NTNU – Trondheim
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Credit Rating and Capital Structure for Norwegian Listed Firms

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3. Masteroppgave

Oppstartsdato	Innleveringsfrist
16. jan 2012	**11. jun 2012**
Oppgavens (foreløpige) tittel	
Credit Rating and Capital Structure for Norwegian Listed Firms	
Oppgavetekst/Problembeskrivelse Purpose: Determine whether credit rating considerations influence choices of capital structure in firms listed on Oslo stock exchange. Main Content: 1. Review and discussion of theoretical and empirical literature examining capital structure, including literature focusing on credit rating considerations. 2. Formulation of testable hypothesis, discussion of data, and analysis of data with the intention of gaining new insight regarding the relationship between credit rating and choice of capital structure in companies listen on Oslo Stock Exchange. 3. Overall assessment of the implications of the empirical study.	
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Kandidatene skal ha *individuell* bedømmelse
Kandidatene skal ha *felles* bedømmelse [X]

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Abstract

We examine how credit ratings affect capital structure of Norwegian listed firms. The data sample comprises 216 companies listed on the Oslo Stock Exchange in the period 2004 to 2010. Three concerns for credit rating are investigated. The first identifies which effect access to the public market, measured by having a credit rating, have on leverage. Secondly, we examine how being near a change in rating level influences decisions regarding leverage. Finally we investigate how firms decide upon leverage after a change in rating. The empirical analysis consists of regressions on panel data models that explain variation in leverage. We model three tests and include proxies for credit rating considerations to capture their influence on capital structure.

Overall we identify that firms are affected of participating in the bond market and take credit ratings into consideration when deciding about capital structure. Participating in the bond market is found to provide a 6.94% higher long term debt ratio than other listed firms. Long term debt is increased by more tangible assets and reduced with increased size. Furthermore, access to capital is found to be most influential for high yield firms, confirming their reliance on the bond market for achieving necessary capital. For firms participating in the public debt market we find no evidence that credit ratings explain variation in leverage. However, concerns for credit ratings are found to influence leverage adjustments. Firms participating in the public debt market are found to reduce long term debt when being near a change in rating. Firms issuing new bonds during the period are found to make larger reduction in long term debt, as well as they reduce their total debt as well. We conclude that Norwegian firms are especially concerned about their credit ratings when making new debt issues.

Sammendrag

Denne masteroppgaven undersøker hvilken innvirkning kredittvurderinger har på kapitalstruktur for norske børsnoterte selskaper. Analysen er utført på et datasett bestående av 216 noterte, eller tidligere noterte, selskaper ved Oslo Børs i perioden 2004 til 2010. Kredittvurderingers innvirkning på gjeld er vurdert i tre situasjoner; ved å være i obligasjonsmarkedet og dermed ha en kredittvurdering, ved å være nær en endring i kredittvurdering, og ved å få en endring i kredittvurdering. Analysen er utført ved å benytte panel data regresjonsmodeller og avdekker hvordan selskapene velger gjeldsgrad eller justerer gjeldsgrad i disse situasjonene. Dette er modellert ved tre tester som hver inkluderer proksier som reflekterer de ulike situasjonene hvor selskaper tar hensyn til kredittvurderinger.

Samlet finner vi at selskapene er berørt av å være i obligasjonsmarkedet og at selskapene tar hensyn til kredittvurderinger ved valg av kapitalstruktur. Selskapene som har utstedt obligasjonslån er funnet å ha en 6.94 % høyere langsiktig gjeldsgrad enn andre børsnoterte selskaper. Langsiktig gjeld for disse selskapene øker med andel varige driftsmidler og reduseres med størrelse. Videre er tilgang til obligasjonsmarkedet funnet å ha størst innflytelses for high-yield selskaper. Dette bekrefter at disse selskapene er avhengig av obligasjonsmarkedet for å oppnå nødvendig kapital. Videre finner vi ingen resultater for at selskapene i obligasjonsmarkedet tar hensyn til kredittvurderinger når de velger gjeldsgrad. Imidlertid finner vi at hensyn til kredittvurdering påvirker selskapene til å justere gjeldsgrad. Selskaper nær en endring i kredittvurdering er funnet å redusere langsiktig gjeld. Selskaper som i tillegg utsteder nye obligasjoner i perioden er funnet å redusere langsiktig gjeld ytterligere. For disse selskapene finner vi også signifikante resultat for at de reduserer sin total gjeld. Vi konkluderer derfor med at norske bedrifter tar særskilt hensyn til kredittvurderinger før de utsteder nye obligasjonslån.

Preface

This master thesis is written during spring semester 2012. It concludes the authors' master degree in Investment, finance and financial management at the Department of Industrial Economics and Technology Management (NTNU).

The starting point for this thesis was the authors' desire for a thorough understanding of the fixed-income market and especially the use of bonds to raise capital. The development of world bond markets during the previous years' financial turbulence has focused our interest particularly to the assessment of credit risk and the use and importance of credit ratings.

Working with this master thesis has been very instructive and challenging. We have studied literature of corporate finance and econometrics in order to address the many aspects of capital structure. The thesis contributes to the ongoing research on capital structure by focusing on the Norwegian market with its peculiar characteristics, and introduces credit rating as a new dimension not formerly encountered in similar studies for this market.

We would like to thank our supervisor Einar Belsom for providing feedback and guidance in working with the assignment. We also express thanks to several discussion partners in Norwegian banks and brokerages for sharing information and for answering our questions.

Trondheim, June 10, 2012

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Table of Contents

List of Figures

List of Tables

1 Introduction

Bond issuances have become an increasingly important financial alternative for companies raising capital. By the end of 2010 the global bond market was approximately twice the size of the equity market. The Norwegian bond market has experienced a similar increase in market capitalization, with a growth exceeding 200% during the last decade. However, in the same period there were also great losses in this domestic bond market. According to Andreassen (2011) about 60 billion NOK was lost in different forms of default, highlighting the severe consequences of companies not being able to fulfill their obligations. A thorough assessment of credit risk is hence of great importance for both investors as well as issuers. Credit ratings have emerged as important instruments assessing credit risk and are applied in most discussions regarding supply of debt. Consequently, an understanding of credit ratings and how they influence a firm's financial performance appear as important for capital structure decisions.

Our main objective is to examine the relationship between credit rating and choice of capital structure for Norwegian listed firms. By discussing different capital structure decisions and features of credit ratings we identify three credit rating considerations that are examined. Inspired by previous empirical findings[1], different proxies for each consideration are defined. The empirical analysis is constructed as a panel data regression evaluating the proxies' influence on leverage decisions for Norwegian listed firms in the period of 2004-2010.

Our empirical analysis is the first examining the relationship between credit ratings and capital structure for listed firms in the Norwegian market, and to our knowledge the only treating credit rating considerations so extensively for another market than the U.S.. Unlike similar studies we also distinguish between long term debt and total debt to explain leverage decisions in further detail. Including credit rating as an influential factor of Norwegian firms' capital structure has never been done before, and is an important contribution that broadens the knowledge of capital structure in the Norwegian market.

The remaining part of the thesis proceeds as follows. Chapter two discusses theories and applied variables of capital structure. Chapter three introduces credit rating as an influential factor of capital structure and chapter four discuss credit ratings in the Norwegian bond market. The dataset is presented in chapter five. Chapter six outlines methodology and evaluation of estimation method discussed in chapter seven. Chapter eight presents empirical results. Finally, Chapter nine concludes.

[1] See Faulkender, 2006; Mitto and Zhang, 2008; Kisgen, 2006; Kisgen 2009.
[2] See also Flannery and Rangan (2006) for how industry median leverage can be used as a proxy for capital

2 Capital Structure

The basic aim of capital structure is to select a combination of debt, equity and hybrid securities that maximizes firm value while minimizing the cost of capital. Efficiency of its capital structure is crucial for the ability of a firm to perform well in the market. This chapter starts by outlining theories of capital structure and previous empirical findings. In light of these, we define capital structure as a concern of leverage and discuss different explanatory variables of capital structure.

2.1 Theories of Capital Structure

In a perfect capital market, Modiligiani and Miller (1958) argue that the choice of capital structure is irrelevant for a firm's value. However, this does not apply in the real world. By repealing the idealized setting in the irrelevance theorem, scholars have identified different conditions affecting corporate structure. Such imperfections account for corporate taxes (Modigliani and Miller,1963), bankruptcy costs (Stiglitz, 1972; Titman, 1984), agency costs (Jensen and Meckling, 1976; Myers, 1977), personal taxes (Miller, 1977) and information asymmetries (Myers, 1984; Myers and Majluf, 1984). These relaxations forms the basis for modern thinking on capital structure, where three prominent theories are the trade-off theory, pecking order theory and market timing theory.

The traditional trade-off theory emerged as an adaption of corporate taxes and concern for bankruptcy. By balancing the tax savings of debt against the costs of risking financial distress, the model targets an optimal debt ratio maximizing the value of the firm (See Modigliani and Miller, 1973, and Miller, 1977). Additional factors can also be considered in the trade-off framework. E.g. Jensen and Meckling (1976) arguments for an agency perspective stating that debt can be used to disciplines managers and hence mitigate the cost of moral hazard.

The second recognized theory is the pecking-order theory articulated by Myers (Myers, 1984). The theory proposes a prioritized order of funding instead of an optimal ratio of leverage. External funds are less desirable because of information asymmetries between internal and external parts. The perception is that external funds are undervalued in relation to the degree of asymmetry (Myers and Majluf, 1984, Myers, 1984). Consequently retained earnings are preferred over debt, convertible debt and equity.

The market timing theory, uttering that firms attempt to time their raising of capital, has become more popular in the recent years. (See e.g. Baker and Wurgler, 2002). The market timing theory is like the pecking order theory not suggesting an optimal leverage ratio. The idea is that managers look at current conditions in both debt and equity markets and use whichever market currently looks more favorable. The theory also argues that managers do not raise capital if either market is not beneficial, or contrary they can raise capital at favorable market situations, despite no need for capital.

2.2 Empirical Modeling of Capital Structure

Capital structure is one of the most studied topics in corporate finance the last decade. Equivalent to the many theories proposed to explain capital structure, a vast number of empirical studies have been performed to support or disprove these theories. One common approach has been to perform cross-sectional tests to discover important determinants of capital structure. Proxies for the variables are motivated from theories of capital structure, explaining how they will influence a firm's debt-equity choice. Consequently, a number of firm characteristics are found to influence the capital structure

choice of companies (See e.g. Titman and Wessels, 1988; Harris and Raviv, 1991; Frank and Goyal, 2009)

A limitation of such single-period capital structure models is that they disregard firm's restructuring choices over time. Fama and French (2002), among others, have expanded the trade-off theories to examine whether companies adjust towards target capital structures and how fast such an adjustment is (See e.g. Fama and French, 2002; Flannery and Rangan, 2006). The capital structure choice has also been modeled in a continuous-time framework to find how firms engage in a dynamic rebalancing of their capital structures. Fisher, Heinkel and Zechner (1989) find an optimal dynamic capital structure policy to depend upon the benefit of debt financing, potential costs of debt financing, underlying asset variability, the riskless interest rate and the size of the costs of recapitalizing. The presence of such adjustment costs is also identified by Leary and Roberts (2005). They find that if the costs outweigh the benefits, firms will wait to recapitalize. This coincides with the market timing perception of Baker and Wurgler (2002), who argues that firms raise capital if market timing is right.

Despite of several significant explanatory variables revealed by quantitative analysis, no unifying theory has evolved that coincides with the practice of capital structure. In an extensive quantitative survey, Graham and Harvey (2001) find that managers are less likely to follow the academically proscribed factors and theories when determining capital structure. 81 % of the responses have a flexible to somewhat tight debt-equity ratio, but they find moderate support in that firms only target debt ratio as their corporate structure policy. Instead, they find informal criteria such as financial flexibility and credit rating to be the most important debt policy factors**,** and earnings per share and recent stock price appreciation to be the most important factors influencing equity issuance. Henriksen and Stjern (2008) did a similar study for Norwegian listed industry companies and observe results in line with Graham and Harvey (2001).

2.3 Capital Structure Decisions

Motivated by the findings of Graham and Harvey (2001), we restrict capital structure decisions to be a regard of firms leverage. Leverage illustrates the importance of non-equity capital for the financing of companies. Two types of decisions regarding leverage are modeled; level of leverage and adjustment of leverage. This is to reveal how firms decide upon debt ratio and how they actively adjust their capital stature with regard to credit ratings.

The empirical definitions of leverage differ widely. A company typically report long term debt and short term liabilities. As the short-term liabilities, e.g. accounts payable, do not claim any explicit interest payments they are most likely not a part of a long-term funding strategy (Eidem, Halvorsen and Vold, 2010). Rauh and Sufi (2010) highlight the importance of not treating debt as uniform. We will hence examine both long term debt and total debt.

Scholars use either book values or market values of leverage. The use of book leverage can be argued as appropriate because debt is better supported by assets in place, rather than growth opportunities (Myers, 1977). Moreover, book values are perceived as more reliable to managers deciding on financial policy, as the financial markets fluctuate and market values are highly volatile. According to Graham and Harvey (2001) a large number of managers confirm that they do not rebalance capital structure in response to equity market movements, but focus on book values when deciding on capital structure. However, Frank and Goyal (2009) argue that the book values are backward looking and measures what have taken place. Hence the book value of equity is primarily used to balance the left-hand side and the right-hand side of the balance sheet rather than being appropriate for future

financial targeting. Bowman (1980) demonstrates a large cross-sectional correlation between the book and market value. This has provided several studies with justification to assume that using book value does not lead to a large misspecification. In addition, we argue for a use of book values since these variables are emphasized by the credit rating agencies (S&P, 2002).

2.4 Explanatory Variables of Capital Structure

A vast number of firm characteristics are found to influence the capital structure choice of companies. The lack of one unifying theory of capital structure does however make the empirical findings overlap and contradict each other. Frank and Goyal (2009) perform a comprehensive analysis incorporating the wide range of factors from the literature. They find a "core model of leverage", consisting of six factors statistically significant across alternative treatments of the data. This model states that industry median leverage, tangibility, firm size, and expected inflation increases leverage, while profits and market-to-book assets decreases leverage. In addition they verify that significant factors can change over time, e.g. the importance of profits has decreased, whereas firm size and dividend paying status have increased.

Similar studies have been performed outside the U.S. to investigate whether the choice of capital structure is based on analogous factors. E.g. Rajan and Zingales (1995) compare public companies in G-7 countries and find factors to be correlated in the same way. In the case of Norwegian firms, a modest number of empirical studies have been performed. Available studies by Frydenberg (2004), Henriksen and Stjern (2008), and Jensen and Tellefsen (2010) analyze capital structure within one specific industry. Mjøs (2007) is the first to perform a comprehensive documentation of capital structure in the Norwegian market. He presents a description of the capital structure for Norwegian private and public companies for the period 1992-2005. For a subsample of listed companies he finds that leverage increase with size, tangibility and industry leverage, and decrease with profitability and interest rate levels.

The previous findings are summarized in Table 1. Mjøs' results are found to be most relevant for the sample of Norwegian listed companies which will be studied in this analysis. Hence, we choose to proceed with the explanatory variables size, tangibility, profitability and industry leverage as these variables explain several aspects of a firm; scale, profile, performance and industry, and correspond with conventional results. Furthermore, Mjøs' outcome is emphasized as representative for the Norwegian listed companies. We will apply these outcomes as hypothesis for how explanatory variables affect leverage for these firms. A discussion of each variable follows.

Table 1: Previous empirical findings: Identified relationships between leverage and its determinants

	Harris and Raviv (1991)	Frank and Goyal (2008)	Rajan and Zingales (1995)	Frydenberg (2004)	Mjøs (2008)
Firm size	+	+	+	+/-	+
Tangibility	+	+	+	+	+
Tax shields	+			+	
Growth opportunities	+	-	-	+	
Profitability	-	-	-	-	-
Volatility	-				
Advertising expenditure	-				
Uniqueness of product	-				
Industry median leverage		+			+
Expected inflation		+			
Interest rate levels					-

Size

Large firms are often more diversified than smaller firms and less vulnerable to fluctuation. Size may therefore be an inverse proxy of bankruptcy risk and have a positive impact on the supply of debt for larger firms. In addition, large and mature firms are often better known. Consequently, larger firms with better reputation in the debt market may face lower debt-related agency costs. In terms of the trade-off theory, larger firms should hence be more leveraged than small firms.

