Norwegian School of Economics
Bergen, Fall 2023

Nordic IPO Pricing in Hot Issue Markets

An Empirical Analysis of the Nordic IPO Surge and its Characteristics, 2015-2022

Johannes Bergh & Jens Harald Johannessen

Supervisor: Prof. Tommy Stamland

Master thesis, Economics and Business Administration

Major: Financial Economics

NORWEGIAN SCHOOL OF ECONOMICS

Acknowledgements

This thesis marks the completion of our Master of Science in Economics and Business Administration program at the Norwegian School of Economics.

As we both pursue majors in Financial Economics and are fueled by a keen interest in the Nordic capital markets, we sought a thesis topic that would not only pose an academic challenge but also enrich the existing literature on IPOs. We were particularly drawn to the unique period of 2020-2022, known for its 'hot issue' markets. This curiosity culminated in a focused study of IPO initial returns and pricing dynamics from 2015 to 2022, a topic that promised a blend of theoretical rigor and practical insight.

We extend our gratitude to our supervisor, Professor Tommy Stamland, for his invaluable guidance and insightful critiques throughout the development of this thesis. His expertise in Corporate Finance has been instrumental in shaping our work.

Norwegian School of Economics

Bergen, December 2023

Jens Harald Johannessen

Johannes Bergh

Abstract

This thesis examines the underpricing and pricing dynamics of Initial Public Offerings (IPOs) in the Nordic region from 2015 to 2022, focusing on the 'hot issue' years of 2020 - 2022 during the COVID-19 pandemic. Utilizing data from the SDC platinum database, complemented by manual sampling, the study investigates factors influencing IPO underpricing and price revision, particularly during the heightened market activity and volatility of 2021.

Our research encompasses a sample of 570 IPOs, using Ordinary Least Squares regression analysis. This approach reveals an unexpected negative correlation between upward price revisions and initial returns, challenging established hypothesis such as the Cascade Hypothesis and the Costly Information Hypothesis. Additionally, a significant finding is the positive relationship between initial returns and positive net income prior to the offer. Supporting this narrative, we found lower price revision among technology firms during 'hot issue' markets, suggesting a shift in investor preference towards financially stable firms.

Through this analysis, our research sheds light on the intricate dynamics influencing IPO underpricing in the Nordics during the COVID-19 pandemic. It highlights the vital role of underwriters and the evolving investor preferences in shaping the IPO pricing landscape. The findings, while constrained by limitations in data availability, emphasize the complexity of market conditions during the pandemic and underscore the need for ongoing research to deepen our understanding of these phenomena. Overall, this thesis not only challenges existing hypotheses in IPO pricing but also paves the way for future explorations in this dynamic field.

Keywords – IPO, Underpricing, Price Revision, The Cascade Hypothesis, The Costly Information Hypothesis

Contents

List of Figures

List of Tables

1 Introduction

The COVID-19 pandemic led to a period of change and uncertainty in global financial markets. As economies worldwide were faced with the challenges posed by the pandemic, this triggered notable shifts in the financial markets, meriting detailed exploration. Particularly compelling was the investigation of IPO pricing dynamics in the Nordic region. In response, this study aims to clarify underpricing [1] and pricing dynamics of IPOs in the Nordic region, offering insights into their performance amid the fluctuations of the pandemic era. Leading into our central investigation, we pose the following research question:

"How were the characteristics of initial returns and pricing dynamics of IPOs in the Nordic region influenced by the market conditions during the COVID-19 pandemic and the associated hot issue market?"

In the wake of the pandemic, the response from central banks globally was marked by aggressive monetary policies aimed at economic stimulation. This shift led to a high initiation of capital. Moreover, lower returns on conventional investments due to decreased interest rates led investors towards the more dynamic fields of the stock market, as the appetite for risk increased. This inadvertently set the stage for a sparking IPO environment. The trend resonated with the 'Windows of Opportunity' hypothesis, linking robust IPO activities to periods of heightened investor optimism and favorable market conditions.

During the 2020-2022 period, market sentiment underwent a notable transformation. Initially marked by uncertainty and fear as the pandemic unfolded, it gradually transitioned to a more stable and optimistic outlook in 2021. This shift, mirrored by a significant rise in IPO activity in the Nordics during the same year, highlighted the complexity and evolving nature of the market, underscoring the abundance of this era as a subject for investigation.

The pandemic period saw technology and growth-oriented firms initially thrive, reflecting the market's shift towards growth-oriented and more risky investments. By the end of

[1] Underpricing, where IPOs are initially priced below their fundamental value leading to positive first-day returns.

2021, however, investor sentiment reverted, impacting these sectors' valuations. Our study examines this shift, highlighting its significance in the broader IPO landscape of 2020-2022.

During the pandemic, the IPO landscape resembled historically "hot issue" markets, which is characterized by an increase in IPO frequency. Such heightened activity, often led by investor optimism and favourable market conditions, typically coincide with high average initial returns. Highlighting this, our sample of Nordic IPOs saw 314 IPOs in the years 2020 to 2022, a significant portion of the total 570 IPOs between 2015 and 2022. Particularly, 2021 accounted for 205 IPOs showcasing a marked increase. This surge adds a layer of depth to our understanding of IPO mechanisms during times of stress and variability in financial markets.

The surge in activity during this period presents an intriguing opportunity to analyze company performance on their first trading day through the evolution of various attributes related to the deal process and company-specific traits. Our thesis is dedicated to investigating these facets within the context of Nordic IPOs during the period 2015-2022, paying special attention to the pandemic years of 2020-2022, and specifically the significant hot issue market witnessed in 2021.

Our research focuses on 570 IPOs in the Nordics, spanning the period from January 2015 to December 2022. Each IPO represents a unique case of public offerings, facilitating raising of equity. This sample allows us to dissect IPO performance against a backdrop of varying market conditions and across diverse industries. To examine this cross-sectional data set comprehensively, we employ Ordinary Least Squares (OLS) regression analysis, a method that enables us to identify and quantify the relationships and impacts within the data.

Turning to the foundational studies in IPO research, we draw attention to Ritter's (1991) findings, which indicate a trend of robust initial returns in hot markets that often give way to more modest performance in the long run. Alongside this, we consider the principle of the Costly Information Acquisition hypothesis, as presented by Benveniste and Spindt (1989), which sheds light on the potential financial implications of price adjustments during the book building process. These pivotal studies frame our examination of the 570 Nordic IPOs, prompting us to question how these companies fit within the established

academic narrative and whether they challenge or confirm the existing theories.

Drawing inspiration from influential works in the field, such as "IPO Pricing in the Dot-com Bubble" by Ljungqvist and Wilhelm (2003), our research seeks to contextualize some of the arguments, but limited to the Nordic landscape. As we compromise some of the aspects of the pricing dynamics in the Nordics, we also acknowledge the limitations encountered and highlight potential avenues for future research.

In essence, this thesis offers insights into the multifaceted world of IPO pricing in the Nordics during a historically significant period, set against the backdrop of hot issue market dynamics. Moreover, the thesis is organized as follows: Section 2 reviews relevant theories and literature on IPOs, Section 3 outlines our data sample and describes the characteristics of the data set. Section 4 examines market conditions during the pandemic, Sections 5 and 6 present our OLS regression analyses on price revision and initial returns respectively, and Sections 7 and 8 discuss the robustness and limitations of our study, culminating in a conclusion in Section 9.

2 Literature Review

2.1 Reasons to go public

Firms typically go public for various reasons, such as securing financial growth, repaying debts, making strategic investments, or allowing owners to cash out. The timing of going public, however, is primarily driven by market conditions, aligning with multiple theoretical frameworks. This decision is often based on optimizing the firm's market position and financial opportunities. Lucas and McDonald (1990) proposed an asymmetric information model wherein firms, aware of their current undervaluation, opt to delay their equity issuance. Specifically, if entrepreneurs perceive that a bear market undervalues their firm, they are more likely to postpone their IPOs, waiting for a bull market that promises more favourable pricing conditions. For an in-detailed overview over the IPO process, see appendix A.1.

This sentiment is further echoed by Choe et al. (1993), who argue that firms tend to avoid going public during periods when other high-quality firms are not issuing. This behaviour suggests a strategic timing, where firms gauge market conditions based on the actions of their peers. Furthermore, the market itself serves as a valuable informant. As discussed by Subrahmanyam and Titman (1999), markets tend to offer "information spillovers", prompting entrepreneurs to gain on growth opportunities signalling by raising prices. Also, looking to asset pricing literature, such as the work by Amihud and Mendelson (2000), which explores the potential interplay between liquidity factors and IPO pricing, which aligns with the notion of information spillovers.

Ritter and Welch, in their comprehensive review titled "A Review of IPO Activity, Pricing and Allocations" (2002), introduce an interesting perspective. They propose a semi-rational theory, devoid of asymmetric information, to elucidate the cyclical nature of issuing activity. According to their theory, entrepreneurs' valuation of their enterprise is predominantly influenced by their intimate involvement with the business's fundamentals, rather than the public stock markets fluctuations. Consequently, abrupt shifts in the valuation of publicly traded entities are not immediately internalized by entrepreneurs. This lag in valuation adjustment implies that even if market prices are swayed by irrational

public sentiment, or if entrepreneurs' prices are influenced by irrational private sentiment, entrepreneurs exhibit a propensity to offload shares once public market valuations escalate.

Given the context of this thesis, which delves into what we refer to as hot issue years, or hot market scenarios, understanding these market-timing theories is crucial. They offer insights into the strategic decision firms make, especially in volatile market conditions, and underscore the intricate interplay between rational and semi-rational behaviours in the IPO landscape.

2.2 Hot Issue Markets and Cyclical IPOs

The patterns observed in IPO markets have gathered significant attention in academic circles. There has been recorded a distinct rhythm in IPO activities, in which is evident not only in the fluctuating frequency of IPOs year over year but also in the variations in their average initial returns (Ibbotson & Ritter, 1995).

In the 1960's, Ibbotson and Jaffe (1975) observed this cyclicality in the US IPO market. Their research highlighted significant patterns of repetition and dependency from one month to the next. They coined the term "hot issue markets" to describe periods when new stock issues perform exceptionally well in their first month (Ibbotson & Jaffe, 1975, p.1027). Building on this, Ritter (1984; 1991) found that while IPOs in these hot markets often have impressive first-day returns, their long-term performance tends to be lacklustre. Ljungqvist et al. (2006) added that investor enthusiasm tends to surge during these hot market periods.

Ibbotson and Ritter (1995) theorized that these hot issue markets arise due to positive feedback strategies. They suggested that investors, observing a trend in IPO's first-day returns, anticipate a continuation of this trend. If they see previous IPOs gaining in value, they're more likely to drive up the price of subsequent IPOs, expecting similar outcomes. Ritter (1984) also noted that hot markets tend to feature IPOs with a higher risk profile, which can contribute to higher average first-day returns. However, he argued that the elevated first-day returns in these markets can't be attributed to risk factors alone. This perspective aligns with the evolution of asset pricing models. Following up on Ritter (1984), Fama and French (1993) expanded the traditional capital asset pricing model by introducing the three-factor model, which considers the size of firms

and their book-to-market values alongside market risk. This model suggests that factor beyond simple market risk can significantly influence asset pricing, offering a more nuanced understanding of IPO pricing dynamics in varying conditions. Later, Fama and French (2015) added robust minus weak and conservative minus aggressive, expanding the model to five factors.

2.3 New Issues Underpricing

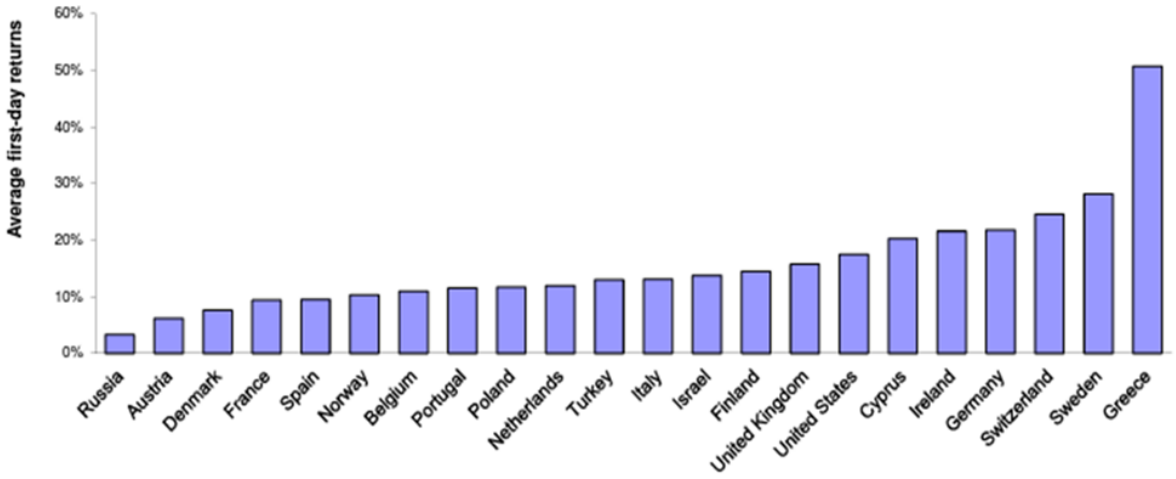
Underpricing in IPOs is a phenomenon where the initial trading day often witnesses a surge in returns, suggesting that the initial offering price might have been set at a value lower than what the market perceives (Berk & DeMarzo, 2020). This surge in returns is closely tied to the retail demand dynamics. When there is a high demand for the IPO, the aftermarket prices tend to diverge from the company's fundamental value. Conversely, when the demand is cooled down, the aftermarket prices tend to hover closer to the initial offering price (Santos, 2017). One prevalent theory behind this underpricing trend is the strategic move by issuers to deliberately set a lower price. This is often done to entice investors and ensure a successful IPO, a strategy commonly referred to as "leaving money on the table" (Loughran & Ritter, 2002). This trend of underpricing in IPOs is a well-documented phenomenon in academic research across various markets. For instance, in the U.S., IPOs between 1960 and 2022 experienced an average first-day return of 17,5% (Loughran et al., 1994/2023). Moreover, this study provides insights into average first-day returns in different countries, underscoring that the trend of underpricing in not confined to the U.S. alone:

- Denmark: 190 IPOs from 1984 to 2021 experienced an average return of 7,6%.
- Norway: 368 IPOs from 1984 to 2021 experienced an average return of 10,3%.
- Finland: 244 IPOs from 1971 to 2021 experienced an average return of 14,5%.
- Sweden: 442 IPOs from 1980 to 2021, the average return was a notable 28,2%.

To further illustrate the prevalence of IPO underpricing across Europe, figure 2.1 presents an overview of average first-day returns on mostly European IPOs, spanning from 1980 to 2023. This data, sourced from Ritter (2023), offers a visual representation and comparative overview of the underpricing trends across various European markets, providing a broader

perspective on the phenomenon.

Figure 2.1: Average first-day returns on (Mostly) European IPOs, 1980-2023



The reasons for such underpricing can vary from attracting investors, compensating them for taking on risk, to signaling firm quality. The phenomenon is particularly pronounced in "hot" markets or periods of economic boom, where investor optimism can drive prices higher (Ritter, 1984).

2.4 Reasons for Underpricing

Several theories have been proposed to explain the underpricing of new issues, each emphasizing the dynamics between investors, issuing companies, and the investment banks facilitating IPOs. It is important to note that theories can coexist and need not be mutually exclusive. Additionally, certain reasons might be more pertinent to specific IPOs than to others.

2.4.1 The Winner's Curse Hypothesis

The concept of IPO underpricing has led to various theories, one of which is the winner's curse hypothesis, highlighting the impact of information asymmetry among IPO participants. In the IPO landscape, there exists a dichotomy of investors: those who are informed and those who are uninformed. The informed cohort possesses critical insights into the actual value of the IPO, granting them a competitive advantage. Conversely, uninformed investors operate without this knowledge.

