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Initial Public Offerings at Nordic Multilateral Trading Facilities during Covid-19

An empirical study of IPOs at Nordic MTF markets during Covid-19 and its performance compared to peers.

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Abstract

This thesis contributes to the IPO literature on Nordic MTF markets from the 1st of January 2011 to the 17th of November 2021. The thesis will emphasize the impact the Covid-19 pandemic has played on the IPO performance by answering our research question; *"How do the IPOs on the Nordic MTF markets during Covid-19 distinguish from the IPOs before Covid-19 and the leading exchanges?*".

From our dataset of 344 observations, we find that IPO-activity in the Nordic countries has been greater than usual. The IPOs at Nordic MTF markets have had greater underpricing and higher long-term performance compared to IPOs issued before Covid-19 and compared to the leading exchanges. By this means, we find the puzzle of underpricing to be valid, but not long-term underperformance for the Nordic market. Additionally, we create an asymmetric information-proxy explaining the excessive performance among the IPOs; we find this proxy to be a better explanatory factor than firm-specific characteristics.

Preface

This thesis is part of the master's degree in financial economics at the Norwegian School of Economics.

The authors of this paper would like to express gratitude to our supervisor, Professor Tore Leite. We are thankful for the guidance provided to us throughout writing the master's thesis, and we appreciate the insightful discussions we had. We would also like to thank Ada Lindmark at Nasdaq Economic & Statistical Research and Hans Martin Male at Oslo Stock Exchange for helping us collect data from IPOs at Nasdaq First North Growth and Euronext Growth.

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Table of Contents

List of tables and figures

1. Introduction

Ending 2021, a record high of 263 companies have chosen to go public in the Nordic markets through an IPO (initial public offering) since the outbreak of Covid-19. The high activity puts the Nordic IPO markets in a unique position as the most active IPO markets in Europe. The year-over-year growth in Nordic IPOs is 260% so far in 2021, compared to the all-time high in 2020. A thriving startup scene and the income of multilateral trading facilities (MTF markets), where the listing requirements are undoubtedly less comprehensive, could be important explanatory factors.

This paper investigates what distinguishes the companies listed during Covid-19 from the last ten years' listings. Moreover, what distinguishes the IPO performances of the IPOs on smaller exchanges, such as the MTF markets. For a company going public, there are mainly two questions raised. First, will the company be adequately valued? Secondly, how will the market value the company in the long run? These two questions have been studied and resulted in two well-known puzzles: underpricing and long-term underperformance. We want to see if these puzzles count for listings in the Nordic countries during Covid-19 and on the MTF markets.

During Covid-19, the financial markets have been exciting to follow. Starting with a bearish free fall in the time of the first lockdowns in March 2020, then coming back up, reaching all-time highs during the summer and autumn of 2020. Since then, we have seen a bullish market. Companies wishing to secure public capital have naturally exploited the high market multiples.

There is extensive research on the stock price performance of IPOs, but to our knowledge, there is little research on IPOs at Nordic MTF markets during Covid-19. The Nordic MTF markets are newcomers from a historical perspective. The short history and lack of empirical studies on the topic make it interesting to investigate. Furthermore, this paper will look at asymmetric information concerning the company's nature listed at the different exchanges.

This paper will start with an introduction to IPOs, looking at the drivers for an IPO. Further, it will describe the bullish Covid-19 period theoretically, following up with theory on the MTF markets. Then, after looking at recent literature, we will build regression models to see what effects drive the pricing, before concluding with what trends, implications, and findings we gather on the underpricing and long-term performance of IPOs in the Nordic markets during Covid-19.

2. Literature review

To get a better understanding of the underpricing and the long-term effect on IPOs at Nordic MTF markets during Covid-19, it is beneficial to review previous studies conducted on related topics thoroughly. This chapter will review theories and empirical findings on why companies choose to go public, Nordic MTF markets as trading facilities, the characteristics of IPOs, Covid-19's impact on the financial markets, and asymmetric information concerning IPOs. At last, we will go deeper into the two IPO puzzles of underpricing and long-term underperformance.

2.1 The rationale to go public

The first time a company decides to go public is a memorable event in the history of any company and is described as an IPO (initial public offering). Making the company available for external capital and public trade causes both advantages and disadvantages. Hence it is an interesting topic to investigate.

The literature focuses mainly on the following reasons why companies choose to list on the public marketplace; capital cost control, strategic reasons, and financial innovation (Loughran & Ritter, 2002). Furthermore, Pagano, Penetta, & Zingales (1998) highlights that primary insiders can withdraw money by selling shares. The authors also highlight that increasing the company's liquidity is of importance.

Brau & Fawcett (2006) shows in a survey from the U.S., in which 336 CFOs participated, that firms are motivated to go public by attaining flexibility in the payment method, as existing shareholders can choose the method of payment that increases their value in the future acquisitions. This view was especially prominent among companies within industries that have high M&A activity. Brau and Fawcett also empathize with the value of brand-building through such processes.

Ritter & Welch (2002) highlight the importance of obtaining finance outside the banking system as the main reason why firms go public. However, the authors also state that reducing debt is essential, while brand equity and indirect marketing are of less valuable benefits.

In case that a private company requires more capital than existing shareholders could provide, and the debt financing gets too expensive, it would be beneficial to go public to sustain the

company's growth, fulfilling the pecking order theory. The pecking order theory proposes that the cost of capital increases as the information asymmetry of companies increases. Therefore, a pecking order occurs, a favoured rank by ways to finance projects (Myers, 1984). The decision of whether to list is used as a last resort to raise capital after investigating the possibility of raising internal capital and raising debt.

With the perspective of the pecking order in mind, choosing the last step of the pecking order and raising capital through an IPO sends signals to the market that the company views this opportunity of raising money as the most desirable. On the other hand, the decision might leave the investors wondering why the firm did not access debt financing or use return earnings (Hall, Sobel, & Crowley, 2010). Hence the company must share sufficient and accurate information during the IPO to convince investors to believe in them. Since if the investors do not receive sufficient information, they might require a discount to compensate for the uncertainty associated with the IPO, leaving the company with less capital raised (Ritter, 1984).

Nonetheless, there are several disadvantages to becoming a public company. First and foremost, the issuing company must cover several costs associated with the listing process. Costs such as bureaucracy related to increased reporting and fees paid to lawyers, underwriters, and accountants. Other disadvantages include increased regulatory oversight, loss of management control, and time spent on the IPO process (Loughran & Ritter, 2002).

Further disadvantages of raising capital through an IPO focuses on the fact that the IPO process is time-consuming and hence an inefficient way to raise capital. A study conducted by PwC shows that the typical IPO process is 4–12 months long (Næss, Fossan-Waage, Holsæter, & Owen, 2014). Inefficient also describes the lump sum raised during the process, another PwC-study shows, as facilitators and underwriters' fees typically require 5-7% of the gross issue proceeds (Curragh, Leveque, & Dhar, 2012). Lastly, the issuing firm faces a reputational risk during an IPO, as an unsuccessful IPO would cause poor marketing and a bad reputation. As a result, it will be more difficult to raise capital at a later occasion (Loughran & Ritter, 2002).

Therefore, a literature review on this topic shows that an IPO brings advantages and disadvantages for the issuing company. Hence, the company must weigh the advantages against the disadvantages when deciding whether to list or not.

2.2 Nordic MTF markets

The focus for this paper will surround listings at Nordic MTF markets. The Nordic MTF markets analysed in this paper include Euronext Growth Oslo and Nasdaq First North Growth, covering Swedish, Finnish, Danish, and Icelandic companies. These exchanges are relatively new, and there is little theory available on Nordic MTF markets. Therefore, it is essential to understand the exchange's history and listing requirements. We want to point out that we have ignored Icelandic companies in this thesis, as the limited listing activity in Iceland will leave us with inappropriate analyses due to few observations.

2.2.1 History

Euronext Growth is an MTF market for listing and electronic trading of shares and equity certificates. The exchange was opened under the name "Merkur Market" in January 2016 as part of the Oslo Børs (Oslo Stock Exchange). It later changed its name to Euronext Growth in September 2020 due to Euronext's acquisition of Oslo Stock Exchange VPS in 2019 (Amundsen, 2021).

Nasdaq First North Growth was developed by Nasdaq Stockholm in 2006 as a marketplace for smaller companies to help them grow financially and organically. It is a subdivision of Nasdaq Nordic and facilitates the listing and trading of smaller companies. The MTF market consists of companies from Denmark, Sweden, Finland, and Iceland (Snellmann, 2021).

The intention of creating secondary marketplaces, alongside the country's leading stock exchanges, is to facilitate trading platforms for SMEs (small and medium-sized enterprises). That way, even the companies that do not meet the listing requirements of the leading stock exchanges could access external capital without easing the listing requirements at the leading stock exchanges. From the 1st of January 2011 until the 17th of November 2021, 313 companies have been listed at the Nordic MTF markets. Meanwhile, 377 companies have been listed at the leading Nordic exchanges (Euronext, 2021).

2.2.2 Listing requirements

Suppose a company wants to collect equity from the Nordic external capital markets. In that case, it must decide whether it should list at the applicable country's leading stock exchange or the respective MTF market. Both marketplaces are subject to the same market surveillance

system. Nevertheless, the marketplaces have a few different characteristics, especially regarding listing requirements.

The table below illustrates the different listing requirements between Norway's leading stock exchange, Oslo Stock Exchange, and its respective MTF market, Euronext Growth (Oslo Børs, 2021).

Table 1. Listing requirements on Oslo Stock Exchange and Euronext Growth.

Requirement	Oslo Stock Exchange	Euronext Growth
Information document:	European Economic Area	Euronext Growth Advisor
Type of marketplace:	Stock Exchange	MTF
Minimum spread of share ownership:	0.25	0.15
Minimum number of shareholders:	500	30
Minimum market value of shares held by each shareholder:	NOK 10 000	NOK 5 000
Minimum price per share:	NOK 1	NOK 10
Total market capitalization:	NOK 300 000 000	No
Financial advisor:	Yes	No
The time frame of the IPO process:	4-8 weeks	1-2 weeks
Due diligence:	Full financial and legal due diligence. Advisors must be independent	Limited due diligence. No requirements of advisor's independence
Admission document:	Requires approval from the Financial Supervisory Authority	Less comprehensive. No approval by the Financial Supervisory Authority
Accounting standard:	IFRS	IFRS, GAAP, or other recognized standards
History:	Three years history and ongoing activities	One revised report. Do not require ongoing activities
Duty to provide information:	When the application is handed in	When listed

Table 1 only illustrates the differences between Oslo Stock Exchange and Euronext Growth. However, similar differences in listing requirements between the leading stock exchanges and MTF markets in Denmark, Sweden, and Finland can be found. The essence of the table is to illustrate the differences in listing requirements between regular stock exchanges and their respective MTF markets, primarily how the listing requirements are softer and less comprehensive at MTF markets.

From *Table 1*, one can see that several traits make Euronext Growth more attractive than Oslo Stock Exchange for smaller companies. E.g., no minimum market size that must be fulfilled. Also, requirements for admission documents are less comprehensive at Euronext, which makes the IPO process less time-consuming. The absence of external financial advisors and limited due diligence lowers the fees to lawyers and underwriters and makes the process less

expensive for companies that choose to be listed at Euronext Growth (Abrahamsen & Sveen, 2021).

From the softer listing requirements, such as financial history, young companies are most likely to choose Euronext Growth. In addition, while the companies must show three years of financial reporting at Oslo Stock Exchange, they need to show one revised half-year report and do not need to show ongoing activities at Euronext Growth. Combined with the requirements related to market capitalization, it has made the exchange more attractive to SMEs (Abrahamsen & Sveen, 2021).

One might believe that investors lose faith in the MTF markets due to the weak regulations. Although the continuous requirements and the formal guidelines are less comprehensive for companies listed on MTFs than on the leading exchanges, the MTF markets are dependent on investor trust. Furthermore, the companies listed at MTF markets are subject to the rules of the Securities Trading Act, insider trading, publish half-yearly reports, and must, on its initiative, reveal any inside information. As a result, the investors may have confidence in the marketplace (Oslo Børs, 2021; Snellmann, 2021).

Chami & Fullenkamp (2002) argues that measurements like these must be present since the MTF markets are utterly dependent on the investors' trust to attract new companies. Investors' trust is critical, given the nature of the companies listed in the Nordic MTF markets. They are undoubtedly riskier than Oslo Stock Exchange, Copenhagen Stock Exchange, Helsinki Stock Exchange, and Stockholm Stock Exchange.

