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Underpricing and short-term returns

An empirical study on Initial public offerings in the Nordics

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Abstract

The study examines the effect underpricing has on short-term returns for 291 Initial public offerings in Denmark, Finland, Norway and Sweden. To test for this, two different OLS-regressions have been developed with Buy-and-hold abnormal returns (BHAR) as the dependent variable, and Market-adjusted abnormal returns (MAAR) as the variable of interest, accompanied by a few control variables. The results of the study show a positive relationship between underpricing and short-term returns, meaning that a higher degree of underpricing has been beneficial for short-term returns. The result deviates from the findings in the majority of previous research, although most of it is based on a long-term perspective. Existing theories such as efficient market hypothesis, signaling and others have provided valuable insights to clarify the observed outcome. The study contributes to a further understanding of what influenced the IPO-market during the 2010s decade.

Keywords: Initial public offering, Stock performance, Underpricing,
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1. Introduction

This section aims to introduce the subject and help the reader to get an overview of what is to be examined in the thesis. First, the background sets the context for the research, thereafter the problem description provides insight into the relevance of the study, lastly the purpose section states what the study aims to achieve.

1.1 Background

In the stock market, initial public offerings (IPO) are a constantly recurring event exhibiting mixed success among the listings. An IPO refers to the process when a privately owned company offers its stock to the public in a stock exchange, allowing them to buy shares, and become owners of the company. The frequency of IPOs has varied widely among the stock markets and so has the performance of the stock after their listing. Recently there has been a notable uptick of IPOs across multiple markets. For instance, the American market saw over 1000 IPOs in 2021, a significant increase compared to 2020 when there were only 480 IPOs in the American market (Statista, 2023). There are a multitude of reasons as to why a company chooses to pursue an IPO. Common motives could be to pay off their debt, to raise capital, for initial owners to be able to sell their share to exit the company or perhaps just be able to diversify their portfolios as they often are heavily invested in the company (Mikkelson & Partch 1985). With multiple motives to pursue an IPO, the occurrence encompasses a rich history.

The phenomenon of IPOs most likely started back in the 1600s as trading companies started issuing stocks to finance their trading voyages. Prior to the IPOs there had been a tradition of issuing stocks to investors to bankroll the voyage but the IPOs in the 1600s were the first time a company made buying their stock possible for the public. From that point on, the IPOs expanded to most markets in the world with substantial growth during the 1900s (Brown et al., 2021). Today, many distinguished and influential companies are listed on stock exchanges meaning that they have previously undergone an IPO, thus the subject has been the interest of many scholars and papers throughout the years.

There are numerous factors that influence how the performance of the stock develops. In this paper we are focusing on the relationship between the initial pricing, the performance of the stock on the first day of listing and the subsequent returns. The pricing is a substantial part of the IPO process for the issuing company as it has both long- and short-term implications both

for the company as well as the owners as they might want to exit the company or just sell part of their shares (Pagano et al., 1998). Initial abnormal returns, also referred to as underpricing, where IPOs tend to perform exceptionally well the first day of listing has long been an observed phenomena and the subject of underpricing has been rigorously investigated (Ritter, 2011). Though the underpricing phenomena is fairly well observed the reason why it occurs is disputed. Allen & Faulhaber (1989) argues underwriters knowingly price their stock below the intrinsic value to ensure positive returns to signal to investors that the company is of high quality while Rock (1986) argues that underpricing occurs as a byproduct of information asymmetry existing in the market. There are more theorized reasons as to why underpricing occurs and this is further expanded upon in subsequent sections.

The phenomena has been researched since the 1970s with Ibbotson & Jaffe (1975) being one of the first researchers to acknowledge the phenomena making it a popular topic when researching IPOs. Ritter (1991) followed this up by researching strategies investors could use to take advantage of this phenomena and whether or not there exists a relationship between underpricing and long-term performance of IPOs. This kind of relationship was further researched in different markets and timeframes in papers written by researchers such as Kooli et al. (2006) and Sahoo & Rajib (2010). While these studies tested similar things with similar methods the results tended to be somewhat different with differing conclusions, a topic that is further explored in section 3. The relationship, based on prior literature, seems to exist in some markets and it is a subject well worth continuing research on.

1.2 Problem Description and Problem Analysis

The performance of a stock following an IPO is of great interest to various stakeholders, each with their own motivations for desiring a positive outcome. Firms seek a well-performing stock to attract higher amounts of capital, undermining the risk of takeover and to generate positive publicity, while shareholders and employees with stock options want it to increase their wealth (Mikkelson et al., 1985). Regardless of how stakeholders can benefit from a good performing stock, there are many factors impacting the performance. One observed influential factor is the initial returns of the stock on the first day of trading (Ritter, 1991), which underscores the importance of the offering price decision. Further research provided in this paper is therefore beneficial for decision makers participating in the underwriting process to

make more legitimate decisions. As previously mentioned the field has been researched since the 1970s in different markets around the world. However, the majority of all research is conducted on long-term performance, while short-term performance remains less explored. To our knowledge there is no study examining the short-term returns in the Nordics using the methodology we are. The Nordics countries excluding Iceland have been clustered with each other due to their harmonized and highly integrated financial markets (Goldschmidt & Tuominen ,2018). Therefore, conducting such research would fill a gap in the existing literature.

1.3 Purpose

The aim of this study is to examine whether there is an existing relationship between underpricing and the short-term returns. The research is conducted on the Danish, Finnish, Norwegian and Swedish stock markets in all size classifications. By investigating this relationship, the study seeks to contribute to a broader understanding on how stocks behave in the aftermath of an IPO. By using a methodology closely aligned with previous studies by Ritter (1991), Kooli et al. (2006) and Sahoo et al. (2010), the study aims to shed light on the dynamics between underpricing and subsequent stock performance. Through a well-conducted analysis and empirical investigation the study aspires to provide valuable insights for market participants. The thesis aims to take a critical stance through a thorough analysis that accounts for both the strengths and weaknesses connected to the research. By doing all of this we aspire to provide a valuable contribution to the academic research on financial markets.

2. Theoretical Framework

This section provides the reader with an introduction to key concepts, components and phenomena for initial public offerings. The following subsection addresses relevant theories that are introduced in the paper to clarify the underlying principles for the reader. The concepts explained in subsection 2.2 are the efficient market hypothesis,winner's curse, information asymmetry, hot issue market and signaling.

2.1 Concepts, components & phenomena

2.1.1 The IPO-process

The IPO process is a critical point for a company aiming to go public and raise money by selling shares to the public market. The reason why many firms choose to go public is often

due to greater liquidity and better access to capital. Once the preparations for the initial public offering have started an underwriter (typically an investment bank) is hired. The next step contains several choices and strategies for the firm, either it could sell new shares, called primary offerings, or it could sell existing shares, known as secondary offerings. A mixture between the two is also possible and the approach differs depending on the firm's situation (Berk & Demarzo, 2019).

The most common deal between underwriters and the firm is called a firm commitment IPO. This entails that the underwriter guarantees to sell all of the stocks at the offer price, by purchasing the entire issue at a price slightly below the offer price. Thereafter the underwriter has to resell the stock at the offer price. However, this deal is risky for the underwriter if they fail to sell all the shares at the offer price. For smaller IPOs, underwriters typically use a best-effort IPO basis where they try to sell shares at the best price but do not guarantee all will sell. An all-or-none clause may apply which implies that either all of the shares are sold, or there is no deal. Other deals using auctions have also been used over the years, although it is not a common procedure (Berk & Demarzo, 2019).

2.1.2 Underwriter

The underwriter plays a significant role in the IPO process, having an impact on the subsequent performance of the newly listed stock. In collaboration with the issuing firm they decide the offer price, ensure compliance with regulatory requirements, and file all necessary paperwork. Moreover, the underwriter connects the issuing firm with potential buyers capable of acquiring large amounts of shares, these potential buyers often being institutional investors (Binay et al., 2007).

The underwriters potentially have an impact on the stock performance post IPOs, for example Dong et al. (2011) suggest that the quality of the underwriter positively affects the long-term performance of the stock. This effect may be attributed to the various activities undertaken by the underwriters, including marketing of the shares, generation of information, and screening. When these activities are executed by proficient underwriters, the demand for the stock is enhanced, which leads to a better performance. Furthermore, underwriters are believed to influence the level of underpricing of the stock. This is partly due to underwriters knowingly setting an offer price below what is expected (Dong et al., 2011). Such strategies are used to ensure the complete sale of all shares on the first day, otherwise the underwriter commonly

has to sell the remaining shares on the open market, depending on the terms agreed upon. Dimovski et al. (2011) states that the reputation of the underwriters also is thought to affect the level of underpricing, where the reputation of the underwriter positively correlated with the level of underpricing. The authors tested how the underwriters impacted the stock performance in Australia by using two calculations for underwriter prestige and what they found was that the underwriter prestige had a positive effect on the underpricing. Although findings of Dimovski et al. support that a better reputation is correlated with a higher underpricing, Carter et al. (1998) found the inverse relationship.