The winner's curse phenomenon arises from this disparity in information. It suggests that when uninformed investors manage to buy all the shares they want, it may indicate that informed investors have avoided the shares, suspecting them to be overvalued. Therefore, the success of obtaining shares might signal a higher likelihood of the shares being overpriced. Underpricing is often used as a strategy to mitigate the risk associated with the winner's curse. By setting the price lower, issues provide a safeguard for uninformed investors against potential overvaluation of shares.

This hypothesis, proposed by Rock (1986), is one of several perspectives used to explain the patterns of IPO underpricing. While influential, it is part of a broader body of research that adds depth to our understanding of IPO dynamics.

2.4.2 The Costly Information Acquisition Hypothesis

The practice of underpricing IPOs by investment banks can be interpreted as a strategic approach to engage investors in the pre-offer phase. This strategy, as described by Benveniste and Spindt (1989), suggests that underpricing serves as an incentive for investors to provide honest and valuable feedback about the IPO. The underlying principle is straightforward: investors are generally more willing to participate in activities that promise financial gain. In the context of IPOs, to elicit genuine evaluations, investment banks might underprice those IPOs that receive positive feedback more than those that receive negative feedback. This approach leads to a prediction of a partial adjustment in the offer price from the initial to the final prospectus. Specifically, IPOs that experience upward price revisions are expected to exhibit greater underpricing compared to those with downward revisions, a pattern that aligns with the findings of Hanley (1993).

2.4.3 The Cascade- and Impresario Hypothesis

Welch (1992) introduced the cascades hypothesis, suggesting that investor behavior in the IPO market is influenced not just by individual insights but also the collective actions of their peers. When investors notice a lack of enthusiasm from others towards a particular IPO, they might become hesitant to invest, even if their personal evaluation is favorable. Issuers, recognizing this potential hesitancy, might strategically underprice their offerings. This deliberate underpricing can serve as an incentive, encouraging an initial group of

investors to buy. This action can then set off a cascade, prompting subsequent investors to follow suit, regardless of their individual evaluations.

This cascading effect is further nuanced by the costly information acquisition explanation proposed by Benveniste and Spindt (1989). In their model, if a subset of regular investors expresses a positive outlook about an IPO, there might be an upward adjustment in the offering price. However, this upward revision is often partial, leading other investors to infer that the IPO remains underpriced. This inference can result in a positively sloped demand curve, where the desire to purchase increases. Yet, this behavior can be tempered by the perceived integrity of underwriters. If underwriters are perceived as taking advantage of investors, their reputation can sway investor behavior, potentially disrupting the cascading effect.

Another crucial aspect in the IPO landscape is the role of the underwriter. Their reputation, often gauged by their ranking, can significantly influence the IPO's success. A superior underwriter ranking typically indicates a wealth of experience and a robust network. Such reputable underwriters can guide firms through pricing decisions. Their credibility and rigorous screening process can influence both IPO pricing and post-IPO performance (Beatty & Ritter, 1986).

Adding another layer to this is Shiller's (1990) impresario hypothesis. He suggested that the IPO market, being attuned to prevailing trends, might witness investment bankers (termed as impresarios) deliberately underpricing IPOs to simulate an aura of overwhelming demand, akin to how an event promoter might generate excitement for an event.

Moreover, the prevailing market sentiment, whether the market is categorized by hot issue market tendencies or in a more restrained state, can profoundly influence these dynamics. The prevailing state of the market is instrumental in shaping investor responses, underscoring the significance of the interplay between the cascades and impresario hypotheses.

2.4.4 The Signalling Hypothesis

When new issues are underpriced, it often creates a favorable impression among investors. This positive perception can potentially enable companies and their insiders to price future equity offerings at a premium. This concept of using underpricing as a strategic tool to signal a firm's value has been explored in depth by researchers such as Allen and Faulhaber (1989), Welch (1989), and Grinblatt and Hwang (1989). These studies suggest that companies possess insider information about their fundamental value and often adopt a sequential issuance strategy, where an IPO is succeeded by a seasoned offering. There exists a possibility that investors might discern the company's true value before the seasoned offering. If this revelation occurs, the strategic decisions made during the IPO might not significantly impact the subsequent offering. Depending on certain factors, high-value firms might opt to underprice their IPOs as a tactic to indicate their superior value. This strategy is effective only if it yields substantial benefits during the seasoned offering. However, if there is a high likelihood of the company's true value being revealed prematurely, a different outcome might emerge where high-value firms inadvertently support low-value ones during the IPO.

Welch (1989) found that approximately a third of companies that go public eventually issue seasoned equity within the subsequent years. This frequency is considerably higher than what one might observe among a random set of firms listed on the New York Stock Exchange. Moreover, a significant number of these companies might also witness open-market sales by their insiders. However, this higher frequency of seasoned equity offerings among newly public companies could be attributed to their unique needs and characteristics. Often, these companies have fewer tangible assets, limiting their ability to secure debt financing through traditional collateral. This lack of collateral, particularly prevalent in growth-oriented, technology-focused, or service-based sectors, necessitates a greater reliance on external equity financing (Knudsen & Lien, 2014).

Furthermore, it is important to consider other perspectives as well. Studies by Garfinkel (1993), Jegadeesh et al. (1993), Michaely and Shaw (1994) challenge the assumed relationship between initial returns and subsequent seasoned issues. Their findings suggest that while underpricing may be a strategic choice, its effectiveness and implications are complex and influenced by a variety of market and company-specific factors.

2.4.5 The Windows of Opportunity Hypothesis and Hot Markets

One of the key explanations for IPO underpricing, especially in dynamic market conditions, is the "Windows of Opportunity" hypothesis. This theory suggests that firms strategically time their IPO to coincide with periods of high investor optimism and market bullishness. During these "hot markets", the general sentiment towards new public offerings is more favorable, potentially leading to an overvaluation of the company's equity. This phenomenon is well-documented in studies such as those by Ritter (1991) and Loughran and Ritter (1995), which highlight the strategic use of market timing to maximize the valuation of IPOs.

The concept of "hot markets" is further supported by research in the field of volatility-managed portfolios. Moreira and Muir (2017) found that adjusting portfolio exposure based on predicted market volatility can lead to improved risk-adjusted returns. This insight into investor behavior during volatile periods aligns with the observed patterns in "hot markets", where investor enthusiasm and market dynamics create opportune moments for IPOs.

In these periods, the traditional static financing hierarchy, or pecking order theory as proposed by Myers (1984), is often contrasted by a more dynamic approach. Companies in hot markets may prefer external equity as a strategic choice, diverging from the conventional preference for internal financing or debt. This shift indicates a tactical adaptation to market conditions, where firms leverage the heightened investor interest to secure better terms and higher valuations for their public offerings. The "Window of Opportunity" hypothesis, supported by empirical evidence, underscores the strategic considerations of firms in timing their entry into the public market.

2.5 Financial Sponsors in IPOs

Financial sponsors, primarily VC and PE firms, play a pivotal role in the life cycle of many companies, especially those that eventually go public through an IPO. These sponsors provide not only capital but also strategic guidance, industry connections, and operational expertise to their portfolio companies. Their goal, however, is to realize a return on their investment, and this is where the concept of exit strategies comes into play. IPOs are

often one of the most sought-after exit strategies, as the financial sponsor, through an IPO, allows them to sell their shares in the public market, often at a substantial premium. This not only provides liquidity but also validates the firm's investment thesis (Gompers, 1996).

2.6 The Role of Underwriters and Principal-Agent Dynamics in IPOs

The choice of underwriters[2] is usually twofold. First, the choice tends to be determined based on the issuing firm's industry, hence matching the underwriter's knowledge around a specific industry. Second, the choice of underwriters tends to be on prestige and track record (Logue et al., 2002). Underwriters serve as critical intermediaries in the IPO process, bridging the gap between companies seeking to go public and potential investors. Through analysis and due diligence, they assess the value of the company and determine an appropriate initial offering price.

As the choice often offers their expertise and investor network, it is important to emphasize the reputational capital of underwriters. Well established underwriters could lend credibility to the IPO, which can be particularly beneficial for lesser-known companies seeking to go public. Their reputation can instill confidence in potential investors, and we would therefore further examine the relationship between prestigious vs non-prestigious underwriters (Ritter & Welch, 2002).

However, this relationship between issuing firms and underwriters is not without complexity, particularly when view through the lens of principal-agent theories. The inherent agency conflict in this relationship arises from the potential misalignment of incentives between the underwriters (agents) and the issuing firms (principals). While underwriters' compensation is often not directly tied to the offer price (Chen & Ritter, 2000), it leads to a reliance on monitoring the underwriters marketing efforts and pricing behaviors.

[2]The underwriters are critical in ensuring the success of the IPO, as they often purchase the shares from the company and then sell them to the public, bearing the risk of the market's reception. However, the practice for the investment banks to guarantee for a certain part of the issue is not likely the case in the Nordics. Their roles extend to advising the issuing company on the optimal timing for the IPO, structuring the offering, and even orchestrating marketing efforts to generate investor interest.

Effective monitoring by the issuing firms can mitigate these agency conflicts. However, the extent of this monitoring is influenced by several factors. In scenarios where the issuing firm itself faces internal agency problems or where monitoring is costly, the oversight of underwriters' activities may be less rigorous (Jensen & Meckling, 1976). According to standard principal-agent theories, agents are likely to exert less effort on behalf of their principals when their stake in the transaction is smaller (Eisenhardt, 1989). This dynamic raises questions about the underwriters' commitment to maximizing the offer price and their overall effort in the marketing the IPO (Baron, 1982).

Last but not least, it is important to mention that underwriters have a fiduciary duty to both the issuing firms and the investors – implying that the underwriters' actions should be balanced and based on the well-being of both parties. Maintaining transparency and avoiding conflicts of interest are key aspects of this responsibility Martin (2009). However, the prevalent fee structure for underwriters typically, a fixed percentage of the total funds raised, can potentially create a conflict of interest. The compensation model might inadvertently incentivize underwriters to prioritize the quantity of funds raised over the quality of the investment, potentially compromising their fiduciary duty Martin (2009). Moreover, he describes the duty from an ethical frame of reference in which the key issue is the "trade-off between client interest and self-interest", implemented by Darwish (2006). Furthermore, Olson (2003) argues that fiduciaries should act "in the sole interest of the beneficiaries".

In light of these considerations, our study further examines the relationship between prestigious and non-prestigious underwriters, with a particular focus on how these dynamics play out in the context of principal-agent theories and the unique characteristics of the hot issue years in the Nordic IPO market.

2.7 Investor Behavior in IPO Pricing

To better grasp the complexities of IPO markets, it is essential to examine the roles of rational and irrational investors, especially during periods characterized by hot market tendencies. Understanding these investor behaviors is crucial for comprehending their influence on IPO pricing dynamics.

Rational investors, grounded in traditional finance theories, base their decision on thorough analysis and a fundamental understanding of the market. Their investment choices, often aligned with the principles of the efficient market hypothesis as proposed by Fama (1970), are expected to contribute to market efficiency. However, the IPO market, with its inherent volatility and unpredictability, often challenges this notion. Even well-informed, rational investors may find it difficult to accurately process all available information, leading to decisions that might not consistently align with market efficiency.

Conversely, the field of behavioral finance sheds light on how cognitive biases and emotional responses can lead to irrational investment behaviors. Kahneman and Tversky's (1979) work on prospect theory heuristics offers insights into such behaviors. In the IPO context, these irrational tendencies, such as herd mentality and overoptimism, play a crucial role in phenomena like underpricing and cyclical IPO activities. The addition of the insights from Shiller (2015) on market irrationality and speculative bubbles, provides a deeper understanding of how investor psychology, particularly during times of market euphoria, can lead to irrational valuation of IPOs.

While rational investors may use underpricing for short-term gains, irrational investors, driven by sentiment, can contribute to the creation of "hot markets" and subsequent overvaluations. This interaction, highlighted by Ritter and Welch (2002), adds a layer of intricacy in forecasting IPO performance and pricing patterns.

3 Data sample and Characteristics

The purpose of the following section is to provide a comprehensive overview of the data gathering process and some of its key characteristics. Most of the data retrieved was directly downloaded from the Thompson Reuters database, specifically SDC Platinum. However, due to absence in some firm, and deal characteristics within the database, we manually collected a portion of the data. Thus, it is crucial to detail the precise steps of our data collection methodology.

3.1 Data sources

In order to best capture the Nordic IPO market, we include the following stock exchanges: Nasdaq OMX Stockholm, Nasdaq OMX Copenhagen, Nasdaq First North, Oslo Stock Exchange, Euronext Growth Oslo, Nasdaq Iceland, and Nasdaq Nordic (Finland). The data consists of IPOs in the Nordic countries during the period 01.01.2015 until 31.12.2022. Most of the key elements in each transaction were retrieved directly from the SDC Platinum data base. Certain key data, including the indicative price range and thus the price revision, were missing from our initial data set. Additionally, we had to manually collect several essential company-specific variables to address gaps in the data. This meticulous process involved cross-verifying certain variables through company prospectuses and the Bloomberg terminal, which proved to be a time-intensive task. The manual data collection was instrumental in enriching our data set with important variables, ensuring a more robust and comprehensive analysis.

3.2 Sample criteria and equity offering attributes

In the process of aggregating data from the Nordic region, we observe a commendable uniformity across nations with respect to transparency and data accessibility. However, due to the complexity and comprehensive scope of our assembled data set, there are instances where specific variables are absent. This omission might introduce a selection bias, as certain types of IPOs or observations could be disproportionately excluded. We recognize this limitation and its potential impact on the robustness and interpretability of our results. Consequently, the quantity of observations across regressions may fluctuate,

and individual regression models might exhibit varying degrees of completeness.

3.3 Data sampling

As our goal is to capture the dynamics of initial public offerings in the Nordic region, we cautiously refined our data set to include only the most relevant transactions. This process led us to focus mainly on traditional IPOs, resulting in the exclusion of listings such as direct listings, transfers, spin-offs, dual listings, or introductions. Unlike traditional IPOs, these listings often do not involve the issuing of shares or raising of capital, aspects that indeed are central in our analysis.

Consequently, our data set is composed of transactions that adhere strictly to the traditional definition of an IPO – an inaugural sale of equity by a private company to the public. The approach ensured that our analysis would be grounded in scenarios that best represents the dynamics and challenges of IPOs in the Nordic market.

Our initial data set collected from SDC Platinum consisted of some 640 transactions, but after a rigorous filtering process, we concentrated the number of transactions by excluding the non-relevant transactions, such as dual listings and spin-offs, we distilled this number to 570 IPOs matching our criteria. The refined data set aligns with the objectives of our study, allowing for a focused and in-depth analysis of the IPO dynamics during the period.

3.3.1 Sampling of Firm- and Transaction Specific Data

Initial returns, offer prices and accounting data are collected from the SDC Platinum database. We collected accounting data from each firm in our sample, focusing on the last twelve months (LTM) before their IPO. This allows for a deeper exploration of potential firm-specific influences on underpricing and price revisions. Given that the transaction data frequently appears in local currencies, a currency conversion was undertaken to standardize the data (see appendix table G.1 for a list of currency converted). By using the average annual exchange rate for each currency, all accounting figures were normalized and denominated in US dollars.

3.3.2 Offer Price

Offer prices are typically determined through one of two methods: a book-building process or a fixed pricing approach. To discern the impact of these methods, we introduce a dummy variable, Book-building. This variable is assigned a value of one when the offer price is ascertained through book-building and zero otherwise. In our data set, 119 offerings utilized the book-building method.

We focus specifically on IPOs that employ the book-building method to understand the market's appetite and moreover its impact on pricing. The variable is assigned a value of one when the final offer price is set above the indicative price range. The indicative price range, often outlined in the prospectus, provides a spectrum within which a company anticipates raising funds, and works as a preliminary estimate of the price spectrum. This range offers insights into the minimum and maximum proceeds expected, hence, indicating a range of which the market perceives the value of the firm. This final price is a reflection of market demand and investor interest, and our "Price Revision > 0" variable captures instances where this demand translates into a higher-than-anticipated pricing outcome.