Internationally, several studies have tried to explain the advantages and disadvantages of MTF markets. For example, a study analysing Chi-X, a London-based MTF market, finds that the introduction of the MTF market led to better overall market quality and gave investors better terms due to the increased competition in the exchange market (Riordan, Storkenmaier, & Wagener, 2011). On the other hand, a Polish study analysing the introduction of the Polish MTF market, NewConnect, found that the long-term low returns, a large number of bankruptcies, and low liquidity of shares led investors to avoid the exchange. Furthermore, the authors highlight that NewConnect is the MTF market with the weakest index compared to its countries leading exchange in relation to other MTF markets in Europe. The reason for this outcome was too liberal regulations (Asyngier & Curie, 2013).

2.3 Hot markets

This paper will review IPOs in light of a pandemic where a record high number of companies have chosen to go public. It is therefore crucial to investigate the theories on how Covid-19 affected the financial markets and on IPO cycles.

2.3.1 Covid-19

As indicated in our introduction, the Covid-19 period is categorized as a hot market. The total amount of 263 new listings in the Nordic markets and a total return of 90% on Oslo Stock Exchange, 95% on Stockholm Stock Exchange, 88% at Copenhagen Stock Exchange, and 76% at Helsinki Stock Exchange since the "Covid-19-low" at 23rd of March 2020, says it all. As we are now in November 2021, there is limited theory available on underpricing, and especially on the long-term performance of IPOs during Covid-19.

However, a study on 81 IPOs in the U.S from the first six months of the pandemic found significantly more underpricing than the mean of underpricing the past 40 years. Moreover, newly listed firms performed better than older firms in the aftermarket (Sahac, 2021). While analysing U.S listings, Baig & Chen (2021) support the statement of increased underpricing but point at the healthcare sector and high-technology sectors as the most prominent factors explaining the underpricing. More locally, a master thesis written in the spring of 2021 found an underpricing of 11% on Euronext Growth in the first year of Covid-19 (Innstrand & Johnsen, 2021).

2.3.2 IPO-cycles and market sentiment

IPOs are an essential part of the dynamics in the financial markets. Several studies on IPOs related to stock price performance, both short- and long-term, find that IPOs tend to be cyclical where some periods have significantly higher activity (Ibbotson & Ritter, 1995; Abrahamsson & De Ridder, 2015). The studies also find performance differences between the companies issued in cycles and companies issued off-cycles.

Some of the sporadically high IPO activity could be explained by companies that want to seize the opportunity and exploit the sentiment in the market. E.g., Lerner (1994) describes how venture capitalists tend to raise money by an IPO when the market sentiment is good, and the

equity valuations are high. Conversely, private funding is preferred when the sentiment and equity multiples are low.

The literature points at two different cycles related to IPOs, namely volume-cycles and hot-issue markets (Ibbotson & Ritter, 1995). Volume cycles can be seen as waves of IPOs, where one sees apparent differences in the number of IPOs in different periods. Ibbotson & Jaffe (1975) find a correlation between the month of the issuance and volume of IPOs in the 1960s U.S. IPO market, proving the presence of volume cycles of IPOs. Hot-issue markets, or underpricing cycles, are described by Ibbotson & Jaffe (1975) as periods where the average first-month performance of newly issued companies is abnormally high.

Ibbotson & Ritter (1995) suggest that companies tend to seize the opportunities to raise money in hot markets, as investors assume there will be positive autocorrelation in the first-day return of the IPO. Furthermore, because of the irrationality among investors, it intensifies the investors to purchase expensive IPO shares if previous IPOs have risen. This way, autocorrelation will occur, which eventually leads to a hot issue market (Loughran & Ritter, 1995).

Ritter (1998) emphasizes that business cycles, or industry cycles, might explain how the IPO waves within different industries occur at different times. Ritter states it can be explained by how companies want to exploit the sentiment within the industry and achieve a price above what can be justified by the fundamentals of the business. Ritter & Welch (2002) later found from studies on IPOs that the significant variation in IPOs suggests that both the market condition and the life cycle of the firms determine when or if the company should issue.

Unlike Ritter's (1998) thoughts on how hot industry cycles contributed to companies within the specific industries seizing an opportunity to get a high IPO price, Shiller (1990) states that to sustain the hot markets, underwriters might purposely set the IPO price lower than what its fundamentals will justify. This is known as the impresario hypothesis and conveys how the underwriters are incentivized to set low IPO prices to achieve underpricing and thus sustain the hot issue market.

The underwriter's unnatural and intentionally low IPO price corresponds to Tiniç (1988) and Hughes & Thakor (1992), who argued that the underpricing would reduce legal liabilities. The hypothesis of impresario also describes how the underwriters will gain positive marketing effects from this, sustaining and amplifying itself as a quality advisor. Further, it will attract

new clients, nurse the hot issue market, and deepen the long-term underperformance of IPOs issued in such markets.

A study conducted by Loughran & Ritter (2004) finds that during the dotcom-bubble early in the 2000's the average underpricing was around 65%, whereas the underpricing was 12% the following years. Furthermore, the authors emphasize different firm characteristics among the IPOs issued in these two periods. Loughran & Ritter found that the companies issued during the dotcom-bubble were younger than the firms issued the following years. Hence, investors must be compensated for the additional risk associated with young firms' IPOs.

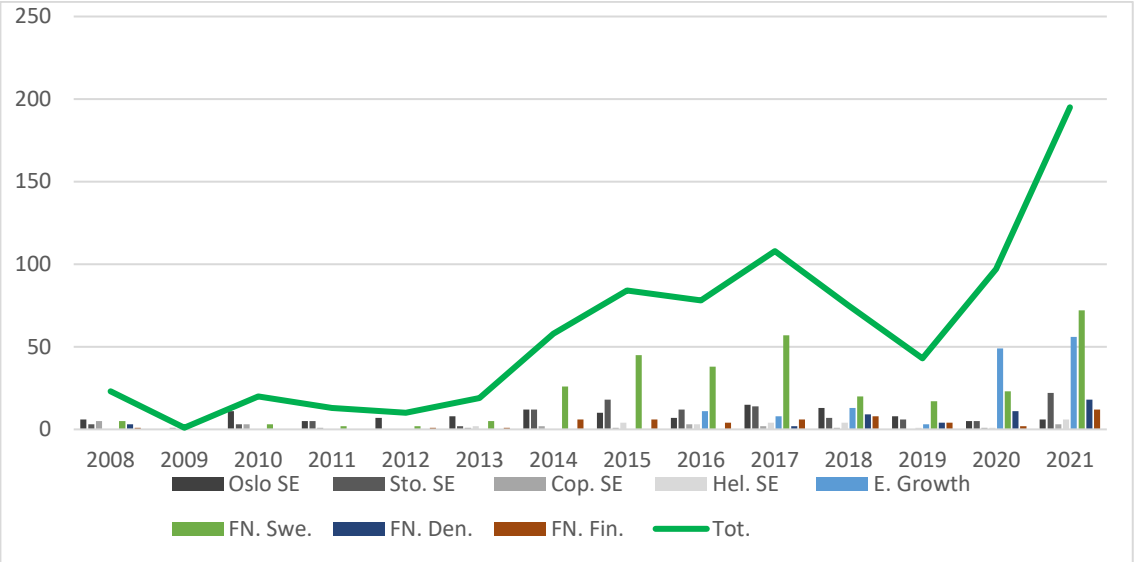
These findings are in unison with the findings of asymmetric information during IPOs by Ritter (1991), given the logical reasoning behind young firms emitting less public information. Further, these findings are also in unison with the findings in Loughran & Ritter (1995), which states that investors during hot issue markets tend to be too optimistic and wrongfully estimate the upside potential of young intangible firms. Rock (1986) describes this as the winner's curse of IPOs and shows how the presence of uninformed investors during IPOs is more significant in hot IPO markets.

In a study seeking to find the optimal strategy for a profit-maximizing issuer during times of high market sentiment, underpricing and long-term underperformance were especially applicable. Further, as investor sentiment grows, the listings get more prominent, and the quality of the listed companies worsens, leading to excessive underperformance for companies that list later in a hot market (Ljungqvist, Nanda, & Singh, 2006). Later findings support Ljungqvist, Nanda, and Singh's evidence of increased underpricing after changing market sentiment (Campbell, Du, Rhee, & Tang, 2008; Baker & Wurgler, 2006).

2.3.3 IPOs in Nordic markets

Figure 1 illustrates the number of IPOs in the Nordic markets since 2008. One can see how the Nordic MTF markets have heavily increased their IPO activity and how the total number of IPOs has increased from 27 IPOs in 2008 to 133 in 2021, by the 17th of November, where our sample ends. The numbers in this graph are sent to us by Ada Lindmark at Nasdaq Economic & Statistical Research and Hans Martin Male at Oslo Stock Exchange.

Figure 1. IPOs in the Nordic markets by year



2.4 Underpricing

Underpricing has throughout the years been defined in several different ways, mainly focusing on two different perspectives: the issuer's perspective and the investor's perspective. The issuer's perspective measures underpricing after considering the expected value of a company before underwriters have set an offer price (Dawson, 1987). The investor's view looks at the difference between the offer price set by underwriters in the prospectus and the price seen in the market during the first day of trading (Reilly & Hatfield, 1969; Ibbotson & Jaffe, 1975). In this study, we have chosen to analyse the investor's perspective, as this is the measure used by most earlier studies found in *Table 3*. Hence, it gives us the most comparable findings.

Several theories aim to describe why underpricing occurs. For example, Bergström, Nilsson, & Wahlberg (2006) explains that a common explanation to why IPOs often are underpriced is that the issuer deliberately leaves money on the table to attract new investors. On the other hand, Tiniç (1988) and Hughes & Thakor (1992) argue that underwriters of IPOs reduce their legal liabilities by underpricing. Anyhow, leaving money on the table seems like a cost-ineffective way of attracting investors and avoiding lawsuits, as the company listed on the exchange will indirectly pay for the cost of underpricing (Loughran & Ritter, 2002).

2.4.1 Studies on underpricing in Nordic markets

Underpricing in IPOs is a global phenomenon. However, Westerholm (2006) finds that underpricing has a smaller scope in Scandinavian markets than in most other markets. Westerholm point at the comprehensive listing requirements as the main reasons for less underpricing. He also states that the Scandinavian countries are among the most transparent countries, where little information is kept secret, making asymmetric information less crucial for the stock price performance at issuance.

The fact that Westerholm points at the comprehensive listing requirements as the main reason for the low level of underpricing in the Scandinavian market are interesting. It might mean that the scope of underpricing could be more present at Euronext Growth and Nasdaq First North Growth, where the listing requirements are softer than the listing requirements at the leading stock exchanges in Oslo, Copenhagen, Stockholm, and Helsinki.

Previous studies and research on underpricing in the Nordic markets clearly show that the phenomenon is present. Nevertheless, one can notice that the effect of underpricing is slowly diminishing through the years. Also, Scandinavian stock exchanges are recognized as some of the stock exchanges that score the lowest on IPO-underpricing internationally (Westerholm 2006). A low degree of asymmetric information is highlighted as an important reason for some countries that experience less underpricing than others, and the listing process is seen as a transparent manner to raise capital for firms (Banerjee, Dai, & Shrestha, 2011).

Table 2 shows previous studies on underpricing at Nordic markets. One can see that the degree of underpricing fluctuates through different periods. However, the trend has been less underpricing in the last decades.

Table 2. Previous studies on underpricing at Nordic markets.

Exchange	Period	Size	Result	Author
Oslo SE.	1984 - 1989	68	**12.5 %**	(Emilsen, Pedersen, & Sættem, 1997)
Oslo SE.	1991 - 2001	62	**22.0 %**	(Westerholm, 2006)
Oslo SE.	2004 – 2005	38	**2.2 %**	(Samuelsen & Tveter, 2006)
Oslo SE.	2004 - 2006	41	**3.0 %**	(Hesjedal, 2007)
Stockholm SE.	1995 - 2001	124	**14.2 %**	(Bodnaruk, Kandel, Massa, & Simonov, 2008)
Oslo SE.	1998 - 2008	62	**6.1 %**	(Ledaal, 2009)
Oslo SE.	1982 - 2008	268	**10.2 %**	(Falck & Hagatun, 2009)
Oslo SE.	1993 - 2007	123	**5.3 %**	(Fjesme & Norli, 2011)
Stockholm SE.	1994 - 2011	185	**11.5 %**	(Henricson, 2012)
Oslo SE.	2006 - 2011	69	**2.4 %**	(Ellingsen, 2012)
Stockholm SE.	1996 - 2006	122	**15.0 %**	(Thorsell & Isaksson, 2014)
Oslo SE.	2009 - 2014	46	**-2.0 %**	(Berg A. J., 2014)
Stockholm SE.	2005 - 2015	41	**4.9 %**	(Göthner & Ramsin, 2015)
Oslo SE.	2006 - 2015	113	**3.1 %**	(Brattabø & Knudsen, 2016)
Scandinavian SE.	2002 - 2015	89	**4.6 %**	(Brattebø & Myhren, 2016)
Nasdaq FN.	2013 - 2016	100	**5.7 %**	(Heikkilä, 2017)
Scandinavian SE.	2001 - 2016	219	**4.5 %**	(Bardoff & Solvik, 2017)
Helsinki SE.	2013 - 2018	38	**3.0 %**	(Mylläri, 2018)
Helsinki SE.	2002 - 2014	50	**3.6 %**	(Syrjäläinen, 2019)
Oslo SE.	2007 - 2018	125	**1.9 %**	(Bjørnerud & Kristiansen, 2019)
Euronext G.	2016 - 2021	71	**12.3 %**	(Innstrand & Johnsen, 2021)

There are found several explanations for what affects underpricing. The following subchapter will review which characteristics and properties of a firm that might affect the firm's underpricing.

