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Determinants of Capital Structure in Finnish Listed Firms

Evidence from Nasdaq Helsinki Non-Financial Companies During Economic Instability

Accounting and Finance,
Department of Accounting and Finance
Bachelor's thesis

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Bachelor's thesis**Subject:** Accounting and Finance**Author:** Tuomas Virtanen**Title:** Determinants of Capital Structure in Finnish Listed Firms**Supervisor:** Ph.D. Javad Rajabalizadeh**Number of pages:** 52 pages + appendices 7 pages**Date:** 13.12.2025**Abstract**

This thesis examines the determinants of capital structure decisions of firms from 2020 to 2024. Capital structure theory has been studied extensively, as it is a crucial financial decision for any company. The years 2020-2024 were exceptionally unstable for Finnish firms, largely due to the COVID-19 pandemic and the war in Ukraine. The crisis period may have reshaped the determinants of capital structure since firms operated under a new set of conditions, such as constrained liquidity and disruptions in supply chains.

In this thesis, capital structure is examined through leverage, and the theoretical framework comprises the trade-off theory, the pecking order theory, and the market timing theory. The empirical analysis is done via a panel data regression spanning across 112 firms and 5 years, resulting in a panel containing 516 firm-year observations, creating a robust sample size. The model is estimated using ordinary least squares (OLS) with industry and year fixed effects.

The results show that profitability and liquidity are associated with lower leverage, and tangibility with higher leverage. Growth opportunities have a modest negative effect on leverage, while no systematic connections emerge for prior stock returns, firm size, business risk, or non-debt tax shields. During the COVID-19 pandemic, the ability of most determinants to explain leverage weakened, except for liquidity. Overall, Finnish listed firms' leverage choices reflect elements of the trade-off and pecking order theories, with limited support for market timing.

Keywords: Trade-off theory, Pecking order theory, Market timing theory, Capital structure, Leverage, COVID-19, Ukraine war

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Tiivistelmä

Tämä tutkielma tarkastelee yritysten pääomarakenteeseen liittyvien päätösten määräytymistä vuosina 2020–2024. Pääomarakenneteoriaa on tutkittu laajasti, sillä se on keskeinen rahoituspäätös kaikille yrityksille. Vuodet 2020–2024 olivat poikkeuksellisen epävakaita suomalaisille yrityksille, erityisesti COVID-19-pandemian ja Ukrainan sodan vuoksi. Kriisiaika saattoi muuttaa pääomarakenteen määääviä tekijöitä, koska yritykset toimivat uusissa olosuhteissa, joille olivat tyypillisiä esimerkiksi likviditeetin kiristyminen ja häiriöt toimitusketjuissa.

Tässä tutkielmassa pääomarakennetta tarkastellaan velkavivun näkökulmasta, ja teoreettinen viitekehys koostuu trade-off teoriasta, pecking order teoriasta ja market timing teoriasta. Empiirinen analyysi toteutetaan paneeliregressiolla, joka kattaa 112 yritystä ja viisi vuotta, sekä yhteensä 516 yritys-vuosihavaintoa ja siten vahvan otoskoon. Malli estimoidaan pienimmän neliösumman menetelmällä (OLS) toimiala- ja vuosikiinteillä vaikutuksilla.

Tulokset osoittavat, että kannattavuus ja likviditeetti ovat yhteydessä alhaisempaan velkaantuneisuuteen, kun taas vakuuskelpoiset varat korkeampaan velkaantuneisuuteen. Kasvumahdollisuuksilla on maltillinen negatiivinen vaikutus velkaantuneisuuteen, mutta aiemmilla osaketuotoilla, yrityksen koolla, liiketoimintariskillä tai velkaan liittymättömillä verosuojilla ei havaita systemaattisia yhteyksiä. COVID-19-pandemian aikana useimpien selittävien tekijöiden vaikutus velkaantuneisuuteen heikkeni likviditeettiä lukuun ottamatta. Kokonaisuudessaan suomalaisten pörssiyritysten velkaantumispäätökset heijastavat sekä trade-off-että pecking order teorian elementtejä, kun taas market timing teorialle löytyy vain rajallista tukea.

Avainsanat: trade-off teoria, pecking order teoria, market timing teoria, pääomarakenne, velkaantuneisuus, COVID-19, Ukrainan sota

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1 Introduction

A company's assets can be financed through two main sources: equity, which represents the owners' share in the business, and debt, which consists of external liabilities. Equity can be divided into external and internal equity. External equity refers to capital raised through issuing shares. On the other hand, internal equity refers to capital generated through retained earnings (Knüpfer, 2024). The theories of capital structure try to explain the optimal balance between debt and equity. To this day, there is no universal theory to explain capital structure decisions; however, multiple theories exist that attempt to solve the puzzle from various perspectives (Myers, 2001).

Deciding between debt and equity is one of, if not the most, crucial financing decisions a firm can have. When a firm requires financing for an investment, it must decide how to obtain it, either by issuing new equity or by taking on more debt. A firm must find a capital structure that maximizes its market value with the lowest cost of capital: this is often referred to in the literature as the optimal capital structure (Chaklader and Chawla, 2016).

The optimal capital structure is needed to maximize shareholder value, which is widely considered to be the single most important objective for a firm. Understanding capital structures is especially important for management. When figuring out what the optimal capital structure could be, the different determinants that affect the capital structure need to be understood. These determinants and capital structure theories give management a stable framework on which they base their capital structure decisions (Chaklader and Chawla, 2016).

Previous studies, such as Frank and Goyal (2009), reported liquidity, tangibility, market-to-book ratio, profitability, and size to be statistically significant in explaining leverage; However, these kinds of studies have not yet been applied to Finnish listed firms during the exceptionally turbulent years of 2020 to 2024. This study aims to fill this research gap. Overall, peer-reviewed studies of the topic are almost non-existent in the Finnish context.

Finland is a small bank-oriented economy. Rajan and Zingales (1995) studied the G7 countries and thus also discussed the effects of bank-oriented versus market-oriented countries. One could assume that there would be major differences in the level of leverage depending on the orientation. However, they did not find evidence for systematic deviations in the results between the different types of countries. They attributed this to the differences being reflected more in the decision between public and private financing, rather than in the use of leverage. Although stronger bank involvement makes debt financing more available, firms might not be willing to increase their debt after a certain level.

The COVID-19 pandemic and the war in Ukraine make the economic environment of the years 2020 to 2024 particularly interesting. The war has not significantly affected the turnover of Finnish firms engaged in trade with Russia, implying that business with Russia has only been a small share of their overall operations. This can partly be attributed to the fact that the volume of business with Russia had already decreased from 2014 onwards due to the conflict in Crimea. Data shows that small firms (turnover below 10 million euros) have suffered most of the negative impact of the war. On the contrary, for large firms (turnover of at least 50 million euros), the war has had no clearly observable average impact (Valtion Taloudellinen Tutkimuskeskus, 2022). This is rather important to note since this thesis is conducted using firms listed on Nasdaq Helsinki, so therefore large firms. Due to these reasons, empirical analysis in this thesis most likely won't show the effects of the war.

COVID-19 caused major liquidity problems for firms, thus increasing the risk of default. Compared to the 2008 financial crisis, the usage of credit lines was similar, but the amount and intensity of drawdowns were much higher during the COVID-19 pandemic (Acharya and Steffen, 2020). Huang and Ye (2021) suggest that lower leverage firms have more liquidity and safety, making them more resilient in a case where cash flows abruptly stop. The impact of COVID-19 varied substantially across industries, but for most firms, the pandemic had effects either as a supply-side disruption, a demand-side disruption, or a combination of both.

1.1 Research Questions

This study aims to research how certain determinants explain the capital structure of Finnish listed firms from 2020 to 2024. The results for the determinants are also discussed in the context of the trade-off theory, the pecking order theory, and market timing theory to provide explanations. There is one main research question.

Q1: *Which determinants best explain the leverage of Finnish non-financial listed firms between 2020 and 2024?*

To support the main research question and ensure a coherent analytical structure, three sub-questions are formulated. These sub-questions deepen the examination of the determinants of leverage by clarifying their empirical effects and linking these effects to the capital structure theory, while also taking into account the possible period-specific effects. This enables the thesis to move beyond simply identifying which determinants matter.

Q2: *How strong and statistically significant are the effects of individual determinants on the leverage of Finnish non-financial listed firms, and what is the direction of these effects?*

Q3: *Are the observed empirical relationships between leverage and its determinants consistent with the predictions of the trade-off theory, the pecking order theory, or the market timing theory?*

Q4: *Has the COVID-19 pandemic or the Ukraine war affected the determinants of capital structure in Finnish non-financial listed firms between 2020 and 2024?*

The determinants are tested with a linear regression to find out if individual determinants have an increasing (+) or a decreasing effect (-) on leverage. The relationships between the determinants and leverage will be examined to find out which of the theories offer suitable explanations for the results, thus a connection between empirical results and the theoretical concepts is formed. Sub-period regressions are conducted to test for period-specific effects.

1.2 Limitations

This study focuses on three widely recognized capital structure theories: the trade-off theory, the pecking order theory, and the market timing theory. Other perspectives, such as the agency theory and the signalling theory, are excluded to maintain a refined focus on the chosen theories, which are the most suitable to explain the determinants' relations to leverage in this specific context. Furthermore, the analysis is limited to firm-specific determinants of leverage that have been linked to these three theories in previous studies. Although some macro-level determinants are excluded, the market-to-book ratio and prior stock returns allow for capturing the influence of markets on capital structure decisions through valuation and past performance. This choice ensures the regression model captures firm-level characteristics.

The study is restricted to firms listed on Nasdaq Helsinki; additional exclusions are made for certain industries, and also if the required data cannot be obtained for a specific firm. The temporal scope covers the years 2020-2024, a period of significant economic instability caused by the COVID-19 pandemic and geopolitical tensions due to the war in Ukraine. The restricted timeframe allows for a concentrated examination of how these external shocks may have affected the determinants of capital structure. On the other hand, this means that the results cannot necessarily be generalized beyond this period.

1.3 Structure

This thesis is divided into six chapters. The second chapter provides an overview explaining the fundamentals and the key differences between the trade-off theory, the pecking order theory, and the market timing theory. In addition, the Modigliani and Miller capital structure irrelevance theorem is

discussed briefly to give a background of the field of research. In the third chapter, hypotheses are formulated regarding the relationships between each determinant and leverage. The chapter includes a thorough review of previous studies and theory concerning each determinant. The determinants are chosen, and the hypotheses are then derived from the previous empirical studies. The fourth chapter describes the research data and methodology. It explains the sample selection, variable definitions, and the econometric approach applied. The fifth chapter includes the empirical results. The relations between the determinants and leverage are examined. The results are compared to the hypotheses developed earlier. In addition, the findings are also discussed in the light of the existing theories and previous studies. It also includes the back testing used to assess the quality of the data and model accuracy. The sixth and last chapter concludes the thesis. It summarizes the main results and discusses possible implications. Furthermore, suggestions for future research on the topic are also presented as seen fit.

2 Capital Structure Theories

In this chapter, relevant capital structure theories are examined in different sections to provide the theoretical framework for the thesis. To begin, Modigliani and Miller's capital structure irrelevance theorem is examined since it is the forefather of all the other theories. The second section introduces the trade-off theory, which is based on the idea that an optimal level of leverage exists. After that, the pecking order theory and the market-timing theory, both of which do not rely on the existence of a predetermined optimal level of leverage, are presented (Saif-Alyousfi et al., 2020).

2.1 Modigliani and Miller Irrelevance Theorem

In 1958, Modigliani and Miller (M&M) introduced a framework that became a cornerstone of financial theory. Prior to their paper, there was no widely accepted explanation of how a firm's capital structure affects its value. Their model is based on the assumption of perfectly efficient markets with no taxes, transaction costs, or bankruptcy costs. Furthermore, the M&M theorem be divided into three propositions (Ahmeti and Prenaj, 2015).