The intent behind the price range variable is to ascertain whether positioning the price high or low relative to this range significantly influences underpricing and subsequent the initial return performance. Numerous studies, such as Hanley (1993), differentiate between firms that debut with an offer price below, within, or exceeding the price range. However, given that only a handful of IPOs in our sample had their offer price outside this range, we deemed it more fitting to categorize firms based on whether they went public below or above the midpoint of the price range. Given the size of our sample, splitting it this way makes more sense. It's worth noting that only a few instances in our sample had their initial price range revised before book closure, so we decided not to incorporate a control variable for such occurrences.

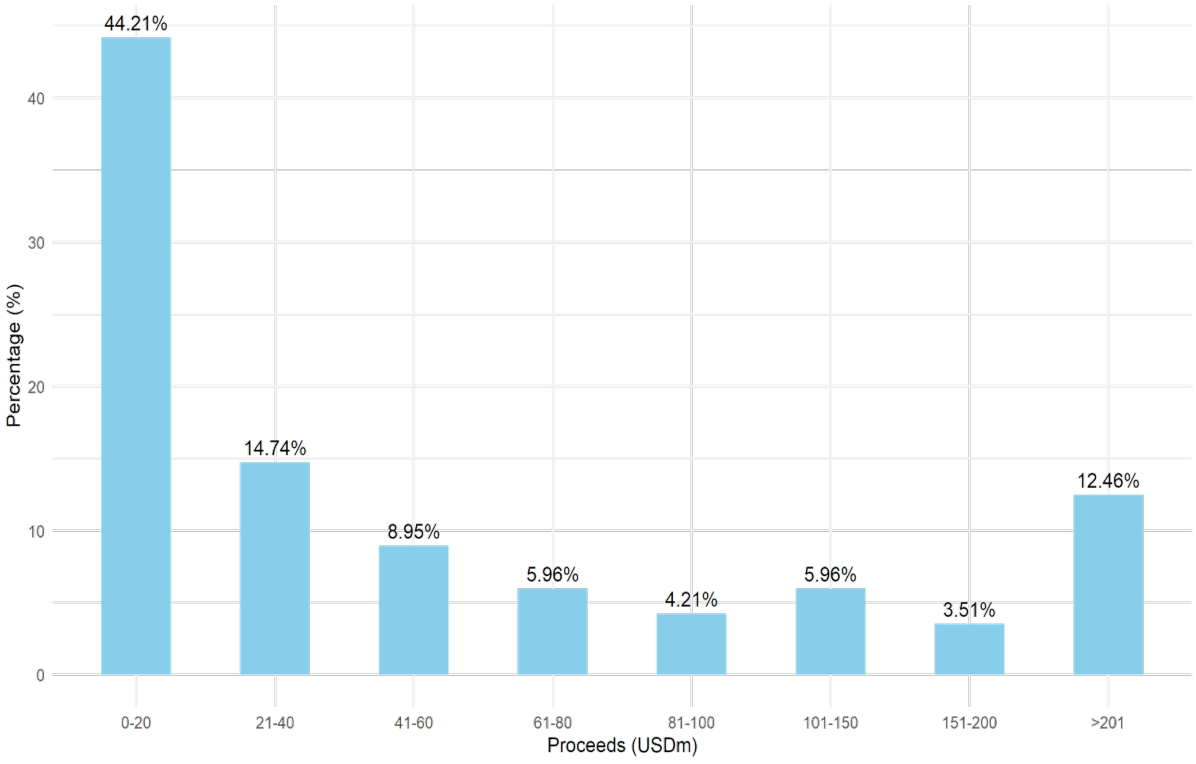
3.3.3 Offer Size

The offer size of an IPO, denominated in terms of the funds raised during the public offering, is a pivotal metric that can influence various facets of the IPO process. As shown in table 3.4, this highlights the distribution and average values of offer sizes in the data set.

The presence of outliers, as indicated by the difference between the average and median offer sizes, is noteworthy and aligns with patterns observed in broader IPO research.

Ritter (1984) and Beatty and Ritter (1986) have posited that larger IPOs, often associated with more established and mature firms, tend to experience lower levels of underpricing compared to smaller IPOs. This is attributed to the reduced information asymmetry associated with larger firms, which are typically more transparent and have a more established track record. Furthermore, the distribution of offer sizes in our data set, with a significant proportion of IPOs raising less than 20 million USD, resonates with the findings of Loughran and Ritter (2002). They observed that smaller IPOs often belong to younger and riskier firms, which might explain the higher degree of underpricing as investors demand a higher return for the perceived risk. On the other end of the spectrum, the 12.4 % of IPOs that gathered more than USD 200 million in proceeds likely represent more established entities. These larger IPOs, as suggested by Derrien (2005), can benefit from enhanced visibility and media coverage, potentially leading to a broader investor base and more stable post-IPO performance.

Figure 3.1: Offer size of Nordic IPOs 2015-2022 in million USD



3.3.4 IPOs by Country

Table 3.1: Number of IPOs by Country and Year

Country	2015	2016	2017	2018	2019	2020	2021	2022
Denmark	1	3	4	7	3	11	26	0
Finland	9	8	8	9	4	2	26	5
Norway	8	4	10	7	8	32	42	11
Sweden	35	31	55	23	16	23	110	23
Iceland	0	0	0	2	0	0	1	0

The data in Table 3.1 illustrates IPO trends across the Nordics[3] from 2015 to 2022, with Sweden dominating in volume, especially in 2021 with 110 IPOs. Denmark and Finland also peaked in 2021, with 26 IPOs each, before Denmark's activity halted in 2022. Norway's IPOs surged in 2020, ahead of its neighbors, but declined by 2022. The year 2021 was a standout across the region, signaling a robust market response during the pandemic recovery.

3.3.5 Industry and Firm Age

To simplify, and to categorize the firms into different industries, we have sorted them into 8 suitable industries: Industrial, Retail, Transportation, Technology, Financial services, Healthcare, Commodities and Energy.

Table 3.2: Number of IPOs by Industry (2015-2022)

Industry	2015	2016	2017	2018	2019	2020	2021	2022
Financial services	13	8	6	8	4	6	31	6
Healthcare	3	1	3	0	0	0	1	1
Industrial	16	16	24	16	10	35	68	9
Retail	8	4	5	2	4	5	14	5
Technology	11	13	36	17	5	21	80	10
Transportation	2	1	1	1	3	0	4	1
Commodities	0	2	0	2	1	1	2	5
Professional services	0	2	1	0	2	1	5	0
Energy	0	0	2	2	2	1	0	2

The observed fluctuations in IPO activity within the Nordic technology sector over our sample period not only reflect the sector's dynamic nature, but also underscore the influence of broader market cycles. The upswing to 80 IPOs in 2021 followed by a sharp

[3]The Nordic countries, include Denmark, Finland, Iceland, Norway, and Sweden (Zeidan, 2023).

decline to 10 in 2022, mirrors the overall markets cyclical trends. This pattern, particularly pronounced in the technology sector, suggests a strong correlation with macroeconomic factors and market sentiment. Also, on the valuation side, pre-mature tech companies tend to be valued on cash flows coming many years in the future. The industry sectors consistent lead, peaking concurrently in 2021, further highlights the cyclical nature of the market. These observations underscore the importance of highlighting time-variant factors in our regression analysis to better understand the underlying dynamics driving IPO activities in different sectors.

When examining the influence of firm maturity of IPOs' initial returns, we calculated the age of firms at the time of listing. This was determined by simply subtracting the year of foundation from the year of listing. The average age in our data set was 16.9 years, with a median of 11 years, providing a nuanced perspective on the relationship between firm age and performance in varying market conditions see table 3.3.

3.3.6 Underwriter Ranking

To delve deeper into the influence of the various underwriters on IPO underpricing and the pricing dynamics, a ranking system for the underwriters present in the data set has been established. This ranking is twofold. Initially, underwriters are ranked based on the sheer number of IPOs they facilitated during the studied period. It is assumed that those involved in a higher number of transactions are likely the more prestigious entities in the field, a sentiment also argued by Carter and Manaster (1990). Additionally, the underwriters have been ranked based on the annual gross proceeds they managed to raise throughout the duration of our sample. This approach aligns with methodologies adopted in numerous other underwriter rankings available in the public domain (Benveniste & Spindt, 1989). Consequently, we posit that underwriters who consistently handle both large and many deals, are indicative of the market's demand for their expertise (Ritter & Welch, 2002). In our main analyses, we employ the 'Underwriter Ranking' variable based on the number of IPOs handled by the underwriter. Conversely, in our IV regression, we use an alternative metric for underwriter ranking, focusing on the total volume of proceeds, as an instrumental variable. Moreover, our data set contains 22 unique underwriters. The ranking on the time of the IPO is determined by an average of their activity in the year prior to their participation. See table D.1, D.2, D.3, and D.4 in the appendix for a

detailed overview.

3.3.7 Financial Sponsors

Furthermore, it is interesting to analyze offerings where financial sponsors held primary ownership before the transaction. Financial sponsors, encompassing both PE and VC firms, specialize in financing ventures. In our data set, 56 transactions were identified where a financial sponsor, be it a PE or VC firm, held complete ownership before the public offering. The unique aspect of financial sponsor ownership leading up to an IPO is their inclination towards viewing the IPO as an exit mechanism, rather than a strategy for financing and growth. This perspective differentiates them from firms that opt for public offerings primarily to secure funding for other objectives. Moreover, the ownership concentration, especially when dominated by institutional investors or financial sponsors, can influence the motivation related to pricing within the transaction, and the corporate governance of the firm could also be different.

3.4 Transaction Specific Characteristics

3.4.1 Firm Specific Characteristics

Table 3.3: Descriptive Summary of Firm Specific Statistics (2015-2022)

Variable	2015	2016	2017	2018	2019	2020	2021	2022	2015-2022
No. IPOs	53	46	78	48	31	70	205	39	570
Mean age	25.64	18.46	15.45	20.88	13.06	13.59	16.16	15.03	16.96
Median age	15.00	12.50	10.50	12.50	9.00	8.00	11.00	10.00	11.00
Mean revenue	634.5	796.4	201.4	318.2	282.8	153.0	318.6	265.84	345.39
Median revenue	135.85	31.18	22.79	2.33	36.97	26.39	3.87	0.49	13.12
Mean EBIT	23.17	18.14	7.13	39.98	47.72	8.56	-7.62	163.46	19.32
Median EBIT	14.55	4.30	1.75	3.05	7.05	0.10	2.80	4.90	2.95
Mean NI	6.23	0.90	3.37	17.48	36.40	0.77	-13.79	40.19	3.79
Median NI	3.30	4.60	0.70	1.85	0.80	-0.10	0.55	0.60	1.00
Mean Equity	483.8	623.2	123.9	168.5	897.4	171.5	161.3	108.5	263.8
Median Equity	89.19	45.00	19.35	16.72	19.47	51.5	12.4	6.31	18.84

The average age of firms going public has generally been decreasing over the years. In 2015, the mean age was 25.6 years, which reduced to 13 years by 2019. Although there was a slight uptick in 2021 to 16.16 years, it decreased again in 2022 to 15.03 years. The median age has also seen a similar trend, hovering around 10-12 years in the recent years. The mean net income (NI) of firms has exhibited variability over the years. Notably, in 2021, a year marked by the highest number of IPOs, the mean NI was a negative 13.79 USDm. In contrast, the median net income stood at USD 0.55m, suggesting that a majority of firms were profitable. This disparity between the mean and median values indicates the potential influence of outliers skewing the mean towards the negative.

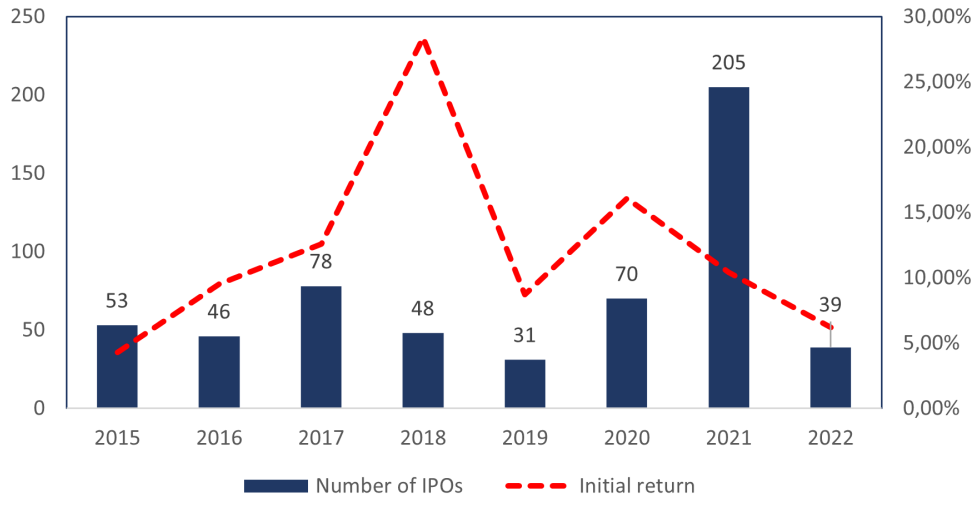
3.4.2 Deal Specific Characteristics

Over the 2015-2022 period, IPOs in the Nordic region exhibited fluctuations in some of its key metrics. Average proceeds stood at 99.7 million USD, with 2016 reaching a top to 205 million USD, largely due to a few high-value IPOs. This contrast between the mean and the median proceeds, which is 26.4 million USD, signals the presence of outliers, especially in 2016. Interestingly, 2016 recorded the highest mean proceeds at 205.3 million USD per transaction. However, when considering the median, which offers a more robust measure by reducing the influence of outliers, the figure stands at 26.4 million USD for the entire period.

Table 3.4: Descriptive Summary of IPO Deal Characteristics (2015-2022)

Variable	2015	2016	2017	2018	2019	2020	2021	2022	2015-2022
No. IPOs	53	46	78	48	31	70	205	39	570
Mean Proceeds[4]	134.85	205.30	70.49	82.13	111.46	75.45	97.03	55.52	99.69
Median Proceeds[5]	58.80	42.60	24.95	25.05	33.10	34.40	21.90	6.10	26.25
Mean Price Revision %	1.92	7.14	1.96	2.32	10.51	4.64	-2.16	13.04	3.27
Median Price Revision %	-2.28	-2.20	-0.51	0.00	2.38	0.00	-3.13	6.25	-0.64
Mean Offer Price	47.44	42.42	33.01	34.53	35.12	34.46	34.03	21.63	35.12
Median Offer Price	40.00	33.00	24.00	21.50	23.50	22.20	18.00	13.00	24.00
Mean Initial Return %	4.32	9.48	12.63	28.37	8.69	16.09	10.40	6.24	11.99
Median Initial Return %	3.16	9.79	7.19	2.93	4.55	12.65	3.79	4.00	4.49
Fraction Tech Firms %	20.75	28.26	46.15	35.42	16.13	30.00	39.02	25.64	33.86
Fraction PE Backed%	24.53	13.04	7.69	4.17	6.67	5.71	7.32	0.00	8.44
Fraction VC Backed Firms%	1.89	2.17	2.56	2.08	0.00	0.00	0.49	2.56	1.23

Figure 3.2: First day returns (line) vs IPO activity (bar)



This suggests that there were a few IPOs with exceptionally high proceeds, especially in 2016, which elevated the mean for that year.

Price revisions showed some variability. The overall mean price revision for the period was 3.5%. Notably, 2022 exhibited a significant mean price revision of 13.0%, while 2021 saw a slight decline at -2.2%.