2.4.2 Characteristics that affect underpricing

As theories and empirical research show, there are differences in the return of IPOs between periods. However, empirical research shows that different firm characteristics also affect underpricing. This subchapter will review some crucial characteristics that might affect the IPO's underpricing.

Firm age

Extensive research shows a different degree of underpricing based on firm characteristics. E.g., it is well known that younger firms with fewer tangible assets are considered riskier than others. Hence, it is associated with more asymmetric information, which leads to higher underpricing. Hall, Sobel, & Crowley (2010) states that firm characteristics, such as the firm's age, affect how difficult it is for them to finance investments and explain more prominent asymmetric information related to young firms with little financial history. Because of this,

investors require a high return for young firms because of significant uncertainty (Ritter, 1991). Alternatively, the investors would require a discount on new issues if they are not well informed (Ritter, 1984).

Industry

The issuing company's industry is also essential for its first-day stock price performance. E.g., research conducted by Ritter (1991), which covers over 1 500 IPOs from 1975–1984, found that the financial- and drug sectors are experiencing the most underpricing, with respectively 128- and 122 percentage underpricing.

2.5 Long-term performance

Several studies on the long-term performance of IPOs show underperformance relative to indexes. For example, Ritter (1991) and Loughran & Ritter (1995) concluded with a long-term underperformance for 3-5 years. The puzzle of IPO underperformance was also confirmed for the Nordic capital markets, on a study reviewing listed companies between 1991-2001 (Westerholm, 2006). In a recent study published by Nasdaq, there were found that the long-term underperformance started around half a year into the issue. Further, it states a trend of extreme returns around this breaking point, with 42% of firms underperforming by more than 10% and 33% outperforming the market by more than 10% (Mackintosh, 2021).

In 2002 Ritter & Welch conducted a meta-study on evidence on long-term underperformance. The study concluded that the issuance of primary in contrast to secondary shares is the most prominent explanation of long-term returns. Principal-agent and non-rational explanators would be the most promising fields of study going forward.

2.5.1 Studies on long-term performance in Nordic markets

Previous studies on the long-term performance of IPOs in Nordic markets confirm the presence of long-term underperformance. However, the findings are not without exception, and some studies even reveal long-term overperformance among the IPOs in Nordic markets.

Table 3 shows previous studies on excessive long-term performance among IPOs in the Nordic markets.

Table 3. Previous findings on excessive long-term performance in the Nordic markets.

Exchange	Period	Duration	Size	Result	Author
Nordic SE	1991 - 2002	60 months	254	**4.5 %**	(Westerholm, 2006)
Scandinavian SE	2000 - 2009	60 months	139	**-13.6 %**	(Berg S. , 2015)
Nordic SE	1996 - 2014	12 months	393	**-6.3 %**	(Gisslén & Raig, 2015)
Nordic SE	1997 - 2012	6 months	239	**-4.6 %**	(Slettebø & Mørland, 2016)
Scandinavian SE	2004 - 2014	36 months	130	**-4.1 %**	(Poulsen & Nielsen, 2017)
Scandinavian SE	2007 - 2016	36 months	164	**-3.9 %**	(Grepp & Sørensen, 2017)
Nordic SE	2002 - 2015	12 months	319	**-2.2 %**	(Aas & Seljeseth, 2018)
Stockholm SE	2000 - 2015	36 months	175	**-5.0 %**	(Åkesson & Fäldt, 2019)
Nordic SE	2005 - 2016	12 months	236	**11.8 %**	(Luukka, 2020)
Nordic SE	2014 - 1018	24 months	123	**38.3 %**	(Ettesvoll & Engebret, 2020)

As we can see from *Table 3*, there are different degrees of long-term performance, depending on the respective markets and period measured. The following sections will further discuss why this may occur.

There have been many theories on what factors explain underperformance throughout the years. The two main clusters surround theories on IPO- and firm characteristics.

2.5.2 IPO characteristics

As the long-term performance is calculated using the stock price of a company's first trading date concerning the stock price after X months/years, the circumstances around the first pricing, hence the IPO characteristics, play a critical role. Therefore, our study has chosen to investigate theory on *windows of opportunity* and the *impresario effect* of underpricing.

Windows of opportunities

The concept *windows of opportunities* were first mentioned in Ritter's study of IPOs in 1991. Furthermore, some years later, Loughran & Ritter (1995) found evidence on windows of opportunities to explain the long-term underperformance. The hypothesis holds that companies looking to go public are timing their listing for periods of high multiples, hence periods where the company is likely to be overpriced. However, studies on the Nordic markets find no clear evidence in market timing explaining long-term underperformance (Eckbo & Norli, 2002; 2005).

Impresario effect

A theory proposed by Welch (1989) says that the price of the IPO is on purpose set a bit lower than what the market might believe it is worth to create a positive aftermarket. This way, the company will leave a positive aftermarket because of the momentum it builds and gain a good reputation as a quality company that might be beneficial later the next time the same company aims to raise capital through the issuance of shares (Allen & Faulhaber, 1989). Furthermore, as both the company and the underwriters get publicity and a good reputation through high first-day returns, it is in both party's interest to have some extent of underpricing (Shiller, 1990).

Shiller (1990) proved a negative relationship between high underpricing and long-term performance. As a study on this relationship from 2013 puts it: "…*investors who are initially overly optimistic about the prospects of the firm become more realistic over time."* (Mohsni, 2013). The controlled underpricing, or impresario effect, implies that when underpricing is maximized, the long-term underperformance will follow.

2.5.3 Firm characteristics

Firm characteristics are being used broadly to control for risk in financial analysis. Nevertheless, there is little evidence for a clear relationship between characteristics, like firm age and industry, and long-term underperformance, which we find interesting to test for in this paper.

Firm age

Beatty & Ritter (1986) looked at firm age as a variable explaining long-term underperformance. Their analysis used firm age as a direct proxy for risk. A study reviewing all American IPOs from 1885-1995 speaks for a new era. The high technology companies which exploited the electricity and internet booms saw a positive relationship between young firm age and long-term returns (Rousseau, 2001). This study where taken up by David T. Clark, who concluded that high technology firms benefitted from being young aged, while nontechnology firms benefitted from being more mature (Clark, 2002). The findings in this study were later confirmed by Loughran & Ritter (2004), who saw the underpricing among young tech firms to be much higher than average during the dotcom-bubble.

Industry

There has been little theory following Ritter's (1991) hypothesis and Clark's (2002) finding of industry-specific characteristics as an explanation for long-term underperformance. However, a contradictory study from 2009 found that IPOs in newly established technologies outperformed IPOs from mature technologies. In addition, it found the companies characterized with newly established technologies to merge less, delist less, and declare bankruptcy less often than its control group (Boyer, 2009).

A study on the Hong Kong Growth Enterprise Market, an exchange targeting high technology SME's, found no evidence for the underperformance during the dotcom-bubble to be explained by the IPO characteristics, but instead by the mispricing of new technology (Chan, Moshirian, Ng, & Wu, 2007).

The findings are further supported by (Keloharju 1993), which finds in empirical studies from the Finnish IPO market from 1984-1989 how investing in IPOs on the first day and holding them for 36 months would underperform. On average, it will leave the investors with 79 cents for every dollar invested at the Helsinki Stock Exchange value-weighted index. Moreover, the strategy will perform even worse compared to the equally-weighted index. However, the study does not find the long-term underperformance to be industry specific.

2.6 Asymmetric information

Asymmetric information describes a situation where different parts have different degrees of information. For example, during an IPO, asymmetric information causes an imbalance of power as the part that obtains more information will value the asset more precisely. Several theories and phenomena aim to describe how asymmetric information causes friction in the market. Some of them will be presented in this subchapter.

2.6.1 Signaling theory

By raising capital through an IPO, the company signals that it would like to fund itself with public capital. Moreover, the details around how the IPO is conducted also send signals to the market. For example, Ljungqvist (2004), conducted a survey on IPO underpricing, and the results highlight that an issuing company can send signals through the IPO process. E.g.,

choosing a well-known underwriter, avoiding insiders selling shares, or addressing potential investors that can fulfill the role of a cornerstone investor are signals of quality.

The theory of signaling effects during IPOs also states that the time between the market receiving the IPO announcement and the first day of trading is essential. Ekkayokkaya & Pengniti (2012) states that the shorter time this process takes, the faster, the IPOs are filled and hence more underpriced. The Finnish study argues that IPOs filled rapidly signal a high demand and thus leaves a positive aftermarket, accelerating the momentum. The authors add that there are execution risks associated with IPOs and hence will less time-consuming IPO processes reduce the execution risk and risk of market shifting sentiment. Lee, Taylor, & Walter (1996) argue that the shorter time the investors must analyse the IPOs, the more considerable discount they require.

However, signaling theory rarely holds in empirical studies. E.g., both Tiniç (1988) and Hughes & Thakor (1992) find that underwriters deliberately underprice to reduce their legal liabilities during IPOs. This way, it will maintain its reputation, but the effect of picking underwriters of high quality will be in vain. Also, Spiess & Pettway (1997) find no statistical significance between insiders holding shares during IPOs and high underpricing, which contradicts what signaling theory suggests.

This is further supported by Garfinkel (1993) who does not find any statistical relationship between insiders holding shares during an IPO and underpricing or long-term performance. Garfinkel argues that if the insider wants to sell its shares, it would be more logical to do so before an IPO. Hence, the insider escapes from the costs associated with underwriters, and instead achieves a more favorable price in an open market sale before the IPO. Barry (1989) argues in his study that the more significant the portion of the company sold during an IPO, the more underpriced the company will be. The argument is that the issuing company must leave some money on the table to attract investors and fill the orders due to the asymmetric information and uncertainty associated with participating in IPOs where a large proportion of the company is sold.

2.6.2 Winner's curse

The winner's curse of IPOs is yet another problem that might occur by asymmetric information during IPOs. The theory by Rock (1986) paints a picture of a binary world containing two different types of investors, well-informed and uninformed investors. The well-informed

investors are mostly professional or institutional investors who sit close to the market and can value the IPOs correctly. Hence, the well-informed investors only purchase undervalued IPOs and do not participate in the IPOs of overvalued companies. However, on the other hand, uninformed, unprofessional investors are more likely to participate in these IPOs as they do not discriminate between such IPOs.

The problem arises when it is assumed that neither of the parts can fully subscribe to the IPO themselves. Therefore, to ensure that the nonprofessionals participate later, they are compensated by underpricing. Therefore, Rock (1986) highlights that nonprofessional investors are compensated for the risk of adverse selection when competing against well-informed investors.

Empirical research by Keloharju (1993) on the Finnish IPO market from 1984 -1989 supports the theory presented by Rock (1986) and finds that the average return pattern is a function of the relative size of IPO. Small IPOs relative to the company's market value are less underpriced and perform better in the long run. While large IPOs, relative to the company's market value, are more underpriced and perform poorer in the long run. Keloharju (1993) implies a relationship between the oversubscription of smaller IPOs, which crowds out uninformed investors, lowers underpricing, and increases the probability of positive aftermarket returns.

Michealy & Shaw (1994) also show that the phenomenon of the winner's curse holds in empirical studies. Consistent with the winner's curse hypothesis, the researchers find less underpricing during IPOs where uninformed investors know that they do not have to compete against informed investors.

However, Leite (2007) find that favorable publicly available information, such as high market return, reduces the informational gap between institutional and nonprofessional investors, which reduces the presence of the winner's curse. Leite also finds a positive relationship between public information and underpricing.

2.6.3 Principal-agent Theory

Suppose the well-informed part is given the power to act on behalf of the uninformed part during a deal or transaction. In that case, it could exploit its information leverage and act in its

interests rather than in its superior party's interest. This is described as the principal-agent problem (Ross, 1973).

In the principal-agent model related to IPOs described by Baron & Holmstrom (1980), they argue that underpricing appears in cases where there is asymmetric information between the issuer and underwriter, and the underwriters use their informational advantage to enrichen themselves and their investors. On the other hand, the issuer might not use its informational advantage to reveal disadvantageous information, leaving a higher IPO pricing.

