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Leverage and Firm Value: The Case of Listed Nordic Real Estate Firms

An empirical study of the relationship between leverage and market value

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Abstract

In this thesis we examine the relationship between leverage and firm value for 31 listed Nordic real estate companies for the period Q1 2006 to Q2 2021. We use enterprise value to invested capital (EV/IC) as a measurement of firm value, which will be the dependent variable throughout the analysis. Further, we have split the leverage component of each company in two ratios: *i)* Long-term debt to total assets (LTD), and *ii)* Short-term debt to total assets (STD). Both ratios are measured in terms of book values. Additionally, to analyse a potential non-linear relationship between the debt-ratios and firm value, we have included a squared term for *i)* and *ii).* The relationship between these four independent variables and EV/IC will be the main point of interest in this thesis.

We motivate our thesis theoretically in view of the trade-off theory and the information asymmetry theory. Based on a multiple regression model using fixed effects estimation, we identify a strictly concave relationship between long-term debt and EV/IC. Our results indicate that listed Nordic real estate companies benefit from long-term debt to a certain extent. Although, high LTD ratios are value deteriorating as our results show that the squared term of LTD is negatively associated with firm value. Our empirical findings further suggest a convex relationship between short-term debt and firm value.

We find market valuation of listed Nordic real estate companies to be significantly related to most of the chosen independent variables. In specific, we find EV/IC to have a significant relationship with the following variables: LTD (+), LTD Squared (-), STD (-), STD Squared (+), tangibility (+), size (+), growth (-), and the global financial crisis (-).

Based on our empirical evidence, we find that that both the trade-off theory and information asymmetry theory have useful explanatory power in describing the relationship between LTD and firm value. Meanwhile, we find that the applicability for of our theoretical framework comes to short in predicting the relationship between STD and firm value.

Keywords: *Capital Structure, Trade-off Theory, Information Asymmetry Theory, Real Estate*

Foreword and Acknowledgements

This thesis concludes five onerous, yet rewarding years at the Norwegian School of Economics. The writing process has given us a lot of perceptive insights into corporate finance as well as the Nordic real estate sector, both providing us with knowledge that we are certain will be useful in our future careers. Hopefully, our work of presenting the findings from this study is sufficient for the reader to find the thesis both interesting and amusing.

Before proceeding, we would like to express our acknowledgement and gratitude to the persons who deserve it. First and foremost, we would like to thank our supervisor, Prof. Emer. Thore Johnsen, for his guidance, exhilarating insights, and valuable contributions. Over the course of the semester, Thore has always been open to intriguing conversations, not only about our thesis but also lively chats about our everyday lives. This certainly made the entirety of the writing process both fruitful and fulfilling.

We are also grateful for the love and support from family and friends. Without them, reaching this milestone would be far less enjoyable.

"Obsessed is a word the lazy use to describe the dedicated"

- Aziz Shavershian

Bergen, December 2021

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I. Introduction

Background and motivation

We have chosen the topic for this thesis as we share a profound interest in corporate finance. With both of us majoring in financial economics and starting our careers in corporate finance the following year, this was a natural theme of choice. Furthermore, we believe choosing the optimal mixture of debt and equity is a fundamental question within corporate finance. Therefore, we thought of the opportunity to gain further insights into the decision making in the process of raising capital to be rewarding. We have chosen to focus on the listed Nordic real estate sector, and there are a couple of reasons for this.

Firstly, as real estate prices have been soaring the last decade, we expect the relevancy of this sector only to increase in the coming years. Another interesting aspect is the intriguing width of the sector, as it plays an essential role in all industries from everything to retail players' demand for logistics facilities, to oil companies' demand for shore facilities. Additionally, even though technology might render some decrease in this demand, real estate is a scarce resource that will never become irrelevant. We have also recognized a rather novel aspect regarding real estate investments, which is the common idea that one needs to buy real estate to get real estate exposure. We argue that publicly traded real estate companies is an under-communicated way to get this exposure, particularly in Norway. Therefore, we eventually expect the focus on publicly traded real estate companies to increase in the years to come. Lastly, considering the applicability of deep knowledge in capital structure, we think investigating the relationship between leverage and firm value will provide knowhow that will be relevant for us in the future. This knowledge will be transferable to all industries and sectors and is an aspect of corporate finance that we do not expect to become irrelevant anytime soon.

In other words, the background and motivation for our selection is a combination of academic interest and pragmatic applicability. We genuinely think that this is a subject that is ready for scrutiny, given our motivations listed above.

Problem statement

This study seeks to find the relationship between capital structure, debt composition, and firm value in the Nordic real estate sector. More specifically, it aims to answer the following problem statement:

"What is the relationship between long- and short-term debt and firm value for listed Nordic real estate companies in the time frame Q1 06 – Q2 21?"

Contribution

Ever since Modigliani and Miller presented their capital structure irrelevancy theorem in 1958, the importance of capital structure choices has been a central and highly debated topic in corporate finance. In the quest of trying to explain how the capital structure of firms are ultimately determined, most recent literature is focusing on explaining the internal underlying drivers of increasing and decreasing debt levels for different firms and industries. While some research has been done in relation to how investors incorporate firms' capital structure decisions into their investment decisions, none has explicitly targeted the Nordic market. With our thesis, we want to contribute to already existing research by targeting the Nordic listed real estate market. We find this study relevant for students, academics, investors, and business executives with an interest in the relationship between leverage and firm valuation.

Outline

This thesis is organized as follows. *Chapter 2* introduces the Nordic real estate market. *Chapter 3* discusses the chosen theories on capital structure. *Chapter 4* provides information regarding selection and handling of data, as well as we discuss predictions based on the chosen theoretical framework and previous empirical research. *Chapter 5* presents the methodology for our study. *Chapter 6* presents the results of the empirical analysis, as well as discussions of the results. *Chapter 7* concludes the paper. *Chapter 8* provides criticism of our thesis and suggestions for future research.

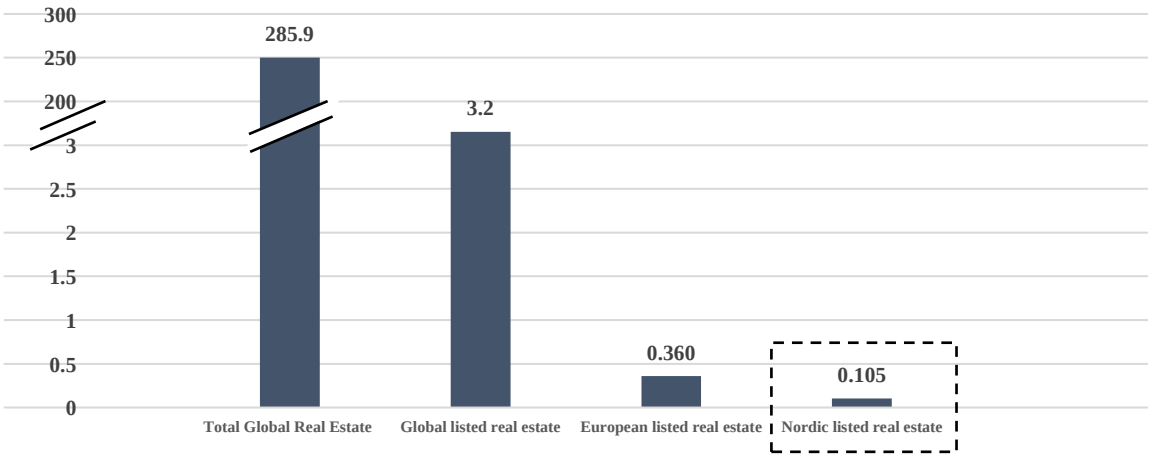
II. The Nordic Real Estate Market

In this chapter we narrow the researched market down to the listed Nordic[1] real estate sector. Thereafter, we present the real estate value chain before giving a brief overview of the favourable market conditions for Nordic real estate companies. Thereon, we present the different real estate segments before finally giving an overview of the companies studied in this paper.

Top-down real estate market sizing

Real estate as an asset class is the world's most significant store of wealth, reaching €285.9 trillion by the end of 2020 (Savills, 2020). This is the value of all the world's real estate, which includes residential real estate (both household-owned and rentals), commercial real estate, and agricultural land. Narrowing this figure down by excluding privately household-owned property and agricultural land, and by also excluding property not owned by listed companies, the global market capitalization of the property sector is valued at €3.2 trillion as of Q4 20 (EPRA, 2021). Of the €3.2 trillion, €360bn[2] is listed in EU-countries and €105bn[2] is listed in the Nordics (Pangea Property Partners, 2021). Our thesis moving forward will target the €105bn listed property sector in the Nordics, as illustrated in *figure 1*. This brief top-down market sizing is presented to give a clear understanding of the real estate market in question.

Figure 1 – Top-down real estate market sizing



Source: Savills annual market report, European Public Real Estate Association, Pangea Property Partners

[1] Norway, Sweden, Finland, and Denmark

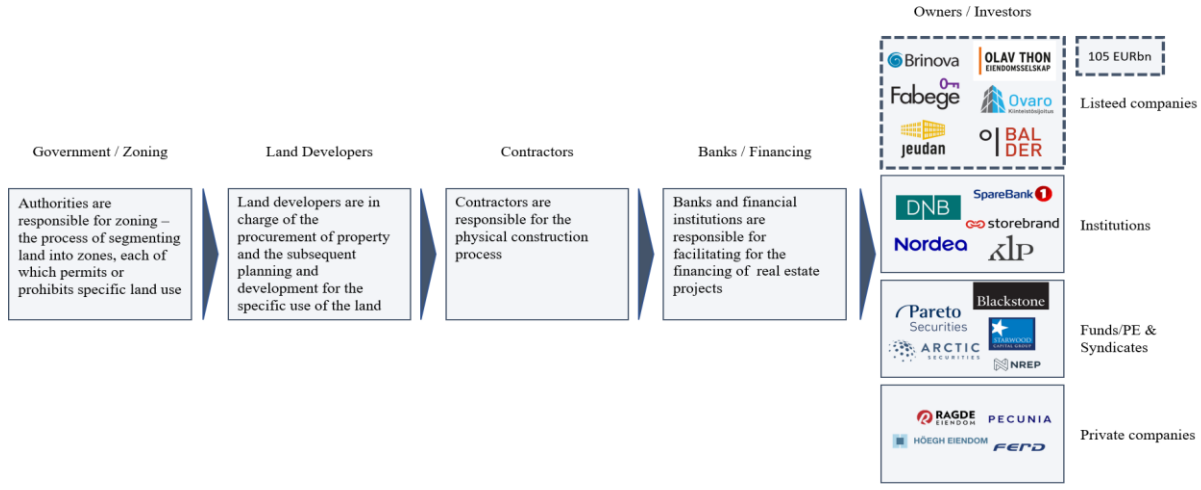
[2] Approximate figures as of Q2 21

Real estate value chain

To place the targeted market for this analysis in the real estate value chain, we present its key players and their respective roles in the process of developing, buying, and selling properties. In the real estate value chain, we separate the players into five different groups based on their core activities: government & zoning, project & land developers, contractors, banks & financing, owners & investors (Pangea Property Partners, 2021). Within the group owners and investors, we further separate into listed companies, institutions, funds/PE & syndicates, and private companies, as illustrated in the *figure 2*. Despite differing in corporate structure, their main activities are highly aligned. They own, operate, and, in some cases, develop real estate, making their money by renting property to consumers or businesses, or through the process of investing and divesting (Lowe & Gereffi, 2008). In other words, the companies' main activity is to manage a portfolio of facilities through direct ownership. As mentioned, our thesis exclusively focuses on the listed property investors.

Figure 2 – Commercial Real Estate Value Chain

Note: The figure illustrates how the different stakeholders in the real estate value chain interact and their main roles. When a property reaches the point of being fully developed, the property is considered to be an active asset available to owners and investors.



Source: Pangea Property Partners, Own Contribution

The listed Nordic real estate market

The Nordics is one of the largest listed real estate markets in Europe, adding up to a market capitalization of €105bn, which compares to EU's total of €360bn. An overview of the market is shown in *table 1*, divided by country. Sweden is by far the largest of the Nordic markets with

an 83% share of the total market cap, followed by Norway (7.69%), Finland (6.67%) and Denmark (1.90%). The main explanation for the large share of listed real estate in Sweden is its residential sector. Only ~64% of the population own their home, compared to ~80% in Norway where tax regulations incentivise privately owned households (Eurostat , 2021). Thus, the residential market is more dominated by rentals in comparison, where listed companies are among the major owners. In turn, this implies that it is more normal to gain real estate exposure through owning shares of listed real estate companies in Sweden, compared to the rest of the Nordics.

We believe the trend of owning public real estate in Sweden also is transferable to other segments, as this is a way of diversifying one's real estate exposure. This is a possible explanation to why the property sector in Sweden has outperformed its Nordic peers and is currently valued at an average of 85%[3] premium to NAV[4], strongly incentivising for companies to go public. In 2021 alone, there have been a total of seven real estate listings on the main list in Sweden alone.

Table 1– Listed Nordic property sector overview

Note: All markets caps in EURbn

	Sweden	Norway	Finland	Denmark	Nordics
Main list	No. of companies	No. of companies	No. of companies	No. of companies	No. of companies
	30	3	4	6	43
	Market cap	Market cap	Market cap	Market cap	Market cap
	83	6	7	2	97
Alternative list	No. of companies	No. of companies	No. of companies	No. of companies	No. of companies
	31	4	-	-	35
	Market cap	Market cap	Market cap	Market cap	Market cap
	30	30	-	-	8
Total	No. of companies	No. of companies	No. of companies	No. of companies	No. of companies
	61	7	4	6	78
	Market cap	Market cap	Market cap	Market cap	Market cap
	86	8	7	2	105

Sources: Pangea Property Partners, Own Contribution

[3] Based on share price as of Q2 21 compared to reported EPRA NAV Q2 21

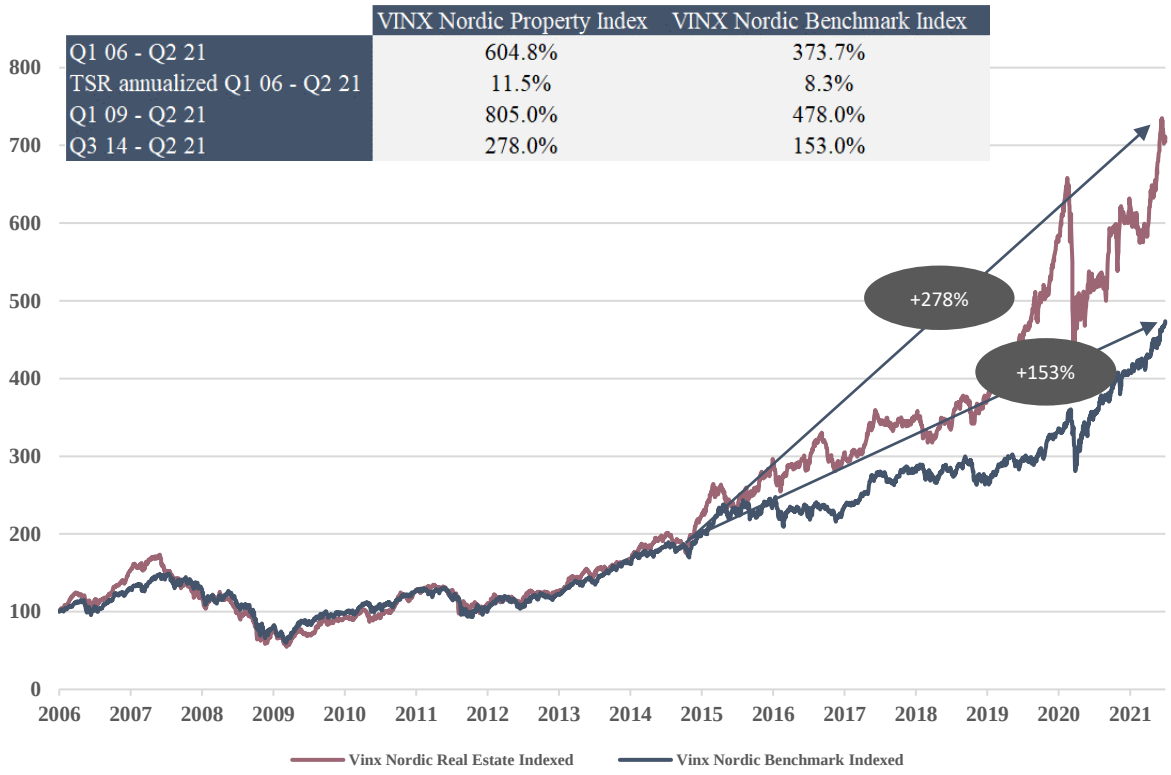
[4] Net Asset Value

To clarify, for the remainder of this study, we focus on the €97bn main list companies, a sample selection decision which is further discussed in *chapter 4. Data*.

The listed Nordic property sector has experienced several tailwinds after the large drawdown under the financial crisis, and has gained 805% since 2009, measured through the VINX Nordic Real Estate index[5]. The index is comprised of market cap weighted major Nordic real estate companies, functioning as fair proxy for the aggregate stock price development of the listed companies in *table 1*. This compares to the overall Nordic stock market, which has gained 478% within the same timeframe, measured through the VINX Nordic Benchmark index[6]. The price development for the two indices is showcased in *figure 3*. The real estate sector has outperformed the broader Nordic equity markets, yielding an annualized total share return (TSR) of 11.5% from Q1 06 to Q2 21, compared to 8.3% for the overall Nordic stock market.

Figure 3 – Indexed VINX indices price development Q1 06 – Q2 21

Note: Both indices indexed from Q1 06.



Source: Refinitiv Eikon, Own Contribution

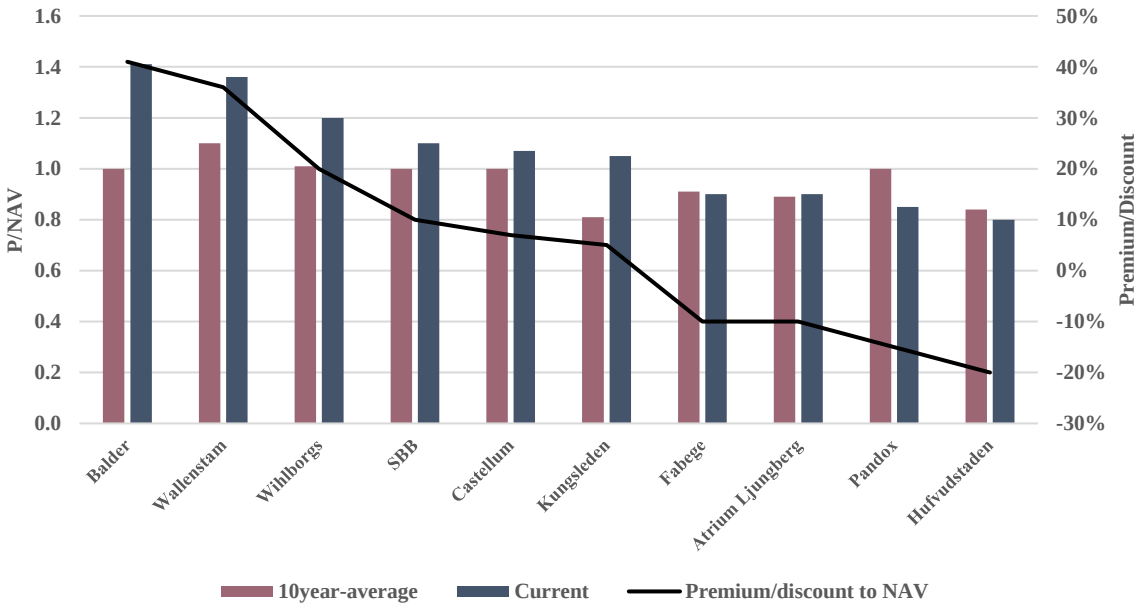
[5] From Q1 09-Q2 21

[6] Market cap weighted stock index comprised of all Nordic main list companies

There is a decoupling of the two indices from Q3 14 to Q2 21. The real estate index significantly outperforms the broader Nordic equity markets, yielding 278% and 153%, or 16.3% and 6.6% annualized, respectively. Commodity prices declined globally, and inflation was lagging the target of 2.0% for the Nordic countries through 2014. In response, the Nordic central banks turned dovish and cut interest rates considerably during 2014, which may be the reason for the recent bull-run in Nordic real estate stocks as low interest rates have persisted. Notably, with inflation rising, a continuing decline in interest rates and bond spreads stabilising at low levels, market conditions have been favourable for real estate in the Nordics the last few years, further discussed in *chapter 2.4*. However, these conditions will not last forever and in combination with many of the listed Nordic real estate names being priced above their 10-year average P/NAV[7] multiple, shown in *figure 4*, one could argue that the market is showing signs of being overheated.

