Norwegian School of Economics
Bergen, Fall 2023

Capital Structure in The Nordics

An empirical cross-country analysis on determinants of capital structure in listed, non-financial firms from 2007 to 2022

Andreas Falke and Fabian Filip Rimestad

Supervisor: Dr.Konrad Raff

Master thesis, Economics and Business Administration

Major: Financial Economics

NORWEGIAN SCHOOL OF ECONOMICS

Acknowledgements

This master's thesis marks the end of our studies at NHH. We hope this thesis will contribute to a fundamental understanding of capital structure dynamics for firms across the Nordic countries. We would like to thank our supervisor, Dr. Konrad Raff, for his guidance and clarifications during the writing process. The writing process has been a test of patience. Looking back, the process has been both educational and rewarding..

Norwegian School of Economics

Bergen, December 2023

Andreas Falke

Fabian Filip Rimestad

Abstract

We examine determinants of capital structure by analyzing the financing decisions of listed, non-financial firms in Denmark, Sweden, Norway, and Finland from 2007 to 2022. At an aggregate level, firm leverage is fairly similar across the Nordic countries, and many firm-specific factors appear to be similar. We find market-to-book value, liquidity, profitability, size, non-debt tax shields, tangibility, bankruptcy risk, corporate tax rate, and term spread to be the most reliable determinants of capital structure in the Nordics. However, due to variations in the composition of sectors and ownership structure, some significant cross-country differences remain.

Keywords – Corporate Finance, Capital Structure, Nordics

Contents

List of Figures

List of Tables

1 Introduction

During our studies at the Norwegian School of Economics, we both found great interest in corporate finance through courses in our master´s degree in financial economics. The concept of capital structure and how decisions differ due to country-specific factors caught our attention. Following this, we wanted to focus our thesis on, and increase our knowledge of capital structure and analyze countries where little prior research has been conducted.

This study investigates how capital structure decisions differ between leading, non-financial listed firms in the Nordic countries between 2007 and 2022. Following the influential research by Rajan and Zingales (1995) on G7 countries, which other researchers later expanded, more research needs to be done on determinants of capital structure in the Nordics. While the Nordic countries share many cultural and economic similarities, we hypothesize that unique economic, regulatory, and sectoral compositions might lead to varying capital structure outcomes. Through this comparative study, we aim to highlight shared and distinct drivers behind capital structure choices in the Nordics. This study analyzes capital structure choices and differences using established theories within corporate finance, mainly the trade-off theory, the cash flow theory, the debt overhang theory, and the pecking order theory.

This study employs two dependent variables, total debt-to-capital, using the book value of equity and the market value of equity to examine capital structure choices. The firm-specific data is gathered from Compustat, and firms with missing financial data are omitted, resulting in 2786 firm-year observations. Furthermore, the macro-economic data is gathered from the WorldBank´s database. To address the statistical outlier problem, all firm-specific observations are winsorized at the 1st and 99th percentiles, the macroeconomic observations are not winsorized. The average observed debt-to-capital using the book value of equity is 0,55 and 0,44 when examining market equity value.

We conclude that fixed effects regression provides the most suitable method, given the nature of the data. Thus, we perform two fixed effects regressions using robust standard errors, with the dependent variables being total debt-to-capital book value and total debt-to-capital market value.

Examining the book value of equity, we find evidence of six statistically significant indicators of capital structure choices for Nordic firms. Market-to-book value and term spread display a positive relationship with leverage, whereas liquidity and Altman´s Z-score exhibit a negative relationship. Furthermore, profitability and non-debt tax shields show mixed positive and negative relationship results between leverage, varying across the Nordic countries.

When using the market value of equity, we observe nine statistically significant determinants of capital structure for firms across the Nordics. Market-to-book value, liquidity, tangibility, and Altman´s Z-score indicate a negative relationship with leverage. Moreover, tax rate and term spread exhibit a positive relationship. Furthermore, profitability, size, and non-debt tax shields exhibit both positive and negative relationships with leverage, differing between the four countries.

Comparing regression results using the book value of equity, our observations regarding liquidity, non-debt tax shields, tangibility, tax rate, and Altman's Z-score align with prior empirical research, including studies by Antoniou et al. (2002) and Frank and Goyal (2009). However, the market-to-book value and term spread findings differ from previous empirical studies.

Observing the market value of equity, the results for market-to-book value, non-debt tax shields, liquidity, and profitability are consistent with prior research, including Rajan and Zingales (1995) and Antoniou et al. (2002). On the other hand, tangibility, tax rate, revenue volatility, and term spread diverge from the findings presented in previous research by Antoniou et al. (2008) and Frank and Goyal (2009).

Our findings suggest that although the Nordic countries share many similarities in terms of well-functioning capital markets, educated workforces, and stable economies, their capital structure decisions are influenced by country-specific factors. One notable difference between the countries, is the composition and weight of various economic sectors. Given the relatively small size of their economies, the sectors that carry the most weight in each country are likely to impact the overall economic landscape significantly. This thesis investigates the causes of the varying determinants of capital structure across Nordic firms.

1.1 Primary Research Question

The field of capital structure has been widely researched, but little cross-country research has been conducted on the Nordic countries. Following this, our thesis aims to answer the following question:

"Which firm- and country-specific variables accurately illustrate capital structure choices in the Nordic countries between 2007 and 2022?"

1.2 Outline

The thesis is divided into eight sections, where, Section 2 examines central theories and prior literature. Section 3 discusses institutional similarities and differences between the examined countries. Section 4 present the selection of data and explain the dependent and independent variables. Section 5 describes the methodology. In section 6 we present the empirical analysis and discuss the results. Section 7 concludes the thesis, while section 8 provides suggestions for further research and criticism.

2 Literature Review

In the upcoming sections, we lay the foundation for our study on how various factors influence the capital structure of Nordic firms. Initially we define and discuss the concept of capital structure. Subsequently, we examine theories that explore the factors shaping firms' capital structure, including Modigliani & Miller's theorem in imperfect capital markets, the static trade-off model, the pecking order theory, the cash flow theory, and the debt overhang theory. Furthermore, we review prior research.

2.1 Capital Structure

While many papers and researchers provide definitions of capital structure. A range of interpretations exist where the term is often used to describe a firm´s mix of debt and equity financing. For instance, Titman and Wessels (1988) view capital structure as *"the variation in debt ratios across firms"*. They argue that firms select capital structures depending on attributes that determine the various costs and benefits associated with debt and equity financing. Another definition states that *"capital structure is the proportion of a firm's permanent long-term financing [...] and is represented by debt to the firm's total capital"* (Van Horne & Wachowicz, 2001). Published works frequently refer to internal, debt, and equity financing as the three primary financing methods. The combination and proportions of these factors represent the capital structure. According to Myers (2003), there is not a one-size-fits-all theory of capital structure. Instead, theories are tailored to specific conditions, each influenced by varying factors determining capital structure choices.

2.2 Modigliani & Miller's Theorem

Modigliani & Miller (1958) argue that capital structure has no impact on firm value or cost of capital in perfect capital markets. They claim that the value of a firm is determined by its expected cash flows and risk, not by its capital structure (Berk & DeMarzo, 2020). They establish their ideas and findings about capital structure in perfect capital markets through what is cornerstones in corporate finance, namely Modigliani & Miller Proposition I and Proposition II.

The perfect markets theory of capital structure does not account for market imperfections in the real world, such as taxes, issuance and transaction costs, and asymmetric information (Dallochio et al., 2017). In 1963, Modigliani and Miller introduced a revised version of their propositions initially formulated under the condition of perfect capital markets to address market imperfections. This revised approach includes corporate tax and the advantages of tax-deductible interest payments when determining firm value and the cost of capital (Dallochio et al., 2017).

In the revised version of their propositions, Modigliani and Miller considered the interest rate on debt to offset the tax savings from the interest tax shield. Thus, as leverage increases, the tax payments decrease due to interest rate expenses on debt being tax deductible. Furthermore, Modigliani and Miller (1963) assume constant interest rates and the value of the interest tax shield to be estimated with permanent debt, meaning it could be considered a perpetuity (Berk & DeMarzo, 2020). This led to the establishment of Equation 2.1.

$$PV(\text{interest tax shield}) = \frac{t_c(r_f D)}{r_f} \implies t_c D \tag{2.1}$$

Equation 2.1 can be used to rewrite Modigliani and Millers' proposition I and II in imperfect capital markets, accounting for the effects of the interest tax shield.

Table 2.1: Modigliani and Miller Propositions I and II

	Modigliani & Miller	
Proposition	**Perfect Capital Markets - 1958**	**Imperfect Capital Markets - 1963**
I	$V_L = V_U$	$V_L = V_U + D \cdot t_C$
II	$r_E = r_U + \left(\frac{D}{E}\right) \cdot (r_U - r_D)$	$r_E = r_U + \left(\frac{D}{E}\right) \cdot (r_U - r_D) \cdot (1 - t_C)$

In the revised equations of 1963, both propositions indicate that as a firm leverage increase, the firm value increase and the cost of equity decrease due to interest expenses offsetting taxation.

Additionally, the weighted cost of capital (WACC) can be adjusted when factoring in the benefits of the interest tax shield. As a firm increases its leverage, its advantage of tax benefits from debt increases, leading to a reduced WACC (Berk & DeMarzo, 2020).

$$WACC = \frac{E}{E+D} \cdot r_E + \frac{D}{E+D} \cdot r_D \tag{2.2}$$

$$\Rightarrow WACC = \frac{E}{E+D} \cdot r_E + \frac{D}{E+D} \cdot r_D \cdot (1 - t_C) \tag{2.3}$$

Modigliani and Miller's propositions do not entirely cover all market imperfections, such as issuance and transaction costs. Other theories like the trade-off, cash flow, debt overhang, and pecking order theories are introduced to explain capital structure decisions further.

2.3 The trade-off theory

Kraus and Litzenberger (1973) propose a different view on firms' choice of capital structure, the static trade-off theory. The theory relaxes the assumptions of Modigliani and Miller (1963)´s perfect market conditions. The theory proposes that firms are not necessarily best off financed entirely by debt to capture the value of tax shields from interest payments. The theory further suggests that the best capital structure differs between firms and industries, and that management should focus on the trade-off between the costs of financial distress and benefits of the interest tax shield. According to Kraus and Litzenberger (1973), a firm´s optimal capital structure is in the equilibrium between the two. They argue that the cost of financial distress is the additional expenses a firm incurs if it faces financial difficulties or bankruptcy.

Kraus and Litzenberger (1973)´s static trade-off theory states that *"the total value of a levered firm equals the value of the firm without leverage plus the present value of the tax savings from debt, less the present value of distress costs"* (Berk & DeMarzo, 2020, p.600).

$$V^L = V^U + PV(\text{Interest Tax Shield}) - PV(\text{Financial Distress Cost}) \tag{2.4}$$

where:

V_L = Value of the firm with leverage

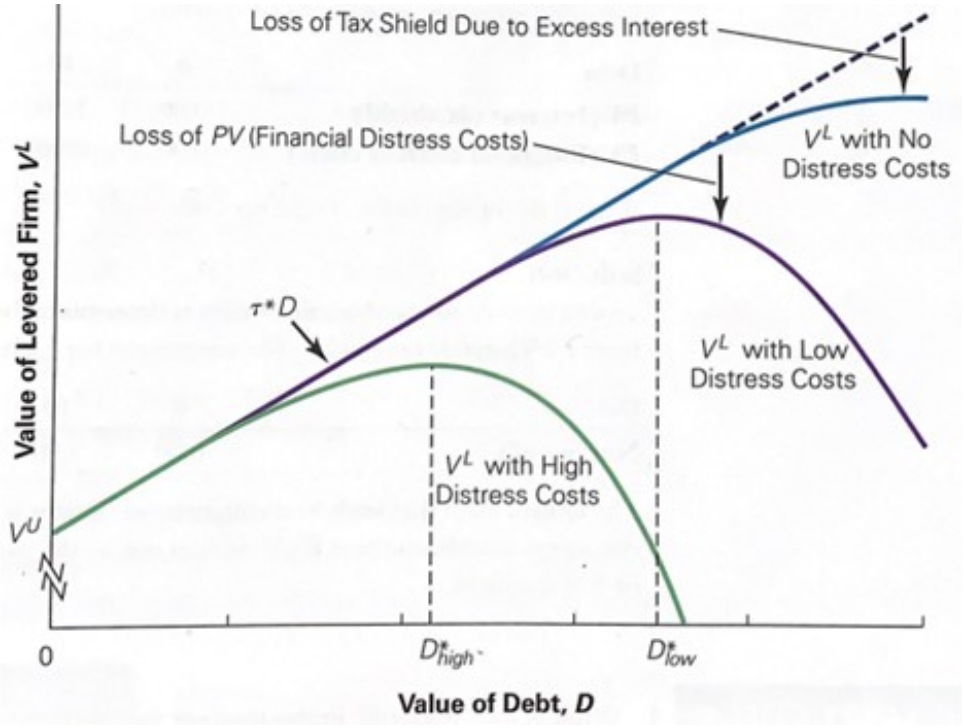
V_U = Value of the firm without leverage

$PV(\text{Interest Tax Shield})$ = The present value of interest tax shield

$PV(\text{Financial Distress Cost})$ = The present value of financial distress costs

Equation 2.4 expresses how leverage has both benefits and costs. Firms are incentivized to increase their leverage to take advantage of tax benefits. Furthermore, firms are prone to excessive risk of default and experience costs of financial distress if their debt becomes too high. Looking at the equation, we can derive a close-to-optimal capital structure by examining the marginal cost of financial distress and the marginal benefits of the interest tax shield. However, the equation is not tailored to different firms in different industries or countries.

Figure 2.1: The trade-off theory



Source: (Berk & DeMarzo, 2020, p.601)

Figure 2.1 illustrates the trade-off theory. The blue line demonstrates that the maximum firm value is achieved through being fully debt-financed, assuming taxation is the only market imperfection. The stippled line illustrates how the present value of the tax shield progressively increases with debt (Dallochio et al., 2017). Observing the purple and green lines, financial distress costs and taxation are present. Both the purple and green lines follow the same project, as illustrated in the blue line. When examining the purple line, it is evident that as debt levels increase, a point is reached where the negative effects of financial distress begin to outweigh the advantages of tax shields (Berk & DeMarzo, 2020). The green line illustrates a scenario in which firms are subject to higher distress costs than those displayed by the purple line. The logic is similar, yet for firms with high distress costs, the benefits from tax shields are outweighed by the drawbacks of distress costs at an earlier stage (Berk & DeMarzo, 2020). The theoretical optimal debt ratio appears to be where the present value of the tax savings arising from additional borrowing is offset by the increase in the present value of financial distress and bankruptcy costs (Dallochio et al., 2017).

Building upon the static trade-off theory, Jensen and Meckling (1976) developed their agency theory. They argue that debt can have a negative impact on firm value due to costs associated with conflicting interests between stakeholders, referred to as agency costs. They state that top managers, who often hold shares in the firm, tend to make decisions that increase the value of the firm's equity. When a firm uses leverage, a conflict of interest arises concerning whether decisions should favor the value of equity or debt (Berk & DeMarzo, 2020).

2.4 The pecking order theory

The pecking order theory, developed by Myers in 1984, suggests that firms prioritize their sources of financing. A firm is believed to follow the pecking order if it favors internal financing over external financing and turns to debt rather than equity when external financing is necessary (Frank & Goyal, 2008). Myers (1984) argue that firms adapt their financing to mitigate problems created by differences in information between inside and outside investors. These differences in information between insiders and outsiders are known as asymmetric information and lead to what is commonly known as the adverse

selection problem. Asymmetric information occurs when management has comprehensive knowledge about the true value of the company and its future projects, while external investors possess limited information (Berk & DeMarzo, 2020). The adverse selection arises when this information is used to benefit those who know the most (Myers, 1984).

Because of asymmetric information, external investors interpret financing decisions as signals about what they do not know. To compensate for this uncertainty, they demand a higher rate of return, making capital more costly for firms (Frank & Goyal, 2008). Firms are expected to follow the pecking order theory if their debt levels solely reflect their need for external financing due to the lack of internal financing opportunities (Myers, 1984). The theory suggests an equilibrium that minimizes the overall costs of external financing. The pecking order theory proposes a ranked sequence of financing sources, as shown in Figure 2.2 - *The Pecking Order Theory*.

Figure 2.2: The Pecking Order Theory

	Financing source	**Degree of sensitivity to asymmetric information**
Internal financing	Retained earnings	Low
External financing	Debt	
	Equity	High

The table describes the preferred financing sources under the pecking order.
Source: Myers (1984)

Considering the variables we have included, the pecking order theory distinguishes itself from the static trade-off theory as it predicts different impacts of several firm-specific variables on leverage.

2.5 The cash flow theory

As a response to the limitations of Modigliani and Miller, 1963´s theorem and the trade-off theory, the cash flow theory argues that firms with predictive and stable cash flows are inclined to take on more debt. Stable cash flow reduces the probability of financial distress, making debt the preferred financing choice due to its tax benefit. Furthermore, the cash flow theory suggests that firms with stable cash flows can dynamically change their capital structure to economic outlooks. The cash flow theory is particularly applicable as firms across the Nordic countries experience varying cash flow fluctuations, primarily influenced by their specific industry sectors.

2.6 The debt overhang theory

Another central theory when examining capital structure decisions is the debt overhang theory introduced by Myers (1977). The theory explains how past financing decisions may affect current or future financing decisions, focusing on firms with excessive leverage. Myers argues that when firms experience financial distress, all potential cash flow is paid to debt holders instead of equity holders. In turn, the excessive debt disincentivizes equity holders to fund new positive net present value projects, referred to as the underinvestment problem. When examining determinants of capital structure, the debt overhang theory provides valuable insights into how past debt levels affect future investments and debt levels of the firm.

Table 2.2: Theoretical Predictions

Variable	**Trade-off**	**Pecking Order**	**Cash Flow**	**Debt Overhang**
Market-to-Book Value	Negative (-)	Mixed (+/-)	Negative (-)	Negative (-)
Liquidity	Positive (+)	Negative (-)	Positive (+)	Positive (+)
Profitability	Positive (+)	Negative (-)	Positive (+)	Positive (+)
Size	Positive (+)	Negative (-)	Positive (+)	Positive (+)
Revenue Volatility	Negative (-)	Mixed (+/-)	Negative (-)	Negative (-)
Non-debt Tax Shields	Negative (-)		Negative (-)	Negative (-)
Tangibility	Mixed (+/-)	Negative (-)	Positive (+)	Positive (+)
Altman's Z-score	Positive (+)	Negative (-)	Positive (+)	Positive (+)
Lagged Debt	Negative (-)		Negative (-)	Negative (-)
Corporate Tax Rate	Positive (+)		Positive (+)	Positive (+)
Inflation	Positive (+)		Positive (+)	Positive (+)
GDP Growth	Positive (+)	Negative (-)	Positive (+)	Positive (+)
Term-Spread	Mixed (+/-)		Negative (-)	Negative (-)

"Positive (+)" and "Negative (-)" indicates a positive and negative relationship between leverage and the independent variable respectively. "Blank" indicates the information was not available.
Source: Own contribution

Examining the theoretical framework, one can observe a consensus between the trade-off, cash flow, and debt overhang theories with an expected negative relationship between leverage and market-to-book value, revenue volatility, non-debt tax shields, and lagged debt. The same three theories anticipate a positive relationship between leverage and liquidity, profitability, size, Altman´s Z-score, corporate tax rate, inflation, and GDP growth. The observed similarities between the three theories can be explained as they all emphasize the importance of balancing debt and equity and the respective benefits of the two financing choices.

The exceptions between the three theories are observed for tangibility and terms spread, where the cash flow and debt overhang theories anticipate a positive and negative relationship with debt, respectively. As tangibility increases in the form of collateral for lenders, the trade-off theory suggests that firms should capitalize on the increased security and easier compliance with covenants by taking on more debt. However, due to sectoral differences, some firms might rely heavily on intangible assets and possess minimal tangible assets. This disparity can result in a negative relationship between leverage and tangibility.