The first proposition states that, in a world with perfect capital markets, the capital structure of a firm is irrelevant to its market value. It makes no difference whether a company finances itself with debt, equity, or any combination of the two, since investors can create their own preferred mix by adjusting their personal portfolios. An investor can either buy shares of a levered firm or invest in an all-equity firm and borrow personally, thereby creating what is known as homemade leverage (Ross, 1988).

The second proposition states that as the leverage of a firm rises, so does the cost of equity. Therefore, a firm's weighted average cost of capital (WACC) is not affected by its leverage (Ahmeti and Prenaj, 2015; Villamil, 2008).

The third proposition states that a firm's dividend policy is irrelevant to its market valuation. Furthermore, it is said that the firm's earning power and the risk of its assets affect it instead (Modigliani and Miller, 1961).

The M&M theorem has been subject to extensive criticism, mainly due to its highly restrictive assumptions. Nevertheless, it is the cornerstone of capital structure research and, therefore, must be acknowledged as a theoretical foundation before addressing other theories. In this thesis, the M&M theory will not be applied further, as more refined theories have since been introduced.

2.2 Trade-off theory

The trade-off theory is one of the most established theories of capital structure. There are plenty of other theories that have been derived from it since then. The roots of the theory extend back to 1963, when Modigliani and Miller extended their original irrelevance theory by introducing taxes. With taxes taken into account, debt financing is typically less costly than equity because interest payments are tax-deductible, which lowers the effective cost of debt. As a result, increasing the use of debt can reduce a firm's WACC, assuming the firm has sufficient taxable income to take advantage of the tax shield. In theory, this would imply that firms should rely entirely on debt financing, yet in reality, this is not the case (Tahvanainen, 2003).

In addition, Kraus and Litzenberger (1973), Robichek and Myers (1966), Stiglitz (1972), and Scott Jr. (1976) introduced bankruptcy costs. With more debt, a firm is at greater risk of being unable to pay its required interest payments and defaulting. Bankruptcy imposes direct costs such as legal and consulting fees. On the other hand, there are indirect costs that can appear even if a firm is not yet in financial distress but faces a significant possibility of bankruptcy in the future. These costs are due to a lack of trust by parties of interest, such as customers and suppliers (Berk et al., 2019).

By adding bankruptcy costs, the theory was born, and it states that a firm must consider both the tax benefits of debt and the costs of financial distress caused by leverage, thus creating a trade-off between the two (Ai et al., 2020).

The basic model is known as the static trade-off theory. It states that a firm reaches its optimal value at the level of debt where the additional benefits of borrowing are exactly offset by the additional costs of borrowing. Therefore, when the tax advantages of extra debt exceed the expected costs associated with financial distress, higher leverage increases the firm's value (Shyam-Sunder and Myers, 1999).

The static trade-off model is limited to a single period; therefore, it does not take into account the adjustments made due to changes in asset values. In addition, it does not include transaction costs, meaning that firms could have vast sums of debt and capture a large tax shield without carrying the risks by implementing a repurchasing strategy.

A dynamic trade-off model tackles these flaws. It is illustrated in a continuous-time framework, and transaction costs are included when assessing the optimal capital structure. Therefore, firms will allow their capital structure to fluctuate within certain boundaries due to the costs of recapitalizing. While not being at the target capital structure, a firm shows adjustment behaviour towards that target.

Abdeljawad et al. (2013) found that the further the firm is from its target, the faster the adjustments towards the target capital structure. Due to the conditions in this world, “the value of an optimally levered firm can only exceed the value of its unlevered assets by the amount of transactions costs incurred to lever them” (Fischer et al., 1989).

Despite extensive criticism by the likes of Titman and Wessels (1988) and Myers (1993) the trade-off theory has maintained its position as a dominant capital structure theory, and in previous studies it has been linked to capital structure determinants included in this thesis. Determinants such as tangibility, size, profitability, growth, liquidity, and non-debt tax shields have been found consistent with the trade-off theory in previous literature (Chaklader and Chawla, 2016).

2.3 The Pecking Order Theory

The pecking theory was first introduced by Myers (1984) and was influenced by Myers and Majluf (1984). According to the studies, firms prefer internal financing over external financing due to adverse selection. Adverse selection can occur when one has more information available than the other, which can lead to an inefficient outcome, since the less-informed party is unable to make an accurate assessment of the situation. The theory does not rely on the existence of a predetermined optimal level of leverage but rather ranks different types of financing in a hierarchy from the first option to the least preferred choice, as the name of the theory suggests (Frank and Goyal, 2003).

The theory develops from dropping the M&M idea of everyone having equal information and instead allowing information differences across parties. This phenomenon is referred to as asymmetric information, which means that managers possess knowledge that investors do not have access to. Asymmetrical information can lead to adverse selection and thus the misvaluation of a firm. Therefore, to minimize adverse selection, firms prefer to use financing sources that are least exposed to misvaluation and least information sensitive (Denis, 2012).

The three financing sources are ranked from most preferred to least preferred in the following order: first, internal funds such as retained earnings, second, debt, and equity as the last option. Regarding this theory, “preferring” implies that firms resort to debt only after retained earnings are spent, and turn to equity only when debt is no longer viable (Frank and Goyal, 2007). Retained earnings do not create adverse selection problems because no outside party needs to assess the firm’s value, since financing comes from within the company. Low-risk debt also involves only limited adverse selection, since its valuation depends mainly on market interest rates rather than on managers’ private information. Equity, however, is most exposed to adverse selection since issuing new shares may

signal to investors that managers believe the firm to be overpriced. As a result, investors demand compensation for this information risk and are willing to buy shares only at a discount. This may cause managers to turn down viable investments if they would require issuing information-sensitive securities. From an investor's standpoint, equity carries more information risk than debt, and therefore, the demanded premium is higher for equity financing than for debt financing (Frank and Goyal, 2003; Berk et al., 2019).

In the pecking order theory, there are exceptions to the rule. If a firm is already heavily leveraged, taking on additional debt, as the theory suggests, can jeopardize the whole business. Companies with a lot of intangible assets tend to use equity financing as it allows them to grow while keeping bankruptcy costs in control (Brealey, 2008).

In previous empirical studies, determinants such as profitability, firm size, tangibility, and growth opportunities have been aligned with the pecking order theory. However, as was pointed out earlier, many of these determinants have been found to support the trade-off theory, so there are contradictions between studies (Chaklader and Chawla, 2016). This forms an interesting research setting.

2.4 The Market Timing Theory

The market timing theory was popularized by Baker and Wurgler (2002), who presented substantial empirical evidence in support of the theory. The theory suggests that managers make financing decisions based on market conditions instead of having a predetermined target leverage level. These so-called periods of opportunity arise when the cost of equity fluctuates over time, in relation to other forms of financing. In contrast to the trade-off and pecking order theories, the market timing theory does not assume the capital markets to be perfectly efficient. Managers assess the market conditions for equity and debt and choose the more favourable one. If neither is suitable, a firm can postpone issuances, and vice versa, meaning if conditions look exceptionally good, funds can be raised even if financing is not needed right now (Frank and Goyal, 2009; Huang and Ritter, 2004).

The theory states that firms should use equity-based funding when their share prices are high, and on the other hand, buy their own stock when it is underpriced. Issuing debt is done when market interest rates are notably low. The success of market timing can be seen when examining long-run stock returns. Surveys have also been conducted to ask managers themselves if they time the markets. (Baker and Wurgler, 2002). Graham and Harvey (2001) reported that over half of managers agree that market timing is used regarding issuances. The market timing theory has previously successfully

predicted the relationship between leverage and factors such as prior stock returns, market-to-book ratio, and expected inflation. However, the theory cannot explain the relationships between all the different determinants and leverage. Nonetheless, it is examined further in this thesis since it gives a valuable additional perspective (Frank and Goyal, 2009).

3 Determinants and Hypotheses Development

This chapter presents the dependent variable and the determinants of capital structure that will be included in the empirical analysis. The determinants are chosen primarily based on what previous studies have identified as the most significant factors influencing leverage. Especially Frank and Goyal (2009) have influenced the choices. In the study, they extensively researched the methods that can be used to decide which determinants to include. They used the Akaike information criterion and Bayesian information criterion described by Hastie et al. (2001) to sort out essential determinants from their long list of possible ones. On the other hand, the limitations of this study have also been considered in the process of choosing the determinants for the model. At every stage, the determinants will be critically assessed, and if necessary, corrective actions, such as refinement or exclusion, will be taken. The main independent variables are profitability, tangibility, market-to-book ratio and prior stock returns. Hypotheses regarding the expected effects on leverage are formulated for these determinants based on the results of previous studies and suggestions of the capital structure theories. The control variables are size, liquidity, non-debt tax shields, and business risk. Industry-specific effects are controlled for through industry fixed-effects. The expected relations of the control variables to leverage are discussed based on previous studies and the capital structure theories. The choice of these independent and control variables will be justified later in their respective sections of this chapter.

3.1 Leverage as the Dependent Variable

Since this thesis studies capital structure by using leverage as a proxy, the definition of leverage is a key consideration. Previous literature on this topic has implemented several different definitions of leverage. Commonly, some type of debt ratio is used. The differences between the definitions mostly stem from the choice between book values and market values (Frank and Goyal, 2009). One perspective suggests that managers focus on book leverage since debt financing is closely backed by a firm's current assets than by its anticipated growth opportunities. In addition, the fluctuations of financial markets can make managers think market leverage is unreliable to guide corporate financial policy (Myers, 1977).

On the other hand, Welch (2004) states the fact that the book value of equity can be zero or less and that the book value of equity is not relevant for managers since it is mostly used to equalize both sides of the balance sheet.

This thesis uses market leverage as the dependent variable. According to Frank and Goyal (2009), this choice is particularly important since it can have major effects on the empirical results. The prior literature often claims that results are robust to different variations of the leverage definition. This is not what Frank and Goyal (2009) found when using book leverage, since the effects of market-to-book, firm size, and expected inflation factors all lost reliability, which they had when testing with market leverage. They interpreted this to endorse the view of Barclay et al. (2006), who suggest that “book leverage is backward-looking, while market leverage is forward-looking”. This perspective implies that the factors named earlier operate through capturing aspects of the firm's expected future, not its past. This is aligned with the general assumption that markets are forward-looking.

In conclusion, the definition of leverage can severely alter the results of empirical tests on the determinants of capital structure, and no clear consensus exists for the definition. Thus, in addition to the tests using market leverage as the main dependent variable, robustness tests will also be conducted with book leverage.

3.2 Independent Variables

3.2.1 Profitability and H1 Development

Profitability refers to a firm's ability to produce earnings and thus returns for shareholders. It is often measured with a ratio that is relative to a firm's resources, such as assets, equity, or revenue (Niskanen and Niskanen, 2007; Hirdinis, 2019).

According to the trade-off theory, more profitable firms face a lower risk of financial distress, which reduces their expected bankruptcy costs. In addition, higher profitability allows firms to make greater use of the tax advantages associated with interest deductions. When these factors are considered together, the benefits of debt outweigh its downsides. Therefore, higher profitability is expected to be associated with higher leverage (Frank and Goyal, 2009).

The pecking order theory expects profitability and leverage to be negatively related. Profitable firms have more retained earnings and prefer internal funding before external funding to avoid information asymmetry. Thus, the more profitable a firm is, the less leverage it tends to use (Adair and Adaskou, 2015).

Several studies across different contexts and settings have reported a negative relationship between profitability and leverage. Frank and Goyal (2009) studied the factors regarding the capital structure decisions of publicly traded American firms during the period ranging all the way from 1950 to 2003

and found a negative relation between leverage and profitability the way as Fama and French (2002) did. Daskalakis and Psillaki (2008) found similar results regarding SMEs in France and Greece. Titman and Wessels (1988) also arrived at the same conclusion in their study of American firms. The majority of the previous literature finds the relationship between leverage and profitability to be negative and aligned with the pecking order theory.

