 2005; Becht, Bolton, and Röell 2002) Owners, being the residual claimants, ultimately carry these costs.

Theory prescribes three main types of agency problems potentially affecting the debt maturity structure. These are asset substitution (the preference for high risk projects over less risky projects with the same NPV), underinvestment (failure to invest in projects with positive NPV as creditors stand to gain more than owners)

and overinvestment (investment in projects with negative NPV at the expense of creditors).

To facilitate the separation of the different potential agency conflicts, a certain terminology seems to have gained ground in the literature. Adopting the notation of Villalonga and Amit (2006) the agency conflict between managers and owners is referred to as A1; the conflict between small and large owner as A2; the conflict between owners and creditors as A3; and the conflict between owners and other non-financial stakeholders as A4.

Myers (1977) and Barnea, Hagen and Senbet (1980) models the relation between agency costs and debt maturity. While Myers (1977) centres his models around the A3 problem, the models of Barnea et al. (1980) comprise both the A1 and the A3 problems. Myers (1977) states that agency costs relating to the issuance of debt can be resolved by shortening the debt maturity. Barnea et al. (1980), also focus on resolving agency problems arising from information asymmetry, risk incentives and underinvestment. However, as opposed to Myers (1977), Barnea et al. (1980) argues that these problems can be resolved by issuing call provisions on corporate debt, as opposed to issuing debt with shorter maturities. Nevertheless, Barnea et al. (1980) admit that the agency problems they explore can equally be resolved by shortening the debt maturity. Corporate debt with call provisions and short term debt consequently represent substitutes as solutions to costs associated with the agency problems explored by Barnea et al. (1980).

While Myers (1977) portrays that there exists an optimal level of promised payments to lenders, Barnea et al. (1980) argues that there exists an optimal expiration date of the call provision. The intuition underlying why firms can eliminate the agency costs through issuing call provisions is as follows; the amount of debt that firms can raise depends upon market expectations toward future performance. Assuming the existence of two projects where one has a greater present value than the other. Firms know that they can invest in the high value project, while the market expects firms to take upon the low value project with greater risk. The amount of debt raised by firms is therefore restricted by market expectations, which in turn affects the value of the firm negatively. Firms

can eliminate this cost by issuing call provisions which allows them to repurchase the debt, issued on the back of current market expectations, at future dates. This feature allows firms to benefit from the arrival of new information in the future, which improves the market expectations of the probability that firms are running the high value project. The call provision enables firms to repurchase outstanding debt and reissue new with improved financial terms and thus increasing the amount of debt raised.

Even though Myers (1977) and Barnea et al. (1980) proposes different approaches to resolving certain agency problems the outcome remains the same. Due to difficulties in observing whether or not firms have issued call provisions, testing hypotheses on the back of Barea et al. (1980) is impaired in this thesis.

2.5.1 Empirics

Easterwood and Kadapakkam (1994) empirically tests several agency cost hypotheses by removing the confounding effect of leverage. The authors find that debt with shorter maturities is more frequent in situations where the potential of agency costs are higher, especially for larger firms with lower costs of issuing debt.

Barclay and Smith Jr. (1995) find empirical support for the inverse relation between growth opportunities and debt maturity structure, predicted by Myers (1977) as a means to reduce the underinvestment problem raising from the conflicting interest between owners and creditors. Barclay and Smith Jr. (1995) also find that regulated firms generally have longer debt maturities, which is regarded as being consistent with the fact that such firms are less prone to the underinvestment problem. However, they do not control for the effect of leverage in their tests.

Stohs and Mauer (1996) conduct broad emprical testing of the determinants of corporate debt maturity structure, including the agency cost, signalling, liquidity risk, maturity matching and tax hypotheses. With regards to the agency cost

theory, the authors predict that debt maturity will decrease with decreasing firm size and also with a larger proportion of growth opportunities in the investment opportunity set. Their results provide only limted support for the claim that debt maturity serves as a mechanism to reduce A3 agency conflicts, and that small firms tends to hold more short term debt. However, the latter finding provides only limited support for the predictions of Myers (1977), that debt maturity is inversely related to proxies for a firm's growth opportunities.

In a study of the relation between agency costs and ownership structure, Ang, Cole and Lin (2000) find that external monitoring by banks reduce the agency cost incurred by firms relying mainly on bank debt.

Datta, Iskandar-Datta, and Raman (2005) argue that the conflict between shareholders and managers, A1, over the debt maturity structure is rooted in the inherent preference for less monitoring by self-centred managers. They find that managers with high stock ownership choose shorter debt maturities and thus accept more frequent monitoring. More entrenched managers, holding less equity, choose longer debt maturities. These findings were significant and robust, even after controlling for a number of determinants of debt maturity structure, identified in the literature, and while modelling debt maturity and leverage as endogenous variables. Similarly, Benmelech (2006) argue that entrenched managers will prefer long term debt financing in order to preserve private benefits of control, even when liquidation is efficient. Benmelech (2006) also provide empirical support for the notion that entrenchment and managerial private benefits are important determinants of debt maturity structure.

García-Teruel and Martínez-Solano (2006) examines the effects of managerial equity holding and the presence of large shareholders on the debt maturity structure of Spanish listed firms. While controlling for known determinants of debt maturity structure they find a non-monotonic or concave relation for both. With regards to the effect of managerial equity holdings, their results correspond to those of Datta, Iskandar-Datta, and Raman (2005), and Benmelech (2006) despite using a sample originated in a different institutional setting, namely civil

law, as opposed to the Anglo-Saxon, or common law, setting often dominating the literature.

Adding to the role of owners' and shareholder rights' influence on debt maturity structure, Jiraporn and Kitsabunnarat (2007) find a inverse relation between the strength of shareholder rights and debt maturity. They contend that weak shareholder rights leads to managers favouring long term debt as this implies less frequent monitoring. Jiraporn and Kitsabunnarat also demonstarte that the use of longer debt maturities are likely to be brought about by weak shareholder rights.

Whereas the preceding paragraphs have been centred on the A1 problem, Deesomsak, Paudyal, and Pescetto (2009) argue that when ownership concentration is high, the interest of managers and owner are likely to be more aligned, thus reducing the A1 problem. However, such alignment is argued to increase the A3 problem due to moral hazard and thus increase the cost of debt. Subsequently the moral hazard hypothesis predicts that firms with high ownership concentration will issue more short term debt to mitigate the A3 problem. Shareholder rights and ownership concentration can therefore to some extent be seen as substitutes as both act as mechanisms to ensure that the control of the firm remains within the hands of the owner.

A particularly interesting issue with regards to agency costs is that of family firms. While rather sensitive to the way in which they are defined, family firms constitute a large fraction of the non-listed firms in the Norwegian economy (Berzins, Bøhren, and Rydland 2007: 38-39). Whereas Schmid et al. (2008) argue that family involvement is an effective governance mechanism resulting in reduced A1 conflicts, García-Teruel and Martínez-Solano (2006) are unable to find any particular effects when the main shareholder is a family, in their survey of Spanish listed firms.

While agency problems are difficult to observe directly, shorter debt maturities are expected to occur more frequently under conditions where asset substitution, under and overinvestment problems are more likely.

2.6 Summary of theoretical predictions

To present a compact overview of the theoretical models described above, a table organised according to the four arguments, containing variables and predictions, is presented.

	Argument	Variables	A priori relation	Reference
Tax-benefit	Short and long term debt differs with respect to the timing of tax-benefits, arising from the deductibility of interest expenses. Depending on the term structure of interest rate, firms seek to maximise the net present value of tax-benefits through an optimal maturity structure of debt – leading to an acceleration of tax-benefits. Depending on whether interest rates as are modelled as stochastic or not, the term structure and the term premium are identified as the respective predicators of debt maturity.	*Term structure*	Positive	(Brick and Ravid 1985)
		Term premium	Positive	(Brick and Ravid 1991)
Risk management	Firms may hedge their exposure to interest rate risks by matching the duration of assets to the debt used in financing these assets. This policy performs best for assets and debt with long maturities. Under certain conditions a complete hedge is not optimal. This is particularly true when firms want to hedge against costly downside, while maintaining the exposure towards positive upside outcomes. If financed mainly using short term debt, firms risk not being able to roll over their loans at maturity. This is especially true for risky firms. Thus to avoid inefficient liquidation, firms with volatile earnings prefer long term debt.	*Asset structure*	Positive	(Morris 1976)
		Earnings volatility	Positive	
Signaling	From the debt issued by firms, investors draw inferences on their inherent quality, and whether they hold positive private information. High quality firms will borrow short term in order to benefit from the release of positive private information. Low quality firms prefer borrowing long term, to avoid liquidation if negative private information is released when short term debt is refinanced. However, low quality firms are screened out of the market for long term debt and thus forced to borrow short term A similar argument can be made with respect to credit ratings; firms with high credit ratings borrow short in order to benefit from private information, while firms with low credit ratings are forced to borrow short term. Firms with medium credit ratings borrow long term, to avoid a fall in the credit rating, and the subsequent liquidity problems in rolling over short term debt, if negative private information is released. Hence a non-monotonic relation between debt maturity and firm quality is predicted.	*Firm quality*	Concave	(Flannery 1986)
		Credit rating	Negative	(Diamond 1991)
Agency problem	Agency problems, A1 and A3, can be resolved or reduced through the use of either short term debt or maturity matching, where the first is generally regarded as most efficient. Thus, under conditions where agency conflicts are likely to be frequent, or severe, theory predicts short term debt to be more frequently used. The agency problems related to the use of debt include underinvestment, overinvestment, and asset substitution. These problems will all intensify as the probability of financial distress increases.	*Underinvestment*	Negative	(Myers 1977) (Barnea, Haugen, and Senbet 1980)
		Overinvestment	Negative	
		Asset substitution	Negative	
		Probability of financial distress	Negative	

Table 2-A Summary of theoretical predictions

2.7 Summary of empirical findings

The comprehensive summary of empirical findings on debt maturity structure is reported in appendix A. The empirics are extensive and some characteristics are therefore useful to present. Firstly, the results obtained by various researches are far from consistent; where some researches find significant positive relations others find the opposite. Secondly, an inconsistency concerning how proxies are both defined and applied seems to exist; significant relations between debt maturity structure and a given explanatory variable may be interpreted as support for different theoretical models, thus indicating a lack of an integrated theoretical framework on debt maturity structure.

2.8 Deducted Hypotheses

On the back of the theories and empirics presented above, testable implications stated as hypotheses are deducted. The hypotheses are organised according to the four arguments used in the theory section.

2.8.1 Tax argument

According to the models of Brick and Ravid (1985, 1991) the tax-benefit hypothesis claims that debt maturity is influenced by the term premium (the difference between the implied forward interest rate and the future expected spot rate). In line with their predictions a positive relation between debt maturity and both the term premium and the term structure of interest rates is expected.

TAX 1 Debt maturity is positively related to the term premium (TP)

TAX 2 Debt maturity is positively related to the term structure (TS)

However, only scarce empirical support for these hypotheses is found in the literature. On the back of the absent empirical support, these hypotheses are not further pursued and tested in this thesis. To control for the effect of the market imperfections brought about by taxes, the following hypothesis is formulated

based on the argument that non-debt tax shields induce more long term borrowing.

TAX 3 Debt maturity is positively related to non-debt tax shields (NS)

2.8.2 Risk management argument

Risk management policies aim at reducing the riskiness of firms. According to Morris (1976) firms essentially choose between two risk management policies; either a "short policy" where the principle of maturity matching is violated by using shorter debt maturities, or a "long policy" where debt maturities are longer and matched to the maturities of assets. The rationale behind a long policy is to avoid inefficient liquidation associated with frequent refinancing (liquidation risk). The rational for the short policy is to benefit from less costly short term financing, while still maintaining a natural hedge when the covariance between net operating income and future interest rates is positive. The latter cause both net income and cost of equity being less variable, thus increasing the value of the firm. The riskiness of firms is proxied by earnings volatility.

However, the issue of risk management is not only of concern to managers, but equally important to creditors. Subsequently, the risk management policy implemented will be influenced by the negotiating power of the firm and creditors, respectively. As negotiating power is difficult to proxy, two opposing hypotheses are formulated and meant to capture both the eventuality that the discretion of debt maturity choices lay with the creditors (supply-side driven) and the firms (demand-side driven).

RM 1 Debt maturity is negatively related to earnings volatility (EV)

RM 2 Debt maturity is positively related to earnings volatility (EV)

Support for RM1 would indicate that creditors exert the most influence over the maturity decision, whereas support for RM 2 would indicate that the firms have relative discretion over the maturity decision.

In accordance with the implications of the "long policy", firms are expected to match the durations of assets to that of debt. To test the predictions of the "long policy" the following hypothesis is formulated.

RM 3 Debt maturity is positively related to asset structure (AS)

2.8.3 Signalling argument

The predictions derived from the models of Flannery (1986) and Diamond (1991) implies a non-monotonic relation between firm quality and debt maturity. The literature also provides ample empirical support for these predictions. In line with the models and empirical findings the following hypotheses are formulated.

SIG 1 Debt maturity is negatively related to high firm quality (HQ)

SIG 2 Debt maturity is negatively related to low firm quality (LQ)

SIG 3 Debt maturity is positively related to medium firm quality (MQ)

Information asymmetries between firms and creditors are expected to decreases with the passage of time. Hence, it is expected that debt maturity is positively related to the duration of creditor relations, proxied by firm age.

SIG 4 Debt maturity is positively related to firm age (FA)

2.8.4 Agency costs argument

Agency problems are inherently difficult to measure directly, and hence a more indirect approach is necessary. Agency problems related to the use of debt will occur in situations where asset substitution, under and overinvestment problems are more likely. If debt maturity is used to remedy these agency problems, shorter maturities are expected to coincide with these situations.

Monitoring costs and size: Large firms generally attract more attention in the societies they operate, and at the same time these firms hold scale benefits in producing and communication information to the public. Based on these assumptions, monitoring is expected to be easier as firms grow and subsequently to reduce the costs of monitoring. As a result, the potential for agency conflicts is reduced, implying that shorter debt maturities not used to resolve agency conflicts.

AC 1: Debt maturity is positively related to firm size (FS)

Monitoring and asset structure: Managers of firms with a high portion of fixed assets generally have less flexibility with respect to investment decisions, compared to managers of firms with higher portions of current or intangible assets. Subsequently, monitoring of firms with a high fixed to total assets ratio should be easier and less costly, again leading to less reliance on short term dept to mitigate potential agency problems.

AC 2: Debt maturity is positively related to asset structure (AS)

Asset substitution: The potential problem of asset substitution increases with decreasing asset duration, as managerial investments discretion increases. Increased possibility for such wealth transfer implies increased monitoring costs for creditors. If short term debt were used to mitigate this potential agency problem, one would expect to observe a negative relation between a firms average asset life and debt maturity.

AC 3: Debt maturity is negatively related to average asset life (AL)

Growth opportunities and underinvestment: Several studies identify relations between debt maturity structure and a firm's growth opportunities. Along with growth opportunities follows numerous future investment decisions for managers of such firms, increasing the potential for underinvestment problems.

AC 4: Debt maturity is negatively related to growth opportunity (GO)

Financial distress: The probability of financial distress intensifies the agency problems between owners and creditors (A3). Risky firms have a higher probability of financial distress and consequently, firms with volatile earnings should experience more severe A3 problems. If short term debt is employed to mitigate these problems one would expect to observe a negative relation between debt maturity and volatility in earnings before interests and taxes.

AC 5: Debt maturity is negatively related to volatility in earnings (EV)

Ownership structure:

The free riding problem occurs in situations where no owner holds a sufficiently large share of the firm, which would allow them to capture enough of the benefits, following an intervention, to offset the costs of such. Low ownership concentration may therefore lead to a lack of monitoring incentives among owners. An approach to remedy this incentive problem is to ensure short term financing and thus shift the monitoring costs to the creditors through frequent renegotiations and refinancing. Firms exhibiting very low ownership concentration are expected to have debt with shorter maturities. On the back of these arguments the following hypothesis is proposed.

AC 6: Debt maturity is negatively related to ownership concentration (OC)

Managerial ownership: With low managerial ownership, the owners will seek to control the discretion of managers through the use of shorter maturities. As managerial ownership increases, the more power the manager exerts on the maturity decision, and in line with their inherent preference for less monitoring, managers seek to increase the maturities to ensure the "quiet life". However as managerial ownership further increases, the more aligned the interest of managers and owners becomes, leading to a less severe A1 problem. With the A1 problem minimised the owners seek to reduce the costly A3 problem by maintaining shorter maturities. In total this indicates a concave relation between debt maturity and managerial ownership.

AC 7: Debt maturity is concavely related to managerial ownership (MO)

Family control: In line with the proposition of Schmid et al. (2008), stating that family involvement may act as an effective mechanism to control agency problems, thus reducing the need for shorter maturities for the same purpose, the following hypothesis on the relation between family control and debt maturity is formulated.

AC 8: Debt maturity is positively related to family control (FF)

The preceding paragraphs have presented the hypotheses and predictions deducted from a variety of theories and existing empirics on the topic of debt maturity structure. However, a majority of empirical studies have rendered no support for the tax-benefit argument. On the back of this fact, and also to limit the scope of this thesis, hypotheses TAX 1 and TAX 2 will not be subject to further analysis.

3 Methodology and Data

This chapter provides a description of the methodology, techniques and procedures to be employed in order to answer the research question.

3.1 Research approach

The purpose of this thesis is to examine the debt maturity structure of Norwegian limited liability firms and how it differs between listed and non-listed firms. In doing so, leading theories and models proposed to explain the debt maturity structure are employed; subsequently a deductive research approach is taken (Saunders, Lewis, and Thornhill 2007: 117). The dual nature of this thesis further calls for a descriptive and explanatory design (Saunders, Lewis, and Thornhill 2007: 134). The descriptive design allows updated characteristics of the debt maturity structure of the sample firms to be identified. The explanatory design enables hypothesis testing and to assess how theories and models, initially derived for listed firms, applies to non-listed firms. The combination of the deductive approach, the descriptive and explanatory research, and the quantitative nature of the data used, calls for a survey strategy to best fulfil the purpose of this thesis (Saunders, Lewis, and Thornhill 2007: 138).

3.2 Research method

The quantitative nature of both the data used and the analytical methods applied, implies following a quantitative mono-method approach. Despite being well suited to examine the research question at hand, given the large sample relative to the population, quantitative methods still hold some weaknesses in their inability to uncover nuances and more fundamental causal links (Saunders, Lewis, and Thornhill 2007).

As pointed out by Stohs and Mauer (1996) the theories on debt maturity structure provide a combination of both cross-sectional and time-series predictions. While agency costs and risk management predictions are primarily cross-sectional, signalling and tax-benefit predictions are generally time series. The mix of both

cross-sectional and time series predictions calls for either a separate cross-sectional and time series analysis, or a panel data approach where fixed effects are controlled for. The nature of the CCGR database, containing both cross-sectional and time-series data, enables the use of panel data techniques.

3.3 The data

The data used in this thesis is provided by the CCGR database, and contains accounting data that follows Norwegian accounting regulations for all firms with limited liability. A total of 28 standard accounting and governance data items were extracted from the database in order to construct the variables required to provide descriptive statistics and to conduct hypothesis testing.

3.4 Population and sample

The CCGR database contains data on all firms registered in Norway with limited liability. The dataset contains fourteen and seven years of accounting and governance data, respectively. Over the sample period (1994-2007) the number of firms in the database increases from initially 100,000 firms to 220,000, thus leaving annual data on 148,000 firms on average. From the relevant population (1994-2005) of about 130,000 AS and ASA firms, Berzins et al. (2007) extract a sample of 77,000 non-listed (private), on average per year, which they analyse. Berzins et al. (2007) also includes complete data on 134 listed (public) firms in their analysis. This thesis aims at following Berzins et al. (2007) and apply similar filters to the data set. Extending the sample period to 2007, using similar filters requiring (1) positive sales, (2) assets, (3) equity and (4) working capital less or equal to total assets and (5) excluding financial firms, without discriminating on firm type, render an average sample of 100,000 firms per annum. Equal filters render a sample of 126 listed firms on average for the sample period. The following tables provide detailed effects of each filter applied to the population of firms.