The trade-off theory proposes that there is a mixed relationship between the term spread and the optimal allocation of debt and equity. As the term spread increases, the cost of long-term debt obligations also increases. Therefore, the trade-off theory suggests reducing reliance on debt. The term spread is considered as an indicator of future economic conditions. An increase in term spread indicates future growth, and the trade-off theory recommends taking on more debt in anticipation of higher future earnings.

In contrast, the pecking order theory emphasizes the use of retained earnings and generally expects a negative relationship between most independent variables and leverage. However, the theory does not predict a clear positive or negative relationship with market-to-book value. The theory predicts that firms use retained earnings to finance growth. If retained earnings are insufficient to fund growth, the pecking order theory indicates that firms prefer debt over equity financing. Similarly, the theory has no definite prediction on the relationship between leverage and revenue volatility. It expects firms to rely on retained earnings during periods of sufficient earnings, and in times of insufficient earnings, it suggests debt financing over equity financing.

2.7 Prior Empirical Research

Numerous studies have previously focused on the determinants of capital structure, with research spanning various economies. We discuss prior research on capital structure conducted at the national and industry-specific levels and studies examining cross-country determinants of capital structure. Lastly, this section includes key insights from more recent research.

2.8 Domestic and industry-specific research

Titman and Wessels (1988) explored the factors shaping a firm´s capital structure by studying U.S. industrial firms between 1974 and 1982. They evaluated, among others, the roles of company size, asset tangibility, growth, non-debt tax shield, and revenue volatility on leverage. They find a relationship where profitable firms tend to have lower levels of debt in relation to the market value of their equity.

Their insights, particularly on tangible assets and company size, can offer valuable perspectives for our research, as the Nordic countries have relatively large industry sectors.

In their study Frank and Goyal (2009) analyze capital structure determinants using data from publicly traded US firms from 1950 to 2003. When examining market values, they find six variables to be significant determinants. Notably, expected inflation, firm size, and tangibility prove a positive relationship with leverage ratios. Further, profitability and market-to-book value demonstrate a negative effect on leverage ratios. They run their regressions using both the book value of leverage and the market value of leverage in accordance with research from Barclay et al. (2006). They argue that the book value of leverage is backward-looking, while the market value of leverage is forward-looking. Following this rationale Frank and Goyal (2009) find that forward-looking determinants such as market-to-book value, expected inflation, and firm size lose their reliability when examining the book value of leverage. Moreover, they comment that the pecking order only accurately explains the effect of profitability. While the predictions of the trade-off theory explain the relationship between leverage and size, tangibility, and market-to-book values, it fails to explain the predictive power of expected inflation.

The significantly different results when analyzing book and market values of equity are interesting for our thesis. Following their observations, this thesis employs two dependent variables, total debt-to-capital using book and market values of equity.

De Jong et al. (2010) research US firms between 1985 and 2005, focusing on debt and equity decisions when the pecking order and the trade-off theories disagree. Their study shed light on capital structure decisions regarding security issuance and repurchase decisions. Their research indicates that in security issuance decisions, 75 percent of the firms with excessive debt continue to issue debt. Their observations deviate from the predictions of the trade-off theory while being in line with the predictions of the pecking order theory.

While our study does not employ the same proxies or variables, De Jong et al. (2010)´s insights on how the pecking order theory best predicts the security issuance decisions will act as the theoretical base in instances where our results diverge from the predictions of the pecking order or the trade-off theories.

Lastly, Leary and Roberts (2014) argue that capital structure choices are not entirely based on firm-specific factors but that peer firms' behavior and capital structure choices play a significant role in the management's capital structure choices. As peer firms adjust their capital structure, Leary and Roberts (2014) argue that managers consider growth opportunities and the financial health of peers when making their own capital structure choices. They find that smaller, less profitable, and more financially constrained firms tend to mimic their peers' capital structure choices. In contrast to earlier empirical research, they find that *"[. . .] peer firm behavior has a remarkably robust and large impact on corporate capital structure, larger than any other observable determinant, on average"* (Leary & Roberts, 2014, p.173).

The observations found in Leary and Roberts (2014) analysis, are interesting for us when examining the capital structure choices of Nordic firms. The four countries examined have one or two primary industries accounting for a substantial part of the respective economies, as explained in Table B.1 - *Sectoral Composition*. We hypothesize that the Nordic firms, in line with the results of Leary and Roberts (2014), show signs of spillover effects on leverage by industry.

2.9 Cross-country research

To investigate variations in capital structure across different nations, Rajan and Zingales (1995) performs a cross-country examination within the G7 countries from 1987 to 1990. Their study is widely recognized as leading on capital structure decision-making and continues to serve as a foundation for the research presented in this thesis. Rajan and Zingales (1995) discover that capital structure choices in the G7 countries were more uniform than initially presumed despite significant differences in tax systems, financial systems, and bankruptcy laws. In their research, Rajan and Zingales use both the market and book equity values to clarify the relationship between market perceptions, reflected by market value, and a firm's actual financial fundamentals, indicated by book value. Their findings indicate that profitability and firm size generally display a negative relationship with leverage throughout the sample, excluding Germany, where profitability and size exhibit a positive relationship. Additionally, Rajan and Zingales present statistically significant evidence that asset tangibility positively influences leverage. At the same time,

the market-to-book ratio shows a negative relationship between leverage for both book and market values of capital.

Following their research, this thesis employs all four variables introduced by Rajan and Zingales, market-to-book value, profitability, and sales at a logarithmic scale, as a proxy for firm size and tangibility.

Expanding the research by Rajan and Zingales (1995), Antoniou et al. (2002) analyze capital structure within British, French, and German firms from 1969 to 2000. The countries were chosen due to their diverse financial systems, business cultures, and size. Antoniou et al. (2002) base their research on the same two dependent and four independent variables as Rajan and Zingales. While introducing additional variables, namely earnings volatility and liquidity ratio, as firm-specific variables and the macro variables, corporate tax rate, and term structure of interest rates. Antoniou et al. present evidence consistent with Rajan and Zingales, affirming that market-to-book ratio, profitability, firm size, and asset tangibility play pivotal roles in capital structure decisions. Furthermore, they provide evidence that the term structure of interest rates negatively correlates with the firm's leverage ratios. Moreover, Antoniou et al. (2002) uncover evidence indicating that firms adjusted their debt levels to align with their respective target debt levels, with country-specific factors offering the best explanation for the extent and speed at which firms adapt their debt levels.

Following the results presented by Antoniou et al. (2002) we analyze whether earnings volatility and liquidity are statistically significant determinants of capital structure in the Nordics. We include term spread and corporate tax rates and hypothesize that volatility in earnings, liquidity, and changes in interest and tax rates, affects capital structure in the Nordics.

Bancel and Mittoo (2004) conduct a qualitative survey across 16 countries to gain deeper insights into managerial perspectives on capital structure choices. Their objective is to assess the extent to which differences in these choices could be attributed to variations in managerial or legal contexts. Their study proves that the primary driver of firms' debt policies is the quality of the country's legal system, closely followed by the country-specific cost of capital. Notably, they find that in countries with lower-quality legal systems, the agency costs of debt are expected to be higher, aligning with previously established

theories proposed by (Harris & Raviv, 1991). *"We find that the Scandinavian managers' views on capital structure differ significantly from their other civil-law peers, especially on equity, convertible debt, and raising foreign capital"* (Bancel & Mittoo, 2004, p.130).

Additionally, Bancel and Mittoo (2004) argue that firm-specific factors, including growth projections, significantly influence the capital structure decisions made by managers. Therefore, while country-specific factors are undeniably important, their study underscores the pivotal role of firm-specific considerations in capital structure decisions. They conclude that *"most firms determine their optimal capital structure by trading off factors such as tax advantage of debt, financial distress costs and accessibility to external financing"* (Bancel & Mittoo, 2004, p.131). The essential takeaway from their research is the inclusion of the Nordic countries with evidence of how legislation, corporate culture, and risk aversion influence capital structure.

De Jong et al. (2008) conducted a study spanning 42 countries from 1997 to 2001. Their research examined both firm-specific and country-specific factors. In line with the findings of Rajan and Zingales (1995) and Antoniou et al. (2002), they find consistent evidence that firm size, tangibility, profitability, and growth opportunities influence capital structure decisions. Furthermore, by incorporating country-specific factors into their analysis, De Jong et al. (2008) find that the protection of creditor rights, financial system differences, and GDP growth are significant determinants of capital structure. Ultimately, their study highlights the importance of considering country-specific factors when conducting empirical research on capital structure. *"The overall results indicate that country-specific factors also have an impact on the roles of firm-specific determinants of capital structure"* (De Jong et al., 2008, p.1966).

Following the observations of De Jong et al. (2008) this thesis includes GDP growth as a proxy for general economic performance and further includes a discussion about creditor rights and a classification of whether the Nordic countries are bank-based or market-based financial systems.

Antoniou et al. (2008) expanded on their earlier empirical research from 2002 by incorporating US and Japanese firms into their sample. This broader sample introduced a mix of economies, including market-based and bank-based economies. Specifically, they include the UK and US as representatives of market-based economies, while France, Germany, and Japan were selected to represent bank-based economies. Consistent with previous research, such as Rajan and Zingales (1995) and their own work in 2002, Antoniou et al. observe a positive relationship between leverage and both asset tangibility and firm size. Conversely, they find an inverse relationship with growth opportunities and profitability. Furthermore, upon introducing a variable for lagged debt, they discover substantial evidence indicating a positive relationship with leverage. This suggests that firms adjusted their leverage ratios in alignment with their target capital structures, with the speed of adjustment believed to be country-specific. Furthermore, their research reveals that non-debt tax shields are negatively correlated with leverage across all European countries in their sample. In summarizing their findings, Antoniou et al. conclude that, while the independent variables provided convincing evidence of being primary drivers of capital structure decisions, *"the capital structure decision of a firm is not only the product of its own characteristics, but also the result of the environment and traditions in which it operates"* (Antoniou et al., 2008, p.25).

Building on the findings of Antoniou et al., this thesis includes non-debt tax shields as a proxy for the tax benefits of debt financing. Furthermore, we include a lagged-debt variable to examine to what extent the Nordic firms show signs of having target debt levels.

Table 2.3: Prior Empirical Research Predictions

Variable	Rajan and Zingales (1995)	Antoniou et al. (2002)	Frank & Goyal (2003)	Antoniou et al. (2008)	De Jong et al. (2008)	Frank & Goyal (2009)
Market-to-Book Value	Negative (-)	Negative (-)	Negative (-)	Negative (-)	Negative (-)	Mixed (+/-)
Liquidity		Negative (-)		Negative (-)	Negative (-)	
Profitability	Negative (-)	Negative (-)	Negative (-)	Negative (-)	Negative (-)	Negative (-)
Size	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Mixed (+/-)
Revenue Volatility		Negative (-)		Negative (-)	Negative (-)	
Non-debt Tax Shields		Positive (+)	Negative (-)	Positive (+)		
Tangibility	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Positive (+)
Altman's Z-score		Negative (-)		Negative (-)	Negative (-)	
Lagged Debt		Positive (+)		Positive (+)		
Corporate Tax Rate		Negative (-)	Negative (-)			
Inflation						
GDP Growth			Positive (+)	Positive (+)		
Term-Spread		Negative (-)				

"Positive (+)" and "Negative (-)" indicate a positive and negative relationship between leverage and the independent variable respectively. "Mixed" demonstrates both values have been observed. "Blank" indicates the information was not available. The table refers to the predictions of research results from Rajan and Zingales (1995), Antoniou et al. (2002), Frank & Goyal (2003), Antoniou et al. (2008), De Jong et al. (2008), and Frank & Goyal (2009).

3 Institutional Similarities and Differences

To further examine the cross-country effects on leverage, this section explains possible country-specific factors that affect capital structure choices for firms in the Nordics. Following Rajan and Zingales (1995), this section explains institutional similarities and differences in bankruptcy laws and tax codes. Furthermore, we discuss the differences between bank-based and market-based economies, followed by a section on ownership and control.

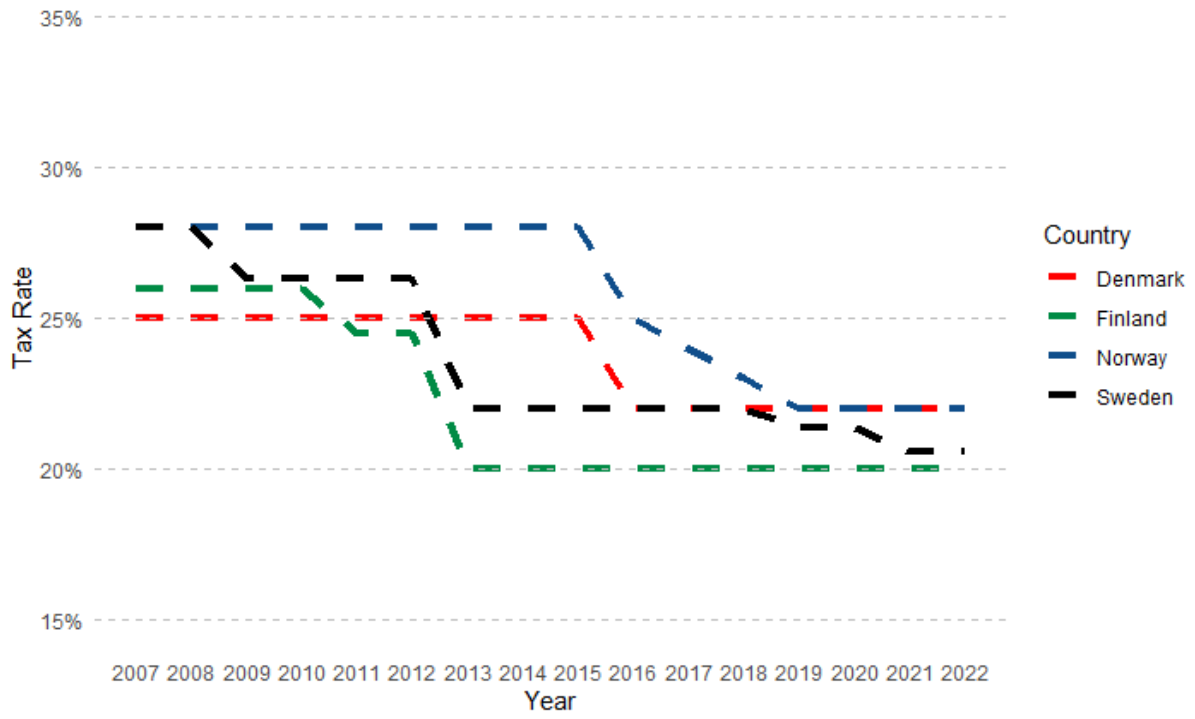
3.1 Tax Codes

This section presents information about the variations in debt policies and leverage ratios between the countries based on differences in tax codes. Corporate tax rates and legislations differ across nations. This analysis will delve into the variation in deductions and tax incentives regulations in the tax codes across the Nordics.

The legislation for carrying forward losses to counteract future tax liabilities varies in the Nordics. In Norway, Denmark, and Sweden, the legislation allows carrying forward losses indefinitely. Whereas, Finnish legislation allows firms to carry losses forward up to ten years (PwC, 2023). Although minor variations exist in the time limitations for carrying forward net operating losses, the countries share several common legal stipulations. For instance, if there is a change in ownership of over 50% in a firm´s share capital, any accumulated carry-forward deductions are forfeited to prevent the purchase of tax breaks in the Nordic countries. Additionally, we observe certain country-specific deductions due to the sectoral differences in the examined countries. For instance, Norway's exploration reimbursement scheme for oil and gas companies grants immediate reimbursement for exploration costs as an incentive for ongoing exploration activities. Denmark and Finland offer tax credits for research and development expenditures, which correspond to their corporate tax rates of 22% and 20%, respectively (PwC, 2023). In contrast, Swedish tax legislation does not offer specific incentives for such activities (PwC (2023)). Tax credits, or incentives like the ones observed in Norway, Denmark, and Finland are politically put in place to promote innovation and firm growth. In the four countries, a key deduction that firms capitalize on relates to the tax advantages of debt, particularly concerning

interest payments. The tax regulations across these countries uniformly treat interest tax shields, calculated as the interest payment multiplied by the corporate tax rate (PwC (2023)).

Figure 3.1: Trends in Tax Rates



The figure contains the Tax Rates from 2007 to 2022.
Source: PwC (2023).

Figure 3.1 - *Trends in Tax Rates* illustrate a declining trend in the relative benefit of debt financing from 2007 to 2022 due to the decline in corporate income tax across the Nordic countries. The decline in corporate tax rates decreases the relative advantages of debt financing, predicting a shift towards more internal financing or equity financing over the past 15 years. Moreover, the reduced corporate tax rates allow firms to reinvest earnings towards new projects, decrease debt, or increase dividends, ultimately increasing the market value of the firm's equity. The political consensus to reduce corporate taxes over time may have several reasons, such as maintaining or increasing country-specific advantages related to foreign investments, innovation, and increased employment Dobbins and Jacob (2016). However, Mayer (1990) argues that *"neither transaction costs nor taxation were found to provide adequate descriptions of corporate financing patterns in*

different countries". This thesis investigates whether we observe the same patterns in the Nordic countries.

3.2 Bankruptcy Law

Bankruptcy laws are crucial and central aspects of capital structure choices enforced by the courts on behalf of lawmakers and governments. The bankruptcy laws act as a shield against actions taken by firm managers in situations of financial distress, where they prioritize their self-interests on behalf of either creditors or shareholders. Thus making choices that are sub-optimal for one or more of the parties involved. Prior empirical research by James and Scott (1977) and Rajan and Zingales (1995) offer insights into how bankruptcy laws impact liquidation rights and control over firms in financial distress or on the verge of bankruptcy. Their research shed light on how bankruptcy laws affect firm value and capital structure choices.

The bankruptcy laws in the Nordics share a common approach, emphasizing a legal framework with a balance between creditor and debtor interests. The laws focus on reorganizing or rehabilitating financially distressed firms or those filing for bankruptcy. The shared and transparent framework for companies with strong legal environments in their respective countries allows for well-informed capital structure choices without the risk of sudden changes. However, cross-country differences are expected. The Norwegian and Swedish bankruptcy laws lean towards reorganizing firms, potentially encouraging firms to use more debt. In contrast, the Finnish law is found to be more rigid with a liquidation-focused approach, ultimately leading to firms' stronger preference for equity financing. The Danish bankruptcy law tends to be more debtor-friendly, with a primary focus on restructuring processes to ensure the firm's continued operation, making debt financing more attractive. The emphasis on a balance between creditor rights and continued operation of firms in Danish, Swedish, and Norwegian law, shows signs of being less rigid than the one observed in Finland (PwC, 2023). The observations of Danish, Swedish, and Norwegian law further strengthen the predictions of the pecking order theory of firms generally prioritizing issuing debt over equity.

3.3 Bank-based versus Market-based Financial Systems

To calculate and demonstrate to what extent the Nordic countries are bank-based or market-based economies, this thesis employs the calculations and rationales by Demirgüç-Kunt and Levine (1999) rather than the simplified calculations conducted by Rajan and Zingales (1995). Their model based on high-income countries, like the Nordics, Demirgüç-Kunt and Levine (1999) argue that The Financial Structure System Formula provides a distinctive classification of bank-based or market-based financial systems.

