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Initial Public Offering methods in the Nordic market

A quantitative study of the relative aftermarket performance between fixed price and bookbuilding IPOs in the Nordic market

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Abstract

The goal of this thesis is to study the relative aftermarket performance of fixed price initial public offerings relative to bookbuilding offerings in the Nordic market and discover whether there are any differences in aftermarket returns depending on the offer method chosen by the offering firm. The choice of thesis subject was motivated by the strong growth in fixed price offerings in the Nordic market since 2014, and we have therefore looked at IPOs between 2014 and October 2020.

We find that the average market adjusted initial return of fixed price offerings over the study period is 13.49%, compared to similar returns for book building offerings of 4.88%. Thus, it appears that the degree of underpricing is affected by the choice of offer method. However, when adjusting for cornerstone investor subscription commitment, we find that the choice of offer method is not statistically significant as an independent variable when predicting returns. While cornerstone investors are present in both fixed price and bookbuilding offerings in our data sample, they are more common in fixed price offerings. Therefore, because cornerstone investment was found to be a significant independent variable when analyzing aftermarket returns, it can be claimed that IPO method is a proxy that can potentially help when predicting short term returns post IPO.

Further, we find no statistically significant difference in the long-run market adjusted returns between fixed price and bookbuilding offerings. This supports the idea that any difference in relative underpricing is due to short-term IPO characteristics, while over time factors such as financial reporting and market conditions become more important.

As there is little previous academic research on the subject of offer method and cornerstone investors in Nordic market IPOs, we believe this thesis paper complements other research material, and could serve as a basis for further research.

Contents

1. Introduction

1.1 Background

Using a fixed share price mechanism in initial public offerings has been a growing phenomenon in the Nordic financial market over the last decade. This thesis paper seeks to investigate the aftermarket performance of fixed price offerings, and whether there is a significant underpricing difference between fixed price offerings and bookbuilding offerings. The study has been conducted on Nordic[1] IPOs in the period between 2014 and October 2020.

An IPO, or Initial Public Offering, is typically the first time a company's shares are offered for purchase to the general public (Ritter, 1998). Therefore, it is an important event in any company's history. While several reasons for why companies go public have been floated, the general reasoning centers around raising capital for growth or balance sheet restructuring and creating a liquidity event for existing shareholders seeking to sell (Pagano, et al., 1998).

The IPO process is also an important part of the stock market dynamic as it provides new companies for general trading. As such, there exists a multitude of academic studies on IPOs and share price performance. Previous empirical studies have found evidence of several aftermarket trading anomalies in IPO issues (Abrahamsson and De Ridder, 2015). Firstly, IPO issues tend to appreciate significantly from the IPO share price on the first day of trading. Second, IPOs tend to be clustered in time, with some years having significantly higher activity. There are also performance differences depending on the timing. Third, the long-run performance of IPO issues tends to underperform the broader market.

When an IPO is launched in the broad Nordic market, the pricing is typically set in two ways. Either through a bookbuilding process where investor demand and price limits are aggregated to form the final offer price, or a fixed price offering where the offer price is set at launch. Previous studies have found evidence for higher underpricing in fixed price

offerings compared to bookbuilding offerings (Chemmanur and Liu, 2002). However, Ljungqvist (2003) also found that the pricing method effect has not been evident in all markets historically.

While studied globally, the academic research on fixed price offerings in the Nordic market is thin, which motivated this paper. As the share of fixed price offerings in the Nordics has grown from 7% in 2014 to 53% in 2019, as shown in our data sample, possible aftermarket performance differences between the pricing methods have similarly grown in importance.

1.2 Thesis questions

Our thesis questions are therefore:

Has the choice of bookbuilding versus fixed price as initial public offering method impacted the short-run aftermarket returns of Nordic IPOs in 2014-2020? And if so, is this a short-term effect, or does it persist in the long-run as well?

1.3 Research method

To answer these questions, we have studied 150 IPOs in the Nordic stock markets between 2014 and 2020, of which 45 were conducted as fixed price offerings and 105 were conducted through a bookbuilding process. We have looked at the first day market adjusted returns as a proxy for initial performance and two-year market adjusted returns as a proxy for long-run performance. The short-run analysis was conducted on all 150 IPOs in our data sample, while the long-run analysis was conducted on all 123 IPO observations where two-year stock price data was available.

Further, we have looked at whether different company and deal structure characteristics have impacted the aftermarket returns. These include the firm market value, the deal size in relation to the firm market value, the age of the listing firm, the proportion of primary issue and secondary sale in the IPO offering, the aftermarket share liquidity, the number of IPO underwriters and whether the firm subsequently has paid dividends.

Another characteristic of the Nordic IPOs in our sample set is the use of cornerstone investors. A cornerstone investor is typically an institutional investor that have pre-subscribed for a number of shares at the time of launch (Tan and Ong, 2013). They are named in the issue prospectus and used in the marketing of the IPO. We find that 73 of the IPOs in our data sample have cornerstone investors. Of the fixed price IPOs, all but 7 have cornerstone investors. Thus, cornerstone investors appear to be more common in fixed price issues, and we have therefore studied whether any aftermarket performance difference can be explained by the inclusion of cornerstones rather than the pricing mechanism. While there are few studies on cornerstone investors in general, and particularly in the Nordic market, a thesis by Engman and Pehrson (2017) on the Swedish market found that cornerstone investors and the degree of initial underpricing does positively correlate.

1.4 Scope and limitations

This thesis paper is limited to look at IPOs on Nordic stock exchange main markets in the period 2014 – October 2020. Adding more markets and extending the time period, thus yielding more data observations, would have been beneficial for the robustness of the analysis results. However, as fixed price offerings first started appearing in the Nordics around 2014, going further back in time would only have limited relevance to the scope of this paper. While adding more markets to the study would increase the number of observations, it would also introduce other market specific influences that are beyond our scope.

Further, while this paper includes an analysis of long-run returns, it is limited to study the relative performance between the fixed price and bookbuilding offer methods. Other academic research on IPOs have done more thorough study on long-term underperformance in IPOs, and possible reasons for this effect. We have limited the scope of this paper to study whether any difference in initial underpricing between the offer methods also persist in the long-term.

2. Theory

2.1 The IPO process

The following section is a brief overview of the process and actions surrounding an IPO. It is based on the framework presented by Berk and DeMarzo (2014), and in part on our discussions with industry professionals and is meant to frame the theoretical discussion that follows.

The typical IPO process is 4 – 12 months long (Næss, et al., 2014). When a company decides to go public, they first hire, or mandate, brokerage firms to help with the listing process as well as marketing the share sale to investors. Then, they prepare for the various listing requirements. These include financial reporting as well as organizing the necessary legal structure.

After all documentation is prepared, the company and their advisors initiate informal discussions with select institutional investors that typically subscribe for large amounts in IPOs. In these discussions, the company gets feedback on their preparedness and the attractiveness of the offering. If the interest is sufficient, the brokerage firms move forward in preparing marketing material and internal education on the company.

When the company is ready to move forward, select institutional investors, usually 10-15, that agree to receive non-public information are engaged for formal discussions regarding the IPO. Here, the institutional investors are expected to give feedback on the company valuation as well as deal structure that they would subscribe to, and the volume they would be interested in. It is after these discussions that the company and their advisors decide on the choice of a fixed price offering or book building with a price range. Based on the investor feedback, they also decide if they want to attach cornerstone investors to the IPO, in agreement with the potential corners.

After the deal structure and offer pricing is decided, the IPO is broadly launched to the market. The underwriters market the issue to their clients, and a company prospectus with issue, financial and legal information is publicized. The prospectus is the most important material in relation to an IPO and is generally considered key in the information production process for investors. The management team typically also go on a road show to meet with potential investors. The timeline from broad launch until first day of trading typically lasts 2 – 3 weeks.

An IPO process is therefore time consuming for the company and the underwriters. It is also costly. PwC estimates that the average IPO costs several million dollars excluding underwriter fees. Underwriter fees are typically 5-7% of the gross issue proceeds (Curragh, et al., (2012). Given the costs of going public for the issuer, both in time and money, it also follows that the chance of failure of the IPO represents risk for the issuing firm and its underwriters. Thus, the choice of fixed price or bookbuilding offer method as well as inclusion of cornerstone investors should be evaluated in light of their impact on risk as well as returns.

2.1.1 Bookbuilding offering

In a book building structure, the issuer and underwriters decide on an indicative price range in the offering, and either a fixed amount of shares to be offered or a volume range, depending on the achieved price. Investor demand for shares is then aggregated in the book, and the issuer sets the final price where the volume of shares offered are covered by the demand (Busaba and Chang, 2010).

2.1.2 Fixed price offering

In a fixed price structure, the issuer and underwriters decide on a fixed offer price ahead of the broad launch of the IPO. Investor demand at that offer price is then aggregated in the book, and depending on an oversubscribed book, investors are either given full or partial share allocation (Busaba and Chang, 2010).

2.1.3 Cornerstone investors

Cornerstone investors are typically large institutional investors that commit to subscribe for a large, fixed number of shares or monetary amount ahead of the broad launch of the IPO. They also agree to be publicized in the marketing material of the IPO. Often, but not always, they also commit to a lock-up period following the IPO first day of trading where they are barred from selling their shares. Having cornerstone investors with committed subscriptions increases the likelihood of a successful IPO launch, as they cover parts of the offering as well as lend credibility to the issue (McNaughton et al., 2015). Studies have shown that IPOs with cornerstone investors have higher short-run aftermarket returns than the average (Engman and Pehrson, 2017).

2.2 Literature review

2.2.1 Short-run underpricing

Given perfect market conditions, the IPO method should not have any impact on the performance of a company when it goes to market. However, perfect market conditions also imply that there should not be any underpricing of an IPO because the appropriate price should be applied from the start. This proves that there are market frictions present, which in turn cause post-IPO price adjustments. The presence of such frictions provides the basis for our analysis of whether the IPO method impact underpricing. There are theories that present concrete market frictions that apply to the IPO space. We will use some of these theories to substantiate our discussion around the IPO methods, and provide insight into why they might provide consistently differing results.

Several theories have been presented in academia for why IPOs tend to be underpriced. No consensus has emerged over a single cause, but various research papers have broadly grouped them into: asymmetric information models, institutional models, control models and behavioral models.

2.2.2 The Winner's Curse Hypothesis

The winner's curse is an idea introduced by Rock (1986) and is related to information asymmetry. The basic assumption is that investors can be classified as informed or uninformed. Informed investors are more likely to identify attractive shares. As a result, unattractive stocks will be underpriced in order to attract uninformed investors. Uninformed investors will therefore be cursed with winning the unattractive stocks (Rock, 1986). In general, institutional investor are considered the informed investors, while private investors are more commonly uninformed. However, the bids of institutional investors are rarely disclosed to the public. Testing the validity of this theory directly has therefore proven difficult (Ljungqvist, 2004). Instead, later research has found that some proxies can be used to test for this information asymmetry. Ritter (1991) found firm age and firm size to be valid proxies. Ljungqvist and Wilhelm (2003) also validated firm age as a proxy.

The referenced research found that firm age is negatively correlated with underpricing. The explanation for this is that younger firms are harder to value, mainly due to less historical data about past financial performance and higher uncertainty about future performance. In other words, information asymmetry decreases with increased firm age (Ritter, 1998; Durukan, 2002). In the analysis of IPO method discrepancies, these factors should therefore be used as control variables. By doing so, claiming that variance is caused by IPO method, when it is in fact a result of these information asymmetries, is avoided.