Table 3.4 Sample filtering and distribution

Panel A Sample filtering all firms

No:	Filtering	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
	No filter	99,379	105,659	111,380	119,100	127,082	131,041	145,656	149,468	153,912	155,996	158,259	182,689	208,971	222,196	147,913
1	Operating profits > 0	86,666	92,012	96,914	102,884	108,806	111,492	122,777	125,724	129,413	132,265	134,566	150,601	161,248	169,152	123,180
2	1+ Assets > 0	86,283	91,631	96,536	102,465	108,423	111,031	122,221	125,136	128,822	131,769	134,034	149,994	160,749	168,652	122,696
3	2 + Equity ≥ 0	70,855	74,743	79,332	85,360	90,761	93,985	103,716	105,641	108,365	111,675	114,658	129,376	138,772	146,016	103,804
4	3+ WC ≤ A	70,380	74,584	79,146	85,171	90,571	93,919	103,599	105,536	108,255	111,501	114,501	128,976	138,636	145,886	103,619
5	4+Excluding financials	69,872	73,510	77,910	83,888	89,244	92,466	99,855	101,202	103,980	107,254	110,485	124,632	132,055	138,702	100,361
	Sample	69,872	73,510	77,910	83,888	89,244	92,466	99,855	101,202	103,980	107,254	110,485	124,632	132,055	138,702	100,361

Table 3-A Sample filtering all firms

Panel B Sample filtering listed firms

No:	Filtering	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
	No filter	116	142	148	187	207	190	188	181	176	157	165	186	199	.	172
1	Operating profits > 0	101	135	135	165	182	167	162	163	156	139	147	167	175	.	153
2	1+ Assets > 0	101	135	135	165	182	167	162	163	156	139	147	167	175	.	153
3	2 + Equity ≥ 0	100	134	135	165	182	166	160	160	152	138	147	167	174	.	152
4	3+ WC ≤ A	100	134	135	165	182	166	160	160	152	138	147	167	174	.	152
5	4+Excluding financials	100	107	109	138	151	136	130	131	124	111	119	137	149	.	126
	Sample	100	107	109	138	151	136	130	131	124	111	119	137	149	.	126

Table 3-B Sample filtering listed firms

Legend: Missing values are denoted with a dot (.).

Panel C Distribution of filtered sample (all firms) across industry sectors, listing status and family firm status															
Categories		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Industry sector codes	0	69,872	25,032	20,173	5,682	6,535	6,026	7,784	20,758	27,607	10,468	15,635	17,439	23,122	6,905
	1	.	879	1,107	1,578	1,752	1,849	1,918	1,676	1,529	1,994	1,970	2,242	2,403	2,716
	2	.	6,895	7,642	8,510	8,810	8,926	8,787	7,187	6,721	8,376	8,159	8,297	8,034	9,207
	3	.	175	227	318	389	470	538	494	484	654	693	760	774	885
	4	.	5,306	6,484	7,471	7,884	8,128	8,132	7,038	6,686	8,317	8,251	8,779	9,137	12,010
	5	.	16,447	21,078	36,394	39,590	42,675	48,180	43,544	41,462	53,543	52,634	63,483	65,715	80,191
	7	.	16,194	18,011	19,546	19,706	19,877	19,892	16,531	15,762	19,287	18,540	18,842	18,145	21,248
	8	.	2,582	3,188	4,389	4,578	4,515	4,624	3,974	3,729	4,615	4,603	4,790	4,725	5,540
Sample size (N)		69,872	73,510	77,910	83,888	89,244	92,466	99,855	101,202	103,980	107,254	110,485	124,632	132,055	138,702
OSE Listing Status	N	69,772	73,403	77,801	83,750	89,093	92,330	99,725	101,071	103,856	107,143	110,366	124,495	131,906	.
	Y	100	107	109	138	151	136	130	131	124	111	119	137	149	.
Sample size (N)		69,872	73,510	77,910	83,888	89,244	92,466	99,855	101,202	103,980	107,254	110,485	124,632	132,055	.
Family Firm	N	.	.	.	.	.	.	16,486	16,681	16,422	16,927	17,231	19,357	19,124	18,726
	Y	.	.	.	.	.	.	64,997	67,906	67,724	70,822	72,370	69,749	67,908	74,933
Sample size (N*)		.	.	.	.	.	.	81,483*	84,587*	84,146*	87,749*	89,601*	89,106*	87,032*	93,659*

Table 3-C Distribution of filtered sample firms

Legend: Missing values are denoted with a dot (.)

Deviation from total sample (N) due to missing values on family ownership (item 15302 in the CCGR database) is denoted by a star (*)

Industry sector codes; 0= missing or multi sector firms, 1=Agriculture, forestry, fishing, mining, 2=Manufacturing, chemical products, 3=Energy, 4=Construction, 5=Service, 6=Financials (excluded), 7=Trade, 8=Transport

For dummy variables Y=yes and N=no

The discrepancy between the filtered dataset used in this thesis and that utilised by Berzins, Bøhren, and Rydland (2007) stems from the latter's use of filters based on employee data and the requirement of current assets being equal or greater than cash equivalents held by the sample firms.

For the purpose of panel data regression analysis, a subsample containing observations between 2000 and 2006 was extracted, as governance data is only available from 2000, while listing status is not available for 2007. Given that the number of cross-sectional observations varies over time, the subsample is categorised as an unbalanced panel data set, with a total of 811,613 entries (195,404 cross-sectional entities, spread across 7 years) (Brooks 2008).

3.5 Descriptive analysis

The descriptive part is aimed at providing the basic characteristics of the debt maturity structure of Norwegian limited liability firms, and outlines categorical differences across industry sectors, listing and family firm status. Both variables directly related to the debt maturity structure, such as leverage, and variables identified by theory as explanatory variables for debt maturity structure, is described in order to provide a comprehensive description of the data. Means and standard deviations for each of these variables are reported annually across industry sectors, listing and family firm status. A correlation matrix, depicting the interrelations among the variables, is also provided. Complete descriptive tables are provided for the following variables.

List of variables used to provide descriptive statistics on debt maturity structure of Norwegian limited liability firms

1)	Debt maturity (DM)	7)	Firm size (FS)*
2)	Leverage (LV)	8)	Managerial ownership (MO)*
3)	Asset structure (AS)	9)	Z-Score (ZS)*
4)	Average asset life (AL)*	10)	Profitability (PR)*
5)	Growth opportunities (GO)*	11)	Non-debt tax shields (NT)*
6)	Firm age (FA)*		

*Descriptive statistics for variables marked with *are reported in Appendix 2*

Table 3-D Descriptive tables presented

3.6 Panel data analysis

In Bøhren and Ødegaard's (2006) empirical work on the interdependency between corporate governance and economic performance several econometric estimation procedures are applied in order to explore how the significance of conclusions drawn varies with different econometric methodologies. The authors demonstrate that when utilising single equation estimation techniques and models that ranges from univariate to fully specified multivariate models, the main conclusions still adhere. Based on the theoretical argument that simultaneous equation systems, capturing both reverse causation and endogenity, are to offer a deeper insight into the relationship researched upon, compared to single equation models, Bøhren and Ødegaard (2006) applies this estimation technique. The sensitivity of estimates, drawn from simultaneous equation models, towards the choice of instrument requires that this decision is driven entirely by theory in order to obtain valid results. The authors conclude that in situations where the ground theory is silent in terms of such predictions, the simultaneous equation modelling approach cannot be argued to provide a greater insight than the single equation approach. Resting on the findings of Bøhren and Ødegaard (2006) and also the dominance of the single equation modelling approach in prior and current research this thesis will combine the use of panel data and single equation estimation techniques.

To examine the hypothesis stated above, panel data analysis is utilised. Advantages of panel data over either cross-sectional or time series data, commonly posed in the literature all revolves in short around the fact that panel data allow researchers to conduct empirical analysis not possible to accomplish with only time series or cross-sectional data (Gujarati 2003). The combination of both cross-sectional and time series data not only considerably increases the number of observations, but also allows the researcher to measure effects that are affected jointly by factors changing due to the mere passage of time, as well as cross-sectional factors. Panel data therefore enables more complicated behavioural models to be examined, as well as analysing the dynamics of change. Furthermore, the theory also predicts that the increase in degrees of freedom, due to the number of observations, should result in more efficient estimates. The combination of cross-section and time series data also allows panel data analysis to explicitly take heterogeneity amongst cross-sectional into account (Baltagi

2008; Brooks 2008). The advantages of using panel data are nevertheless accompanied with several warnings and issues to consider when applying this technique. Baltagi (2008) lists several limitations of panel data, on a general level, relating to the complexity and the time consuming data collection and management processes.

Panel data regression models are broadly separated into two classes, namely fixed effects models (FEM) and random effects models (REM). The essential distinction between the two classes of models lies in the assumption of how individual (i.e. cross-sectional entities) differences are controlled for in the data. FEM controls for fixed effects by lowering or raising the regression line by a fixed amount for each individual. REM on the other hand controls for individual differences by regarding them as random disturbances.

Models covered by the FEM class differ in terms of the type of fixed effects, cross-sectional and/or time effects, controlled for, leaving several models with varying combinations (Brooks 2008). The most prominent FEM is the Least Square Dummy Variable (LSDV) regression model (Gujarati 2003). LSDV models assume that the slope coefficient of the regressors remain constant while the differences in individuality are accounted for by the intercept term, which may vary across cross-sectional entities. These models are therefore time invariant meaning that the intercept term of each individual only varies across cross-sectional units, not over time. The LSDV model derives its name from the approach taken in measuring the individual effects through the use of dummy variables.

The empirical findings of Berzins, Bøhren, and Rydland (2007), drawn from the CCGR database, indicates time invariance in the sense that cross-sectional findings seems to remain constant over the time period studied. Considering this in conjunction with the fact that FEM is regarded to be more appropriate, compared to REM, in situations where the sample drawn corresponds to the entire population, thus favours adopting a LSDV approach in this thesis (Gujarati 2003). The panel data regression models estimated will therefore capture heterogeneity amongst Norwegian limited liability firms through the use of dummy variables.

These individual effects are assumed to only vary cross-sectional and remain constant for each firm over time. The models estimated will further capture unobserved heterogeneous characteristics that have a significant effect on the debt maturity structure, and which may vary both cross-sectional and over time, through an individual error term. The importance of capturing heterogeneity is emphasised by Baltagi (2008) as failing to capture this increase the risk of biased estimates.

While the ease of use and broad applicability stands out as key features of the LSDV approach, Gujarati (2003) lists several issues that researchers must keep in mind when applying such regression models. The main objective however, against this model is the consumption of degrees of freedom, due to the use of cross-sectional dummy variables. Moreover, the increase in number of variables also introduces the risk of multicollinearity and thereby rendering precise estimates of parameters increasingly difficult. Gujarati (2003) furthermore states that REM provides more efficient estimates than FEM when the number of cross-sectional units is large and the number of time series data points are low, given that the assumptions of REM holds. However, a number of the assumptions underlying REM does not hold in this study; REM is only appropriate when the cross-sectional units are believed to be random draws from a vastly larger sample; Furthermore, REM estimators are only unbiased if the unobserved heterogeneity, captured by the cross-sectional specific random disturbance term, is uncorrelated with every regressor, an assumption that cannot be validly claimed to hold given the lack of ground theory within the research area relevant for this study. In short, the issues addressed with respect to FEM and LSDV are generally not resolved by employing a REM approach.

The decision to use FEM and more specifically a LSDV approach, as opposed to taking a REM approach, therefore rests on the arguments presented above and also the results obtained from conducting a formal Hausman's test (Wooldridge 2002). In essence, the Hausman's test examines whether the strict assumptions of REM, where the explanatory variables have to be uncorrelated with the individual random error term (the criteria stated in the null hypothesis), are fulfilled (Brooks 2008). The reasoning that underlies the dual approach taken, verbal reasoning and

formal testing, thus reflects one of the key issues with panel data analysis; that there exists no clear-cut rules guiding researcher in the selection between FEM or REM (Gujarati 2003).

The results of the Hausman's test conducted in this thesis, rejects the null hypothesis at a one percent significance level. This result further supports the argument of FEM being a more appropriate approach than REM for this study. The decision to use FEM is also in line with the approach often used by researchers who empirically investigates debt maturity using panel data (Farooqi-Lind 2006; Heyman, Deloof, and Ooghe 2008; Körner 2007; Stohs and Mauer 1996).

3.6.1 Method of estimation

The dominant estimation method applied in empirical studies on debt maturity structure is pooled Ordinary Least Squares (OLS), where neither cross-sectional (i.e. intercept coefficient) nor temporal (i.e. slope coefficient) differences are captured (Körner 2007). The criticism towards this constant coefficient model is directed at its strong assumption of cross-sectional and temporal differences having no statistically significant effect. The FEM estimated in this thesis addresses this issue by allowing for individual unobservable differences through entity specific intercept terms, while still utilising OLS (Brooks 2008). However, several issues regarding the use of OLS and FEM exist, where those relating to the FEM were discussed above. The main treats to unbiased and efficient OLS estimates are heteroscedasticity, autocorrelation and multicollinearity.

An underlying assumption of OLS is homoscedasticity, or constant error terms. In panel data analysis this assumption is often violated and hence the error term is non-constant and thus exhibits heteroscedasticity. As a consequence the standard errors of coefficient estimates can be underestimated, causing statistical relationships being too frequently judged as statistical significant (Gujarati 2003). Robust estimation techniques can limit the problems caused by heteroscedasticity. A common approach for robust estimation of FEM is using the White heteroscedasticity consistent covariance matrix for OLS (Green 2007).

In regression analysis, autocorrelation refers to a situation where the error terms are correlated. Uncorrelated error terms being an underlying assumption of OLS imply that autocorrelation is a violation to this. Autocorrelation cause the variance of the estimated coefficients to no longer remain efficient, as they do not exhibit minimum variance compared to other linear unbiased estimators. In effect, autocorrelation cause the standard errors to be underestimated and in that sense have the same impact on statistical tests as that of heteroscedasticity (Brooks 2008; Gujarati 2003).

Multicollinearity corresponds to a situation where linear relationships exist between independent variables in a multiple regression model. This statistical phenomenon is common to observe when utilising real world data. Although OLS is applicable, still providing unbiased results as long as the relationship is not one to one, i.e. perfect multicollinearity, there are several problems that can materialise when near perfect multicollinearity is present in the data; overestimated standard errors, inflicting the conclusions drawn from significance testing; high R-squared, even though individual coefficients are insignificant; and estimates that are highly sensitive to model specification. No formal method that is commonly agreed upon exists to test for multicollinearity, even though the Variance Inflation Factor (VIF) has been suggested. Multicollinearity is therefore detected through indicators of the above problems. Several approaches are listed in the literature to remedy multicollinearity. However, a common approach is to do nothing as multicollinearity is a natural part of all real world studies, that utilises real world data (Brooks 2008; Gujarati 2003).

Estimation methods, such as the Instrument Variable (IV) and the General Method of Moments (GMM), represent classes of techniques that are to produce robust estimates in situations where certain assumptions underlying the OLS method are violated. The IV approach, discussed above, was deemed inappropriate due the lack of ground theory that guides the selection of instrument variables. A key advantage of the GMM, on the other hand, is its ability to estimate non-linear models, as opposed to OLS where models have to be solved analytically in order to be estimated (Verbeek 2008).

However, the complexity involved with using GMM has lead researchers to compare the gains, in terms of improved estimates, against the complexity of applying GMM. In empirical research on debt maturity structure it is repeatedly observed that GMM is applied in studies testing for the existence of a target optimal debt maturity structure (Antoniou et al. 2006; Deesomsak, Paudyal, and Pescetto 2009; Ozkan 2000). OLS, on the other hand, is repeatedly used in studies that test for determinants of the debt maturity structure (Deesomsak, Paudyal, and Pescetto 2009; Körner 2007; Stohs and Mauer 1996; Heyman, Deloof, and Ooghe 2008; Scherr and Hulburt 2001). The decision to use OLS over GMM in this thesis is therefore in line with relevant empirical studies. OLS also caps the level of complexity in the regression analysis, as comparing the results of simple (e.g. OLS) versus advanced (e.g. GMM) estimation methods is beyond the scope of this thesis. Nevertheless, it is acknowledged that GMM in general provide more robust estimation in situations where autocorrelation and heteroscedasticity is present in the data set.

In summary, while OLS coefficient estimates remains unbiased in the presence of autocorrelation, heteroscedasticity and multicollinearity, the estimates may not be efficient, i.e. exhibit the minimum variance amongst other linear unbiased estimators. However, to obtain robust estimate the problems caused by heteroscedasticity is limited with the use of White's covariance matrix approach. With multicollinearity, the common approach of simply accepting its natural presence is taken. Autocorrelation on the other hand is not corrected for in this study. Note that, an alternative approach to handle autocorrelation is to apply the Newey-West covariance matrix that corrects for both autocorrelation and heteroscedasticity. However, Eviews 6.0 only provides functionality to apply the White covariance matrix when estimating FEM with OLS. The potential issues related to using OLS in a panel data setting, therefore calls for a dual emphasis on both statistical and economic significance when reporting and evaluating the findings from the panel data regression analysis.

3.7 Model specification

In order to test the hypotheses derived in chapter two, a FEM is specified with debt maturity as the dependent variable. The variables identified by the hypotheses are added as explanatory variables in the model. As only scarce empirical support for the tax argument is found, term premium is not included as an explanatory variable. However a proxy for non-debt tax shields is added to control for tax effects. The regression model is specified as follows:

$$\begin{aligned} DM_{it} = {} & \beta_1 LS_{it} + \beta_2 AS_{it} - \beta_3 LQ_{it} - \beta_4 HQ_{it} + \beta_5 FA_{it} + \beta_6 FS_{it} \\ & - \beta_7 AL_{it} - \beta_8 GO_{it} - \beta_9 EV_{it} - \beta_{10} OC_{it} + \beta_{11} FF_{it} + \beta_{12} MO_{it} \\ & - \beta_{13} MO_{it}^2 + \beta_{14} LV_{it} + \beta_{15} PR_{it} + \beta_{16} NT_{it} + \mu_i + \upsilon_{it} \end{aligned} \quad (3.1)$$

where DM_{it} measures debt maturity; LS_{it} listing status; AS_{it} asset structure; LQ_{it} low credit rating, or low firm quality; HQ_{it} high credit rating, or high firm quality; FA_{it} firm age; FS_{it} Firm Size; AL_{it} average asset life; GO_{it} growth opportunities; EV_{it} earnings volatility; OC_{it} ownership concentration; FF_{it} family firm or not; MO_{it} management ownership; MO_{it}^2 squared value of managerial ownership; LV_{it} leverage, or the level of debt the firm has; PR_{it} profitability; NT_{it} non-debt tax shield; μ_i individual, or cross sectional, unobservable differences, or heterogeneity, for each particular firm; υ_{it} random disturbances.

3.8 Variable definitions

The theoretical variables identified by theory require operationalisation in order to be applicable and testable in this study. To facilitate comparability with other studies, variables are defined as close as possible to the existing literature. The preceding paragraphs present the definitions, and the technical specifications.