Therefore, the principal-agent theory is a highly relevant explanation behind why underpricing occurs. Loughran & Ritter (2004) state that the asymmetric information might provoke conflicts of interest between the issuer and underwriter during IPOs. The underwriter will benefit from a low price, while the issuing firm will not. Bergström, Nilsson, & Wahlberg (2006) states that IPOs often are underpriced since the issuer deliberately leaves money on the table to attract new investors. Furthermore, there has been argued that underwriters of IPOs reduce their legal liabilities by underpricing the IPO (Tiniç, 1988; Hughes & Thakor, 1992). The findings of Bergström, Nilsson, & Wahlberg (2006) are supported by Reuter & Truman (2004), which documents that underwriters deliberately award institutional investors underpriced IPOs as part of a strategy to attract potential future collaboration opportunities.

2.6.4 Ex-ante uncertainty

When a firm announces that it wants to go public, the investors that consider investing in it must examine the company to figure out whether it is a good investment case or not. Of course, the uncertainty around the company's future is the most critical factor the investors must consider. Beatty & Ritter (1986) state a positive relationship between underpricing and ex-ante uncertainty.

Jenkinson & Ljungqvist (2001) find in their study of IPOs in the late 1990s' that IPOs are systematically underpriced and tend to perform poorer in the long run. Another interesting finding is that the degree of underpricing and long-term performance differs from the industries and maturity of the companies. The study supports the findings from Rock (1986) who stated that the older the companies are, the less ex-ante uncertainty is there.

3. Research question

Considering the empirical and theoretical framework presented in the previous chapter, we believe several hypotheses will be interesting to investigate further in this thesis. The literature review covers long-term stock price performance and underpricing based on firm characteristics, the cyclicality of IPOs, and the signals an IPO sends. To our knowledge, there has not been any research conducted at Nordic MTF markets that combine these three topics. Based on the literature review, we would like to forward the following research question;

> *How do the IPOs on the Nordic MTF markets during Covid-19 distinguish from the IPOs before Covid-19 and the leading exchanges?*

To answer the research question, we have designed three hypotheses.

Hypothesis 1: *The Covid-19 outbreak has affected the IPOs underpricing and long-term stock price performance at the Nordic exchanges.*

Hypothesis 1 is interesting as if we accept this hypothesis, we can confirm the theories of *hot issue markets* presented by Ibbotson & Ritter (1995). We will also test the recent studies on IPOs during Covid-19 (Sahac, 2021; Baig & Chen, 2021; Innstrand & Johnsen, 2021).

Hypothesis 2: *The underpricing and the long-term underperformance are more prominent at the Nordic MTF markets than the leading stock exchanges during Covid-19.*

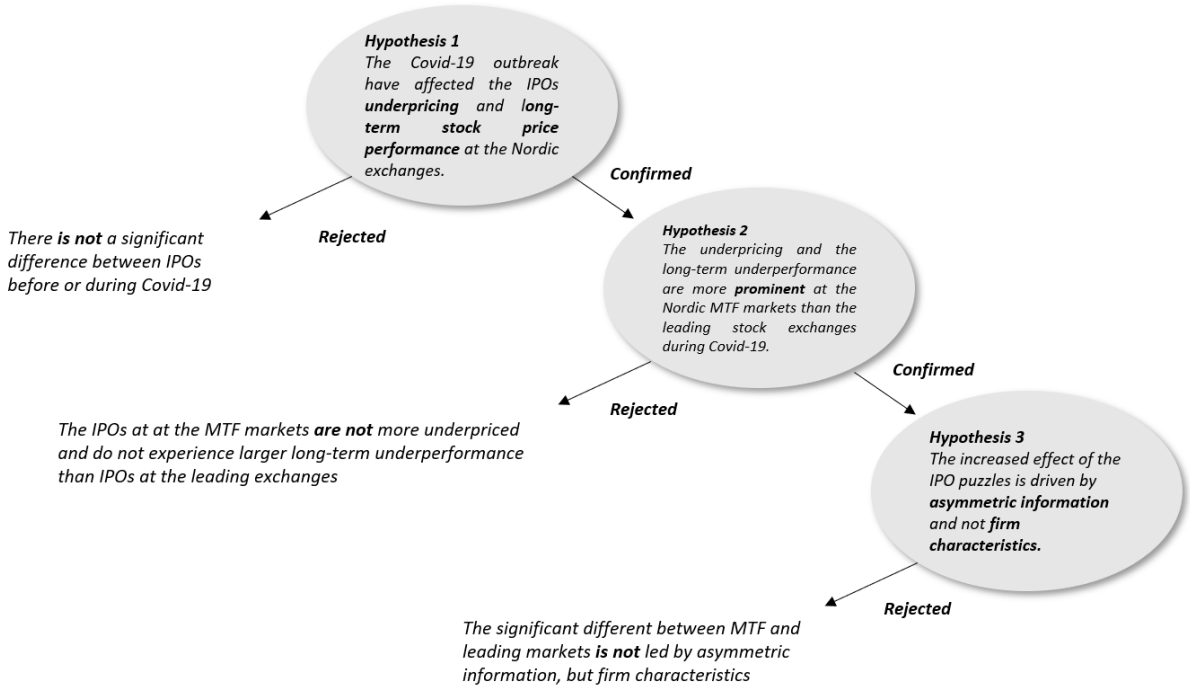
Hypothesis 2 is an exciting hypothesis to examine as MTF markets are exposed to more ex-ante uncertainty and asymmetric information (Beatty, 1986). In addition, there has been found less underpricing in the Nordic markets than internationally due to transparency (Westerholm, 2006). Therefore, this study will look at a less transparent market, the Nordic MTF markets, and see if the same trend of low underpricing and underperformance counts.

Hypothesis 3: *The increased effect of the IPO puzzles is driven by asymmetric information and not firm characteristics.*

Hypothesis 3 is based on theories and empirical research which states that the performance of IPOs differs regarding which industry the companies belong to (Loughran & Ritter, 2004; Boyer, 2009). Also, characteristics such as relative transaction size, firm age, and more could affect the IPO underpricing and long-term performance (Habib & Ljungqvist, 2001; Clark,

2002; Loughran & Ritter, 2004). Nevertheless, these are all studies on the U.S. equity markets. Therefore, *Hypothesis 3* is fascinating to investigate in the Nordic MTF markets.

Figure 2. The thesis' three hypotheses



4. Data

We have reviewed the literature regarding IPOs, their underpricing, their long-term performance, and IPO cycles until this point. We have also looked at the Nordic MTF markets and the listing requirements at the MTF markets compared to the respective countries' leading stock exchanges. This chapter aims to describe further the data, the collection and processing used to answer the research questions.

4.1 Choice of market

After the outbreak of Covid-19 in March 2020, the financial markets across the world were dramatically affected. However, after a few weeks, the markets slowly started recovering. Even though there still was much uncertainty regarding the development of the pandemic, the market sentiment slowly turned towards the better. As a result, the Nordic public markets stand out in the public market sphere, being the most active in Europe in terms of IPOs, totaling a share of 40% of the European IPOs in 2020 and 2021 (S&P Global, 2021).

Since the financial markets hit their "Covid-19-low" on the 23rd of March 2020 and until our data collection ends on the 17th of November 2021, there have been 166 listings at the Nordic MTF markets compared to 97 listings at the respective countries' leading stock exchanges. The relatively large selection enables us to study differences and similarities between IPOs listed at the Nordic MTF markets and the leading stock exchanges, as well as underpricing and long-term performance.

The high number of listings in the Nordic MTF markets since the outbreak of Covid-19 has gotten extensive media attention. As a result of this, and considering the depth and recentness of our data sample, we find it insightful to study the differences between different exchanges within the same country during this period.

4.2 Data collection

This thesis studies initial public offerings in the Nordic countries, both at the Nordic MTF markets and their peers, the respective countries leading exchanges, from the 1st of January 2011 until the 17th of November 2021. From a total population of 770 initial public offerings during this period, our sample consists of 344 initial public offerings with sufficient data. The

relevant *leading stock exchanges* are Oslo Stock Exchange, Stockholm Stock Exchange, Copenhagen Stock Exchange, and Helsinki Stock Exchange. The relevant MTF markets are Euronext Growth, which covers Norway, and Nasdaq First North Growth, which covers the MTF markets in Sweden, Denmark, and Finland.

The data used to answer our hypothesis is mainly gathered from publicly available sources. The companies that make up our data sample are selected from Euronext Growth and Nasdaq First North Growths webpages. In addition, we have utilised several data sources to build our data sample. For example, data regarding share price movements are collected from SDC Platinum and cross-checked to Euronext Growth's, Nasdaq First North Growth's webpages. At some exceptions, data were gathered from the IPO prospectus of the different companies seeking to go public.

Because of the young age of Euronext Growth and Nasdaq First North Growth, we saw that in some fields, there was not sufficient data available, and therefore, have some of the data been gathered manually. The manual data gathering was completed by retrieving information from the company's IPO prospectuses or other reliable sources.

Table 4 show the distribution of listings by country and exchange used in our thesis.

Table 4. Number of IPOs by country and exchange.

	Leading Exchange	**MTF market**	**Total**
Norway	111	80	**191**
Sweden	185	189	**374**
Denmark	58	49	**107**
Finland	48	50	**98**
Total	**402**	**368**	**770**

4.3 Data Processing

The focus for our data processing has been to gather as many companies as possible to base our results on a large sample. Therefore, we put much effort into the manual data gathering from the company IPO prospectuses to increase our sample size. By doing so, we reduce the effect outliers have on the result of our empirical study.

After collecting all available data, we removed IPOs with insufficient observations. The data processing left us with a final data sample of 344 companies with data on long-term

performance, and 173 with data on underpricing, which is the largest sample we have seen, studying IPOs at the Nordic MTF markets.

Table 5. Number of IPOs used in this thesis.

Initial Public Offerings	770
Excluded due to missing values	344
Excluded due to outliers	82
Underpricing sample missing data	-171
Final sample	**344 (173)**

To investigate the hypothesis surrounding "hot issue markets" and to answer whether there are any differences between IPOs issued pre-Covid-19 and during Covid-19, we chose to distinguish between companies issued before and after the 23rd of March 2020 at the different exchanges.

Table 6. Number of IPOs issued pre- and during Covid-19 in our dataset.

	IPO before Covid-19		**IPO post Covid-19**		
	Leading exchange	MTF market	Leading exchange	MTF market	**Total**
Norway	36	0	5	27	**68**
Sweden	60	73	22	26	**181**
Denmark	15	7	3	26	**51**
Finland	15	12	5	2	**34**
Total	**126**	**92**	**35**	**81**	**344**

To investigate whether the IPOs during Covid-19 at the Nordic MTF markets have influenced companies of different characteristics differently, we have divided the companies into different industries. Hence, the companies are sorted by eleven sectors developed by SDC Platinum's database.

Table 7. IPOs pre- and during Covid-19 sorted by industry.

	IPO before Covid-19		**IPO post Covid-19**		
	Leading exchange	MTF market	Leading exchange	MTF market	**Total**
Energy	7	6	0	3	**16**
High Technology	18	32	8	20	**78**
Industrials	19	11	6	9	**45**
Consumer Staples	4	1	0	9	**14**
Health Care	22	18	1	7	**48**
Financials	11	4	6	4	**25**
Materials	4	0	3	7	**14**
Telecommunication	4	2	0	0	**6**
Media & Entertainment	3	2	3	0	**8**
Retail	7	1	5	4	**17**
Real Estate	12	6	1	3	**22**
Total	**111**	**83**	**33**	**66**	**293**

4.4 Variable selection

This section will introduce the variables we use to answer our three hypotheses. The variables are chosen based on the theoretical framework, which suggests these variables are best suited to answer the research questions.

Table 8. Variables and related theory

Variable	Theory investigated
Covid-19	Hot issue market
Exchange	Asymmetric information
TransactionToMarketvalue	Asymmetric information
PrimaryToTotal	Asymmetric information
FirmAge	Asymmetric information
FilingToIssue	Asymmetric information
HighTech	Asymmetric information
Hot	Hot issue market
TransactionSize	Control variable
Industry	Firm characteristics
Nation	Firm characteristics

4.4.1 Covid-19

To answer *Hypothesis 1* and investigate whether the IPOs during Covid-19 differ from the IPOs in the period before Covid-19 at the Nordic Exchanges, we created a dummy variable to distinguish these two periods. This way, we analysed our sample compared to recent studies in the U.S, which showed larger underpricing during Covid-19 (Baig and Chen, 2021) and the Norwegian study implicating larger long-term underperformance and higher underpricing (Innstrand & Johnsen, 2021).