The offer price had an average of 35.1 USD over the years, with 2022 recording the lowest mean at 21.6 USD. Initial returns, representing the % change from the offer price to the closing price on the first trading day, averaged 12% across the period. The year 2018 witnessed a remarkable mean initial return of 28.4%, suggesting a very favourable market response to that year's IPOs. Lastly, the proportion of tech firms going public averaged 33.9% over the period, reaching its zenith in 2017 at 46%. In terms of financial backing, private equity backed firms constituted 8.4% of the total, with 2022 seeing no PE-backed IPOs. VC backed firms were less prevalent, averaging 1.2% across the years.

4 Market Conditions

When the COVID-19 pandemic hit, the Nordic governments were forced to impose measures limiting the spread of the virus, impacting the supply side of the real economy. Central banks, in attempt to counteract these effects and stimulate consumption, implemented aggressive monetary easing policies, lowering interest rates and quantitative easing. Such policies became widespread globally, but during the pandemic, their effect was limited. The primary issue was not a lack of demand but constraints on the supply side due to lockdowns and restrictions (Haugland et al., 2021). This situation, where the restricted real economy coincided with increased liquidity among consumers, led capital to shift towards financial markets.

The opportunity cost of traditional savings and low-risk investments, like bonds and bank savings, rose with lower interest rates, driving capital towards higher yielding options like the stock market. This shift created favorable conditions for IPOs, as companies capitalized on the increased market liquidity and investor appetite. This trend, evident in our data, supports the Windows of Opportunity hypothesis, which correlates favorable market conditions and investor optimism with a surge in IPOs.

Figure 4.1: The VIX index during the sample period 2015-2022

In the face of these market dynamics, the VIX (Volatility Index) emerges as an interesting barometer. Often dubbed the "fear index," the VIX provides a real-time measure of the market's expectation of 30-day forward-looking volatility. It serves as an invaluable tool for gauging investor sentiment, offering insights into potential market overreactions during turbulent times. A spike in the VIX indicates heightened volatility and, by extension, increased investor fear. This was notably evident at the onset of the pandemic when the VIX surged to extreme levels, reflecting the market's uncertainty and apprehension. However, as the months progressed, the VIX gradually receded to more typical levels, signaling a stabilization of investor sentiment, as seen from the exhibition above, indicating that the sentiment for investor was not on the fear-side in 2021. While not directly visualized alongside, this trend in the VIX can be corroborated when connected with the CNN Business Fear and Greed index, further underscoring the market's emotional journey from intense fear to a more balanced sentiment by the end of 2022.

Rationale for Selecting 2020-2022 and Highlighting 2021 as a Hot-Market Year

In light of the economic disruptions posed by the pandemic, our study zeroes in on 2020-2022, with a particular emphasis on 2021. Due to its significant IPO volume emphasizes how 2021 was a hot-market year. Considering the initial financial landscape of the pandemic, 2021 was subject to change. At approximately the end of the year's first quartile, prospects of tighter monetary policies emerged with the increase of treasury bond yields, and subsequent interest rate hikes in the autumn. This economic shift followed a reallocation in the stock market, shifting investor preference from growth-oriented firms to value-based investments, as a response by rational investors (Avalos & Todorov, 2022). This market reallocation reflects fundamental principles of financial theory, illustrating how changes in interest rates influence the opportunity cost of holding various assets, including high-risk growth firms (Cunningham, 1993). As interest rates rise, the opportunity cost associated with investing in these riskier assets also increases, potentially leading investors to seek more predicatable alternatives. The combination of global events, monetary policies, and investor behavior leaves 2021 as an intriguing year for our analysis, providing valuable insights into the workings of a hot IPO market.

Figure 4.2: Market sentiment for growth firms: Ark Innovation ETF captures much of the global sentiment on growth-stocks

Figure 4.2 illustrates a shift in investor sentiment towards higher-risk profiles, as reflected in the valuations of growth-focused firms. However, druing our sample period, this sentiment reversed, moving away from such firms, which is particularly evident given that the ARK Innovation ETF is composed exclusively of high-growth companies.

Studying the 2020-2022 market, with a special focus on 2021, provides valuable insights into how investor sentiment can fluctuate and significantly impact IPO performance, especially for firms in growth sectors. The years serves as a case study in understanding the dynamics of a hot market and its effects on IPO valuation and initial returns. It underscores the importance of considering market conditions and investor sentiment when analyzing IPO performance, particularly for entrepreneurial firms that epitomize innovation and growth potential.

5 Determinants of Price Revision in Nordic Book-Built IPOs

The global economic landscape, including the Nordics, experienced significant shifts during the COVID-19 pandemic, affecting various market dynamics. The following analysis investigates the determinants of price revision for IPOs in the Nordic region over the entire period from 2015 to 2022. While our analysis encompasses this broader time frame, special attention is given to the years 2020 to 2022, defined as our "Hot Issue market" period due to the pandemic's impact, and particularly to 2021, a year marked by an extraordinary number of IPOs.

Price revision, in the context of IPOs, refers to the difference between the IPO's final offer price and the midpoint of the initial filing range (expected offer price). This metric captures the adjustment made based on the demand and feedback received during the roadshow or book-building process. Ljungqvist and Wilhelm (2003) highlighted its significance as a barometer for gauging market sentiment during the IPO process. In our study, we examine price revision as a reflection of market sentiment in the Nordic context. For a more detailed overview of the determination of price revision, see appendix section F.1.

Table 5.1: Regression output: Price Revision in Nordic Book-Built IPOs

The dependent variable in our regression models is "price revision", which is defined as the difference between the IPO's final offer price and the midpoint of the initial filing range. The "log_age" variable denotes the firm's maturity. "Underwriter ranking" provides a score indicating the reputation and capability of the underwriter. "Financial sponsor" signifies backing from PE or VC firms. The "Hot Market 2020-2022" variable represents the years 2020-2022, our broader defined hot issue period, while the "Hot Market 2021" focuses specifically on the year 2021. "Net Income Positive" is a dummy variable indicating if the firm had a positive net income. "Common Equity" depict the financial metrics of the issuing firms in million USD. "Proceeds USDm" indicates the amount a firm secured in its IPO. "Technology" identifies if the firm belongs to the technology sector. "Tech x Hot Market 20-22" and "Tech x Hot Market 21" are interaction terms capturing the effect of being a technology firm during the respective periods. We use ***, **, and * to denote significance at 1 percent, 5 percent, and 10 percent levels (two sided), respectively. For a general expression of the OLS regression model for cross-sectional data, see Appendix F.2.

	Dependent variable:					
	Price_Revision					
	(1)	(2)	(3)	(4)	(5)	(6)
log_age	-0.027**	-0.028**	-0.028**	-0.028**	-0.030**	-0.028**
	t = -2.381	t = -2.422	t = -2.386	t = -2.446	t = -2.634	t = -2.473
Underwriter ranking	0.009*	0.009**	0.009**	0.009**	0.009**	0.009**
	t = 1.984	t = 2.003	t = 2.039	t = 2.002	t = 2.152	t = 2.002
Financial sponsor	0.030	0.030	0.032	0.031	0.037	0.029
	t = 1.266	t = 1.253	t = 1.317	t = 1.316	t = 1.588	t = 1.241
Hot Market 2020-2022	-0.002	-0.00001	-0.0002	-0.0001	0.026	
	t = -0.080	t = -0.0005	t = -0.010	t = -0.006	t = 0.922	
Hot Market 2021						0.061
						t = 1.501
Net Income Positive		0.013	0.013	0.017	0.020	0.016
		t = 0.521	t = 0.528	t = 0.672	t = 0.798	t = 0.663
Common Equity USDm		0.00000	0.00001	0.00001	0.00001	0.00001
		t = 0.264	t = 0.471	t = 0.623	t = 0.737	t = 0.664
Proceeds USDm			-0.00001			
			t = -0.437			

Technology				0.046**	0.068***	0.051**
				t = 2.048	t = 2.638	t = 2.099
Tech x Hot Market 20-22					-0.086*	
					t = -1.680	
Tech x Hot Market 21						-0.059
						t = -0.939
Constant	0.011	0.001	-0.001	-0.016	-0.025	-0.021
	t = 0.279	t = 0.015	t = -0.026	t = -0.381	t = -0.572	t = -0.496
Observations	95	95	95	95	95	95
R2	0.094	0.098	0.100	0.139	0.167	0.161
Residual Std. Error	0.097	0.098	0.098	0.096	0.095	0.096
Degrees of Freedom	df = 90	df = 88	df = 87	df = 87	df = 86	df = 86

Note: *p<0.1; **p<0.05; ***p<0.01

5.1 Price Revision Analysis

Our regression analysis sheds light on the various determinants of price revision for Nordic IPOs during the sample period (2015-2022) and the defined hot issue market years.

The coefficient for the technology dummy indicates a positive relationship with price revision. This suggests that technology firms, on average, experienced an increase in price revision compared to non-technology firms during our sample period. However, the interaction term, Tech x Hot Market 20-22, reveals a significant negative relationship for the hot market years of 2020-2022, indicating a shift in market sentiment, moving from favoring technology companies to a more cautious approach. This change is further contextualized by the broader financial landscape in early 2021, where prospects of a tighter monetary policy emerged with the increase of treasury bond yields, followed by interest rate hikes in the autumn.

This economic pivot led to a reallocation in the overall stock market, rotating away from growth-oriented firms, to more value-based investments (Avalos & Todorov, 2022). This realignment, driven by rational investor responses to macroeconomic shifts, aligns with fundamental finance principles and could explain the observed cautious stance towards tech IPOs during this period. The trend towards caution in tech IPOs, evident in the 2020-2022 period, is also hinted at in the Tech x Hot Market 21 interaction term. Although not statistically significant, its negative coefficient aligns with the broader trend, suggesting a cautious stance during 2021 within the overall period, albeit less pronounced. Ritter's (1984; 1991) insights on 'hot issue' markets and overvaluation of young growth companies gain relevance here, underscoring the dynamic nature of investor sentiments and market trends in influencing IPO outcomes.

Our findings reveal a significant positive relationship between underwriter ranking and price revision. This suggests that firms with higher-ranked underwriters, typically, have higher price revision, leading to final offer prices that are further from the expected offer price. However, the interpretation of this positive coefficient must be considered in the context of the model's constant term. In cases where the constant term is negative, the positive effect of a higher underwriter ranking on price revision might be reduced, leading to smaller revisions.

There could be several possible explanations for such a relationship. One possibility is that top-tier underwriters, with their vast experience and network might adopt a more aggressive approach to pricing. This could be due to their confidence in accurately gauging the market demand or inherent quality of the firms they represent. Another interpretation could be that top-tier underwriters employ a more conservative initial pricing strategy, setting lower price ranges and leaving room for upward revisions. This cautious strategy might be a deliberate choice, allowing them to adjust based on market feedback during the book-building phase (Busaba, 2006). Finally, there may be a selection effect at play. Top-tier underwriters could be more likely to represent firms with robust fundamentals or high growth prospects, naturally leading to larger revisions as the market responds favorably to the quality of these firms.

This discussion of underwriter strategies and their implications also intersects with principal-agent theory considerations, as highlighted by Chen and Ritter (2000). The potential misalignment of incentives between underwriters (agents) and issuing firms (principals) necessitates careful monitoring of underwriters' marketing efforts and pricing behaviors. Continuing, this aligns with the notion that reputable underwriters can influence the IPO pricing and post-IPO performance, as they bring credibility and a rigorous screening process to the table (Beatty & Ritter, 1986). Supporting this, Hanley (1993) found that the extent of price revision during the book-building process is positively correlated with the underwriter's reputation, indicating their expertise in setting appropriate offer prices. Similarly, Chemmanur and Liu (2003) emphasized the crucial role of an underwriter's reputation in the price discovery process, suggesting that high-reputation underwriters are adept at gathering and interpreting private information about the issuing firm. These perspectives underscores the multifaceted role of underwriters in the IPO process and the significance of their reputation in shaping pricing decisions.

The negative coefficient associated with age, significant across all models, indicates that price revisions are more favorable the younger the firm. This suggests that older firms, with their established track records, might face less uncertainty during the IPO process, leading to smaller adjustments in their final offer prices. Hence, one potential explanation for such relationship could be that there, on average, are less available information regarding younger firms, increasing the importance of the book-building phase as a tool

for information extraction (Busaba, 2006). This could lead younger firms to have more conservative expected offer prices and subsequent upward adjusted price revisions. This relationship aligns with the observations made by Loughran and Ritter (2004), who noted the influence of firm maturity on investor perceptions and pricing decisions. Additionally, it is important to acknowledge a likely selection bias in our sample, which only includes successful offerings. This limitation means we cannot observe IPOs that did not materialize, possibly skewing our observations towards younger firms that received positive market feedback and proceeded with their IPOs.

Our findings for the years 2020-2022, which we define as the 'Hot Market' period, reveals that the relationship between this period and price revision in IPOs is not statistically significant. This observation remains consistent even when focusing specifically on the year 2021. These findings suggest that, despite the unique economic and volatilities associated with the pandemic, the 'Hot Market' period did not have significant impact on the price revision of IPOs in our study. This contrasts with the general expectations based on literature such as Ritter (1984), which discusses the influence of 'hot issue' markets in booming economic conditions.

The coefficient for financial sponsors is positive but not statistically significant at all conventional levels. This indicates that, in our sample, the presence of financial sponsors such as Private Equity or Venture Capital firms does not significantly influence price revision. While Kaplan and Strömberg (2003) have highlighted the positive impact of financial sponsors on firm value through strategic guidance and industry connections, our findings suggest that this influence may not extent to a significant effect on price revision in the Nordic IPO market during our sample period.

In our analysis, the 'Net Income Positive' dummy variable and 'Common Equity' in million USD do not show a consistent influence on price revision. Similarly, 'Proceeds' also exhibit limited impact on price revision, remaining statistically insignificant. This aligns with Ritter and Welch (2002), who suggest that financial metrics, while important, may not always be the primary determinants in IPO pricing.

In conclusion, our analysis offers a granular look into the determinants of price revisions in Nordic IPOs. The results underscore the multifaceted nature of IPO pricing, influenced by

firm-specific characteristics and market conditions. While our study is rooted in the Nordic context, it draws parallels with global pricing dynamics and resonates with influential works in the field, such as the insights provided by Ljungqvist and Wilhelm (2003).

6 Initial Returns and Underpricing in the Nordic IPO Market

From our descriptive analysis, we observed fluctuations in the initial returns over the sample period, with notably above-average returns especially in 2020. To better understand and examine the factors influencing the initial returns of IPOs, we conducted a comprehensive regression analysis spanning the entire sample period, from 2015 to 2022.

6.1 Measuring Underpricing

Consistent with existing literature, IPO underpricing is captured by the issue's initial return, often referred to as the first-day return. Both Ritter and Welch (2002) and Loughran and Ritter (2004) contend that previous research most frequently uses the closing price on the first trading day to determine the initial return. In line with this perspective, the initial return is articulated in the equation below. For firms, the initial return is derived from the offer price and the unadjusted historical closing price. This approach aligns with Beatty and Ritter (1986), who posit that adjusting the initial return for market fluctuations is redundant, given that such movements are minimal relative to the typical initial return.

$$IR_i = \frac{\text{ClosingPrice}_{i,1} - \text{OfferPrice}_{i,0}}{\text{OfferPrice}_{i,0}} \tag{6.1}$$

In table 6.1 below, we present the OLS estimates of seven models that differ based on the variables considered, while consistently controlling for a set of firm and deal characteristics. These models are designed to capture the nuances of initial returns during the specified period.

In our regression analysis, we look closer into the market dynamics of the 2020-2022 period, a time marked by significant economic shifts and heightened investor activity. Our focus will be within understanding the influence of these extraordinary years in terms of IPO activity, and look into industries we believe acted differently, or in particular gained from hot issue markets. This approach allows us to explore the nuances of IPO pricing during a period of exceptional high market activity, and by that emphasizing the underlying factors driving these dynamics.