2.1.3 Valuation

During the valuation process, several factors impact the valuation of a company. The demand can make two identical IPOs listed during different market sentiments differ in value due to the timing of the IPO. Factors such as industry and how compelling the business model is are also components taken into account during the valuation process (Kim & Ritter, 1999). At the beginning of the valuation it usually relies on more quantitative methods, the most commonly used being multiple valuation, dividend discount model and discounted cash flow model. These techniques are fair value estimates, and after calculating these the underwriter applies a reasonable price discount to come up with the preliminary offer value. The next step in the process is the collection of information on the demand implemented by the underwriter. The information collected is then used to adjust the price to the final offer price (Roosenboom, 2012).

2.1.4 Underpricing

Underpricing is as mentioned earlier in the paper, a recurring phenomenon in listings and underpricing in the literature generally refers to the returns on the first day of listing. Positive returns on the first day mean that the stock was considered underpriced while a negative return on the day of listing means that the stock was considered overpriced (Ljungqvist, 2007). There are many theorized reasons why underpricing is such a regularly recurring phenomenon, Jamaani & Alidarous (2019) compromised the most common theories into four categories. These are information asymmetry theories, institutional theories, ownership and central theories and behavioral theories. Some of the central theories most relevant to this paper are expanded upon in the next section of the paper.

2.2 Theories

2.2.1 Efficient market hypothesis

Efficient market hypothesis (EMH) is a common theory in finance stating that all the information that pertains to a stock is reflected in the price, thus the fair value of a stock is always equal to the price. This also implies that it is impossible to reliably find alpha in the market though this can be problematized and questioned which is further expanded upon in the following paragraphs (Fama, 1970).

Fama (1970) explains that EMH can be modified into three forms of market efficiency and these are the strong form, semi-strong form and the weak form. The strong form states that exactly all information about the stock is reflected in the price, that is all information available to the public as well as insider information and projections. This is the most radical interpretation of the EMH and the form that states that it is impossible to consistently, long-term, overperform the market.

The semi-strong form of the EMH implies that all public information about the stock is calculated in the price of the share, thus to be able to consistently beat the market you would have to have access to information not available to the public. In other words you would have to have insider information about a stock or market as a whole to be able to consistently produce a positive alpha. The weak form further weakens the assumptions about the market and the share prices. Here the interpretation of the EMH states that technical analysis is fruitless but fundamental analysis might be able to create long-term, consistent alphas due to the fact that today's price is reflected in the past prices of the stock (Fama, 1970).

These forms have been tested thoroughly and there seems to be some contradicting findings regarding the validity of the EHM. Andrianto & Mirza (2016) found that the Indonesian market behaved consistently with the weak form of the EMH. They tested this by using serial correlation tests and some run tests on data collected from the Indonesian stock market. While Andrianto et al. (2016) findings supported the EMH, Dockery & Kavussanos (1996) found the Athens stock market to behave inconsistently with the EMH. They tested this by using wald tests and what the authors found was that not even the weak form was true in the test.

2.2.2 Winner's curse

The winner's curse theory states that in scenarios involving an auction, there exists a tendency for the winning bidder to exceed the intrinsic value, resulting in an overpayment (Levis, 1990). The theory is particularly relevant in the context of IPOs, as the process of an IPO often involves a type of bidding among stakeholders, within the predetermined price range, with the highest bidder ending up securing the shares. However, due to the newly listed status of the company, information asymmetry between investors and insiders is common, which leads to buyers lacking important information that could impact the future performance of the firm. As a consequence, investors might overpay for the shares, which potentially could lead to lower returns than anticipated. The dynamics of the winner's curse theory in the IPO context sheds light on the potential risks and challenges associated with pricing and valuation in the IPO-market (Levis, 1990). A study conducted by Chhabra & Kiran (2020) revealed the presence of the winner's curse, by demonstrating the existence of underpricing in the market. The study which investigated the new issues during 2005-2012 found an average underpricing of 18%, which the authors argue proves the existence of the theory.

2.2.3 Information asymmetry

Information asymmetry is a common occurrence in the stock market as it refers to when one side of a transaction possesses greater information leading them to have an advantage over the other party. This creates a risk that the party with greater knowledge will take advantage of the other side making a transaction unfair from the perspective of the party with less information. This asymmetry can be caused by many reasons such as greater research or a greater familiarity with the item or subject, this could be viewed as inefficiency in the market (Stiglitz, 2000). Payne et al. (2022) found that information asymmetry was prevalent in the IPOs tested in the US stock market and that less information asymmetry was associated with lower level of underpricing. The authors used the days between the filling date and the issue date as a proxy for the amount of information to be made available to the public. Payne et al. tested how the information asymmetry affected the underpricing using a multitude of equations and regressions finding that the level of information asymmetry affects the level of underpricing.

Many models about IPOs and underpricing have originated, and may be explained by inefficiencies in the market created by asymmetric availability of information (Jamaani et al.,

2019). One example of this is the model created by Rock (1986) explaining underpricing as a product of information asymmetry in the IPO market. Rock (1986) theorized that depending on the type of investor, the amount desired to invest and pay will differ for the same stock. An informed investor is assumed to have perfect information about the company and the market, thus they can calculate the fair value of the company while the uninformed investors are not able to calculate a reliable value for the firm. If the IPO is priced too high, based on the company's intrinsic value, the informed investors will not buy the share while they will buy shares if the price is below the intrinsic value of the stock. To compensate for asymmetric information the uninformed investors will want a risk discount, making the shares cheaper than the intrinsic value. The discount must be large enough to make the uninformed investors take the risk to buy the listed shares. While the company wants to be listed at as a high price as possible they do not want to be undersubscribed. Thus, the author theorizes, that the underwriter has to compromise between the investors and the firm, generally listing the shares below the intrinsic value. In essence, Rock's model explains underpricing as a product of asymmetrical information in the market between informed- and uninformed investors (Rock, 1986).

2.2.4 Hot issue market

Hot issue markets are defined differently in the established literature regarding IPOs. It has been defined in some literature as the periods where the market has had abnormal returns the first month after the listing (Ibbotson et al., 1975), while other papers define it as the periods where there has been a larger volume of IPOs than usual (Helwege & Liang, 2004). While the definitions tend to differ slightly the conclusions often are the same, the hot market tends to reflect a bigger optimism in the market (Helwege et al., 2004). The amount of predictability of the hot markets is also believed to be predictable according to Ibbotson et al. (1975). While there have been studies researching how the long-run performance of IPOs are affected by the hot issue markets no real consensus has been reached. Ritter (1991) found a negative relationship between hot markets and long-run performance while Krigman et al. (1999) found a positive relationship. Ljungqvist (2007) built on these contradicting findings and he found that the relationship is not monotone, the relationship between long-term returns and hot markets is negative if the probability that the hot market is going to end soon while the inverse relationship is true if the hot market is believed to remain.

2.2.5 Signaling

Allen et al. (1989) believes that one of the many reasons why underpricing might be a regularly recurring phenomenon in the stock market is that the underwriters want the stock to provide positive returns on the first day of listing to signal that the company is of high quality and that demand for the stock is high. Because of this it could be beneficial for the company to have a low offer price to entice investors to invest more in the company and hopefully provide a positive long-term return on the stock. Welch (1989) further modeled the signaling phenomena. The author argued that the reason as to why it is profitable for the high quality companies to signal their quality by deliberately offer their stock at a lower price than they need is that the cost is smaller for the companies of high quality than the companies of lower quality. This is argued because the investors also will be able to assess the company's quality in the long-run, thus the loss of proceeds during the listing will be compensated for in the long run. The companies with low quality will, according to Welch (1989), not be compensated as their marginal cost is higher and they would benefit more from seeking more proceeds during the IPO. These findings have further been supported by Allen et al. (1989) and Grinblatt & Hwang (1989), where the latter authors also considered the variance in future cash flow. This was done to further the understanding of the signaling theory and what the authors found that the signaling theory held validity and that signaling was used. The authors found that the degree of underpricing was positively correlated with the intrinsic value of the companies tested in the paper.