Table 3.1: Private Credit and Capitalization Data

Country Year	Private Credit (% of GDP)	Stock Market Capitalization (% of GDP)	Outstanding Domestic Private Debt Securities (% of GDP)	Outstanding Domestic Public Debt Securities (% of GDP)
Denmark 2007	197.40	86.93	166.77	31.95
Denmark 2022	158.75	198.02	158.30	40.65
Sweden 2007	114.37	124.68	3.07	30.23
Sweden 2022	135.69	124.53	135.60	22.78
Norway 2007	107.50	88.52	25.53	12.05
Norway 2022	143.58	62.20	141.20	25.08
Finland 2007	76.27	143.99	24.64	9.94
Finland 2022	96.91	86.59	99.40	55.02

Private credit represents to what extent private entities are leveraged through different loans. Stock market capitalization represents the total market value of all publicly traded firms, reflecting the relative importance of the stock market in the countries. Outstanding domestic private debt securities exhibits the scale of private borrowing of bonds and other debt instruments. Outstanding domestic public debt, the metric explains to what extent a country´s public expenses are financed through debt. All observations are calculated as a percentage of GDP in both 2007 and 2022.
Source: World Bank (2023) and YCharts (2023).

$$FSS_C^T = \frac{PC_C^T}{MCAP_C^T + PrivD_C^T + PublicD_C^T} - 1 \tag{3.1}$$

Where: FSS = The Financial Structure System

PC = Private credit by deposit money banks and other financial institutions to GDP (%)

MCAP = Stock market capitalization to GDP (%)

PrivD = Outstanding domestic private debt securities to GDP (%)

PublicD = Outstanding domestic public debt securities to GDP (%)

C = The examined country

T= The examined year

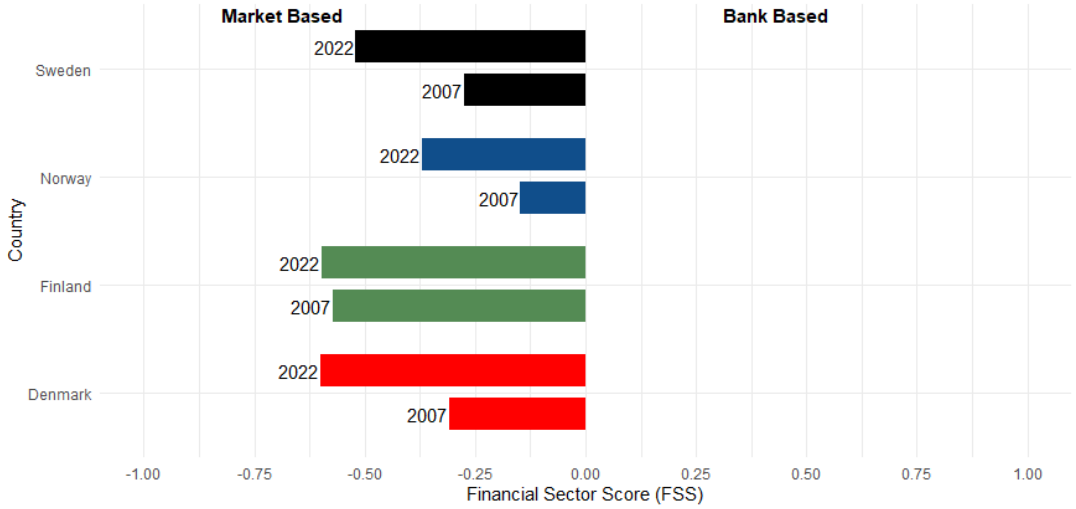
When:

$$FSS_C^T \geq 0.1 = \text{Bank-based}$$

$$-0.1 < FSS_C^T < 0.1 = \text{Mixed}$$

$$FSS_C^T \leq -0.1 = \text{Market-based}$$

Figure 3.2: Market vs Banked Based Financial Systems (2007-2022)



The results are calculated using Equation 3.1 with the data from Table 3.1. The calculations include year 2007 and 2022 in the respective countries. Source: World Bank (2023) and YCharts (2023) .

The results presented in Figure 3.2 - *Market vs Bank Based Finacial Systems* indicate that all countries are market-based, with varying degrees of strength and development over the past 15 years. Our results align with (Demirgüç-Kunt & Levine, 1999, pp. .109–112), who states that *"In high income countries, financial systems tend to be more market-based as [...] stock markets tend to become more active relative to domestic banks".* In Table 3.1 - *Private Credit and Capitalization Data*, we observe that in Denmark, the stock market capitalization to GDP has more than doubled over the past 15 years. As a result, the FSS coefficient has increased substantially. A similar development is observed in Sweden and Norway, where the FSS coefficient has increased by approximately 50% and 100% from 2007 to 2022. While not showing the same tendencies in terms of change, the FSS coefficient in Finland indicates convincing evidence of a market-based financial system in line with the other Nordic countries. The economies across the Nordics is characterized by transparent bond and equity markets with robust external financing accessibility and susceptibility to market volatility. Additionally, the analysis results in Norway are particularly interesting, as the Norwegian State is the majority shareholder of several of the biggest companies listed on Oslo Børs by market cap.

3.4 Ownership and Control Rights

Previous research, by Porta et al. (2002) and Goergen (2012), examines the dynamics of ownership and control, highlighting how ownership and control rights can significantly influence decision-making within firms. Given the possible consequences of agency costs and concentrated ownership, this aspect is highly relevant when examining the determinants of capital structure across different countries.

Porta et al. (2002) distinguish ownership into two distinct categories, dispersed and concentrated ownership. In this context, ownership constitutes holders of rights to vote at general assemblies and the rights related to the distribution of assets during the firm's ongoing operations or in the event of liquidation. Dispersed ownership is characterized by a corporate structure where equity is broadly distributed among numerous shareholders, resulting in limited individual influence. Conversely, concentrated ownership is defined as the scenario where a significant portion of a corporation's equity is held by a few entities, thereby enabling substantial control over business decisions.

Rajan and Zingales (1995) state that in Continental Europe, *ownership is highly concentrated, attributed to the utilization of inter-company cross-holdings, pyramiding of ownership, and dual class stocks*. Examining the Nordic countries, there is clear evidence in the literature suggesting that the ownership structure is predominantly concentrated across all four countries. In Sweden, firms typically operate under industrial conglomerates controlled by a few shareholders (Cronqvist and Nilsson, 2003; Giannetti and Laeven, 2008). In Denmark, the majority shareholders are found to be foundations (Thomsen & Rose, 2004). In Norway, there is a notable presence of large-scale government ownership. Similarly, in Finland, institutional shareholders hold a majority of the shares in listed firms (Khalfan & Wendt, 2020).

Extending this discussion, Goergen (2012) comments on what the literature describes as corporate control rights. In his research, he differentiates between weak and strong control, where control refers to the holders' right to participate in shareholders' meetings and determine the firm's management and strategic direction through votes. Typically, the weight of the votes is determined by what Rajan and Zingales (1995) refer to as dual-class stocks or the pyramid ownership structure. Scenarios where certain shareholders possess advantages and incentives compared to other shareholders regarding control over decisions and the ability to steer management in a specific direction, are described by Goergen (2012) as strong control. In the Nordic countries, ownership is concentrated among a few large stakeholders, resulting in a high degree of control and influence.

The Nordic countries is characterized by concentrated ownership. However, there are some notable differences. We see government ownership and large institutional shareholders in Norway and Finland, whereas conglomerates and foundations hold the majority of shares in listed firms in Sweden and Denmark. Such forms of ownership often suggest strong control, which can contribute to agency costs. The concentration may result in sub-optimal capital structure decisions due to risk aversion or conflicts of interest.

4 Data

In this section, we provide the data collection methodology. Initially, we briefly overview the data sources and the key criteria we have established for the data collection. Additionally, this section covers the accounting standards in the Nordics and comments on the sectoral composition. Furthermore, we explain our approach to handling missing data and outliers. Finally, we outline the parameters we use in our analysis, both the dependent and independent variables.

4.1 Sample selection

The Nordic countries share several similarities in economic history, political relationships, development, and cultural attributes. The common ground provides a solid foundation for a cross-country analysis, as the landscape firms operate in, is comparatively similar.

We analyze the largest non-financial firms by market capitalization in Norway, Sweden, Denmark, and Finland over a 15-year period from 2007 to 2022. The data set consists of 2786 observations, fairly distributed across the countries. Following Rajan and Zingales (1995), we chose to exclude financial firms because *"banks, insurance companies, and other financial corporations have their leverage strongly influenced by explicit (or implicit) investor insurance schemes, such as deposit insurance, and are subject to strict capital requirements"* . Furthermore, to be considered representative, firms must be listed on their respective domestic stock exchange with their headquarters within the nation. These selection criteria result in a diverse range of industries being represented in each country.

The data is collected on an annual basis in the local currencies of the respective countries. Only firms with complete balance sheets are included. Balance sheet and accounting data is gathered from WRDS (Wharton Research Data Services) and Compustat. We use The World Bank database and PwC to gather the data related to macroeconomic variables and tax rates.

4.2 Accounting Standards

Our sample consists of the largest listed non-financial firms in the Nordics by market capitalization. The International Financial Reporting Standards (IFRS) was implemented in 2005 for all four countries (IFRS, 2023). As members of either the European Union or European Economic Area, all firms must follow the same accounting principles, IFRS. This uniformity in accounting standards over the past 15 years allows for a direct comparison of balance sheet items and income statements, eliminating concerns about spurious results due to accounting differences between countries.

4.3 Sectoral Composition

We use Standard Industrial Classification codes (SIC) (SEC, 2023) to categorize the sectors in which the firms in the sample operate. While the four-digit code indicates the sectors of the respective companies, sector definitions are broad. Thus, many companies may be classified within the same sector even when they engage in significantly different activities within that sector. In this regard, the classification, found in Table B.1 - *Sectoral Composition*, serves as a tool to identify industries with a significant presence in the various countries. In our sample, the energy & transportation sectors are more heavily represented in Norway than in the other countries. In Denmark, the life sciences, mainly the pharmaceutical firms sector, is prominent. Examining the sectoral composition, we find approximately one-third of the companies are tied to the broad technology sector in Sweden. In Finland, the manufacturing sector is a significant part of the economy, accounting for approximately 30% of the firms. We emphasize that these classifications alone cannot form the basis for economic interpretation, but the classification acts as a tool to explain some of the cross-country differences. The complete overview can be found in the appendix Table B.1 -*Sectoral composition*.

4.4 Correcting for Missing Data and Outliers

According to Frank and Goyal (2003), missing data is a common challenge faced while working with panels of firm-level data, *"All studies employing panels of firm-level data face the problem of missing data"*. Therefore, it is crucial to handle this issue carefully and in accordance with empirical theory to avoid any biases in the model. Our primary goal is to ensure that our analysis is reliable and trustworthy. Thus, we correct for any observations that could create bias and adjust any unusually high values that lack economic interpretation.

4.5 Correction of Data with Missing and Incomplete Information

Table 4.1 - *Observations before and after data correction* exhibits the observations before and after correcting for observations with incomplete information. Only firms with complete balance sheet and income statement items are included in the analysis. Thus, the remaining observations after the correction, possess all the necessary information required to calculate the proxies for the parameters we include in our model. After omitting firms with incomplete balance sheets and income statement items, we are left with 2786 firm-year observations distributed across Denmark, Finland, Norway, and Sweden.

Table 4.1: Observations Before and After Data Correction

Year	Denmark		Finland		Norway		Sweden	
	Before	After	Before	After	Before	After	Before	After
2007	42	37	43	40	34	34	51	44
2008	42	37	44	40	34	33	52	45
2009	43	38	45	41	35	35	54	46
2010	43	39	47	43	36	36	54	47
2011	44	40	47	43	35	35	57	48
2012	44	40	49	41	37	37	59	50
2013	44	39	49	43	38	38	63	50
2014	44	40	53	46	39	38	65	52
2015	45	41	53	47	39	38	66	52
2016	47	43	53	47	41	39	70	55
2017	48	44	52	47	44	43	68	56
2018	47	43	53	48	44	42	67	55
2019	47	44	54	49	43	42	63	52
2020	45	43	54	49	42	42	57	50
2021	45	43	53	49	42	42	53	48
2022	43	40	51	49	42	42	52	47
Total	713	651	800	722	625	616	951	797

Source: Compustat

4.6 Correction of Outliers

Extreme outliers are defined by Wooldridge (2020) as *"Observations in a data set that are substantially different from the rest of the data, perhaps because of errors [...] outliers might also be extreme cases that are not representative of the total sample and could hence generate seriously misleading conclusions."* To correct for outliers and avoid potential problems, several methods are available. We employ the three most used methods to correct for extreme outliers: (1) Rule of thumb, (2) Winsorization, and (3) Robust Regressions (Baker & Martin, 2011). The rule of thumb involves checking and possibly removing observations that are not within a predetermined interval. For instance, leverage ratios and tangibility must lie in the interval between zero and one. Values below or above this is considered spurious and are omitted. Winsorization refers to *"replacing the furthest extreme ends of the distribution with the most extreme non-adjusted values"* (Wilcox, 2012).

Table 4.2 - *Summary Statistics Before and After Winsorization*, presents the mean and median values of all parameters before and after winsorization. All variables are winsorized at the lower and upper 1% level. The macroeconomic variables, tax, inflation, GDP growth, and term spread, are not winsorized, as all macroeconomic observations are considered credible with no extreme outliers.

Table 4.2: Summary Statistics Before and After Windsorization

Variable	**Before Windsorization**		**After Windsorization**	
	Mean	**Median**	**Mean**	**Median**
DTCB	0.55	0.57	0.55	0.57
DTCM	0.44	0.37	0.44	0.37
MBV	3.53	1.52	2.01	1.52
LIQ	1.73	1.37	1.57	1.37
PRO	0.11	0.11	0.12	0.11
SIZE	8.16	8.41	8.20	8.41
REVV	0.19	0.11	0.17	0.11
NDTS	0.05	0.04	0.04	0.04
TAN	0.25	0.20	0.25	0.20
Z	6.47	2.88	2.96	2.88
LD	0.79	0.78	0.79	0.78
TAX	23.55	22.00	23.55	22.00
INFL	1.89	1.69	1.89	1.69
GDP	2.65	2.66	2.65	2.66
TS	0.55	0.57	0.55	0.57

Where:DTCB=Total debt-to-Capital(Book), DTCM= Total debt-to-Capital(Market), MBV=Market to Book value, LIQ=Liquidity, PRO=Profitability, SIZE=Size, REVV=Revenue Volatility, NDTS=Non-Debt Tax Shield, TAN=Tangibility, Z=Altman´s Z-Score, LD=Lagged Debt, TAX=Corporate Tax Rate, INFL=Expected Inflation, GDP=GDP Growth, TS=Term-spread.
Source: Compustat

4.7 Dependent Variables

In prior studies, leverage is considered some form of a debt ratio. These debt ratios differ according to whether book or market values of leverage are used and whether all debt or only long-term debt is considered (Frank & Goyal, 2003). The measures in prior empirical research (Rajan and Zingales, 1995, Antoniou et al., 2002 Frank and Goyal, 2003, De Jong et al., 2008) is the following ratios: total-debt-to-total-assets, total-debt-to-net-assets, total-debt-to-capital, and interest coverage ratio.

Results from previous research suggest that there is no universally superior measure of leverage, and each measure comes with its own set of strengths and weaknesses (Myers (1977), Rajan and Zingales (1995), Frank and Goyal (2009)).

The ratio of total-debt-to-total-assets measures the extent to which firms are leveraged based on their total assets. This ratio is easily understandable, showing the debt holders' ownership of the firm. However, it does not consider that non-debt liabilities, such as accounts payable and warranty liabilities, may offset some assets. Following the same rationale, total debt-to-net-assets fails to include balance sheet items possibly used to counteract firm's assets. Examples of these balance sheet items are debt-like assets such as employee benefits and contingent liabilities, among others.

Other leverage measurements, such as the interest coverage ratio, although valuable for assessing a firm's capacity to meet its interest payment obligations, have received comparatively less attention in prior empirical studies on capital structure. This is because the interest coverage ratio primarily focuses on a firm's ability to fulfill its short-term interest commitments, potentially overlooking long-term interest obligations.

In their research, Rajan and Zingales (1995) find total-debt-to-capital as the most suitable metric for characterizing a firm's historical financial decisions. *"Therefore, the effects of past financing decisions is probably best represented by the ratio of total debt to capital (defined as total debt plus equity)"* (Rajan & Zingales, 1995, p.1429).

When further examining the total-debt-to-capital ratio, both book and market values of equity can be employed. Myers (1977) argues that the book value of equity is a more accurate measurement of a firm's actual value and makes sense to use when analyzing optimal capital structures. On the contrary, Myers argues that the market value of equity may not accurately measure a firm's value and contends that book value is a better measurement since it refers to the true value of assets the firm currently possesses. While the market value of equity may reflect the firm's assets, a substantial part of the market value is the present value of growth opportunities.

Further, Myers argues that managers' financing decisions are historically based on the book value rather than the market value of equity as the operation, and the operational debt is not affected by equity market movements. Following this rationale, Graham and

Harvey (2001) provides evidence on capital structure and financial policies made by chief financial officers. The results indicate that financial officers and managers are not actively re-balancing their respective firms' capital structures based on equity market fluctuations. Their main findings are based on the cost of adjustments and managers' general belief that the best foundation for financial policy changes is based on actual book values.

On the contrary, Welch (2004) contends that the market value of equity is superior in capturing the immediate value and the intangible components of equity. Consequently, market value can offer a more holistic view of a company's performance and present financial state. Moreover, the unique nature of the book value of equity allows it to be negative in some instances, a situation not applicable to the book value of assets. Frank and Goyal (2009) and Welch (2004) argue that the book value of equity often serves more as an accounting catch-all figure to level the balance sheet, rather than a figure of substantive relevance for managerial decision-making.

We conduct a comparative analysis following historical and recent empirical studies by incorporating two dependent variables. Thus, this thesis employs total-debt-to-capital using the book value and the market value of equity as dependent variables seen in Equations 4.1 and 4.2.

$$\text{Total debt-to-capital}_{\text{Book Value}} = \frac{\text{Total debt}_t}{\text{Total debt}_t + \text{Book value of total Equity}_t} \tag{4.1}$$

$$\text{Total debt-to-capital}_{\text{Market Value}} = \frac{\text{Total debt}_t}{\text{Total debt}_t + \text{Market value of total Equity}_t} \tag{4.2}$$

4.8 Independent Variables

This section addressees the choice of the independent variables we employ as determinants of capital structure. Each of the 13 independent variables are described in line with empirical evidence and theories in order to create clear hypothesis'.

4.8.1 Market-to-book value (MBV)

As a proxy for future growth opportunities and investments, this thesis employs market-to-book value in accordance with prior literature by Rajan and Zingales, 1995,Antoniou et al., 2002, Frank and Goyal, 2003, Frank and Goyal, 2009, Adam and Goyal (2008), who argue that the market-to-book value is the most reliable proxy for growth. The market value of assets serves as a proxy for the present value of future cash flows given the firm´s existing assets and future investment opportunities. The trade-off, cash flow and debt overhang theories predict an inverse relationship between market-to-book value and leverage, as firms with high market-to-book value can issue equity at more favorable terms. Furthermore, when a firm has a high market-to-book value, the equity market has confidence in significant future growth. If these beliefs prove accurate, the firms are expected to boost their earnings, enabling them to meet their debt obligations. Consequently, the management is likely to aim for a reduced reliance on debt to mitigate the potential negative consequences associated with debt, namely agency costs and financial distress. Growth is an essential aspect for all firms operating to maximize profits. While the pecking order theory suggests firms to be internally financed, in the absence of other options, debt financing is preferred over equity financing. Given this, the pecking order does not suggest a definite answer on the relationship between leverage and market-to-book value. When examining growth De Jong et al. (2010) argue that firms aligning with the predictions of the pecking order theory, on average, operate below their respective debt level capacity.

Market-to-book value is calculated as the relationship between market value of equity and book value of equity, (Rajan and Zingales, 1995,Antoniou et al., 2002, Frank and Goyal, 2003, Frank and Goyal, 2009, Adam and Goyal, 2008).

$$\text{Market-to-book value} = \frac{\text{Market Value of Equity}_t}{\text{Book Value of Equity}_t} \tag{4.3}$$

H0: Market-to-book value exhibits a positive relationship with debt levels.

H1: Market-to-book value exhibits a negative relationship with debt levels.

4.8.2 Liquidity (LIQ)

Liquidity is defined as a firm´s possibility and capability to turn its assets into cash at face value. The measure explains to what extent the firms are able to meet their short-term debt obligations with their current assets. Liquid firms, characterized by a lower probability of immediate bankruptcy, should increase their debt levels to fully exploit interest tax shield advantages following the trade-off and cash flow theories. The theories, thus, predict a positive relationship between leverage and liquidity. Contrarily, the pecking order theory predicts a negative relationship where liquid firms prioritize retained earnings over debt financing. Aligning with the pecking order theory's perspective, Ozkan, 2001, Antoniou et al., 2002, De Jong et al., 2008 find an inverse relationship between liquidity and debt levels.