Size may also be a proxy for the information available for outside investors. Fama and Jensen (1983) argue that larger firms would disclose more information to investors and lenders. Reducing informational asymmetries would in line with the pecking order increase the investors' preference for equity relative to debt, suggesting a negative relationship between size and leverage. Most scholars do however approve the trade-off theory explanation finding a positive correlation between size and leverage (see e.g. Titman and Wessels, 1988; Rajan and Zingales, 1995).

Tangibility

Tangible assets, such as property, plant, and equipment, are easier for outsiders to value than intangibles. The more material possessions a firm has, the more security can be set to potential lenders. Jensen and Meckling (1976) address the substitution problem arising when stockholders of leveraged firms shift to riskier investments after an issuance of debt. The conflict can be offset if new debt is issued with collateral in the assets (Scott, 1977). The use of collateral in tangible reduces the cost of financial distress as well as more assets in place should retain more value in liquidation. According to the trade-off theory, this has a positive impact on the supply of debt and predicts a positive correlation between leverage and tangibility.

Contrary, when tangible assets are easier to value, increased tangibility would decrease informational asymmetries between a firm's internal and external interests. This will in turn lower cost of equity and decrease leverage. The pecking order theory hence predicts a negative relation to leverage. Empirical studies show a positive relationship between tangible assets and leverage, valid in both international and national studies (See Rajan and Zingales, 1995; Mjøs, 2007).

Profitability

A profitable firm has a greater chance of fully exploiting the interest tax shield and face lower expected cost of financial distress. The trade-off theory hence predicts a positive correlation between leverage and profitability. Higher debt ratios are also consistent with the agency cost of free cash flow, where debt are used as a motivation for managers, employees and other stakeholders to be efficient and avoid low-return projects.

The pecking order theory predicts an opposite perception of free cash flow. Internal funding is preferred over external financing, which implies a lower debt ratio for profitable firms. Managers of profitable firms may also prefer to avoid the disciplinary role of debt. Previous empirical studies confirm that a negative correlation is the most occurring relationship between profitability and leverage. (See e.g. Harris and Raviv, 1991; Frank and Goyal, 2009; Mjøs, 2007)

Industry leverage

Various industries experience unlike business environments and are subject to different challenges. Some industries are more capital intensive than other, requiring a greater share of fixed assets in order to operate. Consequently, such circumstances can cause variation in capital structure, reflecting the differential costs and benefits of debt which presumably are related to a firm's line of business. Talberg et al. (2008) confirm a significant difference in capital structure depending on the industry where the company operates. High industry leverage should therefore result in higher debt ratios.

The positive correlation can also be a result of managers using industry leverage ratios as a benchmark for target capital structure. Hovakimian, Opler, and Titman (2001) find confirming results for this by identifying that firms actively adjust their debt ratios towards industry leverage[2].

[2] See also Flannery and Rangan (2006) for how industry median leverage can be used as a proxy for capital structure.

3 The Significance of Credit Ratings for Capital Structure

The previous chapter discussed conventional explanatory variables of capital structure. This chapter introduces credit rating as an influencing factor for leverage decisions. The U.S. credit rating industry has grown to become the world leading industry, with Moody's and S&P as the two dominating agencies[3]. Hence, this chapter discusses credit ratings in a U.S. perspective. We first present features of credit ratings that underpin why they are important for a company's debt policy. Thereafter we outline previous empirical findings that illuminate this topic.

3.1 Assessing Default Risk

Credit ratings provide an assessment of a company's creditworthiness or an individual issue's credit quality. This assessment involves analyzing the firm's current operational and financial condition, as well as the industry and market in which the company operates in. The analysis also takes future prospects of these factors into account. Translation of this information into one single letter provides a perceived risk of default. The credit ratings common letter designations are presented in Table 2. The rating levels from AAA to CCC are modified by adding a plus or minus. This creates a relative positioning within each category, where A+ is considered superior to respectively A and A-. Bonds rated with an investment grade are associated with good prospects and less risk of default, whereas high yield bonds are associated with greater default risk. The critical benchmark between investment grade and non-investment grade ratings has therefore an important implication for the issuers, as the perception of the two categories labels the issuers into being either a good investment or a junk bond.

Table 2: Credit Rating Scale (S&P, Moody's and Fitch,2011)

Fitch	S&P	Moody's	Rating grade description of credit risk (Moody's)	
AAA	AAA	Aaa	Investment grade	Minimal
AA	AA	Aa		Very low
A	A	A		Low
BBB	BBB	Baa		Moderate
BB	BB	Ba	Speculative grade, High yield	Substantial
B	B	B		High
CCC	CCC	Caa		Very high
CC	CC	Ca		In or near default, with possibility of recovery
C	C	C		In or near default, without possibility of recovery

[3] Moody's Investor Service (Moody's) and Standard and Poor's (S&P) are the two leading agencies. Together with the minor French rating agency Fitch Ratings (Fitch), these agencies constitute a market share of about 95%. The remaining 5 % consists of about 150 other local and international credit rating agencies (White, 2010).

3.2 Features of Credit Ratings

The corporate bond market is an important area for bringing issuers and investors together, facilitating further operation and development of the company. In such market transactions, credit ratings have emerged as an important intermediary. The credit ratings importance has increased in line with the importance of assessing creditworthiness. By systematically arranging bonds according to their creditworthiness, credit ratings possess features important for the supply of debt.

Providing of information

Common practice in the U.S. bond market is that all corporate bonds registered in the U.S. Securities and Exchange Commission (SEC) are credit rated whether requested by the issuer or not (White, 2002). When a rating is requested the assessment is based on publicly available information as well as private information disclosed by the management, and hence the company gets an opportunity to provide sensitive information to investors. Thus the difference between them is reflected in what information the rating incorporates.

Debt cost of capital

The yield on bonds and other debt securities are determined by a range of factors. The three most discussed risks are interest risk, liquidity risk and default risk, in which default risk is found to constitute the largest part of the risk premium (Huang and Huang, 2002; Driessen, 2004; Olsen and Steffensen, 2010). Hence this risk is a vital determinant of the total borrowing costs for an issuer. As the single mark of a rating provides an external assessment of default risk, ratings are used to compare firms across sectors and geographies and decide upon yield spreads according to their individual risk level. Ratings do therefore affect the debt cost of capital for a firm.

The assessment of a company's creditworthiness often differs between the involved parties, as investors and issuers have different access to information. A principal-agent problem can occur when the investor cannot completely monitor and evaluate the issuer from an external point of view. Knowing that the company has an incentive to ascribe the company better quality to reduce their borrowing cost, an investor typically does not rely solely on the information from the company, and consequently requires a compensation for risk. Companies use credit ratings to reduce this asymmetric information and prevent an additional increase of yield spread and hence reduce total cost of debt.

Rating based regulations

Credit ratings are also used by regulators to influence market players. This is often referred to as 'rating-based regulations'. These regulations originate from SEC's designation of a few credit rating agencies to be a Nationally Recognized Statistical Rating Organization (NRSRO), and ratings from such a NRSRO agency approves for a number of regulations. By acquiring a rating from a NRSRO agency, firms can achieve benefits such as less disclosure requirements, access to regulated investors, as well as access to markets. In addition, these regulations affect regulated investors and by giving restrictions on what assets they can hold using certain credit rating levels as criteria.

3.3 Previous Empirical Findings

The majority of previous empirical work is based on studies performed in the U.S. market, where credit ratings are found to have a significant role in the financial market. Graham and Harvey (2001) found credit ratings to be of the second-highest concern when firms issue debt, outperforming traditional factors like tax- or interest concerns. Quantitative studies of credit ratings have identified a two-way causality; ratings are affirmed as an influencing factor of leverage, while at the same time ratings are predicted as a product of leverage.

For the effect on leverage, Faulkender (2006) investigate whether having a credit rating or not affect a company's level of leverage. He finds that companies with access to capital, measured by having a credit rating, issue 35% more debt relative to companies that do not have this access. A similar study was performed on both Canadian and American high- and low quality companies by Mitto and Zhang (2010), finding the same positive impact on a firm's leverage when having access to public debt markets. In addition, they find that the impact relative to firms without access is greater for firms of low quality. When investigating how different credit rating levels affect leverage, Tang (2009) finds that better ratings allow firms to have enhanced capital market access, both in terms of the cost of borrowing and the amount of debt issued.

Furthermore, Kisgen (2006, 2009) expands the literature by identifying how credit ratings affect leverage decisions. First, he tests whether companies near a change in credit rating issue less debt in a subsequent period relative to companies with a stable rating. He finds significant results showing that firms approximately issue 1.0% less debt than equity when being close to a change in rating. Additionally, the results are found to be more significant at some rating levels, e.g. like being close to the distinction between investment grade and non-investment grade ratings. Second, he investigates how changes in credit ratings affect subsequent decisions regarding capital structure. His main results reveal that downgraded companies issue approximately 2 % less net debt relative to equity.

Opposite of these studies, other scholars investigates ratings as a product of leverage. Ederington (1985) states that even though the different variables vary between studies, measures of leverage, coverage and/or profitability, firm size and subordination status have consistently appeared to be common determinants of credit rating levels.[4] Based on this, Kisgen (2006) finds leverage to be one of three most influencing determinants of credit rating level. Consequently, increased debt is found to have a significant negative effect on a company's credit rating.

[4] The statement of Ederington is in accordance to S&P's specified key criteria for outlining of a credit rating; size, profitability and coverage and leverage and capital structure/ leverage and asset protection (S&P, 2001).

4 Credit Ratings in the Norwegian Bond Market

The Norwegian bond market has been strictly regulated by the government until 1980. Through the following decade, the market became gradually internationalized through deregulation, technological development and increased international trade (Weme, 1999). The effect has been entrance of additional market players, a more liquid market and increased market capitalization. In spite of this development, the market is still small compared to the U.S. bond market, both in market capitalization as well as number and sizes of the issues.[5] Additionally, products are simpler and the market more transparent. These market characteristics affect the existence of ratings.

This chapter presents the use of credit ratings in a Norwegian context and deliberates future prospect of the Norwegian bond market. Finally, important credit rating considerations in this market are presented and discussed, motivating testable hypothesis for the empirical analysis.

4.1 Use of Credit Ratings

As the market is small and more transparent, the use of ratings is less widespread. A minor importance of the global credit rating agencies is reflected in that only 7 non-financial firms have a rating from S&P or Moody's, referred to as 'official credit ratings'. Instead, common practice is that brokerages produce so-called shadow-ratings for all companies issuing bonds, without charging the issuers for it. The ratings are assessed using publicly available information only, but are evaluated using the same criteria and rating-scale as the credit rating agencies. Hence, they provide the same external assessment of default risk, and are used to compare firms according to their individual risk level. These ratings do not provide any sensitive information and do not fulfill the NRSRO rating-based regulations. However, the use of shadow ratings has been customized to meet the rating-based regulations in the Norwegian bond market. E.g. for some of the regulations affecting institutional investors, two credit ratings are equivalent to one official credit rating (The Norwegian Registry of Securities).

As each firm making an issuance gets credit assessed, participating in the Norwegian bond market is equivalent to receive a shadow rating.[6] Hence, we focus on these ratings to identify credit rating considerations being made in this market. The firms need to relate to the rating as it is used to decide upon yield spread. However, the firms may not consider ratings beyond this since the shadow ratings do not reveal any additional value of providing private information or comply with the majority of rating-based regulations. This provides the basis for our hypothesis formulated in the following section. In the remaining part, in the remaining part of this thesis shadow ratings will be referred to as 'credit rating'.

[5] An overview of bond size frequency in the Norwegian market is presented in Appendix A.
[6] Except for some of the large firms having an official rating, where the brokerages rely on these assessments instead of making a corresponding shadow rating.

4.2 Testable Hypothesis of Credit Rating Considerations

Three credit rating considerations will be analyzed to identify the role of credit ratings in the Norwegian market. Each one is expected to affect capital structure and we will find how decisions are made out of concern of these.

The first consideration concerns firms participating in the Norwegian bond market and how this influences the level of leverage. The analysis will be conducted with two interpretations of credit ratings. The first is the impact on leverage by possessing a credit rating, which implies access to the Norwegian bond market. The other distinguishes between levels of rating, primarily investment grade and high yield ratings. According to previous findings it is expected that possessing a credit rating will have a positive effect on long term debt. In addition, the positive effect is expected to be greater for firms of low quality.

H_{BMP} : *Companies participating in the Norwegian bond market, measured by having a credit rating, will have higher debt ratios relative to other listed companies. The effect is expected to be higher for high yield companies.*

The other two considerations examine how concern for credit ratings may affect subsequent leverage decision. We test for both level of leverage and adjustment of leverage. We do also examine whether considerations for credit ratings differ between firms issuing additional bonds versus firms that do not. This distinction is motivated by the quantitative findings of Henriksen and Stjern (2008), stating that Norwegian industrial companies have a special concern for their credit ratings when making debt issues.

The second consideration examines firms possessing a credit rating close to a downgrade or an upgrade and how these firms decide upon leverage. With support in previous findings it is expected that these companies will determine leverage to avoid being downgraded or increase the chance of an upgrade (Kisgen, 2006)

H_{NAC} : *Companies being near a change in credit rating level will have lower debt ratios and will issue less debt relative to companies not near a change in rating level. The negative influence is greater for companies making additional bond issues.*

The third consideration is how an actual change in credit rating level affects subsequent leverage decisions. In this analysis we examine if companies that have been downgraded will make a subsequent leverage reduction the following year to reverse the downgrade. Supported by the findings of Kisgen (2009), we expect that upgraded companies take no subsequent leverage decisions.

H_{AC} : *Companies that have experienced a rating downgrade have lower debt ratios and will issue less debt relative to companies that have not experienced a downgrade, the effect is greater for companies issuing new* bonds. *Companies that have been upgraded will not take this into considerations when making subsequent leverage decisions.*

4.3 Future Prospects of the Norwegian Bond Market

Growing 200% in outstanding bond over the last decade (Andreassen, 2011), the Norwegian market is expanding while becoming more similar to the U.S. market. With this development, the trend is towards a market more similar to the U.S. market. More advanced and complex products and a less transparent market can be an expected outcome.

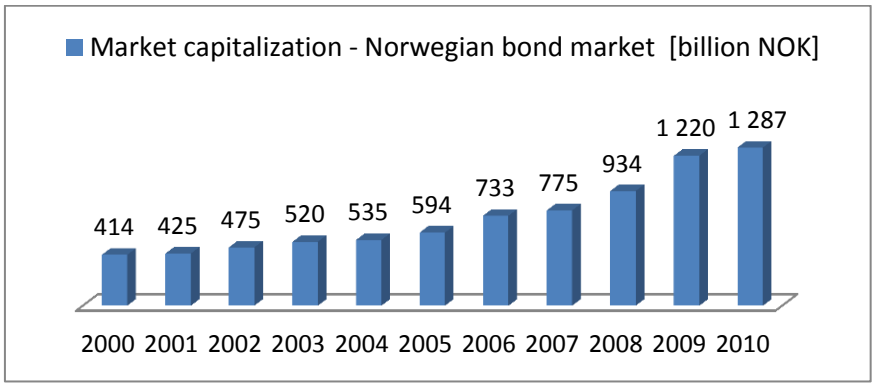


Figure 1 - Development in the Norwegian bond market, 2000-2010 (Andreassen, 2010)

Given the role of NRSRO ratings in the U.S. market an increased use of official credit rating and rating-based regulations might also be expected. There are already two major rating based regulations that are being put into force in January 2013; Basel III is the new capital and liquidity rules for banks and Solvency II is the new capital requirements for insurance companies, two of the major group of investors in the Norwegian market[7]. Hence there is likely to assume that the importance of credit ratings and official credit ratings in the Norwegian market will increase.

[7] See Appendix A for a presentation of investors in the Norwegian bond market.

5 Data

Our dataset consists of non-financial firms listed on the Oslo Stock Exchange and Oslo ABM in the period 2004 to 2010. Accounting data on the Norwegian companies were obtained from the Brønnøysund Register Centre[8]. Credit ratings were obtained from Norwegian brokerages[9]. This chapter describes how the dataset has been obtained and outlines how different samples are constructed. The second part presents statistics of each sample.