Signaling could also be used to make the information asymmetry associated with the listings smaller. This could be argued due to the initial returns being viewed as information used by the investors to determine the quality- and the competency of the management in the company (Carter & Manaster, 1989).

3. Literature & Hypothesis

This part gives a brief review of previous relevant studies within the field while analyzing and comparing the findings to each other, followed by a presentation in Section 3.2, of the hypothesis applied to the study.

3.1 Literature review

The results regarding the underpricing overall seem to support that underpricing is a regularly occurring phenomenon, but there is mixed evidence why it occurs and how it affects the aftermarket performance. There has been a fair amount of prior papers studying the performance of IPOs and the subsequent performance of the stocks. The studies often include different variables explaining the performance, creating a better understanding of the IPO performance. Ritter (1991) analyzed whether a strategy of investing at the end of the first day and holding it for 3 years offers abnormal returns. Ritter (1991) found that in the long-run on average IPOs tended to underperform the market with negative abnormal returns. Further, Ritter conducted a multiple regression trying to explain the phenomena and he found that companies that were younger and going public during years with high volume of IPOs performed even worse. The author also studied the relationship between underpricing and the long-term performance of stocks. What he found was a negative relationship between the IPO performance and the level of underpricing, ie. a greater level of underpricing was correlated with worse long-term returns. Though important to note is that this variable was not significant in the regression. Ritter (1991) argued that the negative coefficient could be because of the market being inefficient during the listing. This he meant would lead to the newly listed stocks being overvalued due to investors being too optimistic following the listing. Following the stock being overvalued the market becomes more efficient, leading the newly listed stock to underperform the market, finally pricing the stock as the intrinsic value the author argues. Following the stock becoming overvalued the market becomes more efficient, leading the newly listed stock to underperform the market, finally pricing the stock as the intrinsic value. The insignificant underpricing variable Miller (2000) argued, could be due to the risk perceived from the underpricing being picked up by other variables such as volume of IPOs during the year and size of the company.

Ritter (1991) also tested 14 different industries' performance, including technology which performed significantly higher than the average industry. The author concludes that the results from his study strengthen the theory that companies tend to go public at the peak of their industry trend. A phenomenon known as the “window of opportunities” is also mentioned as a possible explanation to the negative returns and high volumes during certain times. The expression implies that under certain times many firms saw the opportunity of raising capital as more beneficial than others.

More recently, Sahoo et al. (2010) also found a negative relationship between the level of underpricing and the subsequent performance of stocks testing for the determinants for IPO short-term performance. The authors measured the performance of IPOs in India between 2002-2006 by both using a wealth relative and an OLS regression using buy-and-hold abnormal returns (BHAR) as the dependent variable, which is calculated as the excess return over the CNX-Nifty index acting as a market benchmark. Also a multitude of independent variables were included such as market-adjusted abnormal returns (MAAR), calculated as initial returns on the IPO the day of listing divided by return on the benchmark market CNX-Nifty the same day, accompanied with various other control-variables. Contrary to Ritters (1991) findings regarding the underperformance of IPOs, Sahoo et al. (2010) found an underperformance only one year after the listing followed by an overperformance the following two years. Because of this the authors tested what affected the underperformance of the IPOs in the one year period using an OLS-regression. What the authors found was a negative coefficient for the MAAR -variable supporting the findings of Ritter (1991) suggesting that the IPO aftermarket performance was negatively correlated with the level of underpricing. Sahoo et al. (2010) mentions in the paper that the findings should be analyzed with a certain level of precaution as India had a bull-run during the period tested thus potentially skewering the results.

Kumar & Sahoo (2021) further built upon the findings from Sahoo et al. (2010) by constructing a similar model but this time using the BHAR at a 36- and 24-month timeframe as the dependent variable instead of the BHAR at a 12-month period. The findings support that the underpricing negatively affects the aftermarket performance though in this paper the authors do not find the relationship to be significant. Furthermore, the age variable remains insignificant (Kumar et al., 2021).

Kooli et al. (2006) further studied the relationship between underpricing and the long-term performance of IPOs. This paper analyzed this relationship in the Canadian markets using both a value weighted (VW) - and an equally weighted (EW) portfolio when calculating the abnormal returns. The dependent variables used were both buy-and-hold abnormal returns (BHAR) and cumulative-abnormal-returns (CAR). While the authors claim that the BHAR variable is most appropriate for the purpose of the paper using similar arguments as used by Sahoo et al. (2010), that the BHAR variable more aptly describes the investors experience in

the market. Though, while Kooli et al. (2006) argued that BHAR was the most appropriate, the CAR-variable still had its uses according to the authors as it still could be an interesting variable to use in addition to the BHAR-variable. The relationship was also studied using both an OLS- and an WLS-regression somewhat differing from Ritter (1991) and Sahoo et al. (2010) who only used OLS-regressions. The reason for Kooli et al. (2006) incorporating an WLS-regression was due to the high amount of heteroscedasticity found in the data set using White's test. To better handle this, the authors used a WLS-regression. The author argues that this creates more reliable output and this is reflected in the substantially higher r-squared value in the WLS-regression compared to the OLS-regression.

What the authors found regarding the relationship between the long-term performance of IPOs and the underpricing was contradicting the findings made by Ritter (1991), Kumar et al. (2021) and Sahoo et al. (2010). In both the WLS- and OLS-regression the Kooli et al. (2006) found a positive relationship between the underpricing and long-term performance, a positive return the first day of listing was in the canadian market associated with positive long-term abnormal returns. This, the authors argued, proved that the signaling theory holds merit. This can be questioned as Ritter (2011) called the signaling theory “silly” as he did not find that the theory held any real merit. Furthermore, Kooli et al. (2006) also found that the sector the company operates in affects the long-term performance of newly listed stocks, this in line with the findings made by Ritter (1991).

When analyzing the performance of IPOs in relation to underpricing as Ritter (1991), Sahoo et al. (2010) and Kooli et al. (2006) have done, there are a multitude of variables that have been used, some of which being the same. Both Kooli et al. (2006) and Ritter (1991) have used sector dummies, as they wanted to test for certain sector specific effects. All four papers also use an independent variable for a hot market, having a dummy with the value one if the listing was done in a hot issue market. Ritter (1991) and Sahoo et al. (2010) use a few of the same variables except for the underpricing variable. One example of such a variable is an age variable measuring the age of a company prior to listing of the company.
Furthermore, Kooli et al. (2006) also analyzed the long- and short-term performance of IPOs in the Canadian market using both BHAR and CAR. They analyzed the performance in a 12-, 24- and a 36 months period. What they found was an overperformance of IPOs in the exchange during the time period tested. This is not in line with Ritter (1991) as he found a long-term underperformance of IPOs and the findings made by Kooli et al. (2006) was

somewhat in line with the findings regarding over- and underperformance of IPOs found by Sahoo et al. (2010). What they found was a one year underperformance followed by two- and three year overperformance of IPOs.

Isola et al. (2013), further studied the long- and short-term performance of IPOs, this by analyzing the aftermarket performance of listings in the Euronext Lisbon exchange during 1990-2010. To do this they compared the 12-, 24- and 36-month returns when evaluating the long-term performance of the IPOs and the initial underpricing in one-, five- and twenty-one days market-adjusted abnormal returns when evaluating the short-term performance of IPOs. What the authors found was that the returns when holding the newly listed stocks for 12 months was on average around 44% while the returns when holding the stocks for longer than 12 months got increasingly worse. When holding a newly listed stock for 24 months the average return was 26% and when holding the newly listed stocks for a period of 36 months the returns were around -12%. The reason for the increasingly worsening results, the authors theorized, was that the market got increasingly more efficient, reducing the information asymmetry often existing in listings. Regarding the short-term performance the authors found that the underpricing was most prevalent during the first day of listing and got increasingly smaller the longer time went on (Isola et al., 2013).

3.2 Summary of literature review

The findings regarding the level of underpricing and aftermarket performance tend to differ fairly substantially depending on the study. Ritter (1991), Sahoo et al. (2010) and Kumar et al. (2021) found the relationship to be negative, suggesting that underpricing yields lower returns in the long- and short-term. This, Ritter (1991) theorizes, is due to the market being temporarily inefficient during the listing and the subsequent underperformance is the market correcting itself. Kooli et al. (2006) found the inverse relationship suggesting that a higher degree of underpricing yields higher aftermarket returns. This, the author claims, is due to the signaling theory being true.