Panel A Variable Definitision – Operationalisation

Variable		Operationalisation
Debt Maturity	DM	Debt maturity (DM) is the dependent variable in this thesis. It is measured as the ratio of short term debt to total debt, where short term debt is defined according to Norwegian accounting standards as liabilities due within the following twelve months. The definition follows that of Barclay and Smith Jr (1995: 615) $$DM = Long\ term\ Debt / Total\ Debt$$
Listing Status	LS	Listing status (LS) is a dummy variable, taking the value of either 0 or 1, indicating whether or not a firm is listed on the Oslo Stock Exchange.
Asset Structure	AS	Asset structure (AS) is measured as the ratio of fixed assets to total assets (Sogorb-Mira 2005: 451) $$AS = Fixed\ Assets / Total\ Assets$$
Firm Age	FA	Firm age (FA) is measures as the difference between the current year and the founding year, which is in accordance with the practice used by Romano, Tanewski, and Smyrnio(2001: 310) and Berzins, Bøhren, and Rydland (2007: 125). $$FA = Current\ Year - Founding\ Year$$
Firm Size	FS	Firm size (FS) is, in the absence of market values, measured as the book value of total assets in the descriptive analysis and as the natural logarithm of the book value of total assets in the regression analysis. A similar measure, based on market value however, is widely applied in capital structure research (Garcia-Teruel and Martinez-Solano 2007; Deesomsak, Paudyal, and Pescetto 2009) $$FS = \ln(Total\ Assets)$$
Average Asset Life	AL	Average asset life (AL) is measured by Easterwood and Kadapakkam (1994) using the depreciation rate as a proxy. Depreciation rate is defined as the quotient of depreciation to fixed assets. $$AL = Depreciation / Fixed\ Assets$$
Growth Opportunities	GO	A broad range of proxies for growth opportunities (GO) are used throughout the empirical literature. The ratio of R&D expenses to sales is used by Easterwood and Kadapakkam (1994: 73) $$GO = R\ \&\ D / Sales$$
Earnings Volatitlity	EV	Earnings volatility (EV) is related to the riskiness of a firm and is measures as the absolute value of the annual percentage change in EBIT, less the annual average percentage change in EBIT (Deesomsak, Paudyal, and Pescetto 2009) and is specified as $$EV_{it} = \left\lvert \left((EBIT_{it} - EBIT_{it-1}) / EBIT_{it-1} \right) - (1/N) \sum_{=1}^{N} \left((EBIT_{it} - EBIT_{it-1}) / EBIT_{it-1} \right) \right\rvert$$
Ownership Concentration	OC	Ownership concentration (OC) is measured using the Herfindahl ownership concentration ratio is a predefined item extracted directly from the CCGR database.
Management Ownership	MO	Management ownership (MO) is measured as the share of the firm held by the CEO.
Leverage	LV	Leverage (LE) is measured according to the standard textbook definition, as the ratio of debt to equity and debt. This definition is widely used (Deesomsak, Paudyal, and Pescetto 2009; Barclay, Marx, and Smith Jr 2003) $$LV = Total\ Debt / (Total\ Debt + Equity)$$
Profitability	PR	Profitability (PR) is measured using return on assets (ROA), which is commonly viewed as the best measurement for performance given lack of market values. ROA is defined as net income plus interest expense minus interest tax savings over average total assets (Bøhren and Ødegaard 2006; Abor 2007). $$ROA = (Net\ income + Interest\ expense - Interest\ tax\ savings) / Average\ Total\ Assets$$
Non-Debt Tax Shield	NT	Non-Debt Tax Shield is measured by the ration of depreciation to earnings before interest and taxes (EBIT) $$NT = Depreciation / EBIT$$
Asset Maturity	AM	Asset maturity (AM) is defined as the ratio of fixed assets, squared, to total assets times depreciation (Guedes and Opler 1996: 1812), and represents an alternative proxy for asset structure (AS) $$AM = (Fixed\ Assets)^2 / (Total\ Assets \times Depreciation)$$
Credit Rating/ Firm Quality	ZS	Credit Rating/Firm quality (ZS) is measured using Altman's Z-score as a proxy (Feldman 2005: 82). This approach is also employed by Jun and Jen (2005: 325). The Z-score approach is particularly well suited for non-listed firms where market values are unavailable. The modified Z-score for non-listed firms is defined as $$ZS = 6.56\left(\frac{Current\ Assets - Current\ Liabilities}{Total\ Assets}\right) + 3.26\left(\frac{Retained\ Earnings}{Total\ Assets}\right) + 6.72\left(\frac{EBIT}{Total\ Assets}\right) + 1.05\left(\frac{Book\ Value\ of\ Equity}{Total\ Debt}\right)$$

Table 3-E Variable definitions and operationalisation

The financial strength of non-listed firms is assessed using a modified version of the Altman's Z-score. This measure is designed to estimate the credit rating, or the inverse of the probability of financial distress, of firms not issuing public debt. Additionally, the Z-score can be used to estimate the cost of debt for non-publicly traded firms (Caouette et al. 2008; Feldman 2005). In this thesis, the Z-score will serve as a measure of firm quality, an approach repeatedly found to be used in empirical work on debt maturity structure (Van Binsbergen, Graham, and Yang 2009; Huckins 1999; Scherr and Hulburt 2001; Jun and Jen 2005; Kim, Mauer, and Sherman 1998; Ojah and Manrique 2005). The particular version of the Altman Z-score model applied in this thesis is that specifically suited to measure the firm quality of non-listed firms that finance their assets in very different ways. The model therefore seeks to minimise the potential industry effects (Caouette et al. 2008). The discriminant function of the modified Z-score model is

$$Z = 6.56\left(X_1\right) + 3.26\left(X_2\right) + 6.72\left(X_3\right) + 1.05\left(X_4\right) \tag{3.2}$$

The coefficients in the above function are constants, derived by Altman, based on multivariate analysis. The variables X_1 to X_4 are different ratios, expected to vary coherently according to the financial strength of a private firm. Variable X_1, defined as the ratio of working capital (current assets minus current liabilities) to total assets, reflects that current assets in relation to total assets will decline for firms experiencing consistent operating losses. Variable X_2, defined as the ratio of retained earnings to total assets, reflects that firms exhibiting a low level of retained earnings to total assets are more likely to experience financial distress due to low profitability. Variable X_3, defined as the ratio of earnings before interest and taxes to total assets, measures the productivity, or earnings power, of a firm's assets, which ultimately determines the future existence of a firm. Finally, variable X_4, defined as the ratio of book value of equity to total liabilities, signals when a firm becomes insolvent, as it measures how much the value of a firm's assets can decline before its value drops below the value of its liabilities and hence becomes insolvent (Caouette et al. 2008; Feldman 2005).

The Z-score derived from the modified Altman's Z-score model specified above is an integer reflecting the likelihood of a non-listed firm filing for bankruptcy, within the next two years, based on boundary conditions. A Z-score of 2.6 (high range), or higher, indicates that bankruptcy is unlikely, while a Z-score below 1.1 (low range) indicates the contrary. A Z-score between 1.1 and 2.6 places a firm in the middle range where neither bankruptcy nor future existence can be predicted. The middle range is therefore referred to as the ignorance zone or gray area. In short, a higher score Z-score is desirable and corresponds to increasing firm quality (Caouette et al. 2008; Feldman 2005).

The descriptive analysis applies the Z-score directly, while firm quality is operationalised in the panel data regression analysis as dummy variables. High credit rating, or high firm quality, is denoted HQ and is set to 1 for firms exhibiting a Z-score in the high range. Low credit rating, or low firm quality, is denoted LQ and is set to 1 for firms with a Z-score in the low range. Medium credit rating, or medium firm quality, serves as the reference category to avoid the dummy variable trap (Gujarati, 2003)

4 Empirical Findings and Analysis

The following chapter provides updated characteristics on the debt maturity structure and conducts panel data regression analyses on its determinants for Norwegian limited liability firms.

4.1 Descriptive statistics

Results from the descriptive statistics, obtained using SPSS 16.0.2, are presented in tables reporting means and standard deviations for a selection of the operationalised variables, according to industry sector, listing status and family firm status. The most important tables are presented below and supplementary tables are found in Appendix 2. A general trend found across all variables is lack of central tendencies in distributions and the presence of excessive kurtosis. Furthermore, a majority of the standard deviations reported are rather large, indicating that outliers with significant influence on the means are present. Lack of homogeneity therefore renders drawing inferences on systematic differences across industry sectors, listing status and family firm status difficult. An assessment of correlations among variables and a discussion of the findings drawn from the descriptive results, follows after the tables are presented. This section is concluded with a summary of the key findings drawn from the descriptive analysis.

4.1.1 Debt maturity

Panel A - Annual debt maturity means and standard deviations across industries, listing- and firm- status

Category		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Industry sector codes	0	0.28	0.37	0.39	0.28	0.29	0.29	0.28	0.30	0.29	0.28	0.28	0.31	0.31	0.27	0.30
		(,33)	(,39)	(,40)	(,33)	(,35)	(,33)	(,34)	(,34)	(,34)	(,34)	(,35)	(,36)	(,36)	(,34)	
	1	.	0.37	0.38	0.42	0.44	0.43	0.43	0.42	0.41	0.43	0.42	0.42	0.43	0.42	0.42
		.	(,28)	(,30)	(,32)	(,33)	(,34)	(,34)	(,34)	(,34)	(,35)	(,35)	(,36)	(,36)	(,36)	
	2	.	0.26	0.27	0.27	0.27	0.27	0.27	0.26	0.25	0.26	0.25	0.27	0.25	0.24	0.26
		.	(,26)	(,27)	(,27)	(,28)	(,30)	(,29)	(,28)	(,28)	(,28)	(,27)	(,28)	(,28)	(,28)	
	3	.	0.41	0.41	0.42	0.42	0.44	0.43	0.43	0.44	0.43	0.42	0.43	0.45	0.48	0.43
		.	(,33)	(,34)	(,35)	(,37)	(,37)	(,37)	(,37)	(,37)	(,38)	(,37)	(,40)	(,38)	(,39)	
	4	.	0.18	0.19	0.20	0.20	0.21	0.20	0.20	0.20	0.19	0.18	0.20	0.19	0.19	0.19
		.	(,23)	(,24)	(,25)	(,26)	(,26)	(,26)	(,26)	(,25)	(,24)	(,23)	(,24)	(,24)	(,25)	
	5	.	0.27	0.29	0.36	0.36	0.36	0.36	0.35	0.34	0.36	0.35	0.42	0.41	0.41	0.36
		.	(,33)	(,35)	(,39)	(,39)	(,39)	(,39)	(,39)	(,38)	(,39)	(,39)	(,42)	(,42)	(,43)	
	7	.	0.17	0.18	0.19	0.19	0.19	0.20	0.19	0.18	0.19	0.19	0.20	0.19	0.19	0.19
		.	(,24)	(,25)	(,26)	(,26)	(,26)	(,26)	(,26)	(,25)	(,26)	(,25)	(,27)	(,26)	(,26)	
	8	.	0.35	0.38	0.38	0.38	0.38	0.38	0.37	0.36	0.35	0.34	0.35	0.34	0.34	0.36
		.	(,33)	(,34)	(,35)	(,35)	(,35)	(,35)	(,35)	(,35)	(,35)	(,34)	(,35)	(,35)	(,35)	
Mean		**0.28**	**0.30**	**0.31**	**0.31**	**0.32**	**0.32**	**0.32**	**0.31**	**0.31**	**0.31**	**0.30**	**0.32**	**0.32**	**0.32**	
Listing status	N	0.28	0.28	0.29	0.29	0.30	0.30	0.30	0.30	0.29	0.30	0.29	0.34	0.34	.	0.30
		(,33)	(,33)	(,34)	(,34)	(,35)	(,35)	(,35)	(,35)	(,35)	(,35)	(,35)	(,38)	(,38)	.	
	Y	0.57	0.54	0.52	0.46	0.48	0.45	0.46	0.50	0.45	0.42	0.39	0.43	0.46	.	0.47
		(,26)	(,30)	(,31)	(,34)	(,34)	(,35)	(,34)	(,34)	(,33)	(,33)	(,32)	(,33)	(,34)	.	
Mean		**0.42**	**0.41**	**0.41**	**0.38**	**0.39**	**0.38**	**0.38**	**0.40**	**0.37**	**0.36**	**0.34**	**0.38**	**0.40**	**.**	
Family firm status	N	.	.	.	.	.	.	0.32	0.32	0.31	0.31	0.30	0.33	0.32	0.33	0.32
		.	.	.	.	.	.	(,36)	(,36)	(,36)	(,36)	(,35)	(,37)	(,37)	(,37)	
	Y	.	.	.	.	.	.	0.30	0.30	0.29	0.29	0.29	0.31	0.31	0.31	0.30
		.	.	.	.	.	.	(,34)	(,34)	(,34)	(,34)	(,34)	(,35)	(,35)	(,35)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**0.31**	**0.31**	**0.30**	**0.30**	**0.30**	**0.32**	**0.31**	**0.32**	

Table 4-A Debt maturity

4.1.2 Leverage

Panel A - Annual leverage ratio means and standard deviations across industries, listing- and firm- status

Category		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Industry sector codes	0	0.80	0.65	0.62	0.68	0.66	0.67	0.64	0.66	0.69	0.69	0.72	0.66	0.65	0.57	0.67
		(,24)	(,27)	(,27)	(,24)	(,25)	(,24)	(,27)	(,25)	(,25)	(,25)	(,24)	(,27)	(,27)	(,30)	
	1	.	0.65	0.66	0.67	0.67	0.66	0.64	0.65	0.66	0.67	0.69	0.66	0.64	0.62	0.66
		.	(,23)	(,24)	(,24)	(,24)	(,24)	(,26)	(,27)	(,26)	(,27)	(,26)	(,26)	(,27)	(,27)	
	2	.	0.69	0.68	0.67	0.67	0.67	0.65	0.67	0.68	0.68	0.72	0.67	0.65	0.64	0.67
		.	(,21)	(,21)	(,22)	(,22)	(,22)	(,23)	(,23)	(,22)	(,23)	(,22)	(,22)	(,23)	(,23)	
	3	.	0.53	0.52	0.53	0.52	0.53	0.55	0.55	0.56	0.57	0.57	0.56	0.59	0.59	0.55
		.	(,28)	(,29)	(,26)	(,26)	(,27)	(,27)	(,27)	(,26)	(,27)	(,28)	(,29)	(,28)	(,28)	
	4	.	0.72	0.71	0.71	0.71	0.72	0.71	0.73	0.76	0.76	0.80	0.73	0.71	0.69	0.73
		.	(,19)	(,19)	(,19)	(,19)	(,19)	(,19)	(,19)	(,18)	(,20)	(,16)	(,18)	(,19)	(,20)	
	5	.	0.66	0.66	0.64	0.65	0.66	0.62	0.64	0.66	0.67	0.70	0.66	0.62	0.62	0.65
		.	(,23)	(,24)	(,36)	(,29)	(,25)	(,27)	(,27)	(,28)	(,27)	(,26)	(,28)	(,35)	(,28)	
	7	.	0.70	0.69	0.68	0.69	0.70	0.68	0.70	0.71	0.73	0.76	0.70	0.69	0.67	0.70
		.	(,21)	(,21)	(,91)	(,22)	(,25)	(,45)	(,22)	(,23)	(,22)	(,21)	(,21)	(,22)	(,23)	
	8	.	0.70	0.69	0.65	0.66	0.67	0.66	0.67	0.69	0.70	0.72	0.67	0.66	0.65	0.68
		.	(,22)	(,23)	(,28)	(,25)	(,25)	(,26)	(,25)	(,25)	(,24)	(,23)	(,25)	(,25)	(,25)	
Mean		**0.80**	**0.66**	**0.66**	**0.65**	**0.65**	**0.66**	**0.65**	**0.66**	**0.68**	**0.68**	**0.71**	**0.66**	**0.65**	**0.63**	
Listing status	N	0.80	0.67	0.67	0.66	0.66	0.67	0.65	0.66	0.68	0.69	0.72	0.67	0.65	.	0.68
		(,24)	(,24)	(,24)	(,52)	(,26)	(,24)	(,31)	(,25)	(,25)	(,25)	(,24)	(,26)	(,30)	.	
	Y	0.86	0.48	0.48	0.43	0.43	0.41	0.43	0.44	0.45	0.44	0.42	0.40	0.42	.	0.47
		(,24)	(,21)	(,20)	(,22)	(,24)	(,25)	(,26)	(,23)	(,25)	(,24)	(,22)	(,23)	(,23)	.	
Mean		**0.83**	**0.58**	**0.58**	**0.55**	**0.55**	**0.54**	**0.54**	**0.55**	**0.56**	**0.56**	**0.57**	**0.54**	**0.53**	**.**	
Family firm status	N	.	.	.	.	.	.	0.65	0.67	0.68	0.69	0.71	0.67	0.67	0.67	0.68
		.	.	.	.	.	.	(,25)	(,24)	(,24)	(,24)	(,23)	(,24)	(,24)	(,24)	
	Y	.	.	.	.	.	.	0.67	0.69	0.72	0.73	0.76	0.68	0.66	0.65	0.70
		.	.	.	.	.	.	(,31)	(,23)	(,22)	(,22)	(,20)	(,23)	(,24)	(,24)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**0.66**	**0.68**	**0.70**	**0.71**	**0.74**	**0.68**	**0.67**	**0.66**	

Table 4-B Leverage

4.1.3 Asset structure

Panel A - Annual asset structure means and standard deviations across industries, listing- and firm- status

Category		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Industry sector codes	0	0.37	0.47	0.49	0.34	0.35	0.35	0.36	0.38	0.37	0.35	0.34	0.36	0.36	0.30	0.37
		(,33)	(,37)	(,37)	(,33)	(,33)	(,32)	(,32)	(,33)	(,33)	(,33)	(,33)	(,35)	(,35)	(,33)	
	1	.	0.36	0.40	0.45	0.48	0.49	0.49	0.49	0.50	0.50	0.49	0.47	0.47	0.47	0.47
		.	(,26)	(,29)	(,31)	(,31)	(,31)	(,31)	(,31)	(,31)	(,32)	(,32)	(,32)	(,32)	(,32)	
	2	.	0.33	0.33	0.33	0.34	0.34	0.34	0.33	0.34	0.34	0.32	0.31	0.29	0.29	0.33
		.	(,24)	(,25)	(,25)	(,26)	(,26)	(,27)	(,27)	(,27)	(,27)	(,27)	(,26)	(,26)	(,26)	
	3	.	0.59	0.60	0.58	0.56	0.59	0.59	0.58	0.58	0.58	0.57	0.56	0.59	0.59	0.58
		.	(,32)	(,32)	(,35)	(,35)	(,34)	(,34)	(,34)	(,34)	(,35)	(,35)	(,35)	(,35)	(,36)	
	4	.	0.28	0.28	0.29	0.29	0.30	0.29	0.28	0.28	0.27	0.25	0.24	0.23	0.24	0.27
		.	(,24)	(,25)	(,26)	(,26)	(,25)	(,25)	(,24)	(,25)	(,25)	(,23)	(,22)	(,22)	(,23)	
	5	.	0.39	0.41	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.46	0.49	0.49	0.48	0.46
		.	(,32)	(,34)	(,36)	(,36)	(,36)	(,36)	(,37)	(,37)	(,37)	(,37)	(,38)	(,38)	(,38)	
	7	.	0.19	0.19	0.20	0.20	0.20	0.21	0.21	0.21	0.20	0.20	0.19	0.17	0.17	0.20
		.	(,22)	(,22)	(,23)	(,24)	(,24)	(,24)	(,24)	(,24)	(,23)	(,23)	(,22)	(,22)	(,22)	
	8	.	0.46	0.48	0.48	0.48	0.47	0.47	0.46	0.47	0.46	0.45	0.43	0.42	0.41	0.46
		.	(,31)	(,31)	(,33)	(,33)	(,32)	(,33)	(,32)	(,32)	(,33)	(,33)	(,33)	(,33)	(,32)	
Mean		**0.37**	**0.38**	**0.40**	**0.39**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.39**	**0.38**	**0.38**	**0.37**	
Listing status	N	0.37	0.36	0.37	0.37	0.38	0.38	0.38	0.39	0.38	0.38	0.37	0.40	0.39	.	0.38
		(,33)	(,33)	(,33)	(,33)	(,34)	(,33)	(,34)	(,34)	(,34)	(,34)	(,34)	(,36)	(,36)	.	
	Y	0.67	0.65	0.62	0.61	0.67	0.68	0.68	0.70	0.68	0.71	0.65	0.69	0.66	.	0.67
		(,23)	(,24)	(,26)	(,27)	(,24)	(,23)	(,24)	(,23)	(,25)	(,23)	(,25)	(,23)	(,26)	.	
Mean		**0.52**	**0.51**	**0.49**	**0.49**	**0.52**	**0.53**	**0.53**	**0.54**	**0.53**	**0.55**	**0.51**	**0.54**	**0.52**	**.**	
Family firm status	N	.	.	.	.	.	.	0.40	0.40	0.40	0.39	0.38	0.39	0.37	0.38	0.39
		.	.	.	.	.	.	(,34)	(,34)	(,35)	(,35)	(,35)	(,35)	(,35)	(,35)	
	Y	.	.	.	.	.	.	0.38	0.39	0.39	0.38	0.37	0.37	0.36	0.36	0.37
		.	.	.	.	.	.	(,33)	(,33)	(,33)	(,33)	(,33)	(,34)	(,34)	(,34)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**0.39**	**0.39**	**0.39**	**0.39**	**0.38**	**0.38**	**0.37**	**0.37**	

Table 4-C Asset structure

4.1.4 Summary table

Panel A - Summary tables - Explanatory variables (means and standard deviations) across industry sectors, listing and family status