To capture the prestige of underwriters, we have divided underwriters into four categories: 1st to 4th quartile. The quartiles are a unique way to categorize underwriters from prestigious to not prestigious, based on the ranking system introduced earlier. Further, we saw it valuable to investigate the nature of firms and deal characteristics that associate with either prestigious or less-established underwriters. To provide some clarity to this issue, we have conducted a regression analysis to investigate underwriter rankings and the variety of firm, deal, and market characteristics. Our findings offer some interesting insights on several important variables. For a full disclosure see appendix table C.2.

Furthermore, the variables Financial sponsor, Book-building, Proceeds USDm, and Technology provide insights into the role of backing/ownership of the firm, the method of IPO, the proceeds from the IPO, and the sector of the firm, respectively. In summary, the regression models aim to provide a thorough understanding of the factors influencing initial returns during the period 2015-2022, with a particular focus on the hot issue markets 2020-2022.

Table 6.1: Regression output: Initial Return

The dependent variable in all regressions in table 5 is the initial return (the first day closing price relative to the offer price). The log age variable is based on the age of each firm at the time of offering. Hot Market 2020-2022 is a dummy variable indicating the years of 2020-2022 as hot markets. Tech x Hot Market 20-22 is an interaction variable capturing tech firms' behaviour during this period. Moreover, Hot Market 2021 is a dummy variable for 2021. Net Income Positive is a dummy variable indicating firms with positive net income = 1, this also goes for EBIT Positive having a similar indication. "Financial sponsor" is set to 1 if the firm received backing from either VC or PE firms prior to the offering and 0 otherwise. The book-building variable indicates the IPO process: a value of 1 signifies a book-building process, while a value of 0 denotes a fixed price offering. Proceeds USDm: Continuous variable reflecting the impact of collected proceeds on first day returns. Price revision > 0: Dummy variable; 1 for firms with upward price revision during book-building, 0 otherwise. Technology: Dummy variable; 1 for firms in the tech sector, 0 otherwise. Underwriter Quartile 1-4: ranks underwriters in quartiles (1 = highest rank, 4 = lowest). For a general expression of the OLS regression model for cross-sectional data, see Appendix F.2.

	Dependent variable:						
	'initial return'						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log_age	0.007	0.013	−0.0004	0.003	0.003	−0.002	0.011
	t = 0.556	t = 0.824	t = −0.023	t = 0.148	t = 0.148	t = −0.130	t = 0.695
Hot Market 2020-2022	0.017	0.064*	0.052*				
	t = 0.575	t = 1.784	t = 1.671				
Tech x Hot Market 20-22				0.037	0.037		
				t = 0.608	t = 0.608		
Hot Market 2021						0.130**	
						t = 2.576	
EBIT Positive					0.119***		
					t = 2.726		
Net Income Positive			0.092***	0.072*		0.080**	
			t = 2.814	t = 1.769		t = 2.063	

'Financial sponsor'	0.038		0.019				
	t = 0.941		t = 0.443				
Book-building	−0.028						
	t = −0.891						
'Proceeds USDm'		0.00001					
		t = 0.357					
Price revision > 0		−0.126***		−0.144***	−0.144***	−0.119***	−0.147***
		t = −3.524		t = −4.123	t = −4.123	t = −3.428	t = −4.059
Technology		0.013					
		t = 0.348					
Underwriter Q1	0.019	0.016	0.005	0.023	0.023	0.038	0.035
	t = 0.690	t = 0.431	t = 0.169	t = 0.685	t = 0.685	t = 1.153	t = 0.597
Underwriter Q2							0.056
							t = 0.923
Underwriter Q3							−0.003
							t = −0.046
Underwriter Q4							0.065
							t = 0.767
Constant	0.079*	0.064	0.022	0.057	0.057	0.037	0.075
	t = 1.814	t = 1.120	t = 0.424	t = 0.981	t = 0.981	t = 0.673	t = 1.162
Observations	258	79	203	72	72	72	79
R^2	0.011	0.208	0.051	0.246	0.246	0.311	0.190
Residual Std. Error	0.216	0.144	0.217	0.139	0.139	0.133	0.145
Degrees of Freedom	df = 252	df = 72	df = 72	df = 197	df = 66	df = 66	df = 66

Note: *p<0.1; **p<0.05; ***p<0.01

6.2 Underpricing Analysis

As a starting point for the underpricing analysis, we investigate price revision and its effect on underpricing. The most striking result in our regressions is that upward price revision shows a negative relationship with initial returns, evident at the 1% significant level. The observed underpricing in our data set highlights the nuanced relationship between initial and final offer pricing. In table 3.4, we documented a stable development in magnitude and direction of price revisions, with above average price revision in 2020 and below average in 2021. As information is assimilated during the book-building phase, underwriters adjust the offer price to coincide with investor-, or market valuation. However, the persistence of underpricing suggests that valuations are often conservative. These results are particularly noteworthy as they diverge from the findings of Hanley (1993), highlighted in our literature review, who finds that IPOs with an upward price revision would yield higher initial returns.

Our analysis on price revision reveals a notable trend: in the IPO process, older firms tend to have less price revision compared to their younger counterparts. This pattern prompts a closer look at the role of underwriters. It hints that there might be a preference for younger firms, particularly in hot issue markets. However, it's important to consider that this could be influenced by other factors, such as systematic differences between younger and older companies or varying levels of available information.

In hot markets, the need and urgency to capitalize on a favorable market might lead to younger firms rushing to go public, and underwriters to urge younger firms to take advantage of the advantageous market conditions. Additionally, the hot market of 2021 leads to its activity dominating our sample, potentially causing our results to heavily reflect the market activity of that year. Consequently, our analysis may more accurately represent IPO dynamics of 2021 rather than a widespread bias towards younger firms. Despite that our data suggests such a relationship, we should interpret it with caution as we cannot rule a definite causal relationship. The interplay between market dynamics, firm age, and underwriter strategies is complex and warrants further investigation.

Additionally, the observed negative relationship between initial return and upward price revision prompts a closer examination of the costly information acquisition hypothesis. As

hypothesized by Benveniste and Spindt (1989), underpricing is viewed as a strategic choice by underwriters for eliciting investor feedback in the book-building phase. According to this hypothesis IPOs that receive positive feedback are expected to see a partial upward adjustment to positive investor sentiment. However, there is a possibility that this dynamic could shift in hot market conditions. High investor enthusiasm and heightened risk tolerance, might decrease the importance of this proposed dynamic. Instead, market optimism could lead underwriters to adjust prices closer to, or potentially beyond, a perceived maximum value, deviating from the typical pattern of partial adjustment, taking full advantage of the heightened sentiment. This possible explanation could explain the observed inverse relationship, highlighting how market sentiment might influence IPO pricing strategies and result in a deviation from conventional underpricing theories.

Changing perspective, another possible explanation for the negative relationship between initial returns and upward price revision might be rooted in the cascade hypothesis (Welch, 1992). From our literature review, the cascade hypothesis propose that partial upward price revision can be used as a tool to create a cascading effect in demand for the IPO, resulting in larger initial returns. Central to Welch's findings is the assumption that investors trust underwriters' pricing, believing that the price revision accurately reflect market valuations. However, this trust can be disrupted if underwriters are perceived as taking advantage of the investors. If the market views the final offer price as a result of opportunistic behavior by underwriters and issuers, this perception might lead to the negative relationship we find between initial returns and upward price revision. Our results could be an indication of such dynamics at play.

The year 2021 stands out in our analysis. We observe a strong correlation between the heightened IPO activity, termed as the "hot issue market", and the initial return of IPOs during this year. The coefficient is statistically significant at the 5% level, which confirms the findings of Ritter (1984; 1991) that hot markets and market sentiment have a significant impact on initial returns. Additionally, the "Hot Market 2020-2022" variable also yields significant findings, suggesting the same direction as the 2021 dummy, implying that the market sentiment was positive, also from 2020 throughout 2022.

We find that firms with positive net income prior to the offer tend to experience higher initial returns. The observation is contrary to Ritter and Welch (2002) who find that firms

with negative net income prior to offerings tend to yield higher initial returns. Our findings are further supported by the direction and statistical magnitude of the EBIT Positive dummy, underlining that firms with profitable operations (EBIT) tend to experience higher initial returns.

The divergence between our results and Ritter's findings could have several potential explanations. First, a newly published study by Pirayesh Neghab et al. (2023) identifies a recent investor shift towards valuing sustainable profitability over speculative high-growth potential. This trend, increasingly evident post-2002, suggests investors now favor firms with immediate profitability, potentially explaining the observed preference towards profitable firms in our sample. It is worth noting that in our analysis of price revision, while not statistically significant, we observe a similar trend where firms with positive net income tend to have an upward price revision, aligning with this investor preference.

Additionally, another perspective could be linked to our sample's characteristics and the observed shift in investor preference in early 2021 (Avalos & Todorov, 2022). Given that our sample exhibits a substantial temporal skew towards 2021, this shift might influence our overall findings. The market reallocation from growth to value stocks during this time, which further aligns with the observed decreasing preference towards technology firms in our price revision regression, could thus significantly affect the entire sample's output, creating a perception of a broader trend favoring profitable firms.

Other factors not captured in our models, such as distinctive investor behavior and market dynamics in the Nordic region, could also influence our findings. These may include differences in risk tolerance, economic conditions, and regulatory framework unique to the region. Since our analysis does not specifically investigate these regional factors, it suggests a need for further research to understand their impact on IPO outcomes.

We observed that underwriters' influence goes beyond the initial aspects of IPO pricing, particularly when price revision. However, their influence on initial returns is somewhat more complex, making their direct impact less obvious. This complex role can be better understood through examining two aspects: the information leverage underwriters possess, and the certification benefits they provide. Our findings resonate with those of Benveniste and Spindt (1989), who noted that more active and renowned banks have greater leverage in gathering information from investors, leading to more substantial revisions in proceeds.

In our regression, this was evidenced by the correlation between underwriter prestige and the extent of price revisions, underscoring the nuanced yet significant role of underwriters in the IPO process. To further address this dynamic in our study, we aim to categorize underwriters into four quartiles based on their participation ratio, Underwriter quartile 1 representing the top quartile of underwriters (those with the highest participation ratio) and underwriter quartile 4 representing the bottom quartile (those with the lowest participation ratio during the period). We utilize the categorization by examining the varying impacts of underwriters with different levels of market influence and deal flow on IPO pricing in the Nordics.

Our analysis suggests no direct effect between the prestige of underwriters leading an IPO process and the initial returns of IPOs. This contrasts Loughran and Ritter (2002), who find a negative and significant relation between underwriter prestige and underpricing. This discrepancy could potentially stem from biases in our coefficients, possibly arising from limited variation in our measure of underwriter quality. This suggests that while underwriter prestige may play a role in influencing the IPO outcomes, its impact in our data set is not as pronounced or straightforward as one might expect based on previous literature. Interacting the 'underwriter quartile 1' with the 'Hot issue 2021' dummy variable, we indeed find a positive and significant relation in 2021 (regression to be found in the appendix). However, it could be that underwriter choice is exogenous. This is further examined in the robustness test and IV regression (see appendix E.2).

Previous studies have found that firm maturity in terms of its age has been a clear indicator of initial return. The insights offered by Loughran and Ritter (2004) indicated that there was a negative relationship between the age of firms and the initial day return. Our finding contrasts with these insights. We observed that while the age of a company influences price revision, this effect does not seem to extend to initial returns. One might infer that age-related factors influencing price revision may already be adequately reflected in the final offer price, thereby neutralizing their impact on initial returns.

However, it is crucial to recognize the role of age as a key control variable in our models. Its inclusion ensures a strengthened analysis by accounting for the potential influence of firm maturity on IPO performance. The lack of significance in our findings underscores the complexity of these relationships and highlights the need for further exploration in

varying market contexts.

When investigating IPO pricing strategies, as delineated by 'Book-building', we observed a tendency that, while not reaching statistical significant, warrants further consideration. Specifically, IPOs that employ a book-building process prior to the IPO tend to have lower underpricing than those opting for a fixed price offering. However, given the lack of statistical significance, this observation should be interpreted with caution. Our results raises questions and highlight the potential for different pricing strategies to influence IPO outcomes, particularly in varying market contexts, suggesting areas for future research.

In our analysis of IPO initial returns across the Nordic countries, as detailed in table C.1 in the appendix, both Norway and Denmark stand out in terms of magnitude and direction. After accounting for various factors, we observe that IPOs in Denmark typically sees underpricing, with this trend being statistically significant at the 5% level. Conversely, the model suggests that Norwegian IPOs lean towards a slight overpricing, although this trend is significant at a less robust 10% level. As elaborated in the literature review, there is nothing new that initial returns tend to fluctuate across countries. Historically, Denmark has shown lower initial returns compared to Norway, a trend that aligns with the observed variations across different issues and samples.

7 Robustness test

7.1 Reverse Causality and Endogeneity Considerations

In our analysis, we have interpreted underwriter ranking as a potential determinant of both price revision and initial returns. The underlying assumption in our primary regression models was that underwriter ranking is exogenous with respect to the dependent variables. However, the relationship between firms and their chosen underwriter is complex and multifaceted, leading to potential endogeneity concerns. Given the strategic choices firms make when selecting underwriters, there is an implication that the 'Underwriter ranking' might be endogenous to expected price revision and initial returns, consequently, to realized price revision and initial returns.

The Strategic Choice of Underwriters: As firms prepare for an IPO, they make pivotal decisions that can significantly influence the success of their public offering. Central to these decisions is the selection of an underwriter. This choice is not just about the underwriter's reputation or past performance; it's also deeply intertwined with the firm's expectations and perceptions about how the market might react to their IPO.

A firm's anticipation about the market's reaction, which encompasses both potential price revisions and initial returns, can profoundly influence its underwriter selection. For instance, a firm that believe its IPO will be met with strong market enthusiasm might opt for a specific underwriter that aligns with that sentiment, whether it's a top-tier underwriter to capitalize on the positive momentum or a lower-ranked one to manage costs. Conversely, a firm that is uncertain or pessimistic about the market's reaction might choose an underwriter that they believe can best navigate these challenges, regardless of their rank.

This strategic behaviour underscores the potential for reverse causality in our analysis; It's not just the underwriter's ranking that might influence price revisions and initial returns. The firm's expectations about these metrics could also shape their choice of underwriter. This dynamic, as noted by Ritter (1998), underscores the intricate interplay between expectations, strategic decisions, and actual outcomes, reflecting the complexity of the IPO process and the myriad factors firms must consider.

Implications of Endogeneity: If the above strategic behaviour holds true, then treating underwriter ranking as exogenous could lead to biased and inconsistent estimates. The endogeneity could arise if the error term in our regression, which captures unobserved factors affecting price revision, is correlated with underwriter ranking. This correlation would violate one of the key assumptions of the OLS regression, leading to potential estimation biases (Wooldridge, 2016).

Price revision: To robustly address this endogeneity concern for price revision, we employed the Durbin-Wu-Hausman (DWH) test, selecting 'Ranking (Volume)' as an instrument. This ranking, reflecting the yearly total volume of proceeds from IPOs managed by the underwriters historically up to, but not including, the issue date of each IPO in our data set, serves as a proxy for the 'Underwriter ranking', which considers yearly total number of IPOs managed by the underwriter. This approach ensures that our analysis incorporates only information available to the market before each IPO, thus accurately reflecting the underwriter's reputation and experience at that time. The selection of this instrument is grounded in the relevance of underwriters' experience, gauged by the total volume of proceeds raised, to our original variable. Importantly, while this instrument is correlated with 'Underwriter ranking', we carefully ensured that this correlation is not too strong to avoid over-identification issues, thereby maintaining the balance between instrument relevance and validity in our analysis (Beatty & Ritter, 1986).