Finally, the findings regarding the general performance tend to differ as well. Ritter (1991) and Kumar et al. (2021) finds an underperformance of IPOs in each year in a three year period, while Sahoo et al (2010) only finds an underperformance the first year of listing followed by an overperformance the following two years. Isola et al. (2013) finds an

overperformance the first two years of listing while finding an underperformance the third year. The findings tend to differ a fair amount suggesting that the IPO market is fairly erratic and hard to predict when comparing for different periods and markets.

Table 1- Key finding in prior papers

Author/year	Variable	Key findings
Ritter (1991), Isola et al. (2013), Sahoo et al. (2010), Kumar et al. (2021) Kooli et al. (2006)	Underpricing (MAAR)	Both positive and negative values were found on the MAAR-variable. Although the different studies examine different time periods and markets which could explain why the results differ.
Ritter (1991), Isola et al.(2013), Sahoo et al.(2010), Kumar et al (2021), Kooli et al. (2006)	Abnormal returns (BHAR)	All authors used abnormal returns variables, though the construction differs a bit with some using Buy-and-hold abnormal returns while others used Cumulative abnormal returns.
Mallinguh et al. (2020), Ritter (1991), Guo et al.(2019), Chhabra et al. (2020)	Age	Following authors used age as a control variable, as it could be indicative of the firm's maturity.
Wong, (2002), Bhabra and Pettway (2003), Chhabra et al. (2020)	Size	Various authors have included size as a control variable in their models, as it has been shown to have an impact on the returns.
Bouman & Jacobsen (2002), Zhang & Jacobsen (2021)	Halloween indicator	The variable test for the famous relationship that the period between november to april outperforms the rest of the year,
Ritter (1991), Kooli et al. (2006)	Sector-dummies	Some different sectors were tested for. The findings stated that different sectors behaved differently.

Notes: Table 1 exhibits each variable used in the model, together with information on which authors have been using or arguing for these to have a significant impact. The first column contains information about the studies, while the second column includes the variable the paper tested for and the third column contains summarized findings regarding the variable. Also it summarizes prior findings regarding the variables used in the model described in section 5.

3.3 Hypothesis

In light of the literature examined providing some ambiguity, we want to test for a relationship between underpricing and short-term performance. To test for this a regression containing underpricing or market-adjusted abnormal returns (MAAR) as the variable of interest, and short-term returns (BHAR) as the dependent variable. With consideration to this the null hypothesis has been developed as "Underpricing does not have any impact on short-term returns following an IPO", which is exhibited below with β_1 representing the MAAR-variable.

$$H_0: \beta_1 = 0$$

Consequently, it is logical that the alternative hypothesis of the paper is that "Underpricing does have an impact on the short-term returns subsequent to an IPO".

$$H_1: \beta_1 \neq 0$$

4. Data

The data section starts by informing the reader about how the procedure of collecting the data was conducted. Then it moves on to explain which methods were used to clean the dataset. Lastly descriptive statistics is presented to inform about the distribution within the dataset.

4.1 Data collection

For the data collection, Refinitiv Eikon was primarily used as the database. The data consists of a sample of 291 initial public offerings in Sweden, Denmark, Norway, and Finland between 2011-01-01 and 2020-12-31. The data includes all stock lists available in the Nordic countries except for Iceland, thereby no exclusions have been made based on the size of the stock exchange. The decision was made to capture the effect on all IPOs regardless of size. Only common stocks have been included, other securities such as units, preferred stocks, and warrants were excluded from the data. The decision was taken since it is the primary security traded among investors and simple, also Ritter (1991) made the same exclusion.

The dependent variable BHAR exhibited as Eq (1) found in Section 5, comprises one-year returns, defined as short-term investments according to the IFRS definition of short-term investments (International accounting standards board, 2022). Furthermore, the returns of OMXS30 during the corresponding period was subtracted in Eq (1), obtained from Refinitiv Eikon and added manually into the dataset. The returns calculated are based on the stock price meaning dividends are excluded from the variable. Both the BHAR-variable presented in Eq (1) and the MAAR-variable presented in Eq (2), are based on the stock closing prices while the variables size and age are based on the value before the IPO. In the lack of some data points regarding size and age these have been retrieved from respective annual reports. To handle various violations connected to the regression such as non-linearity and heteroscedasticity in the model, logarithmic values have been used on some of the variables, a common way to handle issues with non-linearity in the model (Benoit, 2011). Further, dummy variables accounting for the seasonality through the "Halloween indicator" and sectors are also included in the dataset using the Excel "IF" function to sort out the dates and sectors.

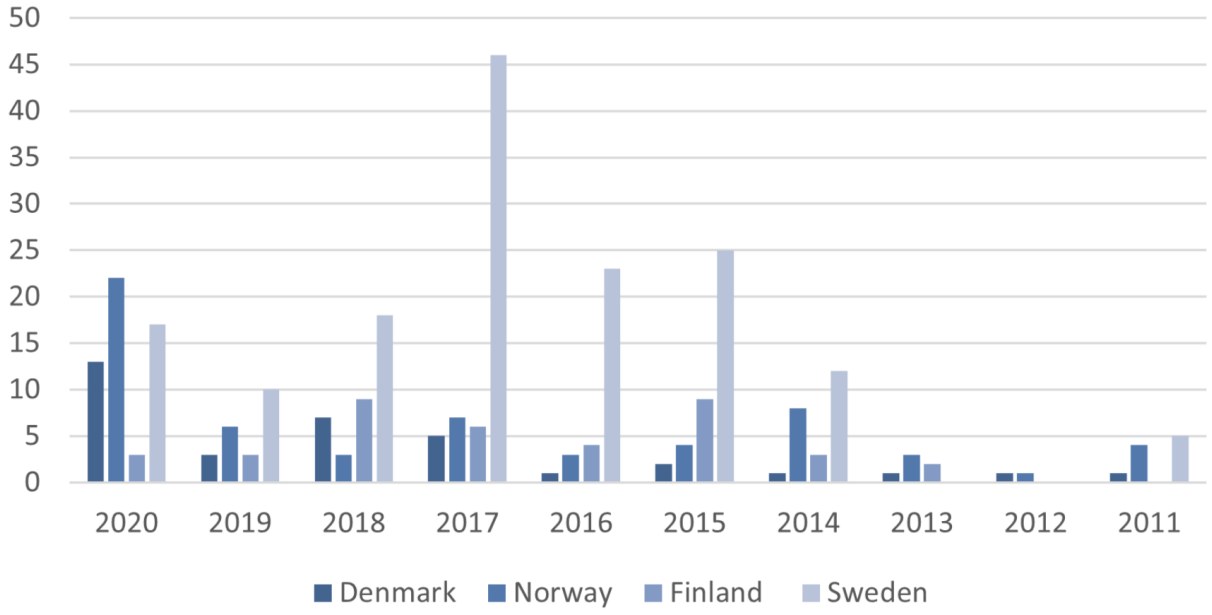
4.2 Cleaning the data

Cleaning the data became a necessity when evaluating the data collected from Refinitiv Eikon as some observations were missing data. Examples of such missing data could be that the book value or founding date were missing. Such observations could be researched and added manually as the data often existed within the program but for some reason was not included within the data set. For those companies where this information still was unavailable the data was researched and added manually. There were also some observations where this information was unavailable, these observations were completely removed from the data set. Those companies that were delisted within a year were also removed from the data set. The cleaning of the data has been done in accordance with Peterson (1989). To deal with outliers the dataset is winsorized to minimize the potential impact of extreme values on the statistical analysis and improve the accuracy of the results. The winsorizing has been done on the independent variables that are not dummy variables.

4.3 Descriptive statistics

The data which consists of IPOs in the Nordic countries between 2011 and 2020 are displayed in Table 2. It shows that Sweden, in particular, is overrepresented among their peers with 158 IPOs, hence the data is mainly weighted towards the Swedish stock market. Thereafter Norway issued 61 IPOs within the period while Denmark and Finland issued 37 and 35 respectively. As visualized in Table 2, the distribution among the years chosen to go public is skewed with some years turning out to have a higher frequency of IPOs. This could be considered a hot issue market meaning that during certain periods the conditions are beneficial regarding investor sentiment and market conditions, leading to a higher frequency of IPOs (Helwege et al. 2004).

Table 2- Frequency of IPOs



Notes: Table 2 exhibits a comprehensive overview of the IPOs conducted in every individual country across multiple years.