Figure 4 – P/NAV for a selection of Swedish listed real estate firms

Note: Share prices and EPRA NAV as of Q2 21.



Source: Company interim reports Q2 21, Refinitiv Eikon, Own Contribution

[7] Market Capitalization to Net Asset Value

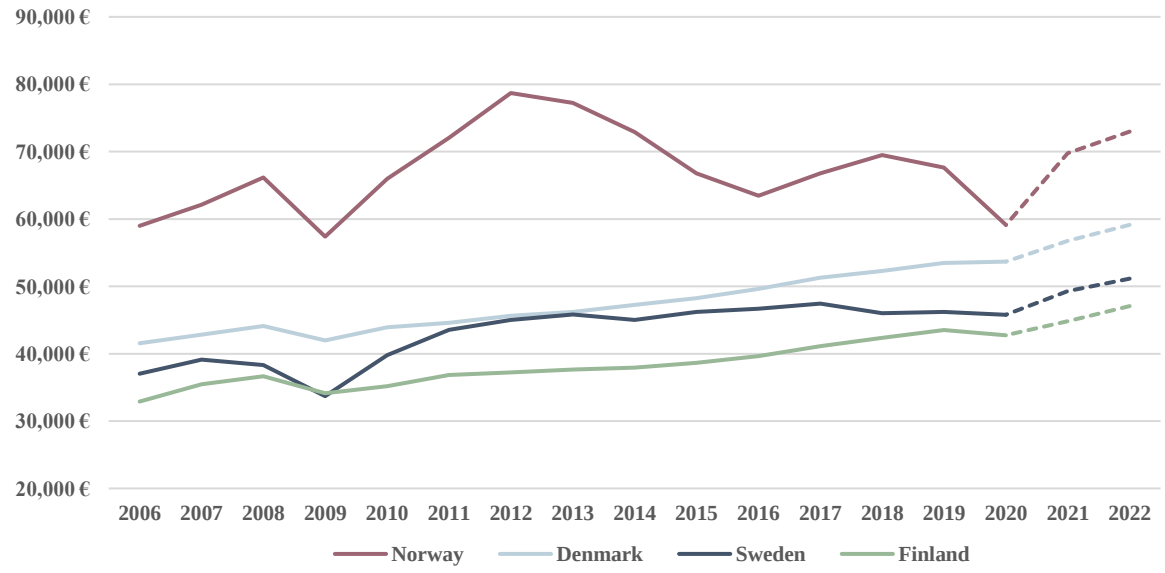
Favorable Nordic market conditions

To understand the key drivers behind the outperformance shown in *figure 3*, we will provide a brief backdrop of the favourable Nordic market conditions, which makes the Nordic real estate sector particularly appealing for further investigation.

Firstly, the Nordic economies have been relatively stable and growing since 2008. The development in GDP per capita per country from 2006 to 2022[8] is displayed in *figure 5*, showing a resilient increase for most of the Nordic countries. The GDP numbers are quoted as current prices in euros and are not seasonally adjusted. The Norwegian real economy exhibits more volatility than its Nordic peers, as GDP is highly dependent on the oil price. Also, there is no change from 2006 to 2020. Finland and Denmark both expanded 29%, while Sweden grew 23% from 2006 to 2020. Notably, the drawdown following the financial crisis in 2008 was quickly recovered and IMF are projecting the public health crisis in 2020 to have limited impacts on GDP going forward (Lawder, 2021).

Figure 5 – GDP per capita for the Nordic countries from 2006 to 2021

Note: Current prices, not seasonally adjusted. Sweden, Norway, and Denmark values have been converted from SEK, NOK and DKK to EUR using annual average exchange ratios. Dashed lines are projections made by IMF.



Source: International Monetary Fund obtained through Refinitiv Eikon

[8] 2021 is a preliminary forecast based on Q1-Q2/2021 while 2022 is forecasted by IMF-World Economic Outlook

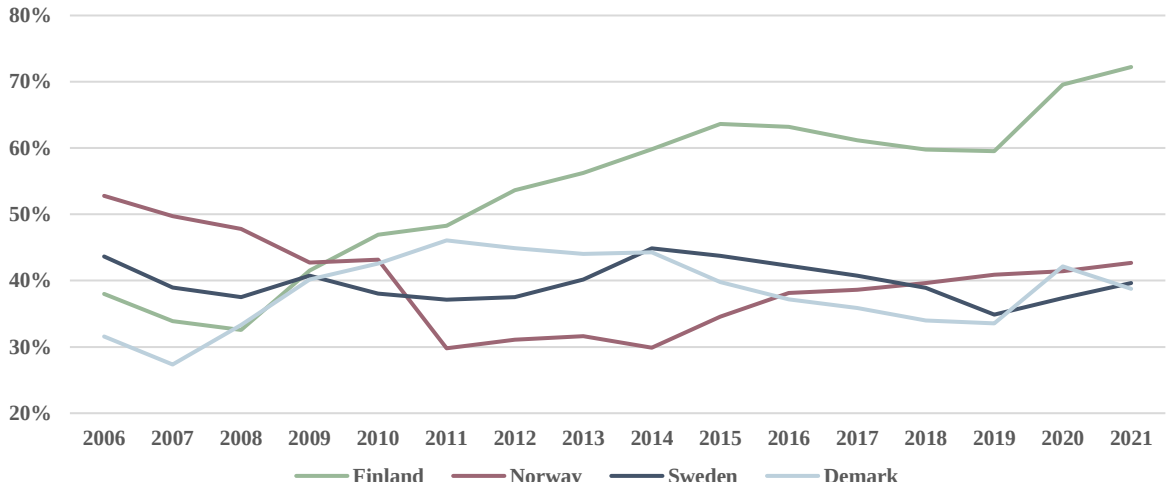
The steady growth is important because GDP can function as a reasonable proxy for the development in most real estate prices. Usually when GDP increases, demand for commercial and residential space also increases. For instance, when an economy expands, tenants of commercial real estate will drive prices upwards. From an investor's perspective, this will increase expected income and expected capital value appreciation from real estate investments.

A stable and growing economic environment coupled with fast recoveries from earlier crisis contributes to making the listed Nordic property market attractive and has historically been supportive of elevated property prices.

The Nordic countries have historically displayed robust public finances. This is fundamentally important for any economy as a public debt overhang may slow the annual rate of economic growth (Eberhardt & Presbitero, 2015). Federal balance sheet expansion can also affect domestic credit ratings, raising the cost of real estate capital, which negatively impacts real estate prices as funding becomes more expensive. *Figure 6* depicts general government gross debt as a percentage of GDP for the Nordic countries. General government gross debt denotes all accrued external financial obligations (OECD, 2017). For Norway, Sweden and Denmark public debt has ranged at healthy levels between 30% and 40%. Finland is displaying a more worrisome trend, as public debt has increased by 34 percentage points from 2006 to 2021. Nonetheless, for all Nordic countries, public debt overhang has not been an issue for domestic credit ratings, leaving cost of real estate unimpacted. Particularly in the case of Norway, where a one-year average expected return from the sovereign wealth fund could cover the total general government gross debt by the manyfold.

Figure 6 – General government gross debt as a percentage of GDP

Note: General government gross debt denotes all accrued external financial obligations



Source: International Monetary Fund obtained through Refinitiv Eikon

Within the same time frame, *figure 7* illustrates how the 5-year swap rates for NOK, SEK, DKK, and EUR has continuously been on the decline, triggered by market turmoil and central bank actions in 2008. For real estate investors, low interest rates often translate into increased investment appetite as the cost of funding decreases. Further, a fundamental principle of finance is that current prices is the present value of future expected cash flows which significantly varies with the applied discount rate.

Over time, falling interest rates pushes the applied discount rate downwards, as future expected cash flows from real estate investments are discounted at lower rates. As a result of lower applied rates, property prices are pushed upwards. This dynamic also impacts the capitalization rate, a common valuation metric for commercial real estate, defined as the annual expected net operating income divided by the property price. Hobijn, Krainer, and Lang (2011) conclude that most of the variation in capitalization rates across markets can be credited to the movement of interest rates over time. This also implies that changes in interest rates drive changes in commercial real estate discount rates. Therefore, the declining trend in interest rates is likely to have been supportive of rising stock prices amid property companies as their assets appreciates in value, especially from Q3 14, which we have highlighted in *figure 3.*

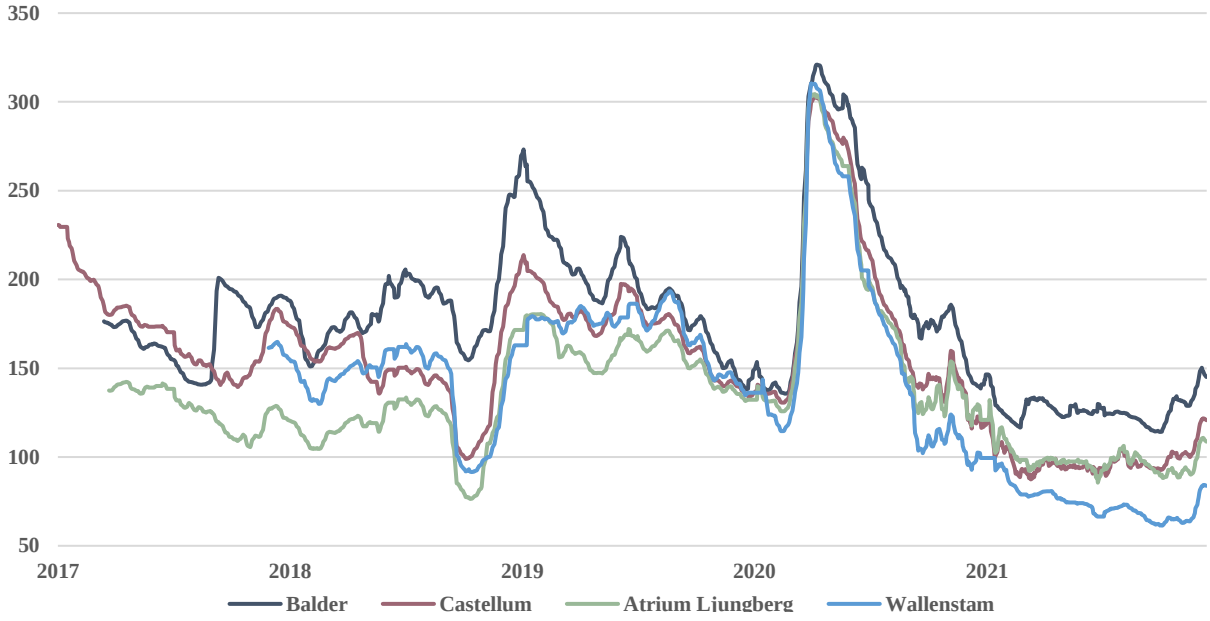
Figure 7 – 5-year Nordic swap rates development

Source: Bloomberg

To also touch upon recent development in credit spreads for the listed Nordic property sector, we have chosen to look at four companies in our study, namely Balder, Castellum, Atrium Ljungberg and Wallenstam. *Figure 8* shows the development in average credit spreads for all active outstanding bonds for the companies between Q1 17 and Q2 21. We observe that the average credit spreads for the four companies mostly range between 100 and 300 basis points. Apart from a dramatic liquidity event in Q2 20 caused by the pandemic, which drove credit spreads from ~120 to ~300 basis points, bond market conditions have been favourable. The low and stable credit spreads is suggestive of high demand for listed Nordic real estate bonds among credit investors. Noteworthy, as swap-rates have declined across the board among the Nordic countries in recent years and bonds spreads have been fairly stable, the overall debt market conditions for Nordic real estate companies have certainly been favourable.

Figure 8 – Average credit spreads of all active outstanding bonds

Note: To obtain the respective credit spreads the 5-year SEK swap rate is subtracted from the average YTM of all active outstanding bonds.



Source: Bloomberg

Segments

In the Nordics, listed real estate companies are usually categorized based on the segments in which they operate. We divide the companies studied in six segments: office, logistics, retail, residential, hotels and mixed[9] as shown in *figure 9*. The reasoning behind this split is that the financial and strategic aspects of direct property ownership vary among the segments due to differences in key property value drivers. Concurrently, the segment split will be of importance in terms of inference later in the analysis. Therefore, we will give a brief introduction to each segment, including some insights on recent development in transaction volumes and prime yields. Finally, we will present the listed Nordic companies included in our study, and comment on the observed historical relation between the performance of these companies, and the coherent development in the segment in which they operate.

Figure 9 - Real Estate Segment Split

Source: Own contribution

[9] Companies that have more than 50% exposure to one segment measured in NAV will be placed in that segment in the following analysis

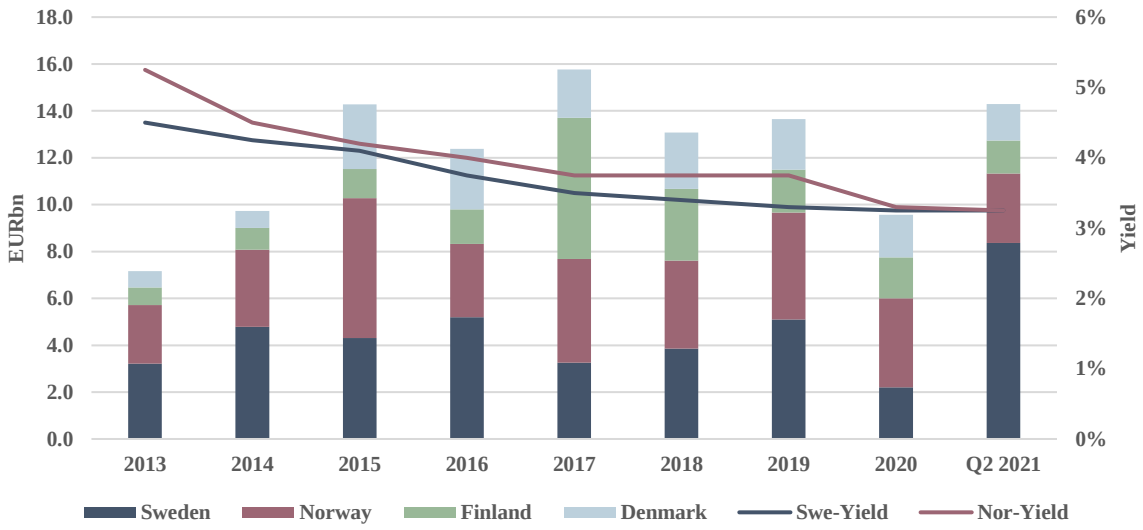
Offices

The office segment includes all office buildings with workspaces that are available for rent for different businesses to operate out of (Reffkin, 2021). Consequently, the main driver for the demand for office facilities is general economic activity. As overall production in the economy fluctuates, the concentration of businesses in need of office spaces changes. On the other hand, the owners, e.g. the supplier, gets better lease terms for their office facilities if there is a lift in the demand, ultimately pushing yields downwards and the prices upwards, and vice versa if there is a drawdown in demand.

In *figure 10* below, we can see the most recent development in transaction volume for office facilities in the Nordic market. There has been a solid increase in the overall Nordic transaction volume since 2013 within the office segment. Despite the low activity in 2020 mainly caused by pandemic-related uncertainties regarding future office vacancies, the overall transaction volume for office facilities has grown at a CAGR of 9% over the past eight years. This is likely a result of the combination of an increased interest in office spaces from businesses, and a limited supply of vacant office facilities in prime locations. This has in turn increased the overall attractiveness of office facilities as a real estate investment class. Following the trend in transaction volume, we can see that prime office yields have been pushed down 2 and 1.25 percentage points in Sweden and Norway, respectively.

Figure 10 – Annual Nordic transaction volume and prime yield - Offices

Note: Based on transactions above EUR 5m



Source: Pangea Property Partners

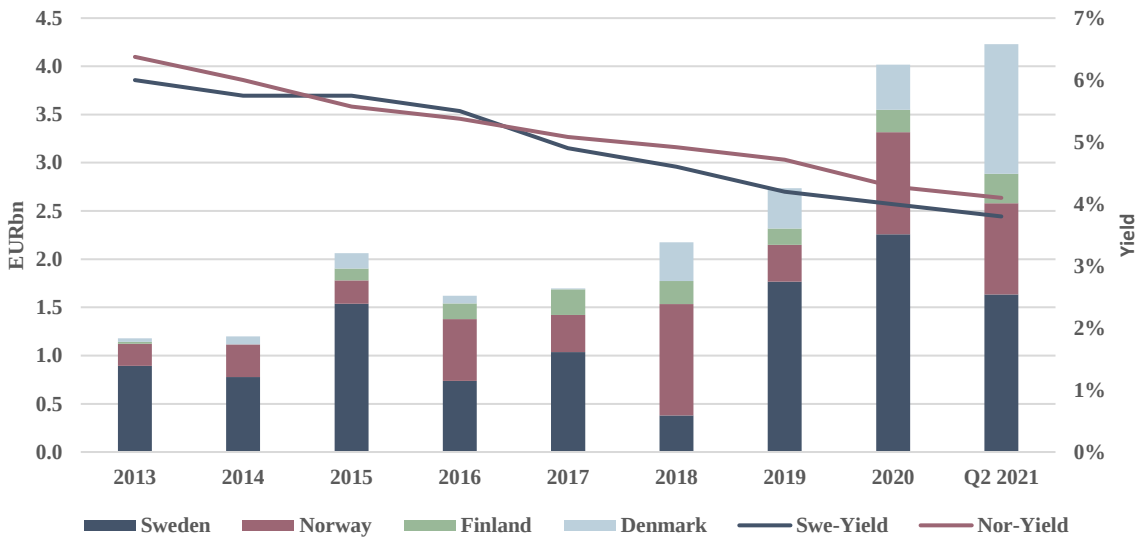
Logistics

The logistics segment refers to any properties used for logistics purposes, including warehouses, distribution facilities and fulfilment centres. The main demand drivers within this segment are growth drivers in every industry that utilises logistics facilities at some point in their value chain.

Over the time period used in this study, the demand for logistics facilities has grown immensely, mainly due to growth within the e-commerce sector. In addition, other trends such as a rising demand for online grocery shopping and continued demand for cold storage space has further pushed the attractiveness of logistics investments to new heights. Consequently, as we can see in *figure 11*, the total Nordic transaction volume within logistics facilities has grown at from approx. 1.2 EURbn to 4.2 EURbn, resulting in a CAGR of 17.3% over the past eight years. Notably, a large portion of the total contribution to this increase can be seen from 2019 to 2021, resulting from the spike in the demand for storage space caused by the pandemic. Moreover, we can see in *figure 11* that prime logistics yields have been pushed down 2.2 and 2.28 percentage points in Sweden and Norway, respectively.