Our first-stage regression results confirmed the relevance of our chosen instrument (see table E.1 in the Appendix). The F-statistic was 15.69, underscoring the strength of our instrument. The coefficient for 'Ranking (Volume)' was approximately 0.64 with a t-value of 7.72, indicating a robust relationship. Furthermore, the instrument was not found to be correlated with the residuals of the price revision regression, indicating its validity. The non-significant DWH test statistic suggests that our OLS estimates, which treat 'Underwriter ranking' as exogenous, appear to be consistent. In the IV regression, the coefficient for 'Underwriter ranking' was approximately 0.002 with a t-value of 0.265. This suggests that, when using the instrument for 'Underwriter ranking', the variable does not have a significant impact on the dependent variable. However, given that the results of the DWH test do not indicate endogeneity, our primary reliance remains on the OLS estimates.

Initial returns: To address potential endogeneity concerns related to initial returns, we again turned to the Durbin-Wu-Hausman (DWH) test. In this context, we again chose the underwriter ranking based on volume of proceeds raised as our instrument. This choice is predicated on the assumption that the volume of proceeds, reflecting the market activity and reputation of underwriters, is likely to influence the ranking used in the initial return regression, which was derived from the numbers of IPOs managed by each underwriter. However, it is important to clarify that while this instrument is correlated with the underwriter ranking, it is not directly related to initial returns. This distinction is crucial to avoid over-identification issues and to ensure the instrument's validity.

The first-stage regression of initial returns confirmed the relevance of our chosen instrument, yielding an F-statistic of 36.973 (see table E.2 in the appendix). The volume-based underwriter ranking coefficient was significant at the 1 percent level, with an estimated value of -0.565 and a t-value of 11.5, indicating a robust relationship. Moreover, the instrument was not found to be correlated with the residuals of the initial return regression, which again confirms its validity. The DWH test yielded a statistic of 1.03 with a p-value of 0.3, which does not provide evidence of endogeneity. Therefore, the OLS estimates are deemed consistent and efficient for our analysis of initial returns. Consequently, we continue to rely on the OLS estimates for interpreting the relationship between underwriter ranking and initial returns.

7.2 Assessing Temporal Robustness

To address the potential implications of our sample's temporal skew, we conduct a robustness test by re-evaluating our regression models within a modified time frame of 2015-2020. This approach seeks to exclude the influence of the heightened IPO activity in 2021, to check if our findings are reflective broader market trends rather than specific anomalies of a singular year. This re-evaluating serves to validate or reject the consistency of our initial results, strengthening our discussion. See appendix for revised price revision and initial return regressions for 2015-2020, respectively E.3 and E.4.

Our initial regression analysis on price revision exhibited a significant negative relationship with the age of firms. Restricting our models to the years 2015-2020, this relationship remains consistent, suggesting that this relationship is a general trend in our sample, and

is not attributed to market conditions of 2021. This highlights the possibility of systematic differences or varying levels of available information between younger and older firms. Despite the consistency in our findings, it is still crucial to consider the potential selection bias, as our sample only include successful IPOs. This selection bias could potentially influence the generalizability of our results, as it might overemphasize the the trend in younger firms, which received positive feedback and successfully completed their IPOs, compared to the broader spectrum of firms in the IPO market.

In our revised initial return regression analysis for 2015-2020, the trend of firms with positive net income achieving higher initial returns continues, contradicting the recognized findings of Ritter and Welch (2002). This persistent pattern in our data suggests that it represents a more general trend in the Nordic IPO market, rather than an anomaly specific to 2021. This trend's alignment with the findings of the recent study of Pirayesh Neghab et al. (2023), further highlights a shift in investor preference towards profitability.

Our robustness test results from 2015-2020 validate the trends observed in our initial analysis, suggesting these are not unique to 2021. This supports the idea of broader market patterns in the Nordic IPO market, particularly regarding age and positive net income influencing IPO outcomes. These findings reinforce the need for a comprehensive understanding of IPO dynamics across different time periods.

7.3 Identification

Our regression models assume that the effects of each variable can be separately identified. This is crucial to ensure that the relationship we observe between variables are not merely reflections of other underlying factors or capturing the same underlying phenomenon.

Each variable in our models captures a unique aspect of the IPO process. For instance, the age of a firm often serves as a proxy for its maturity and experience. In contrast, the underwriter ranking provides insights into the reputation and capability of the underwriter. The presence of a financial sponsor can signal confidence in the company's potential. Variables like Hot Market 2020-2022 and Hot Market 2021 capture unique market dynamics during the specified periods, reflecting potential shifts in investor sentiment and market conditions.

The Nordic IPOs in our sample exhibit considerable cross-sectional variation across the years. This variation, evident from diverse patterns observed in the firm age, revenue, equity, and other characteristics from 2015-2022, underscores the heterogeneity of firms and IPO deals in the Nordic region during the sample period. Such cross-sectional variation is essential for robust regression analysis as it ensures that the relationships observed are not driven by a few outliers or specific years but are representative of the broader sample (Wooldridge, 2016).

While these variables capture distinct phenomena, it's essential to address potential multicollinearity concerns. Multicollinearity arises when two or more independent variables in a regression model are highly correlated, making it challenging to isolate the individual effect of each variable (O'brien, 2007). A common metric to detect multicollinearity is the Variance Inflation Factor (VIF). Typically, a VIF value greater than 10 indicates high multicollinearity (Hair et al., 2010).

In our models, the VIF values for all variables are well below this threshold. For instance, the highest observed VIF value occurs in model 6 of our price revision regression at approximately 2,08 for the interaction term 'Tech x Hot Market 21'. Such values suggest that multicollinearity is not a significant concern in our regression analyses, reinforcing our confidence in the distinct effects of the variables.

7.4 Omitted Variable Bias

When analysing the dynamics of the Nordic IPO market, it is crucial to consider the potential impact of omitted variable bias. A key element in this regard is the overarching influence of the financial market. The market's conditions, such as liquidity, investor sentiment, and risk tolerance, can significantly shape the IPO dynamics. For instance, during periods of market optimism and high liquidity, there might be a greater appetite for IPOs, potentially leading to more aggressive pricing and higher initial returns. Conversely, in times of market uncertainty or downturns, the demand for IPOs may wane, affecting their pricing and performance in a different manner.

Furthermore, broader economic factors, including interest rates, inflation rates, and overall economic growth, also play a crucial role. These elements can influence investor sentiment and their willingness to engage with new stock offerings. For example, in a booming

economy with low-interest rates, investors might be more inclined to invest in IPOs leading to different pricing dynamics compared to a scenario of economic slowdown or high inflation.

While our thesis aims at capturing the effect of so-called "hot issue markets" through the periods of 2020 - 2022, the analysis could indeed benefit from a more in-depth analysis on specific time periods within the hot-market period, thereby being able to more closely examine the variety in the above-mentioned economic factors such as interest rates, inflation and general monetary policy. Also, looking closer towards the behaviour in the coherent financial markets in which the IPO's are being placed, such as intra-day returns together with the initial returns could explain more of the variation within initial return.

Additionally, the performance and prospects of specific industries could also play a pivotal role. For example, if the tech industry is experiencing rapid growth and innovation, tech IPOs might see different pricing dynamics compared to IPOs from more stable, mature industries. Industry-specific shocks or breakthroughs, such as major technological advancements or regulatory changes, could also influence the dynamics and might not be captured in our current models.

An important aspect that our current model potentially omits is the influence of market volatility, as indicated by the VIX in section 4. The relationship between VIX levels and the underpricing of IPOs could be a critical factor in understanding market dynamics. A high VIX might correlate with higher underpricing, as firms and underwriters react to heightened market uncertainty. This aspect of market volatility, if not accounted for, could lead to omitted variable bias in our regression models, affecting the robustness and interpretability of our results.

Moving from broader market considerations, it is crucial to examine potential omissions of firm-specific factors. For instance, consider the possibility that firms going public in recent years, especially during the hot issue period, had different capital structures or financial health compared to those in previous years. This could potentially explain why certain firms, especially those in the tech sector, exhibited distinct price revision patterns during these periods. However, our regression results suggest that while some financial metrics, such as 'Net Income' or 'Common Equity', might hint at a firm's reliance on external financing or its financial health, their influence on the pricing dynamics isn't

strongly evident. Nonetheless, firms with these financial nuances, especially those seeking funds primarily for operational expenses, could present valuation challenges, potentially leading to larger price adjustments and pronounced underpricing.

Additionally, it's essential to capture the broader nature and characteristics of the firms going public. Our models incorporate variables like age and tech sector classification, aiming to account for the firm's age and industry. Yet, they might not encompass all facets of a firm's profile. The 'Underwriter ranking' consistently shows a relationship with price revision, suggesting its potential relevance in the IPO dynamics. However, variables like 'Financial sponsor', despite their theoretical importance, do not consistently exhibit significant relationships in our models. This indicates the need for ongoing refinement of our models to better capture the complexities of IPO pricing and performance.

In essence, our analysis provides insights into the dynamics of the Nordic IPO market, but the potential for omitted variable bias underscores the need for a comprehensive understanding. Unobserved factors, be they related to firm-specific characteristics, market conditions, or intermediary strategies, could be influencing the observed relationships. This serves as a reminder of the intricate nature of IPO dynamics and the importance of continuous exploration in this domain.

8 Limitations and Future Research

Our research into underpricing in the Nordics during the COVID-19 era, has provided valuable insights. Nevertheless, recognizing the limitations we encountered, primarily due to data availability, is crucial to understand the potential implications these constraints might have on our findings.

One of the most significant challenges was the restricted access to comprehensive data. While our study provides a snapshot of the underpricing phenomenon in the Nordics, it might not capture the full complexity of the issue. For instance, research in more mature markets, such as the study by Ljungqvist and Wilhelm (2003) on IPO pricing during the dot-com bubble, had the advantage of accessing a richer data set that encompasses a broader range of variables, including intricate details about ownership structures and insider sales. This depth of data allows for a more nuanced understanding of underpricing, often resulting in regression models with higher explanatory power. In contrast, our research, constrained by the data available for the Nordic region, might miss out on some of these nuances.

The modest R^2 values across our regression analyses suggests that there are no – or little – systematic determinants affecting IPO underpricing in the Nordic markets, or it might suggest that there are no systematic determinants at play. While our findings contribute valuable insights into the dynamics within the IPO market, it does not fully capture the nature of the variability in underpricing.

Our research was intentionally designed to examine the underpricing phenomenon in the Nordics, recognizing the unique economic, cultural, and regulatory landscape of this region. While our findings are tailored to the Nordic context, extrapolating them to other regions may not account for potential regional differences. Furthermore, the unprecedented nature of the COVID-19 pandemic and its multifaceted impact on global economies might introduce external factors that our study are unable to account for. These factors could have influenced IPO behaviours in ways that are yet to be fully understood.

For future research, we recommend efforts to obtain more comprehensive data sets that encompass a wider range of variables. Access to more granular data, such as ownership structures and insider sales, could significantly enhance the explanatory power of the

models. A comparative analysis with other similar-sized markets could provide additional insights into regional differences in underpricing. Additionally, a longer-term study, beyond the constraints of a master's thesis, might provide a more comprehensive understanding of underpricing trends and their determinants. In-depth analyses of market condititions and their variablity would likely provide a more nuanced insight into the IPO pricing dynamics.

In conclusion, while our research sheds light on underpricing in the Nordics during a unique period, it also underscores the need for continued exploration of this area. We hope our findings and recommendations pave the way for more in-depth studies in the future.

9 Conclusion

This thesis investigates the initial returns and pricing dynamics of IPOs in the Nordic countries from 2015 to 2022, uncovering various significant variables through our OLS regression analyses. While these findings, particularly those diverging from prior research, provide surprising and intricate insights, our goal is not to draw definitive conclusions. Instead, we aim to facilitate for further research and discussion into these topics.

As we conclude our exploration into the Nordic IPO market from 2015 to 2022, we revisit our initial research question:

"How were the characteristics of initial returns and pricing dynamics of IPOs in the Nordic region influenced by the market conditions during the COVID-19 pandemic and the associated hot issue market?"

Our analysis of 570 IPOs during the period has revealed and discussed several influencing aspects regarding initial returns and pricing dynamics within the period, that answers our research question.

Our regression analysis presents a notable departure from Hanley's (1993) findings, as we observed a negative correlation between price revisions and initial returns. This challenges the established norms, such as the Costly Information Acquisition Hypothesis, and prompts a reevaluation of the strategic roles played by underwriters in shaping market outcomes. Over the entire period, our sample indicated that younger firms exhibited more upward price revision, and, in general, price revision was higher for those tech-related firms. However, our finding of lower price revision among technology firms during 'hot issue' markets, which highlights how investor preferences can evolve in economic cycles. Also, through our regression models, we experienced higher-on-average initial returns during the hot issue markets, after controlling for firm and deal specific factors.

Our study extends beyond the mechanics of IPOs to question the reasons behind these emerging patterns. Why do certain trends arise during these high-activity periods, and what drives the shifts in investor preferences? These questions push us to explore not only the economic impact but also the broader societal implications of our findings.

While our research is anchored in the Nordic context, its implications resonate on a global scale. The insights we offer contribute with additional knowledge of IPO behaviours during hot issue markets, providing valuable perspectives for both practitioners and academics. Our findings illustrate how regional markets, while unique in their characteristics, can coincide or diverge from previous, global empirical findings. Specifically, our detailed examination uncovers a counter intuitive pattern during the book-building phase: IPOs undergoing upward price revisions frequently saw lower initial returns, a finding that challenges the Cascade Hypothesis, which posits that partial upward adjustments in price revisions should trigger increased demand. This difference points to many opportunities for future research, which could delve into the transactional nuances to unravel the complexities behind this departure from established expectations.

In summing up this thesis, we view our findings as a base for future research within the topic. The dynamics of IPO pricing, and the roles of central figures like underwriters and investors in the Nordic IPO context present rich avenues for further academic research. Our research adds to the discussion on IPO underpricing, particularly within the unique time frame and region we've studied. By providing clarity and posing new questions, we aim to inspire deeper explorations into the ever-evolving IPO landscape, as well as knowledge for future, similar market trends.

References

Allen, F., & Faulhaber, G. R. (1989). Signalling by underpricing in the IPO market. *Journal of Financial Economics*, *23*(2), 303–323. https://doi.org/10.1016/0304-405X(89)90060-3

Amihud, Y., & Mendelson, H. (2000). THE LIQUIDITY ROUTE TO A LOWER COST OF CAPITAL. *Journal of Applied Corporate Finance*, *12*(4), 8–25. https://doi.org/10.1111/j.1745-6622.2000.tb00016.x

Avalos, F., & Todorov, K. (2022, February). Rotation from growth to value stocks and its implications. Retrieved December 1, 2023, from https://www.bis.org/publ/qtrpdf/r_qt2203x.htm

Baron, D. P. (1982). A Model of the Demand for Investment Banking Advising and Distribution Services for New Issues. *The Journal of Finance*, *37*(4), 955–976. https://doi.org/10.1111/j.1540-6261.1982.tb03591.x

Beatty, R. P., & Ritter, J. R. (1986). Investment banking, reputation, and the underpricing of initial public offerings. *Journal of Financial Economics*, *15*(1-2), 213–232. https://doi.org/10.1016/0304-405X(86)90055-3

Benveniste, L. M., & Spindt, P. A. (1989). How investment bankers determine the offer price and allocation of new issues. *Journal of Financial Economics*, *24*(2), 343–361. https://doi.org/10.1016/0304-405X(89)90051-2

Berk, J. B., & DeMarzo, P. M. (2020). *Corporate finance* (Fifth edition, global edition). Pearson.