It is, however, important to acknowledge that the literature is not unanimous. Some studies, such as Chaklader and Chawla (2016), have reported a positive relationship between profitability and leverage, although such findings remain in the minority.

There are other perspectives beyond the pecking order theory. Current profitability can also be an indication of investment opportunities. Therefore, interpretation issues emerge as in the finance literature before, like in Kaplan and Zingales (1997). For this reason, it is difficult to create a robust proxy for investment opportunities. If the determinant is measured inaccurately, it may fail to control for the growth opportunities embedded in a firm's profitability. As the market-to-book ratio is also included in the regression model, this concern is explicitly addressed by examining possible correlations between the two and conducting multicollinearity diagnostics.

With all these factors in mind, based on the previous studies and the limitations of this thesis, profitability is expected to be negatively related to leverage explained by the pecking order theory. Accordingly, the first hypothesis is formulated as follows:

H1: *Profitability has a negative relationship with leverage*

3.2.2 Tangibility and H2 Development

Tangibility refers to the composition of a firm's assets in terms of how much is tangible and how much is intangible. Tangible assets include physical items such as property, plant and equipment. On the other hand, intangible assets consist of non-physical resources like patents, trademarks, and goodwill, to name a few. The value of tangible assets is easier to assess for external entities compared to intangible assets, making them better suited to be used as collateral. In the case of bankruptcy, tangible assets have a market value, while intangible assets can often lose their value completely (Frank and Goyal, 2009).

The pecking order theory states that the relationship between tangibility and leverage is negative. Since valuating intangible assets is not straightforward, asymmetrical information is high, making

equity issuances more costly. According to this, firms with few tangible assets are highly levered (Harris and Raviv, 1991). Nonetheless, this is not regarded as the general assumption.

The more common prediction considering the relationship between tangibility and leverage is aligned with the trade-off theory of capital structure. Tangible assets serve as collateral, thereby supporting debt since collateral reduces the expected costs of financial distress caused by leverage. This suggests a positive relationship between tangibility and leverage (Frank and Goyal, 2009).

Studies such as Frank and Goyal (2009) on U.S. firms, Rajan and Zingales (1995) on Q-7 countries, and Booth et al. (2001) on developing countries all provide robust evidence from several different contexts. Some studies, such as Bauer (2004) and Karadeniz et al. (2009), have found a negative relationship between tangibility and leverage. However, these conclusions are in the minority and have been attributed to exceptional contextual factors such as firm size and industry characteristics, as can be seen in the mentioned studies. All in all, the trade-off theory provides the most convincing explanation for the relationship between tangibility and leverage, so accordingly, the second hypothesis is:

H2: *Tangibility has a positive relationship with leverage*

3.2.3 Growth Opportunities and H3 Development

In this thesis, the market-to-book asset ratio is used as the proxy for growth opportunities. It is a widely recognized measure of a firm's growth. The market-to-book asset ratio is a market-based measure that reflects how the market values a firm's future growth prospects relative to the accounting value of its existing assets. Therefore, it can be misleading if the stock is mispriced; that said, it is nonetheless the most reliable measure among its counterparts (Frank and Goyal, 2009).

According to the pecking order theory, growth opportunities should increase debt. For a growing firm, investment opportunities expand over time, meaning that retained earnings alone are often not enough to finance new projects, so more funding is needed. In the pecking order theory, debt is second in the hierarchy, so leverage tends to increase as growth opportunities increase (Frank and Goyal, 2009).

On the contrary, the trade-off theory predicts a negative relationship between growth opportunities and leverage. This is partly explained by future growth opportunities being intangible capital assets that add value to a firm but cannot be collateralised. As a result, a firm with plenty of growth opportunities is believed to have low tangibility, leading to debt not being as viable (Titman and

Wessels, 1988; Chen, 2004). Growth also reduces free cash flow problems since most extra funds are reinvested, meaning the disciplining effect of debt is diminished. In addition, growth increases the potential costs of financial distress, as growing firms rely more on uncertain future cash flows. All these factors make debt less favourable in the trade-off framework, implying that leverage decreases as growth opportunities increase (Frank and Goyal, 2009).

The market-timing theory also predicts growth opportunities to be negatively related to leverage. A high market-to-book ratio may reflect mispricing in the stock market, implying that the firm's equity is valued above its fundamental level: under the market timing theory, firms take advantage of this situation by raising capital through equity issuance instead of debt, which leads to lower leverage. There can also be a mechanical negative relation between the market-to-book ratio and market leverage, due to the market-to-book ratio effect influencing leverage more through a firm's equity value rather than its debt value (Frank and Goyal, 2009). In this thesis, market leverage is studied as the main dependent variable. Still, a regression for book leverage is also included for robustness, due to many reasons, including this possible mechanical negative correlation.

There is no clear consensus on the relationship between leverage and growth opportunities. Empirical evidence suggesting a positive relationship is found in studies like Kester (1986) on Japanese and American manufacturing corporations. A negative relationship is found by Booth et al. (2001) examining developing countries and by Rajan and Zingales (1995) on G-7 countries and Frank and Goyal (2009) on U.S. companies. The relationship between growth opportunities and leverage is predicted to be negative in accordance with the trade-off theory. In addition, potential implications of the market timing theory are acknowledged. Therefore, the hypothesis is as follows:

H3: *Growth opportunities have a negative relationship with leverage*

3.2.4 Prior Stock Returns and H4 Development

The market timing theory states that firms try to capitalize on stock mispricing by strategically timing their equity issuances. In other words, when getting high stock returns, firms should issue equity, thus decreasing leverage. This means that a negative relationship between prior stock returns and leverage is expected. On the contrary, according to the trade-off theory, firms with low market leverage should increase debt levels to adjust towards their optimal leverage, thus suggesting the relationship between stock returns and leverage is positive (Frank and Goyal, 2009).

According to Welch (2004) stock returns are clearly the most important factor in determining leverage, explaining up to 40 percent of the variation in firms' leverage ratios. This stems from the

argument that firms do little to adjust their capital structure changes caused by fluctuations in stock prices. Welch also states that many previously used variables thought to explain capital structure changes mainly appeared significant since they correlated with the excluded dynamics caused by stock price fluctuations. The study was conducted on U.S. corporations in the years.

Deesomsak et al. (2004) also find a negative relationship between stock returns and leverage, which is aligned with the market timing theory. The study was done on Pacific firms. Bayless and Chaplinsky (1991) show that stock price run-ups cause firms to issue equity. They studied U.S. industrial firms.

Due to most of the previous literature supporting the market timing theory prediction, prior stock returns are expected to be inversely related to leverage; therefore, the hypothesis is formulated as follows.

H4: *Prior stock returns have a negative relationship with leverage*

3.3 Control Variables

3.3.1 Industry

There are vast differences between leverage ratios across industries. One suggested reasoning behind this is that managers use industry average leverage as a target to guide their own firms' capital structure decisions (Frank and Goyal, 2009). This finding is supported by Hovakimian et al. (2001), according to the study, firms make adjustments towards the industry average leverage commonly.

On the other hand, it is suggested that industry effects capture the influence of similar external factors that shape the capital structure of firms within the same industry. These effects may arise due to things like shared market conditions, competition, technology, or regulatory aspects, forming a mix of possibly correlated influences (Frank and Goyal, 2009).

The market timing theory implies that industry affects leverage only if the market values of firms are correlated within a certain industry. By contrast, the trade-off theory predicts a positive relationship between industry median leverage and debt (Frank and Goyal, 2009). Bradley et al. (1984) provide evidence supporting this based on a sample of 851 firms representing 25 industries. Frank and Goyal (2009) also find that industry is a significant factor in determining a firm's leverage. In conclusion, industries heavily affect leverage. Therefore, industry fixed effects are

included in the regression model to account for the systematic differences in leverage across industries.

3.3.2 Size

According to the trade-off theory, there is a positive relationship between firm size and leverage. It is suggested that larger firms can withstand more debt because the larger a firm is, the lower the bankruptcy costs. In addition, larger firms tend to be diversified across industries, which decreases default risk, and they can more easily obtain external financing with lower interest rates. Therefore, the benefits from interest tax reduction increasingly outweigh the potential costs of financial distress, as a firm grows in size. Smaller firms having less leverage can also be attributed to financial distress, posing a greater risk of them being forced out of business compared to larger companies. One contributing factor to this is that in smaller firms, managers are often significant stakeholders as well, making them more willing to reallocate their resources to other investments (Ozkan, 2001; Frank and Goyal, 2009).

Rajan and Zingales (1995) demonstrate that firm size affects leverage and the relationship is positive in all G-7 countries except Germany, thereby supporting the interpretation proposed by the trade-off theory. They attribute the exception to the relatively low costs of liquidation compared to continuing business in Germany.

On the contrary, the pecking order theory predicts that firm size and leverage are negatively related. This stems from larger firms being more well-known, which means information asymmetry between management and stakeholders is minimal. According to the pecking order theory, lower information asymmetry makes issuing equity more favourable (Frank and Goyal, 2009).

All in all, the trade-off theory is largely supported in the previous literature; hence, a positive relationship between firm size and leverage is expected.

3.3.3 Liquidity

Liquidity's effect on leverage has two different interpretations. On one hand, firms with more liquidity might lean towards more leverage, because the liquid assets can be used to pay off debt when it's due. This suggests a positive relationship between liquidity and leverage. However, liquid assets can also be used to fund investments. Thus, implying liquidity should decrease leverage (Ozkan, 2001).

According to the pecking order theory, firms with higher liquidity have a lower need for external financing, which supports the negative relationship between liquidity and leverage (Deesomsak et al., 2004).

Omoriegie et al. (2019) found liquidity to be negatively related to debt during economic downturns. In contrast, a positive relation was found during the economic upturn, suggesting firms with higher liquidity can service high debt, which is supported by the trade-off theory.

Ozkan (2001) examined firms from the United Kingdom and found a negative relationship, as did Deesomsak et al. (2004) on Pacific firms. A negative relationship between liquidity and leverage is expected, based on previous literature. This aligns with the pecking order theory and the specific turbulent time frame of the study.

3.3.4 Business risk

Firms whose cash flows and earnings fluctuate more are exposed to higher bankruptcy costs caused by financial distress. This makes debt less favourable to these high-risk firms. In addition, utilizing tax shields is less likely with fluctuating earnings. So, accordingly, the trade-off theory suggests a negative relationship between business risk and leverage (Frank and Goyal, 2009).

The prevailing view in literature is that the pecking order theory predicts that firms with more volatile cash flows have lower leverage and thus more capacity for debt to finance profitable investments when they appear (Fama and French, 2002). An alternative view is that firms with volatile stocks are typically those where investors disagree or frequently change opinion about the firm's value; thus, those firms would have more adverse selection problems. According to the pecking order theory, this makes issuing equity less preferable compared to debt. This suggests that riskier firms have higher leverage (Frank and Goyal, 2009). However, this was not the result Frank and Goyal (2009) documented. In the empirical results, the risk for which the proxy was the variance of stock returns had a negative relationship with all definitions of leverage.

Previous studies have reported mixed evidence regarding the relationship between business risk and leverage. According to Kale et al. (1991), the relationship between risk and leverage is U-shaped, decreasing for low levels of risk and increasing for high levels of risk. This suggests that firms may operate on different parts of the curve depending on the business cycle conditions. So, during stable conditions, debt decreases with risk, but during an economic downturn, debt can increase with risk.

According to Leland (1994) firms with high bankruptcy costs due to high risk have less debt. Bancel and Mittoo (2004), who studied European firms, came to the same conclusion. In this thesis, a negative relationship between risk and leverage is predicted. This stems from it being the most common result in previous literature.