Figure 11– Annual Nordic transaction volume and prime yield - Logistics

Note: Based on transactions above EUR 5m



Source: Pangea Property Partners

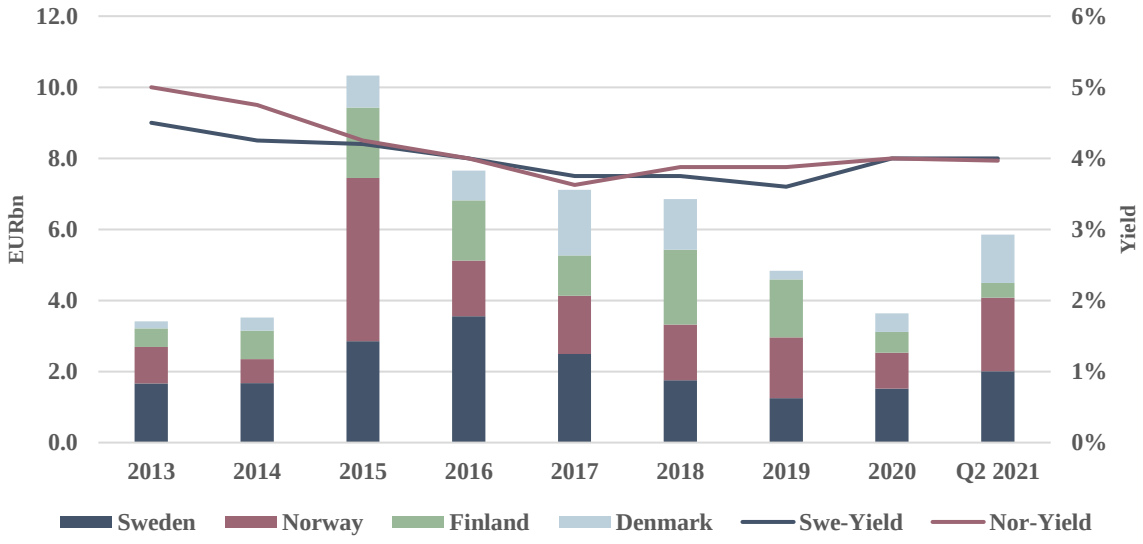
Retail

Retail properties are any buildings used for retail purposes. This can be anything from single storefronts to strip malls and shopping centres (Reffkin, 2021). Consequently, the main players driving the demand for retail facilities are all businesses that actively operates within physical retail.

In *figure 12*, we can see a contradictory development in the Nordic transaction volume compared to what we have seen in the office and logistics segments. Despite the vast increase in transaction volume from 2014 to 2015, we have seen a continuous downturn in total retail transaction volume from 2015 to 2020. The shift from physical retail to e-commerce, reinforced by the impact of Covid-19, have caused the relative attractiveness of investments in retail facilities to decrease, resulting in a CAGR of -9% from 2015 to Q2 21. Although, the strong underlying fundamentals of Nordic commercial real estate combined with declining interest rates have still managed to push the high street prime yields in Sweden and Norway down. Some would argue this is a testimony to the relative attractiveness of Nordic CRE when compared to other western regions, causing a conspicuous and continuous inflow of foreign capital.

Figure 12 – Annual Nordic transaction volume and prime yield - Retail

Note: Based on transactions above EUR 5m



Source: Pangea Property Partners

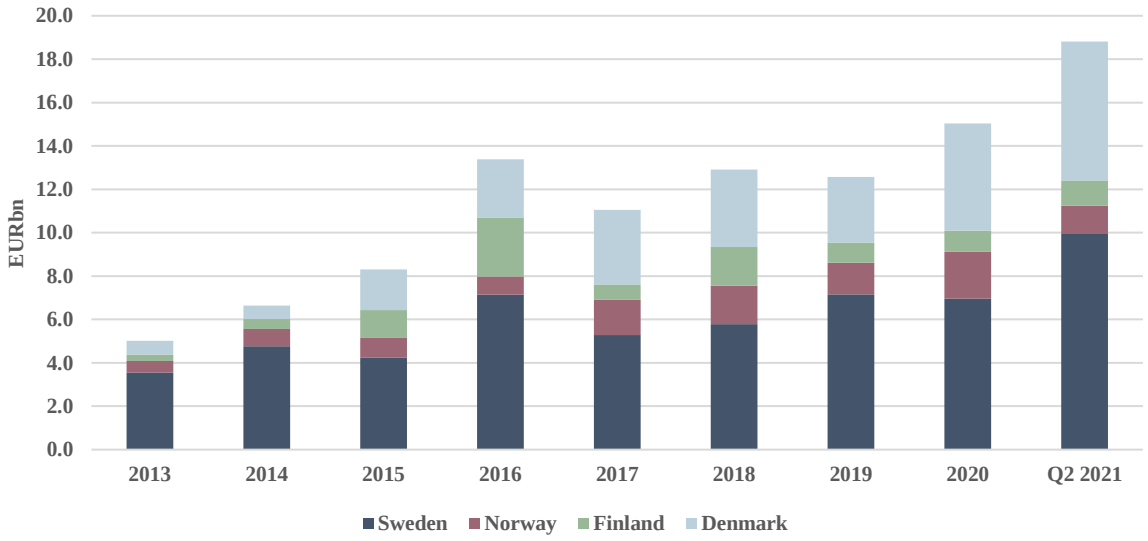
Residentials

In simple terms, residential real estate refers to properties that are homes or apartments (JLL, 2020). Within the scope of this paper, residential real estate transactions most often refer to large portfolios of rental residencies changing hands. Consequently, we do not have data concerning yield-development for residential real estate over the past years. Although, the development within the total transaction volume in Nordic residential real estate still lays ground for an interesting narrative.

In *figure 13*, we can see that there has been a steady increase in the transaction volume within residential real estate over the past eight years. The overall change from 5 EURbn to 18.8 EURbn results in a CAGR of approx. 18%. We can infer from *figure 13* that the overall attractiveness of investing in large portfolios of residential real estate in the Nordics has increased vastly. One explanation for this development can be found by looking at the tightened private Nordic real estate sector. As increased urbanization has elevated the purchasing prices for private real estate in most Nordic cities, increased interest in rentals have been inevitable. Resultingly, the lease terms for the owners of residential real estate are now more attractive than ever.

Figure 13 - Annual Nordic transaction volume and prime yield - Residential

Based on transactions above EUR 5m. Yield for the residential segment was not obtainable.



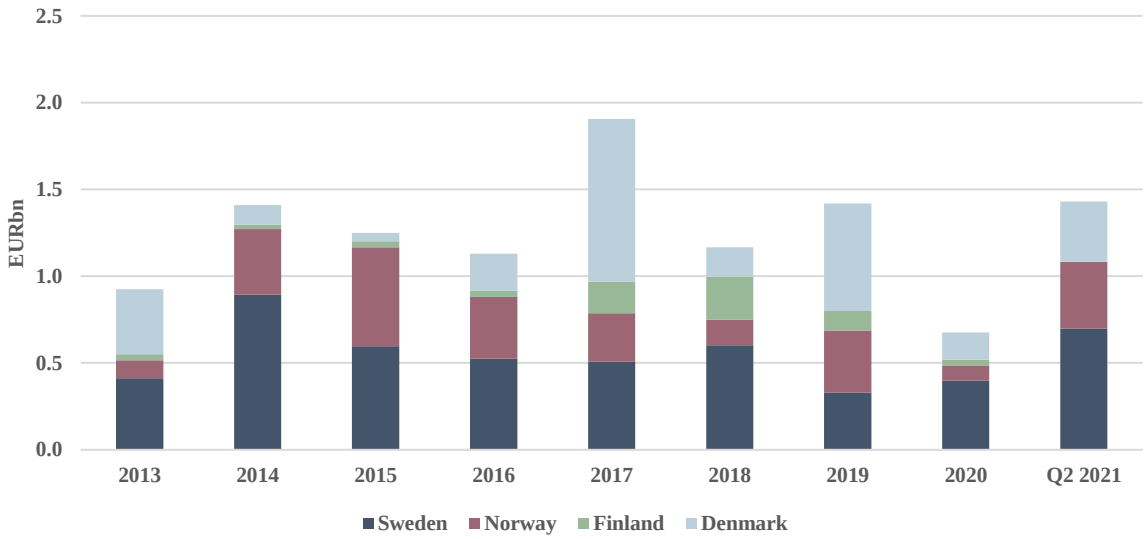
Source: Pangea Property Partners

Hotels

The hotel segment separates hotel properties into two categories: Independent hotels (unaffiliated), and flagged hotels (part of a chain). As hotels as a service is mainly targeting tourism, the affordability of air travel and the concentration of corporate- and experiential travel are the main drivers of demand. Consequently, listed Nordic real estate companies that specialise within the segment is exposed to different, and more specific trends than the rest of the segments. This shows when analysing the activity within hotel transactions over the past eight years, as shown in *figure 14*. Over the past eight years, we have seen a CAGR of 5.6% in total Nordic hotel transactions.

Figure 14 - Annual Nordic transaction volume and prime yield - Hotels

Note: Based on transactions above EUR 5m. Yield for the hotel segment was not obtainable.



Source: Pangea Property Partners

Listed Nordic real estate companies highlights

To give a brief overview of the competitive landscape within listed Nordic real estate, we present a table containing the sample of companies studied in this paper, along with some key characteristics. *Table 2* presents a brief overview of individual company profiles and key financials as of Q2 21. Additionally, the table gives an overview of the different company's historical share price growth, denoted with total share return (TSR)[10]. Lastly, we have presented the two main value creation-indicators of interest in this paper, namely return on invested capital (ROIC) and enterprise value to invested capital (EV/IC). We have also split the averages for each segment, as well as for the total market, into value-weighted averages[11] and unweighted averages. In the following discussion of the table, we will refer to the value-weighted averages.

We can see from *table 2* that the prevalent segment-based characteristics are aligned with the observations made from recent transaction activity and yield development. In terms of TSRs, we can see that logistics have outperformed every other segment in the relevant timeframe, followed by office and residential stocks with somewhat similar growth characteristics. The retail and hotel segment has underperformed in terms of share returns over the same period. Moving on, the historical data implies that the ROIC for the last twelve months also favours the logistics segment, followed by residential, mixed, retail, office, and hotel in descending order. Further, the relative valuation of the different segments affirms recent development in transaction activity. We can see that logistics are on average valued at approximately two times that of the other segments relative to book value, implying that the expectations for future value creation is much higher in this segment. The higher valuation of this segments' equity is clearly reflected in the implied loan-to-value (LTV) ratio, as we can see that logistics have an LTV of 25%.

Despite showing very similar characteristics when comparing EV-weighted and unweighted market averages for ROIC and EV/IC, we observe that there is a 5 ppts difference in TSR between them. This is indicative of higher returns for the larger companies due to higher dividend payments over the studied period.

[10] Total share return = $\frac{(Current\ Price - Purchase\ Price) + Dividends}{Purchase\ Price}$

[11] Weighted on Enterprise Value

Table 2– Listed Nordic real estate company overview and performance split by segment

	Company Data						Company Performance		
	Company Profile			Financials					
	Company	Main Segment	Geography	EV	MCAP	Implied LTV	Total Share Return	ROIC LTM	EV/IC
				EURm	EURm	%	%	%	x
Office	Fabege	Office	Stockholm	7218	4545	37%	13%	5%	1.0
	Entra	Office	Norway	5637	3560	37%	9%	12%	1.1
	Ovaro	Office	Finland	5637	3560	37%	-4%	-14%	0.7
	Wihlborgs	Office	Öresund	5054	2856	43%	19%	6%	1.2
	Atrium Ljungberg	Office	Sweden	4447	2548	43%	13%	5%	0.9
	Jeudan	Office	Denmark	4390	1990	55%	7%	2%	1.2
	Kungsleden	Office	Sweden	4116	2278	45%	8%	8%	1.1
	Hufvudstaden	Office	Stockholm, Gotheburg	3689	2911	21%	11%	1%	1.0
	Platzer	Office	Gothenburg	2626	1554	41%	33%	7%	1.2
	Diös	Mixed	Northern Sweden	2548	1202	53%	14%	8%	1.1
	Corem	Office	Sweden, Denmark, US	2032	1052	48%	29%	5%	0.9
	Sum/Average value-weighted			**47394**	**28056**	**38%**	**12%**	**4%**	**1.0**
	Sum/Average not value-weighted					**42%**	**14%**	**4%**	**1.0**
				EURm	EURm	%	%	%	x
Logistics	Sagax	Logistics	Nordics, Europe	10712	8568	20%	38%	11%	2.7
	Catena	Logistics	Sweden	2884	1843	36%	17%	12%	1.4
	Stendörren	Logistics	Mid Sweden	1011	532	47%	10%	8%	1.1
	Sum/Average value-weighted			**14607**	**10943**	**25%**	**32%**	**11%**	**2.4**
	Sum/Average not value-weighted					**34%**	**22%**	**10%**	**1.8**
				EURm	EURm	%	%	%	x
Retail	Olav Thon	Retail	Norway, Sweden	3917	1842	53%	10%	7%	0.8
	Citycon	Retail	Nordics	3376	1290	62%	4%	3%	0.7
	German High Street Properties	Retail	Germany	97	57	41%	3%	5%	0.9
	Sum/Average value-weighted			**7390**	**3189**	**57%**	**8%**	**5%**	**0.8**
	Sum/Average not value-weighted					**52%**	**6%**	**5%**	**0.8**

	Company	Main Segment	Geography	EV	MCAP	Implied LTV	Total Share Return	ROIC LTM	EV/IC
Residential				EURm	EURm	%	%	%	x
	Heimstaden	Residential	Northern Europe	18483	10868	41%	9%	12%	1.3
	Wallenstam	Residential	Stockholm, Gotheburg	7249	4523	38%	17%	5%	1.3
	Heba	Residential	Stockholm	1600	1109	31%	14%	9%	1.4
	K2A	Residential	Sweden	846	473	44%	11%	8%	3.8
	Sum/Average value-weighted			**28178**	**16973**	**40%**	**11%**	**10%**	**1.4**
	Sum/Average not value-weighted					**38%**	**13%**	**9%**	**1.9**
Mixed				EURm	EURm	%	%	%	x
	Balder	Mixed	Nordics, Europe	19572	10121	48%	27%	6%	1.1
	Castellum	Mixed	Nordics	11871	6034	49%	13%	12%	1.1
	SBB	Mixed	Nordics	9406	4616	51%	44%	13%	0.8
	NP3	Mixed	Northern Sweden	1664	922	45%	33%	5%	1.3
	Brinova	Mixed	Southern Sweden	707	330	53%	9%	3%	1.1
	Oscar Properties	Mixed	Sweden	335	178	47%	-30%	3%	0.5
	Fast Ejendom	Mixed	Odense, Århus	129	43	67%	15%	7%	0.9
	Borgestad	Mixed	Nordics, Europe	112	18	84%	-7%	0%	0.9
	Investors House	Mixed	Finland	63	33	48%	8%	10%	0.9
	Sum/Average value-weighted			**43859**	**22295**	**49%**	**26%**	**9%**	**1.0**
	Sum/Average not value-weighted					**55%**	**12%**	**6%**	**0.9**
Hotel				EURm	EURm	%	%	%	x
	Pandox	Hotel	Northern Europe	5651	2672	53%	7%	0%	1.0
	Sum/Average			**5651**	**2672**	**53%**	**7%**	**0%**	**1.0**
Total	***Sum/Average value-weighted***			**147079**	**84128**	**40%**	**17%**	**7%**	**1.1**
	Sum/Average not value-weighted					**46%**	**12%**	**6%**	**1.2**

Source: Pangea Property Partners, Refinitiv Eikon, Bloomberg, Company Reports, Own Contribution

III. Theory

This paper aims to study the relationship of a firm's choice of capital structure on firm value. In this chapter we elaborate on the implications of including market imperfection into Modigliani and Miller's model. We do so by presenting the two theories we find most relevant in the discussion of the relationship between capital structure and firm valuation, namely trade-off theory and information asymmetry theory.

Capital structure in imperfect capital markets

In 1958, Modigliani and Miller claimed that in a perfect capital market, capital structure is irrelevant for firm valuation. Although, we know that most companies in the real world are subject to market imperfections such as taxes, bankruptcy costs, agency costs, recapitalization costs and information asymmetries. This has led to several research efforts trying to describe the consequences of relaxing the ideal assumptions of MM's perfect capital market, and how this results in different interpretations of the effect of capital structure on firm valuation.

In 1963, Modigliani and Miller incorporated corporate income taxes into their perfect capital market model. With interest payments being tax deductible, and by assuming debt to be riskless, they found that all firms would be incentivised to be 100% debt financed. This is a result of the interest tax shield lowering future tax payments causing an increase in future cash flows.

Although, even when relaxing their original framework, MM's model was still discarded as being highly unrealistic. It became clear that the relaxed MM framework still left out some essential variables when allowing for market imperfections. For example, an important consequence of debt financing, and a missing element in Modigliani and Millers framework, is the increased bankruptcy risk (Baxter, 1967).

Trade-off theory

Kraus and Litzenberger (1973) were the first to propose the static trade-off theory by allowing for bankruptcy costs to influence a firm's choice of capital structure. Their study suggested that the optimal capital structure of a firm could be found at the point where the advantages

and disadvantages of debt converge. In other words, the firm would have to choose their mix of debt and equity based on the trade-off between the benefits of the interest tax shield and financial distress costs. These financial distress costs emerge as the risk of defaulting on debt obligations increases when taking on more debt. Examples are legal and administrative costs in the event of bankruptcy, or costs associated with financial distress prior to bankruptcy such as fire sales of assets and loss of customers (Berk & DeMarzo, 2014). Later, extensions to the static trade-off theory have been made, one of them being the inclusion of agency theory and information asymmetry theory.

The agency theory takes a managerial approach in explaining how companies act (Berk & DeMarzo, 2011). Jensen and Meckling (1976) argued that both costs and benefits occurs when there is a conflict of interest between sponsors of the firm.

In terms of agency related costs of debt, managers are incentivised to take actions that are likely to maximise their own personal wealth. At the same time, shareholders want the company to take actions that maximises shareholder value, while lenders wish for the firm to be solvent enough to meet their debt obligations.

Assuming that management often are personally invested in the company they run, their interests should be aligned with the shareholders in terms of maximising the equity value of the company. This can lead to excessive risk-taking since a potential failure mainly affects the debt owners. This in turn leads to an asset substitution effect, meaning that shareholders desire to replace low-risk assets with riskier assets at the cost of creditors (Berk & DeMarzo, 2014). On the other hand, one can argue that concentration of ownership and commitment is an agency related benefit. By taking on debt rather than issuing new equity, firms keep their initial shareholder base intact, allowing original shareholders with high commitment to run the company without having to take the views of new shareholders into account.