Table 3 summarizes descriptive statistics for all variables divided by countries and for the Nordic market in its entirety. A large range is provided within the different variables, and an indication of the countries and observations impacting the output the most is given. The BHAR variable proves that the range is wide with a minimum value of -94% and a maximum value of 668%. The other variables also show big differences within the sample, which is why winsorizing has been used to deal with outliers. From the table, it can be interpreted that

Sweden drives up the buy-and-hold abnormal returns of the sample with a mean of 16%, which is higher than the other countries ranging from 5% to 0,4%. For the MAAR-variable Denmark shows a significantly higher mean than its peers, indicating that IPOs are more underpriced there. Although, the impact Denmark has on the total mean is lower since it is a smaller share of the sample. For the Size variable Denmark exhibits a significantly higher mean as well, thus, potentially Danish firms wait until they are more mature before entering the public market. The Age variable presents fairly consistent results across all countries with low variability.

Table 3 - Descriptive statistic for variables

	BHAR	**MAAR**	**Size (Millions)**	**Age (Months)**
Denmark Min	-72%	-23%	0.10	4
Denmark Max	316%	170%	23 765	595
Denmark Mean	0.4%	27%	1 044	151
Finland Min	-94%	-27%	1.60	11
Finland Max	187%	36%	6 702	660
Finland Mean	5%	5%	426	206
Norway Min	-91%	-32%	0.1	3
Norway Max	566%	181%	11 851	1 472
Norway Mean	5%	8%	680	222
Sweden Min	-88%	-67%	0.1	2
Sweden Max	568%	160%	16 832	1 452
Sweden Mean	16%	12%	422	222
Total Min	-94%	67%	0.1	2
Total Max	668%	181%	23 765	1 472
Total Mean	11%	12%	552	212

Notes: Table 3 exhibits minimum, maximum and mean values for each country included in the test for all variables, together with the total values from the sample.

5. Method

The method-section introduces the models used to examine the hypothesis, followed by a presentation of each individual variable used in the model split up by dependent variable, variable of interest and control variables. This section ends with a summarization of the test conducted on the data connected to the OLS-assumptions.

5.1 Model specification

To estimate the effect that underpricing has on the one-year performance an appropriate method is to test it using two OLS-regressions. One of them excluding sector variables and the other OLS-regression including sector dummies, to control for industry fixed effects, both with short-term performance as the dependent variable. Both models have the BHAR-variable as the dependent variable and underpricing (MAAR) is used as an independent variable for both models. This model is fairly similar to the model used by Sahoo et al. (2010) with the addition of some variables and the omission of other variables. Also the work by Ritter (1991) and Kooli et al. (2006) has heavily influenced the models used.

$$BHAR = \beta 0 + \beta 1\, MAAR + \beta 2\, Size + \beta 3\, Age + \beta 4\, HLW + U \qquad \text{Mod(1).}$$

Model two has been included in the paper to introduce the industry fixed effect, i.e if the short-term performance of newly listed stocks is affected by the sector the company operates in. Ritter (1991) and Kooli et al. (2006) included similar dummy variables in their regression and found that the sector had a significant effect on the aftermarket performance of newly listed stocks. Thus, the addition of sector dummy variables was deemed to be appropriate as it potentially could create a better fitted model.

$$BHAR = \beta 0 + \beta 1\, MAAR + \beta 2\, Size + \beta 3\, Age + \beta 4\, HLW + \beta 5\, TECH + \beta 6\, HEALTHCARE + \beta 7\, REALESTATE + \beta 8\, CYCLICALS + \beta 9\, NONCYCLICALS + \beta 10\, ENERGY + U \qquad \text{Mod(2).}$$

These statistical models can be used to determine if and how the level of underpricing affects short-term performance, creating a basis for where the null hypothesis can be rejected or not. The remaining control variables are included in the model to reduce endogeneity and omitted variable bias. OLS-assumptions 1-4 according to Stock & Watson (2020) are expected to hold

in the data set while we expect some problems with heteroscedasticity as this is a normal occurring problem in these kinds of models. More specifically, time-variant serial correlation is often the cause of this heteroscedasticity problem in many of these kinds of regressions. Thus, the OLS-regressions are calculated with robust standard error using vce(robust) in Stata, mitigating the problem arising from the heteroscedasticity. While heteroscedasticity might be a problem in the data, due to the variables being logarithmized, this problem may not be as prevalent as it would have been otherwise (Ford, 2018).

Table 4 - Variables included in the models

Variable	Meaning
BHAR	Buy-and-hold abnormal returns
MAAR	Market-adjusted abnormal returns
SIZE	Total assets before offering
AGE	Months between the firms establishment and IPO
HLW	Halloween-indicator , controlling seasonal effects
TECH	Dummy-variable for the tech-sector
HEALTHCARE	Dummy-variable for the healthcare-sector
REALESTATE	Dummy-variable for the real estate-sector
CYCLICALS	Dummy-variable for cyclical consumer-sector
NONCYCLICALS	Dummy-variable for non-cyclical consumer-sector
ENERGY	Dummy-variable for the energy-sector

Notes: Table 4 exhibits all the variables included in the two OLS-regression models, followed by an explanation to clarify what they are meaning.

5.2 Dependent variable

The dependent variable of this model is the 12 months buy-and-hold abnormal returns (BHAR). The returns are calculated using one-year returns of each IPO and the returns from

OMXS30 during the same period. The choice of index was similar to the choice made by both Sahoo et al. (2010), who used the CNX-Nifty, and Senger & Hamdy (2022) who used EGX-30 when calculating the BHAR. The choice of benchmark portfolio was motivated by using these papers. The choice of OMXS30 was made by examining the country having the highest volume of listings, which was Sweden. The OMXS30 is one of Sweden's leading stock indexes, affecting the market substantially (Nasdaq, n.d). The BHAR measures the difference between the returns if an investor buys the newly issued stock the day after the offering and holds it for 12 months and if an investor buys an OMXS30 index fund and holds it for the same period. It can also be called excess returns (Sahoo et al., 2010). Worth noting is that a VW portfolio has been used when calculating the BHAR and not a EW portfolio. This may affect the results as shown by Kooli et al. (2006). In this report, the BHAR is classified as the short-term returns in accordance with IFRS definition of short term (International accounting standards board, 2022). When calculating the abnormal returns the price one day after the offering is used to separate the initial underpricing with the subsequent short-term returns. Another reason why the price one day after the offering is deemed to be appropriate when calculating the one-year abnormal return in this thesis is because most investors are unable to invest at the offer price (Berk & DeMarzo, 2019), thus it would be more useful for most investors if it is calculated using the price one day after the listing. A positive BHAR is to be interpreted as investing in and holding the IPO being more lucrative than investing in and holding the index for the specific period. To calculate the BHAR for each observation eq (1). was used.

$$BHAR = \prod_{t=1}^{T}(1 + R_{it}) - \prod_{t=1}^{T}(1 + R_{mt}) \qquad \text{Eq(1).}$$

In the equation, R_{it} stands for the return of the individual stock in percent and R_{mt} represents the return of the OMXS30 index in percentage during the same period. The reason for using BHAR is because this variable is more apt at measuring precisely the investors' experience. This reasoning was also used by Barber, Lyon and Tsai (1999), motivating Sahoo et al. (2010) to use the same dependent variable when examining the effect underpricing has on IPO one-year performance.

5.3 Variable of interest

In order to examine the degree of underpricing the market-adjusted abnormal returns (MAAR) variable was constructed according to previous studies such as Sahoo et al. (2010) and Kumar et al. (2021), and was originally used by Miller & Reilly (1987). The MAAR variable is calculated as the difference in the initial returns of the stock divided by the return of OMXS30-index on the same day. Since the initial return is market-adjusted, potential influences connected to the market are removed and instead purely focused on the general perception on the pricing of the stock. The MAAR was calculated using eq(2).

$$MAAR = \left[\frac{1+R_i}{1+R_M} - 1\right] \qquad \text{Eq(2).}$$

In the equation, Ri represents the return of the stock on the issue date in percent, while Rm stands for the percent change of OMXS30-index on the same date. The variable is simply the difference between initial returns the market returns the same day. A positive value indicates that the initial returns of the stock were higher than the market returns, meaning that the stock was defined as underpriced. Vice versa a negative value indicates that the stock was overpriced.