Category		DM	LV	AL	GO1	FA	FS	MO	ZS	PR	NT	OC
Industry sector codes	0	0.30	0.70	0.19	0.02	10.12	37.94	63.24	8.61	12.75	0.34	0.62
		(,35)	(,26)	(1,21)	(,08)	(13,59)	(2428,11)	(29,91)	(252,62)	(130,02)	(18,85)	(,31)
	1	0.42	0.65	0.20	0.04	11.86	26.87	59.56	11.02	13.25	0.35	0.54
		(,34)	(,26)	(1,57)	(,11)	(17,01)	(173,82)	(30,39)	(364,20)	(118,47)	(16,82)	(,32)
	2	0.26	0.67	0.26	0.02	14.30	58.78	59.45	8.24	11.62	0.30	0.57
		(,28)	(,22)	(4,87)	(,08)	(14,59)	(1160,55)	(30,66)	(1246,63)	(313,88)	(9,22)	(,32)
	3	0.44	0.56	0.17	0.04	12.97	1609.77	51.20	141.72	9.92	0.34	0.51
		(,38)	(,28)	(2,18)	(,11)	(20,46)	(11530,89)	(31,59)	(11087,63)	(30,32)	(5,03)	(,35)
	4	0.19	0.73	0.27	0.01	10.18	7.97	65.59	3.50	15.42	0.29	0.64
		(,25)	(,19)	(1,96)	(,05)	(8,93)	(68,27)	(28,92)	(19,61)	(29,66)	(7,61)	(,29)
	5	0.37	0.65	0.19	0.02	12.47	22.50	64.08	13.00	18.36	0.32	0.61
		(,40)	(,29)	(2,03)	(,08)	(14,77)	(496,38)	(30,55)	(924,26)	(239,84)	(33,13)	(,31)
	7	0.19	0.70	0.29	0.02	13.12	13.09	66.47	4.42	12.61	0.21	0.66
		(,26)	(,35)	(4,23)	(,06)	(13,99)	(122,28)	(29,38)	(25,42)	(110,86)	(8,56)	(,30)
	8	0.36	0.67	0.35	0.01	12.24	70.33	65.48	-19.26	13.71	0.62	0.61
		(,35)	(,25)	(13,37)	(,07)	(14,36)	(528,36)	(30,13)	(6798,83)	(88,65)	(15,90)	(,32)
Mean		**0.32**	**0.67**	**0.24**	**0.02**	**12.16**	**230.91**	**61.88**	**21.41**	**13.45**	**0.34**	**0.60**
Listing status	N	0.30	0.68	0.23	0.02	12.22	28.22	63.57	9.87	15.03	0.32	0.62
		(,35)	(,29)	(3,81)	(,08)	(14,16)	(1222,50)	(30,03)	(1104,45)	(191,47)	(25,02)	(,31)
	Y	0.47	0.46	0.05	0.04	30.74	4325.73	11.15	7.81	2.43	-0.08	0.13
		(,33)	(,25)	(,12)	(,08)	(34,98)	(18496,82)	(7,77)	(52,16)	(36,34)	(9,47)	(,15)
Mean		**0.39**	**0.57**	**0.14**	**0.03**	**21.48**	**2176.97**	**37.36**	**8.84**	**8.73**	**0.12**	**0.37**
Family firm status	N	0.32	0.68	0.21	0.03	11.67	40.52	26.50	5.70	11.12	0.32	0.27
		(,36)	(,24)	(1,75)	(,10)	(14,98)	(519,51)	(11,23)	(152,60)	(124,90)	(13,52)	(,16)
	Y	0.30	0.70	0.22	0.02	11.74	10.02	70.01	5.23	15.06	0.24	0.68
		(,34)	(,24)	(2,19)	(,07)	(12,01)	(97,08)	(27,79)	(112,39)	(85,57)	(10,17)	(,28)
Mean		**0.31**	**0.69**	**0.21**	**0.03**	**11.71**	**25.27**	**48.25**	**5.47**	**13.09**	**0.28**	**0.48**

Table 4-D Summary table descriptive analysis

4.1.5 Findings

The debt maturity structure (DM) of Norwegian firms with limited liability follows a time-persistent pattern exhibiting only small changes over time. This pattern is observed across all industry sectors and may indicate that firms maintain a debt maturity structure that they perceive as optimal. The debt maturity of industries 4 (constructions) and 7 (trade) are generally the lowest, ranging between 0.17 and 0.20. Industries 1 (agriculture, fishing and forestry) and 3 (energy) are found in the opposite end exhibiting the longest debt maturities ranging from 0.37 to 0.48. This result is somewhat expected on the back of the asset maturities observed in these industries. Moreover, these results, held together with those of asset structure, can also be interpreted as indicators of maturity matching policies being present. With regards to listing status, listed firms have longer debt maturities on average, ranging between 0.39 and 0.57, whereas non-listed firms generally have shorter maturities ranging between 0.28 and 0.34. However, no significant differences as a result of listing status prevail due to large standard deviations and excessive kurtosis. Family firm status also appears to have no influence on debt maturity structure.

Leverage ratios (LV), measured as leverage over leverage plus equity, exhibits a somewhat homogenous pattern across industries, listing status and family firm status. Industry 4 (constructions) and 7 (trade) have the highest leverage ratios on average, ranging between 0.69 and 0.80, and 0.67 and 0.76, respectively. Industry 3 (energy) exhibits the lowest leverage ratios ranging between 0.52 and 0.59. Although the differences does not appear to be significant, the data shows a trend of lower leverage ratios for listed firms (0.41 – 0.48) compared to non-listed firms (0.65 – 0.72), when excluding observations from 1994. The influence of family firm status appear to have no sizable effect on the leverage ratio. It is noted that leverage is included as a control variable in the regression analysis.

Asset maturity (AM) is characterised by weak patterns and large standard deviations, indicating that this proxy performs weakly. Industry sectors 4 (constructions) and 7 (trade) exhibit the lowest asset maturities among all sectors, ranging between 5.01 and 31.46, where the latter represents the somewhat

extreme mean observed in 2007. The asset maturities of these two sectors also appear more stable over time, compared to the remaining sectors. The average asset maturity seems to be consistently longer for non-family controlled firms, ranging between 42.91 and 160.99, despite being fairly unstable over time. Average asset maturity of family firms on the other hand range between 34.33 and 57.55. However, the wide distribution causes the difference between non-family and family firms to arguably remain insignificant. Although the average asset maturity of listed firms seems to generally exceed that of non-listed, the large standard deviations would impair any statistically significant inferences from being drawn. Furthermore, the average asset life of listed firms, exhibits a growing trend, particularly towards the end of the sample period.

Average asset life (AL) show few clear-cut patterns across industry sectors and is characterised by large standard deviations, and thus appears to be a weak proxy for asset duration. Average asset life, as opposed to asset maturity, exhibits a pattern where listed firms on average have lower scores, ranging between 0.03 and 0.08, while non-listed firms score in the range of 0.19 to 0.28. However, these differences cannot be claimed significant, as a result of the wide distributions and large standard deviations.

Asset structure (AS) refers to the ratio of fixed to total assets. This variable exhibits a clear pattern of industry sector dependence, time persistence and a marked difference between listed and non-listed firms. In accordance with the findings reported under debt maturity, industry sectors 4 (constructions) and 7 (trade) distinguish themselves from the remaining sectors having the lowest ratio of fixed to total assets (0.23 to 0.30, for construction, and 0.17 to 0.21 for trade). The energy sector stands out in the opposite direction, with ratios between 0.56 and 0.60. Listed firms hold on average between 60% and 70% fixed assets, whereas non-listed firms only hold between 30% and 40%, on average. However, these differences cannot be regarded as significant, due to the large standard deviations.

Growth opportunities, defined as the ratio of R&D spending to sales (net operating income), renders rather homogeneous results, ranging from 0.00 to 0.06

across all industry sectors, listing status and family firm status. In general, the standard deviations range between 0.03 and 0.14 leaving no significant difference across listing status or family firm status.

Firm age (FA) is only reported from the year 2000 and onwards. Whereas the means remain fairly stable over time, the most apparent pattern is the difference between listed and non-listed firms. Listed firms are on average between 25 and 35 years old, while non-listed firms are on average between 11 and 13 years old.

Firm size (FS) is measured as total assets in millions. Most industry sectors exhibit a trend of growth over the sample period. However, industry sectors 4 (constructions) and 7 (trade) markedly stands out as sectors having the smallest average firm sizes, with assets ranging between 6.05 and 9.17 and 9.46 and 17.52 million, respectively. Not surprisingly, industry sector 3 (energy) exhibits the largest average firm sizes with a typical average firm size of 1.575 billion. Listing status also appears significant with regards to differences in firm size. The average size of listed firms range between 2.2 and 7.33 billions, whereas non-listed firms show average firm sizes ranging between 15.91 and 44.26 millions. Furthermore, family firms generally appear to be smaller than non-family firms, with average sizes ranging between 8.53 to 12.75 millions, as opposed to non-family firms with averages ranging from 30.42 to 49.13 million in total assets. Note that firm size is measured as the log of total assets in the regression analysis.

Management ownership (MO) refers to the share of the firm held by CEO. Ownership data is only available from 2000 through 2007. The cross industry section results are heavily influenced by the non-listed firms due to their dominance in the sample, leaving high average values ranging from 50% to approximately 70%. Management ownership in listed firms varies around 5% to 15% and differs significantly from that of non-listed firms. Non-family firms also have lower management ownership on average (around 26%) compared to family firms (around 70%). The results obtained for family firms are somewhat expected, on the back of how a family firm is defined. These findings indicate that a large number of non-listed firms in the Norwegian economy are management owned,

and thus categorised as family firms. Except for the subsample of listed firms, management ownership appears stable over time.

Z-score (ZS) is a variable meant to measure the riskiness of a firm (i.e. probability of default). However, this measure is sensitive to variation in total assets, as less capital intensive firms (i.e. low fraction of total assets) will systematically "score" better. Few clear patterns emerge from the results. A possible explanation for this might be drawn from the high standard deviations observed and also due to the heterogeneity in terms of the riskiness of firms within some industry sectors. However, industry sectors 2 (manufacturing, chemical products), 4 (construction) and 7 (trade) appears more stable over time, and also shows less variability in standard deviations. The latter finding indicates that the industry sector classification used for these three sectors capture a more homogenous group of firms, compared to the remaining classifications.

Profitability (PR) is measured by return on assets (ROA). Whereas the means observed indicate that some industry sectors are more stable than others, large standard deviations render valid inferences difficult. On average, listed firms appear to exhibit substantially lower profitability, compared to non-listed firms. However, no significant differences across listed and non-listed firms emerge due to the wide distribution of observations. Firms under family control appear to show consistently higher profitability, compared to non-family controlled firms, in the period from 2000 to 2005. However, the pattern cannot be judged significant as non-family firms outperform family firms, in terms of profitability, over the final two years of the data sample. Note that, profitability serves as a control variable in the regression analysis.

Non-debt tax shield (NT) is set to capture any potential effects of taxes on debt maturity structure. Defined as the ratio of depreciation to earnings before interest and tax, this variable exhibits no particular patterns across industry sectors, listing status or family firm status, and also seems to vary sizably over time.

Correlation matrix

The correlation matrix presented in Appendix 2, table 8-I, illustrates how different explanatory variables and the dependent variable are interrelated. The confounding effects of leverage, commented upon by other researchers and discussed more thorough in the next section, is efficiently identified and highlighted with this matrix. The confounding effects are not surprising when considering the fact that debt maturity and leverage rely, to a great extent, on the same observable measures.

The coefficient matrix further shows that the dependent variable debt maturity structure (DM) is significantly correlated with all explanatory variables, at a one percent level. Asset structure (AS), firm size (FS) and leverage (LV) stands out as the variables showing the highest correlation with DM, exhibiting correlations of 0.67, 0.29 and 0.19, respectively. Consequently, these variables are expected to represent important variables explaining variations in debt maturity structure.

4.1.6 Summary of descriptive statistics

The key characteristics on the debt maturity structure of Norwegian limited liability firms, drawn from the descriptive analysis, can be summarised according to industry sector, listing status and family firm status.

A pattern emerges based on industry sector classifications, most notably between the group of least capital intensive (4 and 7), and the most capital intensive (1 and 3) sectors. Capital intensive sectors exhibit longer debt maturities and lower leverage ratios, while the reverse holds for the group of least capital intensive sectors. Additionally, the latter group shows a time invariant pattern with short asset maturities, a low fraction of fixed assets (i.e. low asset structure ratio) and small firm sizes. Furthermore, the opposite pattern with respect to asset structure and firm size is observed for industry sector 3. The pattern emerging from listing status remains that listed firms are on average older, larger, have longer debt maturities and a larger fraction of fixed assets (i.e. a high asset structure ratio), compared to non-listed firms. The relationship between longer debt maturities and higher assets structure ratios indicate that debt and asset maturities are matched, a

finding supported by the high correlation reported in the correlation matrix. Additionally, listed firms exhibits on average lower leverage ratios, lower managerial ownership concentration and weaker performance in terms of profitability, as opposed to non-listed firm. Fewer patterns on debt maturity structure emerge when distinguishing firms according to family control. Family firms are generally smaller and have higher managerial ownership concentrations, compared to non-family firms.

In essence, debt maturity is negatively related to leverage and positively related to asset maturity, asset structure and firm size. This pattern is recurring across industry sectors, although the strength of the pattern is sector dependent. The results therefore indicate that industry sector classification is driving variations in the dependent and independent variables.

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4.2 Panel data regression analysis

The panel data regressions analysis serves to test the hypotheses specified in chapter two. Conclusions are drawn from the coefficient estimates of the FEM specified in equation (3.1), and is here referred to as model 1. In addition to the fully specified model, four additional models, model 2 to 5, are estimated; model 2 and 3 controls for the potential confounding effect between leverage and debt maturity, while model 4 and 5 allows evaluation of robustness.

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4.2.1 Panel model estimations

The following results are obtained from the regression estimates of model 1, reported in table 4-E.

The constant term (C) is negative and statistically significant, at a one percent level, indicating that there exist unobservable individual differences across firms that have a significant impact on the debt maturity structure. These cross-sectional differences are captured in the FEM as it allows firm specific intercept terms. The estimated coefficient on leverage is the highest, in absolute term, amongst all significant variables with -0.99, indicating that entity specific differences have a

significant economic impact on debt maturity structure. Moreover, the constant term also captures the relation between debt maturity and medium firm quality. While separating the cross-sectional effects from that of medium firm quality is impaired, the size of the coefficient is mainly driven by the first effects, when taking the coefficient estimates obtained on the high and low firm quality variables into consideration.

Listing status (LS) is positive, but statistically insignificant at a ten percent level. The results therefore display that there are no significant differences in the debt maturity structure of Norwegian limited liability firms, depending on whether or not they are listed.

Asset structure (AS) is found to have a positive and a statistically significant effect, at a one percent level, on debt maturity structure. Asset structure is further considered to have a significant economic effect with a coefficient value of 0.524, representing the second highest, in absolute value, out of all significant coefficients.

Low credit rating, or low quality firms (LQ), is found to be negative and statistically significant, at a one percent level. A coefficient estimate of -0.097 further renders the variable significant from an economic perspective.

High credit rating, or high quality firms (HQ), is found to have a positive and statistically significant impact, at a one percent level. The effect is also economically significant with a coefficient value estimated at 0.08.

Firm age (FA) is found to have a positive and statistically significant effect, at a one percent level. However, a coefficient value of 0.003 implies that the relationship is economically insignificant.

Panel A: Panel data model estimations

		Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Dependent		DM	DM	LV	DM	DM
Independent	C	-0.990150***	-1.034972***	-0.184808***	-0.819945***	-0.943908***
		(0.047886)	(0.047777)	(0.027593)	(0.015154)	(0.045093)
	LS	0.026300	-0.010717	-0.152627***	-0.255538***	-0.062582
		(0.050103)	(0.046347)	(0.059086)	(0.055654)	(0.067584)
	AS	0.524090***	0.488836***	-0.145356***	0.837226***	N/A
		(0.007156)	(0.007200)	(0.004666)	(0.003703)	(N/A)
	LQ	-0.097410***	-0.075287***	0.091215***	-0.178543***	-0.068958***
		(0.004631)	(0.004052)	(0.001497)	(0.005471)	(0.004332)
	HQ	0.080164***	0.045381***	-0.143416***	0.160308***	0.045055***
		(0.004821)	(0.004040)	(0.001531)	(0.007112)	(0.004472)
	FA	0.003491***	0.000834*	-0.010954***	-0.000166**	-0.001790***
		(0.000432)	(0.000444)	(0.000315)	(8.11E-05)	(0.000424)
	FS	0.060046***	0.077994***	0.074005***	0.028672***	0.079102***
		(0.003477)	(0.003564)	(0.001886)	(0.000752)	(0.003040)
	AL	0.000836***	0.000828***	-3.26E-05	0.001567**	-0.000810
		(0.000292)	(0.000289)	(0.000152)	(0.000721)	(0.000949)
	GO	-0.065397***	-0.056549**	0.036482**	-0.200032***	0.221355***
		(0.023249)	(0.023165)	(0.014589)	(0.017068)	(0.024747)
	EV	-5.72E-05**	-4.38E-05*	5.54E-05*	6.05E-05***	-7.78E-05**
		(2.73E-05)	(2.50E-05)	(3.23E-05)	(1.92E-05)	(3.04E-05)
	OC	0.003207	0.010496	0.030058**	0.003425	-0.000470
		(0.014419)	(0.015207)	(0.012197)	(0.008655)	(0.016570)
	FF	-0.003543	-0.001306	0.009223**	0.013192***	0.000215
		(0.004311)	(0.004522)	(0.003621)	(0.002413)	(0.005081)
	MO	-0.000302	-3.38E-05	0.001107***	-0.000509***	-0.000337
		(0.000257)	(0.000268)	(0.000222)	(0.000158)	(0.000294)
	MO_2	3.15E-06	7.12E-07	-1.00E-05***	3.18E-06**	3.72E-06
		(2.49E-06)	(2.61E-06)	(2.12E-06)	(1.48E-06)	(2.85E-06)
	LV	0.242532***	N/A	N/A	0.547711***	0.170980***
		(0.006832)	(N/A)	(N/A)	(0.010967)	(0.007761)
	PR	-0.001270***	-0.001165***	0.000434***	-0.002729***	-0.002034***
		(0.000364)	(0.000338)	(0.000103)	(0.000417)	(0.000328)
	NT	1.37E-05	3.23E-06	-4.32E-05**	8.95E-05**	2.89E-05
		(3.63E-05)	(3.58E-05)	(2.10E-05)	(4.48E-05)	(4.30E-05)
	AM	N/A	N/A	N/A	N/A	1.02E-05***
		(N/A)	(N/A)	(N/A)	(N/A)	(2.60E-06)
Adj. R-Squared		**0.837206**	**0.830513**	**0.712227**	**0.579791**	**0.815523**
Durbin-Watson		**1.908928**	**1.825198**	**1.895335**	**0.673277**	**1.853222**

**** Significant at 1% level; ** Significant at 5 % level; * Significant at 10 % level*

Table 4-E Panel data model estimations

Firm Size (FS) is from a statistical perspective found to have a positive and significant effect, at a one percent level, on debt maturity structure. The regression output therefore indicates that firm size, proxied by the log of total assets, to represent a key factor determining the choice of long term over short term debt. The conclusion drawn from the statistical inference is in line with the economical as the coefficient is estimated at 0.06.

Average Asset Life (AL) is found to have a positive and statistically significant effect, at a one percent level, on debt maturity structure. The variable is however judged to have an economically insignificant effect, with a coefficient estimate of only 0.0008.

Growth opportunities (GO) shows negative and statistically significant effects, at a one percent level, on debt maturity structure. Growth opportunities are further argued economically significant on the back of the coefficient estimate of -0.065, indicating that an increase in growth opportunities implies more short term debt.

Earnings volatility (EV) is found to have a negative and statistical significant effect, at a five percent level. On the contrary, a coefficient estimate close to zero renders the variable economically insignificant.

Ownership concentration (OC) is both statistically and economically insignificant, at a ten percent level, with a coefficient value of only 0.0032.

Family firm status (FF) is found to have a negative and statistically insignificant effect, at a ten percent level. Family control is also considered insignificant from an economic perspective due to the coefficient estimate of only -0.0035.

Managerial Ownership (MO) exhibits a negative and statistically insignificant effect at a ten percent level. Economically, the effect is also considered insignificant on the back of the coefficient estimate of only -0.0003.

The squared value of Managerial Ownership (MO_2), is also found to be statistically insignificant at a ten percent level. The economical consideration is in line with the statistical, with a positive coefficient estimate close to zero.

Leverage (LV) has a positive and statistically significant effect, at a one percent level, on debt maturity structure. Leverage is further deemed to have a significant economic effect on debt maturity structure, with a coefficient estimated at 0.243.

Profitability (PR), proxied by ROA, shows a negative and statistically significant relation, at a one percent level. However, a coefficient estimated at -0.0013 implies that profitability is economically insignificant.

Non-debt tax shield (NT) is neither statistically significant at a ten percent level, nor economically significant with a positive coefficient estimate close to zero.

4.2.2 Hypotheses evaluation

In the following, the hypotheses formulated in chapter two are evaluated, and the presentation is structured according to the four theoretical arguments initially presented in this thesis. The hypotheses are evaluated on the back of their statistical and economical significance. Hypotheses are supported where coefficient estimates are found to be statistically significant, at a five percent level, and economically significant. When coefficient estimates are found statistically significant, at a five percent level, while economically insignificant, the hypotheses are deemed partly supported. Coefficient estimates found to be statistically insignificant leads to the hypotheses being rejected.