4.4.2 Exchange

We aimed to answer *Hypothesis 2* and see if Covid-19 led to more uncertainty at smaller exchanges like the Nordic MTF markets. Therefore, we have included the dummy for the *MTF market*. Meaning if the exchange-dummy variable is 1, the IPOs have taken place at an MTF market, and if 0, it has taken place at one of the leading Nordic exchanges.

4.4.3 Transaction to Market Value

TransactionToMarketvalue is one of the proxies for asymmetric information included in our model. Research finds that the company's relative portion sold during the IPO could signal

asymmetric information and describe the portion of well-informed versus uninformed investors (Barry 1989; Keloharju 1993). The variable was calculated using the IPO (transaction) size divided on the company's market value at the IPO post-money.

4.4.4 Primary to Total

Another proxy we used for asymmetric information was *PrimaryToTotal*. Several theories find that the relative amount of shares issued by insiders (secondary) versus by the company (primary) indicates the degree of asymmetric information (Ljungqvist 2004).

4.4.5 Firm Age

We chose to include *FirmAge* as a variable since research shows how the age of the issuing firm often affects the degree of underpricing (Ritter, 1991). For our dataset, the age of firms stretches from companies founded right before the IPO, being the youngest observations, to a company founded 173 years ago, being the most mature.

4.4.6 Filing to Issue

FilingToIssue is the time between the announcement (filing) of an IPO and the issue date. Theories argue that the longer the time between filing to issue, the less underpricing is associated with the IPO (Ekkayokkaya & Pengniti, 2012). However, other theorists have found a more extended time between announcement and IPO, leading to higher underpricing (Lee, Taylor, & Walter, 1996). The authors argue that companies who need longer time raising money and publicity signal lower demand from investors. Hence, the underwriters set the IPO price unnaturally low.

4.4.7 High Technolgy Companies

The variable *HighTech* indicates whether the company analysed runs a business involving new, unknown technology. In our study, these companies run within the spaces of industry 4.0, where technology such as the internet of things, machine learning, and automotive transportation is a substantial part of the core business. The dummy is based on Clark's (2002) and Rossau's (2001) findings of high technology companies having a more substantial degree of asymmetric information, leading to higher underpricing.

We are especially curious to investigate whether IPOs among high-technology firms see more underpricing and perform poorer in the long run, as previous studies point in that direction (Clark, 2002; Ritter and Loughran, 2004; Baig & Chen, 2021).

4.4.8 Hot Markets

The variable *Hot* was involved in our study to see how listings during a hot issue market are different from the others. Ibbotson & Ritter (1995) found hot markets exploited by companies seeking to raise money at high multiples, namely "windows of opportunities." Further, Shiller (1990) found IPOs during sentiment markets more underpriced. Therefore, we use Ibbotson & Ritters' (1995) definition to define hot issue months.

4.4.9 Transaction Size

The larger the IPO, the more likely the underwriters will not overprice the IPO to avoid the legal obligation to support the stock price. Therefore, the larger the IPO, the more cases of underpricing. That is the rationale behind Rock's (1986) and Ljungqvist's (2007) findings. The *TransactionSize* variable tends to investigate the presence of the winner's curse at different exchanges. Previous studies show that large-cap IPOs tend to have less underpricing than smaller-cap IPOs (Ibbotson et al., 1994). Therefore, we involve the absolute number of transactions in a million dollars.

4.4.10 Industry

We chose to include industry as a variable to investigate *Hypothesis 3* and see if the IPOs during Covid-19 at the Nordic MTF markets have influenced companies of different industries differently. The explanation behind this variable is shown in several studies, e.g., Clark (2002), shows how industry-specific characteristics might explain the differences in long-term underperformance.

4.4.11 Nation

In addition to characterising the companies by their industry, we chose to look at differences between the Nordic countries. Several studies have looked at IPOs at Nordic MTF markets all together, but little to none, have looked at each nations markets separately. This variable was used when answering *Hypothesis 3* on asymmetric information versus firm characteristics as explanatory variables for underpricing and long-term underperformance.

5. Methodology

This section will highlight the methods used to answer our research question. We will go through both the univariate and multiple regression analysis tools used. Especially the choice of our multiple regression model, where its dependent and independent variables will be highlighted. The section serves as a baseline for our results.

5.1.1 Difference-in-difference

We took on a quasi-experimental approach using the difference-in-difference method to find the causal effect of Covid-19 on the listings underpricing and long-term performance. Having observational data, the retrospective approach serves as a good model. Moreover, the difference-in-difference method has been favored over other statistical models, such as before and after comparisons and time-series design, on evaluating the effect of Covid-19 (Tobías, 2020).

Furthermore, in a meta-study looking at methods used to estimate causal effects of Covid-19, the difference-in-difference method was chosen to be the most accurate, given the right choice of treatment and control group (Goodman-Bacon & Marcus, 2020). Since both underpricing and the long-term performance are fixed, and we looked at the Nordic markets, we did not find it beneficial to use fixed effects in the model.

5.1.2 The treatment and control group

A control group should serve "as if" the treatment group was randomly assigned (Stock & Watson, 2008). We should ideally have had a scenario where we could check companies (treatment group) getting listed during the pandemic (the treatment) against companies getting listed over the same period but not being affected by the pandemic (control group). However, since this scenario is unrealistic and impossible to provide, we had to use pre-Covid-19 (control group) listings and see them related to those during Covid-19 (treatment group). In our final sample of the 770 listings from 2011 until the 17th of November 2021, we have gathered good data points on 344 listings. Out of this, 138 listings were during the Covid-19 period (treatment group), and 206 were listed pre-Covid-19 (control group).

We choose to structure the methodology by looking at both univariate and multiple regression analyses. This way, we were able to answer our hypothesis and explain why the causal effect is found.

5.2 Univariate analysis

To find initial results to base our multiple regression analysis on, we first did a univariate analysis. As we compared two independent populations, the pre-Covid-19 listings and the Covid-19 listings, we found the independent two-sample t-test to be beneficial. Four null hypotheses could answer the research question described in *Chapter 3. Research question.*

1. ***H_0**: The underpricing during Covid-19 is similar to before Covid-19. (Help us answer Hypothesis 1, the Covid-19-effect).*

2. ***H_0**: The long-term performance during Covid-19 is similar to before Covid-19. (Help us answer Hypothesis 1, the Covid-19-effect).*

3. ***H_0**: The underpricing is similar on the MTF markets and the leading stock exchanges during Covid-19. (Help us answer Hypothesis 2, the MTF market-effect).*

4. ***H_0**: The long-term performance is similar on the MTF markets and the leading exchanges during Covid-19. (Help us answer Hypothesis 2, the MTF market-effect).*

We acknowledge that there will always be a risk of type 1 error, rejecting a true null hypothesis, and type 2 error, accepting a false null hypothesis. However, we have reduced the chance for type 1 and 2 errors to apply through a large sample, removing outliers and visual plots to control the observations.

If the null hypothesis is rejected, this does not mean that the statistician can declare that the alternative hypothesis is true (Stock & Watson, 2008). However, it served as an essential insight before moving to the multiple regression analysis. To fulfill the criteria of an unbiased t-test sample. We check for normally distributed samples and equal variances through the Shapiro-Wilk test and the f-test.

5.3 Multiple regression model

The multiple regression model undergoes a stepwise analysis of underpricing and long-term performance. We used ordinary least squares as our base model. First, we looked at our whole sample. We saw all listings from 2011 with our chosen explanatory variables. Then, we isolated the variables explaining underpricing and long-term performance. Second, we split our sample up in the listings at MTF markets and leading stock exchanges. In this way, we spotted differences between variables affecting listings on the different marketplaces. At last, we isolated the variables that we grouped as explaining firm characteristics and asymmetric information. This stepwise approach made us able to answer our research question.

5.3.1 Ordinary least square

OLS (ordinary least square) is a flexible statistical model, which serves the purpose of this study well. Using OLS, we isolated the effect of underpricing and long-term performance on the variables we found interesting to analyse. Furthermore, we aimed to remove the bias created by omitted variables through control variables.

The first regression model measures both underpricing and long-term performance to the variables defined in *5.3.4, Control variables- Asymmetric information.*

$$Excessive\ Underpricing\ \&\ Long\ Term\ Performance$$
$$= \beta_0 + \beta_1 MTF * COVID + \beta_2 MTF + \beta_3 COVID + \beta_4 High.Tech$$
$$+ \beta_5 TransactionToMarketvalue + \beta_6 MoneyRaised$$
$$+ \beta_7 PrimaryToTotal + \beta_8 FirmAge + \beta_9 FilingToIssue + \beta_{10} Hot + \epsilon_i$$

The second regression model measures underpricing related to the firm characteristics defined in *5.3.4, Asymmetric information- Firm characteristics.*

$$Excessive\ Underpricing$$
$$= \beta_0 + \beta_1 MTF * COVID + \beta_2 MTF + \beta_3 COVID + \beta_4 Nation$$
$$+ \beta_5 Industry + \epsilon_i$$

With the dummies *MTF* and *Covid-19*, and through these regressions, we isolated the effect of being listed during Covid-19, being listed at an MTF market, and being listed at an MTF market during Covid-19. Thereby, the models were closely attached to our research question.

5.3.2 Dependent variables

The dependent variables are the variables that we explained. Moreover, that is the underpricing on the IPOs and long-term stock price performance during Covid-19. To measure these variables' excess return, we chose to use a logarithmic transformation to reduce the skewness of the observations and the impact of outliers.

Our literature review shows how researchers measure underpricing differently. For this thesis, we have chosen to follow the most common way of measuring underpricing, using the company's market value on the first day of trading to the market value offered in the prospectus. The calculation assumes that the market is efficient after the first day of trading and is then adjusted for the market movements that day, using relevant indexes (Reilly & Hatfield, 1969; Ibbotson & Jaffe, 1975). We then measured excessive first-day returns for each respective company being listed.

$$Underpricing = \log\left(\frac{Stockprice\ day\ 1}{Offer\ price}\right) - \log\left(\frac{Index\ price\ day\ 1}{Index\ price\ day\ 0}\right)$$

Regarding long-term stock price performance, researchers have defined it in different ways. We chose to define long-term stock price performance as six months return for our analysis. This time frame left us with a sufficient number of companies. The excessive long-term stock price performance is log-transformed and adjusted for the market using its respective indexes.

$$Long - term\ return = \log\left(\frac{Stockprice\ day\ 181}{Stockprice\ day\ 1}\right) - \log\left(\frac{Index\ price\ day\ 181}{Index\ price\ day\ 1}\right)$$

5.3.3 Independent variables

The independent variables are the ones we use to explain the effect of asymmetric information and firm characteristics on our data sample's underpricing and long-term stock performance. The independent variables were included in our empirical research since our hypothesis states that these variables will cause a direct effect on the dependent variables.

As mentioned in *Chapter 3. Research question,* we aimed to investigate whether there were any performance differences between IPOs issued before the outbreak of Covid-19 in the Nordic markets compared to IPOs issued during Covid-19. Therefore, we sorted companies by issuance before or during Covid-19 and created a dummy. This means 0 represents the

period before the 23rd of March 2020. At the same time, 1 represents the IPOs taken place after the 23rd of March 2020. From the 344 IPOs in our dataset, 218 were before Covid-19, and 126 were after Covid-19. This variable lays the foundation to see if anything is different with the IPOs during the Covid-19 period.

Another independent variable that we believed affected our dependent variable were the market where the IPOs were issued. This means that there might had been differences between IPOs issued at MTF markets, such as Euronext Growth and Nasdaq First North Growth, compared to IPOs issued at leading exchanges, Oslo-, Copenhagen-, and Stockholm- and Helsinki Stock Exchange.

5.3.4 Control variables

The control variables are meant to be consistent throughout our empirical study to estimate the isolated effect of our independent variables, presented in the previous section.

Asymmetric information

In the research, we found several explanatory variables that could be classified as describing asymmetric information. Therefore, our third hypothesis indicates that asymmetric information is tightly connected to the underpricing and long-term performance of IPOs. And the asymmetric information proxy we designed was constructed using six variables associated with high asymmetric information. The first one is firm age.

$$Firm\ age = IPO\ year - Inception\ year$$

This variable was included since Ritter and Loughran (2004) explain how there is more uncertainty related to IPOs of young firms, and one will therefore see higher underpricing and poorer long-term performance.