3.3.5 Non-debt tax shields

When issuing debt, a firm benefits from the fact that interest payments can be deducted from tax; however, for this, the firm has to have taxable income to deduct the tax from. Notably, this is not the only way a firm can acquire tax shields. Certain investments can generate non-debt tax shields that are independent of the way a firm finances these investments (Ozkan, 2001).

De Angelo and Masulis (1980) suggest that the marginal advantage of interest being deductible from taxes varies with leverage. Therefore, the target capital structure for a firm should depend on non-debt tax shields that arise, for example, because of depreciation, amortization, and research and development expenditures. These expenses reduce taxable income, thus making the non-debt tax shield a substitute for interest deductions. In other words, larger non-debt tax shields lead to a smaller taxable income, less expected taxes, and a lower benefit from interest tax shields. So accordingly, the relationship between non-debt tax shields and leverage is predicted to be negative by the trade-off theory (Fama and French, 2002).

Fama and French (2002) reported that firms with more non-debt tax shields tend to have less leverage. The study included more than 3000 firms. Frank and Goyal (2009) reported similar results on publicly traded US firms, as did Ozkan (2001) on UK firms.

On the other hand, Titman and Wessels (1988) found that tax shields do not affect a firm's leverage in their study on US firms. Overall, the relationship between non-debt tax shields and leverage is expected to be negative, due to the trade-off theory being the most supported interpretation in previous literature.

Table 1 presents the expected relations between the individual determinants and leverage. For each determinant, only the capital structure theories that supported the assumed sign are marked. If multiple theories predict the same sign, all of them are shown.

Table 1. Expected Signs of Determinants

Determinant	Trade-off theory	Pecking order theory	Market Timing theory
Profitability		-	
Tangibility	+		
Growth opportunities	-		-
Prior stock returns			-
Size	+		
Liquidity		-	
Business risk	-	-	
Non-debt tax shield	-		
Industry			

A plus sign (+) indicates that a positive relationship is expected with leverage, while a minus sign (-) indicates a negative expected relationship.

4 Research Methodology

In this chapter, the methodology used in the thesis is presented, divided into three sections. Firstly, the data sample is discussed. This includes stating sources, exclusions, and describing the final sample itself. In the second part, the specific definitions used for the variables are introduced. The last section presents the regression model and estimation approach used, in addition, econometric considerations of the model are discussed.

4.1 Sampling and Data

The panel data in this thesis is from the London Stock Exchange Group (LSEG) datastream covering Finnish firms listed on the Nasdaq Helsinki over the five years from 2020 to 2024. Before analysis, the dataset was cleaned. Financial sector firms and utilities were excluded because their capital structure decisions are heavily affected by regulations, which could have distorted the regression results. The energy sector, containing only Neste Oyj, was merged with the industrials sector to avoid a single-firm industry category. Some firms are also excluded for not having the required data available. To be precise, firms that have under 3 consecutive years of observations in any of the variables are excluded completely. The original population comprised 134 firms, and after the exclusions, the final sample consists of 112 firms and 516 firm-year observations.

The empirical testing was conducted with RStudio. The program handles missing values by removing the entire yearly observation for a firm whenever any of the variables is missing. As a result, the dataset is an unbalanced panel, since not all firms have observations for the same years. All continuous variables are winsorized at the 1st and 99th percentiles to mitigate the influence of outliers. The winsorization was performed on a pooled basis across the whole sample period for consistency.

After the alterations mentioned earlier, the firms included in the data represent a total of 8 sectors. The sectors are based on the Global Industry Classification Standard (GICS), which is the classification system used in this study. In this section, the term sector is used to remain consistent with the GICS terminology. These same sector definitions are later employed when implementing industry fixed effects, meaning that the terms refer to the same underlying categorization. Most of the firms belong to the industrials sector (34,8 %), the consumer discretionary sector (17%), and the information technology sector (17%) as seen in Table 2.

Table 2. Sector Distribution

Sector	Number of Firms	Share (%)
Materials	8	7.1 %
Industrials	39	34.8 %
Consumer Discretionary	19	17.0 %
Consumer Staples	8	7.1 %
Health Care	8	7.1 %
Information Technology	19	17.0 %
Communication Services	7	6.3 %
Real Estate	4	3.6 %
Total	112	100.0 %

Figures based on the final sample of firms after all exclusions.

Table 3 depicts market leverage statistics of the firms included in the data sample. In 2021, the market leverage of firms decreased to 23%, most likely due to the intense increase in stock prices and, consequently, in market capitalization. From 2022 to 2024, the rise in market leverage has been steady with a cumulative growth of 10%.

Table 3. Capital Structure Statistics

Year	Mean	Minimum	Maximum	Std. Dev.
2020	0.27	0.00020	0.93	0.22
2021	0.23	0.00037	0.81	0.19
2022	0.28	0.0056	0.88	0.20
2023	0.30	0.00079	0.98	0.22
2024	0.33	0.0025	0.86	0.22
Average	0.28	0.0015	0.89	0.21

Market leverages based on the final sample of firms after all exclusions.

4.2 Variable Measurement

The definitions and expected signs of all variables used in the regression are summarized in Appendix 1. The chosen definitions are based on a holistic view that incorporates the consensus of prior literature and, particularly Frank and Goyal (2009), as well as the specific restraints and data availability for this thesis. Therefore, the variable measures reflect both theoretical consistency and

empirical feasibility, given the characteristics of the data sample. In practice, this minimizes mechanical correlations and enhances the comparability of the results to previous empirical studies. Leverage data is collected for the years 2020 to 2024; on the other hand, the explanatory variables are measured one year before leverage from 2019 to 2023, because the values of these variables influence the capital structure decisions made in the following year.

As presented in Appendix 1, the dependent variable, market leverage (LEV), is defined as total debt divided by the sum of total debt and market capitalization. This market-based measure captures the firm's capital structure using current market valuations rather than book values, thus reflecting future expectations and prevailing market conditions.

Now on to the independent variables. Profitability (PROF) is measured as EBIT divided by total assets. This avoids capital structure mechanical correlations that could arise from using profit measures defined after interest expenses, which are directly affected by the firm's leverage. Tangibility (TANG) is defined as net property, plant, and equipment scaled by total assets. The values net of depreciation are used to better reflect the portion of assets that can serve as collateral for debt financing; the majority of previous literature does the same.

The proxy for growth opportunities is the market-to-book assets ratio (GROW), which is calculated as the market capitalization plus book debt divided by book assets. This definition is consistent with the use of market leverage, and it should prevent negative mechanical correlations. Prior stock returns (RET) represent the cumulative raw 12-month stock return from $t-12$ to $t-1$, which is obtained by compounding these monthly returns.

Firm size (SIZE) is measured as the natural logarithm of total assets. The logarithmic transformation improves the normality of the variable's distribution, and since many other variables are scaled by total assets, it also serves as a consistent measure of firm size.

The proxy for Liquidity (LIQ) is the current ratio, which is defined as current assets divided by current liabilities. Business risk (RISK) is captured by the rolling five-year standard deviation of the EBITDA margin, which reflects the variability of operating performance over time. This definition also avoids the bias inherent in equity-based volatility measures, since they mechanically increase with higher market leverage. Non-debt tax shields (NDTS) are measured as depreciation, depletion, and amortization divided by total assets.

4.3 Empirical Model and Estimation

This section describes the empirical strategy used in the thesis. First, the general panel regression and estimation approach is presented. Second, the key econometric considerations for the model are discussed.

4.3.1 General Model and Estimation

The research methodology is based on a linear panel regression estimated using the ordinary least squares method (OLS). In a panel regression setting, the dependent variable is explained simultaneously by multiple explanatory variables. Each explanatory variable receives a coefficient estimate that reflects the magnitude and direction of its effect in the model. Fixed effects are also implemented in the regression. Industry fixed effects represented by $\delta_{\text{IND}(i)}$ control for all industry-specific unobserved heterogeneity, while λ_t represents year fixed effects, absorbing the effects of macroeconomic shocks common across all firms in a given year; this is especially crucial, taking into consideration the period of this study. Firm leverage on year t is represented by $\text{LEV}_{i,t}$. The model uses lagged variables; therefore, firm-level factors observed in year $t - 1$ are represented by $F_{i,t-1}$. The parameters being estimated are constant α and vector β . The error term captures unobserved factors affecting leverage that are not included in the model (Best and Wolf, 2015; Frank and Goyal, 2009).

Equation 1:

$$\text{LEV}_{i,t} = \alpha + \beta' F_{i,t-1} + \delta_{\text{IND}(i)} + \lambda_t + \varepsilon_{i,t} \sim$$

The performance of the regression models is assessed using the adjusted R-squared and the statistical significance of the models. A higher adjusted R-squared indicates that the explanatory variables account for a larger proportion of the variation in the dependent variable. The F-test is used to examine whether the explanatory variables, as a group, have explanatory power.

4.3.2 Econometric Considerations

To be able to produce coefficient estimates legitimately, there are several assumptions regarding the linear regression model. These assumptions can create problems that need to be tested for since the whole model's validity depends on them. Panel data also has its own distinctive complications that should be addressed (Brooks, 2019).

The homoscedasticity assumption requires the error terms to have equal variance across observations. When this condition is violated, and the variance of the errors varies, the model exhibits heteroscedasticity. Heteroscedasticity can affect t-statistics and p-values, altering the significance of the model. Heteroscedasticity is tested with White's test (Brooks, 2019).

Autocorrelation occurs when error terms are not uncorrelated with one another over time. This can be tested with graphical tests such as plotting residuals to look for stereotypical patterns or the Woolridge test (Brooks, 2019). Firm-level clustered standard errors can remove autocorrelation within firms.

OLS relies on the assumption that no significant correlation is found between explanatory variables, meaning that leaving one out of the model would not change the estimated coefficient of the remaining variables. There is always a correlation between the variables in any real context, but to a small degree, it will not cause too much precision loss. A problem arises when explanatory variables are strongly correlated with each other, a phenomenon known as multicollinearity. Therefore, a correlation matrix is examined, and variance inflation factor (VIF) tests are conducted to ensure that multicollinearity is not severe (Brooks, 2019).

To be able to conduct hypothesis tests about parameters, the normality of errors is assumed. Although not critical for a large panel such as in this thesis, it is nevertheless examined to ensure a complete assessment of the model. A residual distribution plot is produced to visually assess the normality. In addition, the Jarque-Bera test is conducted as a formal statistical test (Brooks, 2019).

The possible reverse causality, or in other words, endogeneity, is crucial to be taken into account. In this thesis's context, endogeneity could be seen in leverage decisions affecting variables such as profitability, thus leading to biased coefficient estimates. To mitigate these concerns, all explanatory variables are lagged by one year to ensure that regressors reflect conditions before the leverage decision. Industry and year fixed effects are included to control for unobservable industry-level and time-specific factors that could simultaneously affect both the dependent variable and the explanatory variables. In addition, the crisis period focus can reduce the extent of endogeneity, since exogenous macroeconomic shocks most likely dominate firm-specific decision-making.

Measurement error is another potential issue for variables such as the market-to-book ratio. Measurement error can weaken the estimated relationships and reduce statistical significance. To address this, alternative proxy variables are implemented in robustness checks to capture the same overall concept with different measurement approaches, thus providing consistency for the results.

5 Empirical results

This chapter presents the empirical results. Firstly, descriptive statistics and a correlation matrix are presented; in the second section, the baseline regression results and diagnostics are showcased. Due to the weaknesses in the baseline model, results are also presented using standard errors clustered at the firm level. After that, a book leverage regression is presented as a robustness check. Sub-period regressions are conducted to further study the different periods. Lastly, additional testing, such as regressions with interaction terms are examined.