As the static trade-off theory postulates that the debt ratio that maximises total firm value can be found where the sum of marginal tax benefits, bankruptcy costs, agency costs and agency benefits is zero. The optimal capital structure can be derived by maximising *equation 1*.

$$V^L = V^U + PV(TS) - PV(BC) - PV(AC) + PV(AB) \quad (1)$$

Where:

$V^L = The\ levered\ value\ of\ the\ firm$

$V^{UL} = The\ unlevered\ value\ of\ the\ firm$

$PV(TS)\ is\ the\ present\ value\ of\ future\ interest\ tax\ shields$

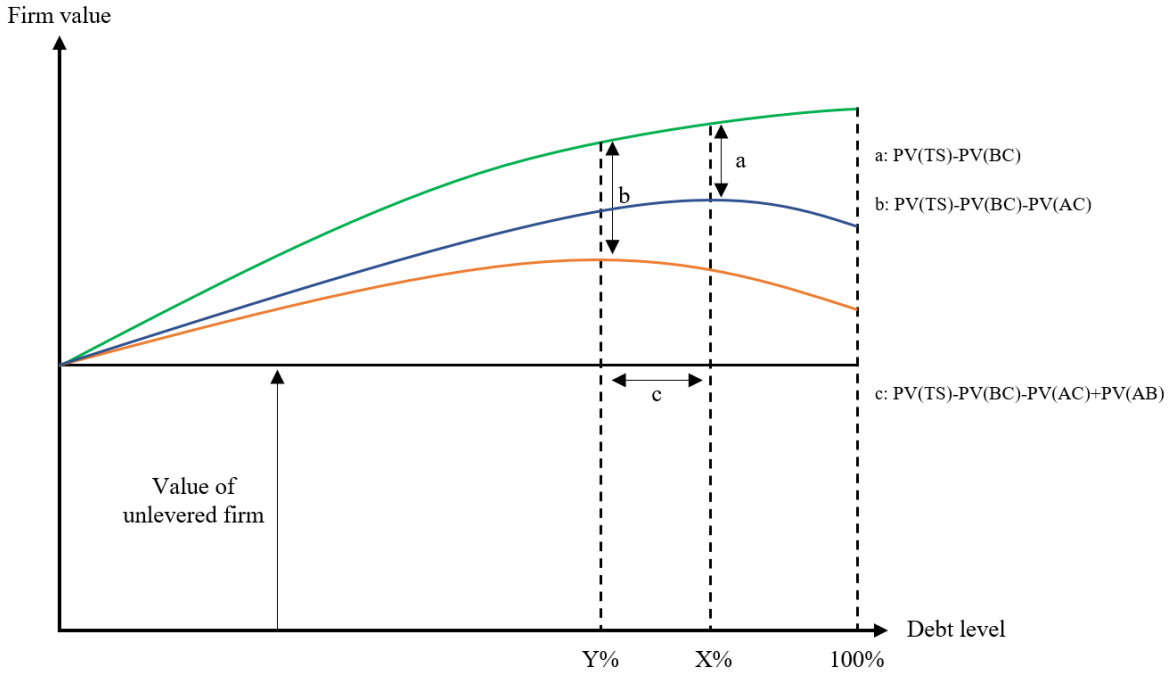
$PV(BC)\ is\ the\ present\ value\ of\ bankruptcy\ costs$

$PV(AC)\ is\ the\ present\ value\ of agency\ costs$

$PV(AB)\ is\ the\ present\ value\ of agency\ related\ benefits$

Considering *equation 1*, we can illustrate the choice of capital structure in the light of static trade-off theory with *figure 15*.

Figure 15 – Static trade-off theory of capital structure choices illustrated



Source: Own Contribution

As we can see from *figure 15*, the green line only considers the benefits of tax shields, which indicate that maximum firm value is achieved when a firm is 100% debt financed. Accounting for bankruptcy costs in *a*, the trade-off theory states that incremental debt is value enhancing until the marginal bankruptcy costs outweigh the marginal benefits of the interest tax shield. When adding agency costs in *b*, incremental debt is value enhancing if the present value of future tax shields is larger than bankruptcy and agency costs. Lastly, accounting for agency

benefits in *c*, the trade-off theory states that the optimal debt level is found somewhere between *Y%* and *X%*. To summarize, at some point incremental debt will be value-deteriorating due to bankruptcy and agency costs, suggesting a non-linear relationship between debt and firm value. This non-linear impact of leverage is important to highlight as it is of high relevance to how we later model the relationship between debt and firm value in *chapter 5. Methodology*.

Information asymmetry theory

"It is generally argued that the existence of information asymmetry between managers of firms and their shareholders drive many corporate decisions" - Myers, 1984

Although remaining as the mainstream theory of capital structure, the trade-off theory has failed to explain the observed corporate behaviour particularly witnessed with the stock market reaction to leverage-increasing and -decreasing transactions, which consistently yields stock price increases and decreases, respectively (Chen, 2003). As a result, theories based on asymmetric information has emerged.

Asymmetric information assumes that firm managers and insiders possess private information regarding a firm's characteristics and future revenue streams not available to outside investors. By making this assumption, Myers (1984) was the first to propose the pecking-order theory (POT). According to Myers, outside investors will interpret issuance of equity as management perceiving the firm's equity to be overvalued. Myers argued that by issuing overvalued equity, the firm will raise more capital than the actual value of the issued equity, making the transaction accretive to existing shareholders. On the other hand, by issuing undervalued equity, the firm will raise less capital than the actual value of the issued equity, making the transaction dilutive. As asymmetric information-based theory assumes that managers act in the interest of existing shareholders, the market would never react positively to a firm issuing new equity.

Meanwhile, by issuing debt, management signals that they expect future revenue streams to be sufficient to handle increased debt obligations. The market may also interpret the issuance of debt as existing equity being undervalued, creating a positive signalling effect.

The idea that firms prefer internal to external financing and debt to equity if they issue securities is the most fundamental aspect of Myers' hypothesis. This is because internal

funds[12] incur no flotation costs and require no additional disclosure of financial information about the firms' investment opportunities (Yousef, 2019). Hence, Myers (1984) states that managers will use internal funds, if sufficient, to avoid costs related to security issuance as well as unnecessary sharing of information about future prospects. Although, if a firm's retained earnings are insufficient, the pecking order theory states that debt is preferred over equity due to the market reaction to management signalling. This suggests that management will follow the hierarchy of financing sources presented in *figure 16*.

Figure 16 – Pecking order sources of financing

	Financing source	Degree of sensitivity to asymmetric information
Internal financing	Retained earnings	Low
External financing	Debt	
	Convertible securities	
	Preferred stock	
	Common stock	High

Source: Own Contribution

When corporate insiders are more informed about the firm's future operations than what is publicly available, investors are less able to accurately calculate the firm's fundamental value. Thus, information asymmetric firms in need of external financing face a higher cost of equity due to the adverse selection costs. All else equal, this leads information asymmetric firms to have suboptimal investments, with a deteriorating effect on their value. In view of this, debt can be value accretive contingent on the level of asymmetric information of a firm, suggesting an equilibrium that minimise the overall external financing costs (Fosu *et al.*, 2016).

[12] Retained earnings

IV. Data

The following chapter presents our data collection. We initiate this chapter by giving an overview of data sources and sample selection. Then, we explain how we have dealt with extreme outliers. Thereon, we explain how we have dealt with a growing number of firms in our data set, before giving an in-depth description of the included variables in the regression model. We discuss how the variables are related to firm value according to the presented theory and previous empirical research.

Sample selection

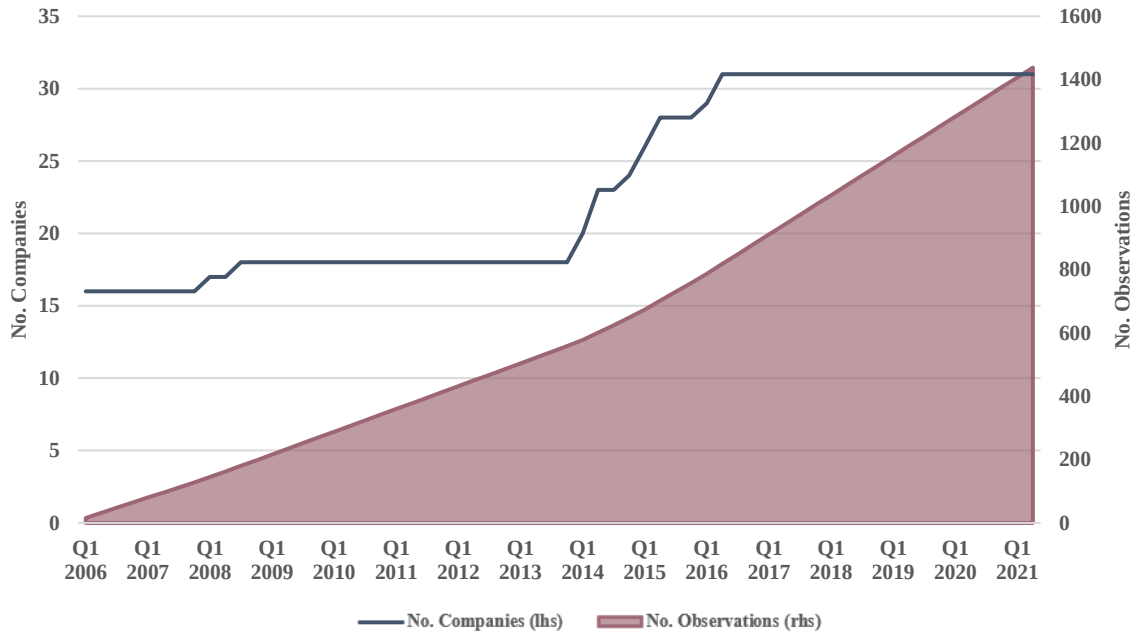
The data sample consists of 31 publicly traded real estate firms listed on OB Euronext, OMX Stockholm, OMX Copenhagen and OMX Helsinki. Nordic real estate firms not listed on their respective domestic stock exchanges[13] has not been considered due to their incomparable size and reporting practices. All relevant accounting and market information has been collected using public company interim reports, Bloomberg, and Refinitiv Eikon by Thomson Reuters. The accounting and market information has been collected on quarterly basis and converted to euros using the average exchange rate for EUR/SEK, EUR/NOK and EUR/DKK in the relevant quarter.

The sample period begins in fiscal Q1 06 to capture the full effect of the financial crisis, and ends in fiscal Q2 21, which is the most recent available public data observation. We exclude companies with missing interim financial reports as key balance sheet and income statement metrics could not be obtained. Furthermore, in accordance with Kisser and Eckbo (2020), we require twenty consecutive quarters with non-missing observations of financial data. Hence, Nordic real estate firms which were initially listed before Q1 06 or during the sample period but were delisted due to various reasons during the timeframe have been excluded from the sample if this criterion is not met. This is sensible as our thesis seeks to investigate the relationship between capital structure and firm value over time. From Q1 06 there are 16 listed Nordic real estate companies with complete quarterly accounting information for the total period. Additionally, another 15 companies are listed after Q1 06 and still satisfy the criterion of twenty consecutive quarters with financial data recordings within the mentioned timeframe.

[13] Main lists

Resultingly, our data sample consists of 31 listed property companies, with a total of 1,438 firm-quarters in an unbalanced data panel format. *Figure 17* shows the development in our sample in terms of number of firms and observations. The number of entities reach the total of 31 in Q2 16.

Figure 17 – Number of companies and running cumulative number of observations



Source: Own Contribution

The number of firms in our sample nearly doubles from Q1 14 to Q2 16, most likely due to favourable market conditions in this period, incentivising real estate firms to go public. Due to the increase in number of firms over the observed period we find it necessary to conduct a robustness check on our choice of analysing an unbalanced data panel. This is because the companies listed between Q1 14 and Q2 16 might display different characteristics from the group of companies listed before Q1 14. The robustness check is done by running the same model as presented in *chapter. 5.3* on *i)* the group of companies listed before Q1 14 for the entire timeframe and *ii)* only the group of companies listed after Q1 14 for the timeframe Q1 16 to Q2 21. The results are presented in *appendix A* and indicate that the companies in the two groups display similar characteristics. Hence, we find it reasonable to conduct the analysis using the unbalanced data panel.

We view our sample as a fair representation of the listed Nordic property sector as there is currently a total of 43[14] main listed real estate companies in the Nordic where we include 78% of them in our analysis. The total market capitalization of the 41 companies as of Q2 21 is €97bn, wherein our sample consists of €83bn or ~87% of the total. The omitted companies either have too short time as a listed company to be included or have missing accounting entries during the period.

Further, to avoid bias in the variable *size* arising from inflation due to the long timeframe in the analysis, we have CPI-adjusted all observations to make the observations comparable. This is in accordance with Kisser and Eckbo (2020).

We recognize that the small entity size may cause reduced statistical power in our analysis as the sample may not appropriately satisfy certain regression modelling assumptions. This is further discussed in the forthcoming *chapter 5. Methodology.*

Handling extreme outliers

Extreme outliers in the data sample may be caused by inaccurate data sources or by wrongful calculations of accounting ratios. Outliers may also be extreme observations in the tails of the variable distributions, not representative for the sample. Consequently, cases of extreme outliers may lead to distorted data and wrongful conclusions. Therefore, we have dealt with outliers by applying two common practices: rule of thumb and winsorization.

Firstly, rule of thumb and common sense has been applied when calculating the financial ratios from the raw data. For instance, long- and short-term debt ratios must fall between a clearly defined interval of 0 to 1. Secondly, all firm-specific continuous intervals are winsorized[15] at a 10%-level in both tails of the distribution and replaced by the most extreme values that are not removed, in accordance with Kisser and Eckbo (2020). *Table 3* shows the independent and dependent variables before and after winsorization. The winsorization process is particularly useful because the sample only consists of 31 companies, increasing the likelihood for extreme values distorting the data sample. For example, the mean value for the control variable *growth* is reduced from 9.2% to 1.0%, suggesting that there are some companies that display unusually

[14] As of Q2/2021

[15] Using *DescTools* data package in R with *winsorize* function

high quarter-over-quarter growth during the sample period, which are not representative for the population. The included variables in *table 3* are explained thoroughly in *chapter 4.3* and *4.4.* For a complete descriptive table for the dependent variable, leverage measures and firm-controls, please see *chapter 6, Table 7.*

Table 3 – Before and after winsorization at upper and lower 10%-level

Note:EV/IC defined as Enterprise Value to Invested Capital. Long-term debt is total interest-bearing debt due in one year or more to total assets. Short-term debt is interest-bearing debt due in less than one year to total assets. Tangibility is total fixed tangible assets to total assets. Size is rental income in EURm. Growth is quarter-over-quarter growth in rental income. All variables are explained in chapter 4.3 and 4.4. Mean is across all firm-quarters. Median is across all firm-quarters. Winsorization is done at upper and lower 10%-level.

		Before Winsorization		**After Winsorization**	
	N	Mean	Median	Mean	Median
Dependent variable					
EV/IC	1,438	1.02	0.995	0.976	0.996
Leverage measures					
Long-term debt (LTD)	1,438	0.433	0.461	0.428	0.461
Long-term debt (squared)	1,438	0.215	0.212	0.215	0.213
Short-term debt (STD)	1,438	0.087	0.044	0.065	0.045
Short-term debt (squared)	1,438	0.048	0.002	0.048	0.002
Firm-controls					
Tangibility	1,438	0.923	0.957	0.923	0.957
Size (Sales in EURm)	1,438	44.612	38.014	39.268	37.984
Growth	1,438	0.092	0.015	0.010	0.015

Source: Own Contributio

Measuring value creation – Choosing the dependent variable

The global financial crisis in 2008, COVID-19, climate change, social inequality and changing demographics are some examples of societal issues that are changing the way consumers behave and how companies operate and allocate capital. We assume this to be equally true for the Nordic real estate industry, as for any other industry. Consequently, the definition of value creation, and the proxies for measuring it, is always changing to some extent.

In this paper we have chosen to look at value creation from two separate perspectives. The reason for this being that the availability of relevant previous studies is limited. By choosing two proxies for value creation, we will be more capable of supporting our hypotheses concerning the impact that the chosen independent variables might have on firm value with empirical evidence later in this chapter.

Firstly, we will measure value creation from a profitability perspective. Specifically, we have chosen to use return on invested capital (ROIC) as a proxy for profitability. We look at ROIC as a measure of value creation stemming from internal sources, i.e., the investment decisions made by management. Secondly, we have chosen to use the EV/IC-multiple as a proxy for measuring firm value from an external point of view, as valuation multiples reflect how outside investors value a company relative to other companies. In the following discussion, we will briefly explain the chosen proxies, and how ROIC and EV/IC is related.

To clarify for the reader; even though we will use both proxies to support our hypotheses in this chapter, our final model will only include EV/IC, as our study is targeting investors in listed Nordic real estate. We find that our model utilizing ROIC as a dependent variable do not add any value to our analysis, but the results of this model can be viewed in *Appendix B.*

Invested capital, ROIC and EV/IC

In short, invested capital, also referred to as assets-in-place, is the sum of all capital raised by issuing securities to equity owners and debt to lenders. In turn, ROIC is a profitability metric that measures the return that companies earn on their total invested capital. Hence, the metric denotes the efficiency of a companies' usage of investors' funds. We calculate ROIC using *equation 2*:

$$Return\ on\ Invested\ Capital\ (ROIC) = \frac{Net\ Operating\ Profit\ After\ Tax\ (NOPAT)}{Invested\ Capital} \quad (2)$$

Enterprise value (EV) denotes the total market value of a company. In this paper, we define the EV of a company as the market value of equity plus the book value of net debt. As we seek to relate a firm's leverage to the firm's value, we adopt book leverage in this paper to mitigate the potential reverse causation from firm value to leverage (Opler & Titman, 1994). Hence, we measure a firm's leverage as the ratio of book value of debt to book value of assets. This measure is consistent with the extant literature (e.g., Fosu; 2013; Opler & Titman, 1994). We will elaborate more on the specific measurements used in our analysis in *chapter 4.4* for the independent variables. We have used EV/IC to measure value creation in this study, and measure it by using *equation 3*:

$$\frac{EV}{IC} = \frac{Enteprise\ value}{Invested\ capital} \quad (3)$$

Where:

$Enterprise\ value\ is\ the\ sum\ of\ the\ market\ value\ of\ equity\ and\ book\ value\ of\ net\ debt$

The reasoning behind our choice of considering both ROIC and EV/IC as proxies for value creation might become clearer when comparing ROIC/WACC[16] to EV/IC. On the one hand, companies create value when they earn a ROIC greater than their opportunity cost of capital, or WACC (McKinsey, 2006). In turn, this implies that if a firm's ROIC/WACC ratio is higher than 1.0, a company creates value, and vice versa if the ratio is lower than 1.0. On the other hand, when dividing the EV of a company by the book value of its invested capital, we get a multiple that ultimately reflects the same: how much value is created in comparison to what the companies' assets are worth in terms of book value.

ROIC/WACC can be used as an estimate of static firm value, excluding growth opportunities. Oppositely, EV/IC also includes investors' future growth expectations. Both metrics measure a firm's ability to create value, although, to fully reflect investors' expectations about future growth opportunities, we apply EV/IC to measure firm value.

Measure for the dependent variable: Enterprise Value/Invested Capital

[16] Weighted average cost of capital

Independent variables

We split the independent variables in two groups *i)* firm-specific variables and *ii)* control-variables. We give specific hypotheses for how each firm-specific variable relates to firm value in light of previous empirical findings and the presented theoretical framework. For the control-variables we do not offer specific hypotheses, but briefly discuss their importance and relevance to our model.

Firm-specific variables

I. Long-term debt (LTD)

We use LTD as a variable to infer whether there is a relationship between a firm's LTD ratio and firm value.

Liow (2010) found a positive relationship between leverage and firm value contingent on the firm being profitable when studying global listed real estate firms between 2000 to 2006. He argues that profitable real estate companies are more likely to take advantage of positive financial leverage effects, contributing to a higher sustainable growth rate.

Fosu *et al.* (2016) finds a negative and statistically significant relationship between leverage and firm value when studying listed UK firms between 1995 to 2013. Further, they observe that the marginal value-deteriorating effect of debt is largest among firms under severe conditions of information asymmetry. Allowing for an interaction-term between leverage and information asymmetry, they even find that debt can be value-enhancing because it may reduce the level of adverse selection costs. This observation is in accordance with the trade-off theory and information asymmetry theory, which predicts a non-monotonic relationship between value and debt. From Fosu *et al.* (2016) and the theoretical framework we have presented in *chapter 3*, we find it reasonable to predict a non-linear relationship between long-term debt and value.

We use the ratio of long-term debt to total assets to measure LTD. LTD is defined as interest-bearing debt that matures in one year or more. In accordance with Fosu *et al.* (2016) we adopt book value of LTD to mitigate the potential reverse causation from firm value to leverage.

Further, in accordance with Kebawar (2013), we add a quadratic variable with the same measure to control for a potential non-linear relationship.