Varying aftermarket returns depending on the choice of fixed price or bookbuilding can also be understood through auction theory in the case of the winner's curse. In an IPO, the issuer is a monopolist auctioning off their goods (Chemmanur and Liu, 2002). Through a bookbuilding, the offer price will be set at the marginal point where demand and supply meet. Thus, bids below the marginal point will be cut. In a fixed price offering, investors with demand at a higher price point will still be cleared at the same level as more conservative investors. In the case of oversubscription, investors instead receive a lower share allocation. Therefore, through a fixed price offering, there is a greater chance that the

marginal demand is at a higher price level than the offer price, and more optimistic investors will bid up the share in aftermarket.

2.2.3 The signaling hypothesis

This hypothesis has been posited by Allen & Faulhaber (1989) and Welch (1989). It assumes that the final IPO share price is underpriced to create a positive aftermarket share return, as it signals a perceived good quality of the firm and gives the company an upward momentum. The reason is that while the IPO issue might be underpriced, it increases the likelihood of higher priced share issues to raise further capital in the future.

Chemmanur and Liu (2002) furthers the auction theory analogy with regards to fixed price offerings and the signal effect. Unlike most auctions, the issuing firm is a monopolist that seeks to sell its goods several times. Therefore, while fixed price offerings are found to have a higher underpricing, it is still rational for the selling firm to choose it over a bookbuilding process in most cases. The exception is in cases where IPO firm is controlled by one or several shareholders that seek to sell most or all of their shares in the IPO. According to Habib and Ljungqvist (2001), the more secondary shares sold in the IPO, the lower the underpricing.

The signaling hypothesis also factor in the time between the initial announcement and the first day of trading. IPO books that are filled fast with a shorter marketing period tend to be more underpriced (Ekkayokkaya & Pengniti, 2012). A quickly filled book signals a high demand for the share, with a positive aftermarket effect. There is also an execution risk involved in IPOs, and a shorter marketing period limits the chance of an adverse development in market conditions. Fixed price offerings increase demand and therefore lowers execution risk. However, investors demand a higher discount when given less time for information discovery (Lee, Taylor & Walter, 1996). In our data analysis, we have used the relation between initial shares offered at IPO announcement compared to the final shares sold at closing as a proxy for investor demand.

2.2.4 The bandwagon effect hypothesis

Welch (1992) also found evidence for a phenomenon where uninformed investors copy the decisions of informed investors. According to the theory, strong demand for an IPO issue will attract even more demand, as uninformed investors assume that investors that have invested in information production on the issue and then subscribed are correct in their decision. Therefore, the issuing company should underprice their offer shares to attract informed investors and uninformed capital also subscribe. Fixed price offerings induce more investors to produce information on an IPO issue as the element of bid price competition is removed (Chemmanur and Liu, 2002). Thus, a cascading effect is potentially created where more investors become informed which again encourage more uninformed investors to subscribe.

2.2.5 Long-run underpricing

Previous academic studies have found evidence for long-run underperformance in IPO issues compared to the broader market (Ritter, 1991). In this paper, we have not looked at the absolute long-run returns from our data set, but relative long-run performance between fixed price and bookbuilding issues. Assuming the larger short-run underpricing in fixed price offerings is due to various theoretical causes discussed above, over the long term the underpricing differential should diminish over time. A study on IPOs in the Indian market finds that there is a short-run difference in underpricing depending on the offer method, but that this difference diminishes in the long-run (Phadke and Kamat, 2019).

2.2.6 The divergence of opinion hypothesis

This theory posits that there exists information uncertainty in new IPO issues, where the optimistic investors are willing to subscribe at a higher price point than the pessimistic investors (Miller, 1977). As more financial and other information becomes available over time after listing, information uncertainty will decrease and various investors opinion on the outlook of the firm should increasingly align. As the initial offer price is set before the broad launch in a fixed price IPO, a divergence of opinion is primarily relevant for the initial settlement price in bookbuilding offerings. Therefore, the underpricing difference between a

fixed price and bookbuilding offering should align over time due to more information becoming available.

2.2.7 The "hot issue markets" hypothesis

Through several papers, Ritter (1984)(1991)(1998) has documented a phenomenon of clusters in the volume of IPOs. During certain periods, the short-run aftermarket return from IPOs have been higher than average. This is followed by periods of a higher than average volume of IPOs. In the period following a "hot market" with a rising volume of new IPOs, the aftermarket return of those IPOs have been lower than in the "hot market" IPOs. This could be caused by companies with plans of going public wanting to use the high investor interest and optimism to accelerate their original timeline.

Ritter (1998) also theorized that periods of high IPO volume in an industry is timed to the business cycle of that industry. As investor optimism is high, companies seek to time their IPO to the sentiment, and thus perhaps securing a higher pricing than justified by the fundamentals. Thus, companies going public in high volume periods will underperform in the long run. If there is a prevalence for the use of either fixed price or bookbuilding during "hot market" periods, this could also help explain the underpricing difference of fixed price offerings.

2.2.8 The impresario hypothesis

This theory is related to the "hot issue markets" hypothesis, and stipulates that underwriters deliberately push for a lower share offer price in IPOs than justified by the fundamentals and investor demand (Shiller, 1990). In markets with high IPO activity, the underwriters are incentivized to induce underpricing in new issues to maintain investor interest and thus the IPO volume. A lower price also lowers the execution risk, and the underwriters can then improve their image as a high-quality advisor, which attracts both investors and other companies seeking to go public to them. The result is that the short-run aftermarket returns in "hot markets" is substantiated, while the phenomenon contributes to the long-run underperformance of IPOs from such periods.

The impresario hypothesis also relates to the general principal-agent problem for underwriters (Karlis, 2000). Underwriters in their advisory and marketing role for the IPO serves two client groups in the issuing firm on the one hand and their investor clients on the other. These two groups do not necessarily have the same interests, as investors want the final share price as low as possible. Therefore, underwriters can also be a factor in the existence of short-run underpricing.

2.2.9 Previous research

The volume of academic research on fixed price and bookbuilding IPO offer method as used in the Nordic markets, as well as the effect of cornerstone investors, is not large. However, Derrien and Womack (2000) did find that fixed price offerings had an initial underpricing of 8.88% while bookbuilding offerings had an initial underpricing of 6.55% when studying french IPOs between 1992 and 1998. Further, Benveniste and Busaba (1997) find that from a theoretical standpoint, bookbuilding offerings should give higher expected proceeds for the issuer, while fixed price offerings should have a higher initial underpricing.

3. Data collection and variable description

3.1 Sample selection

This paper has studied IPOs in Norway, Sweden, Finland and Denmark, collectively the Nordic market, between 2014 and October 2020. From a total population size of 267 IPOs during the period, our total data sample consists of 150 IPOs. The time frame was selected due to it being the main period including fixed price offerings. From a total of 27 IPOs in our data sample in 2014, only two used a fixed price offering. This grew to 14 fixed price offerings out of a total 32 IPOs in 2017.

The main selection criteria were that the company going public was listed on a Nordic main board. These include the Oslo Stock Exchange, Oslo Axess, Nasdaq Stockholm Main Market, Nasdaq Helsinki Main Market and Nasdaq Copenhagen Main Market. Listings on Multilateral Trading Facilities, or MTF, such as Merkur Market and the various Nasdaq First North exchanges are not included, as offerings on these exchanges are not directed towards retail investors, and there are fewer listing criteria for the companies (Nasdaq, 2017). Institutional investor mandates also differ, and it is possible that some are limited from investing in MTF issues, which would create data noise.

Further, our data sample only includes IPOs were the company sold shares either through a primary issue of new shares to raise capital or a secondary sale of existing shares from selling shareholders, or a combination of both. Direct listings are excluded. Therefore, companies that moved from one list to another were excluded, except in the instances were companies moved from an MTF to a main list and conducted a share sale. Also, company demerger, or "spin-off", listings with no listing share sale were excluded. Companies that conducted a dual list IPO were also excluded when the Nordic listing was the secondary or junior list, as currency fluctuations and a potential lack of liquidity could influence the share price development. In addition, we only included companies going public with common shares and preference share issues were excluded.

3.2 Data collection

We identified the various IPOs on the abovementioned exchanges in our data sample directly through the Oslo Stock Exchange and Nasdaq OMX Nordic webpages. The share price return and share liquidity data were gathered primarily from the Orbis database, but also the Refinitiv and Bloomberg databases as well as the Oslo Stock Exchange and Nasdaq OMX Nordic webpages.

Furthermore, we adjusted the long-run share prices for dividend payouts and share splits which were collected from company press releases as well as the Morningstar and Woodseer databases. The databases we collected share price information from do not automatically adjust for dividend payouts. If not adjusted for, the long-run share return data in our analysis would be lower than what a buy-and-hold investor strategy would have achieved.

The IPO floatation method, cornerstone commitment, offer price, initial and final shares offered, degree of primary and/or secondary shares offered, pre- and post-IPO share count and the number of underwriters were primarily gathered from company press releases as well as IPO prospectuses. In some instances where primary data was lacking, secondary sources were used, such as selling shareholder press releases, underwriter press releases and financial media articles. Firm age at the time of listing was gathered from the IPO prospectuses as well as the company webpages.

3.3 Prior trading

While all IPOs in our data sample have been treated equally, several companies that executed an IPO had previously traded on MTF exchanges or Over The Counter exchanges, and therefore had valid share price transactions prior to listing. However, most companies in the data sample had no prior trading expect perhaps private transactions before the IPO. All IPOs in our data sample included a major share sale, but it is possible that instances of trading prior to the IPO skewed the subsequent returns data relative to IPOs with no publicly available share price information. Due to limitations in our data set, we have not adjusted for this factor.

3.4 Variable description

3.4.1 Offer type and Offer price

We divided our data sample into either fixed price or bookbuilding offerings and used a dummy variable where 0 represented a fixed price offering and 1 represented a bookbuilding offering. From the 150 IPOs in our data sample 105 were conducted as bookbuilding offerings while 45 were conducted as fixed price offerings. The listing exchange was divided into four types: "Oslo Bors" with 49 observations, "Nasdaq OMX Stockholm" with 74 observations, "Nasdaq OMX Helsinki" with 18 observations and "Nasdaq OMX Copenhagen" with 9 observations. Oslo Axess was merged into "Oslo Bors" for practical reasons.

We did not use either the final share offer price or bookbuilding initial price range in our analysis. Several studies use the final offer price in relation to the initial price range as a proxy for investor demand (Hanley, 1993). As this is irrelevant for fixed price offerings, and oversubscription data was not available for most IPOs, we have instead used the final shares offered in relation to initial shares offered as a proxy.

3.4.2 Shares offered

We decomposed the number of shares offered into initial shares offered and final shares offered to capture investor demand for the issue. We further decomposed the number of shares offered into both initial and final secondary shares offered from existing shareholders, and initial and final primary shares issued by the company to raise equity. We used this as a control variable to check if companies primarily or solely raising capital for growth has a better aftermarket performance. As Chemmanur and Liu (2002) also theorize, controlling shareholders that sell most or all of their holdings in the IPO are less concerned with the aftermarket share performance which could cause a lower underpricing. Thus, IPOs with mainly or solely secondary shares sold could have lower initial underpricing.