5.1 Descriptive Statistics

Table 4 reports the winsorized descriptive statistics for all variables used in the main empirical analysis. In detail, the table presents the mean, standard deviation, minimum, 25th percentile, median (50th percentile), 75th percentile, maximum, and the number of observations for each variable. The number of observations varies from 540 to 559 between the different variables. In the regression analysis, only complete firm-year observations are used, which makes the default number of observations across all variables 536. The mean values of the variables imply results that are broadly consistent and not unusual, given the definition of the variables. Growth opportunities measured as the market-to-book assets ratio are skewed to the right, due to the presence of high-valuation growth firms, with the max value being 49.00 compared to the median of 1.130. This skewness raises the mean substantially above the median. A similar pattern can be observed for prior stock returns due to the inherently right-skewed nature of equity returns and large positive outliers even after winsorizing. Overall, the variables behave as expected.

Table 4. Descriptive Statistics

Variable	Mean	Std.Dev	Min	p25	Median	p75	Max	N
LEV	0.280	0.215	0.000198	0.0994	0.240	0.418	0.981	547
PROF	0.0530	0.0916	-0.302	0.0164	0.0592	0.0994	0.277	559
TANG	0.207	0.168	0.000678	0.0745	0.157	0.304	0.695	559
GRW	2.510	5.880	0.258	0.764	1.130	3.950	49.00	558
RET	0.150	0.525	-0.699	-0.178	0.0468	0.349	2.580	540
SIZE	19.600	1.820	15.700	18.400	19.200	20.800	23.800	559
LIQ	1.720	1.380	0.240	1.000	1.340	2.010	10.000	559
RISK	0.0675	0.186	0.00463	0.0144	0.0256	0.0498	1.55	555
NDS	0.0513	0.0301	0.000318	0.0308	0.0469	0.0677	0.170	559

Variable definitions are presented in **Appendix 1**. All variables are winsorized at the 1st and 99th percentiles using pooled winsorization to mitigate the influence of outliers.

In table 5 the Pearson correlation matrix is presented. It depicts the correlations between all of the variables. The correlations between the dependent variable and explanatory variables are calculated with a one-year lag on the explanatory variables' part. On the other hand, the correlations between explanatory variables are not lagged. Many of the correlations are statistically significant; however, the correlations themselves are not alarmingly high, with the correlation of 0.418 between liquidity and risk being the most substantial. Therefore, the pairwise correlations do not indicate the existence of problematic multicollinearity. Additionally, variance-inflating factors (VIF) tests are conducted in the regression diagnostics section to further examine multicollinearity.

Table 5. Correlation Matrix

Variable	LEV	PROF	TANG	GRW	RET	SIZE	LIQ	RISK	NDTS
LEV	1.000***								
PROF	0.246***	1.000***							
TANG	0.173***	0.058	1.000***						
GRW	0.307***	-0.008	-0.080	1.000***					
RET	0.268***	0.392***	-0.031	0.220***	1.000***				
SIZE	0.098*	0.233***	0.255***	-0.176***	-0.090*	1.000***			
LIQ	0.319***	0.064	0.159***	-0.005	0.037	0.152***	1.000***		
RISK	-0.126**	0.309***	-0.119**	0.045	0.007	0.182***	0.418***	1.000***	
NDTS	-0.001	0.282***	0.278***	0.169***	-0.074	0.287***	0.227***	-0.068	1.000***

Variable definitions are presented in **Appendix 1**. All variables are winsorized at the 1st and 99th percentiles using pooled winsorization to mitigate the influence of outliers. ***1% level, **5% level, and *10% level, respectively.

5.2 Baseline Regression Results and Diagnostics

The baseline panel regression model equation is presented next.

Equation 2:

$$LEV_{i,t} = \beta_0 + \beta_1 PROF_{i,t-1} + \beta_2 TANG_{i,t-1} + \beta_3 GRW_{i,t-1} + \beta_4 RET_{i,t} + \beta_5 SIZE_{i,t-1} + \beta_6 LIQ_{i,t-1} + \beta_7 RISK_{i,t-1} + \beta_8 NDTS_{i,t-1} + \delta_{IND(i)} + \lambda_t + \varepsilon_{i,t}$$

As the results of the regression analysis are presented, in addition regression diagnostics are examined to ensure the validity of the model. The results of the VIF tests are represented in Appendix 2. The test results indicate how much the variance of the parameter estimate increases due to the correlation between variables. VIF below 5 means multicollinearity is most likely negligible. As

Appendix 2 shows, all the VIFs for the variables are well under 5, which furthermore highlights the absence of multicollinearity, in addition to the correlation matrix results.

Appendix 3 depicts the distribution of residuals. The residual distribution exhibits mild right skewness; this indicates slight deviations from normality, although nothing that would undermine the regression results. As shown in Appendix 4, the Jarque-Bera test, conducted as an additional check, confirms the prior observation: the null hypothesis of normally distributed residuals is rejected since the p-value is < 0.05 . This result aligns with the visual evidence. Despite these results, no action is taken, since the sample size in this thesis is sufficiently large and thus the violation of normality does not cause major consequences (Brooks, 2019).

In Appendix 5, the residuals versus fitted values plot is depicted. The plot shows a clear funnel shape. This pattern is a textbook indication of heteroskedasticity, meaning that the variance of the errors is not constant. These findings indicate nonlinearity. In addition, the White's test is conducted to further examine heteroskedasticity. The test presented in Appendix 6 shows that it rejected the null hypothesis of homoskedasticity; this reinforces the findings from the residuals plot and therefore confirms the heteroskedasticity in the baseline model.

Heteroskedasticity cannot be ignored when implementing OLS since coefficient estimates will no longer be best linear unbiased estimators (BLUE), even though the estimates themselves are unbiased and consistent.

Autocorrelation is tested using a Wooldridge test, which is presented in Appendix 7. The test's p-value is < 0.05 , thus the null hypothesis of no autocorrelation in errors is rejected, meaning that there is statistically significant serial correlation in the errors. This makes the standard errors unreliable and typically biased downwards.

Given the presence of both heteroskedasticity and autocorrelation, firm-clustered standard errors must be implemented to ensure the validity of the empirical results; this is a common measure in prior literature. The clustered standard errors correct the problem of correlation between residuals within a cluster. Frank and Goyal (2009) used both firm and year-level clustering on the estimated standard errors. For the model in this thesis, standard errors clustered by time are not implemented, since the time period 2020-2024 provides too few clusters; therefore, the standard errors could still be biased even if clustered in the time dimension. Nonetheless, possible time effects are still addressed parametrically with the year fixed effects. The results of the baseline regression are presented for

transparency; however, all interpretation of results is based on the estimates using firm-clustered standard errors (Petersen, 2009). The baseline regression results are presented in Table 6.

Table 6. Regression Results for the Baseline Model

Variable	Coefficient	t-value	Std. Error
(Intercept)	0.490	4.272***	0.115
PROF	-0.615	-5.746***	0.107
TANG	0.238	3.947***	0.060
GRW	-0.008	-5.771***	0.001
RET	-0.033	-1.720	0.019
SIZE	-0.005	-1.050	0.005
LIQ	-0.044	-6.297***	0.007
RISK	-0.039	-0.598	0.065
NDTS	-0.888	-2.651**	0.335
Consumer Discretionary	0.061	1.739*	0.035
Consumer Staples	0.007	0.158	0.041
Health Care	-0.018	-0.451	0.041
Industrials	0.016	0.497	0.032
Information Technology	-0.059	-1.680	0.035
Materials	-0.077	-1.717*	0.045
Real Estate	0.219	4.078***	0.054
Year 2021	-0.025	-1.047	0.024
Year 2022	0.023	0.954	0.024
Year 2023	0.017	0.646	0.026
Year 2024	0.039	1.602	0.024
R ²		0.396	
Adjusted R ²		0.374	
F-statistic		17.6***	
Observations		516	
White's test p-value		1.119 x 10 ⁻⁷	
Wooldridge test p-value		1.141 x 10 ⁻⁵	

Variable definitions are presented in **Appendix 1**. All variables are winsorized at the 1st and 99th percentiles using pooled winsorization to mitigate the influence of outliers. Statistical significance ***1% level, **5% level, and *10% level, respectively.

The baseline model has an R^2 of 0.396, indicating that the explanatory variables account for approximately 39,6 % of the variation in leverage. The adjusted R^2 is 0.374, and it is the more reliable measure since it accounts for the number of explanatory variables in the model. The magnitude of the adjusted R^2 is typical for a regression of this type; Frank and Goyal (2009) reported values ranging from 24% to 42% across multiple periods. The F-statistic evaluates whether the model as a whole,

has explanatory power. The p-value is <0.05 , so the model is highly statistically significant. The total number of observations is 516; the number of observations deleted due to missingness is 24. The p-values of both the White's test and the Wooldridge test are <0.05 , confirming the presence of heteroskedasticity and autocorrelation. In terms of coefficient signs, profitability, market-to-book, prior stock returns, size, liquidity, risk, and non-debt tax shields are negatively related to leverage, while tangibility is positively related to leverage. Profitability, tangibility, market-to-book, liquidity, non-debt tax shield, and the real estate industry are statistically significant in the baseline specification. A more in-depth analysis and inference for the coefficients is conducted for the results using standard errors clustered on the firm level, which are presented in Table 7.

Table 7. Regression Results for the Baseline Model using Firm-Clustered Standard Errors

Variable	Coefficient	t-value	Std. Error
(Intercept)	0.490	2.586 **	0.190
PROF	-0.615	-3.668 ***	0.168
TANG	0.238	2.628 **	0.091
GRW	-0.008	-2.882 **	0.002
RET	-0.033	-1.879	0.018
SIZE	-0.005	-0.629	0.008
LIQ	-0.044	-5.044 ***	0.009
RISK	-0.039	-0.641	0.061
NDTS	-0.888	-1.550	0.573
Consumer Discretionary	0.061	1.050	0.058
Consumer Staples	0.007	0.076	0.087
Health Care	-0.018	-0.281	0.065
Industrials	0.053	0.969	0.055
Information Technology	-0.059	-1.032	0.055
Materials	-0.077	-1.297	0.059
Real Estate	0.219	2.681 **	0.082
Year 2021	-0.025	-1.739	0.015
Year 2022	0.023	1.389	0.016
Year 2023	0.031	0.780	0.021
Year 2024	0.039	1.856	0.021
R ²		0.396	
Adjusted R ²		0.374	
F-statistic		17.6***	
Observations		516	

Variable definitions are presented in **Appendix 1**. All variables are winsorized at the 1st and 99th percentiles using pooled winsorization to mitigate the influence of outliers. Statistical significance ***1% level, **5% level, and *10% level, respectively

As seen in Table 7, the standard errors become systematically larger after clustering. This occurs because firm-level clustering accounts for within-firm correlation, meaning the model recognizes that repeated observations from the same firm do not provide fully independent information. The resulting increase in standard errors lowers t-values and weakens the statistical significance of several variables, including tangibility, growth opportunities, and non-debt tax shields. This indicates that part of the original significance was driven by within-firm correlation, and the clustered model provides more conservative and reliable inference (Petersen, 2009).

The first hypothesis predicts that profitability decreases leverage. The regression coefficient for profitability is -0.615, indicating that when profitability increases by one unit, the firm's leverage decreases by 0.615 units. This negative relationship aligns with the pecking order theory, according to which more profitable firms rely less on external financing, as internal funds such as retained earnings are used first. The result is highly statistically significant at the 0.1 % significance level, and it supports the hypothesis.

The second hypothesis states that asset tangibility increases leverage. Tangibility has a coefficient of 0.238, which means that higher tangibility is associated with higher leverage. This positive relationship is consistent with the trade-off theory, which states that tangible assets serve as collateral, reducing the cost of debt. The result is statistically significant at the 1% significance level, and it supports the hypothesis.