Measure: Long-term debt/Total debt
Measure: (Long-term debt/Total debt)^2
H_{01}: Long-term debt has no relationship with firm value
H_1: Long-term debt has a positive relationship with firm value

II. Short-term debt (STD)

We use STD as a variable to infer whether there is a relationship between a firms' STD ratio, and firm value. STD is defined as interest-bearing debt that matures within a year, including current portion of long-term debt.

Lixin and Lin (2011) analysed the relationship between STD and the market value of 272 listed Chinese real estate companies between 2002 and 2007. They found STD to be significant and negatively related to the market value of listed real estate companies. This was supportive of Johnson's (2003) findings while studying the effect of debt maturity on growth opportunities and liquidity risk. He argued that shorter maturities led to underinvestment problems as more working capital was bound to meeting short term debt obligations, which in turn negatively impacted firm value.

We use the ratio of short-term debt to total debt to measure STD. Further, we add a quadratic variable with the same measure to control for potential nonlinear relationships between STD and our dependent variable.

Measure: Short-term debt/Total debt
Measure: (Short-term debt/Total debt)^2
H_{02}: Short-term debt has no relationship with firm value
H_2: Short-term debt has a negative relationship with firm value

III. Size

We use the variable size to infer whether there are scale-related differences between listed Nordic real estate companies in terms of firm value.

Hammes and Chen (2005) adapted simultaneous equations estimations to study private real estate companies in 13 European countries from 1990 to 2003. The results indicated the relationship between profitability and size to be positive. In specific relevance to our paper, the results indicated a significant and positive relationship between profitability and size for all Nordic countries except Sweden. This is similar to Liow (2010) who also found a positive and significant relationship between firm value and size. Complementary to these findings, Deloof (2003) and Lazaridis & Tryfonidis (2006) both found that bigger companies tend to be more profitable than smaller companies due to a higher degree of diversification. They argued that companies with a bigger asset base had more opportunities in terms of optimizing operations, and in turn create more profit. In addition, it is commonly assumed that companies that are larger tends to be valued at higher multiples, as larger companies are more capable of coping with external shocks.

There have been a number of academic studies performed by Price Waterhouse Coopers, Houlihan Lokey and other firms that specialize in business valuations, which uniformly conclude that there is a discount in the multiples applied to the values of smaller companies (Jacobs, 2018). In other words, evidently, size matters in valuation and it favours the large players. Contradictory to these findings, Fosu *et al.* (2016) finds a significant and negative relationship between market valuation and size. He argues that larger firms tend to be more mature, for which valuation tends to be lower.

From an asymmetric information theory perspective, larger firms usually have more equity research coverage and longer sailing time in the market, making it easier for investors to value. This reduces asymmetric information and thereby external financing costs, indicating a positive relationship between size and market value. From the too big to fail paradigm and trade-off perspective, larger firms will have lower bankruptcy costs than smaller firms, suggestive of a positive relationship.

In terms of measuring size, the vast majority of real estate companies' top line is rental income, and rental income in turn is a proxy for the total value of the firm's assets. Moreover, the effect

of size is typically non-linear and concave. Consequently, we find the logarithm of sales measured in euros to be a suitable proxy for size, in line with Deloof (2003).

Measure: Ln(Rental Income)
H_{03}: Size has no relationship with firm value
H_3: Size has a positive relationship with firm value

IV. Tangibility

We use tangibility as a variable to infer whether there is a relationship between the proportion of a firm's tangible fixed assets to total assets, and firm value.

Kebewar (2013) argues that tangibility has a negative relationship with profitability because firms with high levels of fixed assets tend to have less innovation, research and development and investment opportunities in the long run. Although there is little empirical support for this statement for real estate companies. In specific tangible assets are easily verifiable and thereby serve as good collateral, which reduce agency costs between shareholders and creditors. Thus, from a trade-off and asymmetric information theory perspective, firms with higher tangible asset ratios suffer lower costs of financial distress and adverse selection, which point to a positive relationship between tangibility and firm value. Contradictory to the theoretical framework, Liow (2010) finds a negative relationship between tangibility and firm value for listed global real estate companies, which he argues may have been caused by higher operating leverage. Hammes and Chen (2005) have similar findings for private real estate companies in Norway, Sweden, and Finland.

Regardless of what the theoretical framework and previous empirical evidence for this study implies, we must point out the fact that most real estate companies have an extremely high tangibility ratio[17]. As a result, we believe that there should not be any significant differences in value creation between the companies based on the tangibility of their asset-base. We believe the eventual differences in firm value capabilities will be better reflected by other control variables.

[17] A mean value of 0.923 in our data sample, shown in *chapter 6, table 7*

For our selected companies tangibility equal total fixed real estate investments to total assets in each interim accounting report, which is in accordance with Kebawar (2013), Hammes and Chen (2005) and Fosu *et al.* (2013).

Measure: Tangible Fixed Assets/Total Assets
H_{04}: Tangibility has a positive relationship with firm value
H_4: Tangibility has no relationship with firm value

V. Growth

We use growth as a variable to infer whether there is a relationship between a firms' historical growth ratio, and firm value.

House & Benefield (1995) studied the impact of growth in income, assets, and sales, on profitability and market valuation. They found all three growth ratios to have a significant and positive relationship with both profitability and market valuation, with sales growth being the most significant. In addition, while studying the size-effect phenomena on market valuation of US companies, Hirschey and Spencer (1992) found the market valuation of growth to be consistent across all size classes. They concluded that growth has a uniformly positive market-value influence on small, medium, and large firms. They further argued that growth was one of the key fundamental factors that help determine earnings prospects of individual companies, which in turn is highly related to valuation metrics that are inherently forward-looking.

From an information asymmetry perspective, one could argue against the prevalent empirical evidence, as faster growing companies are harder for investors to monitor. In turn, the presence of information asymmetries between management and investors will be higher for the companies that grow fast. In view of this, investments may be based on wrongful valuation, which might result in investors refraining from making investments in high growth real estate companies[18]. In addition, as real estate is inherently a low-growth sector, the gap between growth rates of low-growth and high-growth real estate companies is presumably low compared to more fast-growing sectors such as the technology sector.

[18] Relative to the industry average

In accordance with Deloof (2003) and Fosu *et al.* (2016), we use quarter-over-quarter income growth to proxy growth. Specifically, we use quarter-over-quarter rental income growth.

Measure: Quarter-over-quarter rental income growth
H_{05}: Growth has no effect on firm value
H_5: Growth has a positive relationship with firm value

Control-variables

VI. Country

We use Norway, Sweden, Denmark, and Finland as dummy variables to control for a possible relationship between a firms' home country and firm value.

Adams (1976) studied a sample of 331 large manufacturing companies to find whether there were significant differences in corporate profitability based on the country in which the company was located. He found the country-effect to have both statistically and quantitatively significant impact on a corporate profitability. He argued that the main explanation for these findings was the structure of the market in which firms operate, as well the strength of domestic financial institutions. Supporting these findings, McGahan & Victer (2010) studied home-country and industry effects on corporate profitability for firms with a varying degree of multinationality in the period between 1993 and 2003. They found that both the home-country and industry of firms had a significant impact on firm profitability. Meanwhile, the results implicated that both home-country and industry had a greater impact on corporate profitability for less multinational companies. They argued that this was due to multinationals' opportunities to distribute activities across a broader geography, ultimately making them less dependent on domestic market conditions.

Damodaran (2013) did a study on the effect of country risk on valuation multiples. He found that there was solid evidence of country risk premiums being impounded in valuation multiples that resulted in significant differences in the relative valuation of, all else being equal, similar companies. He further argued that political risk and commodity price risk might be the two most important risk factors from a global perspective. However, as our study is conducted exclusively on listed Nordic real estate companies, these risk factors might not be as prevalent. Although, we still find it reasonable to believe that other risk aspects regarding domestic

financial institutions and access to domestic and international capital. In view of this, we find it relevant to control for country

Measure: Dummy for country

VII. Segment

We use offices, logistics, residentials, hotels, retail, and mixed as dummy variables to control for a possible relationship between a firms' main segment exposure and firm value.

While there are few empirical studies related to the division of segments applied in this paper, we have found broad acceptance between Nordic financial institutions regarding the fact that the main operating segments for real estate companies do impact both profitability and valuation significantly. In *chapter 2.5. Segments* we elaborated on how demand dynamics and the reliance to macrotrends differed for the various segments. Thus, we find it relevant to control segment.

To clarify, we denote companies with more than 50% exposure to one specific segment as specialists in the respective segment. Companies with less than 50% exposure in every segment is considered to be operating in the mixed segment.

Measure: Dummy for main segment

VIII. Crisis variables

We use Financial crisis and Corona crisis as dummy variables to control for a potential relationship between the firm value of listed Nordic real estate firms in the respective pre- and post-crisis periods.

We find it reasonable to believe that the global financial crisis has had an impact on how investors valuate real estate firms. The most prominent argument for this being that the crisis exposed significant risk-shifting behaviour and monitoring lapses in investors (Begg, 2009). Thus, we can expect the lessons learnt, if any, to make firm value more sensitive to information asymmetry (Fosu *et al.*, 2016). Further, from a trade-off perspective, one could make the argument that investors in general incorporates a higher bankruptcy cost when valuating real

estate companies in the post-crisis period. Consequently, we expect the global financial crisis to have a negative impact on firm value, which is the reason we control for it.

Considering we only have five quarters with observations post COVID-19, the valuation implications of the public health crisis for the listed Nordic property sector is difficult to predict. The equity markets initially crashed during Q2 20, but swiftly recovered. In addition, a potential shift in risk-taking behaviour for investors may not have matured sufficiently over the course of the prevalent timeframe. Thus, the impact of the pandemic on firm value is unclear, yet still a relevant factor to control for.

Measure: Dummy for the global financial crisis
Measure: Dummy for the Covid-19 pandemic

Summary

Table 4 and *5* provides a summary of the presented findings from previous empirical papers we deem most relevant for our study and theory predictions.

Table 4 – Theory predictions

Note: "+"indicates a positive relationship between the independent variable and EV/IC. "-" indicates a negative relationship between the independent variable and EV/IC. Empty cells indicate the respective theories do not have a prediction for the relationship between the independent variable and EV/C. The control variables are included to clarify the model structure.

	Theory Predictions	
	Trade-Off Theory	**Information asymmetry theory**
Leverage measures		
Long-term debt	+/-	+/-
Long-term debt (sq)	+/-	+/-
Short-term debt	+/-	+/-
Short-term debt (sq)	+/-	+/-
Firm-controls		
Size	+	+
Tangibility	+	+
Growth	-	-
Control variables		
Country		
Segment		
Financial crisis		
Corona crisis		

Source: Own Contribution

Table 5 – Previous empirical papers

Note: "+"indicates a positive relationship between the independent variable and EV/IC. "-" indicates a negative relationship between the independent variable and EV/IC. Empty cells indicate the respective relationships were not tested.
** Statistical significance at 10%-level*
*** Statistical significance at 5%-level*
**** Statistical significance at 1%-level*

	Deloof (2003)	Hammes & Chen (2005)	Liow (2010)	Kebawar (2014)	Fosu et al. (2016)
Leverage Measures					
Long-term debt	-***	-***	+*	+	-*
Long-term debt (sq)			-***	-	
Short-term debt					
Short-term debt (sq)					
Firm-Controls					
Size	+***	+***	+**		-***
Tangibility	+***	-	-*	-**	-
Growth	+**		+***	+***	+***
Control variables					
Country					
Segment					
Financial crisis					
Corona crisis					
Firm fixed effects	YES	NO	NO	NO	YES
Time fixed effects	YES	NO	NO	NO	YES
Observations	5,045	7,921	2,304	10,653	9,469
Sample industry	Large non-financial Belgian firms	13 European listed real estate companies	Global listed property firms	Listed French companies service sector	UK listed firms
Time period	1992-1996	1990-2003	2000-2006	1999-2006	1995-2013

Source: Own Contribution

V. Methodology

In this chapter we present the methodology used in the study. Initially, we present the fundamentals of panel data analysis, along with the considered estimation models. Thereon, we elaborate on whether the assumptions for multiple linear regressions (MLR) are fulfilled. Based on the test results, we finally present a summary stating the estimation method of choice.

Panel data analysis

Panel data refers to multi-dimensional data with observations of phenomena of more than one observable entity over multiple time periods. In other words, the data is a combination of cross-sectional and time-series observations. In this paper, the panel data consists of observations of different financial ratios from several listed Nordic real estate companies, over multiple time periods.

We have used the following panel data format, as suggested by Gujarati and Porter (2009):

$$Y_{it} = \beta_{1i} + \beta_2 X_{2it} + \beta_3 X_{3it} + u_{it} \quad (4)$$

Where:

$i = 1, \dots, N$

$t = 1, \dots, T$

$i = Company/firm$

$t = Time\ Period$

Three regression estimation methods are considered to investigate the effect of capital structure on firm value, namely, *i)* Pooled OLS regression, *ii)* Fixed Effects estimation, and *iii)* Random Effects estimation. According to Wooldridge (2018), POLS is employed when a different sample for each year/month/period of panel data is observed. Meanwhile FE or RE are employed when a sample of individuals/countries/states/cities etc is observed.

Pooled OLS regression (POLS)

Ordinary Least Squares regression (OLS) is a technique that minimizes the distance between fitted values and residuals to describe the relation between independent variables and a dependent variable. Pooled OLS (POLS) is the practice of applying the OLS method to panel data. By doing so, we simply ignore the fact that we are dealing with both cross-sectional and time-variant observations. In theory, there is no problem doing so as long as two assumptions regarding the error term for our regression is satisfied. Firstly, we must assume that zero covariance between all the explanatory variables and the time-constant unobservable characteristics of the entities impacting the dependent variable. Secondly, we must assume zero covariance between all the explanatory variables and the time-variant unobservable characteristics of the entities impacting the dependent variable. These are strict assumptions which rarely hold, often making relaxed estimation methods like FE or RE more suited to analyse panel data. The MLR assumptions are listed in *appendix C*.

Fixed effects (FE)

In the FE model, also called the Least-Square Dummy Variable, we control for the unobservable time-invariant variables by giving each group a fixed individual effect. This makes the model less strict than POLS and allows us to interpret the results causally more often due to the fact that we actually control for time-constant fixed effects and estimate it. This makes the variable redundant in a regression sense as it is no longer a variable but rather pre-determined. *Equation 5* lays the fundamentals for the FE regression model used in this paper:

$$Y_{it} = \beta_0 + \beta_1 X_{it1} + \beta_2 X_{it2} + \cdots + \beta_j X_{itj} + \epsilon_i + u_{it} \quad (5)$$

Where:

$Y_{it} = Dependent\ variable\ for\ firm\ i\ at\ time\ t$

$\beta_0 = Intercept$

$\beta_j = Paramater\ for\ X_{itj}$

$\epsilon_i = Unobserved\ fixed\ effect\ for\ firm\ i$

$u_{it} = Idisyncratic\ error\ term$

$t = 1, 2, \dots, T$

The FE model averages *equation 5* for each individual firm over time. This allows for arbitrary correlation between the unobserved factor (ϵ_i) and all the independent variables (X_{itj}) (Wooldridge, 2018). Further, due to this potential correlation, the FE model seeks to eliminate the unobserved factor completely (ϵ_i). By doing so we control for heterogeneity in individual entity characteristics by removing the unobserved effect. *Equation 6* and *7* explains this process.

$$\bar{y_i} = \beta_1 \bar{x_{i1}} + \beta_2 \bar{x_{i2}} + \cdots + \epsilon_i + u_{it} \tag{6}$$

$$then\ we\ remove\ the\ average\ firm\ specific\ effect$$

$$(Y_{it} - \bar{y_i}) = \beta_1 (X_{it1} - \beta_1 \bar{x_{i1}}) + \beta_2 (X_{it2} - \beta_2 \bar{x_{i2}}) + \cdots + \beta_j X_{itj} + u_{it} - \bar{u}_{it} \tag{7}$$

As we can see from *equation 7,* the unobserved firm specific effect (ϵ_i) is now removed.

Random effects (RE)

The third estimation model considered in this paper is the Random Effects model (RE). Similar to the FE model, the RE model splits the error term into an unobservable factor (ϵ_i) and an observable time-varying error (u_{it}). Although, contrary to FE estimation, RE estimation bears the advantage of being applicable to time invariant variables by assuming that (ϵ_i) and (X_{itj}) are uncorrelated. This leads us to a different interpretation of the intercept for the individual entities, which can be expressed as:

$$Y_{it} = \beta_0 + \beta X_{it1} + \cdots + \beta_j X_{itj} + \epsilon_i + u_{it} \tag{8}$$

$$Cov(X_{itj}, \epsilon_i) = 0, \qquad t = 1,2 \dots T; j = 1,2 \dots, k$$

Where:

$v_{it} = \epsilon_i + u_{it}$

The composite error term (V_i) contains two separate error components. (ϵ_i) expressing the idiosyncratic error, and (u_{it}) expressing the combined idiosyncratic error and time series error. Consequently, using RE is advantageous compared to FE in that it allows for exploratory variables that are time-invariant. However, the RE model assumes that the unobserved factor (ϵ_i) does not correlate with any of the independent variables (X_{itj}). If there exists correlation between them, the RE estimator will be biased. In other words, the explanatory advantages of the RE model is the explanatory disadvantages of the FE, and *vice versa*.

Testing MLR assumptions

In the following subchapter we test whether the assumptions for the multiple linear regression (MLR) hold. From the results, we conclude whether FE or RE regression is more suited for our data in comparison to pooled OLS. Consequently, we present which model that will be utilized to conduct the empirical study.

Assumption 1 – Linearity

We test the linearity assumption using a set of augmented partial residual plots, also known as component-plus-residual plots, as described by Mallows (1986). This is a common and insightful approach to examine the linearity assumption. We find that the linearity assumption is satisfied. The residual plot and the affiliated discussion of the results can be found in *appendix D.*

Assumption 2 – Random sampling

To make statistical inference for a population by using data from a sample, the sample units must be chosen randomly. In other words, each company in our panel data must be drawn from the total population of listed Nordic real estate firms with equal probability in order for

this assumption to be satisfied. As we have personally picked the companies in our data based on their characteristics and relevance to our study, one could argue that this assumption is violated. Although, since we have narrowed our target population to only listed Nordic real estate companies, we assume that all relevant companies[19] for the target population are included in the panel data. Thus, the assumption of random sampling is fulfilled.

Assumption 3 – No perfect collinearity

We test the no perfect collinearity assumption using a correlation matrix, shown in *Appendix D*. We view correlation coefficients higher than 0.7, in absolute value, as indications of multicollinearity. This is in accordance with Johannessen et al. (2016), who suggests that correlation coefficients above 0.7 between two independent variables imply multicollinearity issues. No indications of multicollinearity are found in the correlation matrix.

To complement the correlation matrix, we have utilized a variance inflation factor test (VIF), which is in accordance with Drobetz et al. (2013). We have set a cut-off-value of 5. A VIF-value above this threshold would indicate a multicollinearity problem. *Appendix D* presents VIF-test results and affiliated discussion of results. We conclude that there are no problems with multicollinearity in the model.

Assumption 4 – Zero conditional mean

The zero conditional mean assumption states that the unobserved factors involved in the regression function are not related in any systematic manner to the observed factors (Wooldridge, 2018). In other words, the assumption is violated if there exist omitted variables that are correlated with one or more of the independent variables. We believe that there is a high chance that we have violated the zero conditional mean assumption, as there are several non-measurable factors affecting value creation. Further, other quantifiable factors that are correlated with one or more of the independent variables might also be excluded due to the lack of data availability.