Following previous empirical research by Antoniou et al. (2002) and De Jong et al. (2008), this thesis uses a proxy for liquidity calculated as the book value of current assets divided by current liabilities.

$$\text{Liquidity} = \frac{\text{Current Assets}_t}{\text{Current Liabilities}_t} \tag{4.4}$$

H0: Liquidity exhibits a positive relationship with debt levels.

H1: Liquidity exhibits a negative relationship with debt levels.

4.8.3 Profitability (PRO)

Profitability serves as a metric for financial efficiency, reflecting how effective management is able to use the firm's assets to generate earnings. The trade-off theory predicts that profitable firms should carry more debt to exploit the interest tax shield. Furthermore, highly profitable firms tend to have less risk of bankruptcy and financial distress. Therefore, the static trade-off theory predicts a positive relationship between leverage and profitability. Profitable firms have the ability to retain earnings, which is the preferred financing source according to the pecking order theory.Thus, the pecking order theory predicts a negative relationship between leverage and profitability.

Previous research by Rajan and Zingales (1995), Antoniou et al. (2002), Frank and Goyal (2003), De Jong et al. (2008) all found a negative relationship between leverage and profitability. In order to maintain consistency and have the opportunity to compare our results with prior literature, we define profitability as the ratio between EBITDA and total assets.

$$\text{Profitability} = \frac{\text{EBITDA}_t}{\text{Total Assets}_t} \tag{4.5}$$

H0: Profitability exhibits a positive relationship with debt levels.

H1: Profitability exhibits a negative relationship with debt levels.

4.8.4 Firm Size (SIZE)

Rajan and Zingales (1995) argue that size is the best inverse proxy for bankruptcy risk. Furthermore, La Rocca et al. (2011) and Keefe and Yaghoubi (2016) find that larger firms usually exhibit stable revenues and cash flows, resulting in reduced risk of financial distress. The pecking order theory suggests that larger firms rely less on debt, preferring internal financing through retained earnings. On the other hand, the trade-off and cash flow theories anticipate a positive relationship between firm size and leverage. Considering their reduced risk of financial distress, less revenue fluctuations, and superior credit ratings in debt markets, larger firms are likely to have relatively lower costs of debt. With stable

revenue and cash flows, larger firms can manage risk more effectively, leading to increased debt levels to exploit the interest tax shield. However, as firms reach a significant size, this trend is expected to decrease.

La Rocca et al. (2011) argue that the best proxy for firm size is the natural logarithm of book value of assets. Frank and Goyal (2009) argue that both the natural logarithm of assets and sales yields similar results as a proxy for size. As firms periodically sell off excess assets, using total assets as a proxy for firm size can produce misleading conclusions (Morellec, 2001). Following De Jong et al. (2008) this thesis employs the natural logarithm of sales as a proxy for firm size.

$$\text{Firm Size} = LN(TotalSales)_t \tag{4.6}$$

H0: Firm Size is exhibits a negative relationship with debt levels.

H1: Firm Size is exhibits a positive relationship with debt levels.

4.8.5 Revenue Volatility (REVV)

Revenue volatility serves as an indicator of a firm's financial stability. Firms experiencing significant revenue volatility face challenges in years of low revenue, where their profits may not suffice to cover interest, debt obligations, and continued operation. As a result, firms with high revenue volatility often opt to decrease borrowing and lean towards equity financing, suggesting an inverse relationship between revenue volatility and leverage. Due to high revenue volatility, firms may be unable to exploit the full benefits of interest tax shields (Antoniou et al., 2002). Furthermore, firms with highly volatile revenue may incur higher costs of debt, or decreased accessibility to debt financing as creditors set stricter covenants. The pecking order theory predicts a positive relationship between leverage and revenue volatility. Facing high revenue volatility and insufficient retained earnings, firms tend to favor issuing debt over equity. Similarly, the trade-off, cash flow, and debt overhang theories predict that firms with higher revenue volatility are at higher risk of financial distress and should opt for less debt to avoid potential costs of bankruptcy or financial distress.

Antoniou et al. (2002) and De Jong et al. (2008) observe negative relationship between revenue volatility and leverage. Following this, revenue volatility is calculated as shown in Equation 4.7.

$$\text{Revenue Volatility} = (log(Revenue_t) - average(log(Revenue) \tag{4.7}$$

H0: Revenue Volatility exhibits a positive relationship with debt levels.

H1: Revenue Volatility exhibits a negative relationship with debt levels.

4.8.6 Non-debt tax shield (NDTS)

With the primary goal of maximizing profits, firms use deductions on taxable income to reduce tax payments. The most commonly used deductions are related to interest payments, and those resulting from depreciation and amortization. However, due to the absence of detailed data regarding the cost of debt, namely interest expense, for the companies in our sample, this thesis focuses on non-debt tax shields. In their study, De Angelo and Masulis (1980) discover that companies with significant non-debt tax shields often fail to take full advantage of interest tax shields. The trade-off theory predicts a negative relationship between leverage and non-debt tax shields, as the advantage gained from non-debt tax shield reduces the relative advantage of tax benefits from interest expenses. Prior empirical research by Harris and Raviv (1991), Antoniou et al. (2002) and Frank and Goyal (2003) all observe a positive relationship between non-debt tax shields and leverage.

Following Frank and Goyal (2003) we use use depreciation and amortization divided by the book value of total assets as the measurement of non-debt tax shield.

$$\text{Non-debt tax shield} = \frac{\text{Depreciation \& amortization}_t}{\text{Total assets}_t} \tag{4.8}$$

H0: Non-Debt Tax Shield exhibits a positive relationship with debt levels.

H1: Non-Debt Tax Shield exhibits a negative relationship with debt levels.

4.8.7 Tangibility (TAN)

Asset tangibility is defined as the asset's financial value and physical presence. When financial stability is in question, tangible assets act as the main security for creditors, serving as collateral. Companies with higher levels of tangible assets can mitigate the fundamental risk of their debt and diminish the expenses related to possible costs of financial distress. Previous empirical studies find a positive relationship between tangibility and leverage (Rajan and Zingales, 1995, Antoniou et al., 2002, Frank and Goyal, 2008, De Jong et al., 2008). The pecking order theory predicts a negative relationship between asset tangibility and leverage, as firms prefer internal over external financing. Therefore, firms with more tangible assets are expected to rely less on debt. On the contrary, the trade-off and cash flow theories predict a positive relationship between asset tangibility and leverage. The theories predict that tangible assets can serve as collateral, reducing the risk for lenders and thereby making it easier for firms to secure debt financing at lower costs.

Following Rajan and Zingales (1995), Antoniou et al. (2002) and Frank and Goyal (2008) this thesis defines tangibility as the ratio of net property, plant and equipment to total assets.

$$\text{Tangibility} = \frac{\text{Net property, plant and equipment}_t}{\text{Total assets}_t} \tag{4.9}$$

H0: Tangibility exhibits a negative relationship with debt levels.

H1: Tangibility exhibits a positive relationship with debt levels.

4.8.8 Altman´s Z-score (Z)

The Altman Z-score is recognized as a predominant model for evaluating the bankruptcy risk for listed firms. The model forecasts the likelihood of a company facing financial distress or bankruptcy within a two-year period. The Z-score can be interpreted as follows: As the Z-score increases, the probability of bankruptcy decreases. Scores beneath 1.8 indicate high bankruptcy risk, whereas scores exceeding 2.99 suggest a low probability of

bankruptcy. Firms with increased bankruptcy risk are likely to experience increased costs of financial distress, leading to reduced credit ratings and accessibility to debt financing. Consequently, the trade-off theory anticipates firms in, or those soon to be in financial distress, to use less debt in their operations. Similarly, the pecking order theory predicts firms with lower bankruptcy risk to use less debt in their operations, as financially stable firms prefer to use retained earnings.

In their study, Frank and Goyal (2003) discover a trend where firms with a reduced risk of bankruptcy typically maintain lower debt levels. Building on this, we aim to investigate whether this pattern holds in the Nordics.

$$\begin{aligned} Z\text{-score} = 1.2 &\left(\frac{\text{Working Capital}}{\text{Total Assets}}\right) + 1.4\left(\frac{\text{Retained Earnings}}{\text{Total Assets}}\right) \\ &+ 3.3\left(\frac{\text{EBIT}}{\text{Total Assets}}\right) + 0.6\left(\frac{\text{Market capitalization}}{\text{Total Liabilities}}\right) \\ &+ 0.999\left(\frac{\text{Total Revenue}}{\text{Total Assets}}\right) \end{aligned} \tag{4.10}$$

H0: Altman´s Z-score exhibits no or a positive relationship with debt levels.

H1: Altman´s Z-score exhibits a negative relationship with debt levels.

4.8.9 Lagged debt (LD)

This thesis examines past leverage ratios following empirical research by Dissanaike et al. (2001) and Frank and Goyal (2003). The trade-off theory suggests that firms aim to maintain a target debt ratio by weighing the advantages of increased debt against the associated costs. The debt overhang theory predicts a positive relationship, as past debt levels affect future investments, later impacting future debt levels. The pecking order theory, on the contrary, does not anticipate firms having a specific target debt ratio. Instead, a firm's capital structure is a result of the firm's operations, and capital structure is changed only when retained earnings are no longer sufficient. In line with Dissanaike et al. (2001) and Frank and Goyal (2003), lagged debt is measured as:

$$\text{Lagged debt} = \frac{\text{Total Debt}_{t-1}}{\text{Total Debt}_{t-1} + \text{Book Value of Total Equity}_{t-1}} \tag{4.11}$$

H0: Lagged debt exhibits no or a negative relationship with debt levels.

H1: Lagged debt exhibits a positive relationship with debt levels.

4.8.10 Corporate Tax Rate (TAX)

As interest payments are tax-deductible, firms are expected to increase their debt levels to capture the full benefit of the interest tax shield. The trade-off theory anticipates a positive relationship between leverage and the corporate tax rate, as the relative benefits of the interest tax shield often outweigh the disadvantages of high debt levels. Prior empirical research from Harris and Raviv (1991), Antoniou et al. (2002) and Frank and Goyal (2009) find negative or insignificant relationships between corporate tax rate and debt levels. This thesis defines corporate tax rates in line with Antoniou et al. (2002) and Frank and Goyal (2009).

$$\text{Tax Rate} = \text{Corporate Tax Rate}_t \times 100 \tag{4.12}$$

H0: Tax Rate exhibits no or negative relationship with debt levels.

H1: Tax Rate exhibits a positive relationship with debt levels.

4.8.11 Inflation (INFL)

Inflation, is a result of previous economic growth. Frank and Goyal (2009) find that firms tend to have high levels of debt in times of high inflation, as they have taken advantage of the relatively low interest rates compared to the economic growth in the past periods. With high levels of expected inflation, the future value of interest and coupon payments become relatively cheaper. Therefore, the trade-off and debt overhang theories predict a positive relationship with leverage, as the real value of current debt decrease. Frank and Goyal (2009) find a positive relationship between leverage and expected inflation. Following their findings, inflation is measured as the expected inflation in percent.

$$\text{Inflation} = \text{Expected Inflation}_t \times 100 \tag{4.13}$$

H0: Inflation exhibits no or a negative relationship with debt levels.

H1: Inflation exhibits a positive relationship with debt levels.

4.8.12 GDP Growth (GDP)

Gross Domestic Product (GDP) growth is considered the most vital indicator of economic performance. In periods of GDP growth, firm earnings generally increase, leading to less difficulty for firms in servicing their debt obligations. The trade-off theory suggests that firms may be more inclined to increase their leverage during economic growth due to better access to debt financing. In contrast, the pecking order theory anticipates a negative relationship between leverage and GDP growth. In times of GDP growth, firms tend to generate higher profits, increasing retained earnings. With a surplus of internal financing, companies are inclined to use these funds for expansion in alignment with the positive economic expectations.*"In the analysis of the direct impact of country-specific factors, we observe that certain factors like GDP growth [...] significantly explain the variation in capital structure across countries"* (De Jong et al., 2008, p.2).

Building on De Jong et al. (2008), GDP growth is determined by:

$$\text{GDP Growth} = \frac{GDP_{t+1} - GDP_t}{GDP_t} \times 100 \tag{4.14}$$

H0: GDP Growth is exhibits no or a negative relationship with debt levels.

H1: GDP Growth exhibits a positive relationship with debt levels.

4.8.13 Term-spread (TS)

The term spread, calculated as the difference between long- and short-term government bonds, is an essential indicator of the economic health and the current conditions in the debt markets. In their study, Wheelock and Wohar (2009) contend that the term spread reliably forecasts both recessionary and growth phases. Additionally, the findings from Wheelock and Wohar (2009) demonstrate that negative term spreads, where short-term

bond rates surpass long-term rates, is a preliminary indicator of reduced economic growth. Periods of positive term spread indicate favorable economic conditions. The trade-off theory anticipate firms to capitalize on comparatively lower interest rates by increasing leverage.

Following Frank and Goyal (2003) and Antoniou et al. (2008) term spread is calculated as the difference between the 10 year Government bond and the 3 month Government bond.

$$\text{Term Spread} = (\text{10 Year Government Bond}_{t-1} - \text{3 Month Government Bond}_{t-1}) \times 100 \quad (4.15)$$

H0: Term-Spread exhibits a positive relationship with debt levels.

H1: Term-Spread exhibits a negative relationship with debt levels.

5 Methodology

In this section, we present the methodology used in the thesis. We introduce the empirical framework of the three main estimation methods for panel data analysis. Furthermore, we test the assumptions for Multiple Linear Regression (MLR) and discuss to what extent they are fulfilled. Finally, we outline the methodology for selecting our regression model.

5.1 Empirical Framework

Wooldridge (2020) states that panel data is a *"dataset constructed from repeated cross-sections over time."* The three main regression methods for panel data are pooled OLS, fixed effects, and random effects. The choice for panel data often lies between these three regression estimation methods due to the complexity of panel data and the methods' ability to handle this complexity. The empirical description and discussion related to the three regression estimation methods is found in Appendix section C - *Pooled OLS, Fixed effects and Random effects model.*

5.2 Testing assumptions for multiple linear regression (MLR)

The assumptions for our regression model analysis follow the multiple linear regression model (MLR). Assumptions 1-6 relate to the MLR model. If assumptions 1-5 are satisfied, the multiple linear regression model is considered to be the best linear unbiased estimator. Assumption seven is included due to the time series in our sample (Wooldridge, 2020). The relevant MLR tests, tables and plots, with associated discussions, are presented in Appendix section E - *Testing The MLR Assumptions.*

5.3 Selection of Regression model

Based on the analysis of the multiple linear regression test results found in the appendix E - *Testing The MLR Assumptions*, it is evident that certain assumptions are violated. The MLR assumptions considered to be violated are homoscedasticity, zero conditional mean, and no serial correlation. This leads to the selection of either Fixed Effects (FE) or Random Effects (RE) estimation as the appropriate method for our regression analysis. To determine the most suitable estimation method, we employ the Hausman test. The hypothesis for the test is:

H0: The coefficients estimated by the random effects model and the fixed effects model are sufficiently close.

H1: The coefficients estimated by the random effects model and the fixed effects model are not sufficiently close.

Table 5.1: Hausman Test Results

	Total Debt to Capital (Book)		**Total Debt to Capital (Market)**	
Country	**Chi2**	**Prob>Chi2**	**Chi2**	**Prob>Chi2**
Denmark	220.17	0.00	50.39	0.00
Finland	825.13	0.00	52.33	0.00
Norway	247.45	0.00	215.51	0.00
Sweden	331.99	0.00	82.85	0.00

Results from the Hausman test for both regression models across Denmark, Finland, Norway, and Sweden.

The results lead to the rejection of the null hypothesis, stating that the coefficients estimated by the random effects model and the fixed effects model are sufficiently close. All observed P-values lower than 0.05 indicate significant inconsistencies for both regression models across all countries. As a result, the Hausman test recommends the adoption of the fixed effects estimation method, primarily due to its fewer restrictive assumptions. Fixed effects estimation is particularly advantageous as it allows for correlations between unobserved effects and each explanatory variable. These characteristic makes the FE estimation a more compelling tool for estimating ceteris paribus effects (Wooldridge,

2020). Furthermore, Wooldridge (2020) underscores the suitability of FE estimation when a sample cannot be treated as a random sample from a large population. Thus, we will use a fixed effects model, leaving us with the following two regression models *Total debt-to-capital(book)* - 5.1 and *Total debt-to-capital(market)* - 5.2.

$$\begin{aligned}\hat{\text{Total debt-to-capital}}_{\text{BOOK,it}} = \beta_0 + \beta_1 \hat{MBV}_{it} + \beta_2 \hat{LIQ}_{it} + \beta_3 \hat{PRO}_{it} + \beta_4 \hat{SIZE}_{it} \\ + \beta_5 \hat{REVV}_{it} + \beta_6 \hat{NDTS}_{it} + \beta_7 \hat{TAN}_{it} + \beta_8 \hat{Z}_{it} + \beta_9 \hat{LD}_{it} \\ + \beta_{10} \hat{TAX}_{it} + \beta_{11} \hat{INFL}_{it} + \beta_{12} \hat{GDP}_{it} + \beta_{13} \hat{TS}_{it}\end{aligned} \tag{5.1}$$

$$\begin{aligned}\hat{\text{Total debt-to-capital}}_{\text{MARKET,it}} = \beta_0 + \beta_1 \hat{MBV}_{it} + \beta_2 \hat{LIQ}_{it} + \beta_3 \hat{PRO}_{it} + \beta_4 \hat{SIZE}_{it} \\ + \beta_5 \hat{REVV}_{it} + \beta_6 \hat{NDTS}_{it} + \beta_7 \hat{TAN}_{it} + \beta_8 \hat{Z}_{it} + \beta_9 \hat{LD}_{it} \\ + \beta_{10} \hat{TAX}_{it} + \beta_{11} \hat{INFL}_{it} + \beta_{12} \hat{GDP}_{it} + \beta_{13} \hat{TS}_{it}\end{aligned} \tag{5.2}$$

6 Empirical Analysis

6.1 Summary Statistics

This section explains capital structure variations across the Nordic region, focusing on mean leverage and balance sheet metrics. While prior research on capital structure is extensive, there is a lack of recent research on Nordic countries. Through this chapter we will compare our observations with prior empirical research by Rajan and Zingales (1995), Frank and Goyal (2003), De Jong et al. (2008), Antoniou et al. (2008) and Frank and Goyal (2008).

Table 6.1: Summary Statistics

	Denmark		**Finland**		**Norway**		**Sweden**	
Variable	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
DTCB	0.52	0.54	0.56	0.58	0.57	0.58	0.55	0.56
DTCM	0.38	0.28	0.45	0.41	0.41	0.37	0.50	0.39
MBV	2.57	1.80	1.59	1.43	2.43	1.60	1.60	1.48
LIQ	1.58	1.40	1.43	1.28	1.83	1.62	1.49	1.32
PRO	0.15	0.12	0.13	0.11	0.11	0.10	0.09	0.11
SIZE	8.40	8.61	6.96	7.25	8.37	8.56	9.04	9.94
REVV	0.17	0.13	0.10	0.07	0.26	0.15	0.17	0.11
NDTS	0.04	0.04	0.05	0.04	0.04	0.03	0.04	0.03
TAN	0.28	0.23	0.23	0.22	0.28	0.23	0.21	0.14
Z	3.83	3.75	2.77	2.73	2.69	2.76	2.62	2.69
LD	0.62	0.75	0.94	0.74	0.41	0.27	1.06	1.17
TAX	23.62	25.00	21.89	20.00	25.55	28.00	23.45	22.00
INFL	1.75	1.15	1.80	1.08	2.42	2.17	1.68	1.16
GDP	2.35	2.74	1.86	1.29	2.67	2.58	2.36	2.47
TS	0.52	0.54	0.56	0.58	0.57	0.59	0.55	0.57

Where:DTCB=Total debt-to-Capital(Book), DTCM= Total debt-to-Capital(Market), MBV=Market-to-Book value, LIQ=Liquidity, PRO=Profitability, SIZE=Size, REVV=Revenue Volatility, NDTS=Non-Debt Tax Shield, TAN=Tangibility, Z=Altman´s Z-Score, LD=Lagged Debt, TAX=Corporate Tax Rate, INFL=Expected Inflation, GDP=GDP Growth, TS=Term-spread
Source: Compustat

6.2 Firm-specific variables

When examining the book value of debt to capital, our results indicate that on average 53% to 57% of the firm's assets are financed by debt across the Nordics. Our results show low signs of skewness, with almost identical findings between the four countries over the past 15 years. Compared to previous empirical research, our results are significantly higher than the ones found by Rajan and Zingales (1995), Antoniou et al. (2008) and Frank and Goyal (2008), who found mean coefficients below 30% across their sample. The results suggest Nordic firms to be more reliant on debt than firms previously examined.