5.1 Sample Construction

By the end of 2010, 209 companies were listed on Oslo Stock Exchange and Oslo ABM. By including companies that have been listed, delisted, merged or demerged, the dataset encloses 274 companies.[10] Financial firms are omitted as they have a more complex capital structure and ratings that are compiled on other considerations than non-financial firms. The data set also excludes companies being main-listed on another stock exchange[11], double-listings and companies that got listed during 2010. Finally, we eliminate financial years where sum of total assets observed is negative. These observations are considered to be outliers and cause biased results. The result is an unbalanced sample consisting of 216 companies and 1293 firm-years, by now referred to as the 'reference' sample.

To perform different analysis the reference sample is divided into different sub samples. The 'rated' sample is compounded by companies that have issued bonds during the years of our analysis period, and hence have an accompanying credit rating. Of the 216 listed companies, 59 firms have issued bonds in the period. The final rated sample consists of 45 companies and 206 observations. The 'unrated' sample consists of accounting years where the companies do not have a credit assessment. The sample includes 1087 firm years, distributed over 200 companies.

Minor sub samples are presented in Appendix B.

[8] The Brønnøysund Register Centre is a government body under the Norwegian Ministry of Trade and Industry, and consists of several different national computerized registers.

[9] Norwegian brokerages that have provided credit ratings: DnB Markets, Nordea Markets, SEB Merchant Banking and Carnegie.

[10] Only firms with available accounting data have been included.

[11] Companies that are listed on another stock exchange might follow other rules or regulations that make them outliers in our analysis, and it is considered reasonable to remove them from the reference sample.

5.2 Descriptive Statistics

Key characteristics for the reference sample, rated sample and unrated sample are presented in the tables below.

Table 3: Key statistics - Reference sample

	LTD-Leverage	TD-Leverage	Size	Tangibility	Profitability	Industry-LTD-average	Industry-TD-average
# Observations	1293	1293	1293	1293	1293	1293	1293
Min	0.0000	0.0000	0.0000	0.0000	-3.6566	0.0645	0.3592
25th percentile	0.0405	0.3642	10.92	0.208	-0.0047	0.2380	0.5253
Median	0.1735	0.5549	12.86	0.0985	0.0591	0.3194	0.5803
Mean	0.2234	0.5147	11.93	0.2132	0.0165	0.3125	0.5830
Standard Deviation	0.2071	0.2308	4.0465	0.2565	0.2968	0.0904	0.0698
75th percentile	0.3528	0.6896	14.33	0.3107	0.1252	0.3910	0.6398
Max	0.9589	0.9949	20.30	0.9857	0.8974	0.5112	0.7026

Table 4: Key statistics - Rated sample

	LTD-Leverage	TD-Leverage	Size	Tangibility	Profitability	Industry-LTD-average	Industry-TD-average
# Observations	206	206	206	206	206	206	206
Min	0.0200	0.01292	0.0000	0.0000	-0.6488	0.1711	0.3592
25th percentile	0.2459	0.5389	12.91	0.1280	0.0193	0.2852	0.5491
Median	0.3822	0.6378	14.84	0.3059	0.0683	0.3459	0.6168
Mean	0.3765	0.6137	14.04	0.3813	0.0686	0.3309	0.5917
Standard Deviation	0.1658	0.1492	3.9688	0.2890	0.1475	0.0665	0.0601
75th percentile	0.5113	0.7161	16.43	0.6686	0.1323	0.3735	0.6356
Max	0.8215	0.9429	20.30	0.8988	0.7086	0.4572	0.6949

Table 5: Key statistics - Unrated sample

	LTD-Leverage	TD-Leverage	Size	Tangibility	Profitability	Industry-LTD-average	Industry-TD-average
# Observations	1087	1087	1087	1087	1087	1087	1087
Min	0.0000	0.0000	0.0000	0.0000	-3.6566	0.0542	0.3592
25th percentile	0.0236	0.3180	10.68	0.0173	-0.0153	0.2337	0.5253
Median	0.1250	0.5212	12.60	0.0707	0.0579	0.3182	0.5707
Mean	0.1944	0.4960	11.53	0.1813	0.0066	0.3090	0.5814
Standard Deviation	0.2013	0.2386	3.9379	0.2370	0.3163	0.0939	0.0714
75th percentile	0.3117	0.6792	13.97	0.2550	0.1227	0.3910	0.6398
Max	0.9589	0.9949	18.00	0.9857	0.8974	0.5112	0.7026

The rated sample consists of companies that on average have higher leverage than the unrated sample. In addition, the rated sample generally consists of companies that are of greater sizes, have more tangible assets and higher profitability relative the companies in the unrated sample. The difference in key characteristics can be explained by properties that are typical for companies entering this market. One example; companies listed on Oslo Stock Exchange are classified into different sectors that likely use bonds to raise capital to different extent. Illustrations of the samples' sector distributions are presented in Figure 2.

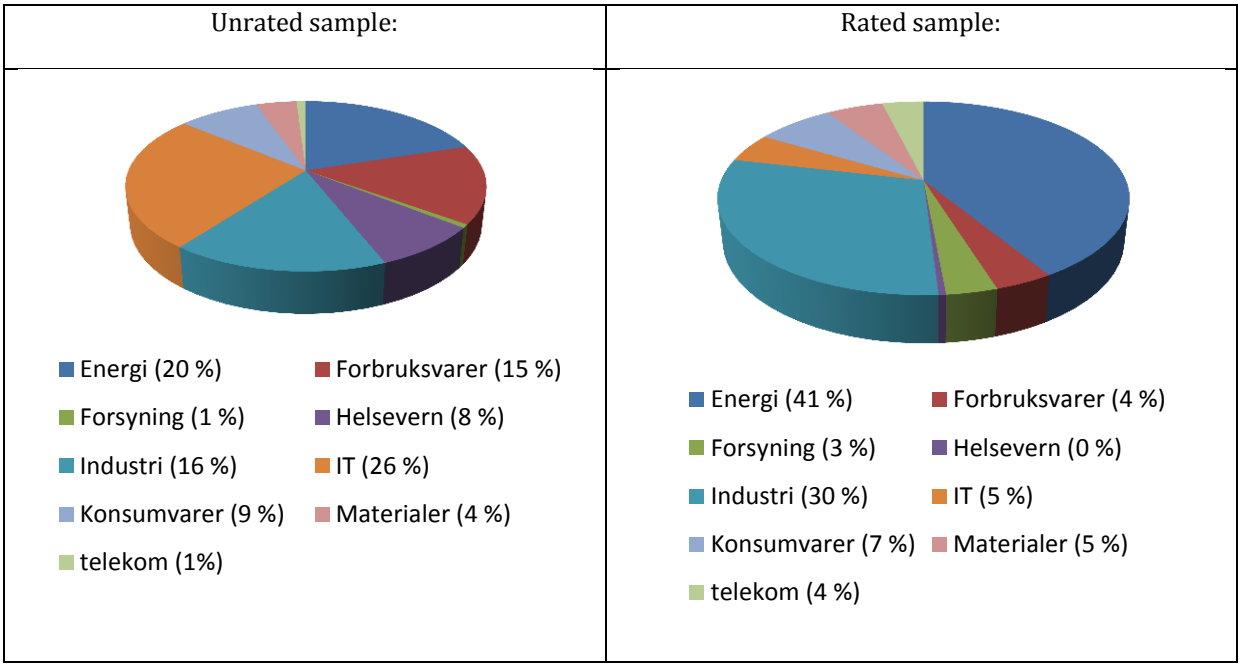


Figure 2: Sector distribution of the rated and unrated sample (oslobors.no)

Figure 2 shows that the sector distribution differs between the samples. The most obvious difference is the share of the energy and industry sectors, which counts for over 70 % of the observations in the rated sample compared to 36 % of the unrated sample. This difference between the samples may help explain the difference in key characteristics since different sectors consist of industries of different sizes and with operations that requires a large share of tangible assets.

According to Holba (2006) it has emerged a marketplace for high yield bonds in the Norwegian bond market recent years, and this is reflected in the credit rating distribution of the rated sample presented in Figure 3. This indicates that the Norwegian bond market consist of a large share of high yield companies.

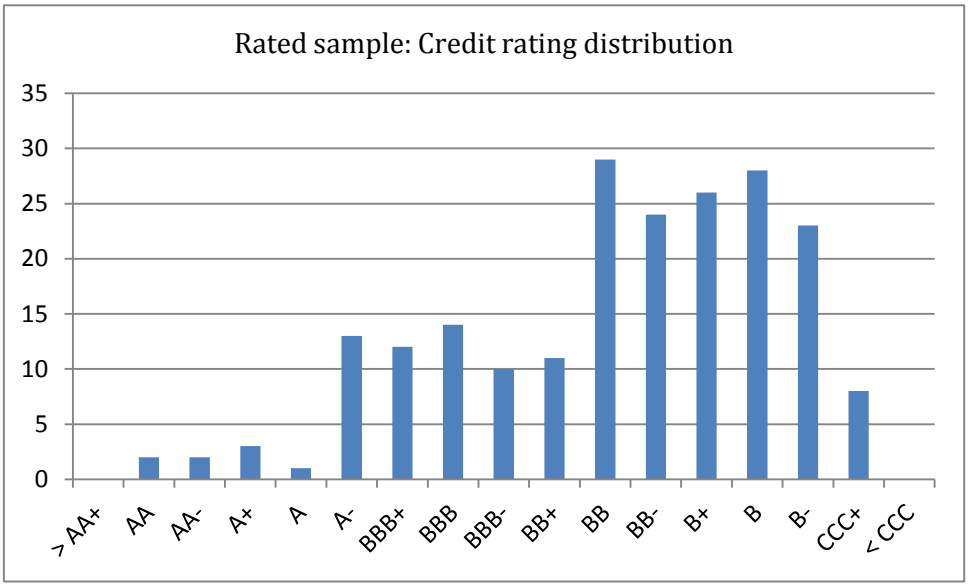


Figure 3: Credit rating distribution of the rated sample

The credit rating levels are divided into two classifications, investment grade and high yield. Credit rating observations on investment grade and high yield ratings in our data are presented in Table 6. According to Norwegian Trustee[12] 73 % of corporate bonds are high yield rated, hence the rated sample provides a good reflection of the Norwegian bond market.

Table 6: Credit rating frequency for investment grade and high yield ratings

Rating Classification:	# observation	%
Investmentgrade	57	27.7
High yield	149	72.3

[12] www.trustee.no

6 Methodology

This chapter presents a generalized empirical model for the analysis of the capital structure decisions presented in chapter 2.3 and defines proxies for the explanatory variables. A theoretical discussion of estimation models that are relevant for the regressions and how to choose the most appropriate will also be presented.

6.1 General Model

The dependent and independent variables selected in chapter 2 forms the basis for the general model of the capital structure decision:

$$\text{Leverage} = f(\text{size, tangibility, profitability, industry leverage}) \qquad (1)$$

The two dependent variables are *level of leverage* (LTD) and *adjustment of leverage* (ΔLTD). The proxy for level of leverage is defined as a companies' debt over total assets and are the static debt ratios for the companies. To measure how firms adjust their leverage the change in debt ratios from one year to the next are used as proxy. As discussed in chapter 2.3 the analysis are conducted on both long term and total debt for both proxies of leverage.

Previous empirical literature[13] is used to decide upon proxies for the explanatory variables. The natural logarithm of annual revenues has been a usual measure of the company size. Titman and Wessels (1988) argument for a logarithmic transformation of size, so that if a size effect exists, it will mainly affect small firms. Tangible assets over total assets are chosen as a proxy for tangibility as this is a frequently used proxy of this variable. Profitability is measured as operating return on assets and gives an indication of how efficient companies use their assets to generate earnings. This proxy also can easily be used to compare different companies' profitability. The last explanatory variable, industry leverage are measured by estimating the average of leverage; an individual average for both long term and total debt for all sectors each year. As a firm's debt ratio one year is assumed to be highly dependent on the debt ratio the previous year, we include last year's debt ratio in the regression on level of leverage to capture some of the more company specific explanation of leverage. Hence, more cross-sectional variation in the other explanatory variables is captured. The general model can be rewritten:

$$\begin{aligned} LTD_{it}/\Delta LTD_{it} = {} & \alpha + \beta_1 SIZE_{it} + \beta_2 TANG_{it} + \beta_3 PROF_{it} + \beta_4 IND\_ltd_{it} / IND\_td_{it} \\ & + \beta_5 LTD_{i(t-1)}/NA + \varepsilon_{it} \end{aligned} \qquad (2)$$

A summary of the variables are presented in Table 7 along with hypothesis of the explanatory variables expected effect on leverage.

[13] See e.g. Titman and Wessels (1988), Frank and Goyal (2009) and Rajan and Zingales (1995).

Table 7: Definition, proxies and hypothesis of the variables to the general model

Variables	Proxy	Label	Hypothesis
Level of leverage	Debt over total assets	LTD/TD	
Adjustment of leverage	Change in debt over total assets from t-1 to t	ΔLTD/ ΔTD	
Size	Natural logarithm of revenues	SIZE	+
Tangibility	Tangible assets over total assets	TANG	+
Profitability	EBIT + financial income over total assets	PROF	-
Industry leverage	Yearly average of each industry's leverage	IND_ltd/IND_td	+
Last year's level of leverage	Debt over asset in t-1	$LTD_{i(t-1)}$	+

6.2 Estimation Methods

In light of earlier research, a common approach to analyze a two-dimensional data set is to use panel data estimation methods. We will discuss three common estimation methods: pooled ordinary least squares model, fixed-effects model and random effect model.

Pooled Ordinary Least Squares Model

The pooled ordinary least squares model is the most restrictive model of the three, as it assumes no individual heterogeneity. The model is estimated by the following equation:

$$y_{it} = \beta_0 + \boldsymbol{\beta}\mathbf{x}_{it} + \varepsilon_{it} \quad (3)$$

where:

y_{it}: dependent variable
β_0: intercept
$\boldsymbol{\beta}$: vector of the explanatory variables coefficients
$\mathbf{x}_{it}$: vector of explanatory variables
ε_{it}: error term/residual

The error term, ε_{it}, is expected to be independent and identical normally distributed with $\varepsilon \sim N(0,\sigma_\varepsilon^2)$. The ordinary least squares (OLS)-estimators[14] are consistent and unbiased if there is no presence of heteroscedasticity or autocorrelation in the residual and no correlation between the residual and the explanatory variables. Assumptions for the error term are summarized in Table 8.

[14] For derivation of the OLS – estimator see Appendix C.

Table 8: Assumptions for the residuals of the pooled ordinary least squares model

	Technical Notation:	Interpretation:	Testing for:
(a1)	$E[\epsilon_{it}\|x_{it}] = 0$	The explanatory variables are strictly uncorrelated with the residuals	Independent residuals
(a2)	$\varepsilon \sim N(0,\sigma_\varepsilon^2)$.	Normally distributed error term	Normality
(a3)	$E[\epsilon_{it}\epsilon_{js}] = \sigma_\epsilon^2$, i = j, t = s	The variance of the error term is constant and finite over all values of x_{it}	Homoscedastic residuals
(a4)	$E[\epsilon_{it}\epsilon_{js}] = 0$, i≠ j,t≠ s	There exist no correlation between the residuals	No autocorrelation

Frydenberg (2004) argues that this is the most usual method in the literature and hence is preferred as method to make the result comparable with other studies. In addition, this estimation approach is simple to perform and requires estimation of few parameters. However, it has some severe limitations. First, in the context of capital structure's vast number of determinants the assumption of no correlation between omitted variables and explanatory variables is unrealistic. If assumption (a1) does not hold, this model will provide biased and inconsistent estimators. Secondly, when pooling the two-dimensional data this model fails to explain some of the structure and information available in a panel. A wider range of issues can be addressed when combining the time-series and cross-sectional data.

Fixed-effects model

The fixed-effects model takes the existence of unobserved heterogeneity into account and decomposes the residuals into two components; one term that capture the variation between the different firms analyzed, categorized as an individual effect term, η_i, and one idiosyncratic error term that capture the remaining disturbance, u_{it}.

$$\varepsilon_{it} = \eta_i + u_{it} \quad (4)$$

This model controls for the potential correlation between the explanatory and omitted variables by treating η_i as a fixed firm effect. The results are constant slopes, but intercept that differ according to the cross-sectional firms. In general terms the fixed-effect model takes the form of equation (5):

$$y_{it} = (\beta_0 + \eta_i) + \boldsymbol{\beta}\mathbf{x}_{it} + u_{it} \quad (5)$$

Two common estimators for the fixed-effects model are the least squares dummy variable (LSDV) estimator and the mean transformed data approach (within estimator). The LSDV estimator requires a number of dummy variables that increases with the size of the sample and hence the within estimator is more appropriate for analyzing large data samples (Brooks, 2008). Based on the size of our reference sample the mean transformation approach is used when applying the fixed-effect model.