The third hypothesis predicts that growth opportunities reduce leverage. The coefficient is -0.008, suggesting that greater growth opportunities are associated with lower leverage, although the effect is modest. This result is aligned with both the trade-off theory and the market timing theory. The trade-off theory implies that growth opportunities make debt less attractive, since they are intangible and increase financial distress costs through reliance on uncertain future cash flows. The market-timing theory states that growth opportunities make equity issuance preferable over debt, due to favourable equity valuations. The result is statistically significant at the 1% significance level and supports the hypothesis.

The fourth hypothesis predicts that the increase in prior stock returns decreases leverage. The coefficient is -0.033, implying a negative relationship between prior stock returns and leverage. Although the direction is consistent with the hypothesis and market timing theory, according to which firms issue equity after strong stock performance, the coefficient is not statistically significant. It barely misses the 5% significance level with a p-value of 0.061. Therefore, the results do not provide evidence of a systematic relationship, and the hypothesis is not supported.

As for the control variables, liquidity was the only one with a statistically significant result, as it was highly significant at the 0.1% level. The coefficient is -0.044, which indicates that more liquid firms tend to use less debt. This negative relationship aligns with the priorly set expectation and with the pecking order theory, which states that with strong internal liquidity, less external financing is needed.

Firm size is predicted to increase leverage. However, the coefficient is -0.005, and it is not statistically significant. The sign contradicts the trade-off theory and supports the pecking order theory, which states that larger firms have less information asymmetry, making equity more preferable over debt, thus decreasing leverage. The lack of significance indicates no systematic relationship. Therefore, firm size does not appear to influence leverage in this sample.

Business risk is expected to reduce leverage, and the coefficient is negative at -0.039, but the estimate is not statistically significant. The negative sign is in line with both trade-off and pecking order theories, but no systematic effect can be found due to the lack of significance.

Non-debt tax shields are expected to reduce leverage. The coefficient is -0.888, suggesting a negative relationship, which is consistent with the trade-off theory. This supports the claim that tax shields substitute for the tax advantages of debt. However, the result is not statistically significant, meaning the effect is not systematic.

Although the industry and year dummies created by fixed effects are included only for control, it is noteworthy that the real estate dummy is statistically significant at the 0.1 % significance level. The coefficient is 0.219, which is substantially larger than those of any other industry. This outcome is consistent with common characteristics of real estate firms, whose business models rely heavily on property investments financed through debt.

In conclusion, the empirical results were very much in line with the expectations made based on prior literature. Out of the statistically significant results, profitability and liquidity have a negative relationship with leverage, which is explained by the pecking order theory. Tangibility has a positive relationship with leverage, which is aligned with the trade-off theory. Growth opportunities have a negative relationship with leverage, which can be explained by both the trade-off and market timing theories. For the statistically insignificant results, prior stock returns explained by the market timing theory, business risk explained by the trade-off and pecking order theory, and non-debt tax shield all have a negative relationship with leverage. The only deviation was that the sign for firm size was negative, thus not really explained by any of the theories.

5.3 Book Leverage Regression

A regression with book leverage as the dependent variable is conducted as a robustness check. Firm-clustered standard errors were implemented for this model. The results are presented in Table 8. This provides valuable information on whether the results are sensitive to alternative definitions of leverage. It should, however, be noted that explanatory variable definitions were originally chosen with market leverage in mind to, for example, avoid mechanical correlations, which must be taken into consideration when interpreting the results. The book-leverage regression exhibits a R^2 of 0.448 and an adjusted R^2 of 0.428, indicating that the variables explain roughly 43% of the variation in book leverage. There is a slight increase compared to the R^2 of the market leverage model, although nothing out of the ordinary. The total number of observations was 519. The book leverage is defined as total debt divided by total assets.

Equation 3:

$$\text{book leverage} = \frac{\text{total debt}}{\text{total assets}}$$

Unlike the definition for market leverage, both the numerator and denominator are book values based on accounting data. These values change slowly over time as they do not reflect market volatility and thus contain less short-term noise. Although statistical significance is scarce for the variables, overall, the book leverage is easier to explain with accounting-based fundamentals such as profitability, tangibility, and liquidity, which inflate the R^2 . The p-value of the F-test is <0.05 , meaning the model as a whole is statistically significant.

Table 8. Regression Results for The Book Leverage Model

Variable	Coefficient	t-value	Std. Error
(Intercept)	0.082	0.499	0.163
PROF	-0.875	-2.227 *	0.393
TANG	0.158	1.620	0.097
GRW	0.023	1.872	0.012
RET	-0.018	-0.760	0.010
SIZE	0.010	1.313	0.008
LIQ	-0.026	-2.442*	0.096
RISK	-0.170	-1.777	0.057
NDTS	1.082	1.444	0.749
Consumer Discretionary	0.072	1.418	0.051
Consumer Staples	-0.078	-1.377	0.057
Health Care	0.070	-1.031	0.056
Industrials	0.006	-0.129	0.057
Information Technology	-0.055	-1.028	0.054
Materials	-0.072	-1.199	0.060
Real Estate	0.200	3.253 **	0.064
Year 2021	-0.052	-2.244*	0.023
Year 2022	-0.241	-1.157	0.022
Year 2023	0.012	0.683	0.020
Year 2024	0.006	0.296	0.019
R ²		0.448	
Adjusted R ²		0.428	
F-statistic		23.18***	
Observations		519	

Variable definitions are presented in **Appendix 1**. All variables are winsorized at the 1st and 99th percentiles using pooled winsorization to mitigate the influence of outliers. Statistical Significance ***1% level, **5% level, and *10% level, respectively.

Profitability has a negative relationship with book leverage, as it did with market leverage. The coefficient is -0.875, and the results are still statistically significant, even though the significance dropped from the 0.1% level to the 5% level. The results are consistent with the pecking order theory and indicate strong robustness.

The coefficient of tangibility is 0.158, and the positive sign persists across both models, which is supported by the trade-off theory. However, tangibility is not statistically significant with book leverage as the dependent variable, as it was with market leverage.

For growth opportunities, the coefficient is 0.023, and it is not statistically significant. The sign is reversed compared to the market leverage regression. These changes are theoretically expected; Frank and Goyal (2009) reported the same type of sensitivity to leverage definition. They attributed the changes in significance or sign to book leverage being backward looking and market leverage being forward looking, thus it is seen that growth opportunities operate through capturing a firm's future anticipations.

Prior stock returns lose statistical significance when compared to market leverage regression. The coefficient is still negative at -0.018. Unlike with market leverage, when using book leverage, there are no mechanical effects when measuring the impact of prior returns. The drop in significance suggests that the results using market leverage are not robust and that no implications for market timing theory can be made regarding prior returns.

Regarding the control variables, liquidity's coefficient is -0.026, and the result is statistically significant at the 5% significance level. Therefore, the effect of liquidity is aligned with the pecking order theory and robust to the leverage definition.

The sign for size is now positive as the coefficient is 0.010, and the results are still not statistically significant, meaning that no systematic relationship between size and leverage is found. One possible reason behind this is that during the sample period, massive exogenous shocks determined the decision-making regarding leverage so heavily that size simply did not affect leverage much. In addition, a five-year panel is quite short when considering size as a variable since it changes relatively slowly.

The coefficient for risk is -0.170, and the result is still not statistically significant, although now close with a p-value of 0.07. In this specification, the coefficient for NDTs is 1.082, so it changes to positive and remains insignificant. This sign reversal is not economically meaningful and likely reflects limited within-sample variation. The real estate industry coefficient is 0.200 and still statistically significant at the 1% level, further validating the effect of the debt-heavy nature of the industry.

Unlike when testing with market leverage, the year 2021 is statistically significant at the 5% level. The coefficient is -0.052, meaning that leverage dropped compared to the baseline year of 2020. One interpretation of this links to the post-pandemic recovery of firms. This suggests that total assets expanded and, thus, debt levels stabilised when economic activities normalised in 2021.

In conclusion, the results greatly vary across different definitions, but it is expected and well-documented in prior research, such as Frank and Goyal (2009).

5.4 Subperiod regressions

Subperiod regressions are estimated separately for the COVID-19 period (2020-2021) and the Ukraine war period (2022-2024) to isolate the effects of two major macroeconomic shocks. This allows examining whether the determinants of leverage behave differently across the two environments. Firm-clustered standard errors were implemented for these regressions as well. The test results for both models are presented in Table 9. For the 2022-2024 period, the regression results remain broadly in line with the baseline regression. Only the coefficient of size changes sign, although it remains statistically insignificant. The adjusted R^2 is 0.371, which is comparable to the baseline specification. The data in this thesis might not reflect the effects of the Ukraine war well, since it does not include small to medium-sized firms that do not have as much market diversification to mitigate the effects caused by the war.

In contrast, the COVID-19 subperiod shows major deviations from the baseline. The adjusted R^2 declines to 0.345. For the key independent variables, profitability, tangibility, and growth opportunities, the estimated coefficients are all smaller and less statistically significant in the 2020-2021 sample. This pattern indicates that the classical capital-structure determinants appear to play a weaker role during the pandemic. However, it is noteworthy that the number of observations for this short period is only 202, which may affect the results. The COVID-19 shock functioned primarily as a liquidity crisis. As firms experienced a collapse in cash flow, they rapidly accumulated liquidity buffers, rather than adjusting their leverage according to a more holistic view of capital structure. Therefore, it is not surprising that liquidity is highly significant at the 0.1% level across all different specifications in this thesis (Acharya and Steffen, 2020).

Table 9. Regression Results for The Subperiod Models

Period	2020-2021	2022-2024
Variable	Coefficient	Coefficient
Constant	0.837**	0.305
PROF	-0.487*	-0.726***
TANG	0.179	0.274*
GRW	-0.006*	-0.009***
RET	-0.047	-0.022
SIZE	-0.020	0.003
LIQ	-0.048***	-0.043***
RISK	-0.159	-0.025
NDTS	-1.457**	-0.455
Consumer Discretionary	0.031	0.084
Consumer Staples	0.020	-0.0001
Health Care	-0.014	-0.016
Industrials	0.040	0.063
Information Technology	-0.077	-0.045
Materials	-0.021	-0.095
Real Estate	0.143	0.269**
Year 2021	-0.024	—
Year 2023	—	-0.002
Year 2024	—	0.016
R ²	0.397	0.403
Adjusted R ²	0.345	0.371
F-statistic	7.612***	12.55***
Observations	202	334

Variable definitions are presented in **Appendix 1**. All variables are winsorized at the 1st and 99th percentiles using pooled winsorization to mitigate the influence of outliers. Statistical significance ***1% level, **5% level, and *10% level, respectively.

5.5 Additional Testing

Size was not found to be a significant factor in any of the regressions. Prior literature highlights that size can not only affect leverage but also affect the other determinants of capital structure. Therefore, to examine whether the core determinants of leverage operate differently for firms of different sizes, several interaction terms with size were tested. The results are reported in Appendix 8. Out of the tested interactions, only profitability-size is statistically significant at the 1% level. For this regression, the profitability coefficient is 5.948, and the interaction coefficient is -0.352, meaning that the effect of profitability on leverage is positive for a few of the smallest firms in the entire sample. However, the major implication is that the negative impact of profitability on leverage becomes

stronger for larger firms. Rajan and Zingales (1995) reported similar results for US firms. The reasoning behind this is unclear, but one interpretation is that profitability may reflect both internal financing and growth opportunities simultaneously.

The other interaction terms, including tangibility-size, market-to-book-size, and risk-size, are statistically insignificant. They were included to test if collateral, growth opportunities, or business risk affect leverage differently in different-sized firms.

As a robustness check, the baseline regression was re-estimated after removing the top and bottom 1% of the leverage distribution. The results reported in Appendix 9 remain consistent with the baseline model. The signs and magnitudes of all independent and control variables remain the same, and the overall explanatory power of the model is almost identical, with an adjusted R^2 of 0.372. The only notable difference is that the year dummies for 2022 and 2024 become statistically significant at the 1% level once outliers are removed, suggesting that extreme leverage observations had previously suppressed the year-fixed effect estimates.