Another variable used in our asymmetric information proxy was transaction size relative to market value. The variable was included since issue size serves as a proxy for ex-ante uncertainty in the regressions (Ritter, 1987). The larger the issue size relative to the market value, the more uncertainty in the IPO. This is because more extensive dilution is associated with more uncertainty.

$$Transaction\ To\ Marketvalue = \frac{Money\ raised\ in\ IPO}{Market\ value\ prior\ to\ IPO}$$

The third variable that made up our asymmetric information proxy was *PrimaryToTotal*. This variable indicates whether current owners would like to exit the company during the issuance or not. A low score on this variable indicates little money raised to the company and the capital flows to current shareholders. At the same time, a high score indicates that the capital raised during this process flows to the company. Moreover, there is less asymmetric information involved. This variable was included as researchers, such as Ljungqvist (2007), highlight how avoiding its insiders selling shares during an IPO will signal good quality and hence less asymmetric information.

$$Primary\ To\ Total = \frac{Primary\ shares\ issued\ at\ IPO}{Total\ shares\ issued\ at\ IPO}$$

Our fourth proxy for asymmetric information is *FilingToIssue*, which is the time between the announcement of the IPO and the issue date. Theory diverges in whether there is a positive or negative relationship between time and underpricing. The longer *FilingToIssue* could suggest that analysts get more extended time to analyse and find the proper price of the company (Lee, Taylor, & Walter, 1996). On the other hand, the longer the time could indicate that the underwriters must spend more time raising capital. Hence the demand from investors is low (Ekkayokkaya & Pengniti, 2012). The variable were calculated using the number of days between the announcement of the IPO and the date of the IPO.

$$FilingToIssue = Issue\ date - Announcement\ of\ IPO\ (date)$$

We have also decided to involve the dummy *HighTech* to see how speculative technological companies differ in their IPO characteristics (Clark, 2002; Rossau, 2001). The dummy was created by looking at each company's core business and indicating whether it could be characterised as speculative.

Hot is our last proxy for asymmetric information. Indicating whether the time of an IPO is hot, marking a time of a sentiment market. The theory has found the underpricing larger during hot markets (Abrahamsson & De Ridder, 2015; Ibbotson & Ritter, 1995). Therefore, we have looked at each unique month since January 2011, split out the 10% "hottest" months, meaning the ten percentile months with the most IPOs. The variable is presented as a dummy variable, meaning the companies that score 1 are classified as hot, while those that score 0 are not.

These six variables combined made up our asymmetric information proxy. Therefore, combining the outputs on these proxies could indicate whether asymmetric information is a good explanatory factor for the puzzles of underpricing and long-term underperformance.

Firm characteristics

We believed several characteristics regarding the firm might affect the stock price performance, both at issuance and in the long-term.

We chose to investigate different nations and exchanges, as we wanted to look at inequalities between nations and exchanges. Both between leading exchanges and MTF markets within a country and leading exchanges and MTF markets between countries. We also wanted to investigate differences between different industries, as our literature review showed that some industries would expect more underpricing and poorer long-term performance than others.

The industries are classified by SDC Platinum and were sorted into eleven categories. These are Energy, High Technology, Industrials, Consumer Staples, Health Care, Financials, Materials, Telecommunications, Media & Entertainment, Retail, and Real Estate. In *Table 7* there is shown how the companies studied are diversified among the different industries and the number of observations on each industry. Finally, we wanted to see if these effects were apparent in our empirical analysis.

In addition to the variables gathered on asymmetric information and firm characteristics, we chose to involve *MoneyRaised*. This was because we found several studies that mention an explanatory factor for both underpricing and long-term performance (Rock, 1986; Ibbotson et al., 1994; Ljungqvist, 2007). Data on transaction size were gathered from SDC Platinum, and press releases post the IPO. It was then log-transformed to adjust for skewness and outliers.

5.3.5 Assumptions and Biases

In a multiple regression analysis using ordinary least squares, there is always a chance of the model being biased. For example, the estimator we would want to isolate, the Covid-19-effect, and the MTF market-effect could be biased towards another coefficient than the true coefficient of the total population. Therefore, four assumptions need to be in place to have an unbiased multiple regression model.

The conditional distribution of U_i given X_i have a mean of zero.

The first assumption we had to check for is the zero conditional mean. We face an endogeneity problem when one or several independent variables correlate with the error term, the unexplained difference between the theoretical and observed values. We involved several control variables in coping with the endogeneity problem, proxying for attributes affecting the independent variables. This said, there is always a risk of omitted variable bias. Our research found several exciting theories we would have liked to create proxies for, but the scarce available data left us with the variables mentioned above.

The observations are randomly selected.

The second assumption is that the selected observations are randomly selected. Our sample came down to between 150 and 344 companies depending on what we analysed in our regressions. This results from the initial population of 770 companies. The most significant lump of companies was removed because of missing data in the SDC Platinum database. Since the companies we have are distributed almost equally in terms of the critical firm characteristics, namely firm size, nation, and industry, we chose not to go after why certain companies have missing values in the dataset.

The observations have large outliers.

The third assumption of the least squares is that significant outliers are rare. We have chosen to remove or winsorize outliers depending on the attributes of the variables. For example, we removed a total of 72 companies due to unrealistic outliers in our dependent or independent variables. Given our large sample, we felt confident that outliers are rare.

No perfect multicollinearity

The last assumption of multiple regression models is no perfect multicollinearity. Perfect multicollinearity applies when one of the regressors is a perfect linear function of the other regressors (Stock & Watson, 2008). We ran plots between each variable used in our multiple regression model and did not find any signs of linear relationships.

In addition to the four least square assumptions, we controlled heteroskedasticity in our models. Even though there will always be a risk of biases in our statistical models, we have taken precautions to limit the probability of affecting our results.

6. Empirical analysis and results

This chapter will present the results of our empirical research. The previous chapter presented the methods used to calculate and estimate long-term stock price performance, underpricing, and different firm characteristics. In this chapter, it will be used in practice. Furthermore, this chapter will present the results from the regression models and a discussion around the output, possible explanations, and the research limitations and validity. Lastly, a part will be presented on how these findings can contribute to further research.

6.1 Descriptive statistics.

Table 9. Descriptive statistics on underpricing of IPOs pre-Covid-19.

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Multilateral Trading Facility	145	0.317	0.467	0	0	0	1	1
Leading Stock Exchange	145	0.683	0.467	0	0	1	1	1
HighTech	145	0.386	0.489	0	0	0	1	1
Hot	145	0.172	0.379	0	0	0	0	1
TransactionToMarketvalue	123	0.399	0.139	0.219	0.255	0.392	0.551	0.586
PrimaryToTotal	145	0.558	0.390	0	0.2	0.6	1	1
FilingToIssue (days)	145	27.159	40.988	8	10	14	24	280
MoneyRaised ($M)	142	90.130	74.103	1.208	25.422	63.328	176.515	202.075
FirmAge (years)	144	19.889	28.744	0.000	0.000	12.500	26.250	173.000
Underpricing	145	0.065	0.124	−0.171	−0.007	0.032	0.127	0.442
Excessive_Underpricing	145	0.065	0.127	−0.173	−0.009	0.029	0.131	0.445
Log_Excessive_Underpricing	145	0.056	0.114	−0.179	−0.009	0.028	0.123	0.368

Table 10. Descriptive statistics on underpricing of IPOs during Covid-19.

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Multilateral Trading Facility	73	0.438	0.500	0	0	0	1	1
Leading Stock Exchange	73	0.562	0.500	0	0	1	1	1
HighTech	73	0.342	0.478	0	0	0	1	1
Hot	73	0.808	0.396	0	1	1	1	1
TransactionToMarketvalue	55	0.381	0.143	0.219	0.239	0.345	0.539	0.586
PrimaryToTotal	73	0.552	0.431	0	0	0.6	1	1
FilingToIssue (days)	73	36.397	46.114	8	15	20	24	237
MoneyRaised ($M)	70	94.323	71.020	4.659	30.322	79.654	165.791	202.075
FirmAge (years)	73	13.699	27.918	0	0	0	14	138
Underpricing	73	0.103	0.134	−0.103	0.000	0.056	0.213	0.464
Excessive_Underpricing	73	0.105	0.135	−0.113	0.005	0.054	0.210	0.465
Log_Excessive_Underpricing	73	0.093	0.118	−0.118	0.005	0.053	0.190	0.368

Table 11. Descriptive statistics on the long-term performance of IPOs pre-Covid-19.

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Multilateral Trading Facility	213	0.427	0.496	0	0	0	1	1
Leading Stock Exchange	213	0.573	0.496	0	0	1	1	1
HighTech	213	0.432	0.497	0	0	0	1	1
Hot	213	0.498	0.501	0	0	0	1	1
TransactionToMarketvalue	174	0.389	0.218	0.004	0.23	0.39	0.515	0.797
PrimaryToTotal	213	0.678	0.384	0.0	0.40	0.99	1	1
FilingToIssue (days)	213	27	40.180	0	10	15	24	280
MoneyRaised ($M)	206	55.22	50.656	0.65	7.38	35.96	109.16	134.19
FirmAge (years)	212	17.92	27.536	0.0	0.0	7.0	21.5	173.0
Return180Day	213	0.024	0.333	−0.693	−0.195	−0.015	0.168	0.874
Excessive_180Day	213	0.118	0.414	−0.628	−0.127	0.039	0.268	2.496
Log_Excessive_180Day	213	0.063	0.373	−1.055	−0.139	0.040	0.263	1.424

Table 12. Descriptive statistics on the long-term performance of IPOs during Covid-19.

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Multilateral Trading Facility	102	0.667	0.474	0	0	1	1	1
Leading Stock Exchange	102	0.333	0.474	0	0	0	1	1
HighTech	102	0.412	0.495	0	0	0	1	1
Hot	102	0.873	0.335	0	1	1	1	1
TransactionToMarketvalue	94	0.380	0.226	0.001	0.210	0.323	0.508	0.797
PrimaryToTotal	102	0.679	0.417	0.00	0.300	1	1	1
FilingToIssue (days)	102	36	48.996	0	8	17	31	237
MoneyRaised ($M)	97	51.845	48.614	1.14	7.37	35.52	87.61	134.19
FirmAge (years)	102	13.0	24.755	0	0	6.0	12.8	138.0
Return180Day	102	0.120	0.393	−0.734	−0.112	0.038	0.314	0.874
Excessive_180Day	102	0.310	0.698	−1.073	−0.020	0.155	0.465	3.933
Log_Excessive_180Day	102	0.212	0.487	−1.130	−0.027	0.166	0.467	1.425

The four tables above describe the raw data that was later being put into the multiple regression analyses. As *Table 9* and *Table 10* illustrate, there is more underpricing among companies issued during Covid-19, 10.3%, compared to companies issued previously to Covid-19, 6.5%. The trend is similar when looking at excessive underpricing, as the excessive underpricing is greater during Covid-19, 10.5%, compared to pre-Covid-19, 6.5%.

We can also see how the average age of firms that decided to go public during Covid-19 is lower, 13.7 years, than the companies who went public before Covid-19, which on average was 19.9 years. Both these findings are in line with our expectations from the literature review. However, we can see from Tables 11 and 12 how the excessive long-term performance among companies who went public during Covid-19 is much higher, 31%, compared to the long-term return of companies that went public before Covid-19, 11.8%. This finding contradicts our expectations of long-term underperformance of IPOs.

The four tables on descriptive statistics reveal little change in the standard deviation for underpricing and long-term performance from the pre-Covid-19 and during Covid-19 samples. It is only marginally higher for the during Covid-19 samples. One could expect a greater divergence in observations post Covid-19 because of the high volatility in the markets. There is also worth mentioning that the number of observations among the 180-day returns during Covid-19 is higher, 102, than the underpricing during Covid-19, 73. This is due to less data on offer prices used in the IPOs.

6.1.1 Underpricing

To answer *Hypothesis 1*, we will have to look at the phenomenon of underpricing during Covid-19 and compare it to the findings previously to Covid-19. To do so, we first conducted an univariate analysis and then a multiple regression model, in line with the model described in *Chapter 5. Methodology*.

Univariate

As we compared two independent populations to answer *hypothesis 1*, we conducted a two-sample independent t-test on the following null hypothesis.

> ***H₀**: The underpricing during Covid-19 is similar to before Covid-19. (Help us answer Hypothesis 1, the Covid-19-effect).*

We looked at both underpricing in absolute numbers and the log-transformed excessive underpricing, which was used in our multiple regression. In absolute numbers, we found an average underpricing of 10.3% during Covid-19 and only 6.5% previously to Covid-19. The selection was a total of 73 listings during the Covid-19 period and 145 before. The t-test confirms the difference to be significant.

Looking at the log-transformed excessive underpricing for the same companies, we saw the same picture. The excessive underpricing is significantly higher during Covid-19, yet the difference is smaller. Therefore, given the results from the t-tests, we reject the null hypothesis.

> ***H₀**: The underpricing is similar on the MTF markets and the leading stock exchanges during Covid-19. (Help us answer Hypothesis 2, the MTF market-effect).*

We found some unexpected results when answering our second hypothesis on whether the listings on the Nordic MTF markets are underpriced more than listings on the leading Nordic stock exchanges. We saw that listings on the leading stock exchanges were more underpriced than those on MTF markets for the absolute underpricing. In absolute numbers, the average underpricing on leading stock exchanges summed up to 15%, while the listings on MTF markets were underpriced by just 12%. This said, the difference is not significant. Excessive underpricing follows the same pattern. The MTF market listings are less underpriced, but the difference is not significant.