This method is based on transforming away all the companies' fixed effects[15]. By subtracting the mean of each the time-varying variables for each company the fixed-effects model become:

$$\ddot{y}_{it} = \boldsymbol{\beta}\ddot{\mathbf{x}}_{it} + \ddot{u}_{it} \qquad (6)$$

The assumptions for the error terms of the fixed-effects model are summarized in Table 9.

Table 9: Assumptions for the residuals of the fixed-effects model

	Technical Notation:	Interpretation:	Testing for:
(b1)	$E[\eta_i \mid x_{it}] \neq 0$	The explanatory variables are correlated with the individual effect term	Individual heterogeneity
(b2)	$E[u_{it}\|x_{it}] = 0$	The explanatory variables are strictly uncorrelated with the idiosyncratic term	Independent idiosyncratic term
(b3)	$\varepsilon \sim N(0,\sigma_\varepsilon^2)$.	Normally distributed error term	Normality
(b4)	$E[\epsilon_{it}\epsilon_{js}] = \sigma_\epsilon^2$, i = j, t = s	The variance of the error terms is constant and finite over all values of x_{it}	Homoscedastic residuals
(b5)	$E[\epsilon_{it}\epsilon_{js}] = 0$, i≠ j,t≠ s	There exist no correlation between the residuals	No autocorrelation

As the model is independent of the individual effect terms, the fixed-effects model solves the omitted variables problem. When assumption (b1) holds the idiosyncratic term can be correlated with the individual effects and if assumption (b2) also holds this model provides consistent estimators. However, as η_i is treated as a fixed unknown constant for each company the impact of time-invariant variables cannot be identified. Thus the fixed-effects model, as the pooled ordinary least squares model, will not utilize all available information in the panel data.

Random effects model

The model presented in equation (5) also applies for the random effect model. The difference is how the individual effect term, η_i, is modeled. This model identifies η_i as a random individual disturbance effect and enters the regressions randomly every year for each company. The assumptions for this model are presented in Table 10.

[15] For derivation of the within–estimator see Appendix C.

Table 10: Assumptions for the residuals of the random effects model

	Technical Notation:	Interpretation:	Testing for:
(c1)	$E[\eta_i \mid x_{it}] = 0$	The explanatory variables are strictly uncorrelated with the individual effect term	No individual heterogeneity
(c2)	$E[u_{it}\|x_{it}] = 0$	The explanatory variables are strictly uncorrelated with the idiosyncratic term	Independent idiosyncratic term
(c3)	$\varepsilon \sim N(0,\sigma_\varepsilon^2)$.	Normally distributed error term	Normality
(c4)	$E[\epsilon_{it}\epsilon_{js}] = \sigma_\epsilon^2$, i = j, t = s	The variance of the error terms is constant and finite over all values of x_{it}	Homoscedastic residuals
(c5)	$E[\epsilon_{it}\epsilon_{js}] = 0$, i≠ j,t≠ s	There exist no correlation between the residuals	No autocorrelation

For the random effects model there are two possible estimators, an OLS-estimator and a generalized least squares (GLS)-estimator[16]. The difference between the two estimators is that the GLS-estimator is efficient with presence of heteroscedasticity and autocorrelation in the residuals while the OLS-estimator is inefficient. Hence, choosing appropriate estimator depends on what assumption that holds. In contrast to the fixed-effect model, this model exploits all information in the panel data so all the effects of the explanatory variables on firm leverage can be illuminated. At the same time, since there is less parameters to estimate, the loss of degrees of freedom is lower than for the fixed-effects model. Thus the random effect model should produce more efficient estimators, including lower volatility in the estimators (Brooks, 2008).

6.3 Selecting Estimation Model

To select the estimation model that fits the available data best, the properties of the data will be explored. First, the models' underlying assumptions regarding the error terms should be tested for; normality, heteroscedasticity, autocorrelation and multicollinearity. Then the data are tested for panel data effects. If panel effects exist, the ordinary least squares model is excluded since it does not take advantage of the structure of the panel data. Hence, either the fixed-effects model or the random effects model is preferred. As the assumptions for the pooled ordinary least squares model and the random effects model initially are the same; the difference being the decomposed assumptions regarding the error term, selecting estimation method are narrowed down to choosing between the fixed-effects model and the random effects model.

The assumption that differs between the models is the assumption regarding correlation between the individual error term and the explanatory variables. The random effects model forces this correlation to zero and allows no correlation, in contrast to the fixed-effects model that does. The Hausman test[17] is a way of determining the plausibility of the fixed-effects versus the random effects model and will be performed to distinguish between these models (Brooks, 2008).

[16] For derivation of the GLS–estimator see Appendix C.
[17] The Hausman test is presented in Appendix C.

7 Evaluation of Estimation Model

This chapter examines how the data fulfills the assumptions of the discussed estimation models. Tests of each assumption are first performed and discussed. Based on this assessment, the most appropriate model is chosen.

The data exploration and preceding empirical analyses are performed using the statistical software R.

7.1 Functional Form

The estimation models assume an existence of linear relationship between the dependent variable and the explanatory variables. If a linear model is fitted to variables that do not have a linear relationship with the dependent variable, the result can be seriously flawed. However, perfect linearity rarely occurs in empirical research. Instead, evidence of nonlinearity should be detected and the variables disproved if this occurs. Although no linearity can be identified from the scatterplot in Figure 4, there is nothing that suggests a different functional form. The other explanatory variables (see Appendix D) also fit the assumption for linearity. Hence it is verified that a linear approximation is proper, although there are outliers in some of the linear relationships.

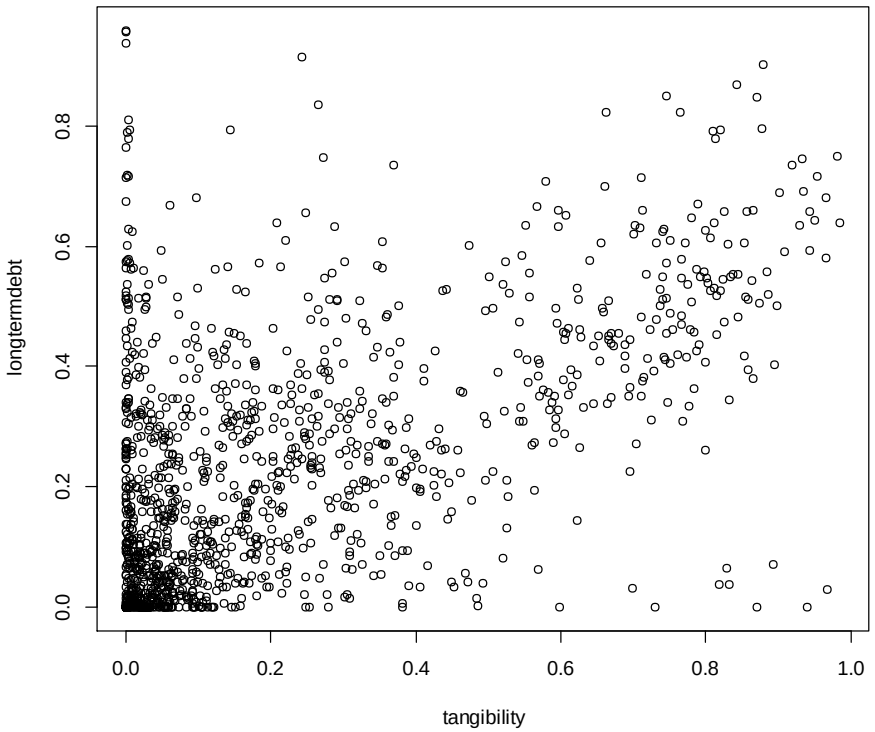
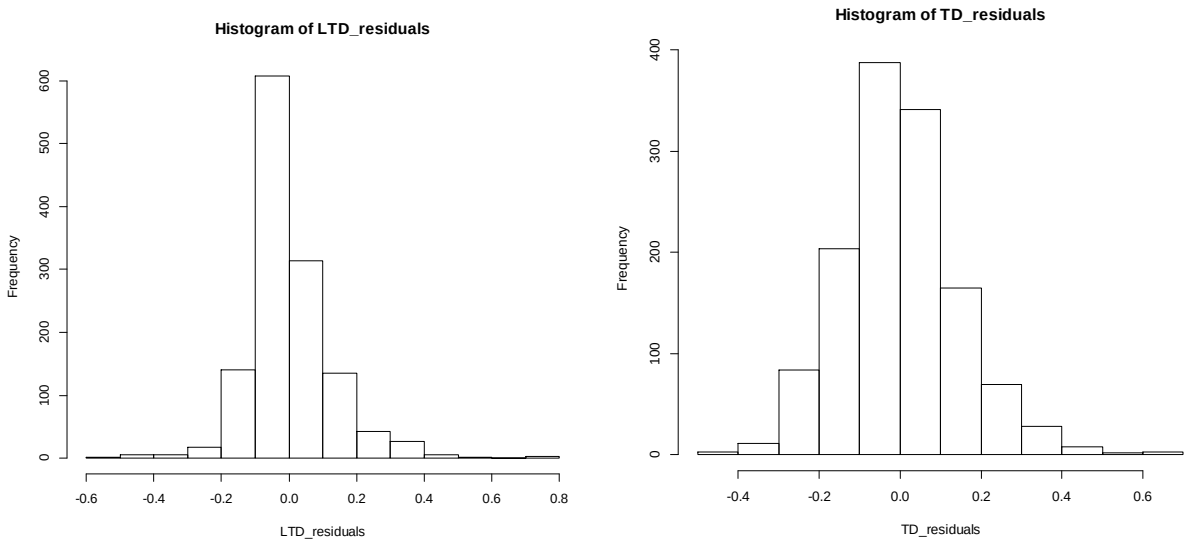


Figure 4: Scatterplot on observations of tangibility and long term debt

7.2 Normality



(a) **(b)**

Figure 5: Normality of the residuals for long term debt (a) and total debt (b) regressions

Figure 5 depicts the distribution of residuals in the regressions on long term debt and total debt. The figure reveals that the residuals are approximately normally distributed, which approves a consistent use of the applied statistical F-test and reliability of the estimations.

7.3 Heteroscedasticity

Heteroscedasticity in the error terms is tested for by using a Breusch-Pagan-test. Results are found in Appendix D, indicating heteroscedasticity in both long term debt and total debt regression. This violation of constant variances for the error terms may be due to large variation in the explanatory variables. As an example, the revenues of smaller firms can be more volatile than for larger firms.

The presence of heteroscedasticity can lead to wrong computations of the standard errors in the analysis, and hence wrong conclusions about the data analyzed. To deal with heteroscedasticity a general method of moments (GMM) estimator can be used while performing a panel data analysis. This estimator is usually robust to violations of heteroscedasticity and normality. However, the GMM estimators are not always the most efficient estimator (Yaffee, 2003). Another way to deal with the heteroscedasticity is to use the GLS estimator for random effects panel data.

7.4 Autocorrelation

Autocorrelation is detected in the regression of long term debt and total debt using a Breusch-Godfrey/Wooldridge test, see Appendix D. This could lead to wrong inferences about the relationship between the dependent variable and the explanatory variables, and weaken the reliability of the model. Autocorrelation are often found due to the inherently dynamic causality of capital structure or due to omitted variables. According to Brooks (2008), the GLS estimator handles the presence of autocorrelation better than for example the OLS estimator. Another way to deal with autocorrelation is to introduce lagged variables in the model. Such a dynamic model can then be modeled by a GMM estimator.

7.5 Multicollinearity

The correlation matrix between the explanatory variables is found in Table 11. The assumption of no multicollinearity usually never holds in practice, and a small degree of correlation will not affect the results in a significance manner (Brooks, 2008). The correlation between size and tangibility, as well as size and profitability, occurs as high, but are not considered to be of such a magnitude that it causes loss of reliability of these explanatory variables. However this does not rule out other sources of multicollinearity, such as correlation between multiple variables. It is anticipated that this will not occur within these variables. Hence, it is concluded to be little multicollinearity in the data.

Table 11: Correlation matrix for explanatory variables

	SIZE	TANG	PROF	IND ltd	IND td
SIZE	1.0000				
TANG	0.3218	1.0000			
PROF	0.3038	0.0889	1.0000		
IND ltd	0.047 4	0.2245	0.0410	1.0000	
IND td	0.0532	0.1961	0.0839	0.8023[18]	1.0000

7.6 Diagnostics

The data set are found to fulfill the assumptions of linearity, normality, and no significant multicollinearity, while violations of homoscedasticity and no autocorrelation are identified

Following the discussion in chapter 6.3, we also found significant panel data effects (See appendix E). This indicates that a fixed effects model or random effects model should be applied. By conducting the Hausmann-test to decide between these two models, no significant correlation between the individual specific residual terms and explanatory variables were identified. This applies for both long term debt regression and total debt regression. Hence the random effect model is found to be the appropriate model.

The presence of heteroscedasticity and autocorrelation favors a use of either GMM- or GLS estimator as they control for these violations of the assumptions. The GMM estimator was tried implemented for this analysis, but was not computable with the available software because of dummy variables for small samples of rating observations. Hence, the GLS-estimator is used in the preceding analysis.

[18] The correlation between industry averages of long term debt and total debt are high, as expected. These are however not used in the same regressions.

8 Analysis

This chapter analyzes the different credit rating considerations discussed in chapter 4.2. Three tests are constructed, where proxies of the considerations are applied with the general model. The aim of these tests is to evaluate how credit ratings affect leverage for Norwegian listed companies.

8.1 The Impact of Credit Rating on Capital Structure

This analysis explores how bond market participation affects firms' level of leverage and how this is influenced by the level of rating. This test will be referred to as "BMP" test.

Participation in the bond market is modeled as having a credit rating. In accordance to Nguyen and Wu (2011) we proxy credit rating by a dummy variable that is equal to one if the firm has a credit rating and zero for all other firms. To investigate whether levels of rating affect leverage, two dummy variables are included to reflect the categories investment grade and high yield ratings.[19] By applying the proxies to the general model introduced in 6.1, the following two models are regressed:

$$LTD_{it} / TD_{it} = \alpha + \beta_1 RATING_{it} + \beta_2 SIZE_{it} + \beta_3 TANG_{it} + \beta_4 PROF_{it} + \beta_5 IND\_ltd_{it} / IND\_td_{it} + \beta_6 LTD_{i(t-1)} / TD_{i(t-1)} + \varepsilon_{it} \quad (7)$$

$$LTD_{it} / TD_{it} = \alpha + \beta_1 IG_{it} + \beta_2 HY_{it} + \beta_3 SIZE_{it} + \beta_4 TANG_{it} + \beta_5 PROF_{it} + \beta_6 IND\_ltd_{it} / IND\_td_{it} + \beta_7 LTD_{i(t-1)} / TD_{i(t-1)} + \varepsilon_{it} \quad (8)$$

The different variables used in the "BMP" test are defined in Table 12, including the credit rating considerations hypothesis, H_{BMP}. The results are presented and discussed in chapter 8.1.1.

Motivated by this test, we regress the general model on the rated sample to identify which explanatory variables affect the level of leverage for firms participating in the bond market. This allows for a comparison against the hypotheses for the overall of Norwegian listed firms discussed in 2.4. The results are presented and discussed in chapter 8.1.2.

[19] The two categories are chosen because the distribution of Norwegian firms' credit ratings does not cover all level of ratings. The major part of the observations is in the middle and lower part of the credit rating scale (See descriptive statistics in chapter 5.2).