The Tax argument

The single tax hypothesis tested (TAX 3) is rejected. Non-debt tax shields are positively related to debt maturity structure, however the relation is statistically insignificant. Hol and van der Wijst (2006) report similar but statistically significant results for a sample of Norwegian limited liability firms. The findings however are contrary to Sogorb-Mira (2005) who identifies a negative relation when examining the capital structure of Spanish SME's. These conflicting results

further weaken the argument that tax considerations drive decisions on debt maturity structure.

The Risk management argument

The first hypothesis (RM 1) under the risk management argument is partly supported. Earnings volatility is negatively related to debt maturity. While the relation is statistically significant it remains economically insignificant, and hence the hypothesis is only partly supported. Although focusing on agency costs, Easterwood and Kadapakkam (1994) reports a negative relation between debt maturity and earnings volatility. Guedes and Opeler (1996) on the other hand report a positive relation, in line with the liquidity risk hypothesis. Guedes and Opeler therefore offers support for the second hypothesis (RM 2) which is however rejected in this thesis; as RM 1 and RM2 are mutually exclusive, support for RM 1 implies that RM 2 is rejected. Lastly, Antoniou et al. (2006) studies British, German and French firms and reports differing relations between debt maturity and earnings volatility, indicating that institutional settings may influence how earnings volatility affect debt maturity structure decisions. The latter finding may in part explain the contradicting results repeatedly found in the empirical literature.

Lastly, the third hypothesis (RM 3) is supported. Asset structure is positively related to debt maturity structure. The relationship is both statistically and economically significant, and in line with the majority of empirical findings such as Stohs and Mauer (1996), Schiantarelli and Sembenelli (1997), Demirguc-Kunt and Maksimovic (1999), Ozkan (2000), Jun and Jen (2005), Scherr and Hulburt (2001), Sogorb-Mira (2005), Hol and van der Wijst (2006) and Körner (2007). Moreover, these results indicate that on average firms follow a long policy where debt and asset maturities are matched, in line with the model predictions of Morris (1976).

The Signalling argument

The first signalling hypothesis (SIG 1) is rejected as a positive relation between debt maturity and high quality firms are found. This relation is both statistically and economically significant and contradicts the negative relation predicted by the

models of Flannery (1986) and Diamond (1991). However, Stohs and Mauer (1996), using bond rating as a proxy for firm quality, reports a statistically significant non-monotonic relation between debt maturity and firm quality, in line with the results obtained in this thesis. The findings of Stohs and Mauer are also in line with the second hypothesis (SIG 2), predicting a negative relation between low firm quality and debt maturity. The statistically and economically significant results obtained in this thesis provide support for SIG 2. The results found for both SIG 1 and SIG 2 are also in line with the findings of Berger et al.(2005) and Scherr and Hulburt (2001). Moreover, these results also corresponds to Highfield (2008) who finds no support for high and low credit rated firms issuing debt with shorter maturities to signal firm quality. Instead, Highfield finds a direct positive relationship between credit rating and debt maturity.

The third hypothesis (SIG 3) on the relation between debt maturity and medium firm quality is not sufficiently tested. The reason for this is the use of the dummy variable approach while testing the effect of high and low quality firms on debt maturity. To avoid the dummy variable trap, medium firm quality represent the base case and the effect is captured in the constant term (Gujarati 2003). However, due to the FEM specification, the cross-sectional differences are also captured in the constant term which restricts separating the entity specific effects from the medium firm quality effects.

The final hypothesis (SIG 4) under this argument concerns the relationship between firm age and debt maturity structure. Firm age is found to be positive and statistically significantly related to debt maturity structure. However, the variable is economically insignificant and thus the hypothesis is only partly supported. With respect to firm age, the results reported by Hall, Hutchinson, and Michaelas (2000) are mixed due to the confounding effect of leverage and debt maturity. Mixed results are also obtained by Scherr and Hulburt (2001) who report opposite results for the sample years 1987 and 1993. Firm age as a proxy for the developing relation between firms and its creditors rests on assumptions that are difficult to validate or control. Subsequently, a more appropriate proxy is argued necessary to obtain more unambiguous results.

The Agency cost argument

The agency cost argument is the most extensive with regards to number of hypotheses tested, and covers a broad range of explanatory variables, mainly related to corporate governance.

The first hypothesis (AC 1) is supported. Firm size is positively related to debt maturity structure, a relation that is both statistically and economically significant. This finding is supported by Stohs and Mauer (1996), Ozkan (2000), Körner (2007). However, Hall, Hutchinson, and Michaelas (2000) and García-Teruel and Martínez-Solano (2006) report opposite results, while the findings of Antoniou et al. (2006) are mixed as the effect of firm size on debt maturity is only significant for British firms.

Support is also found for the second hypothesis (AC 2). Asset structure is positively related to debt maturity and the relation is both statistically and economically significant. This also indicates that maturity matching policies are common among Norwegian limited liability firms. Demirguc-Kunt and Maksimovic (1999) and Hall, Hutchinson, and Michaelas (2000) report similar results, while Antoniou et al. (2006) report mixed findings as the positive relationship is found only for French and German firms. Körner (2007) on the other hand is unable to obtain any significant results, when measuring asset structure by the amount of collateralisable assets.

The third hypothesis (AC 3) is rejected. Average asset life is found to be positively related to debt maturity structure. While statistically significant, the effect is economically insignificant. This result contradicts what is reported by Easterwood and Kadamanpak (1994).

The fourth hypothesis (AC 4) is supported. Growth opportunities are found to have a negative and statistically significant effect on debt maturity structure. The relationship is also found to be economically significant. These findings are in line with the results reported by Barclay and Smith Jr. (1995), Guedes and Opler (1996), Ozkan (2000) and Jun and Jen (2005). Schiantarelli and Sembenelli (1997) and Highfield (2008) also reports similar results for Italian and high-tech

firms, respectively. Hol and van der Wijst (2006) and Sogorb-Mira (2005) obtains the opposite result. Highfield (2008) further reports a positive relation when measuring growth opportunities as R&D over sales, and an insignificant relation when the proxy market value to book value of equity is used. Insignificant results are also reported by Stohs and Mauer (1996), Scherr and Hulburt (2001), Antoniou et al. (2006), Körner (2007) and Fan, Titman, and Twite (2008). Schiantarelli and Sembenelli's (1997) findings for British firms are insignificant and Hall, Hutchinson, and Michaelas' (2000) results are mixed with respect to the relation between debt maturity and growth opportunities.

The fifth hypothesis (AC 5) is partly supported. Earnings volatility is found to have a negative and statistically significant effect on debt maturity structure. The effect, however, is economically insignificant. The negative relation reported in this thesis is in line with the findings of Easterwood and Kadapakkam (1994). Similar results are also obtained by Jun and Jen (2005) when using sales volatility as opposed to earnings volatility, and also for Singaporean firms in a study of the 1997 Asian crisis conducted by Deesomsak Deesomsak, Paudyal, and Pescetto (2009).

The sixth hypothesis (AC 6) is rejected. Ownership concentration exhibits a positive effect on debt maturity structure, which contradicts this hypothesis. The relation is further statistically insignificant and consequently the hypothesis is rejected. Benmelech (2006) finds a negative relation, whereas García-Teruel and Martínez-Solano (2006) report a concave relationship between block holder presence and debt maturity.

Parallel with AC 6, the seventh hypothesis (AC 7) is also rejected. Contrary to predictions, a convex and statistically insignificant relationship between management ownership and debt maturity is found as the coefficient of management ownership is negative while its squared value is positive. Datta, Iskandar-Datta, and Raman (2005) report a monotonic and negative relationship. Benmelech (2006) find that managerial power, measured by the governance index of Gompers, Ishii and Metrick (GIM), is positively related to debt maturity structure, and further that managerial stock ownership shows no relation. García-

Teruel and Martínez-Solano (2006) on the other hand finds a concave relationship.

Finally, the eight hypothesis (AC 8) is also rejected. Family control is found to be negatively but statistically insignificantly related to debt maturity structure. In general, the empirical research on family firms is scarce due to difficulties in obtaining data. In addition, no commonly agreed upon definition of a family firm is found in the literature. The findings of García-Teruel and Martínez-Solano (2006) show no relation between the largest owner being a family and debt maturity.

4.2.3 Differences between listed and non-listed firms

The insignificance of the trends, with respect to listing status, observed in the descriptive statistics where confirmed by the panel data analysis. Based on the regression results, listing status is found to have a statistically insignificant effect on debt maturity structure. Listing status therefore appears to have no sizeable effect on debt maturity structure, indicating that models initially developed for listed also apply to non-listed firms.

4.2.4 Confounding effects

Empirical studies on debt maturity structure that fails to control for leverage runs the risk of introducing a confounding effect between debt maturity and leverage, leading to biased results. The potential confounding effect steams from the fact that leverage and debt maturity are variables created from the same underlying data. In essence, debt maturity measures how leverage is structured, i.e. short versus long term debt.

The overall goal of model 2 and 3 is to control for this confounding effect, by manipulating the dependent and independent variables. Model 2 and 3 decouples the relationship between debt maturity and leverage by estimating models where

leverage is excluded as an independent variable and where debt maturity is replaced by leverage as the dependent variable, respectively.

On the back of the three models estimated (model 1 to 3), the confounding effect is evident when comparing the coefficient estimates of LS, FA, OC and MO that change signs, or becomes insignificant or significant, depending on the model estimated. Moreover, that adjusted R-square remains high across all three models further indicates that there exists a somewhat overlapping relationship between leverage and debt maturity in the data sample and model specification used in this thesis.

4.2.5 Robustness

The robustness of model 1 is evaluated by comparing the estimates to those obtained from model 4 and 5. Here, the term robustness refers to how model 1 performs when independent variables are measured with alternative proxies and when the FEM specification is altered.

Model 4 is a replica of model 1, but specified as a constant coefficients model (CCM) as opposed to FEM. Model 4 therefore represents a benchmark to evaluate the benefits of specifying model 1 as a FEM. Comparing adjusted R-squares and the FEM is argued to be superior to CCM as the adjusted R-square of model 1 exceeds model 4 by 0.257.

The purpose of estimating model 5 is to evaluate the robustness of model 1 with regards to how asset duration is proxied. Substituting AS with AM in model 5 cause the coefficient signs of LS, FA, AL, GO and FF to change and adjusted R-square to decrease by 0.021. Hence, an argument can be made that model 1 is not robust with respect to how proxies are defined.

Overall, model 1 outperforms model 4 and 5 based on adjusted R-square. However, the results obtained from model 1 cannot be deemed robust due to sensitivity to proxy definitions.

4.2.6 Summary of regression analyses

The key results from the panel data regression analysis can be summarised according to the four arguments; tax, risk management, signalling and agency costs.

Panel A: Hypotheses testing results

Hypotheses	Explanatory variables	Predicted relation	Obtained Relation	Conclusion
TAX 3	NT	+	+	rejected
RM 1	EV	-	-	partly supported
RM 2	EV	+	-	rejected
RM 3	AS	+	+	supported
SIG 1	HQ	-	+	rejected
SIG 2	LQ	-	-	supported
SIG 3	MQ	+	N/A	inconclusive
SIG 4	FA	+	+	partly supported
AC 1	FS	+	+	supported
AC 2	AS	+	+	supported
AC 3	AL	-	+	rejected
AC 4	GO	-	-	supported
AC 5	EV	-	-	partly supported
AC 6	OC	-	+	rejected
AC 7	MO	concave	convex	rejected
AC 8	FF	+	-	rejected

Table 4-F Hypotheses testing results

The regression results concerning the tax argument show that non-debt tax shields are not a key factor driving debt maturity structure decisions. In connection with the risk management argument, the regression results lend partly support and support to the first and third hypotheses, respectively. Earnings volatility is found to have a negative impact on debt maturity, lending support to the argument that creditors exert discretion over the debt maturity decisions of firms. The positive relation between asset structure and debt maturity indicate that on average firms follow a long policy where debt and asset maturities are matched.

Overall, a mixed picture for the signalling argument is found. The results indicate a linear, rather than concave relationship between debt maturity and firm quality,

which is in line with the predictions of Flannery's (1986) model. These results are somewhat hampered by the inability to interpret the size and significance of the coefficient estimate for medium firm quality, captured by the intercept term. Although, firm age is found statistically significant, the lack of economical significance limits the impact. In total, the signaling argument is found to hold only limited explanatory power with regards to debt maturity structure.

Under the agency cost argument, the regression results lend support to half of the hypotheses. With respect to debt maturity structure decisions, firm size, asset structure and growth opportunities represent key driving factors while earnings volatility has limited economical effect. Average asset life, ownership concentration, family firm control and management ownership on the other hand, are factors not found to drive these decisions.

On the back of the panel data regression analysis, the agency cost and partly the risk management arguments appear to hold the greatest explanatory power with regards to debt maturity structure decisions.

5 Conclusion and implications for future research

This thesis set out to provide key characteristics of Norwegian non-listed firms' debt maturity structure, and to assess how it deviates from that of listed firms. Key characteristics have been extensively provided and the analyses show that no statistically significant differences with respect to the debt maturity structure of listed and non-listed firms exist. Moreover, the fact that the model specified and tested in this thesis applies to all Norwegian limited liability firms in the sample supports this conclusion.

The main trends identified in the descriptive analysis were firstly that the average debt maturities appear constant over time, indicating the existence of an industry sector dependent optimal debt maturity structure. Moreover, a marked divergence was observed between non-capital intensive and capital intensive industries, where the latter appears to prefer more long term debt. Secondly, listed firms seem to have longer debt maturities compared to non-listed. Thirdly, family firm status appears to have no sizable effect on the debt maturity structure.

The trends observed in the descriptive statistics, indicating that listed firms on average have longer debt maturities, were refuted as statistically insignificant by the panel data analysis. Listing status subsequently appears to have no sizeable effect on debt maturity structure. This observation lends support to the argument that the theoretical models, initially developed for listed firms, apply to both non-listed and listed firms. Furthermore, the data exhibits less variation across listing status compared to industry sector classifications, indicating that the latter exerts greater influence on the debt maturity structure.

The tax argument rests upon precisely defined models with straight forward, testable implications. No support is provided for the tax argument. Subsequently, the tax argument holds minimal explanatory power on the debt maturity structure of Norwegian limited liability firms.

The risk management argument rests upon a theoretical base providing more general guidelines, with limited testable implications. The riskiness of a firm exhibits a negative impact on debt maturity, lending support to the argument that creditors, as opposed to managers, exert discretion over the debt maturity decisions of firms. Moreover, the results indicate that on average firms follow a long policy where debt and asset maturities are matched, in line with the model predictions of Morris (1976).

The signalling argument is founded on theoretical models with clear predictions, facilitating implication testing. In line with the model predictions of Flannery (1986), a linear rather than concave relationship between debt maturity and firm quality is found. Overall, the signaling argument is found to hold only limited explanatory power with regards to the debt maturity structure of Norwegian limited liability firms.

The agency cost argument is not based on one specific theoretical model, but on several autonomous theoretical arguments with separate testable implications. Hence, to evaluate the agency cost argument, the separate regression results are evaluated as a whole. Shorter debt maturities appear to be used as a remedy for agency costs, where the potential for agency conflicts is pressing. The reason being that as debt maturity shortens, the managerial discretion is reduced and hence also the potential for moral hazard. Furthermore, ownership structure (i.e. ownership concentration, managerial ownership and family control) is in general not found to significantly influence decisions on debt maturity structure.

Overall, the agency cost and partly the risk management arguments hold the greatest relevance with regards to debt maturity structure decisions. Hence, the findings show that models initially developed for listed firms also have considerable explanatory power for Norwegian limited liability firms, of which the majority are non-listed.

It is noted that the results obtained are prone to issues concerning proxy definitions and measurement, robustness, estimation methods and sample reductions. Lack of an integrated theoretical framework, providing unambiguous proxy definitions, together with the rude measures for debt and asset maturity,

caused by accounting regulations, reduce the precision of the results obtained. Furthermore, the model specified in this thesis does not exhibit the desired level of robustness, as estimates are found sensitive to how certain proxies are defined

Panel data analysis is inherently prone to heteroscedasticity, autocorrelation and multicollinearity, thus requiring robust estimation methods capable of producing unbiased and efficient estimates under various conditions. In general, GMM, as opposed to OLS, the estimation method applied in this thesis, provide more robust estimation when autocorrelation and heteroscedasticity is present.

Due to lack of governance data, the sample employed in the panel data analysis was limited to seven consecutive years of observation, as opposed to the fourteen used in the descriptive analysis.

5.1 Further research

Further advances in the field of debt maturity research is likely to be obtained if more detailed information, or data, on debt and asset maturities were to become available. The existing proxies rely on rude measures, generated by accounting regulations, where maturities are categorised as either long term or short term, by a dividing line drawn at one year. In addition, development of more unambiguously defined proxies based on solid theoretical foundation would likely reduce the ambiguity currently observed in the empirics. Such development calls for approaches that are more suited to uncover causational relationships.

Further refinement of the results obtained in this thesis, may be obtained by employing the GMM estimation method, as both autocorrelation and heteroscedasticity is present in this dataset. Future research is also likely to benefit from a richer dataset, covering longer sample periods and more governance data.

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7 Appendix 1 – Summary of empirical findings

This appendix provides an overview of the most central empirical findings related to the four respective theoretical arguments. Due to the fact that these arguments constitute a loosely connected theoretical framework for the field of debt maturity structure, most empirical studies investigate more than one argument in order to control for other known effects, and hence one source may be quoted in more than one table. The tables follow the categorisation employed in the sections above (i.e. according to the four arguments) and list the studies chronologically. The tables summarise the findings from twenty three of the most influential empirical studies on debt maturity structure retrieved mainly from refereed academic journals.