5.4 Control variables

5.4.1 Age

Age is a suitable control variable to use for the regression as it could be one parameter to estimate how established a company is before the listing. This could affect the performance as the age could be telling as to how stable and established a company is before the listing. This in turn could be indicative how well tested the business plan is and how experienced the management is. Mallinguh et al. (2020) found that age has an effect on the short-term performance of a stock while Ritter (1991) found a positive relationship between age and the long-term performance of IPOs. Ritter (1991) used Age as a control variable when examining the effect of underpricing on IPOs' long-term performance in the stock market. Further Guo et al.(2019) argued that more than just an established business plan and more experienced management, the older companies also benefit from better, more established contracts. This could have a positive effect on the stock performance of older companies. The age has been

log-transformed as illustrated in eq(3), which was the equation used to calculate the age-variable.

$$Age = Log(\frac{Issue\ date - founded\ date}{30}) \quad \text{Eq(3).}$$

5.4.2 Size

Size is another control variable that is included in the regression. The rationale behind including size as a control variable is that size may affect the short-term performance of a newly listed stock due in part because of the market's bigger trust in large companies helping them post IPO (Baluja, 2018). While this could be one effect on size for stock returns the opposite could also be argued. Some evidence suggests that size negatively affects returns (Wong, 2002). The size of a company could be measured multiple ways such as assets before the offering or market cap among others, but given some restrictions in Refinitiv total assets before offering is the most appropriate for this paper. The total assets before the offering has been log transformed.

$$Size = Log(Total\ assets\ before\ offering) \quad \text{Eq(4).}$$

5.4.3 The Halloween indicator

The dummy variable which is based on the "Halloween indicator" referring to the old saying "Sell in may go away" is included in the model to reduce potential seasonal effects. The dummy takes the value 0 for IPOs issued between May and October and takes the value 1 when issued between November and April. Bouman & Jacobsen (2002) shows that the period November - April has significantly higher returns than the period May - October. Thus, there are certain seasonal effects observed worth controlling for in the study. After critical voices being raised from different directions, Zhang & Jacobsen (2021) tested if the Halloween indicator was still prevailing, this time with a more comprehensive study analyzing 114 stock markets. The findings from the study confirms the persistence of the effect, also it was shown that the effect was particularly strong in developed Western European countries.

5.4.4 Sector dummies

Throughout the preceding decades, the cyclical rise and decline in popularity across different sectors have been evident. Inspired by Ritter (1991), who tested the aftermarket performance for different industries, dummies from the most impactful sectors have been included in one of the models. Adding sector dummies helps control for unobserved sector-specific effects that might influence the BHAR-variable. To begin with, the tech sector has exploded and taken huge market shares from other sectors. Divine (2019) reports that the 2010s decade started Microsoft and Apple were the two only tech companies among the most richly valued companies. At the end of 2010s much has changed and tech-dominated wall street with 5 tech firms valued highest.

Furthermore, the real estate sector has been included as well, as it is a sector that has performed well during the last decade. Looking at a common Swedish real estate fund called "Länsförsäkringar Fastighetsfond A", during the time frame of the study, a remarkable performance of 404.41% was achieved (Avanza, 2023). The energy and healthcare sector has also been included among the sectors used as dummy variables. The energy sector remains a powerful sector and during the past years, many companies within the renewable sector have caught the interest of many investors. Likewise, the healthcare sector remains an important sector with several interesting firms.

5.5 OLS-assumption testing

After the regression output has been calculated, several tests on the data are performed. When testing for multicollinearity the Variance Inflation Factor (VIF) test is used.
The VIF test is a test to measure the level of multicollinearity in a data set. The equation used when calculating VIF is the following.

$$VIF = \frac{1}{1-R^2} = \frac{1}{Tolerance} \qquad \text{Eq(5).}$$

The VIF-value can be interpreted as the inverse of tolerance, thus a high tolerance is something positive for the model and data set, suggesting low multicollinearity. (Shrestha, 2020). A value of mean 1 VIF signifies that there is no multicollinearity at all in the data set, a value between one and five generally means that there is moderate multicollinearity but it is

not necessarily something that should be debilitating for the data set, making the data unreliable from that point of view. Although, a mean VIF above 5 means that the variables are highly correlated (Glen, 2020). This test is easy to interpret and implement, thus being easier to use than many other multicollinearity tests (Shrestha, 2020).

The Shapiro-Wilk test is used to examine whether a random sample follows the standard normal distribution. The test is designed with a null-hypothesis saying that the variable tested is normally distributed. If the p-value is lower than the chosen alpha level the null-hypothesis is rejected, which means that the residuals in the model cannot be proven to be normally distributed (González-Estrada & Cosmes, 2019). The test was created by Shaprio & Wilk (1965) and eq(6) was the original formula.

$$W = \frac{\left(\Sigma_{t=1}^{n} a_{\iota}\gamma_{\iota}\right)^{2}}{\Sigma_{t=1}^{n}\left(\gamma_{\iota}-\bar{\gamma}\right)^{2}} \qquad \text{Eq(6).}$$

OLS-regressions assume homoscedasticity which means that the variance is the same no matter where in the sample one calculates the variance. If the regression is not homoscedastic it means that it suffers from a heteroscedasticity problem. The White test is a test created by White (1980) to test for heteroscedasticity. Many OLS-regressions suffer from heteroskedasticity and that means that the error terms are not homoscedastic (Stock, 2020). This problem is especially prevalent in the kind of data in the model and the data set. To test for heteroscedasticity the White test was used in this paper, this in alignment with Kooli et al. (2006). A low p-value means the null hypothesis, stating that the data set is homoscedastic, can be rejected. One measure that has been made to mitigate heteroskedasticity in this data set is to logarithmize some of the independent variables as logarithmized variables have a tendency to remove part of the heteroscedasticity (Vishwesh, 2023).

6. Results

The section begins by presenting the results received from the OLS-regressions and ends with a presentation of the results from the data testing.

6.1 Regression outputs

The results from these models contain both logarithmic- and variables in ordinal scale. Thus the interpretation of the coefficients will vary depending on the variable analyzed. The dependent- and the variable of interest are both in absolute values which means that one unit change in the independent variable will lead to β change in the dependent variable.

Looking at the regression results for the model without the sector effect, we can see that the only variable that is significant at a 5% level of significance is the MAAR-variable, the variable measuring the underpricing. The fact that the MAAR-variable is significant is true for both of the OLS regressions. An important thing to notice is the positive coefficient for the MAAR variable. The interpretation for this is that the MAAR-variable and the dependent variable are positively related. In other words, a higher level of underpricing is generally associated with a better one-year performance ceteris paribus. More specifically, if the underpricing raises by one percent, the BHAR increases by around 0,264% when interpreting the OLS-regression without the industry fixed effect and around 0,276% when interpreting the OLS-regression containing the sector dummies. A more direct interpretation of the model would be one unit increase in MAAR would lead to a β1 unit change in the dependent variable. To summarize, there seems to be a significant relationship between underpricing and the one-year buy-and-hold abnormal returns, thus we can reject the null hypothesis that the one-year performance of IPOs is not affected by the amount of underpricing.

While only the MAAR variable is significant at a 5% confidence interval in model (1), we can not say with confidence that the other independent variables do not affect the one-year performance, rather a more apt interpretation would be that we can not conclude that these variables affect the one-year abnormal performance in this data set. But to further evaluate the effect of these variables, a jointly-significant test was conducted on the regression excluding the sector dummies. But here, once again, the p-value was above 0,1. Thus we can not conclude with certainty that the remaining variables are jointly significant in the model not containing the sector dummies.

Model 2, which includes the sector effect, finds that another variable becomes significant, though only at a 10% significance level, namely the real estate dummy variable. The coefficient is positive suggesting that the population included in the real estate dummy, i.e. the real estate companies, has performed better than the reference group. The remaining dummy variables are not significant in the regression, thus a conclusion stating that the remaining sector dummies are significantly different from zero can not be made. Also worth noting is the r-squared value of around 2,21% for the OLS-regression without the sector dummies and around 3,39% for the OLS-regression containing the sector dummies. This suggests a rather high amount of variability unable to be explained using the models in this paper. This means that there is uncertainty in the model which could lead to uncertainty when making predictions using the model and the subsequent output.