Table 12: Variables of the "BMP" test

Variables	Proxy	Label	Hypothesis
Level of leverage	Debt over total assets	LTD/TD	
Size	Natural logarithm of revenues	SIZE	+
Tangibility	Tangible assets over total assets	TANG	+
Profitability	EBIT + financial income over total assets	PROF	-
Industry leverage	Yearly average for each industry's leverage	IND_ltd/IND_td	+
Last year's level of leverage	Debt over asset in t-1	$LTD_{i(t-1)}$	+
Credit rating variables:			
Participating in the bond market	Dummy variable (equal to 1) for company i having a credit rating in year t	RATING	+
Investment grade rating	Dummy variable (equal to 1) for company i having an investment grade rating in year t	IG	+
High yield rating	Dummy variable (equal to 1) for company i having a high yield rating in year t	HY	+ (+)

8.1.1 Results of BMP test

According to the results in Table 13, we identify a positive and significant effect of the credit rating dummy variable for the long term debt ratio. Firms participating in the bond market have a 6.94% higher long term debt ratio relative to the firms that do not. This result confirms that acquiring a bond provide access to more capital and hence lead to a higher long term debt ratio for the issuing firm. This is in accordance with the findings of Faulkender (2006).

When distinguishing between levels of ratings in the regressions we identify a positive effect for high yield rated firms on both long term- and total debt ratios. Companies with low credit quality have a 8.90 % higher long term debt ratio and a 3.73 % higher total debt ratio than other listed companies. Coinciding with the findings of Mitto and Zhuang (2010), our results confirm how important the bond market is for companies with high credit risk, reflected in the recent development in this market.

For companies having an investment grade rating, the results show an insignificant influence on both long term debt ratio and total debt ratio. This states that there is no effect on leverage for these firms compared to non-issuing firms. However, the number of observations for investment grade ratings is minor compared to number of high yield ratings as mentioned in chapter *5.2*. Thus these results may be less reliable.

Table 13: Bond market participation and effect on level of leverage

Capital structure decision:
Participating in the Norwegian bond market
("BMP" test)

Coefficients and p-values from random effects regressions. Regressions of the general model including credit rating as measure of market participation and levels of credit rating. The regression is performed on the reference sample with long term debt and total debt as dependent variables.

	Panel A: Long term debt ratio LTD:		Panel B: Total debt ratio TD:	
	(7)	(8)	(7)	(8)
α	-0.0010 (0.9710)	-0.0089 (0.7467)	-0.0896 (0.1344)	-0.0891 (0.1355)
RATING	0.0694*** (0.0000)		0.0206 0.2579	
IG		0.0027 (0.9222)		-0.0456 (0.1949)
HY		0.0890*** (0.0000)		0.0373" (0.0585)
SIZE	0.0022 (0.1286)	0.0030* (0.0422)	0.0189*** (0.0000)	0.0195*** 0.0000)
TANG	0.3078*** (0.0000)	0.3032*** (0.0000)	0.1984*** (0.0000)	0.1948*** (0.0000)
PROF	0.0204 (0.2713)	0.0201 (0.2769)	-0.0975*** (0.0000)	-0.0973*** (0.0000)
IND_ltd/IND_td	0.2151** (0.0013)	0.2162** (0.0012)	0.3743*** (0.0000)	0.3639*** (0.0001)
LTD_{t-1}/TD_{t-1}	0.2373*** (0.0000)	0.2352*** (0.0000)	0.2199*** (0.0000)	0.2193*** (0.0000)
# Observations	1085	1085	1085	1085
# Years	1-6	1-6	1-6	1-6
# Companies	208	208	208	208
R-squared	0.37499	0.38071	0.3011	0.30489
Adj. R-squared	0.37257	0.37791	0.29916	0.30264
F-statistic	107.792	94.5809	77.4003	67.4807
(DF)	(6 and 1078)	(7 and 1077)	(6 and 1078)	(7 and 1077)
p-value	0.00000	0.00000	0.00000	0.00000

*P-values are given in parentheses. *** indicates a significance level of 0.1 %. ** indicates a significance level of 1 %. * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

8.1.2 Results of explanatory variable regression

Size

For firms engaged in the public debt market, we find a negative correlation between size and long term debt ratio. Although the coefficient is small, the relationship is statistically significant. The negative dependence contradicts the hypothesis for the overall of Norwegian listed firms and the trade off-theory, for which size can be an inverse proxy of bankruptcy risk. One possible explanation is that these firms have a relatively high average long term debt ratio, and a further increase of long term debt may be less feasible. As 74 % of the issuing firms are rated as high yield, issuing of more long term debt could be costly. The trade-off theory also ascertains that larger firms face lower debt related agency-costs. This suggest that the issuing firms could benefit from already being known in the debt market, and hence achieve cheaper financing for extra short term debt rather than long term debt. Hence, the negative dependence could be explained by firms rather issuing short term debt, as we find a significant positive result for the total debt ratio. This corresponds to Frydenberg (2004) stating that firms with a low risk of bankruptcy have less short-term debt, while high-risk companies have more short-term debt.

Tangibility

Tangibility is found to have a significant, positive influence on the long term debt ratio for these firms. This corresponds with the hypothesis for the overall of Norwegian listed companies, and is in line with the trade-off theory and empirical evidence (Harris and Raviv, 1991; Frank and Goyal, 2009). The results confirm the importance of tangible assets as collateral for the supply of long term debt.

Profitability

The proxy of profitability has a significant and negative correlation with total debt ratio for firms engaged in the bond market. This corresponds with the hypothesis for the overall of Norwegian listed firms and is supported by the pecking order theory. The theory states that firms prefer internal to external financing and hence use excess profit to reduce debt ratio. The coefficient's magnitude therefore explain down payment of debt as important for firms participating in the bond market. As these firms are frequently credit assessed, this reflects a concern for the overall debt level to maintain a certain rating level. The lack of significant results for the long term debt ratio may indicate that firms rather repay short term debt as this type of debt is easier to adjust.

Industry leverage

For firms participating in the bond market we find a highly positive and significant correlation between total debt ratio and industry average of total debt. This coincides with the findings of earlier studies, confirming that firms actively adjust their debt ratios towards industry leverages (Hovakimian, Opler, and Titman, 2001). The detection of an insignificant correlation for the long term debt ratio is somewhat unexpected. As credit assessments involves comparisons of the market and the industry the firm operates in, it could be expected that average industry leverage for long term debt would be a target for comparison. However, the large magnitude of industry median total debt indicates that firms rather target this as a maximum of leverage. The results may also be biased due to the sector distribution of the rated sample, where the two sectors energy and industry count for over 70 % of the observations.

Table 14: Identifying how firm characteristics explain level of leverage for rated firms

Rated firms:
How firm characteristics affect level of leverage

Coefficients and p-values from random effects regressions. Panel A regress the general model of explanatory variables on the 'rated' sample. The regression is performed with long term debt and total debt as dependent variables.

	Panel A: Rated sample	
	LTD	TD
α	0.3265***	0.0000
	(0.0000)	(0.9997)
SIZE	-0.0117***	0.0062*
	(0.0000)	(0.0488)
TANG	0.2150***	0.0334
	(0.0000)	(0.3857)
PROF	0.0626	-0.2243***
	(0.3363)	(0.0002)
IND_ltd/IND_td	0.1631	0.6107***
	(0.3371)	(0.0002)
LTD_{t-1}/TD_{t-1}	0.2117***	0.2821***
	(0.0004)	(0.0000)
# Observations	189	189
# Years	1-6	1-6
# Companies	45	45
R-squared	0.29974	0.41083
Adj. R-squared	0.29023	0.39778
F-statistic	15.6393	25.488
(DF)	(5 and 183)	(5 and 183)
p-value	0.00000	0.00000

*P-values are given in parentheses. *** indicates a significance level of 0.1 %. ** indicates a significance level of 1 %. * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

8.2 Capital Structure Decisions when Being Near a Change in Rating Level

The proceeding analysis examines whether companies being near a change in rating level adjust their leverage to either avoid a downgrade or increase the chance of an upgrade. This test will be referred to as the "NAC" test.

In accordance to Kisgens' (2006) approach, we define companies near a change in rating level to have ratings designated with a plus or minus sign, whereas companies not near a change lies between these two levels[20]. Three dummy variables are used as proxies for credit ratings. The first measures being near a change in rating and takes the value one if the company has a plus or minus rating the observed firm year and zero otherwise. The second dummy variable proxies being close to an upgrade and is equal to one if the company has a plus rating and zero otherwise. In the same way, for measuring being near a downgrade, the third dummy variable takes the value one if the company has a minus rating and zero otherwise.

We complement the general model presented in chapter 6.3 with the credit rating variables. Regressions of the following two models are performed:

$$LTD_{it}/\Delta LTD_{it} = \alpha + \beta_1 POM_{t-1} + \beta_2 SIZE_{it} + \beta_3 TANG_{it} + \beta_4 PROF_{it} + \beta_5 IND\_ltd_{it} + \beta_6 LTD_{i(t-1)}/NA + \varepsilon_{it} \quad (9)$$

$$LTD_{it}/\Delta LTD_{it} = \alpha + \beta_p PLUS_{t-1} + \beta_m MINUS_{t-1} + \beta_1 SIZE_{it} + \beta_2 TANG_{it} + \beta_3 PROF_{it} + \beta_4 IND\_ltd_{it} + \beta_4 LTD_{i(t-1)}/NA + \varepsilon_{it} \quad (10)$$

The different variables used in the "NAC" test are defined and presented in Table 15 including the credit rating considerations hypothesis, H_{NAC}. The significant results are presented in Table 16 and

Table 17. We find no significant results for the regression on level of leverage; see complete results from the "NAC" test in Appendix F.

[20] Rating levels are defines to include the minus, middle and plus specification for a particular rating. E.g. Companies having a rating of 'BB' refers to ratings of BB-, BB and BB+. Hence, a change in rating level implies an adjustment from BB to B, or BB to BBB.

Table 15: Variables of the "NAC" test.

Variables	Proxy	Label	Hypothesis
Level of leverage	Debt over total assets	LTD/TD	
Adjustment of leverage	Change in debt over total assets from t-1 to t	ΔLTD/ ΔTD	
Size	Natural logarithm of revenues	SIZE	
Tangibility	Tangible assets over total assets	TANG	
Profitability	EBIT + financial income over total assets	PROF	
Industry leverage	Yearly average for each industry's leverage	IND_ltd/IND_td	
Last years level of leverage	Debt over total assets the previous year	LTD(t-1)	
Credit rating variables:			
Near a change	Dummy variable (equal to 1) for company i having a plus or minus rating in year t-1	POM	-
Near an upgrade	Dummy variable (equal to 1) for company i having a plus rating in year t-1	PLUS	-
Near a downgrade	Dummy variable (equal to 1) for company i having a minus rating in year t-1	MINUS	-

Table 16: "NAC" test of non-issuing firms and effect on adjustment of leverage.

Capital structure decisions – Non-issuing firms:
Being near a change in rating
("NAC" test)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings are near a change. The regression is performed on the rated sample with adjustment in long term debt and total debt as dependent variables.

	Panel A: Long term debt ratio ΔLTD_{it}		Panel B: Total debt ratio ΔTD_{it}	
	(9)	(10)	(9)	(10)
α	0.0601 (0.4378)	0.0570 (0.04647)	-0.1508 (0.2102)	-0.1629 (0.1866)
POM_{t-1}	-0.0602** (0.0058)		-0.0039 (0.8524)	
$PLUS_{t-1}$		-0.0527* (0.0454)		0.0037 (0.8838)
$MINUS_{t-1}$		-0.0672** (0.0092)		-0.0119 (0.6350)
$SIZE_{it}$	-0.0025 (0.4592)	-0.0024 (0.4782)	-0.0007 (0.8212)	-0.0005 (0.8659)
$TANG_{it}$	0.0333 (0.4566)	0.0352 (0.4347)	0.0546 (0.1583)	0.0561 (0.1511)
$PROF_{it}$	-0.0071 (0.9293)	-0.0111 (0.8910)	-0.1665* (0.0301)	-0.1740* (0.0248)
Ind_ltd_{it}/ Ind_td_{it}	0.0409 (0.8264)	0.0452 (0.8093)	0.2711 (0.1425)	0.2883 (0.1268)
# Observations	189	189	189	189
# Years	1-6	1-6	1-6	1-6
# Companies	45	45	45	45
R-squared	0.049614	0.05108	0.04999	0.05239
Adj. R-squared	0.048039	0.04919	0.04841	0.05045
F-statistic	1.9097	1.63195	1.92627	1.67705
(DF)	(5 and 183)	(6 and 182)	(5 and 183)	(6 and 182)
p-value	0.09471	0.14059	0.09197	0.12889

*P values are given in parentheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

Table 17: "NAC" test of issuing firms and effect on adjustment of leverage.

Capital structure decisions – Issuing firms:
Being near a change in rating
("NAC" tests)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings are near a change. The regression is performed on the issuing sample with adjustment in long term debt and total debt as dependent variables.

	Panel A: Change in long term debt ratio ΔLTD_{it}		Panel B: Change in total debt ratio ΔTD_{it}	
	(9)	(10)	(9)	(10)
α	0.3260**	0.3260**	0.1463	0.1143
	(0.0088)	(0.0093)	(0.6089)	(0.6895)
POM_{t-1}	-0.0910**		-0.0849*	
	(0.0041)		(0.0139)	
$PLUS_{t-1}$		-0.0975*		-0.0626
		(0.0180)		(0.1597)
$MINUS_{t-1}$		-0.0851*		-0.1044*
		(0.0288)		(0.0135)
$SIZE_{it}$	-0.0024	-0.0024	-0.0039	-0.0033
	(0.6810)	(0.6780)	(0.5117)	(0.5723)
$TANG_{it}$	0.0449	0.0437	0.0778	0.0785
	(0.5382)	(0.5511)	(0.2816)	(0.2750)
$PROF_{it}$	-0.1239	-0.1207	-0.4407*	-0.4536*
	(0.5069)	(0.5232)	(0.0252)	(0.0216)
Ind_ltd_{it}/ Ind_td_{it}	-0.5536"	-0.5520"	0.0035	0.0465
	(0.0658)	(0.6892)	(0.9935)	(0.9132)
# Observations	71	71	71	71
# Years	1-6	1-6	1-6	1-6
# Companies	37	37	37	37
R-squared	0.23947	0.24046	0.20161	0.20968
Adj. R-squared	0.21923	0.21676	0.18457	0.18901
F-statistic	4.06162	3.35182	3.28056	2.82798
(DF)	(5 and 65)	(6 and 64)	(5 and 65)	(6 and 64)
p-value	0.00286**	0.00619**	0.01056*	0.01666*

*P values are given in parentheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

Discussion of results

In this test we examine whether considerations between being near a change in rating level differ between participants of the Norwegian bond market in two settings, firms making additional bond issues and firms that do not.

The results for non-issuing bond market participants are presented in Table 16. We identify a significant and negative effect on companies' adjustment of long term debt. Companies facing a possible change in rating reduce their long term debt 6.02 % in the following year compared to companies with stable ratings. Distinguishing between being near an upgrade or downgrade the negative effect on long term debt adjustments are respectively 5.27 % and 6.72 %. Furthermore, there are no significant results of non-issuing companies adjusting their long term debt due to an unstable rating, indicating that these companies make credit rating concerns mainly related to adjustment of long term debt.

The result for issuing companies is outlined in Table 17. We find a negative correlation between being near a change in rating and adjustment of long term debt. Issuing companies with unstable ratings reduce their long term debt with 9.10 % more than companies with a stable rating the year before a bond issue. The negative long term debt adjustment is 9.75% for companies with a possible rating upgrade and 8.51% for companies being close to a downgrade. For issuing firms the result is also significant for this credit rating consideration on adjustment of total debt. We estimate that issuing companies reduce their total debt by 8.49 % when having concern of a possible rating change. Distinguishing between being near an upgrade and downgrade, we have no findings implying that issuing companies make adjustment of total leverage being near an upgrade. However, issuing companies near a downgrade the year before, reduce their total debt by 10.44 % more than issuing firms with stable ratings.

For firms participating in the public debt market we find no evidence that being near a change in rating level influence their level of leverage. However, concerns for credit rating changes are identified for leverage adjustment. Firms are found to reduce long term when being near a change in rating, independent of making additional bond issues or not. This indicates that the credit rating considerations related to being near a change in rating level have a general negative effect on long term debt adjustments for companies participating in the Norwegian market. This result confirms our hypothesis and implies that companies in the Norwegian bond market adjust their long term debt ratio to avoid a downgrade or increase the chance of an upgrade. This result may imply that credit ratings influence companies' long-term funding strategy. Our findings are consistent with the findings of Kisgen (2006).