[19] Except specific outliers excluded after careful consideration

Assumption 5 – Homoscedasticity

The assumption of homoscedasticity states that the variance of the error term is constant over the population, and thus within the sample. To test whether the homoscedasticity assumption is violated, we have plotted the least square residuals against the explanatory variables and utilized a Breusch-Pagan Lagrange multiplier test. The residual plot, test results and affiliated discussions can be found in *appendix D*. We conclude that there is a proven presence of heteroscedasticity in our data.

Assumption 6 – Normality

The assumption of normality states that the residuals are normally distributed. We have tested this assumption for each regression model by plotting the univariate kernel density estimation. Also, we have plotted quantiles of the regression model against quantiles of the normal distribution The results of the tests and affiliated discussion of the results can be found in *appendix D*. Based on an overall assessment of the tests, the normality assumption is satisfactory fulfilled for the MLR model.

Assumption 7 – Serial Correlation

The assumption regarding serial correlation states that the model must have no serial correlation[20]. To test this assumption. we have used a standard Wooldridge test in R, which simply searches for serial correlation in the panel data. The results from the Wooldridge test and affiliated discussion can be found in *appendix D*. We find that the serial correlation assumption is violated.

Summary and choice of regression model

There is clear evidence that some of the MLR assumptions are not satisfactory met based on the presented tests. Specifically, the assumptions regarding homoscedasticity, zero conditional mean, and no serial correlation are considered breached. Conversely, the assumptions regarding linearity, random sampling, no perfect collinearity, and normality are adequately satisfied. Since three assumptions are violated, the MLR model is not the preferred estimation

[20] Also referred to as autocorrelation

model for our panel data set. Rather, a fixed effect estimation (FE) or a random effect estimation (RE) is more suited for the regression analysis. The Hausman test is utilized to decide between an FE and RE estimation, presented in *table 6*. The null hypothesis for using an RE estimation is not rejected, as the p-value is higher than the threshold of 0.05. We conclude that the Hausman test is indicating that an RE estimation is preferred.

Table 6 – Hausman Test Results

Note: Results from Hausman test indicating that Random Effects Model is preferred.

Dependent variable	Chi	Prob>Chi
EV/IC	11.01	0.312

However, the RE estimation assumes that the unobserved factor does not correlate with any of the independent variables as this estimation method does not control for omitted variables. Also, the RE model tests for time-invariant variables, which in our case is the firm's country and segment, instead of controlling for them. For these reasons and that most relevant previous studies have utilized an FE model, we choose to overlook the Hausman-test results.

Further, to compensate for heteroscedasticity and autocorrelation we utilize cluster-robust statistics, in accordance with Fosu *et al.* (2016). Notably, clustering the standard errors does not correct for heteroscedasticity or autocorrelation, it allows for these features by increasing the requirements for inference.

To summarize, we apply an FE estimation using cluster-robust standard errors for the regression model shown in *equation 9.*

$$\frac{EV}{IC}it = \beta_1 LTD_{it} + \beta_2 LTD_{it}^2 + \beta_3 STD_{it} + \beta_4 STD_{it}^2 + \beta_5 Tangibility_{it} + \beta_6 Size_{it} + \beta_7 Growth_{it} + \beta_8 Country_{it} + \beta_9 Segment_{it} + \beta_{10} FinancialCrisis_{it} + \beta_{11} CoronaCrisis_{it} \quad (9)$$

Where:

$i = Company/Firm$

$t = Quarter, Q1\ 2006, \dots, Q2\ 2021$

VI. Empirical Analysis

In this section we present the empirical analysis of our study. Initially, we present an exploratory data analysis where we briefly discuss the underlying descriptive statistics and historical trends. Thereon, we discuss the results from our regression estimations in relation to both the theoretical framework for this thesis, as well as previous empirical evidence.

Exploratory data analysis

We find it necessary to provide the reader with some core insights regarding our data, before presenting and discussing the results of our regression estimation. We mainly compare the descriptive statistics with the findings of Fosu *et al.* (2016), being the most recent study of special relevance to ours. Keeping in mind that their paper studied a broad sample of listed UK firms, and not real estate specifically, we expect to find somewhat deviating characteristics in our data sample. We have not found an academic paper of relevance studying the relationship between market valuation and leverage for any listed real estate sector.

Table 7 presents descriptive statistics for the 31 listed Nordic real estate firms in our sample. Since we are dealing with unbalanced panel data, we also find it necessary to briefly clarify how the different variables should be interpreted. N, the number of observations, is the total number of firm-quarter observations in our dataset. The number of observed firms is growing over the observed period as real estate companies go public. In view of this, the means are calculated based on the total number of observations. Hence, the companies with many observations have the largest impact on the mean, and vice versa for the companies with few observations. Further, the mean has different interpretations based on whether we are looking at the leverage measures or control variables[21]. The mean of the observed leverage measures can be interpreted as the average of ratios across all firm-quarters, either in normal or squared form. The mean of size can be interpreted as the mean of rental income for all firm-quarters. Further, the mean of Tangibility can be interpreted as the average tangibility ratio, and the mean of Growth is interpreted as the average quarterly growth rate for all firm-quarters. Lastly, the dummies for country and segment are simply interpreted as the portion of all firm-quarters observed from the respective countries and segments.

[21] Tangiblity, Size, Growth, Country-Dummies, Segment-Dummies, Crisis-Dummies

Table 7 – Descriptive statistic

Variables	N	Mean	SD	Min	Median	Max
Dependent variable						
EV/IC	1,438	0.976	0.185	0.303	0.996	1.229
Leverage measures						
Long-term debt	1,438	0.428	0.161	0.021	0.461	0.619
Long-term debt (squared)	1,438	0.215	0.131	0.000	0.213	0.578
Short-term debt	1,438	0.065	0.066	0.000	0.045	0.205
Short-term debt (squared)	1,438	0.048	0.661	0.000	0.002	14.558
Firm-controls						
Tangibility	1,438	0.923	0.109	0.268	0.957	0.988
Size (Sales in EURm)	1,438	39.268	29.359	0.392	37.984	91.300
Growth	1,438	0.010	0.127	-0.608	0.015	0.192
Country-dummies						
Sweden	1,438	0.715	-	-	-	-
Norway	1,438	0.104	-	-	-	-
Finland	1,438	0.081	-	-	-	-
Denmark	1,438	0.099	-	-	-	-
Segment-dummies						
Mixed	1,438	0.259	-	-	-	-
Offices	1,438	0.312	-	-	-	-
Residential	1,438	0.182	-	-	-	-
Retail	1,438	0.122	-	-	-	-
Hotels	1,438	0.020	-	-	-	-

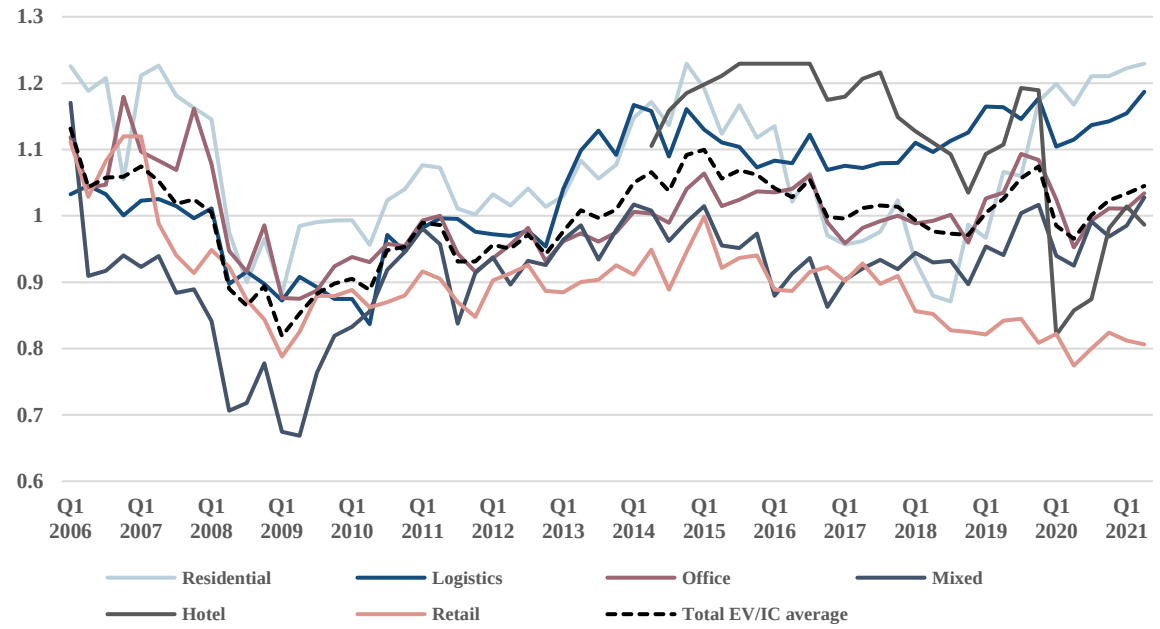
Note: EV/IC is defined as Enterprise Value to Invested Capital. Long-term debt is total interest-bearing debt due in one year or more to total assets. LTD (sq) is long-term debt squared. Short-term debt is interest-bearing debt due in less than one year to total assets. STD (sq) is short-term debt squared. Tangibility is total fixed tangible assets to total assets. Size is rental income in EURm. Growth is quarter-over-quarter growth in rental income. Country and segment variables are dummies. Mean, SD, Min, Median and Max is across all firm-quarters. All variables explained thoroughly in chapter 4.3 and 4.4. Winsorization is done at upper and lower 10%-level for continuous firm-specific variables.

The average EV/IC multiple for the 1,438 observations is 0.98, just below the median of 0.99, indicating a slight negative skew in the distribution. We find the mean to be reasonable as real estate firms are mostly invested in hard assets generating predictable cash flows without significant growth opportunities. Specifically, we observe an average quarterly rental income growth rate of 1.01%, or 4.10% annualized, in line with our expectations of moderate growth rates for the sector. In comparison, Fosu *et al.* (2016) observes an average enterprise value to

total assets[22] of 1.44 and an average annual sales growth rate of 12.20% for their sample of listed UK firms.

Figure 18 presents the historical trend in enterprise value to invested capital from Q1 06 to Q2 21 sorted by segment and on average for the total sample. Keep in mind that a value of 1.0 means that enterprise value and invested capital are valued equally. Market turmoil during the global financial crisis caused the average EV/IC-multiple to drop from a 14% premium to an 18% discount to invested capital driven by declining share prices. Since the trough in Q1 09, the average EV/IC multiple has increased from 0.82 to 1.05 in Q2 21, with a local high of 1.10 in Q1 15.

Figure 18 – EV/IC development by segment Q1 06 – Q2 21



Source: Bloomberg, Refinitiv Eikon, Company Reports, Own Contribution

Notably, the premium pricing levels from the heydays prior to the financial crisis has not been reached, suggesting that investors are on average more reserved from discounting in growth opportunities in the listed Nordic property sector after the global financial crisis. In *chapter 2.3* we discussed whether the steep share price increase from Q1 14 among Nordic real estate companies is indicative of an emerging real estate bubble. Keeping in mind that the average

[22] Fosu et al (2016) applies an enterprise value to total assets multiple to measure market valuation, which is close to our measure of enterprise value to invested capital.

EV/IC-multiple has been on the decline since Q1 15 and is currently at a mere premium to invested capital, we do not find support for stretched valuation on average. However, since property values are adjusted on a fair value basis quarter-to-quarter, the EV/IC multiple will rarely display large deviations from ~1.0 and is not necessarily the best indicator of a potential bubble.

Interestingly, there seems to be a decoupling of the different segments materializing post Q1 15, where the spread in EV/IC widens significantly, as we can observe in *figure 18*. There are mainly two drivers for this development. Firstly, historically low interest rates created a rush for real estate investments in this period (Pangea Property Partners, 2015). Secondly, as more listings have emerged, investors have become more selective. As a result, we see that there has been a diverging yield development between the segments, favouring the segments with the highest apparent growth prospects.

We can see that logistics and residentials, the two segments with the highest growth in transaction volume and steepest decline in prime yields since 2013, are undeniably the most attractive segment to investors as of Q2 21 as measured by EV/IC. Further, we see that the segments with the lowest growth in transaction volumes and yield development, being retail and hotel, have become less appealing to investors since 2013. The EV/IC development of mixed stocks have closely followed the total average, likely due to benefiting from diversification. In addition, even though Nordic office prime yields are historically low, investors may incorporate a lower PVGO[23] for office stocks compared to logistics- and residential stocks, causing the valuation spread between them. In conclusion, the increasing spread in the relative attractiveness among the segments is confirmative of the recent trends elaborated in *chapter 2.5*.

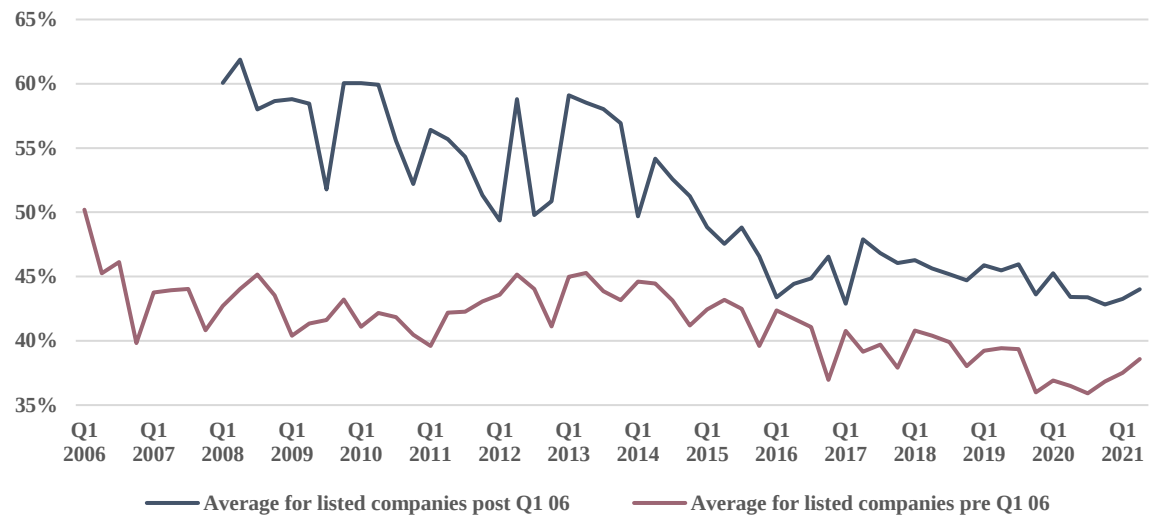
The average long- and short-term debt ratios are 0.43 and 0.06 respectively. In comparison, Fosu *et al.* (2016) observes an average leverage ratio of 0.174[24] for short- and long-term debt combined. The difference can again be explained by the fact that real estate firms on average have a larger portion of fixed assets on its balance sheet, compared to most industries. This results in high tangibility ratios, which in turn functions as a safety-net for credit providers as property assets are utilized as collateral.

[23] Present value of growth opportunities

[24] Measured as book value of debt to book value of assets

The median LTD-ratio is slightly larger than the average value, again indicative of a negative skew in the distribution of LTD-ratios. A reason for this may be the growing entity size in our unbalanced data sample. *Figure 19* shows the average LTD-ratios for the group of companies who were listed prior to Q1 06 and for the group of companies who enter our dataset along the timeframe. Observing the two curves in *figure 19*, the group of companies listed prior to Q1 06 consistently has a lower average LTD-ratio. As already discussed, this group of companies have the largest impact on the total average LTD-ratio from *table 7*. Thus, we can attribute the skewed distribution to the group of companies who go public along the observed timeframe. Intuitively, this makes sense as firms with shorter sailing time rely more on debt to sustain growth. As the firms mature, deleveraging is expected to lower the risk profile and increase flexibility and control (Frielinghaus, Mostert, & Firer, 2005).

Figure 19 – Average LTD-ratios for companies listed pre and post Q1 06

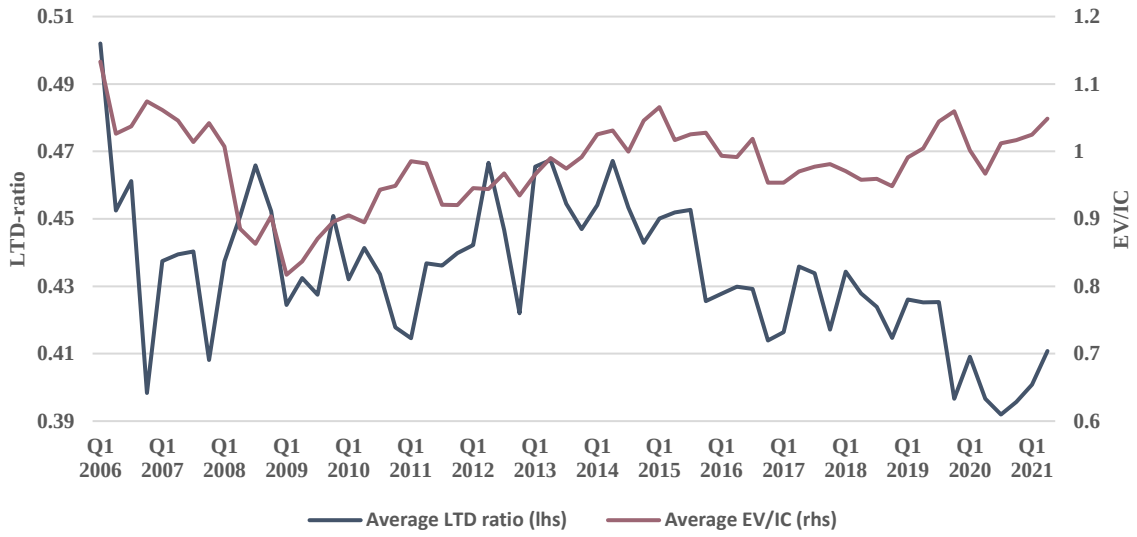


Source: Bloomberg, Refinitiv Eikon, Company Reports, Own Contribution

Figure 20 shows the average long-term debt ratio versus the average EV/IC-multiple for our data sample. The average LTD-ratio has steadily declined from 0.50 to 0.41. Nordic real estate firms are deleveraging, possibly a de-risking response to the financial crisis where credit squeezes ultimately had consequences for firms' pursuit of growth strategies (Vithessonthi & Tongurai, 2015). Another possible reason for the deleveraging trend is that companies may want to be prepared for an economic environment of declining property values and rate hikes, to minimize the risk of failing to meet the covenants of loan agreements (Hagen *et al.*, 2018). Typically, loan covenants are set at 50-60% of Loan-to-Value, indicative of debt levels where firms will experience financial distress. Keeping debt ratios comfortably below the covenant

thresholds may increase capital market confidence and flexibility to pursue growth strategies. We find preliminary support for H_{01} from *chapter 4. Data* as LTD is negatively correlated with EV/IC.