6 Conclusions

In this thesis, the determinants of capital structure have been examined through the perspectives of three capital structure theories, including the trade-off theory, the pecking order theory, and the market timing theory. Based on that purpose, a main research question and three sub-questions were formulated. The main research question was: *Which determinants best explain the leverage of Finnish non-financial listed firms between 2020 and 2024?* The first sub-question was: *How strong and statistically significant are the effects of individual determinants on the leverage of Finnish non-financial listed firms, and what is the direction of these effects?* The second sub-question was: *Are the observed empirical relationships between leverage and its determinants consistent with the predictions of the trade-off theory, the pecking order theory, or the market timing theory?* The third sub-question was: *Has the COVID-19 pandemic or the Ukraine war affected the determinants of capital structure in Finnish non-financial listed firms between 2020 and 2024?*

The study focused on non-financial firms listed on Nasdaq Helsinki during the turbulent period of 2020-2024. The eight variables included in the study and the hypotheses were chosen based on prior literature and empirical results.

The empirical analysis was conducted with a linear regression that was estimated using the OLS method. All in all, four regressions were estimated, including a market leverage regression, a book leverage regression, and sub-period regressions for the periods from 2020 to 2021 and from 2022 to 2024. Firm-clustered standard errors were implemented due to heteroskedasticity and autocorrelation.

The results suggest that profitability negatively affects leverage. The effect is the largest out of all the significant determinants of capital structure, and it is aligned with the pecking order theory, which states that firms prefer retained earnings to external financing. The negative effect of profitability on leverage was found to increase with firm size.

Tangibility positively affects leverage, and the effect is moderately large. The result is in accordance with the trade-off theory, since tangible assets serve as collateral, thus reducing the financial distress costs caused by debt.

Liquidity was originally included as a control variable, but it actually was the most robust determinant of leverage in this sample, as liquidity was highly statistically significant across all different regression specifications.

It has a negative relationship with leverage, which is aligned with the pecking order theory. The theory proposes that firms with more liquidity to use for financing need to rely less on external funds. Growth opportunities are negatively related to leverage. The effect is rather small, and it aligns with both the trade-off theory and the market timing theory. The trade-off theory explains this relationship by growth opportunities not being suitable to be used as collateral and by growing firms relying on uncertain future cash flows, thus increasing the costs of financial distress caused by debt. The market timing theory states that firms with future growth expectations take advantage of stock overvaluation by issuing equity instead of, for example, debt financing.

These results are aligned with Frank and Goyal (2009), who found growth opportunities and profitability to be statistically significant and negatively related to leverage. On the other hand, tangibility was statistically significant and positively related to leverage. They did not include liquidity in the study. Rajan and Zingales (1995) reported similar results for growth opportunities, profitability, and tangibility.

For prior stock returns, firm size, business risk, and non-debt tax shields, no systematic relations to leverage were found. For the book leverage regression conducted as a robustness test, only profitability and liquidity had a systematic relationship with leverage, and several other variables switched signs. This suggests that the results are not robust across leverage definitions, which is also documented in prior literature. Frank and Goyal (2009) reported that the market-to-book ratio and size were unreliable when testing with different leverage definitions.

The sub-period regression results indicate that all the significant capital structure determinants had a reduced role in explaining leverage during the COVID-19 pandemic, except liquidity. The coefficient was smaller, and statistical significance was weaker for profitability, tangibility, and growth opportunities. This likely reflects the fact that COVID-19 was a liquidity shock for many firms as their cash flows abruptly ended. For the Ukraine war period, no systematic results were found.

According to the results, the pecking order theory and trade-off theory both seem to influence the leverage decisions of Finnish listed firms. For the market timing theory, little evidence was found. The different theories have their strengths, but none of them perfectly explain the relationships between the determinants and capital structure. Based on these results, no definite conclusion can be drawn regarding which theory best explains firms' capital structure during the period in question. For the COVID-19 period, capital structure theory fundamentals seem to have had less of an effect on decision-making, since a large exogenous shock created an entirely new set of conditions. Now onto the limitations regarding this study.

This thesis has a lot of limitations due to its specified nature. Only a few of the determinants of capital structure were tested, with plenty of different options left out. Also, this thesis focused on only certain definitions of the determinants. The period in the study was only five years, which could affect the reliability of the results. The period was also a unique one for Finnish listed firms due to the COVID-19 pandemic and the war in Ukraine. This makes it so by design that the results of this thesis are not suitable to be generalized. The scarcity of prior peer-reviewed literature on this topic in the Finnish context also made the analysis less fruitful since there were no similar studies to compare results with.

The limitations of this thesis create windows of opportunity for future research. Further research could include different variables and definitions. A study on small to medium-sized firms would be interesting since the effects of the crisis period might be vastly different for them. Further research could also be made more suitable for detecting the market movements and thus the market timing theory, as in this thesis, its role was that of a lesser one.

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Appendices

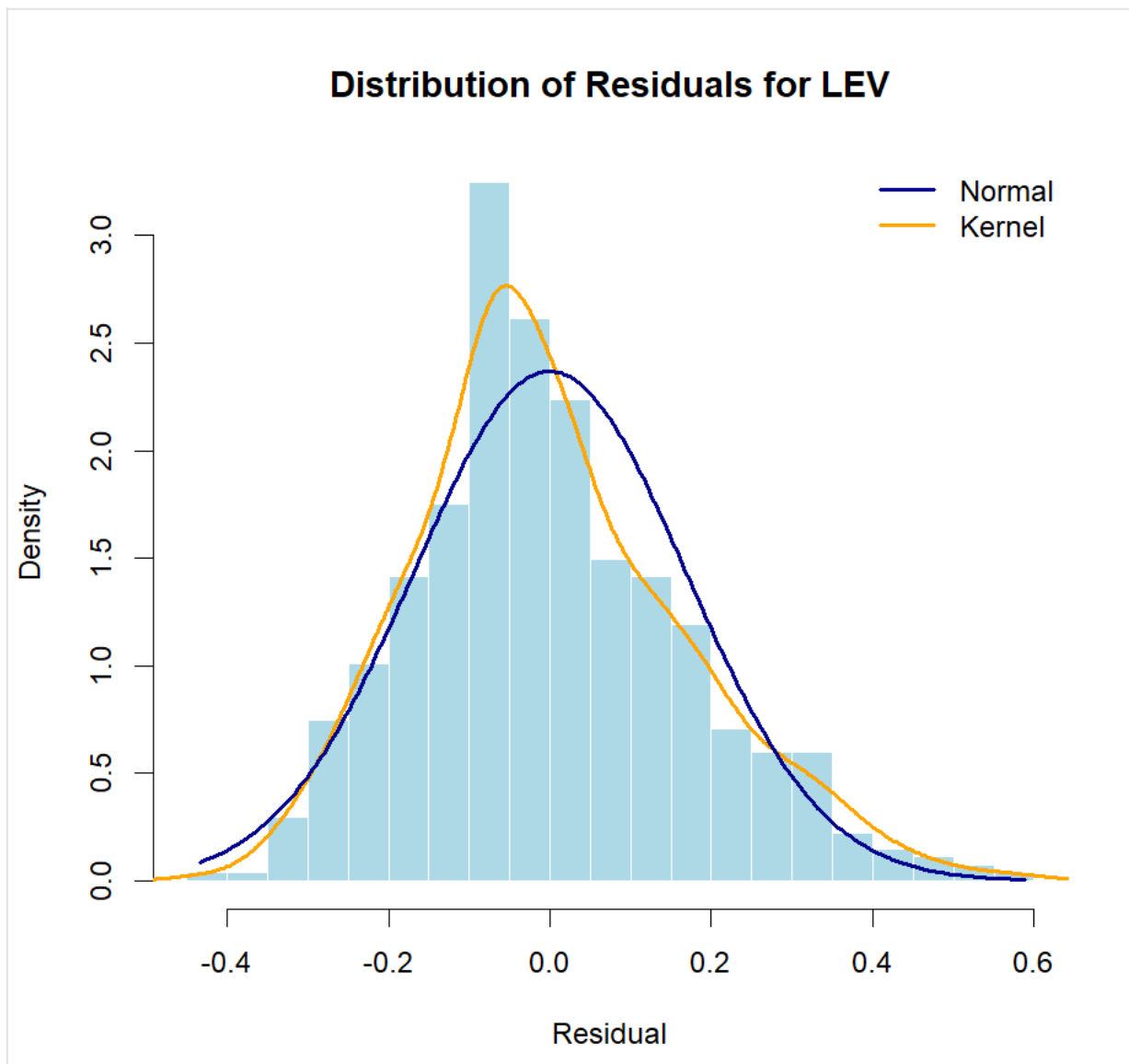
Appendix 1 Variable Definition Table

Variable	Symbol	Definition	Source	Expected sign
Market leverage	LEV	Total debt / (Total debt + Market capitalization)	LSEG database	
Profitability	PROF	EBIT / Total assets	LSEG database	–
Tangibility	TANG	Net property, plant and equipment / Total assets	LSEG database	+
Growth Opportunities	GRW	(Market capitalization + Book debt) / Book assets	LSEG database	–
Prior stock returns	RET	Cumulative raw 12-month return	LSEG database	–
Firm size	SIZE	Natural logarithm of total assets	LSEG database	+
Liquidity	LIQ	Current assets / Current liabilities	LSEG database	–
Business risk	RISK	Rolling 5-year standard deviation of EBITDA margin	LSEG database	–
Non-debt tax shields	NDTS	Depreciation, Depletion and amortization / Total assets	LSEG database	–

Appendix 2 VIF test

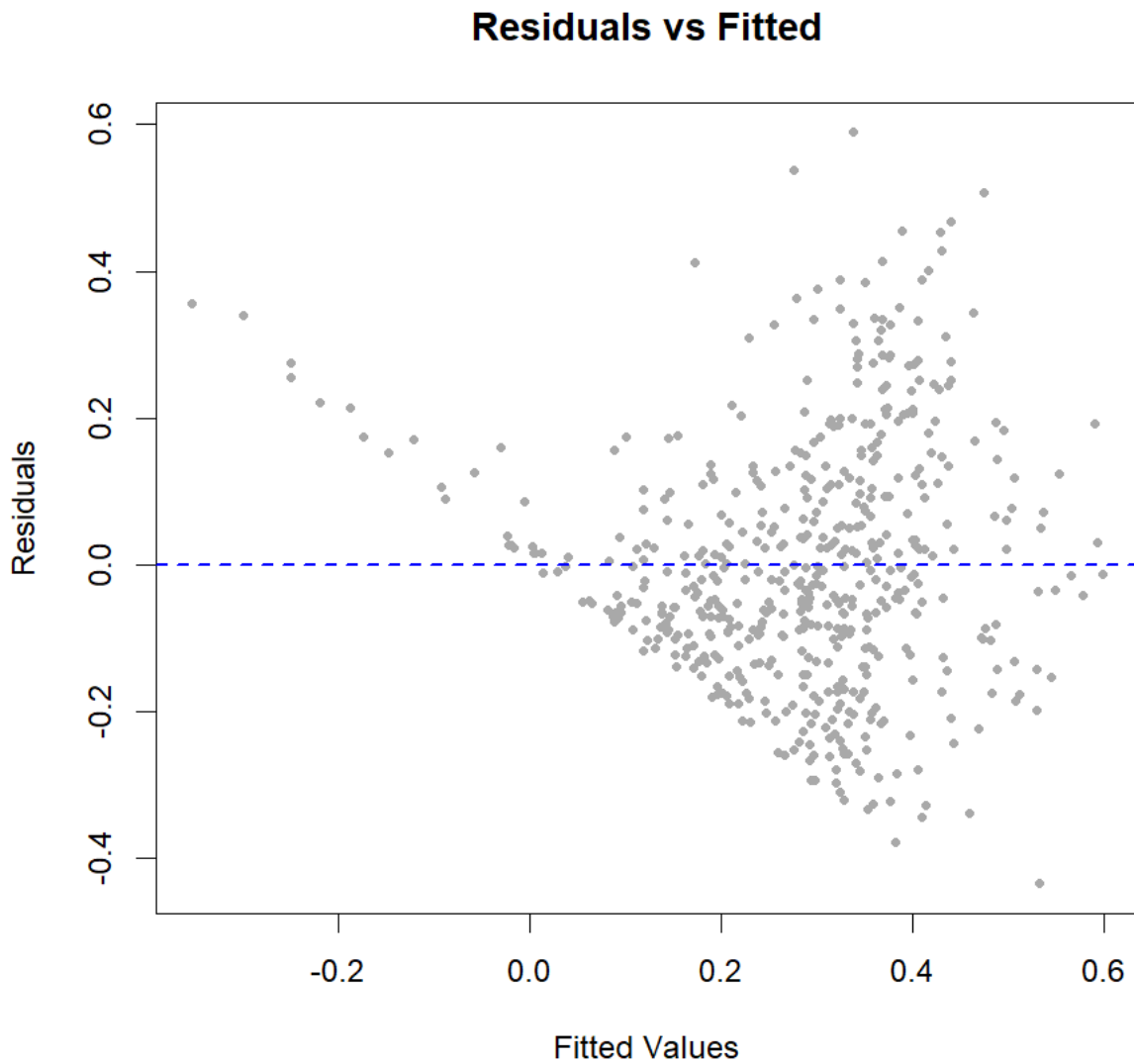
	PROF	TANG	GRW	RET	SIZE	LIQ	RISK	NDTS
VIF	1.62	1.89	1.18	1.74	1.57	1.55	1.39	1.87