The negative effect on long term debt adjustment is found to be greater for issuing firms. In addition, we find that these firms significantly reduce their total debt as well. This finding indicates that issuing companies actively adjust leverage the year before a new debt issue as a consequence of being near a change in rating level. These results hence confirm that these firms have additional concern for their credit ratings in the sake of their upcoming bond issue. This is in accordance with the findings of Henriksen and Stjern (2008), who identify credit ratings as an important factor for leverage decisions.

8.3 Capital structure decisions after a change in rating level

This test examines if a change in company rating has subsequent impact on companies' capital structure decisions. By distinguishing between an upgrade and a downgrade of company ratings we will be able to reveal whether there are differences regarding how companies make subsequent leverage decisions. This test will be referred to as the "AC" test.

Credit rating changes are measured by two dummy variables. The first is equal to one if the company has been downgraded or zero otherwise. Similar measures the second variable if companies have been upgraded when taking the value one. A regression on the following two models test whether companies' level of leverage or leverage adjustment is affected by a company rating change the previous year.[21]

$$LTD_{it}/\Delta LTD_{it} = \alpha + \beta_1 DOWN_{t-1} + \beta_2 UP_{t-1} + \beta_1 SIZE_{it} + \beta_2 TANG_{it} + \beta_3 PROF_{it} + \beta_4 IND\_ltd_{it} + \beta_4 LTD_{i(t-1)}/NA + \varepsilon_{it} \quad (11)$$

The different variables used in the "AC" test are defined and presented in Table 18 including the credit rating considerations hypothesis, H_{AC}. The results are presented in Table 19 and Table 20. We find no significant results for the regression on level of leverage; see complete results from the "AC" test in Appendix G.

Table 18: Variables of the "AC" test.

Variables	Proxy	Label	Hypothesis
Level of leverage	Debt over total assets	LTD/TD	
Adjustment of leverage	Change in debt over total assets from t-1 to t	ΔLTD/ ΔTD	
Size	Natural logarithm of revenues	SIZE	
Tangibility	Tangible assets over total assets	TANG	
Profitability	EBIT + financial income over total assets	PROF	
Industry leverage	Yearly average for each industry's leverage	IND_ltd/IND_td	
Last year's level of leverage	Debt over total assets the previous year	LTD(t-1)	
Credit rating variables:			
After a downgrade	Dummy variable (equal to 1) for company i being downgraded in year t-1	DOWN	-
After an upgrade	Dummy variable (equal to 1) for company i being upgraded in year t-1	UP	NA

[21] A downgrade may affect behavior beyond this first year. But behavior in upcoming years may be affected by subsequent changes in ratings and other changes to the company.

Table 19: "AC" test of non-issuing firms and effect on adjustment of leverage

Capital Structure Decisions – Non-issuing firms:
After a Change in Rating
("AC" test)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings have either been upgraded or downgraded. The regression is performed on the rated sample with adjustment in long term debt and total debt as dependent variables

	Panel A: Change in long term debt ratio ΔLTD_{it}	Panel B: Change in total debt ratio ΔTD_{it}
	(11)	(11)
α	0.0487 (0.5302)	-0.1423 (0.2420)
$DOWN_{t-1}$	0.0078 (0.7856)	-0.0200 (0.4701)
UP_{t-1}	-0.0578" (0.0741)	-0.0376 (0.2278)
$SIZE_{it}$	-0.0034 (0.3104)	-0.0006 (0.8371)
$TANG_{it}$	0.0372 (0.4093)	0.0594 (0.1301)
$PROF_{it}$	-0.0259 (0.7488)	-0.1763* (0.0217)
Ind_ltd_{it}/ Ind_td_{it}	0.0287 (0.8782)	0.2635 (0.1571)
# Observations	189	189
# Years	1-6	1-6
# Companies	45	45
R-squared	0.02811	0.06009
Adj. R-squared	0.02706	0.05786
F-statistic	0.87594	1.9391
(DF)	(6 and 182)	(6 and 182)
p-value	0.5137	0.07676

*P values are given in parentheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

Table 20: "AC" test of issuing firms and effect on adjustment of leverage

Capital Structure Decisions – Issuing firms:
After a Change in Rating
("AC" test)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings have been upgraded or downgraded. The regression is performed on the issuing sample with adjustment in long term debt and total debt as dependent variables.

	Panel A: Change in long term debt ratio ΔLTD_{it}	Panel B: Change in total debt ratio ΔTD_{it}
	(11)	(11)
α	0.3693** (0.0049)	0.2417 (0.4124)
$DOWN_{t-1}$	-0.0302 (0.5366)	-0.0894" (0.0949)
UP_{t-1}	-0.0731 (0.1664)	-0.0651 (0.2344)
$SIZE_{it}$	-0.0040 (0.5016)	-0.0059 (0.3242)
$TANG_{it}$	0.0811 (0.2919)	0.1116 (0.1355)
$PROF_{it}$	-0.1915 (0.3370)	-0.5032* (0.0134)
Ind_ltd_{it}/ Ind_td_{it}	-0.7368* (0.0182)	-0.1634 (0.7096)
# Observations	71	71
# Years	1-6	1-6
# Companies	37	37
R-squared	0.16058	0.17041
Adj. R-squared	0.14475	0.15361
F-statistic	2.00718	2.18907
(DF)	(6 and 64)	(6 and 64)
p-value	0.07756"	0.05539"

*P values are given in parentheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

Discussion of results

As in the "NAC" test we examine whether considerations after a change in rating level differ between participants in the Norwegian bond market, distinguishing between firms issuing additional bonds and the firms that do not.

The results for non-issuing firms are presented in Table 19. We find that these firms reduce long term debt by 5.78 % following an upgrade in rating level compared to companies with stable ratings. Our results identify no effect on leverage for companies being downgraded the previous year. Both findings contradict our hypothesis, and this result seems peculiar.

Table 20 presents the results for companies making additional bond issues. These companies are found to reduce their total debt the year after a rating downgrade by 8.94 %. Our result identifies no effect on leverage after an upgrade.

We have no findings identifying that change in rating influence level of leverage. The significant results find that changes in ratings affect leverage adjustments. The results indicate that issuing firms respond to a downgrade by reducing their total debt the following year trying to reverse the rating change, since higher rating leads to better borrowing conditions on their upcoming debt issue. Issuing companies experiencing an upgrade are already associated with lower credit risk and they are not influenced by the rating change in subsequent leverage decisions. The results confirm our hypothesis and indicate that issuing companies actively adjust their total debt following a downgrade to increase the chance of lower debt cost of capital. These findings are in compliance with the findings of Kisgen (2009) in the U.S. market.

8.4 Summary of main findings

Listed companies participating in the Norwegian bond market are found to have a 6.94% higher long term ratio than other listed companies. The identified leverage effect is found to be greater for high yield companies. Examining what explanatory factors determine capital structure decisions for rated companies we find that long term debt ratio is positively influenced by tangibility while increased company size reduces it. Total debt ratio is increased by industry leverage and decreased by profitability.

We find no evidence of credit ratings' influence on level of leverage. However, concerns for credit ratings are identified for leverage adjustments. We find that non-issuing companies reduce long term debt by 6.02 % as a consequence of being near a change in rating level. Issuing companies are identified to make long term and total debt reductions of 9.20 % and 8.49 % the year after they have been near a change in credit rating level. In addition they actively reduce they total leverage following a rating downgrade with 8.94 % more than other issuing companies.

These findings indicate that firms in the public market primarily reduce long term debt when being near a change in credit rating. This implies that credit ratings influence these firms' long-term funding strategy. Companies that make additional bond issues also make subsequent total debt reductions of 10.44 % and 8.94 % when they are concerned of being downgraded or experience an actual downgrade. This reveals that issuing companies are concerned about their company ratings effect on their upcoming bond issues yield spread. Thus they actively adjust total leverage to maintain a certain rating level to influence their cost of debt capital. In sum, Norwegian companies are especially influenced by their credit ratings in capital structure decisions when making additional debt issues on the public market.

8.5 Weaknesses in the Analysis

Our findings reveal the role of credit ratings in the Norwegian market. There are however limitations and weaknesses affecting different aspects of the analysis.

Model limitations:

The three analysis presented in this chapter are all conducted based on the general model. The model includes only four explanatory variables and it is likely that there exist omitted variables that influence a company's capital structure. The achieved values for adjusted R-squared vary between the different tests, being consistently lower for adjustment of leverage as dependent variable. In some analyzes the model only explains 2-5 % of the variation in leverage adjustments. The adjusted R-squares from traditional leverage regressions range from 18% to 29% (Lemmon, Roberts and Zender, 2008). Hence it could be desirable to include additional determinants of capital structure to make the model more refined and to increase accuracy.

Sample limitations:

The rated sample is small compared to the reference sample, accounting for less than 15 percent. A small sample size does often affect the reliability of the results because it leads to higher variability.

The sample size is also affected by uncover age bias, as it was difficult to obtain credit ratings from Norwegian brokerages. The sample does not reflect all bond issuing firms, as the majority of brokerages do not track historical ratings.

In addition, we have made some controversial assumptions when constructing the rated sample with the available ratings. When we only were provided with a companies' bond rating we substituted these to be valid as a company rating. If we had discontinuous credit ratings we assumed a linear relationship between the outer years and estimated credit ratings for the years in between. Seen in context with lack of credit ratings from additional brokerages some observations may create a bias in our results when the company are analyzed as unrated when it actually have a credit rating, and vice versa. This might be one of the most important limitations of our study.

The rated sample has ratings that are unevenly distributed across the credit rating scale, and most of the observations are on the middle of the scale.

Analysis-construction limitations
In the "NAC" test, we define credit ratings near a change to be designated with a plus or minus sign. This may be an inappropriate approximation of 'rating being near a change' since a company that such a rating may not be closer to a change in rating than a company that has a rating without a plus or minus. In addition, there is possible that companies will have concern of rating changes moving from a BB to either a BB+ or BB-, since it is possible to be close to a rating change for all 27 levels of rating[22]. This was taken into consideration but due to the distribution of the credit ratings and the few observations on each rating in total we preceded the analysis with nine levels of credit ratings. With a larger rated sample in would have been interesting to define 'ratings close to a change' in a more accurate way.

Market and economic limitations:
It is likely that additional factors may have influenced the observed capital structures decisions in our study. The Norwegian financial market has experienced severe market fluctuations during the analyzed period, as well as the bond market has experienced extensive growth. Among other, these factors may also have affected the firms' debt ratio.

[22] Ksigen (2006) uses two different proxies being near a change in credit rating level. One is based on nine rating levels while the other is based on 27.

9 Conclusion

Using panel data analysis we have examined the role of credit ratings in the Norwegian market, and identified how leverage decisions are made out of concern of these. Norwegian listed companies are found to be influenced by credit ratings when making decisions regarding leverage based on three tested considerations. The first confirms that participation in the bond market leads to a 6.94% higher long term debt ratio, as a result of access to capital. A greater effect for high yield companies is also identified. Secondly, firms in the public market reduce long term debt 6.02 % more when being near a change in rating level the previous year. This negative effect on long term leverage is identified to be greater for companies making additional bond issues. Finally, firms in the public debt market that make new bond issues during the analysis period are identified to reduce their total debt with 10.44 % and 8.94 % as a result of either a concern of being downgraded or experiencing a downgrade. Our findings reveal that credit rating considerations for firms in the public market have impact on leverage adjustments. We found no significant result suggesting credit ratings influence the level of leverage.

There are limitations in the empirical model and the data. The results are affected by few observations, unequal distribution of credit rating levels and limited access to historical credit ratings for Norwegian companies, which limits the data set used in the analysis. Nevertheless, the limitations in the data are a result of characteristics in the Norwegian market.

The empirical model is applied for all analyses and the explanatory degree is low in some the achieved results. This makes it difficult to draw any general conclusions. A model explaining more of the variation in capital structure might have provided more accurate results. Further, analyzing other proxies for credit ratings would have been interesting. This is especially with regards to the definitions of a credit rating near a change in rating level. Assuming that the Norwegian bond market continues to develop, it would be interesting to do a similar examination in this market in a few years to follow the evolution of credit ratings in this market.

This paper represents the foundations of empirical literature combining credit rating and capital structure in the Norwegian market. Hence this is a contribution to the knowledge of capital structure in this market. In addition, this is the first empirical study analyzing the importance of credit ratings to such an extent for another market than the U.S. We identify credit rating effects on long term debt and that these may influence companies as part of a long-term funding strategy. In addition, maintaining a certain credit rating level are of importance for companies making bond issues as higher credit rating levels are associated with better costs on debt capital. Overall, we conclude that Norwegian firms have especially concern for their credit ratings when making debt issues.

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Appendices

Appendix A: Market Characteristics of the Norwegian Bond Market

A.1. Bond Issues – Oslo Stock Exchange

Approximately 75% of all Norwegian bonds are listed and is an indication of the total Norwegian bond market regarding size of issuance and number of loans. These characteristics are illustrated in Figure 6.

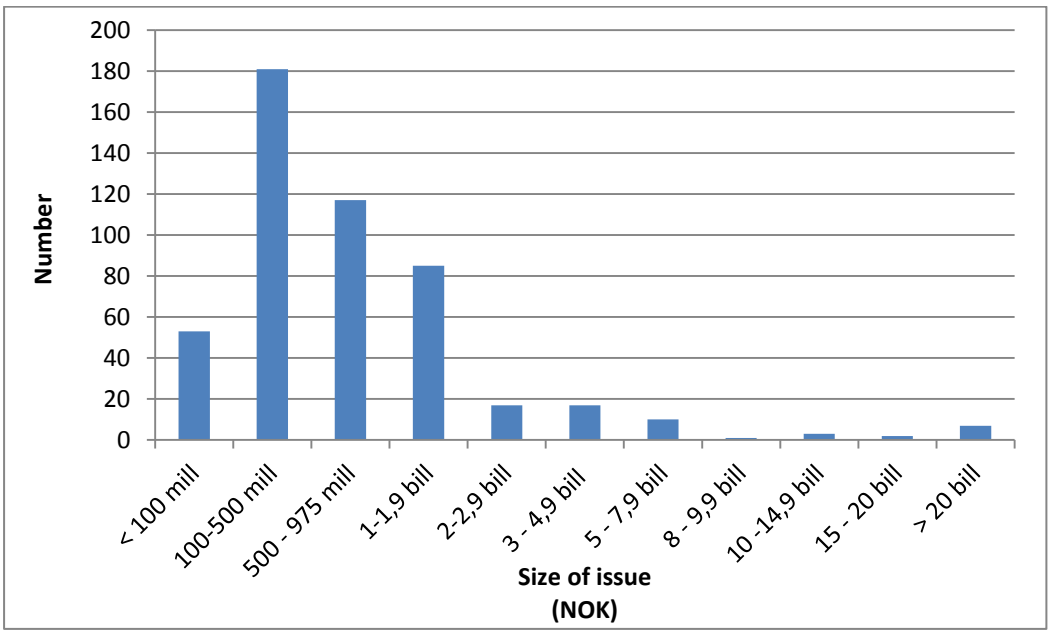

Figure 6: Overview of bond issues listed on Oslo Stock Exchange per 05.12.2011

A.2. Investors in the Norwegian market

The major groups of investors in the Norwegian bond market are foreign investors, insurance companies, social security administration and banks. Figure 7 shows the investors of the bonds in the Norwegian market by sector.