Table 5- Regression outputs

	(1) OLS	(2) OLS
MAAR	0.264**	0.276**
	(0.134)	(0.136)
Size	0.0329	0.0277
	(0.0258)	(0.0295)
Age	0.00619	-0.00389
	(0.0760)	(0.0778)
HLW	0.0245	0.0311
	(0.0497)	(0.0504)
Tech		-0.0207
		(0.0722)
Healthcare		0.0603
		(0.0759)
Real estate		0.199*
		(0.113)
Cyclicals		0.0180
		(0.0729)
Non-cyclicals		-0.0640
		(0.138)
Energy		-0.132
		(0.143)
_cons	-0.107	-0.0935
	(0.164)	(0.174)
N	291	291
R2	0.021	0.039

Notes: Robust Standard errors in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 5 exhibits the results provided from the two different OLS-regressions, the first one (1) being the shorter model and the second one (2) the longer including dummies for sectors.

6.2 OLS-assumptions test results

When looking at the VIF-test, the mean VIF in the data set is close to one which means that the independent variables are not particularly correlated. This means that the independent variables do not have a multicollinearity problem.

As exhibited in Table 6 the output in the Shapiro-Wilk test is significant, meaning that we cannot say that the residuals are normally distributed. As showcased by the findings from the White test in Table 6, problems with heteroscedasticity are prevalent, even after the efforts to make the error variance homoscedastic. Robust standard errors were used when conducting the OLS-regression to deal with the heteroscedasticity to provide reliable results.

Table 6- OLS-assumption test results

Test-type	Testing for	Findings
VIF-test	Multicollinearity	The mean shows a value close to 1, which indicates that there are no issues with multicollinearity.
Shapiro-Wilk W test	Standard normal distribution	Significant values were found meaning that we cannot say that the data is normally distributed.
White-test	Heteroskedasticity	The test indicates that issues with heteroscedastic exist in the data.

Notes: Table 6 exhibits the results provided from the different tests conducted, divided in sections for the type of test, what it is testing for and what was found from the tests. The output is further illustrated in the appendix.

7. Discussion & Limitations

This part discusses the results presented in the former section by proposing different reasons for why the result was given. Then it continues with a discussion on how limitations might have affected the study.

7.1 Discussion

As can be viewed in Table 4, there is a positive relationship between the return during the day of listing and the one-year abnormal return in the data set. This was fairly surprising as it contradicts several of the existing literature such as Ritter (1991), Sahoo et al. (2010) and Kumar et al. (2021). As mentioned earlier in the report all these prior papers found a negative relationship between the level of underpricing and the aftermarket performance of IPOs. Thus, perhaps one would expect to find a similar relationship between the underpricing in the Nordic markets, but this is not the case here. Important to note that most of these prior papers and most of the existing literature analyzed in this paper use different periods and lengths. For example, Ritter (1991) analyzed the 3-year BHAR as the dependent variable while this paper uses a shorter-term perspective of one year. While some of the previous literature contradicts the findings from our regression, the results regarding the relationship between the level of underpricing and abnormal returns are consistent with Kooli et al. (2006).

The positive relationship between the BHAR and the MAAR could be explained by the signaling hypothesis being true. Kooli et al. (2006) proclaim that the results in the regression output found in his paper confirm the signaling theory, thus, perhaps it would be appropriate to claim the same following the regression results in this paper. The results in this paper support the claim that the signaling theory holds merit, that positive returns on the first day of listing signals that the company is of high quality and has the potential to provide positive returns in the future. The underpricing then provides a foundation that the newly listed shares are a good investment and will continue to attract demand in the secondary market. But while the results support the signaling theory and the conclusion made by Kooli et al. (2006), the literature suggests that there may be more factors playing into the positive relationship between performance and underpricing. Another thing that is important to note when discussing the signaling in this context is that the positive effect underpricing has on the IPO performance suggests that the signaling theory remains true for the Nordic underwriters in the Nordic markets. In other markets, the investors may not view the underpricing the same and thus that may explain the negative coefficient found in other papers in the underpricing variable.

The positive relationship between the performance and the underpricing could also be partly explained by the information asymmetry prevalent in the stock market, especially in the IPO

market as the stocks are newly listed (Rock, 1986). Isola et al. (2013) found the underpricing in the Portuguese stock exchange to be largest during the first day of listing while it subsequently got smaller and smaller during the first month of listing. The market-adjusted longer-term returns were largest during the first year of listing while it got subsequently worse during the following years. The abnormal returns for the first two years were positive while the third year's abnormal-returns were negative. What this suggests is that the information asymmetry that exists when stocks get listed, can remain for a long time and thus the market can be inefficient for a long period. This inefficiency that exists in the IPO market in turn suggests that there exists strategies providing investors abnormal returns in certain markets. This would not exist if the market was truly efficient.

Also worth discussing is the economic interpretation of the finding in the regressions, i.e. if the economic effects are negligible or if the findings have significant implications. As the underpricing coefficient is rather small in both regression models it could be argued that the real economic implication is moderately negligible. But, it could also be argued that due to the fairly large mean underpricing, illustrated in Table 3, the economic implications could be rather large. Due to the rather large underpricing in the data set for this paper and in other papers such as Sahoo et al. (2010), we do not believe that the economic effect should be considered negligible but due to the small underpricing coefficient, the relationship between the underpricing and short-term performance should not be considered to be exceptionally large either.

Ritter (1991), Kumar et al. (2021) ,and Sahoo et al. (2010) found the inverse relationship between underpricing and longer-term performance. Ritter (1991) explains this as the effect of the market correcting itself after being overly optimistic during the listing. As the investors often are overly optimistic during the listing, Ritter (1991) argued that the stocks became overvalued, making it natural for the overvalued companies to underperform in the aftermarket. This underperformance could be argued as making the market more efficient again.

When analyzing the results of the study the potential effect of the period examined should be considered. In line with previous research by Bask & Läck Nätter (2021) which analyzes IPOs in the Nordics between 2009 and 2019, the number of IPOs proceeding in the earlier years is significantly lower than the latter. The authors mention the lagging effect from the

great recession as the main reason why a lower number of companies choose to go public. This, in turn, is connected to “the window of opportunities" discussed by Ritter (1991) and Lowry & Schwert (2002) who both found tendencies of firms choosing to go public during times where large initial returns occur. The skewed distribution is also connected to the “hot market issue”, a relationship between the performance of IPOs and hot issue markets discussed by Ljungqvist (2007) among others. Although no accepted conclusion on short-term returns is known yet, a potential reason for the positive short-term returns could be because the majority of IPOs issued during bullish market sentiment. Ritter (1991) found that the average beta for IPOs is higher than 1.00 and then decreases as time goes on. Thus, the combination of a beta higher than 1.00 and the majority of IPOs proceeding during a bullish climate could help explain the findings. Potentially, the high betas provided during “hot markets” have a lagging positive impact on one-year abnormal returns, but turn negative in the long run when market sentiment shifts. Sahoo et al. (2010) also theorized that the market conditions affected the IPO one-year performance, thus affecting the regression output.

Further, this could be put in relation to Ritter's (1991) findings regarding the negative relationship in a 3-year perspective. The results provided by Isola et al. (2013) could help explain the contradicting relationships found in this paper compared to others examining the abnormal returns during a longer time perspective. The negative underpricing coefficient found in previous studies by Ritter (1991) and Kumar et al. (2021), reflects the efficient market potentially removing the market anomaly found in the short-run in this study. Though, Sahoo et al. (2010) could observe an opposite relationship between the performance and the three-year abnormal return. The findings in that paper found an underperformance of IPOs in one-year returns but an overperformance when calculating for the three-year returns. This further highlights the unpredictable nature of IPOs and their subsequent performance.

The Age-variable not being significant is in line with Sahoo et al. (2010). That paper also was unable to find significance in the Age-variable leading the authors to conclude that the age of a company prior to listing is not a reliable indicator as to how the company will perform in a one-year time frame after the listing. As the regression results are the same for the Age-variable on both the regressions in this paper and the regression made by Sahoo et al. (2010) an apt conclusion is that the Age-variable is not a reliable indicator for newly listed stocks one-year performance in the Nordic markets. While this is the results here it is important not to draw this conclusion for all markets at all times as Ritter (1991) found the

Age-variable to be significantly positive in the regression measuring the long-term performance of IPOs.

The differing findings compared to much of the findings made in prior papers could also potentially be due to the different countries tested in addition to the difference in periods tested. Hopp & Dreher (2007) found fairly substantial differences in underpricing in different countries. The authors concluded that the level of underpricing differed due to different legislation and protection for investors. These circumstances change the incentive for underwriters to underprice the stocks. Shuster et al. (2003) also found that different cultures and factors such as taxation affect both the level of underpricing and long-term performance. These differences in IPO performance and level of underpricing depending on macro-variables such as culture and taxation could help explain the differences found in some of the prior studies and explain why the IPO market is seemingly so unpredictable.