Throughout the sample, the market value of debt to capital is slightly lower than the book value of debt to capital, ranging from 39% to 50%. The relative debt-to-capital measure decreases as the market value of equity is often higher than the book value. Our results indicate higher levels of sample variation than the ones observed for debt-to-capital book value. Comparatively, our results are generally higher than the ones observed by Rajan and Zingales (1995), Antoniou et al. (2008) and Frank and Goyal (2008).

In table 6.1, we find the mean market-to-book value to differ significantly between the four countries. Notably, the difference between the market-to-book value of companies in Denmark and Norway is significantly higher than those in Finland and Sweden. The results suggest that Danish and Norwegian firms, on average, have market values considerably higher than book values of equity. As shown in Table B.1 - *Sectoral composition*, Denmark has a substantial pharmaceutical sector compared to the other countries in the sample. Gleason and Klock (2006) argue that high levels of intangible assets characterize pharmaceutical firms in the form of patents and strong growth for the past 15 years. Furthermore, we find that almost one-third of the firms in Norway are related to the energy and transportation sector. Together with consistent oil and gas demand, the market values of these firms have risen drastically over the past 15 years, resulting in high market-to-book value observations. Thus, we hypothesize that the key drivers of the differences seen in the mean market-to-book values across the four countries are the prominent energy & transportation, and life sciences sectors in Norway and Denmark, respectively. Compared to the results by Antoniou et al. (2008), De Jong et al. (2008) and Frank and Goyal (2009), the average market-to-book value in the Nordics in the past 15 years has been significantly higher. The high average market-to-book value observation

in Denmark is in line with the observed stock market development seen in Table 3.1 - *Private Credit and Market Capitalization to GDP*, over the past 15 years increasing from 87% of GDP to 198% in 2007 and 2022, respectively.

In terms of liquidity we find minor differences in the data statistics. De Jong et al. (2008) find similar variations within their data set, with both mean and median values showing minor differences across countries. Previous studies have shown higher overall liquidity multiples, but more recent research suggests a decreasing trend. Federal Reserve Bank of New York (2016) argue that the reason for the reduction of liquidity buffers is due to more sophisticated and less liquidity-dependant risk management tools. Furthermore, the Nordic countries have demonstrated stable economic growth and outlooks, reducing the need for substantial liquidity reserves to counteract potential macroeconomic shocks. Despite the regulatory environment and market attributes appearing similar, marginal differences might impact liquidity differences.

The profitability metric is observed to be almost identical for all countries. Our results align with mean values Antoniou et al. (2008) find in their study. On the contrary, our results are significantly higher than those observed by Frank and Goyal (2008), possibly caused by the financial and economic environment in the countries and time periods examined.

Observing size as the natural logarithm of sales, the mean statistic suggests that Danish, Swedish, and Norwegian firms on average are similar. For this metric, the numbers themselves do not offer any economic interpretation, but the distance between the values is the basis for comparison.

In examining revenue volatility, we find no significant signs of skewness. The median and mean values across all countries are closely aligned, indicating that firms throughout the Nordic region are similarly exposed to revenue volatility. This can be explained by factors such as small differences across the countries in aspects of business culture, market conditions, and the overall economic environment.

The non-debt tax shield shows no differences throughout the sample with coefficients of 0.04 in all four countries. Our results are comparable to the ones observed by De Jong et al. (2008), Frank and Goyal (2008) and Antoniou et al. (2008).

The mean tangibility coefficient varies between 0.21 and 0.28. Our results are in line with the observations of Frank and Goyal (2003) and Antoniou et al. (2008), however, our results are slightly lower than the ones observed by Frank and Goyal (2008). An interesting observation is linked to the distinct median in Sweden. We hypothesize the lower median tangibility measure results from the high concentration of technology firms, characterized by high levels of intangible assets not captured by the tangibility measure.

The Altman´s Z-score statistic suggests that Danish firms in the sample have the lowest probability of bankruptcy, with a mean observation of 4.18. Mean observations for Finnish, Norwegian, and Swedish firms are all above the bankruptcy risk benchmark of 2.6.

6.3 Country-specific variables

The Nordic countries have shown a trend of decreasing corporate tax rates over the past 15 years, with slightly higher rates in Denmark and Norway. The gross domestic product growth in Denmark, Finland, and Sweden is similar, ranging from 1.68% to 2.35%, marginally higher than the average growth in the European Union over the past 15 years. Norway has a moderately higher GDP growth, likely due to increased oil revenue and productivity over the same period. Inflation is observed to be relatively similar thorough the Nordics, with slightly higher values in Norway. These countries' economic outlooks and financial policies have been almost identical, resulting in an almost constant term spread for all of them. By examining the country-specific variables, we find that our results align with those of Antoniou et al. (2008) and De Jong et al. (2008).

6.4 Summary of statistics

Our observations indicate minor differences between the firm-specific independent variables liquidity, profitability, revenue volatility, non-debt tax shields, and tangibility. The similarities in our sample are consistent with the observations of Antoniou et al. (2002), Frank and Goyal (2008) and De Jong et al. (2008). However, the market-to-book value is found to be significantly lower in Finnish and Swedish firms compared to Danish and Norwegian firms. The substantial difference in market-to-book values is in line with what Antoniou et al. (2008) and Frank and Goyal (2009) found. The average market-to-book value of Nordic firms is higher than those found in studies conducted by Antoniou et al.

(2008) and De Jong et al. (2008). Our results indicate that Nordic firms between 2007 and 2022, on average, have experienced high growth compared to the firms observed by Antoniou et al. (2008) and De Jong et al. (2008). However, in line with our initial thoughts and previous empirical research, we observe minor cross-country differences in the market-to-book values.

6.5 Analysis of Descriptive Statistics

To provide a comprehensive analysis of the descriptive statistics, Table 6.2 - presents the *Mean Balance Sheet* for firms across the four countries from 2007 to 2022. Initial observations reveal substantial differences in the categorization of current assets between the countries. The percentage of current assets to total assets is relatively consistent across the sample, ranging from 26% to 32%. Notable differences is observed when comparing Norwegian and Swedish firms to their Nordic peers. They exhibit higher percentages of cash & short-term investments at 12.6% and 13.7% of total assets, respectively. Compared to Danish and Finnish firms, with average cash & short-term investments at 8.5% and 7.3% of total assets, respectively. Additionally, a significant contrast in the mean accounts receivable as a percentage of total assets is observed. Evidently, Swedish, and Norwegian firms appear to excel in their ability to collect outstanding claims compared to their Danish and Finnish peers. We hypothesize that these differences may be influenced by variations in legal frameworks, payment practices in the respective countries or the standards of the different industries across the sample. Comparing our findings with those of Rajan and Zingales (1995), we observe consistency in the results for cash & short-term investments, inventory, and other current assets. However, the Nordic countries show a considerably lower percentage of total assets tied up in accounts receivable when compared to the G7 countries.

When analyzing the categorization of non-current assets, a substantial difference in the proportion of tangible assets to total assets is evident. Spanning from 29% to 53% within the sample. The average balance sheet suggests a significant reliance on tangible assets for Norwegian and Finnish firms. A plausible reason for these observations is the heavy proportions of oil-related companies in Norway and manufacturing firms in Finland. Substantial tangible assets, such as oil rigs and manufacturing plants, characterize

firms operating in these sectors. Moreover, substantial variations in intangible assets is observed between firms in Finland and Sweden, where intangible assets account for 3.8% and 22.1% of total assets, respectively. The differences may be explained by the variations in the sectoral composition of firms, where the low levels of intangible assets are assumed to result from the broad sector in manufacturing and trade firms in Finland. Our observations indicate that Swedish and Danish firms rely less on tangible assets in their operations compared to their Nordic peers. A plausible reason for our results is the prominent technology sector and pharmaceutical sector in Sweden and Denmark, respectively, compared to more prominent energy and industry-related firms in Norway and Finland, respectively. Technology and pharmaceutical firms, by nature rely on intangible assets such as patents, intellectual property and goodwill from mergers (Gleason & Klock, 2006). Comparing our results to the ones by Rajan and Zingales (1995) on G7 countries, our results indicate a noticeable shift toward companies with a heavier reliance on non-current assets, particularly intangible assets. Given that this thesis examine a different set of countries in a different time frame, some of the disparities compared to prior empirical research may be attributed to these contextual differences.

Table 6.2: Mean Balance Sheets

	Norway	Denmark	Finland	Sweden
Cash & Short-Term Investments	12.6%	8.5%	7.3%	13.7%
Accounts Receivable	10.7%	16.8%	14.2%	7.9%
Inventory	12.0%	16.6%	12.7%	16.8%
Other current assets	1.0%	0.2%	1.5%	2.4%
Total Current Assets	**36.3%**	**42.1%**	**35.7%**	**40.9%**
Tangible Assets	40.1%	29.2%	53.0%	31.1%
Intangible Assets	11.9%	16.7%	3.8%	22.1%
Long-Term Investments	7.6%	9.8%	7.5%	4.6%
Other Non-Current Assets	4.1%	2.2%	0.0%	1.3%
Total Non Current Assets	**63.7%**	**57.9%**	**64.3%**	**59.1%**
Total assets	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Accounts Payable	4.0%	4.8%	8.6%	4.4%
Current Debt	2.1%	3.4%	6.5%	2.2%
Accrued Expenses	2.6%	3.9%	4.1%	2.5%
Other Current Liabilities	11.1%	10.9%	16.5%	8.6%
Total current liabilities	**19.7%**	**23.0%**	**35.6%**	**17.7%**
Long-Term Debt	17.2%	11.1%	16.7%	12.2%
Deferred Taxes	4.4%	2.4%	2.4%	2.7%
Other Non-Current Liabilities	27.3%	25.7%	25.8%	28.6%
Total Non-Current Liabilities	**49.0%**	**39.3%**	**25.8%**	**43.4%**
Total Liabilities	**68.7%**	**62.3%**	**61.4%**	**61.1%**
Shareholders Equity	**31.3%**	**37.7%**	**38.6%**	**38.9%**
Liabilities & Equity	**100.0%**	**100.0%**	**100.0%**	**100.0%**

The calculated values represents the average balance sheet items for all firms in the four examined countries between 2007 and 2022. Source: Compustat

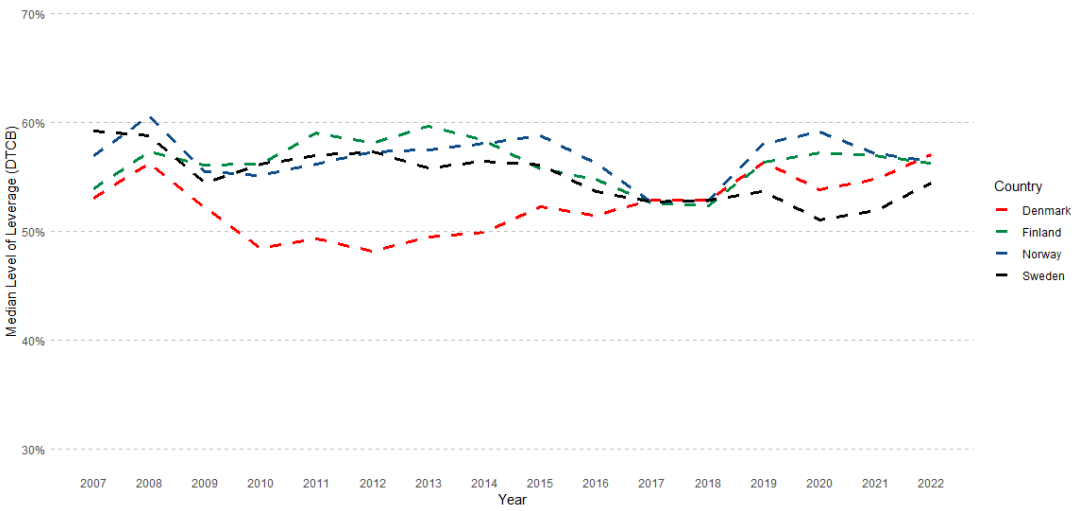
Further analyzing the mean liabilities of firms in the four countries, we observe similar results in the mean accounts payable, approximately 4% of total liabilities for Danish, Norwegian, and Swedish firms. Whereas for Finnish firms, accounts payable represent 9%. The largest portion of current liabilities for the examined firms is other current liabilities, ranging from 8.6% to 16.5%, primarily consisting of deferred revenue and provisions. This variation could be attributed to the different laws and obligations firms face regarding the recognition of income due to guarantees. Examining current liabilities, we observe that Finnish firms have significantly higher accounts payable than its Nordic peers. The difference may arise as a result of different business practices, where Finnish firms allow for longer deferrals of payments. The widespread observations of accounts payable are

significantly lower than those observed in G7 countries by Rajan and Zingales (1995), both in terms of percentage of total liabilities and country-specific variations. Conversely, the mean observations of other current liabilities, fall within a range where similar results are found by Rajan and Zingales (1995).

Analysis of tangible assets indicates that Norwegian and Finnish firms prefer to finance their tangible assets with long-term debt more than their Swedish and Danish counterparts. These findings aligns the results of Rajan and Zingales (1995) in G7 countries, as both Nordic and G7 firms demonstrate similar levels of long-term debt. All Nordic countries show signs of significant dependence on other non-current liabilities, which exceed 25% of their total liabilities, surpassing the average levels reported by Rajan & Zingales in 1995. The increased reliance on non-current liabilities may be attributed to a trend towards longer contracts and commitments, which has resulted in higher amounts of deferred revenue being recorded under non-current liabilities in Nordic firms. In recent years, there has been a notable shift towards leasing properties and production plants, which has led to a significant increase in debt categorized under non-current liabilities among Nordic firms.

Figures 6.1 and 6.2 present the historical median levels of both book and market measures of total debt-to-total capital for each of the countries in our sample.

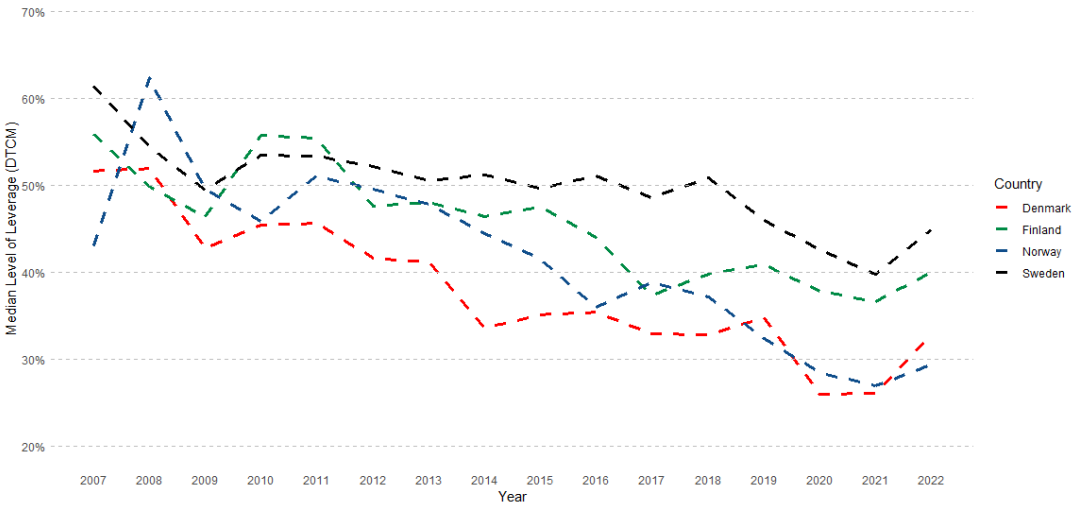
Figure 6.1: Median Total Debt-to-Capital (Book)



Trends in debt-to-capital development 2007-2022, using book value of equity.
Source: Compustat

In terms of trends, the book values of leverage appear to have remained stable at levels between 50% and 60% throughout the period. However, examining book values, Danish firms appear to have systematically lower debt levels than their Nordic peers during the period between 2009 and 2017. This may result from the more debtor-friendly bankruptcy laws observed in Denmark.

Figure 6.2: Median Total Debt-to-Capital (Market)



Trends in debt-to-capital development 2007-2022, using market value of equity. Source: Compustat

Observing market measures of leverage, we observe a negative trend starting between 2007 and 2008, possibly, but not exclusively explained by the Financial Crisis of 2008. Following a sharp decline in 2019, the lowest point of median total debt-to-capital is observed by the end of 2020. The observed decline could potentially be, but not solely, explained by the Covid-pandemic. Without investigating the reasons for the declines in debt-to-capital ratios in 2008 or 2020, the observations could provide valuable insights into how capital structure choices have changed over the past 15 years. Furthermore, we find an interesting pattern, whereas the corporate tax rates have increased, seen in Figure 3.1 - *Corporate Tax Rates 2007-2022*, the median total debt-to-capital has decreased, opposing the predictions of financial theory. As the corporate tax rate increases, an increase in debt levels is expected, as firms seek to exploit the interest tax shields to its full extent.

6.6 Estimation Results

In the following section, the regression results are presented and discussed. Rather than examining each country separately, we focus on the cross-country differences. Our regression analysis employs a fixed effects estimation with robust standard errors.

6.7 Regression Results using Book Value of Equity

Table 6.3: Fixed Effects Regression Results for Total Debt-to-Capital (Book)

Dependent variable: Total Debt-to-Capital (Book)	Denmark	Sweden	Norway	Finland
MBV	0.010***	0.030***	0.022***	0.047***
LIQ	-0.025***	-0.030***	-0.006**	-0.038***
PRO	-0.134***	0.202***	0.045	0.118**
SIZE	0.007	0.021***	0.009	0.005
REVV	-0.0003	0.053*	0.014	0.145***
NDTS	-0.004	2.074***	0.379*	0.566***
TAN	-0.022	0.006	0.127***	-0.155***
Z	-0.014***	-0.050***	-0.033***	-0.059***
LD	0.001	0.008	0.005	0.001
TAX	-0.001	0.005***	0.001	0.001
INFL	0.0003	-0.002	0.001	-0.001
GDP	0.0002	-0.00002	0.0001	-0.0001
TS	0.494***	0.118***	0.258***	0.185***
Intercept	0.508***	0.545***	0.527***	0.598***
Observations	651	797	616	722
Country fixed effects	Yes	Yes	Yes	Yes
Adjusted R2	0.576	0.283	0.411	0.535
F Statistic	72.464***	30.001***	37.330***	68.723***

Note: *p<0.1; **p<0.05; ***p<0.01
Where: MBV=Market to Book value, LIQ=Liquidity, PRO=Profitability, SIZE=Size, REVV=Revenue Volatility, NDTS=Non-Debt Tax Shield, TAN=Tangibility, Z=Altman's Z-Score, LD=Lagged Debt,
TAX=Corporate Tax Rate, INFL=Expected Inflation, GDP=GDP Growth, TS=Term-spread
Source: Compustat

The estimated model shows moderate explanatory power, and F-statistic, ranging from 30,1 to 72,4, indicates the model's overall level of significance to be adequate.