Multiple regression model

In the following, we will look at a multiple regression model with the insights gotten from this univariate analysis in mind.

Table 13. Multiple Regression on underpricing

	Dependent variable:				
	Log_Excessive_Underpricing				
	(1)	(2)	(3)	(4)	(5)
Multilateral Trading Facility	0.004 t = 0.201		0.014 t = 0.606		0.031 t = 0.996
COVID		0.036** t = 2.166	0.053*** t = 2.596		0.092*** t = 3.373
MTF:COVID			−0.041 t = −1.111		−0.060 t = −1.443
TransactionToMarketvalue				−0.095 t = −1.628	−0.124* t = −1.923
PrimaryToTotal				−0.033 t = −1.526	−0.028 t = −1.250
FirmAge				−0.001** t = −2.005	−0.0003 t = −1.155
FilingToIssue				−0.0002 t = −1.211	−0.0003* t = −1.722
Hot				0.0004 t = 0.021	−0.037 t = −1.530
Log(MoneyRaised)					0.018* t = 1.703
HighTech					0.034* t = 1.835
Constant	0.067*** t = 7.532	0.056*** t = 5.916	0.052*** t = 5.186	0.133*** t = 4.432	0.035 t = 0.671
Observations	218	218	218	177	173
R^2	0.0002	0.022	0.029	0.041	0.133
Adjusted R^2	−0.004	0.017	0.015	0.013	0.079
F Statistic	0.047 (df = 1; 216)	4.846** (df = 1; 216)	2.094 (df = 3; 214)	1.466 (df = 5; 171)	2.480*** (df = 10; 162)
Note:					*p<0.1; **p<0.05; ***p<0.01

The multiple regression model shows five models. Firstly, we look at the effect on being listed at the MTF markets isolated. Secondly, we look at companies listed during Covid-19 in *Model 2* before we control the two attributes for each other in *Model 3* In *Model 4*, we look at how

asymmetric information relates to underpricing before we in *Model 5* look at all the variables controlled for each other.

In *Model 2*, we saw the Covid-19 effect isolated. As we see from the results of our regression model, we can see how the excessive underpricing is 3.6% higher during Covid-19 when the variable is isolated and 9.8% higher when controlled for omitted variables, compared to pre-Covid-19, the result is significant at 99% confidence level.

Further, from the multiple regression model, we answered parts of *Hypothesis 2* on whether the underpricing during Covid-19 on the MTF markets is greater than the leading exchanges. In *Model 1*, one can observe that in general, there is more underpricing at MTF markets, 0.4%, but not during Covid-19, -4.1%. However, none of these findings are significant, and we could not draw any conclusion.

Looking *Model 4*, we can see the proxies for asymmetric information. *FirmAge*, *FilingToIssue*, *PrimaryToTotal* and *Hot* have a negative relationship with underpricing. *FirmAge* is significantly negative, -0.1% when only looking at proxies for asymmetric information isolated. Adjusting for all variables, the coefficient is insignificant but is still negative, meaning the older the firm is, the less underpricing is there. *FilingToIssue* is significant adjusted for all control variables. For each marginal day used on preparing the auction, the underpricing is reduced by 0.03%.

From our variable *PrimaryToTotal*, we can see that IPOs with more primary shares, compared to total shares, experience less underpricing, 3.1%, which is in line with our expectations as it indicates less uncertainty related to these issues. However, it is not statistically significant. The *Hot* variable implicates a small negative effect on underpricing. This regression will be further discussed, answering *Hypothesis 3* on the effect of asymmetric information on underpricing.

In *Model 5*, we have, in addition to the abovementioned variables, involved *MoneyRaised* and the dummy *HighTech*. We see how the companies classified as *HighTech* experience more underpricing in the Nordic markets during an IPO, 3.1%, the statistical relationship is insignificant. We did not find any significant statistical relationship between money raised during an IPO and underpricing. If anything, it is weakly positively correlated where a percentage increase in *MoneyRaised* increases underpricing by 1.4%, meaning the higher the issue size, the higher is the underpricing.

Even though our model left us with some insights, it did not provide a sufficient base to answer our research question. We noticed that the adjusted R is low. Hence it was to a low extent able to predict the variance in the observations. However, the theory deviates from its belief in adjusted R as a good proxy for the model's explanatory value. We acknowledged the low adjusted R and interpreted the results with caution.

Discussion on our results

Our results build up the recent studies, finding a higher underpricing on listings during the Covid-19-pandemic (Sahac, 2021; Baig & Chen, 2021; Innstrand & Johnsen, 2021). Our findings are in that way further strengthening Ritter's (1991) implications of higher underpricing in windows of opportunities. Furthermore, we find a positive relationship between the MTF market variable and underpricing. This could be interpreted as asymmetric information, given the less comprehensive listing requirements needed to be listed at the multilateral trading facilities, supporting Westerholm's study from 2006. Furthermore, in unison with Ritter's (1991) findings on increased asymmetric information, as young firms emit less public information than mature firms with more extensive financial history.

Our model found some support to asymmetric information being the most influential explanation for the degree of underpricing. The proxy for signaling theory and winner's curse, *TransactionToMarketvalue*, is insignificantly negative. The negative relationship between the relative size of IPO and underpricing contradicts Keloharju's (1993) findings of an increase in asymmetric information leading to higher underpricing. Further, we found significant numbers for *FirmAge* to negatively affect ex-ante uncertainty and presumably lead to lower underpricing, yet the coefficient is insignificant when adjusted for omitted variables. The finding that the more mature the firm is, the lower the underpricing is supported by theory (Jenkinson & Ljungqvist, 2001; Rock, 1986).

Looking at the proxy for signal theory, *PrimaryToTotal*, which Ljungqvuist (2007) found to have a negative relationship with underpricing, is negative in our model. The negative relationship between the portion of issuance of primary shares and underpricing is in one way intuitive. One would expect that a more significant portion of primary shares would signal belief in the company from insiders. External investors should then demand little initial returns; hence the underpricing should be lower. Our results, supporting Ljunqvist (2007), diverge from the results provided by Spiess & Pettway (1997) and Garfinkel (1993), which did not find any relationship between the portion of primary shares issued and underpricing.

The proxy *FilingToIssue* returns a negative coefficient, indicating that the longer the time between the IPO and IPO announcement, the lower the underpricing. This supports the theory of Ekkayokkaya & Pengniti (2012), who assumed that the longer the time available for analysts to value a company, the less the underpricing would be. In contrast, it contradicts the theory provided by Lee, Taylor, & Walter (1996), who found the underpricing to increase when *FilingToIssue* increased. The authors explained the effect of extended *FilingToIssue* signaling lower investor demand. Ekkayokkaya and Pengniti studied Finnish IPOs, while Lee, Taylor & Walter studied U.S. IPOs. One could argue that the limited financial ecosystem in the Nordic markets compared to the U.S, which has interests from all over the world, has led us to the same finding as the Finnish study by Ekkayokkaya and Pengniti.

However, our last proxy for asymmetric information, *Hot*, shows a negative relationship to underpricing. The rationale behind the proxy was that during hot periods, the limited supply of underwriters would increase their hedge against overpricing, setting the IPO price unnaturally low (Ibbotson & Ritter, 1995; Abrahamsson & De Ridder, 2015). Nevertheless, our finding suggests that there is lower underpricing during hot periods.

After all, we have found some interesting results indicating that the Nordic IPO markets are not necessarily following the same patterns as theorists in the U.S have suggested. Our results support Westerholm's (2006) findings of lower underpricing in the Nordic markets than in the U.S. Further, our research question surrounding underpricing during Covid-19 shows a strong sign towards higher underpricing during this hot issue market. Lastly, we found divergent results on asymmetric information being as an explanatory factor for underpricing.

6.1.2 Long-term performance

Following the same methodology as *6.1.1 Underpricing*, we conduct a univariate analysis and then a multiple regression model, in line with the model described in *Chapter* 5. *Methodology.*

Univariate

We used the same approach when looking at the long-term performance. With an independent two-sample t-test, we looked for the difference in long-term stock price performance before and after Covid-19. The null hypothesis we wanted to investigate were then:

> ***H_0**: The long-term performance during Covid-19 is similar to before Covid-19. (Help us answer Hypothesis 1, the Covid-19-effect).*

In our sample, there were gathered 213 listings pre-Covid-19 and 102 listings during Covid-19. We did not find long-term underperformance on IPOs pre or during Covid-19. The positive long-term excessive performance was highest during Covid-19, 31%, in contrast to the 11.8% increase before Covid-19. The difference is significant on a 99% significance level. We found the same significant pattern on the log-transformed excessive long-term performance.

> ***H_0**: The long-term performance is similar on the MTF markets and the leading stock exchanges during Covid-19. (Help us answer Hypothesis 2, the MTF market-effect).*

From our sample of 54 listings on the leading Nordic stock exchanges and 124 listings on the Nordic MTF markets, we saw a long-term performance of 18% on listings at MTF markets and 7% on the leading stock exchanges. The difference was not significant on a 95% level. When looking at excessive returns, we found the difference even smaller. Also, the difference in excessive returns was not significant.

Multiple regression model

Table 14. Multiple regression on long-term performance.

	Dependent variable:				
	Log_excessive_180Day				
	(1)	(2)	(3)	(4)	(5)
Multilateral Trading Fac.	0.096**		0.039		0.098
	t = 2.048		t = 0.710		t = 1.262
COVID		0.148***	0.074		0.082
		t = 2.709	t = 1.102		t = 1.039
MTF:COVID			0.097		0.108
			t = 0.922		t = 0.942
TransactionToMarket				−0.154	−0.122
				t = −1.222	t = −0.915
PrimaryToTotal				−0.063	−0.099
				t = −1.071	t = −1.575
FirmAge				0.001	0.001
				t = 0.968	t = 1.007
FilingToIssue				−0.0002	−0.0003
				t = −0.295	t = −0.583
Hot				0.049	−0.023
				t = 0.918	t = −0.405
High.Tech					−0.055
					t = −0.958
Log(MoneyRaised)					0.010
					t = 0.374
Constant	0.063**	0.063**	0.047*	0.190***	0.136
	t = 2.463	t = 2.476	t = 1.672	t = 2.672	t = 1.055
Observations	315	315	315	267	261
R^2	0.013	0.028	0.037	0.016	0.070
Adjusted R^2	0.010	0.025	0.027	−0.003	0.033
F Statistic	4.189** (df = 1; 313)	8.906*** (df = 1; 313)	3.952*** (df = 3; 311)	0.828 (df = 5; 261)	1.882** (df = 10; 250)
Note:					*p<0.1; **p<0.05; ***p<0.01

For us to answer *Hypothesis 1*, whether Covid-19 has affected the long-term stock price performance of IPOs, and *Hypothesis 2*, whether the long-term underperformance is more prominent at Nordic MTF markets than at the leading exchanges during Covid-19, we ran a multiple regression model resulting in five models. Just like we did in *6.1.1. Underpricing*, we started by isolating the MTF market and Covid-19 as explanatory variables before looking at asymmetric information and then run the model altogether.

As we can see from *Model 2*, the effect of Covid-19 has led to better long-term stock price performance, where companies listed in this period have seen 14.8% greater returns. However, adjusting for all control variables in *Model 5*, the effect is only 8.2%. The result is not significant when adjusted for control variables. The result matched our expectations from *Hypothesis 1*, where Covid-19 is affecting the long-term performance of IPOs. However, the results were insignificant, and one could not draw any conclusions.

Further, we can see how long-term stock price performance is positively related to MTF markets, by 9.6%, which contradicts *Hypothesis 2* of more significant long-term underperformance among IPOs at MTF markets. However, there is no significant relationship between the long-term performance and MTF markets when adjusted for control variables in *Model 5*.

We can further see how IPOs issued at an MTF market and issued during Covid-19 performed better the first 180 days, with a 10.8% return. This finding contradicts *Hypothesis 2*, which predicted underperformance among the IPOs at Nordic MTF markets during Covid-19. However, this finding was also not statistically significant.

In *Model 4*, looking at our proxies for asymmetric information, we see *TransactionToMarket* and *PrimaryToTotal* have a negative relationship with long-term performance. A 100-percentage change increase in *TransactionToMarket* resulting in -12.2% lower returns, and in *PrimaryToTotal* resulting in -9.9%. However, none of these findings are significant.