Further, we included a variable for the offer size as a percentage of the company size, through dividing the total final shares offered by the post-IPO shares outstanding, to check if

the offer size affects underpricing. In this calculation, “overalloted” shares are included in the shares offered as they are sold on similar terms. “Overallotment” or the “greenshoe option” are shares that are sold in conjunction with the offer shares, usually loaned by the underwriters from one or several large shareholders. If the share price drops below the offer price in a short-term period of aftermarket trading, usually 30 days after the listing day, the underwriters will buy back shares to support the price and subsequently return them to the lending shareholder(s). In our data sample, only 11 out of 150 IPOs did not include an overallotment.

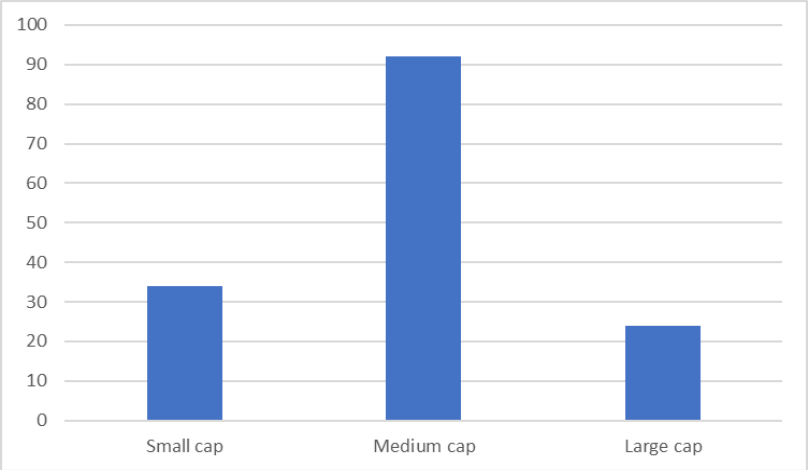
3.4.3 Company size

The company size is also included as a variable, through multiplying the post-IPO shares outstanding with the final offer price. The market value data has been currency adjusted in order to compare the IPOs across listing country. All company market values have been converted to dollar from the local currency with the listing date used for the conversion rate.

Further, we have divided the market values into three groups, “small cap”, “medium cap” and “large cap”. “Small cap” companies have a market value of less than 150 million euros. “Medium cap” companies have a market value between 150 – 1000 million euros. “Large cap” companies have a market value above 1000 million euros. This is in accordance with Nasdaq’s classification of company size (Nasdaq, 2017). Company size was grouped in order to get more comprehensive output from the analysis.

Previous studies have found that large capitalization companies and large IPO share offers, which are usually interlinked, tend to exhibit lower underpricing than smaller issues (Ibbotson, et al, 1994). This could be due to larger offerings getting more investor attention. Some sophisticated institutional investors that manage big funds are also less likely to invest in smaller offerings due to share liquidity issues. As more investors produce information on the IPO, underpricing could possibly decrease.

Figure 1. Number of observations per market value group



3.4.4 Cornerstone investors

While there are a multitude of academic studies on IPOs in general, and various aspects of them, studies on the effect of cornerstone investors in IPOs are more limited. This is likely due to the use of marketed cornerstones being a relatively modern concept. Cornerstone investors started appearing in European IPOs in 2011. In the context of this paper's geographic footprint, cornerstone investors first appeared in Swedish IPO's in 2014, thus at the beginning of our data sample time frame (Engman and Pehrson, 2017).

The element of cornerstone investors is also prevalent particularly in the fixed price offerings in our data sample. Out of the entire 150 IPOs, 73 have cornerstone investors. However, out of the 45 fixed price offerings, 38 have cornerstone investors. Thus, it appears that cornerstone investors and fixed price offerings are somewhat interlinked. The rise of cornerstone investor offerings in the Nordics in recent years, as reported by Engman and Pehrson (2017) appear to follow the rise of fixed price offerings over the same time period.

We find that on average cornerstone investors have been allocated 37% of the final shares offered in the data sample IPOs where they are present. With the combination of their early subscription commitment, and the volume of shares they are allocated, it is reasonable to

assume that these investors are the price setters in IPOs where they are present. Our conversations with industry professionals back up this assumption.

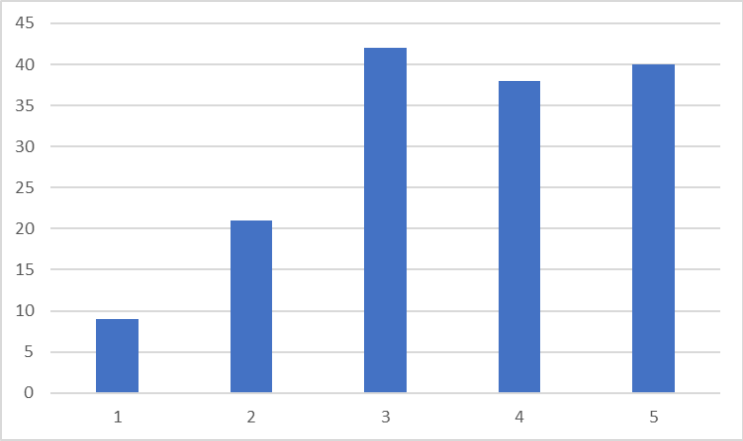
For the analysis, variables considered were; a dummy variable, number of cornerstone investors in an IPO, and the amount of shares they were allocated as a percentage of the total offer. The variable used in the final analysis was allocation percentage, as this provided the most accurate results.

Intuitively, the more shares bought by cornerstone investors, the less available for others, which could be a factor in increasing aftermarket demand for shares and thus initial return performance. However, even if the use of cornerstone investors is positively correlated with the degree of underpricing in IPOs, it could still be rational for the issuer to include them. One argument in favor of cornerstones is risk mitigation. The firm subscription commitment early in the process lowers the risk of the IPO failing. Another argument ties into the signaling effect and bandwagon effect theories. Being able to market commitments from large and well renowned investors could potentially attract subscriptions from other, less informed investors and increase the attention of the IPO issue in aftermarket trading.

3.4.5 Firm age

As the IPO firm age is found in other research to affect the degree of underpricing (Ritter, 1991), we have included a variable, to account for this effect. Firm age is set as the time between company inception and the first day of trading. Furthermore, the companies in our data sample have been divided into five age groups, for better readability of the results. Group 1 is companies aged 0-5 years, group 2 aged 6-10 years, group 3 aged 11-20 years, group 4 aged 21-40 years and group 5 aged 41 years and above. Out of our data sample, 9 companies are in group 1, 21 companies are in group 2, 42 companies are in group 3, 38 companies are in group 4 and 40 companies are in group 5. The youngest company is 0 years old at the time of listing, while the oldest is 203 years old.

Figure 2. Number of observations per age group



3.4.6 Share liquidity

A study on the British stock market found that aftermarket share liquidity, as measured by the amount of shares transacted in relation to total outstanding shares, affect the degree of underpricing in IPOs (Ellul and Pagano, 2006). They also found evidence for expectations of share liquidity prior to initial trading affecting the degree of underpricing. This is commensurate with the general tendency in the market for illiquid shares to be priced at a discount. We have included a variable, to account for this effect. This is calculated from the aggregated trading volume in the second to seventh day after listing, divided by the post-IPO shares outstanding. The reason for excluding the first trading day volume is that secondary shares sold in the IPO are typically included in the first day trading volume, creating data noise.

3.4.7 Underwriters

The element of underwriters in the IPO process has been studied in several academic papers, as they hold a key function in advising the company going public and marketing the issue to investors. Particularly whether the underwriter reputation and perceived quality, so called "prestigiousness", affects the degree of underpricing. Carter, et al (1998) found that IPOs marketed by perceived prestigious underwriters tend to exhibit lower underpricing. This

could be due to investors having a higher degree of trust in the information received. Due to limitations in our data set, we have not controlled for the perceived quality of underwriters but are open to this being a relevant unobserved variable. We have instead included a variable for the number of underwriters participating in the IPO. Corwin and Schultz (2005) found that a larger number of underwriters in an IPO lowers the underpricing. However, this could also be due to other factors such as larger IPOs tending to have more underwriters participating.

3.4.8 Dividend

Further, we have included a dummy variable for whether the IPO company paid dividends in the years following the listing. Previous studies have found that IPO companies that subsequently started paying dividends outperformed others that did not in long-run returns (How and Verhoeven, 2010). It is also possible that dividend expectations and the related signaling effect prior to listing affects the short-run aftermarket returns.

Table 1. Independent variables and their related theories

Variable	Model code	Variable measure	Related theory
IPO method	FlotationCode	Dummy variable for the choice of fixed price or bookbuilding offer method	Winner's curse effect
Final shares offered	FinalOfferPC	Final shares offered relative to initial shares offered	Bandwagon effect
Offer size	PCSharesSold	Final shares offered relative to post-IPO shares outstanding	Signaling effect
Firm size	ValueGroup	Post-IPO shares multiplied by the final offer price	Winner's curse effect
Corner commitment	CommitmentPC	The offer shares subscribed for by corners relative to final shares offered	Bandwagon effect
Firm age	AgeGroup	Years between company inception and first day of	Winner's curse effect

		listing	
Share liquidity	LiquidityPC	Day 2 – 7 post listing share transaction volume relative to post-IPO shares	Signaling effect
Dividend	DividendDummy	Dummy variable for post-IPO dividend payouts	Divergence of opinion effect
Type of shares offered	N/A	Degree of share issue relative to secondary shares offered	Signaling effect
Underwriters	N/A	The number of underwriters working on the IPO	Impresario effect

3.5 Omitted variables

With any statistical analysis of real-world observations, there will be explanatory variables that are not included. These can be unknown variables that are not recognized to affect the dependent variable that is being studied. They can also be known omitted variables that are not included either due to a lack of data or being outside of the scope of the study. In the case of this paper, there are several known omitted variables that we have excluded in the analysis due to both a lack of data and the time constraints.

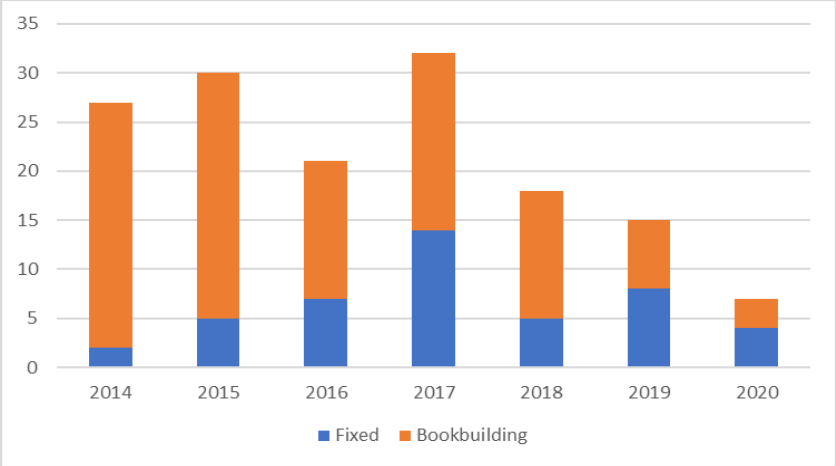
3.5.1 Market conditions

In line with the "hot issue markets" hypothesis, Ibbotson and Jaffe (1975) found that "hot" conditions are predictable and resulting in highly cyclical IPO volumes. This is also intuitive as both investors and firms going public in most instances do so on a voluntary basis. Rational investors seek a positive return on their investment, while the issuing firm want to time their offering to favorable market conditions.