Busaba, W. Y. (2006). Bookbuilding, the option to withdraw, and the timing of IPOs. *Journal of Corporate Finance*, *12*(2), 159–186. https://doi.org/10.1016/j.jcorpfin.2004.12.003

Carter, R., & Manaster, S. (1990). Initial Public Offerings and Underwriter Reputation. *The Journal of Finance*, *45*(4), 1045–1067. https://doi.org/10.1111/j.1540-6261.1990.tb02426.x

Chemmanur, T. J., & Liu, M. H. (2003). How Should a Firm Go Public? A Dynamic Model of the Choice Between Fixed-Price Offerings and Auctions in IPOs and Privatizations. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.423860

Chen, H.-C., & Ritter, J. R. (2000). The Seven Percent Solution. *The Journal of Finance*, *55*(3), 1105–1131. https://doi.org/10.1111/0022-1082.00242

Choe, H., Masulis, R. W., & Nanda, V. (1993). Common stock offerings across the business cycle. *Journal of Empirical Finance*, *1*(1), 3–31. https://doi.org/10.1016/0927-5398(93)90003-A

Cunningham, S. R. (1993). The relationship of opportunity cost to the interest elasticity of money demand. *Eastern Economic Journal*, *19*(3), 309–319. Retrieved December 12, 2023, from http://www.jstor.org/stable/40325855

Derrien, F. (2005). IPO Pricing in "Hot" Market Conditions: Who Leaves Money on the Table? *The Journal of Finance*, *60*(1), 487–521. https://doi.org/10.1111/j.1540-6261.2005.00736.x

Eisenhardt, K. M. (1989). Agency Theory: An Assessment and Review. *The Academy of Management Review*, *14*(1), 57. https://doi.org/10.2307/258191

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance*, *25*(2), 383–417. Retrieved December 7, 2023, from http://www.jstor.org/stable/2325486

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, *33*(1), 3–56. https://doi.org/10.1016/0304-405X(93)90023-5

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, *116*(1), 1–22. https://doi.org/10.1016/j.jfineco.2014.10.010

Garfinkel, J. A. (1993). IPO Underpricing, Insider Selling and Subsequent Equity Offerings: Is Underpricing a Signal of Quality? *Financial Management*, *22*(1), 74. https://doi.org/10.2307/3665967

Gompers, P. A. (1996). Grandstanding in the venture capital industry. *Journal of Financial Economics*, *42*(1), 133–156. https://doi.org/10.1016/0304-405X(96)00874-4

Grinblatt, M., & Hwang, C. Y. (1989). Signalling and the Pricing of New Issues. *The Journal of Finance*, *44*(2), 393–420. https://doi.org/10.1111/j.1540-6261.1989.tb05063.x

Hair, J. F., Black, W. C., & Babin, B. J. (Eds.). (2010). *Multivariate data analysis: A global perspective* (7. ed., global ed). Pearson.

Hanley, K. W. (1993). The underpricing of initial public offerings and the partial adjustment phenomenon. *Journal of Financial Economics*, *34*(2), 231–250. https://doi.org/10.1016/0304-405X(93)90019-8

Haugland, K., Grytten, O. H., & Sveen, T. (2021, March). Norges Bank Watch 2021. https://www.bi.no/globalassets/forskning/centre-for-monetary-economics/nbw/210503-nbw-2021.pdf

Ibbotson, R. G., & Jaffe, J. F. (1975). "Hot Issue" Markets. *The Journal of Finance*, *30*(4), 1027. https://doi.org/10.2307/2326721

Ibbotson, R. G., & Ritter, J. R. (1995). Chapter 30 Initial public offerings. In *Handbooks in Operations Research and Management Science* (pp. 993–1016, Vol. 9). Elsevier. https://doi.org/10.1016/S0927-0507(05)80074-X

Jegadeesh, N., Weinstein, M., & Welch, I. (1993). An empirical investigation of IPO returns and subsequent equity offerings. *Journal of Financial Economics*, *34*(2), 153–175. https://doi.org/10.1016/0304-405X(93)90016-5

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

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*(2), 263–291. Retrieved December 7, 2023, from http://www.jstor.org/stable/1914185

Kaplan, S. N., & Strömberg, P. (2003). Financial Contracting Theory Meets the Real World: An Empirical Analysis of Venture Capital Contracts [Publisher: [Oxford University Press, Review of Economic Studies, Ltd.]]. *The Review of Economic Studies*, *70*(2), 281–315. Retrieved November 16, 2023, from http://www.jstor.org/stable/3648635

Knudsen, E. S., & Lien, L. B. (2014, September). Investments in Recessions. In B. Villalonga (Ed.), *Advances in Strategic Management* (pp. 3–36, Vol. 31). Emerald Group Publishing Limited. https://doi.org/10.1108/S0742-332220140000031001

Ljungqvist, A., Nanda, V., & Singh, R. (2006). Hot Markets, Investor Sentiment, and IPO Pricing*. *The Journal of Business*, *79*(4), 1667–1702. https://doi.org/10.1086/503644

Ljungqvist, A., & Wilhelm, W. J. (2003). IPO Pricing in the Dot-Com Bubble [Publisher: [American Finance Association, Wiley]]. *The Journal of Finance*, *58*(2), 723–752. Retrieved November 16, 2023, from http://www.jstor.org/stable/3094556

Logue, D. E., Rogalski, R. J., Seward, J. K., & Foster-Johnson, L. (2002). What Is Special about the Roles of Underwriter Reputation and Market Activities in Initial Public Offerings? *The Journal of Business*, *75*(2), 213–243. https://doi.org/10.1086/338702

Loughran, T., & Ritter, J. (2004). Why Has IPO Underpricing Changed over Time? [Publisher: [Financial Management Association International, Wiley]]. *Financial Management*, *33*(3), 5–37.

Loughran, T., & Ritter, J. R. (1995). The New Issues Puzzle. *The Journal of Finance*, *50*(1), 23–51. https://doi.org/10.1111/j.1540-6261.1995.tb05166.x

Loughran, T., & Ritter, J. R. (2002). Why Don't Issuers Get Upset about Leaving Money on the Table in IPOs? [Publisher: [Oxford University Press, Society for Financial Studies]]. *The Review of Financial Studies*, *15*(2), 413–443. Retrieved November 16, 2023, from http://www.jstor.org/stable/2696783

Loughran, T., Ritter, J. R., & Rydqvist, K. (1994). Initial public offerings: International insights. *Pacific-Basin Finance Journal*, *2*(2-3), 165–199. https://doi.org/10.1016/0927-538X(94)90016-7

Lucas, D. J., & McDonald, R. L. (1990). Equity Issues and Stock Price Dynamics. *The Journal of Finance*, *45*(4), 1019–1043. https://doi.org/10.1111/j.1540-6261.1990.tb02425.x

Martin, W. (2009). Socially responsible investing: Is your fiduciary duty at risk? *Journal of Business Ethics*, *90*(4), 549–560. Retrieved December 7, 2023, from http://www.jstor.org/stable/27735265

Michaely, R., & Shaw, W. H. (1994). The Pricing of Initial Public Offerings: Tests of Adverse-Selection and Signaling Theories [Publisher: [Oxford University Press, Society for Financial Studies]]. *The Review of Financial Studies*, *7*(2), 279–319. Retrieved November 16, 2023, from http://www.jstor.org/stable/2962357

Moreira, A., & Muir, T. (2017). Volatility-Managed Portfolios. *The Journal of Finance*, *72*(4), 1611–1644. https://doi.org/10.1111/jofi.12513

Myers, S. C. (1984). The Capital Structure Puzzle. *The Journal of Finance*, *39*(3), 574–592. https://doi.org/10.1111/j.1540-6261.1984.tb03646.x

O'brien, R. M. (2007). A Caution Regarding Rules of Thumb for Variance Inflation Factors. *Quality & Quantity*, *41*(5), 673–690. https://doi.org/10.1007/s11135-006-9018-6

Olson, R. (2003). *Investing in pension funds endowments*. McGraw Hill.

Pirayesh Neghab, D., Bradrania, R., & Elliott, R. (2023). Deliberate premarket underpricing: New evidence on IPO pricing using machine learning. *International Review of Economics & Finance*, *88*, 902–927. https://doi.org/10.1016/j.iref.2023.07.008

Ritter, J. (1998). Initial public offerings. *Contemporary Finance Digest*, *2*, 5–30.

Ritter, J. R. (1984). The "Hot Issue" Market of 1980. *The Journal of Business*, *57*(2), 215. https://doi.org/10.1086/296260

Ritter, J. R. (1991). The Long-Run Performance of initial Public Offerings. *The Journal of Finance*, *46*(1), 3–27. https://doi.org/10.1111/j.1540-6261.1991.tb03743.x

Ritter, J. R. (2023, October). Graph of average underpricing around the world. https://site.warrington.ufl.edu/ritter/files/IPOs-International-underpricing.pdf

Ritter, J. R., & Welch, I. (2002). A Review of IPO Activity, Pricing, and Allocations [Publisher: [American Finance Association, Wiley]]. *The Journal of Finance*, *57*(4), 1795–1828. Retrieved November 16, 2023, from http://www.jstor.org/stable/3094524

Rock, K. (1986). Why new issues are underpriced. *Journal of Financial Economics*, *15*(1-2), 187–212. https://doi.org/10.1016/0304-405X(86)90054-1

Santos, F. (2017). IPO market timing with uncertain aftermarket retail demand. *Journal of Corporate Finance*, *42*, 247–266. https://doi.org/10.1016/j.jcorpfin.2016.11.013

Shiller, R. J. (1990). Speculative Prices and Popular Models [Publisher: American Economic Association]. *The Journal of Economic Perspectives*, *4*(2), 55–65. Retrieved November 16, 2023, from http://www.jstor.org/stable/1942890

Shiller, R. J. (2015). *Irrational exuberance* (3. ed., rev. and expanded). Princeton Univ. Press.

Subrahmanyam, A., & Titman, S. (1999). The Going-Public Decision and the Development of Financial Markets. *The Journal of Finance*, *54*(3), 1045–1082. https://doi.org/10.1111/0022-1082.00136

Welch, I. (1989). Seasoned Offerings, Imitation Costs, and the Underpricing of Initial Public Offerings. *The Journal of Finance*, *44*(2), 421–449. Retrieved November 16, 2023, from https://onlinelibrary.wiley.com/doi/10.1111/j.1540-6261.1989.tb05064.x

Welch, I. (1992). Sequential Sales, Learning, and Cascades. *The Journal of Finance*, *47*(2), 695–732. https://doi.org/10.1111/j.1540-6261.1992.tb04406.x

Wooldridge, J. M. (2016). *Introductory econometrics: A modern approach* (Sixth edition, student edition). Cengage Learning.

Zeidan, A. (2023, December). Nordic countries | Region, Number, Meaning, & vs Scandinavian | Britannica. Retrieved December 16, 2023, from https://www.britannica.com/place/Nordic-countries

Appendices

A Timeline - From Decision to Go Public to Completed Issue

Below, we present a timeline that, in our view, delineates the typical stages of an IPO process. In our dataset, we observed that the average time taken from officially filing for an IPO to the actual issue date, or the "IPO launch" as we describe it below, is approximately 62 days.

Figure A.1: The IPO process

Initial discussions: The journey to going public begins with strategic deliberations, where a company decides to enter the public market to tap into a broader capital base. This phase often involves intensive consultations with financial advisors to assess the market conditions, company valuation, and the feaasibility of an IPO.

Preparation of Documents: A critical phase where the company, along with its legal and financial teams, drafts the prosepctus. Concurrent financial audtis are conducted to ensure the accuraccy of the financial information presented.

Filing with Financial Authorities: The company submits the required documents, including the prospectus and financial statemtns, to the relevant financial authorities.

Regulatory Review: The financial authority rigorously examines the IPO filing to verify compliance with regulatory standards. This review process is aimed at protecting investors by ensuring that all material information has been disclosed

Investor roadshow: The company's executive team, alongside underwriters, embarks on a roadshow to present their value proposition to institutional investors and analysts in various locations. This stage is crucial for drumming up interest and gauging the investment community's

Pricing the IPO: Based on the feedback from the roadshow and current market conditions, the offer price per share is finalized. This price is set to balance maximizing funds raised for the compaany and providing an attractive entry point for investors.

IPO launch: The company's shares ar eoffered to the public on a stock exchange. This is the culmination of the IPO process, where the shares are purchased by investors, and the company officially transitions to a publicly-traded entity.

Post-IPO Transition: After the IPO, the company enters a new phase as a public entity. This involves a series of adaptations such as heightened regulatory scrutniy, the need for greater transparency, and regular disclusres to the shareholders and the public. The company must now consisteently deliver on its growth promises and manage investor relations effectively.

B List of Variables

Table B.1: Variable Descriptions

Variable	Unit	Range	Interpretation
log_age	Dimension less	0-149	Log_age, the natural logarithm of a company's age, is used to provide a more balanced view of its maturity.
Hot Market 2020-2022	dummy	0,1	"Hot Market 2020-2022 is a variable indicating the presence of highly active IPO markets in the Nordics during these years.
Tech X Hot Market 20-22	Dummy	0,1	Interaction term combining the dummy variables Technology firms and Hot Markets 2020-2022..
Hot Market 2021	Dummy	0,1	Capturing the effect on initial returns and price revision in the most significant hot market, being in 2021, as of the number of IPOs in the Nordics.
EBIT Positive	Dummy	0,1	If a firms earnings before taxes, interest expenses and taxes are positive in the year before going public.
Net Income positive	Dummy	0,1	If a firms net earnings are positive in the year before going public.
'Financial sponsor'	Dummy	0,1	Ownership before going public is predominantly consisting of VC or PE firms.
Book-building	Dummy	0,1	Dummy variable implying firms that used the book-building method in the IPO process.
'Proceeds USDm'	Continuous	0.2-2600 USDM	Gross proceeds collected when raising funds in the IPO.
Price revision > 0	Dummy	0,1	Capturing the effect on initial returns of firms' that experienced positive price revisions from the midpoint in their book-building process
Technology	Dummy	0,1	Firms defined as "Technology" firms.
Underwriter Q1-Q4	Categorization	1-4	A categorization variable of underwriters from 1-4. 1 = top-tier.