Figure 20 – Average LTD-ratio vs. average EV/IC-multiple

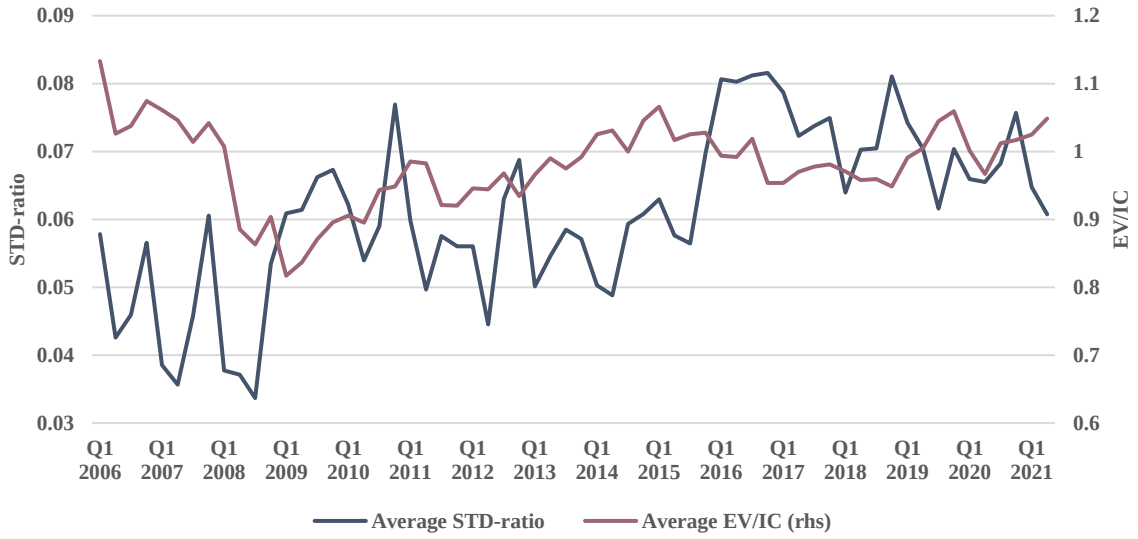


Source: Bloomberg, Refinitiv Eikon, Company Reports, Own Contribution

Figure 21 displays the average STD-ratio plotted in the same graph as the average EV/IC-multiple. The average short-term debt ratio decreased by 2.5 percentage points from 0.058 to an absolute low of 0.033 from Q1 06 to Q3 08. Thereafter, we observe an uptick in the average STD-ratio, which has increased steadily from the low in Q3 08 and is currently at an average of 0.06. We observe no clear pattern between STD and EV/IC but note a slight negative correlation. The spike in Q1 16 is explained by the inclusion of SBB, who enters our dataset with an STD-ratio of 0.2. The increase in STD from the lows in Q3 08 to Q2 21, and the corresponding decrease in LTD, is not easily explained as short-term debt is associated with higher liquidity and refinancing risk. Seeing that the overall terms for long-term financing has improved over the course of the observed time frame, a matter more thoroughly discussed in

chapter 2.4, one would assume that the inherently stable listed Nordic real estate sector would increase LTD rather than STD.

Figure 21 – Average STD-ratio vs. average EV/IC-multiple



Source: Bloomberg, Refinitiv Eikon, Company Reports, Own Contribution

One possible reason for the development in STD could be that expectations for changes in interest rates in the future have led listed Nordic real estate companies to shorten their durations by utilizing interest rate swaps, in hope for better long-term loan terms in the time coming. If the net effect of this financial engineering strategy results in an increase in STD- and decrease in LTD commitments, this will result in a higher STD-ratio.

In addition, one could also back the increase in STD with standard immunization theory. If there is a bigger portion of total market assets in play, it means that the companies studied on average are more actively involved in buying and selling properties. In turn, the companies could increase their usage of short-term debt to lower their overall duration to match a lower selling horizon for their assets.

Further, as real estate companies have extremely predictable cash flows, risk management in terms of balancing liquidity- and refinancing risk is more comprehensible when compared to other large Nordic industries with less predictable future earnings. Lastly, seeing that the overall transaction activity has increased in every segment from Q1 13 to Q2 21, as discussed thoroughly in *chapter 2.5*, one could also argue that increasing STD ratios is a result of

companies utilizing STD to temporary finance the increase in investment activities. Since STD induces more flexibility in one's investment strategy, we find this to be a reasonable argument for the recent development in leverage ratios.

On average, tangible assets in any given quarter totals 92% of total assets, which compares to Fosu *et al.* (2016) average tangibility ratio of 30%. Our observation may seem high but keeping in mind that real estate firms almost entirely consist of fixed assets, we find the observation to be in line with preliminary expectations. Also, this is the observation with the smallest standard deviation among the firm-specific control variables, indicative of a small spread in the variable among our sample firms.

Lastly, the average size in any given quarter, proxied with rental income in EURm, amounts to €39.27m. The standard deviation of size relative to mean is €29.36m, suggesting that there is a considerable spread in size among our sample companies. Observing the minimum and maximum values we see that size has a wide range from €0.39m to €91.3m.

Observing the dummy variables in *table 7* for country and segment, 71% of the observations are of firms with main operations in Sweden, while mixed is the most represented segment representing 46% of the observations.

Regression estimation results

In the remainder of this chapter, we present and discuss the results from our regression. First, we discuss the variable estimates and what they indicate. Thereon, we present an overview of our most important findings. The regression is estimated using the fixed effects method, where firm- and time fixed effects are included. The modelling choice is extensively discussed in *chapter 5*. The regression is estimated using cluster-robust standard errors to compensate for autocorrelation and heteroskedasticity, also discussed in *chapter 5*.

Table 8 presents the results from the regression model. The FE estimation has an adjusted R^2 of 0.224. Hence, our included variables have moderate explanatory power on EV/IC for the listed Nordic property sector.

Tabel 8 - Fixed Effects Regression Results

Dependent variable: Enterprise Value / Invested Capital	
Leverage Measures	
Long-term debt	0.216**
	(0.089)
Long-term debt (sq)	-0.638***
	(0.093)
Short-term debt	-0.585***
	(0.079)
Short-term debt(sq)	0.017***
	(0.005)
Firm Controls	
Tangibility	0.676***
	(0.055)
Growth	-0.041*
	(0.025)
Size (lnSales)	0.064***
	(0.005)
Crisis Dummies	
Financial-crisis	-0.102***
	(0.011)
Corona-crisis	0.008
	(0.010)
Observations	1,438
R2	0.245
Adjusted R2	0.224
Firm Fixed Effects	YES
Quarter Fixed Effects	YES
F-statistic	50.488*** (df=9; 1398)

*Note: *p<0.1; **p<0.05; ***p<0.01 P-values given in parenthesis. EV/IC is defined as Enterprise Value to Invested Capital. Long-term debt is total interest-bearing debt due in one year or more to total assets. LTD (sq) is long-term debt squared. Short-term debt is interest-bearing debt due in less than one year to total assets. STD (sq) is short-term debt squared. Tangibility is total fixed tangible assets to total assets. Size is natural logarithm of rental income in EURm. Growth is quarter-over-quarter growth in rental income. Financial-crisis is a dummy that takes the value 1 for all observations after Q1 09. Corona-crisis is a dummy that takes the value 1 for all observations after Q2 20. All variables explained thoroughly in chapter 4.3 and 4.4. Winsorization is done at upper and lower 10%-level for continuous firm-specific variables.*

We observe that the long-term debt variable is positively related to EV/IC with a statistical significance level of 5%. The coefficient for LTD has a value of 0.216. A one standard deviation increases in LTD is associated with about a 3.56%[25] increase in value, indicative of an economic significant relationship. The variable LTD (sq) is however negatively associated with value on all relevant significance levels. Thus, we find a strictly concave relationship between long-term debt and value. Specifically, the relationship between LTD and value turns negative for LTD ratios above 0.17[26]. Economically, a one standard deviation increases in LTD (sq) is associated with an estimated 8.56% decrease in EV/IC in the fixed effect estimation.

A possible explanation of the non-monotonic relationship is that debt at some levels is a necessary source of capital and a useful instrument to fuel growth strategies, especially in a capital-intensive sector such as real estate. In other words, long-term debt is associated with value-enhancement for companies who take advantage of positive leverage effects, contributing to sustainable growth in the longer term (Liow, 2010).

Nonetheless, at high debt levels, the Nordic property companies may risk breaching loan covenants, which in worst-case scenarios lead to bankruptcy. In these scenarios we are more likely to see enterprise values at discounts to invested capital. The concave relationship is in line with the trade-off theory and information asymmetry theory. The finding of a negative relationship between LTD (sq) and value is in accordance with Fosu *et al* (2016), Liow (2010), Hammes and Chen (2005), and Deloof (2003).

Short-term debt is negatively associated with valuation and is statistically significant at all relevant significance levels. Interpreting this result in terms of economic impact, we observe that a one standard deviation increase in the STD-ratio is associated with a 0.36% decline in firm valuation. Said differently, although the regressor is statistically significant, we do not find an economically significant relationship.

We find a convex relationship for short-term debt as short-term debt (sq) is positively related to market valuation in the estimation model. The variable is statistically significant at all relevant significance levels. Economically, the coefficients of 0.017 is associated with 1.1%

[25] Calculated by standardizing the regression coefficient followingly: $b_{LTD} * \frac{St.dev_{LTD}}{STD_{EV/IV}}$

[26] When $B_1 > 0 \; and \; B_1 + 2 * B_2 LTD_{i,t} > 0$ the effect of debt will be positive

increase in firm valuation with a one-unit standard deviation increase. We are somewhat surprised by this finding, as it contradicts economic intuition. We have offered some possible explanations for the increase in STD-ratios and why it may be beneficial in *chapter 6.1*.

We have not found any previous studies who test for a non-monotonic relationship between short-term debt and firm value. However, the negative relationship between the variable STD and value is in line with Fosu *et al.* (2016), Lixin & Lin (2011), Hammes & Chen (2005), Deloof (2003) and Johnson (2003).

The coefficients for our control variables have signs that are both supportive and contradictory of our predictions. Firstly, firm value is positively related to tangibility in our estimation model, with the coefficient having a significance level of 1%. Due to the level-level relation, the coefficient of 0.676 can be interpreted as one standard deviation increase in tangibility is associated with a 7.55% increase in firm valuation. This is in accordance with the findings from Deloof (2003) and Kebewar (2013).

Further, the coefficient for size is significant and positive. This is in line with Deloof (2003) who argued that bigger companies create more value by being more profitable on average than smaller firms. This could also imply that the diversification possibilities, both segmentational and geographical, increases the potential for value creation. From a trade-off perspective, as real estate is commonly viewed as a low-risk asset class, investors might value the benefit concurring from investing in large and well diversified players more than they benefit from the potential upside of investing in smaller, less diversified real estate companies. In addition, it is reasonable to assume that the presence of asymmetric information between management and investors is lower for larger companies.

The results suggest rental income growth to have a negative relationship with firm value. This is a rather surprising finding, as no previous studies of relevance have found the impact of growth on firm value to be negative. Although, a possible explanation could be that the growth has not been profitable on average between Q1 06 and Q2 21. In addition, one could also argue that the finding can be explained by the presence of asymmetric information. As fast-growing companies are inherently harder to monitor, investors might wrongly valuate them, or completely refrain from investing. However, the coefficient for growth is significant on the 10% level only, thus, we should treat the above inference with caution.

We included two crisis variables in our regression model, one for the global financial crisis and one for the recent Covid-19 pandemic. We can see from the results that the coefficient for the global financial crisis have had a significant and negative impact on the valuation of real estate firms in the post-crisis period. The coefficient -0.102 is significant at the 1%-level. This implies that the global financial crisis has had a negative impact of 2.97% on firm value on average. This postulates that investors have become more sensitive to information asymmetries. In addition, from a trade-off perspective, this finding suggests that investors have become more risk-averse in that they demand a higher value in terms of benefits when taking the same amount of risk in terms of costs, compared to the pre-crisis period.

Regarding the coefficient for the pandemic-dummy, we do not find sufficient statistical ground to infer any effects on firm value. Although, the model suggests a slightly positive relationship between the pandemic, and firm value. We find two reasons for why this could in fact be true. Firstly, most of the companies in our data made a swift recovery from the pandemic. Hence, with quarterly observations, our estimations model can have neglected the event to a certain extent. Secondly, a positive pandemic coefficient could imply that investors in general have become more aware of listed real estate as an asset. In specific, the interest in logistics stocks have increased immensely because of the booming e-commerce activity from Q2 20 and onwards. In addition, the general activity levels within the Nordic CRE market have reached record highs in 2021, attracting the attention of both private and institutional investors. In other words, one could argue that the pandemic in fact have decreased level of information asymmetries between management of listed real estate firms and the market.

VII. Conclusion

Despite the theoretical potential connection between leverage and firm value, existing empirical studies have only to a limited degree studied the relationship between short- and long-term debt and company valuation. Consequently, we motivate theoretically and empirically test this relationship using a sample of 31 publicly listed Nordic real estate companies in the period Q1 06 to Q2 21.

Over the observed timeframe we found that the average long-term debt to total assets (LTD) ratio has decreased by 9 percentage point from 0.50 to 0.41 for the companies studied. Further, we found a strictly concave relationship between long-term debt and firm value. In other words, the results indicate that listed Nordic real estate companies benefit from debt to a certain extent. This finding is in tune with both previous empirical research and the chosen theoretical framework. Meanwhile, the average short-term debt to total assets (STD) ratio has increased from a low of 0.03 in Q3 08 to 0.06 in Q2 21. We find a strictly convex relationship between STD and firm value, indicating that STD is value deteriorating for listed Nordic real estate firms only to a certain extent. This finding contradicts our preliminary expectations of a negative linear relationship.

From the selected firm-specific variables, we find most of them to be significantly related to the market valuation in the case of listed Nordic real estate companies. In addition to the results regarding the relationship between leverage and firm value, our empirical findings suggest the following stylized facts:

- Asset tangibility is value enhancing for listed Nordic real estate companies
- Investors discounts small RE companies at higher rate than large RE companies
- Growth has been negatively related to firm value over the observed period
- The valuation of listed Nordic RE companies has been lower on average in the period after the global financial crisis, measured through EV/IC

Based on these findings, we conclude that the chosen theoretical framework is not fully able to predict the relationship between leverage and firm value. Although, both the trade-off theory and pecking-order theory have been highly applicable in terms of predicting the relationship between firm value and most of the selected firm-specific variables.

VIII. Limitations and Criticism

All empirical research has weaknesses to some extent, and our thesis is no exception. Concluding on our problem statement have sometimes left us no choice but to be pragmatic. The most conspicuous limitation in our thesis is the ones rooted in the lack of observable entities. By narrowing the target population to only the listed Nordic real estate firms, we have also limited the data available for us to analyse. We have dealt with this by utilizing an unbalanced data panel with a growing number of companies, but even though our estimation model should control for differences between the companies that might arise from coming to market at different points in time, it is far from optimal.

There are also limitations linked to the lack of previous empirical research of special relevance to our study. These studies are an important aspect of creating a liable and sound theoretical fundament for discussion.

For future research, we have several suggestions that might result in additional knowledge on the subject. Firstly, one could widen the target population studied by *i)* analysing a more comprehensive geography, or *ii)* analysing a broader set of industries. By doing so, it will be easier to conclude on the significance of the relationship between leverage and firm value, as well as it will enhance the accessibility to relevant previous empirical research. In addition, it would be interesting to analyse the interconnected relationships between the different participants in the real estate value chain, and how the performance of each group is related to one another.

Lastly, to better understand the implications of our results, we advise future researchers to include a survey aimed towards the companies analysed. We believe that the obtainable insights from industry experts working with real estate on a day-to-day basis would alleviate the discussion of our findings.

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X. Appendices

A. Robustness check of unbalanced model

Fixed Effects Regression Results Complete Timeframe for Companies Listed Q1 06 – Q1 14

	Dependent variable: Enterprise Value / Invested Capital
Leverage Measures	
Long-term debt	0.272***
	(0.098)
Long-term debt (sq)	-0.613***
	(0.104)
Short-term debt	-0.472***
	(0.092)
Short-term debt(sq)	0.017***
	(0.005)
Firm Controls	
Tangibility	1.088***
	(0.091)
Growth	-0.059*
	(0.034)
Size (lnSales)	0.079***
	(0.007)
Crisis Dummies	
Financial-crisis	-0.110***
	(0.011)
Corona-crisis	0.002
	(0.013)
Observations	1,036
R2	0.281
Adjusted R2	0.263
Firm Fixed Effects	YES
Quarter Fixed Effects	YES
F-statistic	43.752*** (df=9; 1010)

*Note: *p<0.1; **p<0.05; ***p<0.01 P-values given in parenthesis. EV/IC is defined as Enterprise Value to Invested Capital. Long-term debt is total interest-bearing debt due in one year or more to total assets. LTD (sq) is long-term debt squared. Short-term debt is interest-bearing debt due in less than one year to total assets. STD (sq) is short-term debt squared. Tangibility is total fixed tangible assets to total assets. Size is natural logarithm of rental income in EURm. Growth is quarter-over-quarter growth in rental income. Financial-crisis is a dummy that takes the value 1 for all observations after Q1 09. Corona-crisis is a dummy that takes the value 1 for all observations after Q2 20. All variables explained thoroughly in chapter 4.3 and 4.4. Winsorization is done at upper and lower 10%-level for continuous firm-specific variables.*

Fixed Effects Regression Results in period Q1 16 – Q2 21 for Companies Listed after Q1 14

	Dependent variable: Enterprise Value / Invested Capital
Leverage Measures	
Long-term debt	-0.373*
	(0.218)
Long-term debt (sq)	-0.380*
	(0.217)
Short-term debt	-0.871***
	(0.193)
Short-term debt(sq)	0.101
	(0.290)
Firm Controls	
Tangibility	0.501***
	(0.076)
Growth	0.030
	(0.033)
Size (lnSales)	0.077***
	(0.010)
Crisis Dummies	
Corona-crisis	0.007
	(0.015)
Observations	340
R2	0.299
Adjusted R2	0.255
Firm Fixed Effects	YES
Quarter Fixed Effects	YES
F-statistic	16.983*** (df=8; 319)

*Note: *p<0.1; **p<0.05; ***p<0.01 P-values given in parenthesis. EV/IC is defined as Enterprise Value to Invested Capital. Long-term debt is total interest-bearing debt due in one year or more to total assets. LTD (sq) is long-term debt squared. Short-term debt is interest-bearing debt due in less than one year to total assets. STD (sq) is short-term debt squared. Tangibility is total fixed tangible assets to total assets. Size is natural logarithm of rental income in EURm. Growth is quarter-over-quarter growth in rental income. Corona-crisis is a dummy that takes the value 1 for all observations after Q2 20. All variables explained thoroughly in chapter 4.3 and 4.4. Winsorization is done at upper and lower 10%-level for continuous firm-specific variables.*

B. ROIC regression model

ROIC Fixed Effects Regression Results

Dependent variable: Return on Invested Capital

Leverage Measures	
Long-term debt	0.045*
	(0.025)
Long-term debt (sq)	-0.159***
	(0.026)
Short-term debt	-0.102***
	(0.022)
Short-term debt(sq)	0.003**
	(0.001)
Firm Controls	
Tangibility	0.089***
	(0.016)
Growth	0.015**
	(0.007)
Size (lnSales)	0.010***
	(0.001)
Crisis Dummies	
Financial-crisis	-0.034***
	(0.003)
Corona-crisis	-0.019***
	(0.003)
Observations	1,438
R2	0.159
Adjusted R2	0.135
Firm Fixed Effects	YES
Quarter Fixed Effects	YES
F-statistic	29.291*** (df=9; 1398)

*Note: *p<0.1; **p<0.05; ***p<0.01 P-values given in parenthesis. ROIC is defined as NOPAT to Invested Capital. Long-term debt is total interest-bearing debt due in one year or more to total assets. LTD (sq) is long-term debt squared. Short-term debt is interest-bearing debt due in less than one year to total assets. STD (sq) is short-term debt squared. Tangibility is total fixed tangible assets to total assets. Size is natural logarithm of rental income in EURm. Growth is quarter-over-quarter growth in rental income. Financial-crisis is a dummy that takes the value 1 for all observations after Q1 09. Corona-crisis is a dummy that takes the value 1 for all observations after Q2 20. All variables explained thoroughly in chapter 4.3 and 4.4. Winsorization is done at upper and lower 10%-level for continuous firm-specific variables.*

C. MLR Assumptions

Appendix A presents all relevant assumptions for the MLR estimation model. If assumption 1-5 are fulfilled, the MLR model is considered be Best Linear Unbiased Estimator (BLUE) (Wooldridge, 2018). The seventh assumption is added since we are dealing with time series.