Due to the limited time period in our data sample, it is difficult to compare multiple "hot issue markets" accurately. However, in our data sample there were a total of 32 IPOs in 2017, significantly above the 21 recorded in 2016 and 18 in 2018. This is also matched by 52 IPOs during 2017 in the entire data population, which was the highest during the time

frame. Thus, we find that 2017 can be described as a "hot issue market", preceded by the market conditions in 2016 and followed by the market conditions in 2018. As we only have one "hot issue market" period, and a limited data sample, we have not included this in our statistical analysis of control variables. It is included in the descriptive statistics section.

Figure 3. The IPO volume grouped by offer method and year



3.5.2 IPO by country

Another omitted variable we recognize is the difference in IPO markets. This paper studies IPOs in the main four Nordic markets. While similar in structure and culture, there are still differences in their characteristics. The reason for looking at all four markets instead of one was primarily to increase the number of observations in our data sample. Similarly, the reason for not using IPO market as a control variable is primarily the small country specific data samples.

As can be seen in table 2, while Sweden had 74 IPOs over the relevant time frame, Denmark only had 9 IPOs. There is however a large difference in IPO underpricing between the markets. In Norway the average adjusted initial return was 0.77%, whereas in Sweden it was 11.85%. While some of this discrepancy is explained by the variables included in our analysis, for example the relative share of fixed price IPOs, there are likely to be other variables not included that are relevant as well.

Table 2. The IPOs grouped by market, offer method and initial return

	Norway	Sweden	Finland	Denmark
Number of IPOs	49	74	18	9
Fixed price price IPOs	9	33	3	0
Bookbuilding IPOs	40	41	15	9
Average initial return	0.77%	11.85%	6.23%	10.35%

3.5.3 Sector classification

Another known variable we have chosen not to include in the analysis is IPO firm industry classification. In part, this was also due to the small data samples per industry, which would make meaningful comparisons difficult. It was also due to the limits of the industry classification data available to us. The Industry Classification Benchmark, or ICB, is the official classification system used by Nasdaq since 2012 (Nasdaq, 2011). However, as Kim & Ritter (1999) argues, various classification benchmarks are an imperfect way of grouping companies, particularly companies that operate in multiple business segments. When we checked the ICB classification for some of the IPO firms in our data sample, we found examples of arguably inaccurate classifications. For example, a crude oil tanker shipping company is classified as an Oil&Gas firm in ICB.

4. Data Methodology

4.1 Methodology of IPO returns measurement

4.1.1 Research strategy

We have used a quantitative research approach in this study. This involves using existing research and theories to draw conclusions about our thesis questions, based on the numerical values found using statistical analysis. The quantitative research method allows for measurement of the correlation between factors, facilitating the data into statistics that can be analyzed. The research method start with an analysis of related theories. The purpose of these analyses are to deduct an argument for relationships between selected variables. Following this, hypotheses are formed to investigate whether such relationships exist. These hypotheses are tested empirically, using statistical methods performed on the data sample. The results of these methods are then used to decide whether to accept or reject the hypotheses in question (Bryman, 2012).

4.1.2 Building the theoretical framework

The examined literature was accessed through textbooks used throughout our studies as well other sources. In order to find the most relevant literature, our search was narrowed down to literature about IPOs and drivers for market returns. When assessing the quality of the literature, we assumed that papers, research and theories used in the courses at NHH are of adequate quality.

4.1.3 Development of hypotheses

Based on the research question, and the associated theoretical framework, the following hypotheses are derived:

Hypotheses 0: The immediate effect of IPO method on market adjusted return is equal to 0
Hypotheses 1: The immediate effect of IPO method on market adjusted return is not equal to 0

Hypotheses 0: The effect of IPO method on market adjusted return in the long term is equal to 0
Hypotheses 1: The effect of IPO method on market adjusted return in the long term is not equal to 0

4.1.4 Research design

The research conducted in this paper will follow an explanatory design. This design is used as it aims to explain a relationship between two variables, and the subject of the paper is to determine whether the IPO offer method impacts aftermarket return performance (Bryman, 2012).

4.1.5 Devise measurement of concepts

In quantitative research, a concept is a building block of the analysis, and is derived from relevant theories. It represents a central point around which the research is performed. As such, the concept must be measurable. The standard method of measurement involves a dependent and an independent variable (Bryman, 2012). In this study, a linear regression model will be used. The dependent variable will be post-IPO share returns, and the independent variable IPO method. Control variables included will be derived from theories that describe factors which tend to affect share returns.

4.1.6 Measurement of initial returns

The short-run initial returns, or IR, performance of the IPOs in our data sample have been calculated as the closing price from the first day of trading divided by the final offer price in the issue. To get the market adjusted initial return, or MAIR, that have been used in our analysis, the returns have been adjusted for the benchmark return on the first day of trading. This is in accordance with most studies on IPOs (Logue, 1973). In the short-run underpricing analysis, all 150 IPOs in our data sample have been utilized.

For the Oslo Bors IPOs the OBX-index have been used as benchmark. For the Nasdaq OMX Stockholm IPOs the OMXS30-index has been used. For the Nasdaq OMX Helsinki IPOs the OMXH25-index has been used, and for the Nasdaq OMX Copenhagen IPOs the OMXC20-index has been used. The reason for not using a common benchmark is to capture as much of the country specific market conditions as possible. For the benchmark, the closing price from the day prior to the day of first trading is subtracted from the closing price on the day of first trading and then divided by the closing price the day before first trading. The calculation of MAIR follows the formula below:

$$MAIR = IR - BR = \frac{P_{i,1} - P_{i,0}}{P_{i,0}} - \frac{BM_1 - BM_0}{BM_0}$$

MAIR = Market adjusted initial return of company i

IR = Initial return of company i

BR = The relevant benchmark return

$P_{i,0}$ = The IPO offer price for company i

$P_{i,1}$ = The first trading-day closing price for company i

BM_0 = The prior trading-day closing price for the relevant benchmark

BM_1 = The first trading-day closing price for the relevant benchmark

In the instances where the IPO was underpriced, the MAIR will simply be above zero, and in the instances of overpricing, the MAIR will be below zero.

4.1.7 Measurement of long-run returns

As the scope of this paper on long-run returns analysis is to study the effect of fixed price relative to bookbuilding in IPOs, not the existence of long-run underperformance in IPOs, we have used a simplified version of the buy-and-hold, or BHAR, method from Ritter

(1991). Through this method, the accumulated abnormal returns over the observed holding period, including compound interest effect, is measured. The main benefit of this approach is that it is close to the returns investors would realize. The drawback is that there could be a cross-sectional dependence in the data sample, as IPO volume tend to be clustered, and as such susceptible to correlating factors. However, as this paper's objective is to measure relative performance of fixed price and bookbuilding IPOs, cluster-related data noise is less problematic.

An alternative approach would be to use the cumulative abnormal return, or CAR, method. Here, the daily or monthly abnormal returns over the time period are summed. Fama (1998) argues in favor of this approach as it minimizes the cross-sectional dependence problem. Due to the compounding effect of BHAR, some observations in this approach will also likely have very large returns and become outliers depending on the sample size and time horizon, which could skew the data set causing issues for some statistical tests. This is avoided in the CAR approach, where data samples should be more normally distributed.

In calculating the long-run simplified BAHR in our data sample, we have used the closing price on the day two years after the first day of trading, and then divided it by the final offer price in the IPO. When the day two years following fell on a closed day on the stock exchange, the closing price on the following open day was used. We subsequently adjusted the long-run accumulated return of the firm for the country-specific benchmark return over the same two-year time period. The same benchmarks as in the short-run calculation were applied. All long-run share prices have been adjusted for dividend payouts when applicable, as the databases used do not automatically adjust for this. They have also been adjusted for share splits or reverse share splits when applicable. The observations are equal-weighted. Another approach here would be to use market value weighted observations. This has the benefit of more correctly measuring the aggregated returns from IPOs as a group. However, as this paper studies the relative performance between different types of IPOs, we did not utilize this approach. Following is the formula used to calculate the BAHR:

$$BAHR = LR - BR = \frac{P_{i,1} - P_{i,0}}{P_{i,0}} - \frac{BM_1 - BM_0}{BM_0}$$

BAHR = Buy-and-hold abnormal return of company i

LR = Long-run return of company i

BR = The relevant benchmark return

$P_{i,0}$ = The IPO offer price for company i

$P_{i,1}$ = The 2-year closing price for company i

BM_0 = The prior trading-day closing price for the relevant benchmark

BM_1 = The 2-year closing price for the relevant benchmark

Further, some long-run IPO performance analysis excludes the first day returns to remove the initial underpricing effect. However, as this paper investigates the existence of any difference in underpricing between fixed price and bookbuilding IPOs, and whether this is a short-term effect or also persists in the long run, we have included first day returns in the long-run data analysis.

4.1.8 Matched pairing benchmark

An alternative approach to the use of market indices as benchmark is to match the IPO observations with other stocks that have similar firm specific characteristics and compare the long run returns of these to the IPO observations. This has the benefit of better capturing the expected return from firm specific risk. A related approach for our thesis problem would be to match fixed price and bookbuilding IPO firms with similar characteristics and look at their relative return. We have chosen not to do this due to our data sample is being too small to get statistically significant results, and due to the scope of our analysis.

4.1.9 Testing for statistical significance

After calculation of the MAIR, the next step is to determine whether these returns are statistically significant. Because the sample was not normally distributed, a non-parametric test was used (Gujarati, 2003).

4.1.10 One-sample Student's t-test

A student's t-test was used to statistically examine returns for both fixed price and bookbuilding IPOs. The test analyses whether there are significant returns for each sample group. The following formula is used to calculate the test statistic:

$$T = \frac{\bar{X} - \mu}{S/\sqrt{N}}$$

T = test statistic

X = sample mean

μ = lowest possible mean to reject the null hypothesis

S = sample standard deviation

N = sample size

4.1.11 Welch two-sample Student's t-test

A two-sample t-test is used to determine whether there is a significant difference in mean for the two methods of IPO. The Welch variation of the test is used to account for differences in sample size and standard deviation for the two groups (Welch, 1947). The formula for the test is as follows:

$$T = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{(\frac{S_1^2 - S_1^2}{N_1 - N_2})}}$$

Where:

X1 X2 = mean of sample 1 and 2

S1 S2 = Standard deviation of sample 1 and 2

N1 N2 = size of sample 1 and 2

In addition, the degrees of freedom must be calculated due to the non-consistent sample size using the Welch-Satterthwaite formula:

$$v = \frac{(\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2})^2}{\frac{S_1^4}{N_1^2 v_1} + \frac{S_2^4}{N_2^2 v_2}}$$

Where, in addition to previously described variables:

V = aggregate degrees of freedom

V1 = degrees of freedom for sample 1 (N1 – 1)

V2 = degrees of freedom for sample 2 (N2 – 1)

4.2 Multiple regression model

An ordinary least squares (OLS) multiple regression model will be used to determine whether the method of an IPO affects the immediate and long-term return of stock. Control variables are included in accordance with selected theories in order to increase the accuracy of the model. Increasing the overall precision of the model also increases the reliability of findings related to IPO method. Some control variables were also considered, but in the end omitted, due to their insignificance in the output of the model. The multiple regression model is one of the most common statistical methods used to analyze the relationship between stock returns and suspected causal factors. The model in this study includes seven control variables in addition to IPO method (table 1).