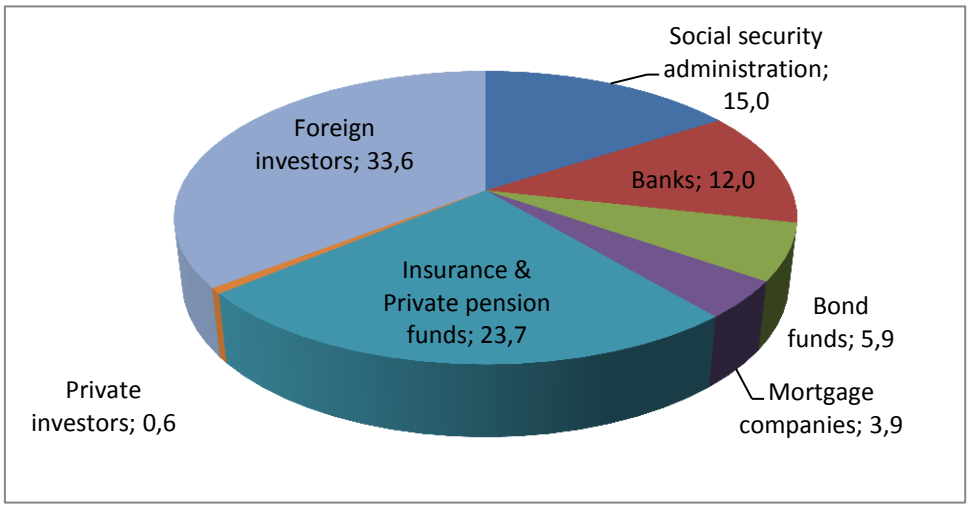

Figure 7: Investors in the Norwegian bond market, by sector and market (ssb, 2010)

Appendix B: Construction of subsamples

Rated sample

The rated sample is based on companies that have issued bonds[23] during the years of our analysis period, due to the practice of Norwegian brokerage to produce a credit assessment (shadow rating) of bond issuers. Of the 216 listed companies, 59 have issued bonds during the seven years of our analysis period. It has been difficult to obtain shadow ratings from brokerages and only four have had historical shadow ratings we can use in our analysis; DnB Markets, Nordea Markets, SEB Merchant Banking and Carnegie.

If both DnB and Nordea have provided us with ratings for the same company we prefer DnB's ratings over Nordea's because they also have provided us with the historical data of the official credit ratings. If there are ratings from only one of the brokers they are included in the analysis to make the sample larger and more reliable. It is worth mentioning that there are no major differences between the ratings from DnB and Nordea. Including the discontinuous ratings from Carnegie and SEB as well, the sample size increases but as a whole it is natural to assume that the sample becomes less reliable and the results more controversial, since they are based on an underlying assumption that the discontinuous ratings from Carnegie and SEB are linear between the ratings. When including these ratings in the sample lead to a sample size of 45 of the companies with bond issues, more than 76 % of the possible companies. The ratings from Carnegie and SEB also provide the analysis with a broader understanding regarding different level of a company's credit risk, since they have issued lower rated companies relative to DnB and Nordea. Comparing the ratings from the four brokers, we have the following order of priority: DnB, Nordea, SEB and Carnegie. We prefer rating from SEB over them from Carnegie because the ratings from Carnegie seem to me the most controversial based on the information provided by the different brokerages themselves. This sample consists of 206 observations.

First time issuing sample

In the period 2004-2010, 33 firms got rated for the first time as they entered into the bond market. To be able to investigate the change in debt ratios to the year before a debt issue we exclude the companies first-time-rated in 2004 and 2005, seven of the 33 firms, are omitted. Of the resulting 26 firms, 22 companies have available fiscal years for our calculation.

Issuing sample

During the years 2004-2010 we initially have 76 bond issues. Due to the empirical design of the "POM" and "AC" tests we control the sample for issues in 2004. The sample is left with 71 observations that are used when analyzing credit rating considerations impact on capital structure when making a new bond issue.

[23] Overview over bond issues, dated back to October 2003, was obtained from www.oslobors.no. Based on the available historical bond issues we narrowed down the analysis period to 2004 until 2010.

Appendix C: Methodology

The estimators presented in this appendix are the estimators of the panel data models. We have the OLS-estimator (pooled ordinary least squares model), within-estimator (fixed effect model) and the GLS-estimator (random effect model). For complete derivation see Brooks (2008).

C.1. OLS-estimator

The POLS estimators are consistent and unbiased if there is no presence of heteroscedasticity or serial correlation at the same time as there is no correlation between the residual and the explanatory variables. The POLS coefficient estimates for our vector of k parameters are calculated by the following equation:

$$\boldsymbol{\beta}_{POLS} = \quad \boldsymbol{x}'\boldsymbol{x}\ ^{-1}\boldsymbol{x}'y \tag{12}$$

C.2. Mean transformation approach – within estimator

This method is based on transforming away all the companies' fixed effects. The idea is to transform equation 5 in chapter 6.2 to eliminate η_i; by introducing the variables as the mean of the time-varying variables for each company i and subtracting this from (4)[24] we get:

$$y_{it} - \ y_i \ = \boldsymbol{\beta}\ \boldsymbol{x}_{it} - \boldsymbol{x}_i \ + (u_{it} - u_i) \tag{13}$$

$$y_{it} = \boldsymbol{\beta}\boldsymbol{x}_{it} + u_{it} \tag{14}$$

Now the companies' fixed effects are canceled and the model is independent of η_i. Now we can estimate the betas in (15) with an OLS estimator, defined as the "Within- estimator" (β_W):

$$\boldsymbol{\beta}_W = \ [\ \boldsymbol{x}'\boldsymbol{x}\ ]^{-1}\boldsymbol{x}'y \tag{15}$$

C.3. Generalized least squares procedure – GLS estimator

The transformation involved in this procedure is to subtract a weighted mean, θ, of the y_{it} over time. By weighted mean, we refer to a part of the mean rather than the whole mean, as was the case for the fixed-effect model.

$$y_{it} - \ \theta y_i \ = \boldsymbol{\beta}\ \boldsymbol{x}_{it} - \theta\boldsymbol{x}_i \ + (\varepsilon_{it} - \theta\varepsilon_i) \tag{16}$$

$$y_{it}{}^* = \boldsymbol{\beta}\boldsymbol{x}_{it}{}^* + \varepsilon_{it}{}^* \tag{17}$$

From (17) we can make the following observations; First, if θ =1 the model is equal to the fixed effect model, and the GLS-estimator will be equal to the within-estimator. Secondly, if θ = 0 the model is equal to the pooled OLS model and the GLS-estimator will be equal to the OLS-estimator. This indicates that if the GLS-estimator is equal to the within-estimator, the firm specific residual will be uncorrelated with the explanatory variables. But if the GLS-estimator is relatively unequal to the within-estimator the random effect model will not provide efficient estimators and the fixed-effect model would be preferred.

Θ will be the correction term and are calculated as a function of the variance of the observation error term, σ_u^2, and of the variance of the individual company disturbance term, σ_η^2:

[24] $y_i = \frac{1}{T}\ \sum_{t=1}^{T} y_{it}$; $x_i = \frac{1}{T}\ \sum_{t=1}^{T} x_{it}$ and $u_i = \frac{1}{T}\ \sum_{t=1}^{T} u_{it}$ → *mean equation:* $y_i = (\beta_o + \eta_i) + \beta_1 x_{1\imath} + \beta_2 x_{2\imath} + \cdots + \beta_k x_{k\imath} + u_i$.

$$\theta = \sqrt{\frac{\sigma_u^2}{T\sigma_\eta^2 + \sigma_u^2}} \tag{18}$$

The GLS-estimator is given by the following equation:

$$\hat{\beta}_{GLS} = \left[\left(x^{*\prime} x^{*}\right)\right]^{-1} x^{*\prime} y^{*} \tag{19}$$

This transformation of the model ensures that there is no cross-correlation in the error terms. The same procedure can be done in the case of time variations in our data. If that where the case, a time-specific error term would be introduced as the individual company disturbance term. A two-way model could be the solution if we envisaged both cross-sectional and time varying random effects, allowing the intercepts to vary in both dimensions (Brooks, 2008).

C.4. Hausman test

The Hausman test is a way of determining the plausibility of the FE versus the RE model (Brooks, 2000) and is based on detection possible correlation between omitted and explanatory variables. Formally the test shows to hypothesis based on assumption (b1) and (c1):

$$H_0 : E\ \eta_i\ x_{it}\ = 0 \tag{20}$$

$$H_1 : E\ \eta_i\ x_{it}\ \neq 0$$

(x10)

Based on these hypotheses, a true null hypothesis provides a random effect-estimator that is efficient and therefore preferable. This will provide a GLS-estimator that is approximately equal to the "Within Company"-estimator (θ = 1).However, if the alternative hypothesis is true, the fixed-effects method is preferred. This will provide a GLE-estimator relative different from the "Within Company"-estimator (θ = 0). Hence, when the null hypothesis is true, the GLS-estimator and the "Within Company"-estimator do not differ systematically from each other. To test this:

$$\beta_{WC} - \beta_{GLS} = 0 \tag{21}$$

The test observer is chi-distributed and is given by the following:

$$T_{Hausman} = \chi^2_{k=} = \frac{\beta_{WC} - \beta_{GLS}\ ' (\beta_{WC} - \beta_{GLS})}{[Var\ \beta_{WC}\ - Var\ \beta_{GLS}\ ]} \tag{22}$$

where k is the number of degrees of freedom and equal to the number of explanatory variables. If the test observer exceeds the critical value of the chi-distribution, we rejected the null hypothesis and use the fixed effects model. In practice is it quite common to reject the null hypothesis of the random effects model in favor of the fixed-effects model just because of the strict assumption about no correlation between the explanatory and omitted variables (c1).

Appendix D: Evaluation of Assumptions

D.1. Test of Linearity

The following figures presents scatterplots of explanatory variables and debt ratios.

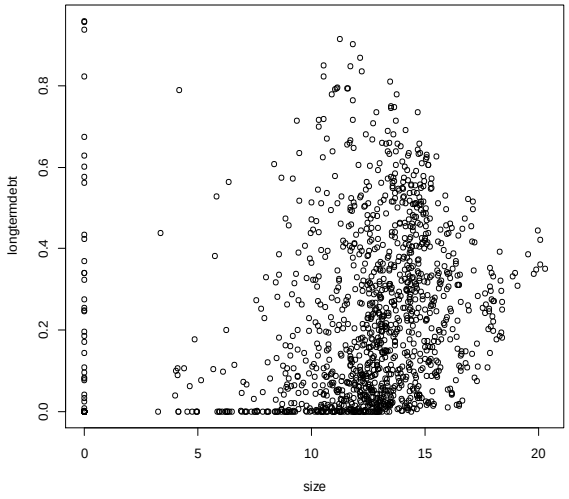

Figure 8: Scatter plot of size and long term debt

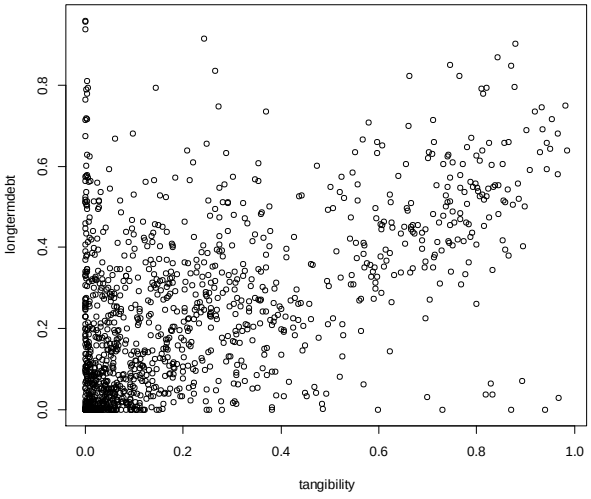

Figure 9: Scatter plot of tangibility and long term debt

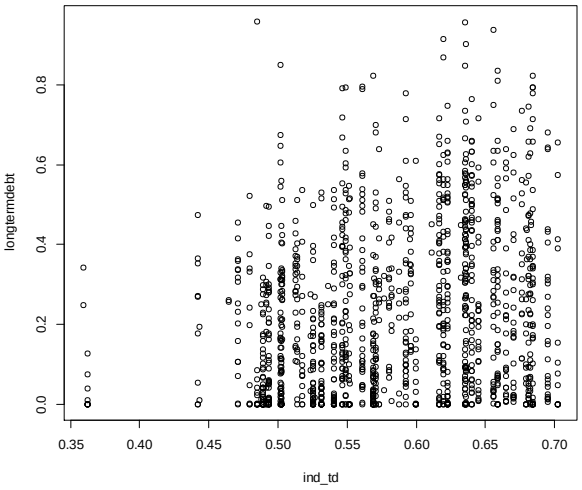

Figure 10: Scatterplot of industry leverage and long term debt

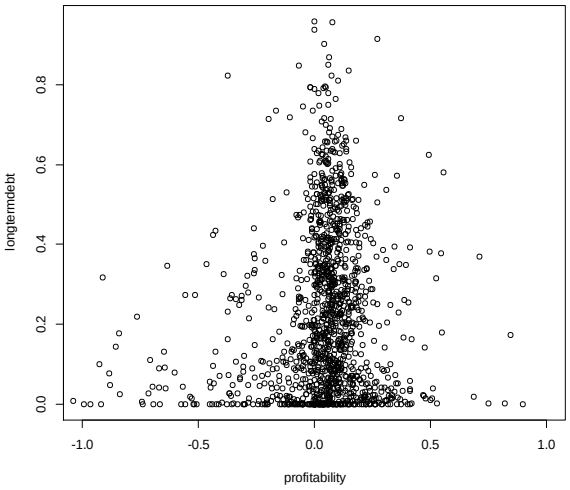

Figure 11: Scatterplot of profitability and long term debt

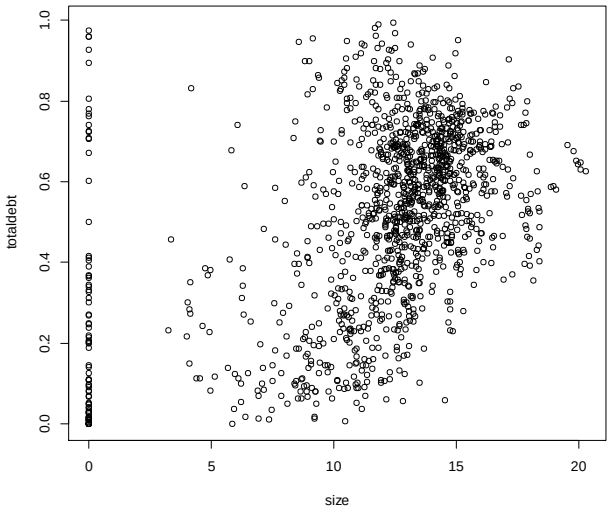

Figure 12: Scatterplot of size and total debt

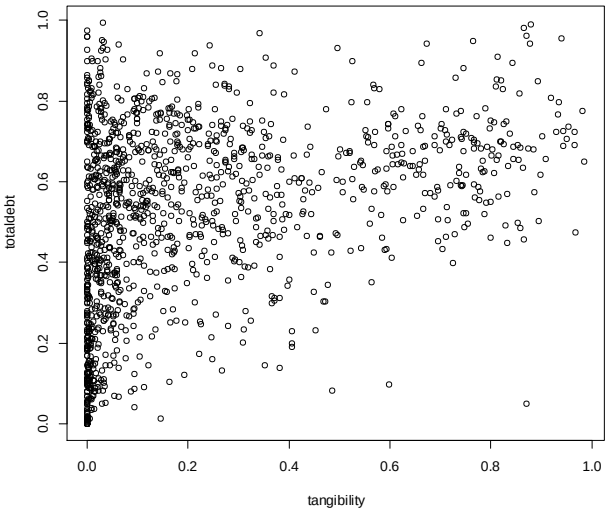

Figure 13: Scatter plot of tangibility and total debt

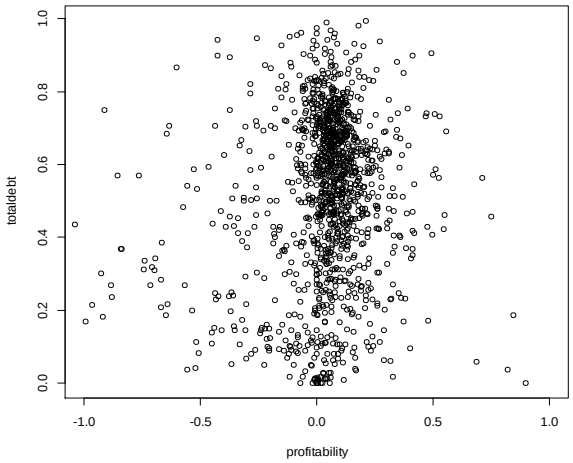

Figure 14: Scatter plot of profitability and total debt

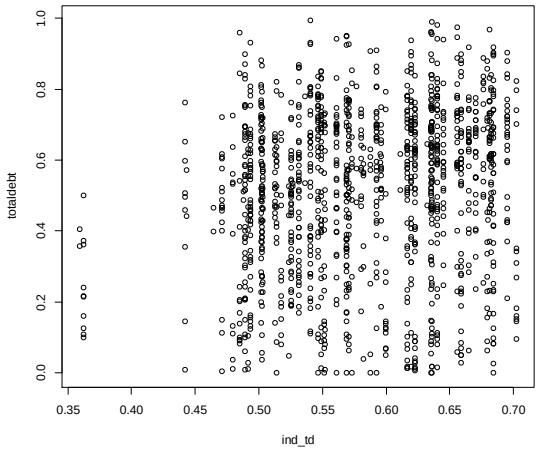

Figure 15: Scatter plot of industy leverage and total debt

D.2. Test of Heteroscedasticity in Panel Data Models

The following results are found by the Breuch-Pagan test. P-values below a 5% significance level, indicates a presence of heteroscedasticity.