7.1 The Tax argument

Source	**Description**	***Variable***	**Findings**
(Barclay and Smith Jr 1995)	Testing the tax hypothesis`s ability to account for variation in debt maturity, by employing the term structure as an explanatory variable renders no significant results.	*Term structure*	Not significant
(Guedes and Opler 1996)	Under the tax hypothesis long term debt is believed to be associated with firms having a higher expected marginal tax rate; however this association is not supported by the data. The opposite seem to be the case.	*High expected marginal tax rate*	Negative
	Unexpectedly ,the term premium is found to be negatively related to debt maturity.	*Term premium*	Negative
	The interaction variable between the term premium and the tax variable (higher expected marginal tax rate) is found to be insignificant.	*(Term premium x tax)*	Not significant
(Stohs and Mauer 1996)	The coefficient estimates on tax rate and earnings volatility were found to be negative as predicted, and significant in the pooled and fixed effects regressions. However, the economical significance appear to be marginal as a 10-percentage point increase in the tax rate, decreases debt maturity by a mere 1,7%, and a 1 standard deviation increase in earnings volatility decreases debt maturity by only 3,1%.	*Tax rate* *Earnings variability*	Negative Negative
	No evidence was found that the slope of the term structure is positively related to debt maturity. Contrary to predictions a negative, although insignificant relation was found.	*Term structure*	In-significant
(Ozkan 2000)	Defining taxes as the total tax charge divided by the total taxable income, renders a negative correlation with debt maturity.	*Taxes*	Negative
(Scherr and Hulburt 2001)	The tax-timing option following long term financing depends upon the term structure of interest rates and the firm`s tax rate. Due to data limitations the authors substitute the tax rate with a dummy variable indicating whether the firm is profitable i.e. is in a tax position. The regressions render mixed results and generally economically insignificant relations between tax status and debt maturity.	*Tax status*	In-significant
(Sogorb-Mira 2005)	Examining the capital structure of Spanish SMEs, significant negative coefficient estimates were achieved for both effective tax rate and non-debt tax shields on debt maturity (measured as long term debt ratio)	*Effective tax rate* *Non-debt tax shields*	Negative Negative
(Antoniou et al.	Testing the tax hypothesis, three factors believed to affect debt maturity		

2006)	were included. The effective tax rate was found to have a significant positive effect for German firms, whereas it was insignificant for UK and French firms. Term structure was found to have significant positive effects in Germany and the UK. Volatility of interest rates is finally found to be insignificant in France and Germany, while significant negative for UK firms. In sum the results indicate that the effect of tax considerations are rather weak and dependent on both sample period and country analyzed.	*Effective tax rate* *Term structure* *Volatility of interest rates*	Mixed Mixed Mixed
(Hol and van der Wijst 2006)	Using the ratio of depreciation charges to total costs as a proxy, the effect of taxes on debt maturity structure is tested for Norwegian non-listed firms. Non-debt tax shields give firms an incentive to take on more debt, as well as to lengthen the maturity of debt. The results indicate a significant positive effect on debt maturity, but a negative effect on total debt.	*Depreciation/total costs*	Positive
(García-Teruel and Martínez-Solano 2006)	To analyze the tax effects on debt maturity the term premium and a proxy for corporate tax rate (the ratio of total tax charge to total taxable income) were used on a sample of Spanish firms. Whereas corporate tax is significant in the estimations it is of marginal economic effect (near zero). A significant negative relation between the term premium and debt maturity was found, indicating that firms use short-term debt to avoid the term premium	*Corporate tax rate* *Term premium*	Zero Negative
(Körner 2007)	Both personal and corporate tax rates are believed to influence the financing decisions of firms. A decreasing tax shield should optimally cause a lengthening of debt maturity in order to amortize the flotation costs incurred in issuing debt. However, no significant relation was found. Firms are believed to rebalance its capital structure less frequently when asset returns are less volatile. Company value volatility is measured using the annual percentage change in EBITDA. No significant results were obtained.	*Corporate tax rate* *Company level volatility*	In-significant In-significant
(Highfield 2008)	Financial firms, issuing either fixed or floating rate debt are found to be more sensitive to the term structure premium. Whereas non-financials are fond to be indifferent to the term structure premium for floating rate debt. A positive relation between debt maturity and the term structure premium is found for non-financial companies issuing fixed-rate debt.	*Term structure premium*	Positive (fin) No relation (nonfin) Positive (nonfin+ fixed-rate)

Table 7-A Tax-benefits argument empirics table

7.2 The Risk Management argument

Source	**Description**	***Variable***	**Findings**
(Guedes and Opler 1996)	Larger firms are on average found to issue debt with shorter maturities. This is consistent with the liquidity risk hypothesis; as larger firms are less likely to default. Firms in industries with more volatile earnings are found to issue more long term debt. This is inconsistent with the liquidity risk explanation of debt maturity, but may reflect collinearity among the measure of earnings volatility and other variables.	*Firm size* *Earnings volatility*	Negative Positive
(Stohs and Mauer 1996)	Strong support for the maturity matching hypothesis is found as the coefficient estimates for asset maturity are found to be significantly positive across regression specifications. Consistent with the hypothesis, that firms increase their debt maturities to offset the higher probability of a liquidity crises due to leverage, a significant positive relation between debt maturity and leverage was found across regression techniques.	*Asset maturity* *Leverage*	Positive Positive

(Schiantarelli and Sembenelli 1997)	In a comparison of debt maturity choices between the UK and Italy, asset maturity was found to produce a significant positive relation with debt maturity. This is in line with the predictions of Myers (1977), and supports the idea of maturity matching.	*Asset maturity*	Positive
	Fixed assets are more easily used as collateral. Asset structure, reflecting the tangibility of assets, is therefore also found to render a significant positive relation with debt maturity. (Asset structure is measured by fixed capital over fixed capital plus gross working capital)	*Asset structure*	Positive
	The effect of leverage on debt maturity is found to be mostly positive. This is in accordance with expectations as higher leverage increases the threat of liquidation, subsequently inducing firms to prefer long term financing. Leverage might also work as proxy for lack of growth options.	*Leverage*	Positive
(Demirguc-Kunt and Maksimovic 1999)	Included as a control variable, inflation was found to render a significant negative relation with debt maturity for both small and large firms.	*Inflation*	Negative
	High rations of fixed to total assets were found to be positively associated with longer debt maturities.	*Asset structure*	Positive
	Furthermore, high levels of government subsidies were found to be positively related to debt maturity for small firms.	*Government subsidies (small firms)*	Positive
(Ozkan 2000)	Asset maturity, measured as ratio of net property, plant and equipment to annual depreciation expenses, render a significant positive relation to debt maturity.	*Asset maturity*	Positive
	By including the lagged version of the dependent variable, debt maturity, the adjustment speed towards a target or optimal debt maturity structure was investigated. The variable proved to be a strong and significant predictor of the debt maturity structure, indicating that deviations from an optimal maturity structure are associated with significant costs for the firms in the sample.	*Lagged debt maturity*	Positive
(Scherr and Hulburt 2001)	The weighted average asset maturity is computed as the sum of each asset`s book value, divided by the book value of total asset, times its maturity in months. For accounts receivable and inventory, maturity is measured by the asset`s sales turnover ratios (sales/asset book value). For other asset categories, maturities are set according to assumptions made by the authors. Strong evidence of a positive relation with debt maturity is found.	*Weighted Average Asset Maturity*	Positive
	In accordance with a priori expectation leverage was found to be positively related to debt maturity.	*Leverage*	Positive
(Jun and Jen 2005)	Firms with a high degree of maturity matching are found to more likely stabilise equity values, and firms employing a higher degree of maturity matching are found to have lower stock return volatility. This indicates asset maturity to be an important determinant of debt maturity.	*Asset maturity*	Positive
(Sogorb-Mira 2005)	In accordance with the notion that larger firms are less likely to default, firm size is found to be positively related to debt maturity (measured as long term ratio) in a survey of Spanish SME`s.	*Firm size*	Positive
	Using the quotient between tangible assets and assets as a measure of asset structure yielded a significant positive relation with debt maturity, indicating maturity matching policies being practiced.	*Asset structure*	Positive
	Firm size, measured by the natural logarithm of total assets, is found to produce a significant positive relation with both debt maturity and leverage, indicating that the increase in leverage related to firm size is mainly long term.	*Firm size*	Positive
	Profitability, measured as the quotient between EBIT and assets was also found to be a significant predictor of debt maturity, but stronger relations were found between the short-term debt ratio and profitability. The results thus seem to indicate that profitability is mainly related to leverage. Separating the effect is thus impaired.	*Profitability*	Mixed
(Antoniou et al. 2006)	A positive relation between leverage and debt maturity in Germany, UK and France was found, indicating that highly leveraged firms seek to control for bankruptcy risks and the cost of financial distress by using long term debt.	*Leverage*	Positive
	The effect of earnings volatility on debt maturity where found to be insignificant for German firms, positive for French firms and negative for British firms. The positive relation found for French firms suggest that firms with volatile earnings issue long term debt to avoid liquidation. The negative relation found for British firms indicate a possible aversion for long term commitment.	*Earnings volatility*	Mixed

	Using size mainly as a control variable, but at the same time building on a number of arguments related to the liquidity risk hypothesis, a marginal but significant positive effect of firm size on debt maturity is found in a sample of Norwegian non-listed firms. Firm size is proxied by the natural logarithm of total assets.	*Firm size*	Positive
(Hol and van der Wijst 2006)	The maturity matching principle is tested by adding the asset structure, proxied by the ratio of current to total assets (book values). This measure implies a negative relation with debt maturity if maturity matching policies are in place. Converted to the definitions used by this thesis the results are reported as positive.	*Assets structure*	Positive
	Information asymmetries are proxied by the level of cross-investments in daughter companies relative to total assets. Such investments make the firm less transparent, which again is predicted to be related to less debt and relatively shorter maturities. The results show a significant and negative effect on debt maturities.	*Investments in daughter companies*	Negative
	According the theories of maturity matching, firms seek liquidity immunization through matching of asset and liability maturities. In line with expectations asset maturity is found to be a significant predictor of debt maturity.	*Asset maturity*	Positive
(Körner 2007)	Theory on the effect of leverage on debt maturity offer different predictions across theoretical perspectives. While the liquidity risk implies that firms lengthen the maturity in order to avoid exposure to bankruptcy risk, the agency cost and tax arguments predict the opposite relation. In the study of Czech firms leverage is found to be positively related to debt maturity.	*Leverage*	Positive
	In an international comparison of capital structure and debt maturity choices, a significant positive relation between asset tangibility (tangible assets to total assets) and debt maturity was found across economy classifications and time-sub-samples.	*Asset tangibility*	Positive
(Fan, Titman, and Twite 2008)	Contrary to predictions, no evidence was found for maturity matching as asset maturity was found to produce mixed signs and no significant coefficients. (Asset maturity was measured by gross PPE over total assets time gross PPE over depreciation)	*Asset maturity*	In-significant
	Using return on assets (ROA) as a measure of firm profitability, positive and significant coefficient estimates were found across economy classifications and time-sub-samples, indicating ROA to be a significant predictor of debt maturity.	*Profitability (ROA)*	Positive

Table 7-B Risk management argument empirics table

7.3 The Signalling Argument

Source	**Description**	***Variable***	**Findings**
	Among publicly traded industrial firms with bond ratings, those with higher rating tend to have more short-term debt, and those with low ratings tend to have more long-debt.	*Credit rating*	Negative
(Barclay and Smith Jr 1995)	Firms without ratings generally have more short-term debt If the lack of rating is interpreted as high risk, while low and high ratings are seen as low and intermediate risk, these findings are consistent with Diamond`s (1991) predicted non-monotonic relation.	*Credit rating*	Concave
	Estimating the coefficient on the abnormal earnings variable renders statistically significant negative, though economically trivial results.	*Abnormal earnings*	Negative
	Usually one would expect a stock price runup prior to the issue of informationally disadvantaged securities, however tests show no statistically significant association between the past stock price runup and the maturity of new debt issues.	*Past stock price runup*	No relation
(Guedes and Opler 1996)	Signaling models imply that undervalued firms signaling their undervaluation through issuing short-term debt will experience positive abnormal stock return at the time of issue. Test reveal that the stock return after debt issues does not depend on debt maturity.	*Stock return after debt issue*	No relation
(Stohs and Mauer 1996)	In line with the signaling hypothesis, abnormal earnings (ΔEPS) were found to have a significant negative effect on debt maturity. A standard	*Abnormal earnings*	Negative

	deviation increase in ΔEPS reduces debt maturity by 3,5%.	*(ΔEPS)*	
	Strong support is provided for the relation between debt maturity structure and bond rating. Both bond rating and the square bond rating are found to be significant positive and negative respectively, thus providing support for the non-monotonic relation between debt maturity and bond rating.	*Bond rating* *Squared bond rating*	Positive Negative
(Hall, Hutchinson, and Michaelas 2000)	Since small size is likely to lead to severe information asymmetry problems between owner-managers of small enterprises and potential lenders as small enterprises are unlikely to have adequate and reliable financial statements. In accordance with these assumptions firm size was found to produce a significant negative relation to debt maturity.	*Firm size*	Negative
	Asset structure shows the level of fixed assets, such as land, buildings and machinery, which a firm has and serves as a proxy for collateral. It is measured as a ratio of fixed assets to total assets. Collateral will mitigate information asymmetry and agency problems because it will secure the interests of lenders in the event of problems arising due to lack of information or conflicts of interest with the owner-managers of SMEs. It will be positively related to leverage although the maturity structure of debt may result in `matching' taking place such that long term assets are used as collateral for long term loans and short-term assets for short-term loans in which case the relationship between asset structure and short-term debt will be negative. In line with these arguments assets structure was found to exhibit a significant positive relation to debt maturity.	*Asset structure*	Positive
	Defining short-term debt ratio as short-term debt to total assets renders a significant negative relation between profits and short-term debt. Although long term debt was not found to be significantly related to profitability, this may be due to the definition using total assets as opposed to total debt. Thus this result is reported here as mixed.	*Profits*	Mixed
	Age is found to be negatively related to both short-term and long term debt ratios, making it infeasible to separate the effect of age on leverage and debt maturity. Consequently these results are reported here as mixed	*Age*	Mixed
(Ozkan 2000)	Firm quality, proxied by the difference in earnings in t+1 and t, divided by earnings in year t, is found to have mixed and only partly significant effect on debt maturity.	*Firm quality*	Mixed
(Scherr and Hulburt 2001)	As opposed to the use of bond rating, the use of accounting based measure of risk ratings, the Z-Score, for small businesses provide evidence for a non-monotonic relation between debt maturity and risk ratings. The non-monotonic relation is uncovered by using the second-power measure, computed by the Z-Score times the absolute value of the Z-Score. The regressions uncover a negative and positive relation between debt maturity and the Z-score and the Z-Score squared respectively – confirming the concave relation.	*Z-Score* *Z-Score squared*	Negative Positive
	In order to measure the existence of information asymmetries firm age and firm size are used as proxies. Firm age is measured as the natural logarithm of one plus the age of the firm. Firm size is measured using the natural logarithm of firm sales. The findings indicate that firm age is found to be significantly and positively related to maturity in 1987, but negatively in 1993. Firm size is found to be negatively and significantly related to debt maturity – as opposed to the a priori expectations	*Firm age* *Firm size*	Mixed Negative
(Johnson 2003)	Using two accounting based measures assumed to approximate for risk rating along with a variable differing on whether the debt is investment grade or not, a concave relation between debt maturity and risk rating for traded non-financial firms is found for the accounting based measures. However, contrary to Diamond`s (1991) predictions a positive relation is found between debt maturity and investment grade debt.	*Firm size* *Earnings volatility* *Investment grade debt*	Concave Concave Positive
(Berger et al. 2005)	Testing the effects of banks` risk ratings on maturity under conditions where information asymmetries are expected to be great (no credit ratings available) showed that low risk firms tended to have significantly shorter debt maturities.	*Low Credit risk*	Negative
	Testing the effects of reducing information asymmetries (the use of credit scoring in conjuncture with another lending technology) on maturity for each of the different risk ratings showed debt maturities to increase significantly when information asymmetries were reduced.	*Information asymmetry* *High credit risk*	Negative Positive
	Contrary to Diamond`s (Diamond 1991) model, no significant difference in maturity were found between high and intermediate risk	*Intermediate*	Positive

	firms.	*credit risk*	
(Antoniou et al. 2006)	The signalling hypothesis predicts a negative relation between firm quality and debt maturity. No significant relations were found between debt maturity and firm quality for German, French and British firms. Firm quality is proxied using to measures; the ratio of net income plus depreciation to net debt, and the ratio of shareholder funds to net debt.	*Firm quality*	In-significant
	The equity risk premium is found to have a positive and significant effect on debt maturity in both the UK and Germany, while positive but not significant in France. British and German firms issue long term debt if the equity premium is high, reflecting the managers attempts to minimize the cost of capital, naturally the findings are stronger in the UK, where the economy is more market oriented.	*Equity risk premium*	Mixed
	The association between share price performance and debt maturity is found to be positive and significant for German and British firms, but not significant for French firms. The positive relation supports the hypothesis that firms issue informationally disadvantaged securities (long term debt) after the rise in share prices.	*Share price performance*	Positive (mixed)
(Hol and van der Wijst 2006)	Using profitability (return on assets) to test the Peking Order hypothesis, renders a significant negative relation between long term debt and profitability. However the results are of limited economically significance and the result using total debt as dependent variable is positive and significant (leverage is commonly found to be related to debt maturity). Hence these results hold limited validity.	*Return on assets*	Negative
(Fan, Titman, and Twite 2008)	Using the natural logarithm of total assets as a proxy for firm size, a positive and significant relation between debt maturity and firm size was found across economy classifications and time-sub-samples.	*Firm size*	Positive
(Highfield 2008)	In examining the relation between quality and debt maturity, no support was found for the use of short-maturities being used by investment grade firms to signal quality. No evidence was found for high- and low-rated firms issuing shorter-term debt, but a direct positive relation between credit rating and debt maturity was found.	*Moody`s investment grade*  *Moody`s credit rating*	Negative Positive

Table 7-C Signaling argument empirics table

7.4 The Agency cost argument

Source	**Description**	***Variable***	**Findings**
(Easterwood and Kadapakkam 1994)	Agency conflicts arise primarily when a firm is in financial distress. Firms with more volatile earnings face a higher probability of financial distress. Thus, agency problems are more severe for those firms with more volatile earnings. This notion is confirmed by the empirical findings.	*Earnings volatility*	Negative
	The results also show that R&D expenses exhibit a significant and negative relation to short-term debt ratios, implying that the inverse relation also holds. (*However this inference may not be validly drawn as it may confound the effects of leverage.)	*R&D expenses*	Positive*
(Barclay and Smith Jr 1995)	By comparing the debt maturity of deregulated firms prior and after deregulation, it is found that these firms significantly reduce the maturity of their debt following deregulation. However this reduction can be entirely explained by a general time trend of debt maturity reduction, thus invalidating the effect of deregulation on debt maturity.	*Firm regulation*	In-significant
	Firms with more growth options in their investment opportunity sets are found to issue more short-term debt.	*Growth opportunity*	Negative
(Guedes and Opler 1996)	The assumption that utility firms have less growth opportunities and thus are less prone to the underinvestment problem is supported by the data, showing that on average utilities issue relatively long term debt.	*Firm is a utility*	Positive
	Similarly a statistically and economic significant negative relation is found between growth opportunities (measured by the market-to-	*Growth*	Negative

	book ratio) and debt maturity. Growth opportunities are believed to be associated with the underinvestment problem.	*opportunities*	
(Stohs and Mauer 1996)	Inconsistent with the predictions of the agency cost argument, the market-to-book ratio was found to either be insignificant or have the wrong sign. Thus no support was provided for the prediction that debt maturity structure decreases with the portion of growth options in the firm`s opportunity set.	*Growth opportunity (MV/BV)*	In-significant/negative
	Evidence that larger firms have longer debt maturities was found. A standard deviation increase in size was found to increase debt maturity by 5.7%. Size was measured as the natural logarithm of an estimate of the market value of the firm.	*Size*	Positive
(Schiantarelli and Sembenelli 1997)	The existence of growth options should, according to theory, be associated with greater use of short-term debt to control for the greater likelihood of conflicts between owners and creditors. Empirical support for this is found in Italy, but not for the UK sample. (Growth opportunities are proxied by the growth rate of sales between t and t-1, and t-1 and t-2)	*Growth opportunity (IT)*	Negative
		Growth opportunity (UK)	In-significant
	An alternative to the liquidation-risk explanation for the relation between debt maturity and leverage is offered by the agency perspective, where leverage can be viewed as a mechanism to reduce the free cash flow in the firm and thereby reducing potential agency conflicts.	*Leverage*	Positive
(Demirguc-Kunt and Maksimovic 1999)	Fixed assets are more suited as collateral, and thus firms with a high fixed assets ration should have higher borrowing capacity. On the back of this borrowing capacity and the fact that firms tend to match the duration of assets and liabilities, the fixed asset ratio is predicted to be positively related to debt maturity. (Debt maturity is measures as the ratio of long term debt to total assets). The empirical findings support the predictions and indicate matching of maturities.	*Asset structure*	Positive
	A firm with a high ratio of net sales to net fixed assets is assumed to need more short-term financing to support its sales, however this prediction only receives limited empirical support.(Significant positive for short-term debt, but not significant negative for long term debt)	*Net sales to net fixed assets*	Negative
	The quality of the legal institutions is predicted to influence the potential agency problems between owners and creditors. The findings show that the effect of the quality of legal institutions is greater for large firms.	*Quality of legal institutions (Large firms)*	Positive
		Quality of legal institutions (Small firms)	In-significant
	Large firms in markets with active stock markets are found to have longer debt maturities.	*Active stock markets (large firms)*	Positive
	A large banking sector is found to enable small firms to extend the maturity of their debt.	*Large bank sector (small firms)*	Positive
(Hall, Hutchinson, and Michaelas 2000)	Agency problems are also likely to be greater because small-scale entrepreneurs have an incentive to take risks to grow, especially if they have limited liability, because they will benefit from the extra value created whereas lenders will only recover the amount of the loan. Subsequently debt maturity is found to be inversely related to firm size.	*Firm size*	Negative
	Asset structure is found to be positively related to debt maturity, indicating that maturity matching may be practiced within the sample.	*Asset structure*	Positive
	Growth (sales growth over the last three years), used as a proxy for conditions under which the agency problems are assumed to be more severe, is found to produce a significant positive relation to short-term debt. However, the inverse relation to long term debt is not significant. This result is reported as mixed here. The effect of growth remains stable across industries.	*Growth*	Mixed