The market-to-book value (MBV) is significant at the 1% level, with positive coefficients across all countries. The positive relationship between market-to-book value and leverage deviates from the predictions of the trade-off, cash flow, and debt overhang theories. The theories all predict an inverse relationship because firms with a high market-to-book value can issue debt at more favorable terms than those with a low market-to-book value. The pecking order suggests that firms are best off internally financed from retained earnings. In scenarios where retained earnings are insufficient to exploit growth opportunities, the pecking order predicts firms will increase their debt levels rather than issue equity. Previous research by Frank and Goyal (2009) found a positive relationship between market-to-book value and leverage when observing the book measures of leverage. However, they argue that the interpretation of market-to-book value is more reliable when studying market-based leverage. This is because book values of leverage tend to be backward-looking, while the market value of leverage is forward-looking (Barclay et al., 2006).

In the regression results of liquidity (LIQ), we observe a negative relationship between liquidity and book value of debt at the 1% significance level for all countries. In line with the predictions of the pecking order theory, a negative relationship is expected as firms prefer internal financing over external financing. Examining the coefficients, we find cross-country differences, with coefficients ranging from -.038 to -.006. A possible explanation for the observed differences could be the differences in the composition of liabilities. The data indicates that Danish and Finnish firms rely more heavily on current liabilities, whereas Norwegian and Swedish firms rely more on non-current liabilities. Following Table B.1 - *Sectoral Composition*, we observe an overweight of Technology and Trade & Services firms in Denmark, Finland, and Sweden compared to Norway, while the predominant sectors in Norway are Energy & Transportation and Real Estate & Construction. Our results suggest that the differences in sectoral composition, to some extent, explains the deviation in how liquidity affects capital structure decisions across the Nordics. However, the negative relationship between liquidity and leverage across all Nordic countries is in accordance with previous research by Ozkan (2001), Antoniou et al. (2002) and De Jong et al. (2008).

Our regression predicts that size is not a statistically significant determinant of capital structure when using book values in Norway, Denmark, and Finland. However, the model predicts a positive coefficients of 0.021 for Swedish firms, being significant at the 1% level. The results in Sweden align with the prediction of the trade-off and cash flow theories, suggesting that bigger firms rely more on debt to take advantage of the interest tax shields in regard to sales. Previous research by Titman and Wessels (1988), Antoniou et al. (2002), De Jong et al. (2008) and Frank and Goyal (2009) found positive coefficients for size, but with varying degrees of impact on leverage. Our regression results, combined with Table 6.1 - *Summary Statistics*, suggest that firms in Sweden, on average, are larger in terms of sales compared to their Nordic peers. Consequently, our results suggest that firms with higher levels of sales tend to have higher levels of leverage. A plausible reason for the deviating observation in Sweden, could be that Swedish creditors view firm size as a more significant factor when providing debt. Rajan and Zingales (1995) also observed a positive relationship between size and leverage, but with the following remark, *"We have to conclude that we don't really understand why size is correlated with leverage."*

Our results suggest that revenue volatility (REVV) is a statistically significant determinant of capital structure in Sweden and Finland and the 10% and 1% level, respectively. Our results diverge from those of Antoniou et al. (2002, 2008) and De Jong et al. (2008), who all observe a negative relationship between leverage and revenue volatility. However, the estimation results align with the predictions of the pecking order theory. As firms experience volatile earnings, the pecking order theory suggests that, while firms are preferably internally financed, in times when revenue is insufficient to operate and grow, the reliance on debt financing is preferred over equity financing.

The non-debt tax shields (NDTS) exhibit varying results across the sample both when examining the coefficients and the significance. The fixed effects regression model suggests that non-debt tax shields are statistically significant at a 1% level in Sweden and Finland, at the 10% level in Norway, while being insignificant in Denmark. All significant observations deviate from the predictions of the trade-off, cash flow, and debt overhang theory, expecting that firms with large non-debt tax shields rely more on debt in their operations. Our results, align with those of Antoniou et al. (2002, 2008) and Frank and Goyal (2009). Furthermore, the observed coefficients differ throughout the sample, with significant observations between

0,379 and 2,074 in Norway and Sweden, respectively. These observations suggest that a one percent increase in non-debt tax shield increases the expected book value of leverage to increase between 0,379 and 2,074 units. Table B.1 - *Secotral Composition* shows a comparatively large presence of manufacturing firms in Sweden and Finland compared to Denmark and Norway. In combination with the regression results, this suggests that such firms increase their leverage ratios as non-debt tax shields increase.

Our regression results exhibit varying results of both statistical significance and the influence of tangibility on leverage. For Swedish and Danish firms, tangibility exhibits no statistically significant influence on capital structure when measured at book values. Furthermore, when examining Norway, tangibility exhibits a positive relationship with leverage, statistically significant at the 1% level. According to Table B.1 - *Sectoral Composition*, Norway has a higher presence of Energy & Transportation and Real Estate & Construction firms than its Nordic peers. Firms in these sectors tend to generally have higher levels of tangible assets.

On the contrary, tangibility shows a negative relationship with leverage for firms in Finland at the 1% significance level. The coefficients for Norway and Finland indicate that a one percent increase in tangibility increases leverage by 0.127 units for Norwegian firms while decreasing leverage by 0.155 units in Finnish firms. The results for Norwegian firms is in line with prior empirical literature (Rajan and Zingales, 1995, Antoniou et al., 2002, Frank and Goyal, 2008, De Jong et al., 2008), while the observations from Finland deviate from the aforementioned literature. The results for Finnish firms, align with the pecking order theory, predicting that firms with higher levels of tangible assets will rely less on debt and more on retained earnings. On the other hand, the observations in Norway align with the trade-off theory, predicting that as tangibility increases, the costs of financial distress is reduced. Consequently, it allows firms to secure debt on more favorable terms and exploit the interest tax shield to its full extent.

Altman´s Z-score, employed as a proxy for bankruptcy risk, indicates a statistically significant negative relationship between leverage at the 1% level for all countries. Our model suggests that firms with reduced bankruptcy risk reduce their debt levels. The regression results align with predictions of the pecking order theory, suggesting that as bankruptcy risk decreases, firms reduce their reliance on debt, preferring to use retained

earnings. In addition, if companies are experiencing financial difficulties and insufficient earnings, indicated by a low Z-score, the pecking order theory predicts that companies will choose to issue debt before equity. This aligns with the results of our regression analysis. Our results align with those of Frank and Goyal (2003), Antoniou et al. (2008) and De Jong et al. (2008). The cross-country differences in coefficients in our sample, suggest that Danish firms to a lesser extent reduces their debt as bankruptcy risk increases compared to their Nordic peers. A possible explanations for this can be managerial views on capital structure decisions in times of both growth and decline.

Lagged debt, the proxy to analyze whether firms are observed to have target debt levels, is found to be statistically insignificant in the Nordics when employing the book value of equity. The results are in line with the predictions of the pecking order theory, suggesting that firms do not have target debt levels and rather strive to use retained earnings over external financing.

Our results suggest that the corporate tax rate is only a statistically significant determinant of capital structure in Sweden. The observation in Sweden aligns with the trade-off theory, anticipating a positive relationship between leverage and taxes due to the increased potential interest tax shield. The observed coefficient suggests that a one percent increase in tax will increase the debt ratio of Swedish firms by 0,005 units. Prior research by Harris and Raviv (1991), Antoniou et al. (2002), and Frank and Goyal (2009) also observed no or small impact of tax on leverage.

Inflation is observed to be an insignificant determinant of leverage for all countries when using book measures. Research by Frank and Goyal (2009) observed the same results, further strengthening the argument that book values are backward-looking, making expected inflation insignificant.

No significant relationship is observed between economic growth (GDP) and the book value of leverage. This reflects how the book value of total debt-to-capital does not ideally capture economic growth, as it primarily represents historical costs rather than current market conditions. Additionally, the book value of debt may not capture the dynamic aspects of a firm's financial decision-making in response to economic growth, which can be more accurately reflected using the market value of equity.

Lastly, we observe the term spread (TS) to have a positive relationship with leverage for firms across all countries at the 1% significance level. This implies that Danish, Swedish, Norwegian, and Finnish companies tend to increase their leverage when the term spread increases. The positive relationship between term spread and book values of leverage across all countries can be explained by the fact that all four countries have strong national banks, increasing accessibility to debt in macroeconomic hardship and uncertainty. The trade-off theory provides a mixed prediction, indicating that in periods of positive term spread, firms should capitalize on comparatively lower interest rates by increasing leverage. Conversely, in periods with a negative term spread, firms should decrease their reliance on debt. Both positive and negative relationships between term spread and leverage have been observed in prior research. Antoniou et al. (2008) and Frank and Goyal (2003) observed negative coefficients for term spread in their respective research. On the other hand, Antoniou et al. (2008) found a positive relationship between term spread and leverage for Germany in their research. The empirical outcomes in the Nordic countries, when compared with the observations made by Antoniou et al. (2008) regarding Germany, might be attributable to underlying similarities in the legal framework, bankruptcy laws, and active involvement from governments and national banks when needed.

In summary, when employing book values of leverage, our results suggest that firm-specific variables such as market-to-book, liquidity, profitability, and Altman Z-score are significant determinants of capital structure for firms across all countries in the Nordics. Furthermore, we observe some cross-country variations for the firm-specific variables, namely size, revenue volatility, non–debt tax shields, and tangibility. Size is only observed to be a significant determinant for Swedish firms. For Swedish and Finnish firms, our results suggest that revenue volatility has a significant impact on leverage. Our results suggest that non-debt tax shields is a statistically significant determinant of capital structure for firms in Sweden, Norway and Finland. Furthermore, the results indicate that tangibility is a significant determinant of book values of leverage in Norway and Finland. In general, the country-specific macroeconomic variables do not significantly impact capital structure decisions when employing book values of leverage in the Nordics.

6.8 Regression Results using Market Value of Equity

"Book values of leverage are backward looking, while market value of leverage is forward looking"(Barclay et al., 2006). Building on this premise, it is reasonable to anticipate differing results when comparing book and market values of leverage. In the following, we discuss the fixed effects regression where we use market measures for total debt-to-capital as the dependent variable.

Table 6.4: Fixed Effects Regression Results for Total Debt-to-Capital (Market)

Dependent variable: Total Debt-to-Capital (Market)	Denmark	Sweden	Norway	Finland
MBV	-0.054***	-0.173***	-0.051***	-0.201***
LIQ	-0.015	-0.028***	0.016*	-0.038***
PRO	0.587***	0.173***	0.232**	0.475***
SIZE	-0.041***	-0.010**	0.021**	0.006
REVV	0.021	0.012	0.085***	0.157***
NDTS	-1.178***	0.584***	0.982**	0.428
TAN	-0.124*	-0.093**	0.002	-0.325***
Z	-0.094***	-0.018***	-0.087***	-0.097***
LD	-0.002	0.0003	-0.009	0.013***
TAX	0.017***	0.004***	0.017***	0.004***
INFL	0.001	0.001	0.003	-0.004**
GDP	0.0004	-0.0002	0.0005	0.0001
TS	0.178***	0.208***	-0.038	0.129***
Intercept	0.713***	0.862***	0.850***	0.932***
Observations	651	797	616	722
Country fixed effects	Yes	Yes	Yes	Yes
Adjusted R2	0.664	0.688	0.659	0.751
F Statistic	103.273***	140.853***	95.617***	171.973***

Note: *p<0.1; **p<0.05; ***p<0.01
Where: MBV=Market-to-book value, LIQ=Liquidity, PRO=Profitability, SIZE=Size, REVV=Revenue Volatility, NDTS=Non-Debt Tax Shield, TAN=Tangibility, Z=Altman's Z-Score, LD=Lagged Debt, TAX=Corporate Tax Rate, INFL=Expected Inflation, GDP=GDP Growth, TS=Term-spread
Source: Compustat

Using market values of leverage, the regression demonstrates a significantly higher explanatory power than the regression using the book value of equity. Furthermore, the model's F-statistic, ranging from 95,6 to 171,9, indicates that the model's overall level of significance is adequate. Although there are similarities between this regression and the one presented in Table 6.3, we observe some differences.

The model now estimates a negative relationship between market-to-book value and market measures of total-debt-to-total capital at the 1% significance level for all Nordic countries. The negative coefficients are in line with the results of Rajan and Zingales (1995), Antoniou et al. (2002) and De Jong et al. (2008) who all observed a negative relationship between market to book ratio and leverage. We find individual differences in the coefficients, where we observe the coefficient in Sweden and Finland to be comparatively large. Thus, our results indicate differences in how capital structure choices are made in high-growth firms compared to low-growth firms. Where firms with a high market-to-book value in Sweden and Finland, who experience growth, tend to be less reliant on debt.

Examining liquidity (LIQ), the model continues to estimate negative coefficients for Denmark, Sweden, and Finland. The observations for Swedish and Finnish firms are significant at the 1% level. The negative relationship aligns with the predictions of the pecking order theory, stating that firms with easily convertible assets will convert current assets, especially accounts receivable, to fund new investments rather than issue debt. Prior research by Antoniou et al. (2002) and De Jong et al. (2008) also found results in line with the pecking order theory, indicating a negative relationship between liquidity and leverage. When using market rather than book values of leverage, we find liquidity to be an insignificant determinant of capital structure for Danish firms. The weakening of significance may indicate that market values do not reflect the impact of liquidity as well as book values, given how the metric is calculated. However, the observations of Norwegian firms indicate a positive relationship at the 10% level, aligning with the predictions of the trade-off, cash flow, and debt overhang theories. The trade-off theory states that firms with high liquidity also face a lower risk of bankruptcy due to their ability to pay for their short-term debt obligations, thus increasing the accessibility of debt. The presence of large-scale government ownership could explain the significance for Norwegian firms, as creditors may be more willing to providing financing, knowing that large firms have government backing, lowering the risk of financial distress.

For size, we now observe more significant results compared to the model using book values of equity. We find size to be a significant determinant in Denmark, Sweden, and Norway, at 1%, 5%, and 5% respectively. In Denmark and Sweden, the model indicates an inverse

relationship between size and the market value of leverage. The negative relationship is in line with the predictions of the pecking order theory, stating that larger firms may have greater internal financing capacity due to higher profits and cash flows. Titman and Wessels (1988) observed evidence supporting the pecking order theory of size being negatively related to leverage.

However, we observe a positive relationship in Norway, aligning with the predictions of the trade-off, cash flow and debt overhang theories. The positive relationship observed in Norway can be explained by the cash flow theory, which suggests that firms with stable cash flows can change their capital structure more dynamically. The energy & transportation sector in Norway has experienced significant growth in demand over recent years and can expect stable cash flows in the future. The cash flow theory argues that in sectors where constant cash flows is expected, capital structure can be adapted more dynamically, thereby explaining a positive relationship between size and leverage. The results obtained for Norwegian firms are in line with those of Rajan and Zingales (1995), Antoniou et al. (2002), Frank and Goyal (2003), Antoniou et al. (2008), De Jong et al. (2008), who all observe a positive relationship.

We find significant differences in revenue volatility (REVV) compared to the regression model presented in Table (6.3) - *Regression results using book value of equity*. Using market value of leverage, revenue volatility demonstrates a statistically significant relationship with leverage at the 1% level in Norway and Finland. Antoniou et al. (2002) find, consistent with our results, that revenue volatility affects capital structure differently depending on the country examined. Our model predicts a positive relationship for all countries, which can be explained by the developed capital markets and bankruptcy laws in the Nordics. In the Nordics, debtholders have substantial creditor rights, which makes them willing to provide financing even in uncertain times. The positive, significant relationship suggests that companies in Norway and Finland have the capacity to service debt obligations well beyond their current debt levels. As a result, the debtholders may consider volatility in revenue to be less critical. Conversely, for Danish and Swedish firms revenue volatility does not appear to be a significant determinant of capital structure when employing market value of leverage.

We find non-debt tax shield to be a statistically significant determinant of capital structure for Danish and Swedish firms at the 1% level, furthermore, non-debt tax shield is significant at the 5% level for Norwegian firms. Examining the non-debt tax shields, we find evidence of cross-country differences in the sample. The observations for Sweden and Norway oppose the predictions of the trade-off theory, which expects a positive relationship between leverage and non-debt tax shields. The coefficients of 0,584 and 0,982, respectively, from Sweden and Norway, suggest that a one percent increase in non-debt tax shields increases the leverage by 0,584 and 0,982 units. Our observations are in line with prior empirical research (Antoniou et al., 2002, Antoniou et al., 2008,Frank and Goyal, 2009) who all observed a positive relationship. On the other hand, the statistically significant observation in Denmark with a coefficient of -1,178 is in line with the trade-off theory as the advantages gained from non-debt tax shields reduces the net benefits of tax deductions related to interest payments. We hypothesize that the negative coefficient observed in Denmark is likely due to the significant presence of the pharmaceutical sector, known for having a high proportion of intangible assets. Since these assets are subject to amortization instead of depreciation, the non-debt tax shield for Danish pharmaceutical firms could be close to zero in certain years. However, in other years, there may be significant annual tax benefits due to substantial amortization charges.

Our model suggests a negative relationship between leverage and tangibility. The observations for Finland, Sweden, and Denmark is statistically significant at the 1%, 5%, and 10% levels, respectively, while not showing statistical significance for Norwegian firms. Previous cross-country research by Rajan and Zingales (1995), Antoniou et al. (2002), Frank and Goyal (2008), De Jong et al. (2008), all observe a positive relationship. According to our model, there is a negative relationship between tangibility and leverage. This aligns with the predictions of the pecking-order theory, which suggests that firms that possess higher amounts of tangible assets depend more on internal financing from retained earnings rather than debt financing.

The comparatively large coefficient for Finland is likely due to the prominent manufacturing and trade & services sector. As seen in 6.2 - *Mean Balance Sheet*, Finnish firms show a relatively large portion of tangible assets compared to their Nordic peers. Moreover, we hypothesize that the insignificant observation for Norwegian firms results from the

close relationship between Norwegian public firms and lenders. As firms with government ownership might face reduced demand for collateral when issuing debt.

Altman´s Z-score is negatively related to leverage for all four countries at the 1% level. The model predicts similar results when using both the book and the market value of equity. The observed coefficients in Denmark, Norway, and Finland exhibit similar expected reductions in leverage as bankruptcy risk decreases. Examining the coefficients, we find that Swedish firms on average reduce their debt by a smaller margin than their Nordic peers, as indicated by an observed coefficient of -0.0018. This implies that with a one percent increase in the Z-score, Swedish firms, on average, reduce their debt by 0.018 units. This trend may possibly, but not exclusively, be explained by the large technology sector in Sweden. Our results align with our predictions as the growing technology sector is known for its heavy reliance on equity financing due to its relatively high bankruptcy risk and substantial growth potential. Furthermore, our results are in line with those of Frank and Goyal (2003), who found Z-score to be a statistically significant determinant of capital structure with negative coefficients for all firms in their sample. Swedish firms have the lowest debt-to-equity ratio in the Nordics, as shown in Table 6.2. This aligns with the findings of Frank and Goyal (2003), who observed the lowest Z-score coefficient for firms with low debt-to-equity value.

The proxy for target debt levels, lagged debt, exhibits a statistically significant impact on capital structure for firms in Finland at the 1% level. We find lagged debt to have no predictive power in capital structure choices for Danish, Swedish, and Norwegian firms when examining market values of equity. Our results suggest that Danish, Swedish, and Norwegian firms do not have target debt levels, but determine their debt levels based on other metrics, aligning with the predictions of the pecking order theory. On the other hand, our results suggest that Finnish firms exhibit evidence of having target debt levels in line with the prediction of the trade-off theory. Examining the regression results, together with the observations in Table 6.2 - *Mean Balance Sheet*, one can observe how finish firms over the past 15 years have shown significantly less reliance on long-term debt, in the form of non-current liabilities. Thus, our model suggest that firms with a generally lower duration of debt contracts show signs of having target debt levels.

Our model predicts a statistically significant and positive relationship between corporate tax rate (TAX) and leverage for all countries at the 1% level. Notably, the positive coefficients are identical in Denmark and Norway at 0.017 and in Sweden and Finland at 0.04. These results are consistent with the trade-off theory, predicting a positive relationship due to firms' desire to fully benefit from the interest tax shield, given that interest payments are tax-deductible. The observed similarities in coefficients may stem from minimal differences in tax codes across the four countries, shown in Figure (3.1) - *Tax Rates 2007-2022*. Prior research, such as Antoniou et al. (2008) and Frank and Goyal (2009) , observed negative coefficients for tax. However, they also note that tax can influence debt policies differently from country to country, depending on the specific tax codes employed in the respective nations.