Table 21: Results of testing for heteroscedasticity

	BP	Degrees of freedom	p-values
Long term debt	74.667	10	5.524e-12
Total debt	150.857	10	< 2.2e-16

D.3. Test of Autocorrelation

The following results are found by the Breusch-Godfrey/Wooldridge. P-values below a 5% significance level, indicates a presence of autocorrelation

Table 22: Results of testing for autocorrelation

	Chi^2	Degrees of freedom	p-values
Long term debt	11.518	1	0.00069
Total debt	44.782	1	2.202e-11

Appendix E: Diagnostic Results

The following results are found by a Lagrange Multiplier Test. P-values below a 5% significance level, indicates a presence of panel data effects

Table 23: Results of testing for panel data effects

	Chi^2	Degrees of freedom	p-values
Long term debt	1307.946	1	< 2.2e-16
Total debt	1522.773	1	< 2.2e-16

The following results are found by a Lagrange Multiplier Test. P-values below a 5% significance level, indicates correlated individual specific residual terms and explanatory variables. The recommended estimation model is then the fixed effects model, otherwise use the random effects model.

Table 24: Results of testing for correlated individual error terms

	Chi^2	Degrees of freedom	p-values
Long term debt	7.9636	4	0.09292
Total debt	5.4844	4	0.2411

Appendix F: Results "NAC" test

F.1. Results: Non-issuing firms

Table 25: "NAC" test of non-issuing firms and effect on level of leverage

Capital Structure Decisions – Non-issuing firms:
Being near a change in rating
("NAC" test)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings are near a change. The regression is performed on the rated sample with level of long term debt and total debt as dependent variables.

	Panel A: Long term debt ratio $\underline{LTD_{it}}$		Panel B: Total debt ratio $\underline{TD_{it}}$	
	(9)	(10)	(9)	(10)
α	0.3256*** (0.0000)	0.3235*** (0.0000)	0.0044 (0.9668)	0.0035 (0.9737)
POM_{t-1}	-0.0096 (0.5710)		-0.0013 (0.9310)	
$PLUS_{t-1}$		0.0056 (0.7822)		0.0025 (0.8903)
$MINUS_{t-1}$		-0.0229 (0.2443)		-0.0046 (0.7949)
$SIZE_{it}$	-0.0115*** (0.0009)	-0.0115*** (0.0010)	0.0063" (0.0504)	0.0063" (0.0512)
$TANG_{it}$	0.2125*** (0.0000)	0.2203*** (0.0000)	0.0337 (0.3850)	0.0356 (0.3648)
$PROF_{it}$	0.0618 (0.3430)	0.0544 (0.4042)	-0.2259*** (0.0002)	-0.2287*** (0.0002)
Ind_ltd_{it}/ Ind_td_{it}	0.1672 (0.3272)	0.1730 (0.3111)	0.6083*** (0.0002)	0.6106*** (0.0002)
$LTD_{i(t-1)}/TD_{i(t-1)}$	0.2199*** (0.0004)	0.2118*** (0.0006)	0.2779*** (0.0000)	0.2756*** (0.0000)
# Obs.	189	189	189	189
# Years	1-6	1-6	1-6	1-6
# Companies	45	45	45	45
R-squared	0.2994	0.3028	0.41091	0.4114
Adj. R-squared	0.2883	0.2900	0.39569	0.3939
F-statistic	12.9483	11.2208	21.1335	18.0485
(DF)	(6 and 182)	(7 and 181)	(6 and 182)	(7 and 181)
p-value	0.00000	0.00000	0.00000	0.00000

*P values are given in parantheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

Table 26: "NAC" test of non-issuing firms and effect on adjustment of leverage

Capital structure decisions – Non-issuing firms:
Being near a change in rating
("NAC" test)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings are near a change. The regression is performed on the rated sample with adjustment of long term debt and total debt as dependent variables.

	Panel A: Long term debt ratio ΔLTD_{it}		Panel B: Total debt ratio ΔTD_{it}	
	(9)	(10)	(9)	(10)
α	0.0601 (0.4378)	0.0570 (0.4647)	-0.1508 (0.2102)	-0.1629 (0.1866)
POM_{t-1}	-0.0602** (0.0058)		-0.0039 (0.8524)	
$PLUS_{t-1}$		-0.0527* (0.0454)		0.0037 (0.8838)
$MINUS_{t-1}$		-0.0672** (0.0092)		-0.0119 (0.6350)
$SIZE_{it}$	-0.0025 (0.4592)	-0.0024 (0.4782)	-0.0007 (0.8212)	-0.0005 (0.8659)
$TANG_{it}$	0.0333 (0.4566)	0.0352 (0.4347)	0.0546 (0.1583)	0.0561 (0.1511)
$PROF_{it}$	-0.0071 (0.9293)	-0.0111 (0.8910)	-0.1665* (0.0301)	-0.1740* (0.0248)
Ind_ltd_{it}/ Ind_td_{it}	0.0409 (0.8264)	0.0452 (0.8093)	0.2711 (0.1425)	0.2883 (0.1268)
# Observations	189	189	189	189
# Years	1-6	1-6	1-6	1-6
# Companies	45	45	45	45
R-squared	0.049614	0.05108	0.04999	0.05239
Adj. R-squared	0.048039	0.04919	0.04841	0.05045
F-statistic	1.9097	1.63195	1.92627	1.67705
(DF)	(5 and 183)	(6 and 182)	(5 and 183)	(6 and 182)
p-value	0.09471	0.14059	0.09197	0.12889

*P values are given in parentheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

F.2. Results: Issuing firms

Table 27: "NAC" test of issuing firms and effect on level of leverage

Capital structure decisions – Issuing firms:
Being near a change in rating
("NAC" tests)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings are near a change. The regression is performed on the issuing sample with level of long term debt and total debt as dependent variables.

	Panel A: Long term debt ratio $\underline{LTD_{it}}$		Panel B: Total debt ratio $\underline{TD_{it}}$	
	(9)	(10)	(9)	(10)
α	0.4187*** (0.0000)	0.4219*** (0.0000)	0.4134* (0.0331)	0.3990* (0.0433)
POM_{t-1}	-0.0100 (0.6613)		-0.0230 (0.3413)	
$PLUS_{t-1}$		0.0013 (0.9665)		-0.0129 (0.6720)
$MINUS_{t-1}$		-0.0192 (0.4831)		-0.0313 (0.2887)
$SIZE_{it}$	-0.0076" (0.0814)	-0.0078" (0.0771)	-0.0024 (0.5242)	-0.0022 (0.5766)
$TANG_{it}$	0.0899" (0.0927)	0.0936" (0.0831)	0.0065 (0.8918)	0.0071 (0.8843)
$PROF_{it}$	0.0863 (0.5346)	0.0847 (0.5449)	-0.2583* (0.0499)	-0.2677* (0.0454)
Ind_ltd_{it}/ Ind_td_{it}	-0.1620 (0.4748)	-0.1609 (0.4790)	0.0959 (0.7325)	0.1130 (0.6917)
$LTD_{i(t-1)}/TD_{i(t-1)}$	0.3806*** (0.0000)	0.3742*** (0.0000)	0.3908*** (0.0000)	0.3931*** (0.0000)
# Obs.	71	71	71	71
# Years	1-6	1-6	1-6	1-6
# Companies	37	37	37	37
R-squared	0.4134	0.4179	0.4412	0.4481
Adj. R-squared	0.3726	0.3708	0.3977	0.3976
F-statistic	7.5161	6.4608	8.3927	7.2741
(DF)	(6 and 64)	(7 and 63)	(6 and 64)	(7 and 63)
p-value	0.00000***	0.00000***	0.00000***	0.00060***

*P values are given in parentheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

Table 28: "NAC" test of issuing firms and effect on adjustment of leverage

Capital structure decisions – Issuing firms:
Being near a change in rating
("NAC" tests)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings are near a change. The regression is performed on the issuing sample with adjustment of long term debt and total debt as dependent variables.

	Panel A: Change in long term debt ratio ΔLTD_{it}		Panel B: Change in total debt ratio ΔTD_{it}	
	(9)	(10)	(9)	(10)
α	0.3260**	0.3260**	0.1463	0.1143
	(0.0088)	(0.0093)	(0.6089)	(0.6895)
POM_{t-1}	-0.0910**		-0.0849*	
	(0.0041)		(0.0139)	
$PLUS_{t-1}$		-0.0975*		-0.0626
		(0.0180)		(0.1597)
$MINUS_{t-1}$		-0.0851*		-0.1044*
		(0.0288)		(0.0135)
$SIZE_{it}$	-0.0024	-0.0024	-0.0039	-0.0033
	(0.6810)	(0.6780)	(0.5117)	(0.5723)
$TANG_{it}$	0.0449	0.0437	0.0778	0.0785
	(0.5382)	(0.5511)	(0.2816)	(0.2750)
$PROF_{it}$	-0.1239	-0.1207	-0.4407*	-0.4536*
	(0.5069)	(0.5232)	(0.0252)	(0.0216)
Ind_ltd_{it}/ Ind_td_{it}	-0.5536"	-0.5520"	0.0035	0.0465
	(0.0658)	(0.6892)	(0.9935)	(0.9132)
# Observations	71	71	71	71
# Years	1-6	1-6	1-6	1-6
# Companies	37	37	37	37
R-squared	0.23947	0.24046	0.20161	0.20968
Adj. R-squared	0.21923	0.21676	0.18457	0.18901
F-statistic	4.06162	3.35182	3.28056	2.82798
(DF)	(5 and 65)	(6 and 64)	(5 and 65)	(6 and 64)
p-value	0.00286**	0.00619**	0.01056*	0.01666*

*P values are given in parentheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

Appendix G: Results "AC"-test

G.1. Results: Non-issuing firms

Table 29: "AC" test of non-issuing firms and effect on level of leverage

Capital Structure Decisions – Non-issuing firms:
After a Change in Rating
("AC" test)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings have either been upgraded or downgraded. The regression is performed on rated sample with level of long term debt and total debt as dependent variables.

	Panel A: Long term debt ratio $\underline{LTD_{it}}$	Panel B: Total debt ratio $\underline{TD_{it}}$
	(11)	(11)
α	0.3277***	0.0086
	(0.0000)	(0.9355)
$DOWN_{t-1}$	0.0068	-0.0040
	(0.7442)	(0.8308)
UP_{t-1}	-0.0176	-0.0132
	(0.4511)	(0.5301)
$SIZE_{it}$	-0.0116***	0.0062"
	(0.0009)	(0.0530)
$TANG_{it}$	0.2137***	0.0357
	(0.0000)	(0.3625)
$PROF_{it}$	0.0565	-0.2290***
	(0.3874)	(0.0001)
Ind_ltd_{it}/ Ind_td_{it}	0.1646	0.6025***
	(0.3393)	(0.0002)
$LTD_{i(t-1)}/TD_{i(t-1)}$	0.2082***	0.2789***
	(0.0006)	(0.0000)
# Observations	189	189
# Years	1-6	1-6
# Companies	45	45
R-squared	0.29168	0.41217
Adj. R-squared	0.27933	0.39473
F-statistic	10.6315	18.1137
(DF)	(7 and 181)	(7 and 181)
p-value	0.00000	0.00000

*P values are given in parentheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

Table 30: "AC" test of non-issuing firms and effect on adjustments of leverage

Capital Structure Decisions – Non-issuing firms:
After a Change in Rating
("AC" test)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings have either been upgraded or downgraded. The regression is performed on rated sample with adjustment of long term debt and total debt as dependent variables

	Panel A: Change in long term debt ratio ΔLTD_{it}	Panel B: Change in total debt ratio ΔTD_{it}
	(11)	(11)
α	0.0487 (0.5302)	-0.1423 (0.2420)
$DOWN_{t-1}$	0.0078 (0.7856)	-0.0200 (0.4701)
UP_{t-1}	-0.0578" (0.0741)	-0.0376 (0.2278)
$SIZE_{it}$	-0.0034 (0.3104)	-0.0006 (0.8371)
$TANG_{it}$	0.0372 (0.4093)	0.0594 (0.1301)
$PROF_{it}$	-0.0259 (0.7488)	-0.1763* (0.0217)
Ind_ltd_{it}/ Ind_td_{it}	0.0287 (0.8782)	0.2635 (0.1571)
# Observations	189	189
# Years	1-6	1-6
# Companies	45	45
R-squared	0.02811	0.06009
Adj. R-squared	0.02706	0.05786
F-statistic	0.87594	1.9391
(DF)	(6 and 182)	(6 and 182)
p-value	0.5137	0.07676

*P values are given in parentheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

G.2. Results: Issuing firms

Table 31: "AC" test of issuing firms and effect on level of leverage

Capital Structure Decisions – Issuing firms:
After a Change in Rating
("AC" test)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings have been upgraded or downgraded. The regression is performed on the issuing sample with level of long term debt and total debt as dependent variables.

	Panel A: Long term debt ratio $\underline{LTD_{it}}$	Panel B: Total debt ratio $\underline{TD_{it}}$
	(11)	(11)
α	0.4233***	0.4613*
	(0.0000)	(0.0226)
$DOWN_{t-1}$	-0.0111	-0.0209
	(0.7263)	(0.5625)
UP_{t-1}	-0.0092	0.0221
	(0.7966)	(0.5568)
$SIZE_{it}$	-0.0079"	-0.0028
	(0.0719)	(0.4918)
$TANG_{it}$	0.0970"	0.0034
	(0.0745)	(0.9472)
$PROF_{it}$	0.0801	-0.2606"
	(0.5775)	(0.0581)
Ind_ltd_{it}/ Ind_td_{it}	-0.1688	0.0371
	(0.4623)	(0.8997)
$LTD_{i(t-1)}/TD_{i(t-1)}$	0.3710***	0.3597***
	(0.0000)	(0.0000)
# Observations	71	71
# Years	1-6	1-6
# Companies	37	37
R-squared	0.41373	0.48279
Adj. R-squared	0.36711	0.42839
F-statistic	6.35093	8.36613
(DF)	(7 and 63)	(7 and 63)
p-value	0.00001***	0.00000***

*P values are given in parentheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*

Table 32: "AC" test of issuing firms and effect on adjustments of leverage

Capital Structure Decisions – Issuing firms:
After a Change in Rating
("AC" test)

Coefficients and p-values from random effects regressions. Regressions of the general model including proxies of credit rating measuring if the credit ratings have been upgraded or downgraded. The regression is performed on the issuing sample with adjustment of long term debt and total debt as dependent variables.

	Panel A: Change in long term debt ratio ΔLTD_{it}	Panel B: Change in total debt ratio ΔTD_{it}
	(11)	(11)
α	0.3693**	0.2417
	(0.0049)	(0.4124)
$DOWN_{t-1}$	-0.0302	-0.0894"
	(0.5366)	(0.0949)
UP_{t-1}	-0.0731	-0.0651
	(0.1664)	(0.2344)
$SIZE_{it}$	-0.0040	-0.0059
	(0.5016)	(0.3242)
$TANG_{it}$	0.0811	0.1116
	(0.2919)	(0.1355)
$PROF_{it}$	-0.1915	-0.5032*
	(0.3370)	(0.0134)
Ind_ltd_{it}/ Ind_td_{it}	-0.7368*	-0.1634
	(0.0182)	(0.7096)
# Observations	71	71
# Years	1-6	1-6
# Companies	37	37
R-squared	0.16058	0.17041
Adj. R-squared	0.14475	0.15361
F-statistic	2.00718	2.18907
(DF)	(6 and 64)	(6 and 64)
p-value	0.07756"	0.05539"

*P values are given in parentheses. *** indicates a significance level of 0.1 %, ** indicates a significance level of 1 %, * indicates a significance level of 5 % and " Indicates a significance level of 10 %.*