(Ozkan 2000)	As a proxy for growth opportunities, the ratio of market value to book value, defined as the ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of total assets is used. The regression results indicate a significant negative effect on debt maturity across models.	*Market Value/ Book Value*	Negative
	As a second proxy for growth opportunities, firm size, defined as the natural logarithm of sales in 1983 prices, is used. As expected firm size is found to produce a significant positive relation to debt maturity across regression models.	*Firm Size*	Positive
(Scherr and Hulburt 2001)	To capture the level of intangibles and growth-oriented investments the ratio of depreciation to total assets and R&D employees to all employees were used. No significant results were obtained.	*Depreciation/ Total Assets*	In-significant
	Assuming that firms that grow faster have greater opportunity for future growth, past growth is used as yet another proxy for growth opportunity. No significant results were obtained.	*R&D Employees/ Total Employees*	In-significant
	Based on self-reported estimated of market values for the 1987 observations, the market-to-book ratio is used as the final proxy for growth options. No significant results were obtained.	*Growth in sales*	In-significant
		Market Assets/ Book Assets	In-significant
(Sogorb-Mira 2005)	Using the quotient between intangible assets and company assets as a proxy for growth opportunities a significant positive relation between debt maturity (long term debt ratio) and growth opportunities was found for Spanish SME`s	*Growth opportunity*	Positive
(Datta, Iskandar-Datta, and Raman 2005)	Examining the hypothesis that managers with the highest stock ownership utilize the shortest debt maturity structure, by comparing the means for the highest and lowest ownership quartiles render a significant negative and monotonic relation between debt maturity and managerial stock ownership.	*Managerial stock ownership*	Negative
(Jun and Jen 2005)	Debt maturity choices and debt maturity matching are proposed as alternative financial strategies in reducing agency and contracting costs. Debt maturity choice is found to be a more efficient strategy in controlling agency conflicts or contracting costs. Agency and contracting costs are found to vary with the financial strength of a firm, its growth opportunities and risk as measured by sales volatility.	*Financial strength*	Positive
		Growth opportunities	Negative
		Sales volatility	Negative
(Antoniou et al. 2006)	The association between debt maturity and liquidity is found to be negative for firms in Germany, France and the UK. The findings indicate that firms with high liquidity are unable to obtain long term financing. This is possibly due to the agency costs associated with free cash flows. Moreover, liquid assets are less suited as support for long term debt as it exposes lenders to the risk of asset substitution.	*Liquidity*	Negative
	Market-to-book as a proxy for growth opportunities was not found to be a significant predictor of debt maturity in Germany, France or the UK. The lack of significance indicates that sub-optimal investment concerns are not important.	*Growth opportunity (MV/BV)*	In-significant
	Firm size is found to have a significant effect on debt maturity only for British firms, thus supporting the idea that indirect bankruptcies costs are lower in Germanic and Latin economies.	*Firm size*	Mixed
	For French and German firms asset maturity is found to be a significant predictor of debt maturity. This supports the notion that firms match durations of assets and liabilities (immunization). The combination of insignificant effects of both market-to-book and asset maturity for the case of British firms seem to imply that the under-investment problem is less severe in the UK.	*Asset maturity*	Mixed
(Benmelech 2006)	Using three different measures as proxies for managerial entrenchment, the effect of managerial entrenchment on debt maturity was examined. According to the entrenchment-theory, although based on leverage, managerial power (GIM) was found to be positively related to debt maturity. Correspondingly, the existing of a block holder was found to be negatively related to debt maturity. Using managerial stockownership as a proxy for managerial entrenchment rendered non-significant findings, indicating this variable to be a poor proxy for entrenchment.	*Managerial power (GIM index)*	Positive
		Block holder	Negative
		Managerial stock ownership	No relation
(García-Teruel and Martínez-Solano 2006)	Based on a sample of Spanish companies the effect of managerial stock ownership on debt maturity was examined. While controlling for several know determinants of debt maturity, a concave relationship between managerial ownership and debt maturity was	*Managerial ownership*	Concave
		Large	Concave

	uncovered, indicating that as managerial ownership increases the interest of owners and managers converge, thus leading to a preference for shorter-term debt. A similar relation was found for the relation between a major block holder and debt maturity, indicating that with high block holder ownership there is a need to signal to the market that potential expropriation is countered by the use of short-term debt. The presence of a bank as main owner is found to be negatively related to debt maturity, indicating less monitoring by banks in the owner role. No particular effect is found when the main owner is a family.	*shareholder* *Largest owner is a bank* *Firm size* *Leverage* *Credit risk (Z-score)* *Largest owner is a family*	Negative Negative Positive Concave No relation
(Hol and van der Wijst 2006)	Contrary to expectations, the proxy for growth options, growth of sales, was found to be significant positively related to debt maturity for a sample of non-listed Norwegian firms.	*Growth of sales*	Positive
(Körner 2007)	Testing the hypothesis that shortening debt maturity contributes to mitigating the agency problem between owners and creditors, depreciation over total assets is used as a proxy for growth opportunities. The regression results render an insignificant relation. Firm size is assumed to influence agency costs as larger firms are believed to have easier access to capital markets and greater negotiation power. The empirical test finds a significant and positive relation between firm size and debt maturity. Firms able to provide collateral for their credits are assumed to be seen as safer customers by lenders and thus less prone to agency problems. Based on the agency problem argument one should expect a positive relation between the volume of collateralizable assets and long term debt. The results however find no support for this hypothesis.	*Growth options* *Firm size* *Collateralizable assets*	In-significant Positive In-significant
(Highfield 2008)	Considering whether debt maturity is used to mitigate agency conflicts the relation between debt maturity and firms with high growth opportunities were tested, using three different measures of (proxies) to growth opportunity. Furthermore the proposition that regulated firms are less prone to agency conflicts and thus employ a higher fraction of long term debt was tested. Excluding financial institutions, a clear positive relation was found.	*High tech firm (binary variable)* *Market-to-book ratio* *R&D to sales ratio* *Regulated firm*	Negative No relation Positive (weak) Positive
(Fan, Titman, and Twite 2008)	Using market-to-book as a proxy for growth opportunity no significant relation with debt maturity was found in an international comparison of debt maturity choices.	*Growth opportunity (MV/BV)*	In-significant
(Deesomsak, Paudyal, and Pescetto 2009)	Firms with higher business risk are prone to higher agency costs, and thus they have an incentive to shorten debt maturity to lower agency costs. However, in the empirical results following an investigation into debt maturity structure and the 1997 Asian financial crisis, a significant negative relation between earnings volatility and debt maturity is only found for Singapore.	*Earnings volatility*	Negative (Singapore only)

Table 7-D Agency cost argument empirics table

8 Appendix 2 – Descriptive statistics

The results from the descriptive statistics, that are not included in chapter 4.1 are presented in the following. The tables presented report means and standard deviations for the operationalised variables, according to industry sector, listing status and family firm status.

8.1 Average asset life

Panel A - Annual average asset life means and standard deviations across industries, listing- and firm- status

Category		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Industry sector codes	0	0.23	0.15	0.14	0.20	0.25	0.20	0.19	0.16	0.18	0.20	0.20	0.20	0.17	0.15	0.19
		(1,44)	(,65)	(,69)	(,71)	(2,39)	(,77)	(,69)	(,53)	(,94)	(,67)	(1,00)	(2,35)	(,97)	(,87)	
	1	.	0.19	0.19	0.18	0.16	0.28	0.20	0.20	0.17	0.17	0.18	0.20	0.19	0.22	0.19
		.	(,22)	(,53)	(,81)	(,30)	(4,08)	(1,39)	(1,21)	(,48)	(,33)	(,62)	(1,61)	(1,20)	(1,80)	
	2	.	0.27	0.22	0.24	0.36	0.25	0.22	0.24	0.25	0.25	0.28	0.25	0.22	0.33	0.26
		.	(4,17)	(,47)	(1,33)	(11,51)	(2,14)	(,43)	(,76)	(,79)	(,74)	(2,81)	(1,26)	(,59)	(10,84)	
	3	.	0.16	0.10	0.10	0.49	0.25	0.09	0.22	0.38	0.11	0.11	0.20	0.08	0.10	0.18
		.	(,67)	(,19)	(,17)	(6,00)	(3,19)	(,18)	(2,83)	(2,59)	(,32)	(,33)	(2,86)	(,17)	(,46)	
	4	.	0.25	0.29	0.23	0.24	0.31	0.24	0.27	0.28	0.27	0.30	0.31	0.25	0.24	0.27
		.	(,53)	(2,61)	(,32)	(,62)	(3,72)	(,43)	(,74)	(1,27)	(,84)	(2,45)	(4,12)	(,70)	(,95)	
	5	.	0.24	0.22	0.19	0.20	0.19	0.17	0.19	0.21	0.21	0.20	0.17	0.16	0.17	0.19
		.	(,85)	(,67)	(1,58)	(1,70)	(,88)	(,70)	(1,40)	(2,63)	(3,65)	(1,47)	(1,30)	(1,33)	(3,16)	
	7	.	0.30	0.30	0.32	0.28	0.26	0.28	0.26	0.39	0.26	0.29	0.27	0.27	0.26	0.29
		.	(1,52)	(1,83)	(4,89)	(,88)	(1,05)	(3,34)	(,79)	(14,44)	(,85)	(2,11)	(,95)	(,95)	(,91)	
	8	.	0.27	0.23	0.30	0.22	0.25	0.26	0.43	1.38	0.30	0.27	0.23	0.30	0.29	0.36
		.	(1,01)	(,50)	(2,98)	(,96)	(,88)	(3,47)	(13,24)	(48,51)	(2,64)	(1,23)	(,94)	(2,78)	(4,98)	
Mean		**0.23**	**0.23**	**0.21**	**0.22**	**0.27**	**0.25**	**0.21**	**0.25**	**0.40**	**0.22**	**0.23**	**0.23**	**0.21**	**0.22**	
Listing status	N	0.23	0.23	0.23	0.23	0.24	0.23	0.21	0.21	0.28	0.23	0.23	0.21	0.19	.	0.23
		(1,44)	(1,61)	(1,27)	(2,67)	(3,98)	(1,68)	(1,76)	(2,87)	(11,06)	(2,68)	(1,75)	(1,81)	(1,24)	.	
	Y	0.08	0.05	0.06	0.06	0.06	0.04	0.05	0.03	0.04	0.03	0.04	0.04	0.04	.	0.05
		(,24)	(,05)	(,07)	(,07)	(,19)	(,07)	(,23)	(,08)	(,06)	(,06)	(,08)	(,08)	(,09)	.	
Mean		**0.16**	**0.14**	**0.14**	**0.15**	**0.15**	**0.13**	**0.13**	**0.12**	**0.16**	**0.13**	**0.14**	**0.12**	**0.12**	**.**	
Family firm status	N	.	.	.	.	.	.	0.22	0.20	0.24	0.23	0.21	0.21	0.20	0.19	0.21
		.	.	.	.	.	.	(2,03)	(,79)	(3,79)	(1,96)	(,72)	(,86)	(1,05)	(,62)	
	Y	.	.	.	.	.	.	0.20	0.21	0.21	0.22	0.22	0.21	0.23	0.22	0.22
		.	.	.	.	.	.	(,69)	(3,31)	(1,01)	(1,19)	(1,66)	(1,06)	(1,49)	(4,14)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**0.21**	**0.21**	**0.22**	**0.22**	**0.22**	**0.21**	**0.22**	**0.20**	

Table 8-A Average asset life

8.2 Growth opportunities

Panel A - Annual growth opportunities means and standard deviations across industries, listing- and firm- status

Category		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Industry sector codes	0	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02
		(,06)	(,08)	(,07)	(,07)	(,07)	(,07)	(,08)	(,09)	(,10)	(,10)	(,10)	(,09)	(,08)	(,06)	
	1	.	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.05	0.05	0.06	0.06	0.06	0.03
		.	(,03)	(,03)	(,05)	(,08)	(,08)	(,09)	(,09)	(,09)	(,12)	(,13)	(,13)	(,14)	(,14)	
	2	.	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02
		.	(,04)	(,05)	(,06)	(,06)	(,07)	(,07)	(,08)	(,08)	(,09)	(,09)	(,09)	(,08)	(,08)	
	3	.	0.01	0.01	0.02	0.03	0.06	0.05	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.04
		.	(,08)	(,05)	(,08)	(,11)	(,14)	(,13)	(,14)	(,12)	(,12)	(,11)	(,10)	(,09)	(,09)	
	4	.	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01
		.	(,03)	(,05)	(,05)	(,05)	(,06)	(,05)	(,05)	(,05)	(,05)	(,05)	(,05)	(,04)	(,04)	
	5	.	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
		.	(,07)	(,09)	(,08)	(,08)	(,09)	(,08)	(,08)	(,08)	(,08)	(,08)	(,08)	(,08)	(,07)	
	7	.	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02
		.	(,04)	(,05)	(,05)	(,06)	(,07)	(,07)	(,07)	(,07)	(,07)	(,07)	(,07)	(,06)	(,06)	
	8	.	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
		.	(,04)	(,05)	(,05)	(,05)	(,06)	(,07)	(,07)	(,07)	(,08)	(,08)	(,08)	(,08)	(,07)	
Mean		**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.02**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	
Listing status	N	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.02	.	0.02
		(,06)	(,06)	(,07)	(,07)	(,07)	(,08)	(,08)	(,08)	(,08)	(,08)	(,08)	(,08)	(,08)	.	
	Y	0.01	0.01	0.01	0.01	0.02	0.04	0.03	0.04	0.05	0.06	0.06	0.06	0.06	.	0.04
		(,04)	(,04)	(,03)	(,04)	(,05)	(,08)	(,08)	(,08)	(,10)	(,12)	(,11)	(,10)	(,09)	.	
Mean		**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.03**	**0.03**	**0.03**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**.**	
Family firm status	N	.	.	.	.	.	.	0.03	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03
		.	.	.	.	.	.	(,10)	(,10)	(,11)	(,11)	(,11)	(,11)	(,10)	(,09)	
	Y	.	.	.	.	.	.	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
		.	.	.	.	.	.	(,07)	(,07)	(,07)	(,07)	(,07)	(,08)	(,07)	(,06)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**0.02**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.02**	

Table 8-B Growth opportunities

8.3 Firm age

Panel A - Annual firm age means and standard deviations across industries, listing- and firm- status

Category		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Industry sector codes	0	.	.	.	.	.	.	9.81	9.56	10.74	10.46	10.60	9.19	9.04	16.24	10.71
		.	.	.	.	.	.	(12,16)	(11,03)	(11,20)	(12,56)	(12,32)	(11,85)	(14,58)	(21,40)	
	1	.	.	.	.	.	.	10.86	10.33	11.75	12.13	12.62	12.42	12.37	11.90	11.80
		.	.	.	.	.	.	(15,50)	(16,73)	(17,55)	(18,73)	(18,48)	(17,94)	(16,14)	(15,23)	
	2	.	.	.	.	.	.	13.62	12.28	13.40	14.47	15.16	15.05	15.19	14.85	14.25
		.	.	.	.	.	.	(15,38)	(12,96)	(13,18)	(15,11)	(15,04)	(15,11)	(14,67)	(14,35)	
	3	.	.	.	.	.	.	12.82	12.05	13.03	13.31	13.33	13.45	12.69	12.86	12.94
		.	.	.	.	.	.	(22,00)	(20,35)	(19,73)	(21,61)	(21,16)	(20,81)	(18,97)	(19,48)	
	4	.	.	.	.	.	.	9.56	9.39	10.42	10.28	10.90	10.52	10.57	9.80	10.18
		.	.	.	.	.	.	(9,01)	(7,98)	(7,95)	(9,10)	(9,12)	(9,17)	(9,08)	(9,30)	
	5	.	.	.	.	.	.	10.85	11.04	12.17	12.21	12.82	13.69	13.58	12.38	12.34
		.	.	.	.	.	.	(14,04)	(13,96)	(14,17)	(14,95)	(14,98)	(15,49)	(15,15)	(14,57)	
	7	.	.	.	.	.	.	12.45	11.76	12.94	13.19	13.98	13.54	13.63	13.29	13.10
		.	.	.	.	.	.	(13,93)	(12,70)	(13,17)	(14,24)	(15,46)	(14,49)	(13,65)	(13,76)	
	8	.	.	.	.	.	.	11.80	11.13	12.17	12.18	12.83	12.65	12.72	12.25	12.22
		.	.	.	.	.	.	(15,15)	(13,87)	(13,92)	(14,61)	(14,52)	(14,56)	(14,04)	(14,00)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**11.47**	**10.94**	**12.08**	**12.28**	**12.78**	**12.56**	**12.47**	**12.95**	
Listing status	N	.	.	.	.	.	.	11.27	11.02	12.16	12.24	12.81	12.87	12.65	.	12.15
		.	.	.	.	.	.	(13,79)	(13,11)	(13,36)	(14,36)	(14,55)	(14,62)	(14,55)	.	
	Y	.	.	.	.	.	.	33.15	24.84	25.12	35.50	34.15	30.96	29.42	.	30.45
		.	.	.	.	.	.	(35,55)	(32,92)	(31,18)	(37,10)	(36,57)	(35,03)	(34,62)	.	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**22.21**	**17.93**	**18.64**	**23.87**	**23.48**	**21.92**	**21.03**	**.**	
Family firm status	N	.	.	.	.	.	.	11.20	10.66	11.86	11.29	11.83	11.57	12.42	12.26	11.64
		.	.	.	.	.	.	(15,91)	(14,65)	(14,96)	(15,48)	(15,24)	(14,69)	(14,70)	(14,20)	
	Y	.	.	.	.	.	.	10.77	10.63	11.73	11.70	12.33	11.60	12.53	12.36	11.71
		.	.	.	.	.	.	(12,17)	(11,38)	(11,44)	(12,21)	(12,27)	(12,05)	(12,06)	(12,09)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**10.98**	**10.65**	**11.79**	**11.50**	**12.08**	**11.59**	**12.47**	**12.31**	

Table 8-C Firm age

8.4 Firm size

Panel A - Annual firm size (in millions NOK) means and standard deviations across industries, listing- and firm- status

Category		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Industry sector codes	0	19.84	10.45	8.50	14.89	13.95	17.41	15.63	66.73	69.42	15.96	21.80	18.11	107.88	164.94	40.39
		(552,32)	(92,64)	(86,37)	(206,21)	(208,96)	(259,67)	(139,15)	(2301,83)	(2529,26)	(155,88)	(634,57)	(199,87)	(7100,24)	(3143,85)	
	1	.	14.75	14.66	15.59	18.63	20.02	24.77	28.10	28.63	28.33	32.18	31.88	38.63	32.60	25.29
		.	(38,81)	(36,13)	(37,97)	(47,10)	(50,77)	(90,40)	(120,22)	(127,73)	(129,08)	(144,78)	(124,76)	(435,30)	(159,57)	
	2	.	41.48	41.27	44.07	44.95	46.23	63.59	42.40	43.30	73.68	75.04	92.80	69.28	76.92	58.08
		.	(712,13)	(732,49)	(782,04)	(832,05)	(1199,36)	(1610,98)	(539,07)	(458,72)	(1617,17)	(1477,01)	(1776,94)	(965,69)	(1078,32)	
	3	.	1856.84	1651.65	1343.42	1303.49	1487.89	1547.54	1152.97	1260.93	1571.42	1561.99	2343.55	1735.16	1654.77	1574.74
		.	(8002,70)	(7700,36)	(6842,11)	(6780,52)	(8283,72)	(8981,12)	(5597,92)	(6752,52)	(10452,75)	(10966,10)	(19304,87)	(12381,57)	(14479,15)	
	4	.	6.33	6.05	6.67	8.47	7.25	8.26	6.65	7.30	8.31	9.03	9.32	8.70	9.17	7.81
		.	(54,63)	(49,69)	(52,42)	(112,40)	(62,52)	(78,66)	(48,15)	(51,06)	(74,07)	(80,13)	(73,49)	(47,35)	(63,62)	
	5	.	14.91	15.26	14.39	17.41	19.09	21.82	24.04	22.95	22.29	24.82	23.87	25.68	28.23	21.13
		.	(228,51)	(208,90)	(215,22)	(296,89)	(357,34)	(502,58)	(585,34)	(552,30)	(466,23)	(489,06)	(461,47)	(526,49)	(714,57)	
	7	.	9.48	9.46	9.69	10.22	11.12	13.30	11.20	12.04	14.83	16.62	17.52	16.22	17.30	13.00
		.	(74,33)	(76,02)	(71,93)	(75,37)	(96,57)	(118,85)	(103,57)	(102,15)	(132,55)	(149,49)	(164,81)	(153,35)	(182,00)	
	8	.	35.18	57.18	58.28	57.79	66.50	74.34	73.97	69.48	78.33	80.93	76.93	80.90	81.70	68.58
		.	(388,76)	(530,68)	(513,14)	(495,15)	(534,61)	(559,48)	(538,26)	(452,58)	(590,88)	(555,43)	(495,47)	(574,33)	(537,83)	
Mean		**19.84**	**248.68**	**225.50**	**188.37**	**184.36**	**209.44**	**221.16**	**175.76**	**189.26**	**226.64**	**227.80**	**326.75**	**260.31**	**258.20**	
Listing status	N	16.19	15.91	17.08	19.41	21.03	24.34	28.16	31.14	34.71	28.74	31.09	35.43	44.26	.	26.73
		(486,00)	(410,54)	(437,25)	(457,32)	(489,55)	(640,17)	(746,41)	(898,55)	(1199,21)	(563,87)	(600,33)	(1353,85)	(2992,28)	.	
	Y	2566.11	2250.07	2408.76	2206.82	2488.68	2950.19	3688.88	5582.08	5693.26	6296.88	6132.33	6012.21	7330.30	.	4277.43
		(6502,32)	(6069,59)	(6605,01)	(6421,23)	(7039,68)	(10332,66)	(13697,63)	(21273,57)	(22290,51)	(25287,38)	(25921,00)	(26578,34)	(29142,11)	.	
Mean		**1291.15**	**1132.99**	**1212.92**	**1113.12**	**1254.85**	**1487.27**	**1858.52**	**2806.61**	**2863.98**	**3162.81**	**3081.71**	**3023.82**	**3687.28**	**.**	
Family firm status	N	.	.	.	.	.	.	38.20	42.99	40.71	30.42	32.67	39.55	48.76	49.13	40.30
		.	.	.	.	.	.	(468,56)	(508,06)	(692,55)	(374,72)	(308,59)	(467,41)	(603,44)	(612,54)	
	Y	.	.	.	.	.	.	8.53	9.53	9.29	9.39	10.09	9.22	11.09	12.75	9.99
		.	.	.	.	.	.	(65,45)	(95,06)	(71,02)	(74,84)	(80,90)	(79,96)	(97,20)	(165,44)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**23.37**	**26.26**	**25.00**	**19.90**	**21.38**	**24.38**	**29.92**	**30.94**	