C Complimentary Regressions

Table C.1: Country specific Initial Return

	Dependent variable:			
	'initial return'			
	(1)	(2)	(3)	(4)
log_age	0.007	0.011	0.012	0.011
	(0.023)	(0.023)	(0.023)	(0.022)
Bubble_2021	−0.030	−0.025	−0.025	−0.033
	(0.045)	(0.045)	(0.045)	(0.045)
Norway_dummy	−0.095*			
	(0.056)			
Sweden_dummy		0.021		
		(0.045)		
Finland_dummy			−0.030	
			(0.067)	
Denmark_dummy				0.158**
				(0.073)
Constant	0.133**	0.091	0.105*	0.089
	(0.064)	(0.067)	(0.062)	(0.062)
Observations	480	480	480	480
R^2	0.007	0.002	0.002	0.011
Adjusted R^2	0.001	−0.005	−0.005	0.005
Residual Std. Error (df = 476)	0.484	0.486	0.486	0.484
F Statistic (df = 3; 476)	1.160	0.269	0.262	1.751
Note:				*p<0.1; **p<0.05; ***p<0.01

Table C.2: Underwriter Regression

	Dependent variable:		
	Underwriter Ranking		
	(1)	(2)	(3)
log_age	−0.109		
	(0.179)		
NI_Positive	−0.857**		
	(0.358)		
'EBIT LTM USD'	0.003***		
	(0.001)		
'Proceeds USDm'		0.002***	
		(0.0005)	
'Offer price'		0.0003	
		(0.003)	
'PE Backed'		−0.804**	
		(0.403)	
'VC Backed'		−0.952	
		(1.152)	
Bubble			0.869***
			(0.310)
Technology_Bubble_Interaction			−0.170
			(0.459)
Constant	5.119***	4.228***	4.057***
	(0.503)	(0.210)	(0.206)
Observations	240	318	319
R^2	0.049	0.075	0.026
Adjusted R^2	0.036	0.064	0.020
Residual Std. Error	2.546 (df = 236)	2.510 (df = 313)	2.564 (df = 316)
F Statistic	4.011*** (df = 3; 236)	6.389*** (df = 4; 313)	4.199** (df = 2; 316)
Note:			*p<0.1; **p<0.05; ***p<0.01

D Underwriter rankings

Below follows the data based on the different underwriters, and their deal count, as well as volume by proceeds raised in the Nordics, and thereafter the normalized ranking based on number of IPOs and Volume by institution and year. For the normalized rankings,

Table D.1: Number of IPOs by Institution and Year

Institution	2015	2016	2017	2018	2019	2020	2021	2022
Carnegie	16	16	20	10	8	12	46	3
Danske	5	4	12	5	1	3	17	1
Nordea	6	8	4	5	1	9	16	5
ABG	9	9	12	4	4	16	26	2
SEB	18	8	8	7	5	4	19	3
Pareto	3	4	7	4	5	7	14	5
Arctic	2	3	3	3	2	7	7	2
DNB	2	2	7	2	3	14	15	4
MS	8	3	2	3	2	0	1	1
GS	1	3	2	1	1	0	5	0
Swedbank	0	0	2	0	5	5	7	1
JP	1	2	0	1	2	1	4	1
Deutsche	3	2	1	2	1	0	0	0
Jefferies	1	0	3	0	0	2	3	0
SP1M	0	1	4	3	2	8	16	1
BNPPARIBAS	1	0	0	0	0	0	2	0
Nordnet	0	0	0	1	0	0	0	0
Fearnley	0	0	0	0	0	2	5	4
Citi	3	1	0	1	0	2	6	0
Clarksons	0	0	0	1	1	0	3	2
UBS	1	1	0	0	1	0	1	0
Norsec	1	0	0	0	0	0	0	0

Table D.2: Volume (Proceeds in Million USD) by Institution and Year

Institution	2015	2016	2017	2018	2019	2020	2021	2022
Carnegie	3461	2910	3694	1739	758	2468	12419	1144
Danske	731	6077	2036	671	82	362	5600	31
Nordea	1326	7132	1149	1758	1522	986	6952	431
ABG	2047	1202	1094	1037	355	2610	7159	1151
SEB	4183	1421	1664	919	1871	1537	8040	436
Pareto	258	168	483	217	329	835	1425	1136
Arctic	184	114	121	322	386	787	536	49
DNB	333	2563	908	357	344	2284	4214	1422
MS	2999	5851	1344	1586	1470	0	4742	865
GS	486	1291	907	825	1321	0	4791	0
Swedbank	0	0	254	0	696	496	2363	378
JP	283	6615	0	559	1657	1057	6932	865
Deutsche	974	3577	500	756	422	0	0	0
Jefferies	538	0	1596	0	0	573	3882	865
SP1M	0	4	306	464	86	314	1028	865
BNPPARIBAS	309	0	0	0	0	0	3851	0
Nordnet	0	0	0	9	0	0	0	0
Fearnley	0	0	0	0	0	24	134	448
Citi	864	2597	0	1096	0	1236	3658	0
Clarksons	0	0	0	249	40	0	205	364
UBS	809	5636	444	0	1325	0	527	0
Norsec	7	0	0	0	0	0	0	0

Table D.3: Normalized Ranking (Number of IPOs) by Institution and Year

Institution	2015	2016	2017	2018	2019	2020	2021	2022
Carnegie	8.89	10.00	10.00	10.00	10.00	7.50	10.00	6.00
Danske	2.78	2.50	6.00	5.00	1.25	1.88	3.70	2.00
Nordea	3.33	5.00	2.00	5.00	1.25	5.62	3.48	10.00
ABG	5.00	5.62	6.00	4.00	5.00	10.00	5.65	4.00
SEB	10.00	5.00	4.00	7.00	6.25	2.50	4.13	6.00
Pareto	1.67	2.50	3.50	4.00	6.25	4.38	3.04	10.00
Arctic	1.11	1.88	1.50	3.00	2.50	4.38	1.52	4.00
DNB	1.11	1.25	3.50	2.00	3.75	8.75	3.26	8.00
MS	4.44	1.88	1.00	3.00	2.50	0.00	0.22	2.00
GS	0.56	1.88	1.00	1.00	1.25	0.00	1.09	0.00
Swedbank	0.00	0.00	1.00	0.00	6.25	3.12	1.52	2.00
JP	0.56	1.25	0.00	1.00	2.50	0.62	0.87	2.00
Deutsche	1.67	1.25	0.50	2.00	1.25	0.00	0.00	0.00
Jefferies	0.56	0.00	1.50	0.00	0.00	1.25	0.65	0.00
SP1M	0.00	0.62	2.00	3.00	2.50	5.00	3.48	2.00
BNPPARIBAS	0.56	0.00	0.00	0.00	0.00	0.00	0.43	0.00
Nordnet	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
Fearnley	0.00	0.00	0.00	0.00	0.00	1.25	1.09	8.00
Citi	1.67	0.62	0.00	1.00	0.00	1.25	1.30	0.00
Clarksons	0.00	0.00	0.00	1.00	1.25	0.00	0.65	4.00
UBS	0.56	0.62	0.00	0.00	1.25	0.00	0.22	0.00
Norsec	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table D.4: Normalized Ranking (Volume) by Institution and Year

Institution	2015	2016	2017	2018	2019	2020	2021	2022
Carnegie	8.27	4.08	10.00	9.90	4.05	9.46	10.00	8.04
Danske	1.75	8.52	5.51	3.82	0.44	1.39	4.51	0.22
Nordea	3.17	10.00	3.11	10.00	8.14	3.78	5.60	3.03
ABG	4.89	1.69	2.96	5.90	1.90	10.00	5.76	8.09
SEB	10.00	1.99	4.51	5.23	10.00	5.89	6.47	3.07
Pareto	0.62	0.24	1.31	1.24	1.76	3.20	1.15	7.99
Arctic	0.44	0.16	0.33	1.84	2.07	3.02	0.43	0.34
DNB	0.80	3.59	2.46	2.04	1.84	8.75	3.39	10.00
MS	7.17	8.20	3.64	9.02	7.85	0.00	3.82	6.08
GS	1.16	1.81	2.46	4.69	7.06	0.00	3.86	0.00
Swedbank	0.00	0.00	0.69	0.00	3.72	1.90	1.90	2.66
JP	0.68	9.27	0.00	3.18	8.86	4.05	5.58	6.08
Deutsche	2.33	5.02	1.35	4.30	2.25	0.00	0.00	0.00
Jefferies	1.29	0.00	4.32	0.00	0.00	2.20	3.13	6.08
SP1M	0.00	0.01	0.83	2.64	0.46	1.20	0.83	6.08
BNPPARIBAS	0.74	0.00	0.00	0.00	0.00	0.00	3.10	0.00
Nordnet	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
Fearnley	0.00	0.00	0.00	0.00	0.00	0.09	0.11	3.15
Citi	2.07	3.64	0.00	6.24	0.00	4.74	2.95	0.00
Clarksons	0.00	0.00	0.00	1.42	0.21	0.00	0.17	2.56
UBS	1.94	7.90	1.20	0.00	7.08	0.00	0.42	0.00
Norsec	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00

D.1 The Transactions

Figure C.1,2,3 shows the transactions of which our data set is built upon. D.1-D.3 in chronological order.

Figure D.1: IPOs 0-200

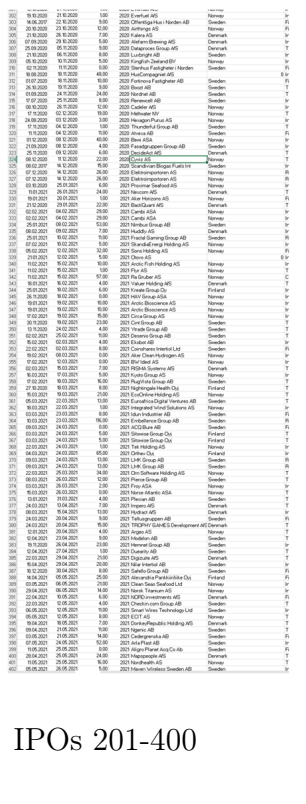
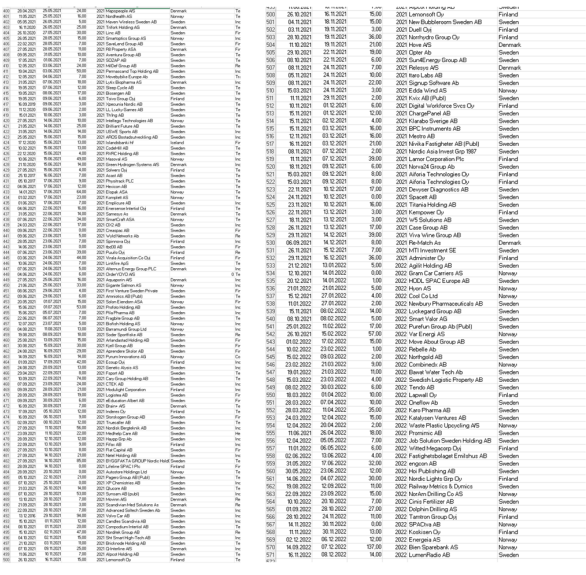


Figure D.2: IPOs 201-400

Figure D.3: IPOs 401-570



E Robustness Regression

Table E.1: IV Regression: Price Revision

	Dependent variable:	
	OLS	*IV: Price revision*
	(1)	(2)
UW Ranking (Volume)	0.6382	
	(t = 7.7166)	
log_age	0.4258	-0.0249
	(t = 2.1848)	(t = -2.4716)
Underwriter ranking		0.0018
		(t = 0.2650)
Financial sponsors	0.1274	0.0317
	(t = 0.3034)	(t = 1.4744)
Hot Issue 2020-2022	0.6806	0.0039
	(t = 1.6497)	(t = 0.1873)
Constant	0.4940	0.0398
	(t = 0.6433)	(t = 0.9599)
Observations	105	105
R^2	0.3856	0.0785
Adjusted R^2	0.3610	0.0416
Residual Std. Error	1.8521 (df = 100)	0.0946
F Statistic	15.6908 (df = 4; 100)	
Note:		*p<0.1; **p<0.05; ***p<0.01
Note:	D WH test statistic: 1.731; DWH p-value: 0.191	

Table E.2: IV Regression: Initial Return

	Dependent variable:	
	Underwriter Ranking	*IV: Initial return*
	(1)	(2)
Predicted UW ranking		-0.010
		(0.01)
log_age	0.194	0.001
	(0.141)	(0.016)
$NI_{positive}$	-0.214	0.086
	(0.284)	(0.033)
Hot Issue 2020-2022	1.083	0.057
	(0.269)	(0.031)
Constant	6.371	0.068
	(0.463)	(0.036)
Observations	255	255
R^2	0.372	0.055
Adjusted R^2	0.362	0.036
Residual Std. Error	2.077 (df = 250)	0.216 (df = 198)
F Statistic	36.973 (df = 4; 250)	
Note:		*p<0.1; **p<0.05; ***p<0.01
Note:	D WH test statistic: 1.036; DWH p-value: 0.3087	

Table E.3: Price Revision 2015-2020

	Dependent variable:		
	Price_Revision		
	(1)	(2)	(3)
log_age	−0.032**	−0.032**	−0.033**
	t = −2.442	t = −2.422	t = −2.530
'Underwriter ranking'	0.009*	0.009*	0.009*
	t = 1.808	t = 1.857	t = 1.878
'Financial sponsor'	0.026	0.030	0.032
	t = 0.945	t = 1.031	t = 1.164
'Net Income Positive'	0.011	0.011	0.017
	t = 0.385	t = 0.389	t = 0.580
'Common Equity MUSD'	0.00000	0.00001	0.00001
	t = 0.291	t = 0.510	t = 0.641
'IPO Proceeds'		−0.00002	
		t = −0.465	
'Tech Dummy'			0.051*
			t = 1.963
Constant	0.012	0.010	−0.008
	t = 0.261	t = 0.220	t = −0.172
Observations	81	81	81
R^2	0.102	0.105	0.147
Residual Std. Error	0.103 (df = 75)	0.104 (df = 74)	0.101 (df = 74)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table E.4: Initial Return 2015-2020

	Dependent variable:		
	'initial return'		
	(1)	(2)	(3)
log_age	0.008	0.008	−0.035*
	t = 0.456	t = 0.456	t = −1.820
EBIT_Positive			0.030
			t = 0.791
Technology_Bubble_Interaction	−0.031	−0.031	0.015
	t = −0.369	t = −0.369	t = 0.195
NI_Positive	0.086**	0.086**	
	t = 2.336	t = 2.336	
Price_revision_positive	−0.128***	−0.128***	
	t = −4.098	t = −4.098	
CM_quartile_1	0.001	0.001	0.032
	t = 0.017	t = 0.017	t = 0.781
Constant	0.011	0.011	0.157***
	t = 0.215	t = 0.215	t = 2.807
Observations	61	61	126
R^2	0.279	0.279	0.033
Residual Std. Error	0.114 (df = 55)	0.114 (df = 55)	0.179 (df = 121)
Note:			*p<0.1; **p<0.05; ***p<0.01

F Methodology

F.1 How to Measure Price Revision

1. **Initial Filing Range:** Let limit $P_{\text{initial,lower}}$ and limit $P_{\text{initial,upper}}$ represent the lower and upper limits of the initially proposed price range for the IPO, respectively.

2. **Midpoint and Initial filing range:** The midpoint of the initial filing range, denoted as P_{midpoint}, is calculated as:

$$P_{\text{midpoint}} = \frac{P_{\text{initial,upper}} - P_{\text{initial,lower}}}{2}$$

3. **Price Revision:** The price revision, denoted as Delta P, is the difference between the final offer price P_{Final} and the midpoint of the initial filing range:

$$\Delta P = P_{\text{Final}} - P_{\text{Midpoint}}$$

4. **Percentage price revision:** The percentage price revision, expressed as a percentage, is calculated by dividing the price revision by the midpoint of the initial range and then multiplying by 100:

$$\text{price revision} = \left(\frac{\Delta P}{P_{\text{midpoint}}} \right) \times 100\%$$

F.2 OLS Regression

The general OLS regression model for cross-sectional data can be represented as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_n X_n + \varepsilon \tag{F.1}$$

where,

- Y is the dependent variable.
- β_0 is the intercept of the regression.
- $\beta_1, \beta_2, \ldots, \beta_n$ are the coefficients of the independent variables.
- $X_1, X_2, \ldots, X_n$ are the independent variables.
- ε is the error term.

This model assumes a linear relationship between the independent variables and the dependent variable, and it's flexible enough to accommodate any number of independent variables. In the context of your study:

- Y would be the initial return or price revision.
- $X_1, X_2, \ldots, X_n$ would represent variables such as log_age, EBIT_Positive, Price_Revision_Positive, Prestigious_Underwriters, etc.

The model relies on 6 important assumptions:

1. Linearity: The relationship between the independent variables and the dependent variable is assumed to be linear
2. No perfect multicollinearity: The independent variables should not be perfecctly correlated with eachother.
3. Independence of errors: The residuals (errors) from the regression should be independent on each other.
4. Homoscedasticity: The variance of the error terms should be constant across all levels of the independent variables.

5. Normal distribution of Errors: For the purpose of hypothesis testing, it is often assumed that therror terms are normally distributed.

6. No endogeneity of regressors: The independent variables should not be correlated with the error term.

G Forex Conversion Rate

We calculated the average convertion ratio for each year and currency in the sample, and matched it to fit the time of IPO timing, coherent to the respective currency. As Iceland only exhibited 3 IPOs during our dataset, we manually dealt with this as we found the precise exchange ratio for the specific IPOs. This method seemed more efficient than incorporating them into the matrix below and integrating them into our larger dataset.

Table G.1: Currency Exchange Rates

Years	DKK/USD	NOK/USD	EUR/USD	SEK/USD
2015	0,149	0,124	0,900	0,119
2016	0,149	0,119	0,900	0,117
2017	0,140	0,121	0,880	0,117
2018	0,158	0,123	0,840	0,115
2019	0,150	0,114	0,890	0,106
2020	0,153	0,107	0,870	0,109
2021	0,159	0,116	0,840	0,117
2022	0,142	0,104	0,950	0,099