Furthermore, inflation and GDP do not significantly influence capital structure in the Nordics when employing the market value of leverage. Our results suggest that the macroeconomic environment contributes to a smaller extent on capital structure decisions than originally anticipated.

Our model suggests a positive relationship between term-spread (TS) and leverage in Denmark, Sweden, and Finland at the 1% level while not exhibiting explanatory power of capital structure choices in Norway. The model suggests that Danish, Swedish, and Finnish firms for the past 15 years have increased their debt levels in periods with low interest rates and predictions of future economic growth. The observations for Danish, Swedish and Finnish firms are in line with the predictions of the trade-off theory. Antoniou et al. (2002) argue that a positive relationship between term spread and leverage could be explained by similarities in the accessibility of debt. In our sample, this may indicate that Danish, Swedish, and Finnish banks incentivize firms to issue additional debt during periods of high term spreads.

In summary, when employing market values of leverage, our results suggest differing results from those observed in Table 6.3 - *Book Value of Equity Regression results*. Our model now predicts a negative relationship between market-to-book value and leverage for all countries. We find profitability and tax to have a positive relationship with leverage. Revenue volatility is significant in Norway and Finland, showing positive coefficients. Tangibility exhibits a negative relationship in Denmark, Sweden, and Finland. Our model

suggests a negative relationship between size and leverage for Danish and Swedish firms, while we observe a positive relationship for Norwegian firms. Furthermore, that non-debt tax shield seems to impact leverage for firms in Sweden and Norway positively. However, in Denmark, firms tend to reduce their leverage as the non-debt tax shield increases. Thus, our findings indicate cross-country differences as determinants show varying degrees of impact on capital structure choices in the Nordics.

7 Conclusion

This thesis examines listed, non-financial Nordic firms from 2007 to 2022 to determine factors that significantly impact capital structure choices. We use total debt-to-capital as the dependent variable, considering the book value and market value of equity. As independent variables, we use 13 firm- and country-specific metrics proven by previous empirical research to be significant determinants of capital structure in other countries.

Our results suggest that revenue volatility and lagged debt are only statistically significant determinants of capital structure in certain countries. Thus, these variables do not serve as key determinants of capital structure in the Nordics. Additionally, our results indicate that inflation and GDP growth are not significant determinants.

Examining the book value of total debt-to-capital, our results suggest the following six variables as significant determinants of capital structure: Market-to-book value, liquidity, profitability, non-debt tax shields, Altman´s Z-score, and term-spread.

Examining the market value of total debt-to-capital, market-to-book value, liquidity, profitability, non-debt tax shields, Altman´s Z-score and term-spread remain statistically significant and reliable determinants of capital structure. Furthermore, size, tangibility, and tax are significant determinants of capital structure when using the market value of equity.

The determinants of capital structure vary across the Nordic countries, indicating that capital structure decisions are country-specific. We argue that differences in ownership structures and sectoral composition are key factors impacting the observed differences.

8 Thesis Limitations

In conducting our research on the determinants of capital structure in Nordic countries, several limitations have been identified that could influence the conclusions. The study does not examine interest rates, which are central in capital structure decisions. The exclusion of interest rates could lead to an incomplete understanding of how capital structure decisions are made across the Nordics. Another notable limitation is the exclusion of non-listed firms from the study. The focus on publicly traded firms means the findings may not entirely represent the broader business environment. Including non-listed firms could influence the results, offering a more comprehensive view of capital structure dynamics for Nordic firms.

Lastly, this thesis finds bankruptcy risk as a significant determinant of capital structure. However, it does not explore the costs associated with bankruptcy. Therefore, we suggest future research to examine how bankruptcy costs, varying across different sectors, impact capital structure decisions.

References

Adam, T. R., & Goyal, V. K. (2008). The investment opportunity set and its proxy variables. *The Journal of Financial Research*, *31*(2), 41–63. https://doi.org/10.1111/j.1475-6803.2008.00231.x

Andersen, R. (2008). *Modern methods for robust regression*. SAGE.

Antoniou, A., Guney, Y., & Paudyal, K. (2002). Determinants of corporate capital structure: Evidence from european countries. https://www.researchgate.net/publication/239504636

Antoniou, A., Guney, Y., & Paudyal, K. (2008). The determinants of capital structure: Capital market-oriented versus bank-oriented institutions. *Journal of Financial and Quantitative Analysis*, *43*(1), 59–92. https://www.researchgate.net/publication/227406434

Baker, H. K., & Martin, G. S. (2011). *Capital structure and corporate financing decisions: Theory, evidence, and practice*. Wiley.

Bancel, F., & Mittoo, U. R. (2004). Cross-country determinants of capital structure choice: A survey of european firms. *Journal of International Business Studies*, *35*(3), 201–231. https://doi.org/10.1057/palgrave.jibs.8400094

Barclay, M. J., Jr., C. W. S., & Morellec, E. (2006). On the debt capacity of growth options. *Journal of Business*, *79*(1), 365–405. https://www.jstor.org/stable/10.1086/497404

Berk, J. D., & DeMarzo, P. M. (2020). *Corporate finance, global edition* (5th ed.). Pearson Education Limited.

Cronqvist, H., & Nilsson, M. (2003). Agency costs of controlling minority shareholders. *The Journal of Financial and Quantitative Analysis*, *38*(4), 695–719. https://www.jstor.org/stable/4126762

Dallochio, M., Le Fur, Y., Quiry, P., Vernimmen, P., & Salvi, A. (2017). Capital structure and the theory of perfect capital markets. In *Corporate finance* (pp. 589–600). John Wiley Sons, Ltd. https://doi.org/10.1002/9781119424444.ch32

De Angelo, H., & Masulis, R. (1980). Optimal capital structure under corporate and personal taxation. *Journal of Financial Economics*, *8*(1), 3–29. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1482270

De Jong, A., Kabir, R., & Nguyen, T. T. (2008). Capital structure around the world: The roles of firm- and country-specific determinants. *Journal of Banking and Finance*, *32*(9), 1954–1969. https://doi.org/10.1016/S0378-4266(08)00011-3

De Jong, A., Verbeek, M., & Verwijmeren, P. (2010). Firms' debt–equity decisions when the static tradeoff theory and the pecking order theory disagree. *Journal of Banking and Finance*, *34*(5), 1943–1957. https://doi.org/10.1016/j.jbankfin.2010.08.007

Demirgüç-Kunt, A., & Levine, R. (1999). *A cross-country comparison of banks, markets and development*. The World Bank. https://books.google.no/books?id=8XFFO-MK13QC

Dissanaike, G., Lambrecht, B. M., & Saragga, A. (2001). Differentiating debt target from non-target firms: An empirical study on corporate capital structure [Working Paper]. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=293103

Dobbins, L., & Jacob, M. (2016). Do corporate tax cuts increase investments? *Accounting and Business Research*, *46*(7), 731–759. https://doi.org/10.1080/00014788.2016.1192985

Federal Reserve Bank of New York. (2016). *Market liquidity after the financial crisis* (Staff Reports No. 796) (Accessed: 2023-12-15). Federal Reserve Bank of New York. https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr796.pdf

Frank, M. Z., & Goyal, V. K. (2003). Capital structure decisions [Working Paper]. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=410920

Frank, M. Z., & Goyal, V. K. (2008). Trade-off and pecking order theories of debt. In *Handbook of empirical corporate finance* (pp. 135–202). Elsevier. https://doi.org/10.1016/S1574-0730(07)02005-8

Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? *Financial Management*, *38*(1), 1–37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

Giannetti, M., & Laeven, L. (2008). Pension reform, ownership structure, and corporate governance: Evidence from a natural experiment. *The Review of Financial Studies*, *21*(5), 2173–2212. https://doi.org/10.1093/rfs/hhn042

Gleason, K. I., & Klock, M. (2006). Intangible capital in the pharmaceutical and chemical industry. *The Quarterly Review of Economics and Finance*, *46*(2), 300–314. https://doi.org/10.1016/j.qref.2005.03.001

Goergen, M. (2012). *International corporate governance*. Pearson, Harlow, England. https://search.worldcat.org/title/international-corporate-governance/oclc/756767681

Graham, J. R., & Harvey, C. R. (2001). The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics*, *60*(2-3), 187–243. https://doi.org/10.1016/S0304-405X(01)00044-7

Harris, M., & Raviv, A. (1991). The theory of capital structure. *The Journal of Finance*, *46*(1), 297–355. https://doi.org/10.1111/j.1540-6261.1991.tb03753.x

Hoechle, D. (2007). Robust standard errors for panel regression with cross-sectional dependence. *The Stata Journal*, *7*(3), 281–312.

James, C., & Scott, J. (1977). Bankruptcy, secured debt, and optimal capital structure. *Journal of Finance*, *32*(1), 1–19. https://www.jstor.org/stable/2326898

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

Keefe, M. O., & Yaghoubi, M. (2016). The influence of cash flow volatility on capital structure and the use of debt of different maturities. *Journal of Corporate Finance*, *38*, 18–36. https://doi.org/10.1016/j.jcorpfin.2016.03.005

Khalfan, T. M., & Wendt, S. (2020). The impact of ownership concentration on payout across nordic firms. *Journal of Corporate Finance*, *64*, 101704. https://doi.org/10.1016/j.jcorpfin.2020.101704

Kraus, A., & Litzenberger, R. H. (1973). A state-preference model of optimal financial leverage. *The Journal of Finance*, *28*(4), 911–922. https://doi.org/10.1111/j.1540-6261.1973.tb01415.x

La Rocca, M., La Rocca, T., & Cariola, A. (2011). Capital structure decisions during a firm's life cycle. https://www.researchgate.net/publication/225650340_Capital_Structure_Decisions_During_a_Firm's_Life_Cycle

Leary, M. T., & Roberts, M. R. (2014). Do peer firms affect corporate financial policy? *The Journal of Finance*, *69*(1), 139–178. https://www.jstor.org/stable/43611058

Mayer, C. (1990). Financial systems, corporate finance, and economic development. In *Asymmetric information, corporate finance, and investment* (pp. 307–332).

University of Chicago Press. https://www.nber.org/system/files/chapters/c11477/c11477.pdf

Modigliani, F., & Miller, M. H. (1963). Corporate income taxes and the cost of capital: A correction. *American Economic Review*, *53*, 433–443.

Morellec, E. (2001). Asset liquidity, capital structure, and secured debt. *Journal of Financial Economics*, *61*(2), 173–206. https://doi.org/10.1016/S0304-405X(01)00059-9

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, *5*(2), 147–175. https://doi.org/10.1016/0304-405X(77)90015-0

Myers, S. C. (1984). The capital structure puzzle. *The Journal of Finance*, *39*(3), 574–592.

Myers, S. C. (2003). Financing of corporations. In *Handbook of the economics of finance* (pp. 215–253). Elsevier. https://doi.org/10.1016/S1574-0102(03)01014-3

Ozkan, A. (2001). Determinants of capital structure and adjustment to long run target: Evidence from uk company panel data. *Journal of Business Finance Accounting*, *28*(9-10), 1751–1782. https://doi.org/10.1111/1468-5957.00370

Porta, R. L., Lopez-De-Silanes, F., & Shleifer, A. (2002). Government ownership of banks. *Journal of Finance*. https://doi.org/10.1111/1540-6261.00422

PwC. (2023). Corporate taxes, tax credits and incentives [Accessed: 2023-04-15]. https://taxsummaries.pwc.com

Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? some evidence from international data. *The Journal of Finance*, *50*(5), 1421–1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

Thomsen, S., & Rose, C. (2004). Foundation ownership and financial performance: Do companies need owners? *European Journal of Law and Economics*, *18*, 343–364. https://doi.org/10.1023/B:EJLE.0000049205.67570.0c

Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. *The Journal of Finance*, *43*(1), 1–19.

Van Horne, J. C., & Wachowicz, J. M. (2001). *Fundamentals of financial management*. Google Bøker.

Welch, I. (2004). Capital structure and stock returns. *Journal of Political Economy*, *112*(1), 106–131. https://www.jstor.org/stable/10.1086/379933

Wheelock, D. C., & Wohar, M. E. (2009). Can the term spread predict output growth and recessions? a survey of the literature. *Federal Reserve Bank of St. Louis Review*, *91*(5), 419–440. https://research.stlouisfed.org

Wilcox, R. R. (2012). *Introduction to robust estimation and hypothesis testing* (3rd ed.). Elsevier Inc.

Wooldridge, J. M. (2020). *Introductory econometrics - a modern approach* (7th). Cengage Learning.

World Bank. (2023). Gdp (current us$) - norway, sweden, finland, denmark. https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=NO-SE-FI-DK

YCharts. (2023). Market capitalization of listed companies. https://ycharts.com/indicators/norway_market_capitalization_of_listed_companies_usd

Appendices

A Variables, Calculations and Sources

Table A.1: Variable Definitions, Calculations and Sources

Variable	Acronym	Calculation	Source
Debt-to-capital Book value	DTCB	$\frac{\text{Total Debt}_t}{\text{Total Debt}_t + \text{Book Value of Total Equity}_t}$	Compustat
Debt-to-capital Market value	DTCM	$\frac{\text{Total Debt}_t}{\text{Total Debt}_t + \text{Market Value of Total Equity}_t}$	Compustat
Market-to-Book Value	MBV	$\frac{\text{Market Value of Equity}_t}{\text{Book Value of Equity}_t}$	Compustat
Liquidity	LIQ	$\frac{\text{Total Current Assets}_t}{\text{Total Current Liabilities}_t}$	Compustat
Profitability	PRO	$\frac{\text{EBITDA}_t}{\text{Total Assets}_t}$	Compustat
Size	SIZE	$\ln(\text{Total Sales}_t)$	Compustat
Revenue Volatility	REVV	$\log(\text{Revenue}_t) - \text{average}(\log(\text{Revenue}))$	Compustat
Non-debt Tax Shields	NDTS	$\frac{\text{Depreciation \& Amortization}_t}{\text{Total Assets}_t}$	Compustat
Tangibility	TAN	$\frac{\text{Net Property, Plant \& Equipment}_t}{\text{Total Assets}_t}$	Compustat
Altman's Z-score	Z	$1.2\left(\frac{\text{Working Capital}}{\text{Total Assets}}\right) + 1.4\left(\frac{\text{Retained Earnings}}{\text{Total Assets}}\right) + 3.3\left(\frac{\text{EBIT}}{\text{Total Assets}}\right) + 0.6\left(\frac{\text{Market Capitalization}}{\text{Total Liabilities}}\right) + 0.999\left(\frac{\text{Total Revenue}}{\text{Total Assets}}\right)$	Compustat
Lagged Debt	LD	$\frac{\text{Total Debt}_{t-1}}{\text{Total Debt}_{t-1} + \text{Book Value of Total Equity}_{t-1}}$	Compustat
Corporate Tax Rate	TAX	Corporate Tax Rate $\times$ 100	PwC
Inflation	INFL	Expected Inflation $\times$ 100	The World Bank
GDP Growth	GDP	$\frac{\text{GDP}_{t+1} - \text{GDP}_t}{\text{GDP}_t}$	The World Bank
Term-Spread	TS	(10 Year Government Bond$_{t-1}$ − 3 Month Government Bond$_{t-1}$) $\times$ 100	The World Bank, Ycharts

B Sectors

Table B.1: Sectoral Composition

Country	Energy & Transportation	Industry & Services	Life Sciences	Manufacturing	Real Estate & Construction	Technology	Trade & Services
Denmark	18%	16%	18%	20%	7%	16%	7%
Finland	7%	11%	2%	31%	13%	20%	16%
Norway	31%	8%	2%	20%	18%	12%	8%
Sweden	6%	8%	5%	21%	11%	32%	17%

The table is based on SIC-Codes to identify which sector firms operate in.
Source:Compustat and U.S. Securities and Exchange Commission (2023).

C Pooled OLS, Fixed effects and Random effects models

Pooled OLS

The pooled OLS (Ordinary Least Squares) regression seeks to minimize the distance between fitted values and the residuals in order to make precise statements about the variables in panel data (Wilcox, 2012). A fundamental limitation of this method arises from the assumption that there is an absence of covariance between the independent variables and unobservable factors in the panel data. For this reason, Pooled OLS may not always be appropriate, especially if unobserved individual effects correlate with the explanatory variables.

Fixed effects

Fixed effects estimation is a statistical method used in econometrics to address unobserved heterogeneity in panel data. The technique transforms the unobserved effects ahead of estimation; more specifically, it splits the unobserved effects into time-variant and time-invariant variables. Deriving the Fixed Effects regression starts with a general model, shown in Equation C.1. It involves including unit-specific or entity-specific dummy variables in the regression model. The method subtracts the time averages from the corresponding variables found in Equation C.2, ensuring that time-constant factors are removed, which makes control of the time-invariant effects unique for each unit possible, as shown in Equation C.3. Consequently, a fixed effects estimator imposes less stringent requirements than a Pooled OLS (Wooldridge, 2020). The fixed effects estimator can be expressed as Equation C.4

As the main objective of the fixed effects method is to eliminate the time-invariant effects, the fixed effects approach allows for correlation between the independent variables and the time-invariant error terms. Consequently, the fixed effects method controls the model for harmful homoscedasticity in the time-invariant effects (Wooldridge, 2020). Conversely, the fixed effects methodology exhibits certain constraints, particularly in its efficiency when applied to panel data characterized by many time periods, with a small number of observations within each period.

$$y_{it} = \beta_0 + \beta_1 x_{1,it} + \cdots + \beta_j x_{j,it} + \alpha_i + u_{it} \tag{C.1}$$

Where:

$$\begin{aligned} y_{it} &= \text{The dependent variable for firm } i \text{ at time } t \\ \beta_0 &= \text{The intercept} \\ \beta_j &= \text{The coefficient associated with } x_{j,it} \\ x_{j,it} &= \text{The independent variable } j \\ \alpha_i &= \text{The unobserved time-invariant effects} \\ u_{it} &= \text{The unobserved idiosyncratic error} \end{aligned}$$

$$\bar{y}_{it} = \beta_0 + \beta_1 \bar{x}_{1,it} + \cdots + \beta_j \bar{x}_{j,it} + \alpha_i + \bar{u}_{it} \tag{C.2}$$

$$(y_{it} - \bar{y}_{it}) = (\beta_0 - \beta_0) + \beta_1 (x_{it} - \bar{x}_{1,it}) + \cdots + \beta_j (x_{j,it} - \bar{x}_{j,it}) + (a_i - a_i) + (u_{it} - \bar{u}_{it}) \tag{C.3}$$

Through deriving Equation C.3 we find:

$$\hat{y}_{it} = \hat{\beta}_1 \hat{x}_{1,it} + \cdots + \hat{\beta}_{j,it} \hat{x}_{j,it} + \hat{u}_{it} \tag{C.4}$$

Random effects

Random effects are also an estimation method often applied to panel data. In contrast to fixed effects, the random effects method is based on additional assumptions beyond those of fixed effects, including no correlation between unobserved time-varying effects and all explanatory variables. Furthermore, the model requires the expected value and the variance of the unobserved time-varying effect to be constant (Wooldridge, 2020). In this context, the method is perceived to be stricter than the fixed effects approach due to its additional assumptions. Consequently, the random effects method is beneficial for panel data sets that meet these criteria. However, if the assumption of no correlation between all explanatory variables and the unobserved time varying effects is violated, the estimator produces unreliable results.

D Robust regression

Robust estimations refers to "any regression method that limits the influence of unusual observations on the values of the estimates" (Andersen, 2008, p.4).Hoechle (2007) does, however, state that employing robust statistics will neither assess nor correct for the violated assumptions but will warrant robust inference by heightening the requirements for statistical inference.