The findings on *FirmAge* indicate a slightly better long-term performance the older the company is, where each year indicates 0.1% better performance. However, the result is not significant. *FilingToIssue* negatively affects long-term performance, where each extra day the process takes reduces the long-term performance. The effect is minimal and not significant. The variable *Hot* returns a negative, insignificant coefficient, where the dummy reduces long-

term performance by 2.3%. The long-term stock price performance does not seem to be higher among *HighTech* companies, as the relationship is negative, -5.5%, yet, not significant.

Discussion on our results

The long-term positive stock price performance, both in excessive and absolute numbers, increased during Covid-19. This finding contradicts the broadly studied puzzle of long-term underperformance in the U.S (Ritter, 1991; Welch, 2002) and the Nordics (Westerholm, 2006). However, these studies looked at a time horizon of 3-5 years, giving us little to no comparable results, just looking at 180 days. Moreover, as seen in theory, the half-year performance of IPOs is almost as likely to be positive as negative (Mackintosh, 2021).

Due to a higher degree of asymmetric information on the MTF markets than the leading exchanges, we implied that the puzzles would be significantly more visible on the MTF markets. However, the MTF market-effect is positive in relation to long-term performance. This exact trend of positive aftermarket returns of listings on the MTF markets could be why so many companies chose to list at the MTF markets. It contrasts with the theory implying that the MTF market-listings experience poor aftermarket returns (Asyngier & Curie, 2013).

Further, the finding of Welch and Ritter (2002), indicating that the share issue characteristics are a central indicator of how the market moves the stock, is supported in our model. However, the negative relationship indicates that the larger the portion of primary shares, the worse is the stock price performance over 180 days.

Our proxy for winner's curse and signaling theory, *TransactionToMarketvalue*, indicates that a smaller *TransactionToMarketvalue* multiple will be oversubscribed and is smaller by nature because management and owners believe in positive news in the future (Keloharju, 1993; Barry, 1989). Further, we found no results supporting Ekkayokkaya & Pengniti's (2012) theory of long *FilingToIssue* time indicating low investor demand, hence, leaves the listings with poor aftermarket returns. Instead, we found a small positive relationship. Finally, we do not find significant numbers for the *Hot* variable to play a role in long-term performance, supporting the findings of Eckbo & Norli (2002; 2005).

6.1.3 Asymmetric information and firm characteristics

In *Chapter 2. Literature review*, we came across diverging explanations for the two puzzles of underpricing and long-term underperformance. The different findings were especially

surrounding two categories, firm characteristics and asymmetric information. Our regression models used both firm characteristics and proxies for asymmetric information. Since it became clear that only the puzzle of underpricing was present in our study, we have decided to look at the relationship between underpricing and firm characteristics in comparison with the abovementioned models.

We used log-transformed excessive underpricing and perform a multiple regression model with the independent variables *MTF*, *Covid-19*, and *MTF*Covid-19*. Our proxies for firm characteristics are *Nation* and *Industry*.

Table 15. Multiple regression on firm characteristics

	Dependent variable:					
	log_excessive_Underpricing					
	(1)	(2)	(3)	(4)	(5)	(6)
Multilateral Trading Facility	0.004 t = 0.201		0.014 t = 0.606			0.004 t = 0.143
COVID		0.036** t = 2.166	0.053*** t = 2.596			0.045* t = 1.939
MTF:COVID			−0.041 t = −1.111			−0.028 t = −0.660
Finland				−0.009 t = −0.245		−0.004 t = −0.098
Norway				−0.031 t = −0.900		−0.024 t = −0.666
Sweden				0.012 t = 0.365		0.012 t = 0.354
Consumer Staples					0.034 t = 0.483	0.038 t = 0.568
Energy and Power					0.022 t = 0.393	0.033 t = 0.541
Financials					0.034 t = 0.951	0.023 t = 0.603
Healthcare					0.041 t = 1.193	0.039 t = 1.054
High Technology					0.054* t = 1.726	0.048 t = 1.475
Industrials					0.051* t = 1.835	0.041 t = 1.419
Materials					0.041 t = 0.923	0.034 t = 0.790
Media and Entertainment					0.025 t = 0.436	0.012 t = 0.239
Real Estate					0.040 t = 1.226	0.035 t = 1.043
Retail					0.041 t = 1.181	0.031 t = 0.915
Telecommunications					0.068 t = 1.286	0.074 t = 1.424
Constant	0.067*** t = 7.532	0.056*** t = 5.916	0.052*** t = 5.186	0.069** t = 2.305	0.029 t = 1.268	0.020 t = 0.489
Observations	218	218	218	218	218	218
R^2	0.0002	0.022	0.029	0.019	0.019	0.057
Adjusted R^2	−0.004	0.017	0.015	0.006	−0.033	−0.023
F Statistic	0.047 (df = 1; 216)	4.846** (df = 1; 216)	2.094 (df = 3; 214)	1.411 (df = 3; 214)	0.364 (df = 11; 206)	0.717 (df = 17; 200)
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 15, the multiple regression model on firm characteristics, shows six models. The first three models are already shown in the previous multiple regression model from *6.1.1 Underpricing*. The fourth regression investigates the differences between the countries. The model finds minor differences, with respectively -0.9%, -3.1%, and 1.2% for Finland, Norway, and Sweden. Again, the results are seen in relation to Denmark.

The fifth model regresses the eleven industries, as mentioned in *Chapter 5. Methodology*. We observe few statistically significant results, with *High Technology* being the only independent variable to yield a significant result, 5.4% at a 90% confidence interval. The sixth and last model shows both nation- and industries with multilateral trading facilities and Covid-19. This regression yields significant results on Covid-19, 4.5% at a 90% confidence interval.

Discussion on results

We find few significant numbers from a total sample of 218 listings, both before and after Covid-19 and at MTF markets and leading stock exchanges. Firstly, looking at the groupings of each nation, there is an indication for Norway to be the country with the lowest degree of underpricing. Finland, Denmark and lastly Sweden followed. A rationale for Sweden to experience the highest underpricing could be that Sweden has the most listings during the period studied. As theory has suggested, hot markets tend to increase underpricing. Looking at the model with the Nation as the only explanatory variables of underpricing, we find it to explain less than 1% of the variance in the observations.

When looking at each industry, we see that *technology*, *industrials*, and *telecommunication*, stand out and trends towards higher underpricing. This is because these industries have experienced considerable growth, especially during Covid-19, representing a significant portion of our study. However, we see that grouping by industry explains none of the variances in the model, following the rationale behind adjusted R as a measure of explanation. Hence, our findings do not support several studies pointing at industry-specific differences in underpricing (Ibbotson & Ritter, 1995; Clark, 2002).

Even though the theory has found firm characteristics to be a good category explaining underpricing, we find no implications for it to serve as suitable control variables in models trying to explain underpricing in the Nordic markets.

6.2 Limitation on research

Throughout this empirical study, we would like to make the reader aware of some limitations and constraints in our study. As mentioned previously in the paper, most of our data were collected from SDC Platinum. However, some observations were missing from SDC Platinum, and we gathered these data points manually to create a large dataset with sufficient observations. The manual gathering especially applies to offer prices gathered from the

respective companies' IPO-prospectus and conversion from local currency to dollars. Manually data gathering leaves room for human mistakes, which means errors in our data sample may occur.

This was also the case for variables such as *HighTech*. This variable was created as a dummy to distinguish whether they are considered high tech, categorising all companies as binary. In contrast to reality, ranking firms on technological capabilities can be seen as a scale. Therefore, the findings from these variables might be biased towards our personal beliefs and knowledge.

Regarding our data sample, which gathers IPOs from four countries, are Swedish and Norwegian IPOs overrepresented, as these are the countries in our study that have seen the most IPOs during Covid-19. This means that our results on MTF markets during Covid-19 will leave Danish and Finnish IPOs more biased towards the Norwegian and Swedish IPO markets.

Additionally, this study's long-term stock price performance is set to be 180 days. Therefore, six months is a short estimate of long-term stock price performance relative to previous studies on the same topic. However, the mark was set to be 180 days, as we faced a tradeoff of a high number of observations or expanding our definition of long-term. After all, Covid-19 is a new phenomenon seen from a historical perspective. Thus, we found it more purposeful to set a "short" time horizon on long-term stock price performance to gain a sufficient number of observations to build on.

6.3 Further studies

Some of the results in this paper lay the foundation to further insightful research. Both in terms of underpricing, long-term stock price performance, and perhaps especially on firm characteristics concerning IPOs. Our data gathering ended on the 17th of November 2021. It would be fascinating to conduct the same regressions in a broader data sample with a longer time horizon, where one can measure the stock price performance of more companies' IPOs.

As our results on firm characteristics show, there are differences between IPOs within different industries during Covid-19. It could also be interesting to distinguish the industries further to see which subsectors perform significantly differently from the index. Furthermore, to study what might explain these findings.

There have been several international studies on the signaling effect of underwriters and cornerstone investors regarding underpricing. As we have stated, the transparent attributes of the Nordic equity markets make the nature of Nordic IPOs different from most other markets. Therefore, a study analysing the quality of underwriters and cornerstone investors related to underpricing would be fascinating.

Additionally, it would be exciting to further develop our "asymmetric information"-proxy to see if other variables are available that could explain some of the uncertainty related to IPOs. Our study emphasizes the IPO process's time, the firm's age, the portion of primary shares issued, transaction size compared to market value, and sentiment as the main "uncertainty drivers." However, it could be insightful to see if other factors might affect investors' confidence.

Our paper is a quantitative approach to IPOs in the Nordic stock markets, but further research could, for example, be a qualitative questionnaire among investors, underwriters, and issuing companies on which factors provoke uncertainty, and perhaps see the results in light of period, market sentiment and stock exchange, to spot and critically study the differences.

7. Conclusion

The purpose of this master's thesis was to investigate IPOs at Nordic MTF markets during Covid-19 and to conduct a comparison to their peers. This was done by answering the research question; "How do the IPOs on the Nordic MTF markets during Covid-19 distinguish from the IPOs before Covid-19 and the leading exchanges?".

In our empirical study of 344 IPOs from the 1st of January 2011 until the 17th of November 2021, we found few variables from which we can draw significant statistical conclusions. Moreover, since our sample size was relatively large compared to other studies conducted on similar topics, the insignificant results are likely due to minor differences in IPO characteristics pre-and-post Covid-19 and between MTF markets and the respective countries' leading exchanges. Either way, our analysis provides insightful results on IPOs during Covid-19 and on the Nordic MTF markets.

A literature review on IPOs and post-issue performance indicates two main trends: underpricing and long-term underperformance. However, the established consensus has not been as countable for the Nordic equity markets as for the U.S market. Our findings from this research support the two IPO puzzles partly. We found underpricing present from the 1st of January 2011 till the 17th of November 2021. On the other hand, there has been positive long-term performance during the same period.

With these findings as a base, we have developed answers to our research question surrounding the effects of Covid-19 and listing on the MTF markets. Firstly, the listings during Covid-19 have experienced significantly higher underpricing. We have defined the Covid-19 period as a hot issue market, which leads our finding to support theory on higher underpricing during hot issue markets also in the Nordic markets. The puzzle of long-term underperformance is not found evident during Covid-19.

Secondly, we found implications for higher underpricing on the MTF markets concerning leading stock exchanges during the ten years analysed. However, during Covid-19, there was a trend towards lower underpricing on the MTF markets. Further, the long-term performance is better on the MTF markets before and after Covid-19, relative to the leading stock exchanges. Nonetheless, we found no significant difference in long-term performance.

By these means, we find substantial implications for the puzzle of underpricing to be countable for the Nordic equity markets and that the puzzle is more present during Covid-19 and on the MTF markets.

We further questioned whether asymmetric information is the driving force behind the two puzzles. We developed several proxies to explain several theories within asymmetric information and IPOs. We found good results on the proxies explaining the degree of underpricing but not on explaining long-term performance. As the proxies for asymmetric information assumed the puzzles of underpricing and long-term underperformance to be true, we found it natural not to be applicable for the long-term overperformance that we found.

At last, we saw the proxies for asymmetric information in relation to more typical firm characteristics. Furthermore, we found the firm characteristics to explain little to no variation in observations of underpricing. Hence, our study supports the theory of asymmetric information being the most prominent factor explaining underpricing.

Summing up, through this study we have found empirical data supporting theory on underpricing but not on long-term underperformance. Moreover, we found it to be larger underpricing during Covid-19 and in this period, it was more extensive on the leading stock exchanges compared to the MTF markets. After that, we have found asymmetric information to be the most prominent factor explaining underpricing through looking at the Covid-19 effect, the MTF market-effect, and using proxies for asymmetric information. The puzzle of long-term underperformance is not present. We have stressed that our long-term performance of 180 days is much shorter than comparable literature.

We believe our study serves as an essential contribution to understanding the post-pandemic effect on IPOs at the Nordic MTF markets. We look forward to seeing how the Nordic IPOs evolve in the aftermath of Covid-19 and whether the trend towards more listings on the MTF markets continues.

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