The following regression model was used to analyze the empirical data:

$$MAIR = \alpha + \sum_{n=1}^{m} \beta_n V_{n,i} + \varepsilon_i$$

Where:

α = intercept

β_n = coefficient for variable n

$V_{n,i}$ = independent variable

E_i = standard error term

4.2.1 Regression diagnostics – OLS assumptions

There are four central assumptions on which an OLS regression is based. Violations of these assumptions would render the results of the model unreliable. The assumptions, along with the test performed to control them, are presented in table 3 below:

Table 3. The IPOs grouped by market, offer method and initial return

Assumption	**Test**
Homoskedasticity	Scatterplot interpretation
Autocorrelation	Durbin Watson
Normality	Jarque-Bera, Histogram, Central Limit Theorem
Multicollinearity	Variance Inflation Factor (VIF)

The dependent variable should follow a normal distribution. Heteroskedasticity infers that the dependent variable has a non-constant standard deviation depending on its value and should be avoided. The goal is homoskedasticity. Autocorrelation suggests that one value of a variable affects another, meaning that different observations affect each other. This should

also be avoided. Multicollinearity suggests that independent variables are correlated. This should also be avoided in the data.

4.2.2 Histogram and Jarque-Bera test for normality

A normal distribution is important because it is necessary for most statistical tests, including linear regressions. The simplest explanation for why normal distribution is important is that it provides a mean and a standard deviation to a sample and a population, which are core features in simpler and more intuitive predictive models. There are models that allow for analysis of other distributions, but they are generally more complex due to the higher complexity of the data structure. Three considerations will be made to assess whether the dependent variable is normally distributed. The first it to present the data in a histogram, which is evaluated qualitatively. The second is a Jarque-Bera test. This test generates quantitative factors for the kurtosis and skewness of the variable and has specific limit values used to evaluate these factors. The final consideration is the Central Limit Theorem, which allows for models that require normal distribution even though the data only approximates such distribution due to a large sample size.

4.2.3 Plot test for heteroskedasticity

Heteroskedasticity should be avoided in order to have a strong regression model. The reason is that the regression provides both coefficients as well as the accuracy of these coefficients. With heteroskedasticity present, the stated accuracy of the model cannot be correct, as it should vary for different ranges of the model. Therefore, homoskedasticity is key in order to make the whole model reliable. The evaluation of heteroskedasticity is done through a visual consideration of a scatter plot that presents the standard deviation of an observation relative to its expected value.

4.2.4 Durbin Watson test controlling for autocorrelation

Autocorrelation is a problem in a regression because it means that the dependent variable to some degree can be explained by itself. If observation n is somehow dependent on observation n-1, then this should be included in the model as well. However, if independent variable n-1 affects dependent variable n-1, then the independent n-1 also has an indirect impact in the dependent variable n. Thus, it becomes increasingly difficult to determine how independent variables affect the independent variable. Due to this, a standard linear regression would not be sufficient given the presence of autocorrelation. However, this is mostly an issue in time-series data. Given this, it should not be a concern in the dataset used in this paper, but it will still be controlled for. To control for autocorrelation in the dependent variable, a Durbin-Watson test is performed. Similarly to the Jarque-Bera test, it provides a test statistic as well as limit values that are used to evaluate the outcome.

4.2.5 Variation Inflation Factor to control for multicollinearity

Multicollinearity can cause significant problems in a regression where the coefficients of specific independent variables are important. If the primary independent variable is correlated with other independent variables, its coefficient becomes less reliable as the standard error gets inflated, and so does the analysis of this independent variable. It is therefore important in this case to test for multicollinearity between the choice of IPO method and the other independent variables. In this paper, the method used to control this is the Variance Inflation Factor. The test used provides a statistic ranging from 1 and upwards, where a test statistic of 1 indicates no multicollinearity, while a higher value indicates that there might be a problem. In this test, the limit value if five, and a higher statistic indicates that the coefficients of the related independent variables in a regression are unreliable.

5. Empirical results

5.1 Descriptive statistics

5.1.1 Overall short-run IPO returns

Our data sample of 150 IPOs in the Nordic markets between 2014 and October 2020 had an average first day market adjusted return of 7,46%. Further, the similar median return was 4.58%. When splitting the observations based on IPO offer method, we find that fixed price IPOs had an average first day adjusted return of 13.49%, while bookbuilding IPOs had an average first day adjusted return of 4.88%. The median first day adjusted return for fixed price IPOs was 10.42% while the median first day adjusted return for bookbuilding IPOs was 2.63%.

Furthermore, the variance, standard deviation and skew of fixed price offerings were all higher than for bookbuilding IPOs, indicating that the observation distribution in fixed price offerings is more skewed to the right. This is also shown by the highest observation in fixed price offerings of 55.53%, compared to 37.48% for bookbuilding IPOs. It should be noted that the higher standard deviation does not relate to IPO risk discussed previously, as that is related to the risk of IPO completion.

Table 4. Short-run IPO descriptive statistics

	All IPOs	Fixed price	Bookbuilding
Observations	150	45	105
Mean	7,46 %	13,49 %	4,88 %
Median	4,58 %	10,42 %	2,63 %
Variance	0,01692	0,02190	0,01273

Std deviation	13,01 %	14,80 %	11,28 %
Max	55,53 %	55,53 %	37,48 %
Minimum	-25,20 %	-6,02 %	-25,20 %
Skew	0,83657	1,09253	0,28785
Kurtosis	1,51434	0,56056	0,65055

5.1.2 Overall long-run IPO returns

For the long-run IPO return analysis, all observations without two-year share price history were excluded. The remaining 123 observations are thus from the period between 2014 until December 2018. The overall 2-year average cumulative and market adjusted return for the entire data sample was 38.33%. When splitting the observations based on IPO offer method, we find that fixed price IPOs had an average 2-year cumulative adjusted return of 44.24%, while the similar median return was 21.99%. Bookbuilding IPOs had average 2-year cumulative adjusted return of 36.25%, while the similar median return was 29.02%. Furthermore, the variance, standard deviation and skew of fixed price offerings were all higher than for bookbuilding IPOs in the long-run data.

Table 5. Long-run IPO descriptive statistics

	All IPOs	Fixed price	Bookbuilding
Observations	123	32	91
Mean	38,33 %	44,24 %	36,25 %
Median	28,39 %	21,99 %	29,02 %
Variance	0,62724	0,81498	0,56785

Std deviation	79,20 %	90,28 %	75,36 %
Max	351,90 %	344,63 %	351,90 %
Minimum	-98,60 %	-98,60 %	-97,90 %
Skew	1,19325	1,25536	1,14158
Kurtosis	2,88212	2,52562	3,14875

5.1.3 Annual returns

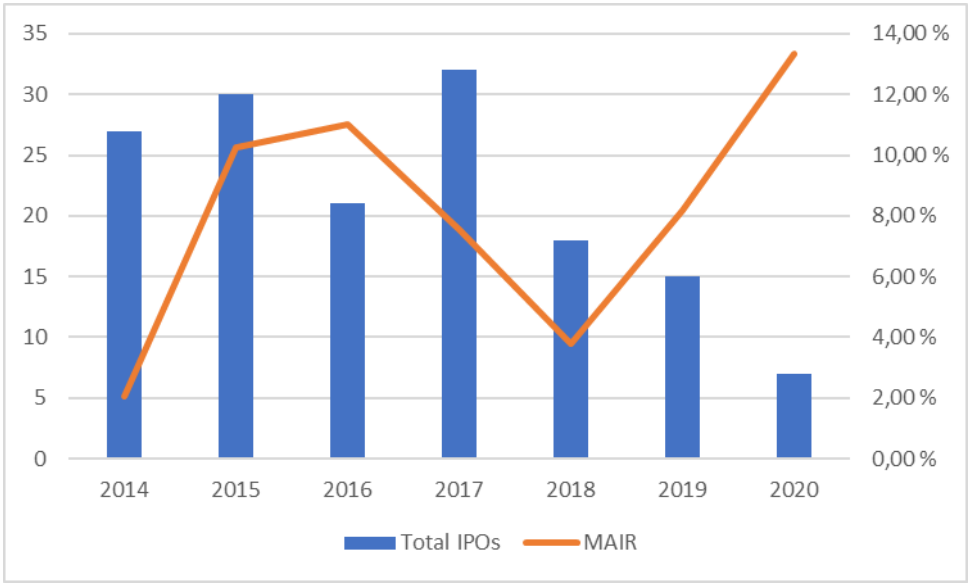
We have defined 2017 as a "hot issue market" preceded by the observations in 2016 and followed by the observations in 2018. As can be seen in table 6, we find that the average initial adjusted return for IPOs in 2016 was 11.02%, while it was 7.53% in 2017 and 3.78% in 2018. This is consistent with strong aftermarket returns preceding a "hot issue market" which then results in lower aftermarket returns in the following period. These results are thus in line with the "hot issue markets" hypothesis and indicate that market conditions do affect the short-run initial returns in our data sample.

Furthermore, it is interesting to note that the average initial adjusted returns of fixed price offerings have exhibited a much larger volatility depending on IPO year compared to bookbuilding offerings. Fixed price offerings had an average initial return in 2018 of 2.01% compared to 23.01% in 2016. Bookbuilding offerings had an average initial return of 0.42% in 2014 compared to 8.92% in 2015. It should be noted that the data samples per year are thin, with for example only five fixed price observations in 2018. However, these results could indicate that the initial underpricing of fixed price offerings are more sensitive to market conditions than bookbuilding offerings. Thus, as the relative share of fixed price and bookbuilding offerings are not evenly distributed across the observed years, it is possible that our analysis results are skewed by market conditions.

Table 6. Descriptive statistics for annual IPO data

	2014	2015	2016	2017	2018	2019	2020
All IPOs	27	30	21	32	18	15	7
MAIR	*2,03 %*	*10,27 %*	*11,02 %*	*7,53 %*	*3,78 %*	*8,20 %*	*13,33 %*
Fixed price	2	5	7	14	5	8	4
MAIR	*22,21 %*	*17,03 %*	*23,01 %*	*10,44 %*	*2,01 %*	*10,11 %*	*19,87 %*
Bookbuilding	25	25	14	18	13	7	3
MAIR	*0,42 %*	*8,92 %*	*5,03 %*	*5,27 %*	*4,46 %*	*6,01 %*	*4,60 %*

Figure 4. Annual volume of IPOs and the MAIR per year



5.2 Statistical significance of IPO method

5.2.1 Test for one-sample statistical significance

Table 7, Statistical significance for initial returns

One sample student t-test statistics	Value
T	7,05
Df	150
Mean	7,48%
Significance, two-tailed	0
99% conf interval	
Lower	4,72%
upper	10,26%

The one-tailed one-sample student t-test has a test statistic of 7,05 and p-value of ~0, with a mean of 7,49%. This allows us to reject the null hypothesis, conclude that returns on the first day are greater than zero, and significant at a 99% confidence level.

Table 8, Statistical significance for long term returns

One sample student t-test statistics	Value
T	5,37
Df	122
Mean	38,33%
Significance, two-tailed	0
99% conf interval	
Lower	21,49%
Upper	Infinite

For 2-year returns, the one-tailed student t-test shows a test statistic of 5,37, and a p-value of ~0 as well. Similarly to the initial returns, we can conclude that long-term returns are significantly greater than zero at a 99% confidence level.