The real estate dummy being significant suggests that, during the 10 years tested in this paper, the real estate companies that get listed on a stock exchange generally have performed better than most other sectors in one year. This makes an investment in the real estate sector generally a better investment than its peers included in the reference group for newly listed companies. This could be explained by the strong performance of the real estate sector in Sweden highlighted by the performance of "Länsförsäkringar Fastighetsfond A", mentioned in the method section (Avanza, 2023). Further, it is worth noting that the r-squared improved when adding the sector dummies. This suggests that the model is better fitted when adding the sector fixed effect thus the IPOs perform differently depending on which sector the company is active in. The findings that the sector plays a part in the performance of a newly listed stock are consistent with Ritter (1991).

7.2 Limitations

Due to several reasons, the paper has some limitations which might affect the outcome. Firstly the database available which was Refinitiv Eikon could not provide us with all desired variables. After consideration, it was concluded that the missing variables could not be extracted from other sources without risking major errors in the collection process. Also, among the variables included in Refinitiv Eikon there were still some missing data points that had to be added manually, which increases the risk of errors. To deal with the potential errors

connected to this, winsorizing was used to improve the dataset. Winsorizing has some benefits, but also its shortcomings, the procedure can for instance result in biased estimates, loss of information and violations of assumptions (Aguinis, 2013).

A critical step during the calculation of the dependent variable consists of the difference in returns one year after the IPO, this being impossible to calculate if the stock gets delisted. There are several reasons why a firm is delisted such as going bankrupt or being bought by another firm. However, this leads to the data suffering from survivorship bias, which might cause the results to be overestimated. Though the delisted companies could also contain high-performing firms being acquired, thus conclusions on how the delisted firms affect the result are difficult to draw.

Furthermore, our models provide a low r-square which potentially is due to some of the omitted variables, although a low r-square was expected due to many factors impacting the returns post an IPO. The rather low r-squared is lower than many prior papers studying the same thing, Sahoo et al. (2010) estimated a r-squared of around 26,1%, Bhabra & Pettway (2003) found an estimated adjusted r-squared of around 14,96 and Agarwal et al. (2004) found a r-squared of around 21%. While this is the case and we would have liked a higher r-squared, the low r-squared is fairly frequently required in some of the prior studies such as Kooli et al. (2006) who found a value of around 1,9% for their OLS-regression and Ritter (1991) who found an adjusted r-squared of around 7%. Though we saw it as a positive that the r-squared improved when including the sector variable as that would suggest a better-fitted model.

Continuing, the low r-squared compared to much of the contemporary research in addition to the low number of variables with significance found in this paper compared to the contemporary research illustrated in Table 1 suggests that the IPO market is highly erratic. This could further be supported by the differentiating findings made by Ritter (1991), Isola et al. (2013), and Sahoo et al. (2010) regarding the long-term performance of IPOs. Due to the nature of the IPO returns, investors should be careful when formulating investment strategies based on the findings in this paper, or any other paper studying the same subject for that matter.

Furthermore, another limitation of this paper is the omission of cumulative abnormal returns (CAR) and an EW portfolio when calculating abnormal returns. The inclusion of these adjustments in separate regressions could further deepen the understanding of the effect that underpricing has on the return during the timeframe analyzed in this paper. The BHAR returns have been used as that more aptly illustrates the investors' experience if they were to buy the newly listed stocks (Barber et al. 1999), and the MAAR has been the dependent variable generally used in similar papers to this for the same reason. While this is true Kooli et al. (2006) lift that CAR could still be an apt dependent variable to use in addition to the BHAR as they have different implications and could provide different results. Kooli et al. (2006) also mention that the EW portfolios could be used in addition to the VW portfolios as they could provide different results with different implications for the investors and the IPO performance. While we would have liked to use both the CAR and EW portfolio in addition to the BHAR and VW portfolio used in this paper we decided that this would, considering the scope of this paper, be too extensive. A WLS-regression, similar to the one made by Kooli et al. (2006) could have been made in addition to the OLS-regression with robust standard errors to deal with the heteroscedasticity but, once again, considering the scope of this thesis it would be too extensive.

8. Conclusion

This section concludes the paper summarizing the important findings, what the study has contributed with and potential for further studies.

The scope of the study was to increase the knowledge on how underpricing affects returns in a shorter term than usually examined, based on the Nordic stock markets specifically. A positive relationship was found between the MAAR-variable representing underpricing and the BHAR-variable representing abnormal returns. The results were slightly unexpected as the majority of previous papers found a negative relationship. The short-term perspective analyzed differs from most of the previous studies analyzed in this paper, and many existing theories support our results as discussed in the previous part. Though, interpretations should be done with caution in mind. The positive relationships discovered were found during a specific period on specific markets, therefore general conclusions about the overall IPO market are difficult. Yet, the study contributes to further expanding the relatively small research base on underpricing in the Nordics. The real-world implications connected to the

findings could potentially be of interest to firms considering going public and assuming to raise new capital prior to the listing. Thus, the findings could be used to determine an appropriate time for this. Further, stakeholders with incentives connected to the short-term perspective could find this beneficial.

Due to various reasons, the study was limited and therefore a bit more simplified than other peers within the field of finance. For future research, a more thorough analysis could focus on providing a more pure effect of underpricing. A model with higher significance could decrease the risk of type 1 error, creating stronger evidence that could increase the power of the conclusions. In conclusion, the findings of the study offer valuable insights for various stakeholders within the field of finance to inform their strategies based on the observed impact of underpricing on short-term returns. To further develop the study, future research could include analysis regarding investment behavior connected to IPOs. The study could provide insights into how trading patterns, risk perceptions, and investment decisions affect the performance of IPOs connected to underpricing. Further research could also include different benchmark portfolios or different dependent variables such as CAR in addition to BHAR. Perhaps a WLS- regression could be used instead of an OLS-regression containing robust standard errors to deal with the heteroscedasticity.

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Appendix A: Regression outputs

Table A1: Regression output model 1

Linear regression

Number of obs	= 291
F(4, 286)	= 1.31
Prob > F	= 0.2666
R-squared	= 0.0207
Root MSE	= .42031

BHAR	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
MAAR	.2635327	.1336178	1.97	0.050	.0005336	.5265318
SIZE	.0328935	.0258462	1.27	0.204	-.0179794	.0837664
HLW	.0244909	.0497164	0.49	0.623	-.0733655	.1223472
AGE	.0061865	.0759844	0.08	0.935	-.1433732	.1557461
_cons	-.107328	.1642829	-0.65	0.514	-.430685	.2160289

Table A2: Regression output model 2

Linear regression

Number of obs	= 291
F(10, 280)	= 1.21
Prob > F	= 0.2828
R-squared	= 0.0394
Root MSE	= .42071

BHAR	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
MAAR	.276227	.135539	2.04	0.042	.0094223	.5430318
SIZE	.0277092	.0295289	0.94	0.349	-.0304176	.0858359
HLW	.0311047	.050421	0.62	0.538	-.0681477	.1303571
TECH	-.0206963	.0721508	-0.29	0.774	-.1627232	.1213305
AGE	-.0038857	.0778009	-0.05	0.960	-.1570348	.1492633
HEALTHCARE	.060315	.0759481	0.79	0.428	-.0891867	.2098167
REALESTATE	.1985319	.1130383	1.76	0.080	-.0239809	.4210446
CYCLICAL	.017963	.0729459	0.25	0.806	-.125629	.161555
NONCYCLICALS	-.0640116	.1378405	-0.46	0.643	-.3353469	.2073237
ENERGY	-.1324614	.1429182	-0.93	0.355	-.4137921	.1488692
_cons	-.0934613	.1739557	-0.54	0.592	-.4358882	.2489656

Appendix B: Outputs OLS-assumption testing

Table 1B: White's test

Source	chi2	df	p
Heteroskedasticity	62.63	43	0.0268
Skewness	26.32	10	0.0033
Kurtosis	18.95	1	0.0000
Total	107.90	54	0.0000

Table 2B: Shapiro-Wilk test

Variable	Obs	W	V	z	Prob>z
resid	291	0.96453	7.356	4.677	0.00000

Table 3B: VIF-test

```
vif
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Variable	VIF	1/VIF
SIZE	1.11	0.899536
AGE	1.11	0.902263
MAAR	1.02	0.981886
HLW	1.01	0.988143
Mean VIF	1.06	