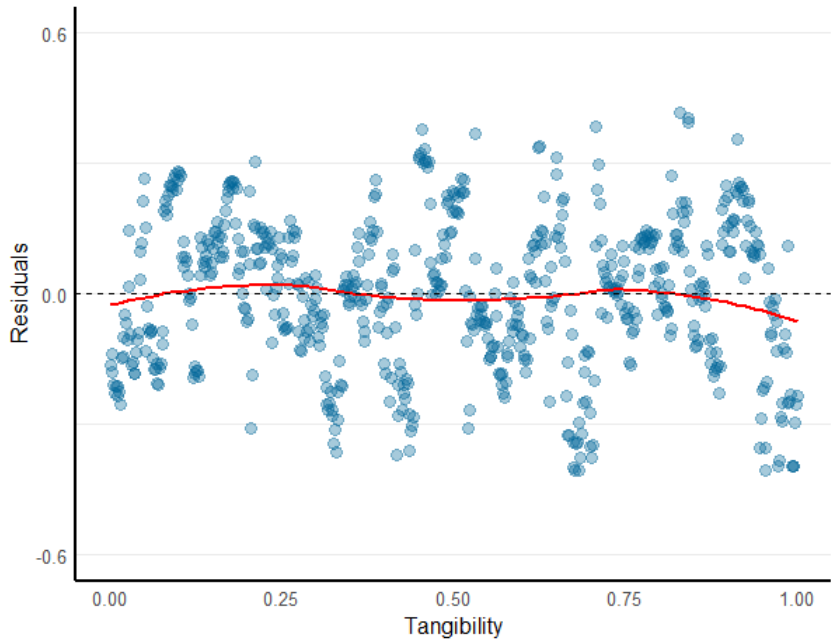
E Testing The MLR Assumptions

In the following, we will discuss the assumptions of Multiple Linear Regression (MLR). Due to the large number of outputs, we have chosen to present results for Norway exclusively. The tests have been conducted across all four countries and have consistently produced similar results.

E.1 Linearity - Assumption 1

The key assumption of linearity states that there should be a linear relationship between the parameters in the model. To test this assumption, we have utilized an augmented component plus residual plot. O'Hara Hines & Carter (1993) emphasize the importance of graphical methods in the preliminary stages of an analysis to screen variables and their relationships, and they note that augmented partial residual plots are useful for examining the relationship between the dependent and independent variables. Based on the results of these plots, we conclude that the assumption of linearity is satisfied. The results from the linearity test is found below E.1.

Figure E.1: Augmented Component-Plus-residual plot for Tangibility (Norway)



Source: Compustat

In this plot, the red line represents the actual relationship between the dependent variable Total debt-to-capital and the independent variable Tangibility. Each dot signifies an individual observation's residual, and the dashed line denotes the linear relationship. In this model, the red line closely aligns with the dashed black line, showing only slight variations. This consistency allows us to conclude that the linear relationship assumption holds. We have applied this test across all independent variables in relation to the dependent variables and have found similar results for all.

E.2 Random Sampling - Assumption 2

The second assumption states that we should have a random sample of 'n' observations following the population model outlined under Assumption MLR (Wooldridge, 2020). There are no specific tests that can be conducted to determine whether this assumption is satisfied, thus a discussion is needed. Regarding our sample, there are several arguments both for and against the fulfilment of this condition. On one hand, it could be argued that the exclusion of financial firms and non-listed firms leads to a violation of random sampling. On the other hand, the inclusion requirements are broad, and a random selection has been made given the limitations we have outlined. Assuming that our sample is representative and does not deviate significantly from the total population, we argue that the assumption of random sampling is met.

E.3 No perfect Colinearity - Assumption 3

Assumption number three suggest that none of the independent variables in the sample should be constant, and there should be no exact relationships among the independent variables (Wooldridge, 2020). This means we should not find independent variables that are strongly correlated. Observing two or more independent variables that are strongly correlated might lead to multicollinearity. To test for this, we have utilized the correlation matrix, Table E.1 and a VIF (Variance Inflation Factor) **??** test. The correlation matrix is used to check for any high correlations between the independent variables. According to Johannessen et al. (2010), potential problems of multicollinearity may arise if the correlation among independent variables exceeds 0.7.

Table E.1 - *Correlation Matrix*, illustrates how the variables in the data set are related and correlate with each other. There are no signs of harmful multicollinearity as there are no correlation surpassing the widely accepted benchmark of ($>$0.7) for correlation between explanatory variables.

Table E.1: Correlation Matrix

Variables	DTCB	DTCM	MBV	LIQ	PRO	SIZE	REVV	NDTS	TAN	TAX	INFL	GDP	Z	TS	LD
DTCB	1,000***														
DTCM	0,297***	1,000***													
MBV	-0,172***	-0,751***	1,000***												
LIQ	-0,520***	-0,206***	0,193***	1,000***											
PRO	-0,004	-0,449***	0,414***	0,019	1,000***										
SIZE	0,285***	-0,142***	-0,027	-0,204***	0,305***	1,000***									
REVV	-0,139***	0,013	0,124***	0,223***	-0,175***	-0,308***	1,000***								
NDTS	0,053***	-0,087***	0,132***	-0,163***	0,294***	-0,006	-0,071***	1,000***							
TAN	0,061***	0,040**	-0,060***	-0,064***	0,107***	0,215***	-0,042**	0,419***	1,000***						
TAX	0,026	0,127***	-0,070***	0,129***	-0,027	0,066***	0,166***	-0,061***	0,057***	1,000***					
INFL	0,028	-0,012	0,020	-0,002	0,033*	0,057***	0,129***	0,011	0,022	0,015	1,000***				
GDP	0,002	0,006	0,015	0,003	0,041**	0,019	0,048**	-0,040**	-0,001	0,039**	0,179***	1,000***			
Z	-0,226***	-0,776***	0,673***	0,171***	0,666***	0,218***	-0,082***	0,056***	-0,065***	-0,068***	-0,026	-0,004	1,000***		
TS	0,869***	0,256***	-0,174***	-0,471***	0,009	0,287***	-0,157***	0,040**	0,048**	0,025	0,021	0,008	-0,185***	1,000***	
LD	0,002	0,092***	-0,122***	-0,071***	-0,033*	-0,023	-0,138***	-0,047**	-0,072***	0,011	-0,093***	0,144***	-0,047**	-0,029	1,000***

*** - Statistical significance at 1% level, ** - Statistical significance at 5% level, * - Statistical significance at 10% level.
Source: Compustat

Furthermore, Table E.2 - *VIF Test* suggests that multicollinearity does not seem to be a significant issue in our model, due to no values being greater than the threshold VIF value of 10.

Table E.2: VIF Test

Variable	**Norway VIF**	**Sweden VIF**	**Denmark VIF**	**Finland VIF**
MBV	2.88	3.93	4.04	2.66
LIQ	1.45	1.16	2.33	1.79
PRO	2.04	5.06	1.54	2.20
SIZE	2.01	3.07	1.50	1.46
REVV	1.51	1.61	1.21	1.21
NDTS	1.90	1.33	1.80	1.85
TAN	1.37	1.52	1.70	1.63
TAX	1.43	1.22	1.24	1.11
INFL	1.35	1.09	1.09	1.13
GDP	1.27	1.22	1.08	1.08
Z	2.43	7.57	4.54	3.14
TS	1.50	1.42	1.97	1.80
LD	1.10	1.29	1.18	1.05

Source: Compustat

E.4 Zero Conditional Mean - Assuption 4

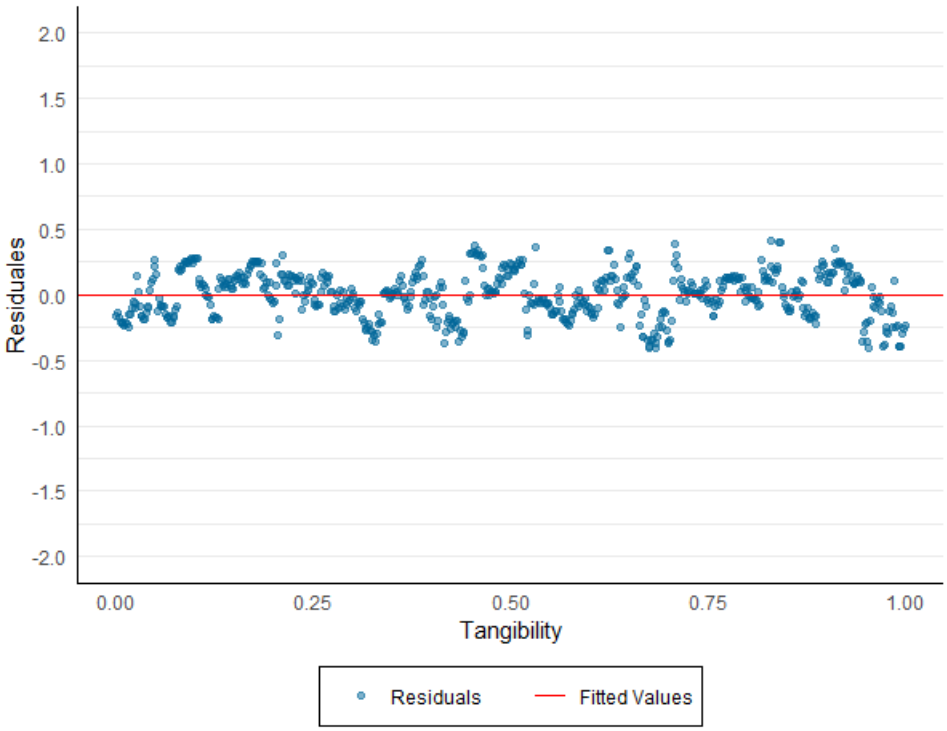
According to Wooldridge (2020), the assumption of zero conditional mean states that the error term should have an expected value of zero given any values of the independent variables. This assumption is at risk of violation if there are omitted variables that are correlated with one or more of the independent variables in the model. The likelihood that our model has not accounted for certain variables, potentially correlated with the explanatory variables, is present. This situation could arise due to factors such as lack of data availability, measurability, among others. Given this potential issue, it is plausible that this assumption may be violated.

E.5 Homoscedasticity - Assumption 5

Homoscedasticity, the fifth assumption, refers to the condition where the error term in the model should have the same variance given any value of the explanatory variables. Through the Breusch-Pagan Lagrange multiplier test, White's test, and residual plots have tested our model for homoscedasticity. The results are presented in E.3, E.4 and E.2 below. The Breusch-Pagan test checks for heteroscedasticity, and a significant result suggests varying residual variances in the regression model. Here, with all Prob $>$ Chi^2 values at 0.000, the test indicates heteroscedasticity in all models across the countries, rejecting the null hypothesis of constant variance in the residuals (homoscedasticity). Additionally, the results of the White's test support the presence of heteroscedasticity in the Total Debt to Capital data for both the (Book) and (Market) multiples. This is consistent across all examined countries.

The results indicate that the assumption of constant residual variance in the regression model is being violated.

Figure E.2: Residual Plot For Tangibility (Norway)



Source: Compustat

Table E.3: Breusch-Pagan Test Results

Country	Model	Chi2	Prob>Chi2
Sweden	Total Debt to Capital (Book)	94.486	0.000
Sweden	Total Debt to Capital (Market)	187.117	0.000
Denmark	Total Debt to Capital (Book)	55.846	0.000
Denmark	Total Debt to Capital (Market)	97.924	0.000
Norway	Total Debt to Capital (Book)	50.186	0.000
Norway	Total Debt to Capital (Market)	107.803	0.000
Finland	Total Debt to Capital (Book)	115.645	0.000
Finland	Total Debt to Capital (Market)	158.220	0.000

Source: Compustat

Table E.4: White's Test Results for Norway

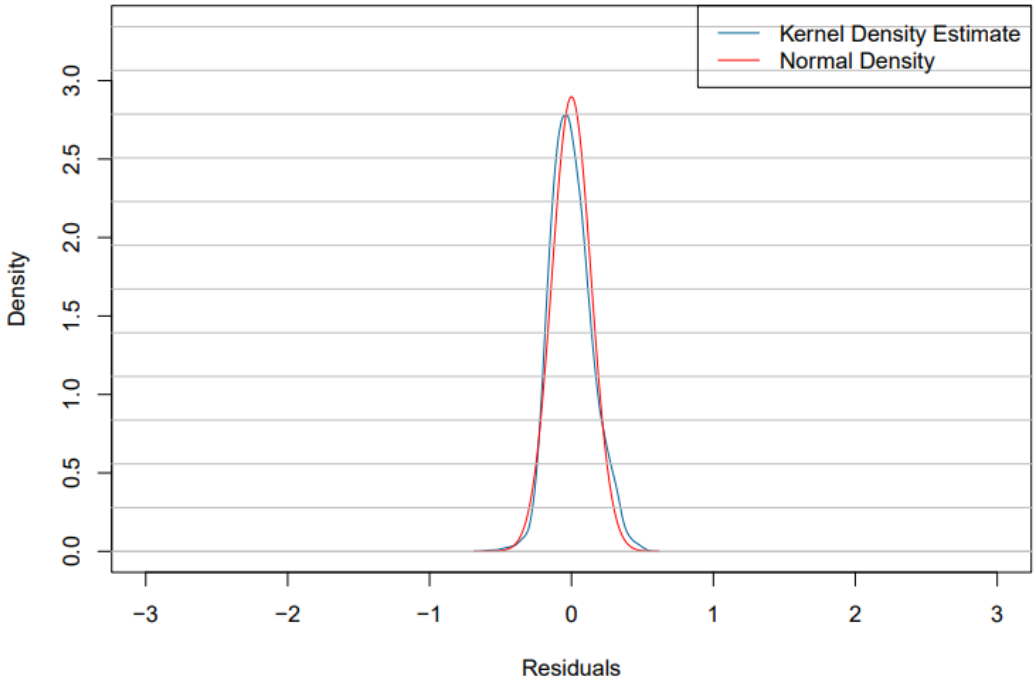
	Total Debt to Capital (Book)			Total Debt to Capital (Market)		
Source	**Chi2**	**Prob>Chi2**	**df**	**Chi2**	**Prob>Chi2**	**df**
Heteroscedasticity	205.526	0.000	104	327.830	0.000	104
Skewness	9.322	0.001	13	43.439	0.000	13
Kurtosis	1.558	0.106	1	3.268	0.035	1

Source: Compustat

E.6 Normality - Assumption 6

The assumption of normality states that the error terms are independent and normally distributed (Wooldridge, 2020). To assess this assumption, we have provided illustrative plots testing the residuals. The Kernel Density Distribution of Residuals (Figure E.3) and plots the residuals of each regression against a normal distribution. The Q-Q Plot of residuals (Figure E.4) is utilized to plot the quantiles of the regression model against the quantiles of a normal distribution and is complemented by Standardized Normal Probability Plots (Figure E.5).

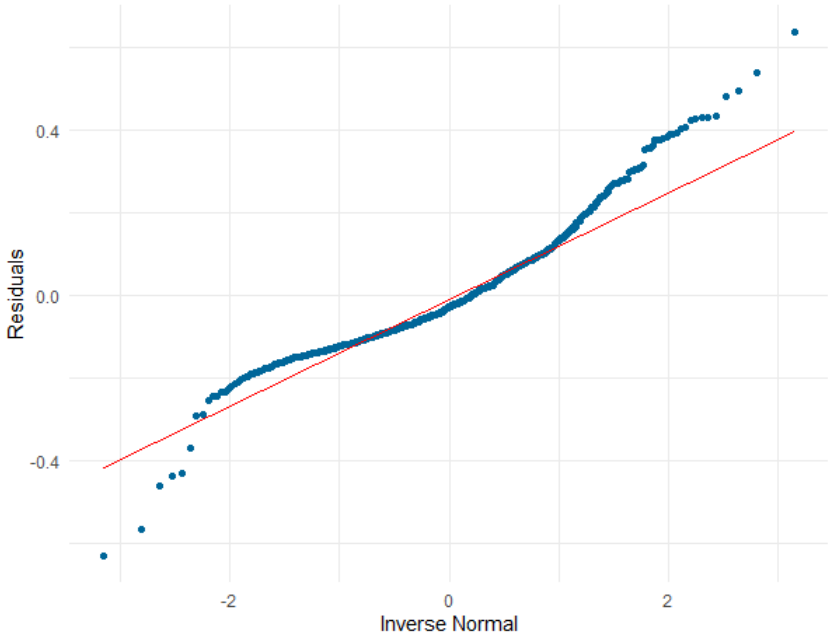
Figure E.3: Kernel Density Distribution of Residuals (Norway)



Source: Compustat

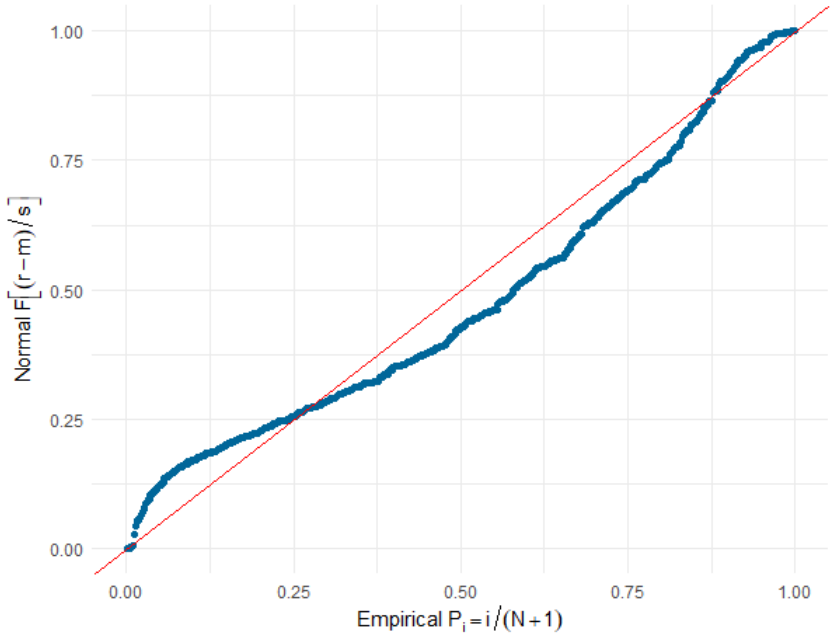
In the Kernel Density distribution the red line shows the expected normal distribution, while the blue line traces the actual distribution of the residuals. There is a close alignment between the two lines, indicating that the residuals approximate a normal distribution. This suggests that the assumption of normality for the regression model's residuals holds. We observe similar results for both dependent variables and across various countries.

Figure E.4: Q-Q Plot of Residuals (Norway)



Source: Compustat

Figure E.5: Standarized Normal probability Plot (Norway)



Source: Compustat

The Q-Q and standardized probability plots serve as tools for verifying the normality of residuals in our regression model. The red line within these plots represents the theoretical normal distribution. Observations closely clustered around this line, as seen in our plots,

support the conclusion that the distribution of the sample aligns well with a normal distribution, confirming that the normality assumption for our model is met.

All plots support the assumption of normality in our data. We have also carried out a Skewness and Kurtosis test that backs up the assumptions of normality found in Table E.5.

Table E.5: Skewness and Kurtosis Test Results for Norway

Model	Observations	Pr(Skewness)	Pr(Kurtosis)	Adj Chi^2	Prob>Chi^2
Total Debt to Capital (Book)	616.000	0.000	0.000	780.875	0.000
Total Debt to Capital (Market)	616.000	0.000	0.000	143.455	0.000

Source: Compustat

E.7 No Serial Correlation - Assumption 7

The assumption of no autocorrelation suggests that there should be no correlation between regression residuals across successive time intervals. In our data set, this assumption is violated. This is confirmed through a Wooldridge test for autocorrelation, where we observe a Prob>F value of 0 for all countries, which strongly indicates the presence of autocorrelation in our data set.

Table E.6: Wooldridge Test for Serial Correlation

Country	Model	F-statistic	Prob > F
Denmark	DTCB	33.75	0.00
Denmark	DTCM	176.05	0.00
Finland	DTCB	70.21	0.00
Finland	DTCM	156.83	0.00
Norway	DTCB	6.34	0.01
Norway	DTCM	151.19	0.00
Sweden	DTCB	9.52	0.00
Sweden	DTCM	135.48	0.00

Source: Compustat

Testing for autocorrelation has been done through a "Standard Wooldrigde test". The null hypothesis states "No serial correlation in the residuals". Based on the test results the null hypothesis is violated, indicating that there is evidence of serial correlation in the residuals.