5.2.2 Test for two-sample statistical significance

Table 9, Welch t-test summary on initial returns

Two sample Welch t-test statistics	Value
T	3,49
Df	66,90
Mean fixed price	13,49%
Mean ranged price	4,88%
Significance, two-tailed	0

The two-tailed Welch's two-sample t-test for the initial returns shows that the average return for fixed price IPOs is 13,5%, and 4,9% for IPOs using a price range. The test-statistic is 3,5, and the p-value is ~0. As a result, we can reject the null hypothesis, and conclude that the short term means for the two IPO methods are not equal. It is also clear that fixed price offerings have a significantly greater mean than IPOs that use a price range. In appendix 4, a more visual representation of the difference is presented in a boxplot.
Said figure also shows that fixed price offerings appear to have a much larger standard deviation than its counterpart.

Table 10. Welch-test summary on 2-year returns

Two sample Welch t-test statistics	Value
T	0,45
Df	47,08
Mean fixed price	44,24%
Mean ranged price	36,24%
Significance, two-tailed	0,66

For 2-year returns, the two-tailed Welch's two-sample t-test finds that the average aggregated returns for fixed price offerings is 44,2%, and 36,2% for ranged price offerings. The test statistic is 0,45, and the p-value is 0,66. As a result, we accept the null hypothesis, meaning that there is no significant difference in long term average returns between the two methods. In appendix 5, a more visual representation of the average returns is presented in a boxplot. Similarly to short term IPOs, the boxplot for long term returns show that fixed price offerings have a greater standard deviation.

5.3 Regression analysis

5.3.1 Regression output

Table 11. Regression output

Regression	Short term	Long term
R-Squared	0,3238	0,1215
Adjusted R-squared	0,2855	0,0582
Standard error	10,99%	72,56%

The R squared calculated in the regression output represents the model's goodness of fit. In the short-term regression, the R squared was 0,32. The value of a high R squared as a measurement of the viability of a regression is heavily debated. The authors of this paper assume that this R-squared is good enough to consider the model sufficiently accurate, based on previous experience with goodness of fit with regards to analyses of empirical data.

In the long-term regression, the R squared found is 0,12. This is much lower than that of the short-term regression. As a result, it can be assumed that as time passes, other factors not included in this study start to have a greater effect on stock returns. This is to be expected, but because the difference in returns based on IPO method was found to be most prevalent in the short term, it was beyond the scope of this analysis to incorporate other factors that primarily affect returns in the long run.

5.3.2 Regression diagnostics

6.3.2.1 Normality

Figure 5. Histograms of short term and long term returns

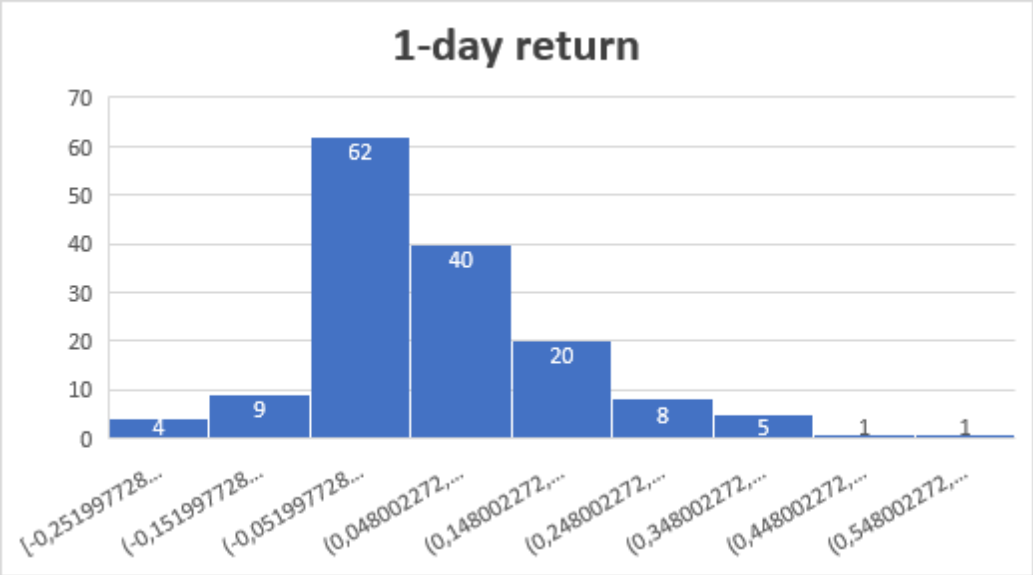


Table 12. Jarque-Bera Test results

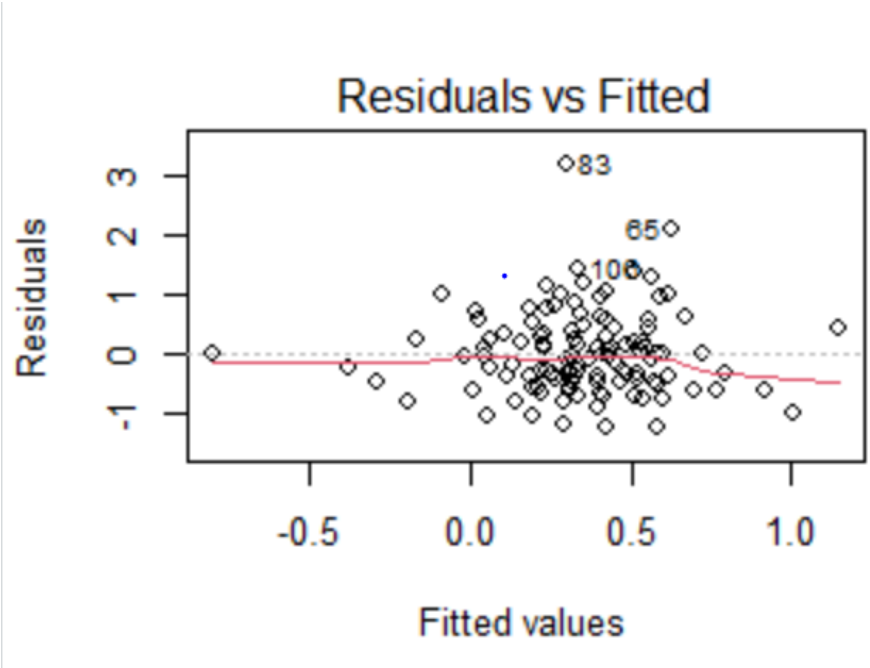
Determinant	Short term	Long term	Correct
Skewness	0,83	0,95	0
Kurtosis	1,38	2,05	3
Jarque-Bera p-value	0	0	P>0,05

As we see from the histogram, both short term and long-term returns have a longer right tail, but overall, they appear to be somewhat normally distributed. However, a better method of controlling for this is to use the Jarque-Bera test for skewness and kurtosis explained earlier. From the output, we see that the p-value is ~0 for both periods, and we reject the null hypothesis of normality. The conclusion is therefore that the data for returns both short term and long term is not normally distributed. However, the Central Limit Theorem is a theory which explains that with a large enough sample size, the distribution of the sample mean will be approximately normally distributed and can be treated as such (Source: stat book). From the histogram, it is reasonable to claim approximate normal distribution, and we therefore consider that this assumption holds.

6.3.2.2 Heteroskedasticity

The assumption of homoskedasticity will be controlled using a scatterplot of the residuals for each regression. It can be observed from the plots bellow that the residuals in neither the short term or long term regressions show any pattern. This confirms that the assumption of homoskedasticity holds in both cases.

Figure 6. Scatterplot of residuals



6.3.2.3 Autocorrelation

The third assumption for a regression is that no autocorrelation is present. As previously explained, there should be no reason to expect a breach of this assumption, as we are not dealing with time series data. However, a Durbin Watson test is used to control for the assumption. From the test output, it can be observed that the short term test statistic is 1,81, and the long term test statistic is 1,92. Both are well within the commonly accepted boundaries of 1,5-2,5. We therefore accept the null hypothesis of no autocorrelation for both short term and long term returns.

Table 13. Durbin Watson test output

	Short term	**Long term**	**Correct**
Test-statistic	1,8	1,9	1,5 < T < 2,5

6.3.2.4 Multicollinearity

Table 14. VIF analysis output

Variable	**Short term**	**Long term**
IPO method	1,68	1,64
Cornerstone commitment	1,46	1,41
Firm age	1,35	1,39
Firm size	1,18	1,19
Relative IPO size	1,70	1,66
Starting vs final IPO size	1,23	1,16
Dividends	1,41	1,55
Liquidity	1,29	1,25

The Variance Inflation Factor test shows that the variables with highest multicollinearity is IPO method with a factor of 1,68 and relative IPO size with 1,69. These test statistics are still significantly lower than the limit of 5, so the assumption of no multicollinearity holds.

5.4 Results Analysis

5.4.1 Summary of independent variables

Table 15 summarizes the t-statistic and the statistical significance of all the included independent variables for both time periods. The full regression output short term and long term can be found in appendix 2 and 3. In the short run, cornerstone commitment, firm age, relative IPO size, difference in initial and final IPO size, as well as liquidity are significant at a 95% confidence level. In the long run, only the difference between initial and final IPO size is significant at a 95% confidence level. In addition, firm age is significant at a 90% confidence level. This further implies that the model is more accurate in the short run.

Table 15. Summary statistics of independent variables

Variable	Short term		Long term	
	T	p-value	T	p-value
IPO method	-1,00	0,32	0,23	0,82
Cornerstone commitment	3,70	0,00	0,38	0,70
Firm age	2,75	0,01	1,82	0,07
Firm size	1,32	0,19	0,88	0,38
Relative IPO size	-3,41	0,00	0,54	0,59
Starting vs final IPO size	2,38	0,02	2,73	0,01
Dividends	0,78	0,43	-1,52	0,13
Liquidity	3,32	0,00	0,91	0,37

5.4.2 IPO method

The Welch two sample t-test for initial returns within fixed price and bookbuilding showed a significant difference in the average return. While IPOs with bookbuilding offer method had an average initial return of 4.9%, those with a fixed price offer method had an average return of 13.5%. The test result allows us to reject a null hypothesis of no difference in average initial returns at a 1% significance level for IPOs in the Nordic markets between 2014 and 2020. When the same test was performed on 2-year returns, the results were different. The average compound return for bookbuilding IPOs was 35.7%, while the similar average return for fixed price offerings was 34.5%. In this case, the null hypothesis of no difference in means is accepted, as we cannot find a significant variation in the means.

The regressions confirm these findings, as the impact of IPO method is shown to have a significantly higher impact short term than long term. A fixed price IPO is expected to have a 3.2% higher initial return than its counterpart. In the long term, the difference is 4.7%, but standard error of the long-term coefficient is 19.3% while the short-term standard error is 2.6%. This means that the coefficient is less precise in the long term, although neither time frame has a statistically significant variable in terms of IPO method.

The findings coincide with the expectation that a difference in returns based on IPO method should be more prevalent in the short term. It is reasonable to assume that IPO companies have imperfect information at the time of determining the price, and that mispricing should be expected to some degree. Based on these expectations and the earlier theoretical discussion, a fixed price offering should tend to have more mispricing, as a price range would end up with a price that is drawn closer to the real market price through the auction mechanism. Considering that the analysis in this paper covers successful IPOs only, a majority of the observations should be underpriced compared to the aftermarket share price level because overpriced IPOs are intuitively more likely to fail. Therefore, the expected underpricing should be larger for fixed price offerings, and the initial aftermarket returns should be similarly greater.