Appendix 3 Distribution of Residuals



Appendix 4 Jarque-Bera Test

Statistic	Value
X-squared	25.168
Degrees of freedom	2
p-value	3.427×10^{-6}

Appendix 5 Residuals versus Fitted Values**Appendix 6 White's Test**

Statistic	Value
BP	32.011
df	2
p-value	1.119×10^{-7}

Appendix 7 Woolridge Test

Statistic	Value
F-statistic	19.729
df1	1
df2	422
p-value	1.141×10^{-5}

Appendix 8 Regressions with Interaction Terms

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	-0.0012854	0.2744684	-0.0047	0.996265	
profitability	5.9477797	1.9686921	3.0212	0.002643	**
size	0.0184660	0.0126354	1.4614	0.144503	
tangibility	0.1659262	0.0892314	1.8595	0.063526	.
market_to_book	-0.0059190	0.0024957	-2.3717	0.018073	*
prior_stock_returns	-0.0364510	0.0169271	-2.1534	0.031750	*
liquidity	-0.0383977	0.0079504	-4.8296	1.806e-06	***
risk	-0.0620092	0.0419730	-1.4774	0.140191	
ndts	0.0428494	0.6156414	0.0696	0.944538	
factor(gics)Consumer_Discretionary	0.0597773	0.0543836	1.0992	0.272204	
factor(gics)Consumer_Staples	0.0104150	0.0795553	0.1309	0.895893	
factor(gics)Health_Care	-0.0026177	0.0600179	-0.0436	0.965228	
factor(gics)Industrials	0.0595508	0.0517456	1.1508	0.250332	
factor(gics)Information_Technology	-0.0559364	0.0525921	-1.0636	0.288013	
factor(gics)Materials	-0.0436041	0.0563095	-0.7744	0.439070	
factor(gics)Real_Estate	0.2306268	0.0762509	3.0246	0.002614	**
factor(year)2021	-0.0298569	0.0139885	-2.1344	0.033282	*
factor(year)2022	0.0259400	0.0167825	1.5457	0.122802	
factor(year)2023	0.0246729	0.0206217	1.1965	0.232070	
factor(year)2024	0.0442091	0.0198636	2.2256	0.026471	*
profitability:size	-0.3521060	0.1088244	-3.2355	0.001292	**

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.4073756	0.2498565	1.6304	0.1036203	
tangibility	0.5946060	0.7330378	0.8112	0.4176524	
size	-0.0014201	0.0114054	-0.1245	0.9009584	
profitability	-0.6319953	0.1650545	-3.8290	0.0001445	***
market_to_book	-0.0075647	0.0026861	-2.8162	0.0050459	**
prior_stock_returns	-0.0299025	0.0169966	-1.7593	0.0791164	.
liquidity	-0.0427266	0.0085048	-5.0238	6.998e-07	***
risk	-0.0366122	0.0475569	-0.7699	0.4417348	
ndts	-0.8604172	0.5741297	-1.4986	0.1345782	
factor(gics)Consumer_Discretionary	0.0613861	0.0575597	1.0665	0.2867079	
factor(gics)Consumer_Staples	0.0096101	0.0867335	0.1108	0.9118177	
factor(gics)Health_Care	-0.0174560	0.0650108	-0.2685	0.7884154	
factor(gics)Industrials	0.0537477	0.0542439	0.9909	0.3222231	
factor(gics)Information_Technology	-0.0571231	0.0549440	-1.0397	0.2989861	
factor(gics)Materials	-0.0659527	0.0637481	-1.0346	0.3013492	
factor(gics)Real_Estate	0.2181768	0.0798521	2.7323	0.0065061	**
factor(year)2021	-0.0262279	0.0147047	-1.7836	0.0750721	.
factor(year)2022	0.0226510	0.0162467	1.3942	0.1638609	
factor(year)2023	0.0183069	0.0210223	0.8708	0.3842513	
factor(year)2024	0.0404012	0.0210668	1.9178	0.0556935	.
tangibility:size	-0.0179505	0.0363657	-0.4936	0.6217925	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.37814210	0.20749506	1.8224	0.068972	.
market_to_book	0.04661674	0.03978997	1.1716	0.241911	
size	0.00024685	0.00950730	0.0260	0.979296	
profitability	-0.53010859	0.17452930	-3.0374	0.002508	**
tangibility	0.26727785	0.09254393	2.8881	0.004039	**
prior_stock_returns	-0.02817753	0.01660961	-1.6965	0.090403	.
liquidity	-0.04273185	0.00812525	-5.2591	2.126e-07	***
risk	-0.01650209	0.05247900	-0.3145	0.753306	
ndts	-0.88713338	0.57785368	-1.5352	0.125344	
factor(gics)Consumer_Discretionary	0.05329230	0.05730416	0.9300	0.352812	
factor(gics)Consumer_Staples	-0.00439711	0.08581936	-0.0512	0.959157	
factor(gics)Health_Care	-0.01457324	0.06304220	-0.2312	0.817277	
factor(gics)Industrials	0.05400394	0.05374643	1.0048	0.315469	
factor(gics)Information_Technology	-0.06073649	0.05430441	-1.1184	0.263898	
factor(gics)Materials	-0.09625881	0.06027468	-1.5970	0.110879	
factor(gics)Real_Estate	0.21705522	0.07975290	2.7216	0.006717	**
factor(year)2021	-0.02239982	0.01484635	-1.5088	0.131969	
factor(year)2022	0.02571786	0.01614708	1.5927	0.111836	
factor(year)2023	0.01673979	0.02066991	0.8099	0.418393	
factor(year)2024	0.03787626	0.02032553	1.8635	0.062963	.
market_to_book:size	-0.00311015	0.00235838	-1.3188	0.187834	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.5373778	0.2019914	2.6604	0.0080482	**
risk	-1.7702313	1.6375371	-1.0810	0.2801885	
size	-0.0081023	0.0092429	-0.8766	0.3811105	
profitability	-0.6399861	0.1694992	-3.7757	0.0001781	***
tangibility	0.2206309	0.0926828	2.3805	0.0176522	*
market_to_book	-0.0077750	0.0027178	-2.8608	0.0043980	**
prior_stock_returns	-0.0289402	0.0173721	-1.6659	0.0963410	.
liquidity	-0.0416608	0.0089480	-4.6559	4.11e-06	***
ndts	-0.8373120	0.5714081	-1.4653	0.1434361	
factor(gics)Consumer_Discretionary	0.0640868	0.0585124	1.0953	0.2739114	
factor(gics)Consumer_Staples	0.0138267	0.0868136	0.1593	0.8735192	
factor(gics)Health_Care	-0.0128252	0.0667870	-0.1920	0.8477938	
factor(gics)Industrials	0.0555053	0.0551092	1.0072	0.3143177	
factor(gics)Information_Technology	-0.0552798	0.0559997	-0.9871	0.3240356	
factor(gics)Materials	-0.0676604	0.0613770	-1.1024	0.2708144	
factor(gics)Real_Estate	0.2235861	0.0822068	2.7198	0.0067528	**
factor(year)2021	-0.0270982	0.0146994	-1.8435	0.0658328	.
factor(year)2022	0.0210951	0.0162302	1.2997	0.1942705	
factor(year)2023	0.0171609	0.0208255	0.8240	0.4103018	
factor(year)2024	0.0391112	0.0209115	1.8703	0.0620067	.
risk:size	0.0919794	0.0869915	1.0573	0.2908532	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

Appendix 9 Regression Without Leverage Outliers

```

> reg_no_outliers_clustered

t test of coefficients:

      Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.44401083  0.17728166  2.5046 0.0125748 *
profitability -0.59364243  0.15374110 -3.8613 0.0001274 ***
tangibility   0.23565250  0.08793473  2.6799 0.0076059 **
market_to_book -0.00803214  0.00245738 -3.2686 0.0011546 **
prior_stock_returns -0.02276259  0.01669889 -1.3631 0.1734523
size         -0.00361261  0.00811322 -0.4453 0.6563125
liquidity    -0.04401831  0.00883011 -4.9850 8.529e-07 ***
risk         -0.03233574  0.04940898 -0.6545 0.5131193
ndts         -0.77882980  0.52367214 -1.4872 0.1375737
factor(gics)Consumer_Discretionary  0.04616004  0.05376750  0.8585 0.3910171
factor(gics)Consumer_Staples        -0.00092349  0.08386129 -0.0110 0.9912181
factor(gics)Health_Care              -0.02545501  0.06173112 -0.4124 0.6802557
factor(gics)Industrials              0.03229728  0.05013864  0.6442 0.5197645
factor(gics)Information_Technology   -0.06860578  0.05154097 -1.3311 0.1837594
factor(gics)Materials                -0.08654034  0.05498627 -1.5739 0.1161475
factor(gics)Real_Estate              0.21517559  0.07654066  2.8113 0.0051266 **
factor(year)2021                     -0.01483558  0.01411474 -1.0511 0.2937294
factor(year)2022                      0.03432906  0.01318103  2.6044 0.0094738 **
factor(year)2023                      0.03574196  0.01832597  1.9503 0.0516879 .
factor(year)2024                      0.05471544  0.01828665  2.9921 0.0029062 **
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

Appendix 10 Explanation of the use of AI

- Tool: Chat GPT 5.1
- Tasks: Coding, Formatting, Proofreading
- Purpose: I used ChatGPT to resolve problems with difficult parts of the coding done during the data analysis. I also used ChatGPT to format data into the right form for the tables. In addition, I used AI to proofread my text to detect errors in grammar and spelling
- Verification: At first, I did not successfully complete the coding of the winsorizations and the needed exclusions for the data. The suggestions made by AI helped me formulate the right code. The winsorization was checked by printing out and examining percentile information manually. The exclusions were checked by examining the final data sample manually. As for the formatting, every piece of data that was formatted by AI was manually checked to be correct. Lastly, for proofreading, AI presented me with recommendations which I checked myself and decided if they should be implemented to improve the language of the thesis.