Assumption 1 – Linearity

The model is linear in the parameters $\beta_0, \beta_1, \ldots \beta_k$ ((Wooldridge, 2018). There is a linear relationship between the dependent and independent variables, which results in the following population model:

$$y = \beta_0, \beta_1 x_1 + \cdots + \beta_k x_k + u$$

Assumption 2 – Random sampling

The second assumption states that the observations *n* is a random sample from the population (Wooldridge, 2018). Said differently,

$$\{(x_{i1}, \ldots, x_{ik}, y_i), i = 1, \ldots, n\}$$

is a random sample, given the population model in *assumption 1*.

Assumption 3 – No perfect collinearity

The third assumption states that no independent variable *x* is constant and that there is no perfect collinearity among the *x* variables (Wooldridge, 2018). In other words, none of the independent variables are exact linear combinations of other independent variables. In such cases, the MLR model will suffer perfect collinearity. When two or more independent variables correlate strongly, the model suffers from multicollinearity. Notably, independent variables are allowed to correlate, yet not perfectly or close to a correlation coefficient with an absolute value of 1.

Assumption 4 – Zero Conditional mean

The fourth assumption states that no matter the value of the observed variables $(x_1, x_2, \dots, x_k)$, we always expect the value of the unobserved variable (u) to be zero (Wooldridge, 2018).

$$E(u|x_1, x_2, \dots, x_k) = 0$$

Assumption 5 – Homoskedasticity

The fifth assumption states that the error term (u) has the same variance for any value of the independent variables (Wooldridge, 2018).

$$Var(u|x_1, x_2, \dots, x_k) = \sigma^2$$

Assumption 6 – Normality

The sixth assumption states that the error term (u) is normally distributed with a mean of zero and a variance of σ^2. In essence, this implies that the zero conditional mean and homoscedasticity assumptions must be satisfied at the same time.

$$u \sim N(0, \sigma^2)$$

Assumption 7 – Serial Corelation

The final assumption that must be satisfied is that there is no serial correlation, also known as autocorrelation, in the data sample. This is a necessary assumption when dealing with time series data, as presence of correlation between observations of the same unit over time violates the assumption of random sampling.

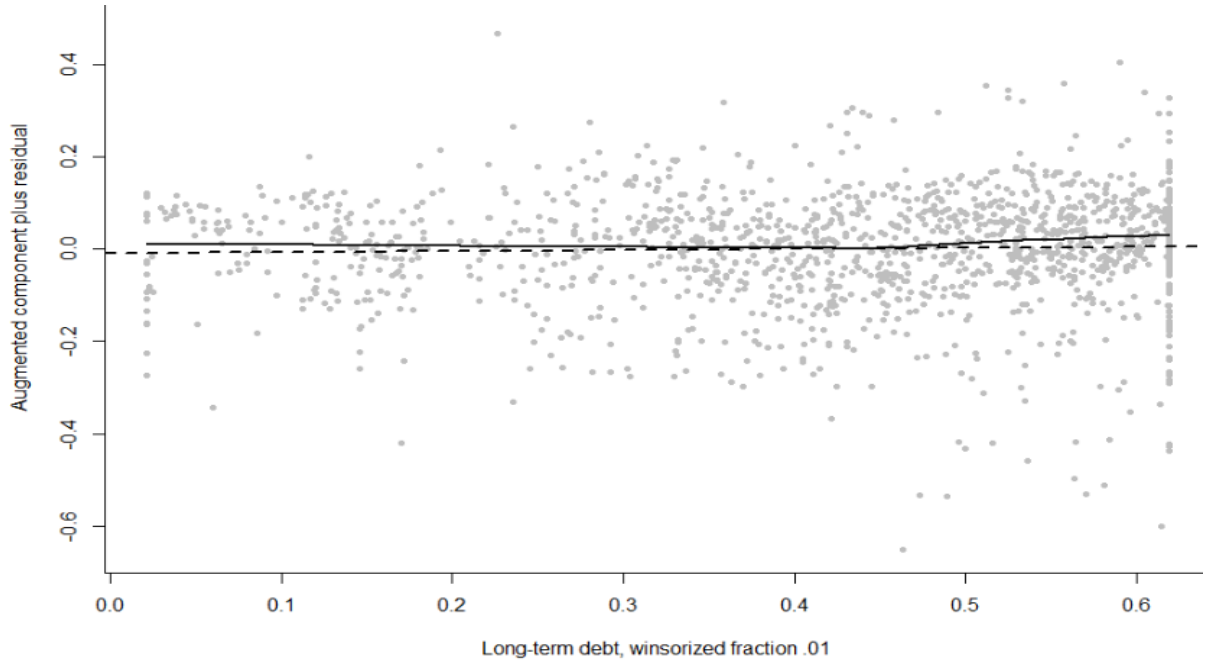
$$Corr\ (u_t, u_s) = 0, for\ all\ t\ \neq s$$

D. Testing MLR assumptions

Appendix B presents all relevant tests for the MLR estimation model from *chapter 5.2. Testing MLR assumptions*. If assumption 1-5 are fulfilled, the MLR model is considered be Best Linear Unbiased Estimator (BLUE) (Wooldridge, 2018). The seventh assumption is added since we are dealing with time series.

Assumption 1 – Linearity

Figure 1 – Long-term debt residual plot



The scattered line in *figure 1* depicts the actual relationship between EV/IC and long-term debt, meanwhile the solid line displays the linear relationship. Notably, the solid and scattered line are approximately equivalent to each other, which provides coating for a linear relationship. Thus, the linearity assumption holds for EV/IC and long-term debt. A similar relationship is found between all dependent and independent variables. Hence, the linearity assumption is considered satisfied for the MLR model.

Assumption 3 – No perfect collinearity

The correlation matrix in *table 2 (page below)* shows that only long-term debt (sq) and short-term debt (sq) of the independent variables have correlation coefficients above the defined

threshold of 0.7. Although, this is due to the mathematical artifact caused by creating new predictors from other predictors. In this case, we have created the squared terms LTD^2 and STD^2 from the predictors STD and LTD to control for a non-linear relationship, resulting in correlation coefficient of 0.949 between LTD and LTD^2. Followingly, knowing that the only correlation coefficients above 0.7 is between the squared long-term debt and long-term debt variable, we conclude that there is no perfect collinearity in our panel data.

To complement the correlation matrix, we have utilized a variance inflation factor test (VIF), which is in accordance with Drobetz et al. (2013). We have set a cut-off-value of 5.0. A VIF-value above this threshold would indicate a multicollinearity problem. *Table 1* presents VIF-values from the MLR model.

Table 1 – VIF-test results

Variable	**VIF**
Long-term debt	3.67
Long-term debt (squared)	3.70
Short-term debt	2.33
Short-term debt (squared)	2.12
Tangibility	1.92
Growth	1.07
Size(lnsales)	1.65
Factor(Country)	1.75
Factor(Segment)	1.63
Factor(Financial-Crisis)	1.23
Factor(Corona-crisis)	1.17
Mean VIF	2.01

From the table, we see that none of the values exceed the cut-off value of 5.0. Further, the average VIF-value of 2.01 is well below 5.0. From the results of the correlation matrix and the VIF-test we conclude that there are no problems with multicollinearity in the model.

Table 2 – Correlation matrix

	LTD	*STD*	*Growth*	*EVIC*	*LTD2*	*STD2*	*Tangibility*	*LnSales*	*Mixed*	*Logistics*	*Offices*	*Residential*	*Hotels*	*Retail*	*Sweden*	*Norway*	*Denmark*	*Finland*	*FC*	*CC*
LTD		0.575***	0.106***	-0.061*	**0.949*** **	0.003	0.192***	0.016	0.182***	0.120***	-0.083**	-0.224***	0.011	0.021	-0.049	0.157***	0.251***	-0.018	-0.028	-0.079**
STD	0.575***		-0.003	0.095***	0.545***	0.146***	-0.187***	0.044	-0.038	0.006	-0.037	0.162***	0.003	0.093***	0.124***	0.051	-0.137***	0.112***	0.082**	0.037
Growth	0.106***	-0.003		0.075**	0.097***	-0.080**	0.197***	0.075**	0.022	0.038	-0.050	0.030	-0.016	-0.022	0.078**	0.088***	-0.021	-0.008	-0.009	0.003
EVIC	-0.061*	0.095***	0.075**		-0.073**	-0.024	0.472***	0.301***	0.229***	0.151***	0.059*	0.172***	0.110***	0.167***	0.296***	0.235***	-0.023	0.201***	0.132***	0.029
LTD2	**0.949*** **	0.545***	0.097***	-0.073**		0.009	0.188***	-0.014	0.191***	0.111***	0.093***	-0.154***	-0.021	-0.036	-0.017	0.186***	0.286***	-0.077**	-0.066*	-0.11***
STD2	0.003	0.146***	-0.080**	-0.024	0.009		-0.001	0.133***	-0.029	-0.019	-0.033	-0.007	-0.009	0.115***	-0.062*	-0.018	0.130***	-0.020	0.020	-0.016
Tangibility	0.192***	0.187***	0.197***	0.472***	0.188***	-0.001		0.209***	0.318***	0.014	0.174***	0.136***	0.157***	0.074**	0.125***	0.302***	0.092***	0.031	0.015	-0.049
LnSales	0.016	0.044	0.075**	0.301***	-0.014	0.133***	0.209***		-0.084**	-0.125***	0.234***	-0.128***	0.142***	-0.012	0.274***	0.023	-0.315***	0.133***	0.009	0.032
Mixed	0.182***	-0.038	0.022	0.229***	0.191***	-0.029	-0.318***	-0.084**		-0.202***	0.398***	-0.279***	-0.085**	0.221***	0.068**	0.120***	-0.197***	-0.031	0.007	0.025
Logistics	0.120***	0.006	0.038	0.151***	0.111***	-0.019	0.014	0.125***	0.202***		0.230***	-0.161***	-0.049	0.127***	0.216***	0.116***	-0.113***	0.102***	-0.021	-0.009
Offices	-0.083**	-0.037	-0.050	0.059*	0.093***	-0.033	0.174***	0.234***	0.398***	-0.230***		-0.318***	0.097***	-0.251**	0.242***	0.102***	-0.078**	-0.200**	-0.001	-0.016
Residential	0.224***	0.162***	0.030	0.172***	0.154***	-0.007	0.136***	0.128***	0.279***	-0.161***	0.318***		-0.068*	0.176***	-0.069**	0.161***	0.216***	0.057*	-0.004	0.010
Hotels	0.011	0.003	-0.016	0.110***	-0.021	-0.009	-0.157***	0.142***	-0.085**	-0.049	0.097***	-0.068*		-0.054*	0.091***	-0.049	-0.048	-0.043	0.045	0.030
Retail	0.021	0.093***	-0.022	0.167***	-0.036	0.115***	0.074**	-0.012	0.221***	-0.127***	0.251***	-0.176***	-0.054*		0.591***	0.303***	0.245***	0.370***	-0.002	-0.027
Sweden	-0.049	0.124***	0.078**	0.296***	-0.017	-0.062*	0.125***	0.274***	0.068**	0.216***	0.242***	-0.069**	0.091***	0.591***		0.540***	-0.526***	0.471***	-0.024	-0.004
Norway	0.157***	0.051	0.088***	0.235***	0.186***	-0.018	-0.302***	0.023	0.120***	-0.116***	0.102***	-0.161***	-0.049	0.303***	0.540***		-0.113***	0.102***	-0.021	-0.009
Denmark	0.251***	0.137***	-0.021	-0.023	0.286***	0.130***	0.092***	0.315***	0.197***	-0.113***	-0.078**	0.216***	-0.048	0.245***	0.526***	0.113***		0.099***	0.039	-0.003
Finland	-0.018	0.112***	-0.008	0.201***	-0.077**	-0.020	0.031	0.133***	-0.031	-0.102***	0.200***	0.057*	-0.043	0.370***	0.471***	0.102***	-0.099***		0.022	0.020
FC	-0.028	0.082**	-0.009	0.132***	-0.066*	0.020	0.015	0.009	0.007	-0.021	-0.001	-0.004	0.045	-0.002	-0.024	-0.021	0.039	0.022		0.109***
CC	-0.079**	0.037	0.003	0.029	0.116***	-0.016	-0.049	0.032	0.025	-0.009	-0.016	0.010	0.030	-0.027	-0.004	-0.009	-0.003	0.020	0.109***	

*Statistical significance at 10%-level ** Statistical significance at 5%-level *** Statistical significance at 1% level. The table shows correlation coefficients between the independent variable, leverage measures, firm-controls, country-dummies, segment-dummies and crisis-dummies. All firm-specific continuous variables are winsorized at upper and lower 10%-level*

Assumption 5 – Homoskedasticity

To test whether the homoskedasticity assumption is violated, we have plotted the least square residuals against the explanatory variables and utilized a Breusch-Pagan Lagrange multiplier test. *Figure 2* shows the residual plot for the independent variable LTD. There is no evident pattern present in the figure. However, the variation in EV/IC seems to be smaller for higher levels of long-term debt, potentially introducing problems with heteroskedasticity.

Figure 2 – Residual plot for long-term debt

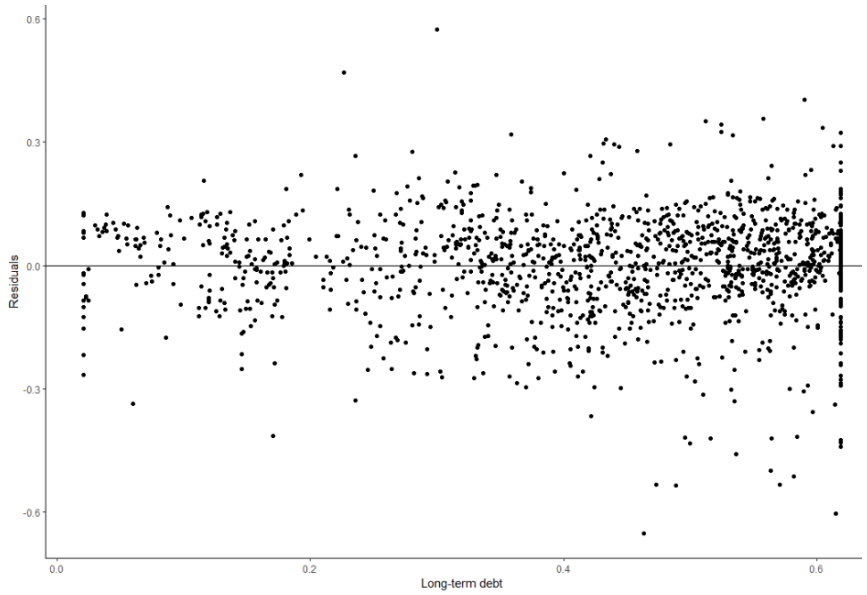


Table 3 - Breusch-Pagan Lagrange multiplier test

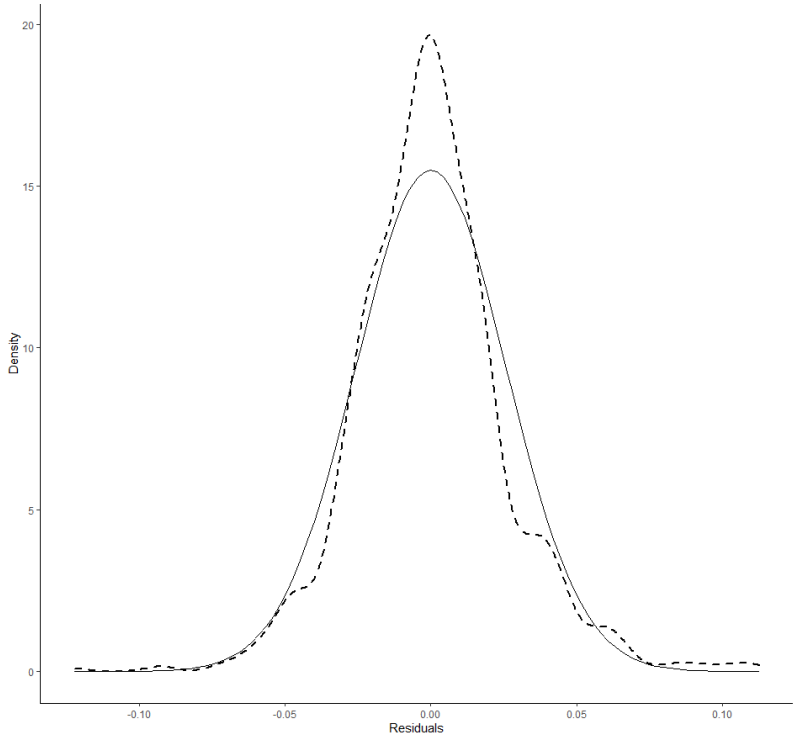
Model	**Chi^2**	**Prob>chi^2**
EV/IC	244.44	0.00

From the Chi^2-coefficients, as well as the P-values, we can see that the null hypothesis for homoskedasticity has clearly been violated for the model. Hence, the variance of the error terms in our panel data is not constant for different levels of EV/IC, meaning that there is a proven presence of heteroskedasticity in our panel data.

Assumption 6 – Normality

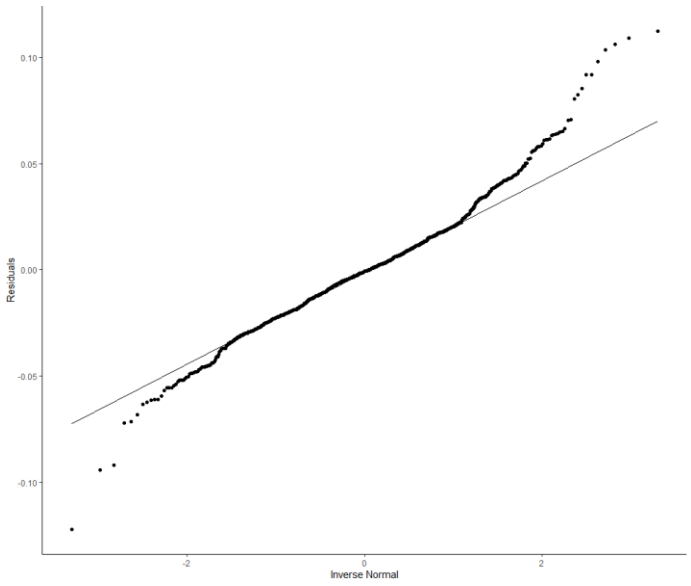
We have tested this assumption for each regression model by plotting the univariate kernel density estimation. The dashed line in *figure 3* below displays the distribution of residuals, while the solid line depicts the normal distribution. We can see from *figure 3* that the residuals are close to being normally distributed.

Figure 3 - Univariate kernel density distribution



To provide additional acumen, we have plotted quantiles of the regression model against quantiles of the normal distribution, shown in *figure 4*. The figure is showing some deviations from the normal distribution, which could be due to the small entity size. The figure curves off in the extremities, displaying characteristics of having heavier tails than if the sample truly came from a normal distribution.

Figure 4 - Q-Q plot of the residuals from MLR model



Additionally, in accordance with Woolridge (2016), we can apply the central limit theorem to infer for an asymptotic normal distribution, with the sample size being large enough. The samples of 1,438 is therefore assumed large enough to conclude for an asymptotic normal distribution. Accordingly, based on an overall assessment of the presented figures and the central limit theorem, the normality assumption is satisfactory fulfilled for the MLR model.

Assumption 7 – Serial Corelation

To test this assumption. we have used a standard Wooldridge test in R, which simply searches for serial correlation in the panel data. The null hypothesis for this test is that there is no serial correlation. The results from the test are presented in *table 4*.

Table 4 - Breusch-Godfrey/Woolridge test results for serial correlation

Model	**Chi2**	**Prob>chi^2**
EV/IC	133,11	0,00

From *table* 4, we reject the null hypothesis of no autocorrelation in the MLR model. In conclusion, the serial correlation assumption is violated, which implies that there is autocorrelation in the panel data.