5.4.3 Cornerstone investment

The regression analysis shows that the degree of cornerstone investment impact returns in the short run, but not in the long run. Within the data sample used, if cornerstones subscribed for 100% of the final offer shares, however unlikely, it would result in a 18.2% increase in initial returns at a 95% confidence level. In comparison, the cornerstone commitment has no significant effect on long term returns. These findings confirm the expectations presented previously. The primary argument for the impact of cornerstone commitment is the tradeoff for the issuing firm between IPO offer pricing and the risk of failing. This is created in the form of a discount for cornerstone investors that reduce the IPO risk of failing by guaranteeing the purchase of offered shares. In addition, as previously discussed in the

theory section, a signaling effect is generated as the commitment by cornerstones creates positive momentum for the issuing firm.

5.4.4 Market capitalization

According to research on older data samples, such as the research used to create the Fama-French three factor model, found that smaller firms tend to have higher returns than their larger counterparts (Fama, 1998). However, the results in this analysis does not coincide with such findings. The regression output indicates that "large cap" firms have approximately 6% higher expected returns than "small cap" firms short term, while "medium cap" firms have approximately 3% higher returns than "small cap" firms. The test statistic also shows that this is significant at a 90% confidence level. In the long term the same is implied, although the coefficient does not reach requirements for statistical significance. Though older research contradict these findings, research on newer data samples have found similar tendencies. One example is more recent research into the Fama-French model with data on stock returns after 2008, which found that firm size no longer seem to have a significant impact on expected returns (Kim, et al, 2015).

5.4.5 Company age

Previous research has indicated that younger firms tend to have higher initial underpricing, and the primary argument is that the higher risk taken due to less historical firm information is rewarded with higher returns. However, this sample shows the opposite tendency. Older firms have higher initial returns short term and long term. In the MAIR data, returns increase by an expected 2.1% per degree of age (0-5 years, 6-10 years, 11-20 years, 21-39 years, and 40+ years). Similarly, the expected aggregate long-term returns increase by approximately 11% per age group. It should also be noted that these coefficients are only significant at a 90% confidence level. Another consideration is that the exclusion of age as a factor resulted in firm size becoming more significant in the short term, even though the VIF analysis rejected any suspicion about multicollinearity with a test statistic of 1,36 for age and 1,16 for size. For reference, the limit before indicating a problem is at least 5.

While the results of these empirical results are in conflict with historical findings, there are some arguments that could explain the discrepancy. Firstly, the market could have higher expectations for old companies, as they either are more familiar with them due to long years of exposure to their existence, or because their ownership structure tends to include more funds and large corporations that create a signaling effect of reliability. Another reason could be that most other studies on returns tend use a point in time after an IPO as the starting value of a firm, usually after a lock up period is over. This is to eliminate price adjustments due to mispricing. However, such price adjustments are key to this study, and are therefore included. This could affect the mentioned discrepancy compared to other research.

5.4.6 Dividends

According to the principles of market efficiency, dividends should not impact stock returns because the payout should be accounted for when the market prices a stock similarly to other negative cash flows. Furthermore, companies tend to have clear dividend policies, which make this one of the more predictable valuation factors. The data analysis confirms this expectation, as the variable for dividends is far from statistically significant in relation to both short-term and long-term returns.

5.4.7 Relative IPO size

The data analysis finds that the amount of shares offered for sale in an IPO relative to the post-IPO number of shares is negatively correlated with short term returns. If a company was to offer 100% of its shares, the expected return in the first day would be 17% lower than if the amount of issued stock was insignificant compared to existing shares. This expectation is statistically significant at a 95% confidence interval. In the long run, the relative IPO size appears to have no significant impact on returns, as the variable does not satisfy any statistical requirement. These findings would most likely be a result of liquidity and the basic concept of supply and demand. If a company was to offer more stock in the IPO, the initial

supply increases, and as a result the price goes down. However, in the long run the pricing becomes more reflective of the actual financial performance of the company.

5.4.8 Final shares offered

The difference between the initial amount of shares offered in an IPO and the final amount sold is a proxy for the demand of the IPO. If the initial demand for shares at the issuing firm's desired offer price is lower than the announced share offer volume, the issuing firm might complete the IPO with fewer shares sold than originally intended, but the desired offer price. However, when the shares start trading in the market, the marginal demand for shares, as discovered in the IPO process, is at a lower price point, and thus the share price should decrease in aftermarket trading. Our data analysis supports this assumption. The variable coefficients for both short-term and long-term returns are statistically significant on a 95% confidence level.

5.4.9 Liquidity

The regression analysis shows that a higher aftermarket share liquidity has a positive impact on expected returns. The coefficient of the variable in the short term is 1.11, meaning that a 100% liquidity rate would increase the expected return by 111%. The variable is also significant at a 99% confidence level. For reference, the average liquidity in our data sample is 4.2%, meaning that the average stock can expect a 4.7% increase in return due to this factor in the short run. In the long term, liquidity does not present itself as impactful. The coefficient is 2.44, but is not significant at any relevant confidence level. This should be expected, as the data used on liquidity only covers the first days of trading. The reason that data was not used for a 2-year period was due to the time required to acquire and process this data compared to the importance of both the variable itself and that of the long-term regression in this study. As a result, the long-term impact of the liquidity factor in this paper should not be considered a perfectly accurate reflection of actual market conditions.

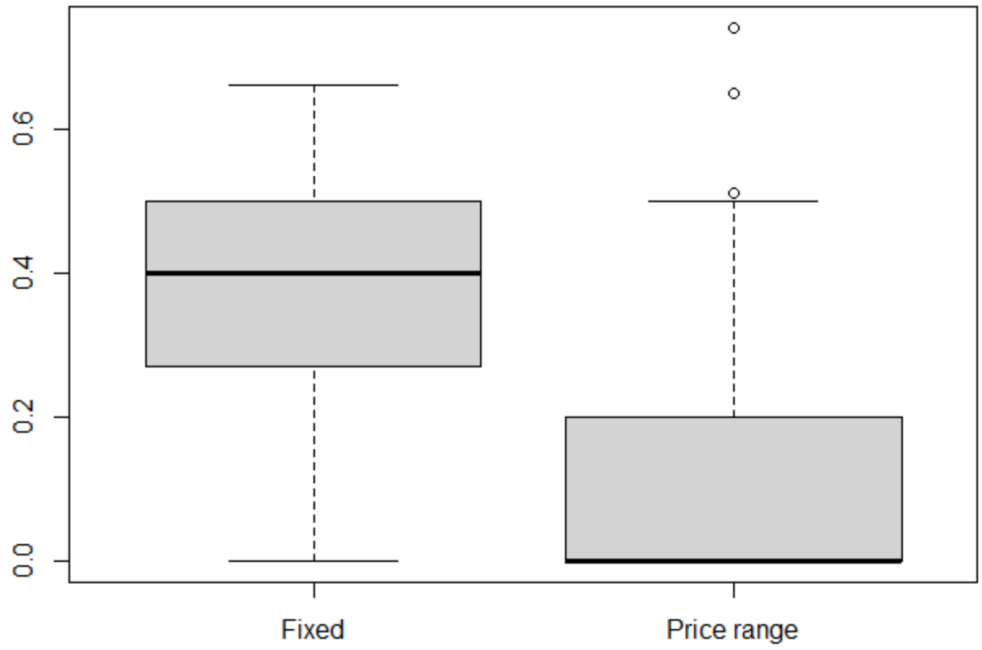
5.4.10 Omitted variables

In addition to the variables included in the final model, some were considered, but eventually excluded. One of the main variables excluded were the ratio between new primary shares issued versus existing secondary shares sold in the IPO. This was because we did not find any significant effect from the variable for either short term or long term returns. The other excluded variable was the number of underwriters engaged in an IPO. The possibility that a higher number of underwriters increased the positive signaling effect to the market was the primary argument. However, this variable did not impact expected returns either. The conclusion is therefore that the only reason to include more underwriters is to reduce the risk of the IPO failing, but as this paper only studies successful IPOs, it did not have an effect on the results.

5.4.11 Relation between IPO method and other independent variables

Even though the assumption of no multicollinearity for the multiple regressions holds, some of the independent variables appear to be linked with the IPO method. From figure x, it is clear that the level of cornerstone commitment is larger for fixed price IPOs. A two-sample t-test (table x in the appendix) confirms that this difference is significant. The average commitment for fixed price offerings is 35.2%, while its only 10.8% for IPOs that use a price range. The difference is significant at a 99% confidence level. It is therefore possible that higher commitment levels from cornerstone investors lead to a higher probability of using a fixed price offer method. This expectation was also suggested through our discussions with industry professionals. The main argument for this is that a higher cornerstone commitment reduces an IPO's risk of failure due to mispricing and makes it easier to determine the highest possible price that still leads to a successful IPO. This reduces the need for a price range when offering the remaining shares in the IPO. As a result, IPO method itself could be a simplified proxy for cornerstone commitment when predicting short term returns for post-IPO stocks.

Figure 7. Boxplot of level of cornerstone investments based on IPO method (1=100%)



6. Conclusion

This thesis paper has looked at Initial Public Offerings in the Nordic market between 2014 and October 2020, and studied the relative characteristics and aftermarket performance between fixed price and bookbuilding offer methods. The goal of the paper was to discover whether the choice of offer method is related to the aftermarket return of an IPO firm, and whether any difference in underpricing also persisted in the long term. Fixed price offerings have become significantly more common in the Nordic market after 2014, which motivated our choice of thesis subject.

Based on the analysis, we find that IPOs in our data sample using a fixed price offer method have an initial market adjusted return of 13.5%, while IPOs with a bookbuilding offer method have an initial market adjusted return of 4.9%. Thus, it appears that the choice of offer method is related to the degree of underpricing, which is consistent with the research of Chemmanur and Liu (2003). We also find that the standard deviation of fixed price offerings is higher than for bookbuilding offerings, indicating that the final offer price in fixed price IPOs has a higher chance of being mispriced. When looking at the long term returns of the different offer methods, we find no statistically significant difference. This indicates that any variation in underpricing is related to the characteristics of the IPO, while other factors have more impact longer term.

Furthermore, we conducted a regression analysis on aftermarket returns based on the offer method as an independent variable and using various other IPO characteristics as control variables. The regression analysis determined that the offer method itself did not appear to be the driver of the short-term aftermarket return variation. When controlling for other factors, the offer method was not statistically significant. Instead, we found that the level of cornerstone investor commitment and share liquidity was the most significant in predicting the initial aftermarket returns. The use of cornerstone investors is a relatively new phenomenon in the Nordic market, and while they appeared in both fixed price and bookbuilding offerings in our data sample, they were relatively more common in fixed price offerings.

As both fixed price offerings and the use of cornerstone investors are relatively new characteristics of IPOs in the Nordic market, there is little previous academic work on the subject. This thesis paper could therefore function as a starting point for further research. Given that IPOs are an important aspect of the financial markets, this paper should also be relevant material for financial investors and firms seeking to go public in the Nordic market.