Table 8-D Firm size

8.5 Managerial Ownership

Panel A - Annual management ownership means and standard deviations across industries, listing- and firm- status

Category		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Industry sector codes	0	.	.	.	.	.	.	62.31	62.26	61.83	62.39	63.01	66.21	65.15	66.06	63.65
		.	.	.	.	.	.	(29,20)	(30,29)	(29,81)	(29,50)	(29,50)	(29,96)	(30,06)	(31,03)	
	1	.	.	.	.	.	.	56.61	57.56	58.78	59.03	59.06	59.79	59.56	64.58	59.37
		.	.	.	.	.	.	(29,67)	(30,59)	(30,61)	(30,23)	(30,42)	(30,07)	(29,97)	(30,87)	
	2	.	.	.	.	.	.	58.03	58.70	59.08	58.76	59.59	60.18	60.29	61.31	59.49
		.	.	.	.	.	.	(30,73)	(30,43)	(30,45)	(30,50)	(30,51)	(30,73)	(30,77)	(31,01)	
	3	.	.	.	.	.	.	54.07	48.99	51.98	49.80	48.92	51.03	50.98	53.78	51.20
		.	.	.	.	.	.	(30,29)	(29,58)	(31,88)	(31,14)	(30,95)	(33,62)	(32,15)	(32,34)	
	4	.	.	.	.	.	.	64.92	64.92	64.44	64.34	64.36	65.96	65.97	68.78	65.46
		.	.	.	.	.	.	(28,68)	(28,60)	(28,61)	(28,90)	(28,81)	(29,00)	(29,05)	(29,20)	
	5	.	.	.	.	.	.	61.79	62.21	62.37	62.37	62.79	65.33	65.36	68.96	63.90
		.	.	.	.	.	.	(30,04)	(30,09)	(30,17)	(30,27)	(30,50)	(30,77)	(30,82)	(30,79)	
	7	.	.	.	.	.	.	65.46	65.39	65.44	65.56	65.83	67.59	67.80	68.99	66.51
		.	.	.	.	.	.	(29,34)	(29,27)	(29,18)	(29,37)	(29,42)	(29,26)	(29,37)	(29,60)	
	8	.	.	.	.	.	.	63.08	63.64	63.27	64.05	65.15	67.28	67.42	69.46	65.42
		.	.	.	.	.	.	(30,52)	(30,27)	(30,05)	(29,89)	(30,08)	(29,88)	(29,85)	(29,86)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**60.78**	**60.46**	**60.90**	**60.79**	**61.09**	**62.92**	**62.82**	**65.24**	
Listing status	N	.	.	.	.	.	.	62.60	62.77	62.68	62.93	63.32	65.53	65.41	.	63.61
		.	.	.	.	.	.	(29,83)	(29,94)	(29,84)	(29,92)	(30,01)	(30,22)	(30,28)	.	
	Y	.	.	.	.	.	.	6.67	9.43	13.36	14.30	12.86	5.10	10.85	.	10.37
		.	.	.	.	.	.	(5,27)	(4,81)	(5,09)	(10,84)	(8,74)	(.)	(8,13)	.	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**34.63**	**36.10**	**38.02**	**38.61**	**38.09**	**35.31**	**38.13**	**.**	
Family firm status	N	.	.	.	.	.	.	26.12	26.29	26.69	26.69	26.65	26.43	26.36	26.71	26.49
		.	.	.	.	.	.	(11,65)	(11,42)	(11,17)	(11,04)	(11,08)	(11,08)	(11,12)	(11,26)	
	Y	.	.	.	.	.	.	68.68	68.69	68.57	68.82	69.26	71.43	71.29	73.61	70.05
		.	.	.	.	.	.	(27,51)	(27,75)	(27,73)	(27,80)	(27,82)	(27,69)	(27,79)	(27,75)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**47.40**	**47.49**	**47.63**	**47.76**	**47.96**	**48.93**	**48.83**	**50.16**	

Table 8-E Managerial ownership

8.6 Z-Score

Panel A - Annual Z-Score means and standard deviations across industries, listing- and firm- status

Category		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Industry sector codes	0	2.72	11.08	7.44	6.38	6.22	7.83	11.09	10.14	7.81	8.98	7.83	12.14	16.53	28.93	10.37
		(85,55)	(549,65)	(76,05)	(43,76)	(40,28)	(157,03)	(86,79)	(177,66)	(102,58)	(93,02)	(119,57)	(158,79)	(305,17)	(808,06)	
	1	.	5.57	4.56	12.55	13.85	5.79	7.72	6.18	7.45	22.52	5.97	6.87	11.85	21.53	10.19
		.	(36,20)	(19,32)	(377,46)	(359,45)	(78,88)	(65,13)	(23,98)	(45,16)	(672,55)	(39,34)	(39,09)	(238,58)	(770,09)	
	2	.	3.38	4.08	4.03	4.01	4.39	4.01	4.62	3.97	4.69	3.31	4.95	57.09	4.99	8.27
		.	(4,77)	(31,69)	(17,25)	(19,63)	(72,21)	(10,39)	(63,42)	(18,80)	(58,71)	(15,72)	(40,36)	(4515,06)	(112,44)	
	3	.	4.93	8.79	5.87	6.89	12.81	10.76	4.75	13.64	1413.24	7.24	6.77	6.50	5.35	115.97
		.	(6,93)	(43,31)	(12,47)	(27,52)	(167,34)	(88,95)	(8,68)	(190,41)	(35911,48)	(34,10)	(29,23)	(27,08)	(14,27)	
	4	.	3.08	3.34	3.81	3.50	3.26	3.50	4.12	3.02	2.73	2.47	3.73	3.99	4.38	3.46
		.	(6,53)	(27,23)	(17,82)	(8,31)	(4,82)	(11,01)	(56,29)	(10,39)	(6,15)	(6,50)	(15,35)	(16,11)	(14,58)	
	5	.	5.41	4.72	6.19	8.76	6.58	11.73	10.98	11.55	10.98	12.15	25.75	19.35	14.57	11.44
		.	(102,90)	(34,35)	(77,41)	(323,20)	(125,48)	(231,59)	(121,42)	(187,58)	(177,49)	(209,64)	(2751,94)	(398,52)	(381,03)	
	7	.	4.41	4.14	4.63	4.16	4.19	4.40	4.15	4.42	4.24	3.55	4.64	4.98	5.47	4.41
		.	(54,14)	(12,28)	(27,08)	(12,57)	(16,94)	(12,81)	(16,24)	(23,14)	(31,42)	(13,20)	(25,95)	(32,45)	(24,32)	
	8	.	3.17	5.56	8.77	9.32	5.00	7.23	8.68	4.89	7.80	4.07	34.26	9.59	-280.82	-13.27
		.	(8,84)	(76,48)	(121,14)	(102,30)	(36,43)	(90,73)	(98,64)	(25,21)	(135,32)	(22,94)	(1820,94)	(91,84)	(21519,35)	
Mean		**2.72**	**5.13**	**5.33**	**6.53**	**7.09**	**6.23**	**7.55**	**6.70**	**7.09**	**184.40**	**5.82**	**12.39**	**16.23**	**-24.45**	
Listing status	N	2.72	6.68	5.16	5.66	6.74	5.58	8.58	8.57	8.15	17.08	8.25	17.60	17.56	.	9.10
		(85,61)	(325,69)	(47,61)	(80,11)	(222,94)	(98,93)	(164,53)	(117,41)	(131,10)	(2810,37)	(152,02)	(1998,29)	(1156,96)	.	
	Y	1.67	8.03	5.57	8.91	9.10	9.18	7.53	4.50	5.26	4.56	5.09	9.71	17.97	.	7.47
		(3,08)	(19,44)	(7,43)	(21,27)	(19,56)	(20,54)	(20,78)	(7,01)	(12,11)	(11,86)	(10,59)	(47,94)	(160,11)	.	
Mean		**2.20**	**7.36**	**5.37**	**7.29**	**7.92**	**7.38**	**8.05**	**6.53**	**6.70**	**10.82**	**6.67**	**13.66**	**17.76**	**.**	
Family firm status	N	.	.	.	.	.	.	5.46	5.28	5.07	5.39	4.35	5.74	6.24	7.81	5.67
		.	.	.	.	.	.	(87,71)	(55,88)	(57,96)	(249,68)	(43,80)	(71,28)	(70,44)	(307,16)	
	Y	.	.	.	.	.	.	5.92	4.67	3.83	3.69	3.50	6.32	7.14	6.81	5.24
		.	.	.	.	.	.	(176,56)	(88,59)	(39,69)	(48,51)	(78,03)	(133,55)	(166,54)	(91,44)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**5.69**	**4.98**	**4.45**	**4.54**	**3.92**	**6.03**	**6.69**	**7.31**	

Table 8-F Z-score

8.7 Profitability

Panel A - Annual profitability means and standard deviations across industries, listing- and firm- status

Category		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Industry sector codes	0	11.63	11.69	12.46	12.58	12.15	12.85	16.25	12.84	14.32	11.88	12.23	14.80	13.59	13.35	13.04
		(153,99)	(50,77)	(57,87)	(30,58)	(36,06)	(32,58)	(65,58)	(112,90)	(255,96)	(44,41)	(53,98)	(117,48)	(89,82)	(47,85)	
	1	.	12.24	8.45	5.24	9.70	11.35	16.33	17.76	20.59	8.87	11.80	16.26	15.56	14.00	12.93
		.	(21,01)	(23,29)	(182,95)	(35,44)	(24,52)	(126,36)	(130,76)	(295,32)	(96,30)	(38,09)	(115,22)	(76,13)	(64,81)	
	2	.	10.64	9.94	10.58	10.55	9.26	8.86	9.68	10.90	9.35	12.24	9.95	24.89	13.68	11.58
		.	(24,26)	(24,26)	(25,40)	(33,18)	(39,76)	(31,30)	(34,32)	(41,11)	(30,86)	(32,33)	(54,03)	(1117,15)	(28,60)	
	3	.	8.91	9.61	13.66	5.17	7.41	8.65	9.53	12.29	8.12	10.03	10.09	11.75	11.18	9.72
		.	(17,61)	(20,62)	(33,36)	(39,27)	(24,00)	(25,64)	(23,75)	(56,37)	(26,31)	(24,59)	(27,94)	(23,33)	(31,26)	
	4	.	12.70	13.70	15.07	15.53	14.76	13.80	14.01	15.29	14.34	16.86	16.52	16.40	18.29	15.17
		.	(24,17)	(22,67)	(22,97)	(30,14)	(23,52)	(32,71)	(22,55)	(24,82)	(28,33)	(29,65)	(48,38)	(30,07)	(28,17)	
	5	.	14.91	12.28	14.02	14.07	16.01	16.73	17.75	19.45	19.07	19.79	24.50	18.90	19.78	17.48
		.	(360,37)	(49,76)	(88,79)	(45,52)	(90,05)	(84,04)	(113,28)	(197,60)	(262,12)	(70,94)	(506,10)	(174,93)	(293,00)	
	7	.	10.82	10.49	14.57	10.48	11.92	11.86	11.99	14.04	12.66	13.92	13.74	12.41	14.33	12.56
		.	(31,52)	(30,54)	(327,67)	(106,70)	(59,13)	(56,54)	(43,44)	(89,31)	(60,43)	(43,65)	(45,96)	(32,90)	(80,94)	
	8	.	13.39	11.24	12.98	14.47	12.98	10.71	12.79	12.33	14.20	13.12	15.14	17.13	15.81	13.56
		.	(27,44)	(33,92)	(36,22)	(109,50)	(85,44)	(55,83)	(41,48)	(33,25)	(180,18)	(61,57)	(58,51)	(152,03)	(64,46)	
Mean		**11.63**	**11.91**	**11.02**	**12.34**	**11.51**	**12.07**	**12.90**	**13.29**	**14.90**	**12.31**	**13.75**	**15.12**	**16.33**	**15.05**	
Listing status	N	11.64	12.26	11.70	13.58	12.88	13.96	14.48	14.75	16.20	15.63	16.49	19.40	17.12	.	14.62
		(154,10)	(174,14)	(43,72)	(171,38)	(65,56)	(72,25)	(70,80)	(94,49)	(188,90)	(192,05)	(58,92)	(365,47)	(306,53)	.	
	Y	3.23	7.74	6.00	8.40	0.42	0.29	-4.37	-4.65	-4.43	3.61	0.85	5.79	7.91	.	2.37
		(33,15)	(9,20)	(9,70)	(15,19)	(29,82)	(40,39)	(69,86)	(49,42)	(46,89)	(15,80)	(47,06)	(19,76)	(19,18)	.	
Mean		**7.43**	**10.00**	**8.85**	**10.99**	**6.65**	**7.13**	**5.06**	**5.05**	**5.88**	**9.62**	**8.67**	**12.59**	**12.51**	**.**	
Family firm status	N	.	.	.	.	.	.	7.36	8.08	9.03	9.69	11.86	11.67	16.18	13.82	10.96
		.	.	.	.	.	.	(91,73)	(103,60)	(62,80)	(33,21)	(32,21)	(35,10)	(300,52)	(38,28)	
	Y	.	.	.	.	.	.	14.92	13.89	14.34	14.81	15.78	14.95	14.97	16.64	15.04
		.	.	.	.	.	.	(45,74)	(36,25)	(50,74)	(214,72)	(30,36)	(39,90)	(35,98)	(43,70)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**11.14**	**10.98**	**11.68**	**12.25**	**13.82**	**13.31**	**15.58**	**15.23**	

Table 8-G Profitability

8.8 Non-debt tax-shields

Panel A - Annual non-debt tax shields means and standard deviations across industries, listing- and firm- status

Category		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Industry sector codes	0	0.33	0.31	0.34	0.22	0.42	0.57	0.30	0.23	0.56	0.49	0.19	0.23	0.19	0.70	0.36
		(6,48)	(9,98)	(6,32)	(4,96)	(6,89)	(16,42)	(8,91)	(7,26)	(48,62)	(21,59)	(6,30)	(6,39)	(4,77)	(40,41)	
	1	.	0.40	0.14	0.47	0.26	0.92	0.18	-0.21	0.59	0.43	0.61	0.31	0.14	0.28	0.35
		.	(3,01)	(6,64)	(7,12)	(4,71)	(16,35)	(8,25)	(21,21)	(9,16)	(20,56)	(16,65)	(37,49)	(11,45)	(7,36)	
	2	.	0.38	0.39	0.33	0.30	0.30	0.36	0.06	0.22	0.44	0.34	0.24	0.25	0.23	0.30
		.	(6,70)	(5,64)	(7,31)	(5,68)	(8,67)	(9,93)	(21,53)	(6,17)	(10,51)	(5,90)	(7,09)	(7,06)	(7,56)	
	3	.	1.12	0.65	0.25	0.78	0.69	0.40	0.33	0.11	0.11	0.36	0.15	0.36	0.14	0.42
		.	(9,68)	(1,84)	(1,33)	(6,69)	(5,55)	(2,32)	(1,79)	(5,65)	(4,39)	(3,47)	(4,21)	(3,97)	(8,05)	
	4	.	0.25	0.34	0.43	0.39	0.38	0.30	0.40	0.27	0.29	0.17	0.26	0.25	0.18	0.30
		.	(3,98)	(4,34)	(9,06)	(5,12)	(8,67)	(6,84)	(7,47)	(11,72)	(6,83)	(6,62)	(7,60)	(11,01)	(5,11)	
	5	.	0.44	0.36	0.35	0.29	0.28	0.26	0.29	0.35	0.21	0.32	0.33	0.57	0.21	0.33
		.	(11,51)	(11,52)	(6,71)	(9,49)	(6,24)	(9,52)	(12,68)	(17,37)	(7,89)	(9,92)	(15,57)	(95,45)	(8,01)	
	7	.	0.22	0.30	0.22	0.21	0.25	0.27	0.17	0.19	0.16	0.35	0.13	0.13	0.12	0.21
		.	(3,15)	(8,94)	(4,29)	(7,58)	(10,27)	(8,46)	(5,05)	(10,44)	(4,18)	(17,05)	(8,74)	(8,67)	(4,41)	
	8	.	1.14	0.85	0.54	0.64	1.08	0.76	0.35	0.95	0.33	0.34	0.46	0.53	0.44	0.65
		.	(11,44)	(15,08)	(14,05)	(13,20)	(17,26)	(11,30)	(7,45)	(31,47)	(16,71)	(22,28)	(10,00)	(9,59)	(13,82)	
Mean		**0.33**	**0.53**	**0.42**	**0.35**	**0.41**	**0.56**	**0.35**	**0.20**	**0.40**	**0.31**	**0.33**	**0.26**	**0.30**	**0.29**	
Listing status	N	0.33	0.35	0.36	0.33	0.31	0.36	0.30	0.24	0.39	0.26	0.30	0.28	0.39	.	0.32
		(6,49)	(8,72)	(8,91)	(7,04)	(8,45)	(9,61)	(9,16)	(11,43)	(28,52)	(10,52)	(11,53)	(13,32)	(67,60)	.	
	Y	0.67	0.36	0.32	0.02	0.42	-0.28	-0.22	0.12	0.17	-3.21	0.15	0.00	0.25	.	-0.10
		(2,29)	(,85)	(1,11)	(4,29)	(2,70)	(5,78)	(2,93)	(,59)	(,68)	(34,95)	(1,03)	(2,84)	(1,59)	.	
Mean		**0.50**	**0.36**	**0.34**	**0.17**	**0.36**	**0.04**	**0.04**	**0.18**	**0.28**	**-1.47**	**0.23**	**0.14**	**0.32**	**.**	
Family firm status	N	.	.	.	.	.	.	0.29	0.28	0.39	0.27	0.45	0.34	0.21	0.31	0.32
		.	.	.	.	.	.	(13,79)	(7,08)	(22,39)	(10,78)	(17,89)	(13,15)	(6,67)	(10,05)	
	Y	.	.	.	.	.	.	0.31	0.19	0.28	0.26	0.26	0.26	0.20	0.20	0.24
		.	.	.	.	.	.	(6,09)	(12,66)	(11,99)	(11,03)	(8,83)	(14,36)	(7,32)	(5,51)	
Mean		**.**	**.**	**.**	**.**	**.**	**.**	**0.30**	**0.24**	**0.33**	**0.26**	**0.35**	**0.30**	**0.20**	**0.26**	

Table 8-H Non-debt tax shields

8.9 Correlation matrix

Panel a: Correlation matrix

	DM	LV	AS	AM	AL	ZS	FA	FS	OG	MO	FF	PR	NT
DM	1.000												
LV	.187***	1.000											
AS	.670***	.030***	1.000										
AM	.024***	-.012***	.036***	1.000									
AL	-.057***	-.010***	-.091***	-.004**	1.000								
ZS	-.016***	-.082***	-.021***	.006***	.000	1.000							
FA	.059***	-.136***	.065***	.012***	-.019***	.011***	1.000						
FS	.294***	.101***	.180***	.046***	-.054***	.012***	.249***	1.000					
OG	.005***	-.017***	.103***	-.004**	-.004**	-.009***	-.092***	-.072***	1.000				
MO	-.027***	.022***	.002	.002	.004**	.002	-.011***	-.177***	-.023***	1.000			
FF	.027***	.020***	.043***	.002	-.002	.001	.037***	-.118***	-.052***	.494***	1.000		
PR	-.174***	-.048***	-.184***	-.005***	.008***	.042***	-.016***	.065***	-.132***	.034***	.035***	1.000	
NT	.012***	.004***	.011***	-.001	.000	.000	-.003*	.004**	.009***	.002	.001	.001	1.000

Table 8-I Correlation matrix