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8. Appendix

Appendix 1, Complete data sample used

Market	Year	Company Name	Flotation Type	Cornerstone	MAIR	2-year BAHR
Nasdaq OMX Copenhagen	2014	ISS	Bookbuilding	no	14,57 %	25,79 %
Nasdaq OMX Copenhagen	2014	OW Bunker	Bookbuilding	no	19,33 %	
Nasdaq OMX Copenhagen	2015	NNIT	Bookbuilding	yes	25,83 %	46,04 %
Nasdaq OMX Copenhagen	2016	Scandinavian Tobacco Group	Bookbuilding	no	-4,13 %	6,93 %
Nasdaq OMX Copenhagen	2016	DONG Energy	Bookbuilding	no	10,55 %	58,14 %
Nasdaq OMX Copenhagen	2016	Nets	Bookbuilding	no	-1,93 %	
Nasdaq OMX Copenhagen	2017	Orphazyme	Bookbuilding	yes	-1,27 %	-44,24 %
Nasdaq OMX Copenhagen	2017	TCM Group	Bookbuilding	yes	-0,08 %	9,70 %
Nasdaq OMX Copenhagen	2018	Netcompany	Bookbuilding	no	30,29 %	130,02 %
Nasdaq OMX Helsinki	2015	Evli Pankki	Fixed price	no	23,43 %	34,39 %
Nasdaq OMX Helsinki	2015	Consti Yhtiöt	Bookbuilding	no	6,11 %	-4,47 %
Nasdaq OMX Helsinki	2015	Asiakastieto Group Oyj	Bookbuilding	no	4,25 %	24,83 %
Nasdaq OMX Helsinki	2015	Pihlajalinna	Bookbuilding	no	10,57 %	52,00 %
Nasdaq OMX Helsinki	2015	Kotipizza Group	Bookbuilding	yes	6,03 %	156,92 %
Nasdaq OMX Helsinki	2016	Tokmanni	Bookbuilding	no	1,09 %	-12,16 %
Nasdaq OMX Helsinki	2016	DNA Oyj	Bookbuilding	no	-0,58 %	68,55 %
Nasdaq OMX Helsinki	2016	Lehto Group	Bookbuilding	yes	15,04 %	101,92 %
Nasdaq OMX Helsinki	2017	Terveystalo	Fixed price	yes	2,62 %	-8,21 %
Nasdaq OMX Helsinki	2017	Rovio	Bookbuilding	yes	0,08 %	-64,31 %
Nasdaq OMX Helsinki	2017	Silmäasema	Bookbuilding	no	9,16 %	-18,79 %
Nasdaq OMX Helsinki	2017	Kamux	Bookbuilding	yes	5,28 %	-17,40 %
Nasdaq OMX Helsinki	2018	Oma Säästopankki	Bookbuilding	no	2,63 %	12,81 %
Nasdaq OMX Helsinki	2018	Altia	Bookbuilding	no	3,56 %	28,39 %
Nasdaq OMX Helsinki	2018	Harvia Oyj	Bookbuilding	no	1,59 %	85,34 %
Nasdaq OMX Helsinki	2018	Kojamo	Bookbuilding	no	1,24 %	130,55 %
Nasdaq OMX Helsinki	2019	Optomed	Fixed price	no	2,03 %	
Nasdaq OMX Helsinki	2020	Musti Group	Bookbuilding	yes	17,94 %	
Nasdaq OMX Stockholm	2014	NP3 Fastigheter AB	Fixed price	no	13,83 %	57,91 %
Nasdaq OMX Stockholm	2014	Lifco AB	Fixed price	yes	30,58 %	152,60 %
Nasdaq OMX Stockholm	2014	Bactiguard Holding AB	Bookbuilding	no	-17,66 %	-59,73 %
Nasdaq OMX Stockholm	2014	Bufab Holding AB	Bookbuilding	no	5,98 %	13,03 %
Nasdaq OMX Stockholm	2014	Com Hem Holding AB	Bookbuilding	no	9,48 %	30,94 %
Nasdaq OMX Stockholm	2014	Scandi Standard AB	Bookbuilding	no	17,02 %	61,95 %
Nasdaq OMX Stockholm	2014	Inwido AB	Bookbuilding	no	-5,37 %	72,10 %
Nasdaq OMX Stockholm	2014	Thule Group AB	Bookbuilding	no	12,08 %	86,42 %
Nasdaq OMX Stockholm	2014	Gränges AB	Bookbuilding	no	3,86 %	97,85 %
Nasdaq OMX Stockholm	2014	Recipharm AB	Bookbuilding	no	10,56 %	101,46 %
Nasdaq OMX Stockholm	2014	Hemfosa Fastigheter AB	Bookbuilding	no	4,92 %	102,45 %
Nasdaq OMX Stockholm	2014	Besqab AB	Bookbuilding	no	15,94 %	147,63 %
Nasdaq OMX Stockholm	2015	Capio AB	Fixed price	yes	1,16 %	6,33 %
Nasdaq OMX Stockholm	2015	Attendo AB	Fixed price	yes	39,08 %	72,03 %
Nasdaq OMX Stockholm	2015	Collector AB	Fixed price	yes	14,22 %	74,06 %
Nasdaq OMX Stockholm	2015	Eltel AB	Bookbuilding	yes	6,51 %	-21,30 %
Nasdaq OMX Stockholm	2015	Nordax Group AB	Bookbuilding	yes	-1,51 %	4,17 %
Nasdaq OMX Stockholm	2015	Bravida Holding AB	Bookbuilding	no	7,60 %	37,94 %
Nasdaq OMX Stockholm	2015	Hoist Finance AB	Bookbuilding	yes	14,37 %	40,64 %
Nasdaq OMX Stockholm	2015	Dustin Group AB	Bookbuilding	yes	15,91 %	47,91 %
Nasdaq OMX Stockholm	2015	Pandox Aktiebolag	Bookbuilding	yes	1,36 %	49,52 %

Nasdaq OMX Stockholm	2015	Dometic Group AB	Bookbuilding	yes	14,23 %	55,70 %
Nasdaq OMX Stockholm	2015	Nobina AB	Bookbuilding	no	-5,56 %	57,75 %
Nasdaq OMX Stockholm	2015	Alimak Group AB	Bookbuilding	yes	9,80 %	58,51 %
Nasdaq OMX Stockholm	2015	Scandic Hotels Group AB	Bookbuilding	yes	-5,07 %	59,14 %
Nasdaq OMX Stockholm	2015	CLX Communications AB	Bookbuilding	yes	26,26 %	61,93 %
Nasdaq OMX Stockholm	2015	Coor Service Management Holding AB	Bookbuilding	no	-0,97 %	71,92 %
Nasdaq OMX Stockholm	2015	Tobii AB	Bookbuilding	yes	37,48 %	99,16 %
Nasdaq OMX Stockholm	2015	Camurus AB	Bookbuilding	yes	17,84 %	110,82 %
Nasdaq OMX Stockholm	2015	Troax Group AB	Bookbuilding	yes	20,10 %	274,22 %
Nasdaq OMX Stockholm	2016	Serneke Group AB	Fixed price	yes	-0,11 %	-49,69 %
Nasdaq OMX Stockholm	2016	Volati AB	Fixed price	yes	14,13 %	-37,03 %
Nasdaq OMX Stockholm	2016	Alligator Bioscience AB	Fixed price	yes	17,39 %	-20,87 %
Nasdaq OMX Stockholm	2016	TF Bank AB	Fixed price	yes	11,98 %	-14,56 %
Nasdaq OMX Stockholm	2016	AcadeMedia AB	Fixed price	yes	45,14 %	14,48 %
Nasdaq OMX Stockholm	2016	Internationella Engelska Skolan AB	Fixed price	yes	32,02 %	20,97 %
Nasdaq OMX Stockholm	2016	GARO AB	Fixed price	yes	40,50 %	135,39 %
Nasdaq OMX Stockholm	2016	Edgeware AB	Bookbuilding	yes	0,79 %	-51,68 %
Nasdaq OMX Stockholm	2016	Humana AB	Bookbuilding	yes	19,00 %	-29,07 %
Nasdaq OMX Stockholm	2016	Ahlsell AB	Bookbuilding	no	21,55 %	-2,16 %
Nasdaq OMX Stockholm	2016	Resurs Holding AB	Bookbuilding	yes	2,26 %	0,88 %
Nasdaq OMX Stockholm	2016	Nordic Waterproofing Holding A/S	Bookbuilding	yes	2,86 %	9,01 %
Nasdaq OMX Stockholm	2016	Wilson Therapeutics AB	Bookbuilding	yes	1,04 %	351,90 %
Nasdaq OMX Stockholm	2017	Actic Group AB	Fixed price	yes	0,63 %	-36,14 %
Nasdaq OMX Stockholm	2017	Handicare Group AB	Fixed price	yes	10,22 %	-26,43 %
Nasdaq OMX Stockholm	2017	Munters Group AB	Fixed price	yes	19,23 %	-18,19 %
Nasdaq OMX Stockholm	2017	Ferronordic Machines AB	Fixed price	yes	6,96 %	-1,97 %
Nasdaq OMX Stockholm	2017	Ambea AB	Fixed price	yes	9,76 %	8,89 %
Nasdaq OMX Stockholm	2017	FM Mattsson Mora Group AB	Fixed price	yes	38,06 %	23,01 %
Nasdaq OMX Stockholm	2017	Balco Group AB	Fixed price	yes	17,38 %	55,34 %
Nasdaq OMX Stockholm	2017	MIPS AB	Fixed price	yes	10,78 %	155,84 %
Nasdaq OMX Stockholm	2017	Oncopeptides AB	Fixed price	yes	-6,02 %	160,95 %
Nasdaq OMX Stockholm	2017	BioArctic AB	Fixed price	yes	20,65 %	177,88 %
Nasdaq OMX Stockholm	2017	SSM Holding AB	Bookbuilding	yes	-1,20 %	-90,67 %
Nasdaq OMX Stockholm	2017	Bonesupport Holding AB	Bookbuilding	yes	10,71 %	-0,18 %
Nasdaq OMX Stockholm	2017	Boozt AB	Bookbuilding	yes	25,04 %	19,82 %
Nasdaq OMX Stockholm	2017	Medicover AB	Bookbuilding	no	16,20 %	47,21 %
Nasdaq OMX Stockholm	2017	Instalco Intressenter AB	Bookbuilding	yes	18,64 %	65,69 %
Nasdaq OMX Stockholm	2018	Projektengagemang Sweden AB	Fixed price	yes	-0,19 %	-68,07 %
Nasdaq OMX Stockholm	2018	Calliditas Therapeutics AB	Fixed price	yes	2,65 %	97,53 %
Nasdaq OMX Stockholm	2018	NCAB Group AB	Fixed price	yes	1,03 %	106,74 %
Nasdaq OMX Stockholm	2018	Lime Technologies	Fixed price	yes	7,03 %	344,63 %
Nasdaq OMX Stockholm	2018	Bygghemma Group First AB	Bookbuilding	yes	-12,48 %	13,80 %
Nasdaq OMX Stockholm	2018	Q-Linea	Bookbuilding	yes	-2,11 %	109,13 %
Nasdaq OMX Stockholm	2018	Better Collective A/S	Bookbuilding	yes	25,91 %	138,66 %

Nasdaq OMX Stockholm	2019	Ascelia Pharma AB	Fixed price	yes	-0,94 %	
Nasdaq OMX Stockholm	2019	Karnov Group AB	Fixed price	yes	3,12 %	
Nasdaq OMX Stockholm	2019	K2A Knaust & Andersson Fastigheter AB	Fixed price	yes	10,28 %	
Nasdaq OMX Stockholm	2019	John Mattson Fastighetsföretagen AB	Fixed price	yes	13,03 %	
Nasdaq OMX Stockholm	2019	K-Fast Holding AB	Fixed price	yes	55,53 %	
Nasdaq OMX Stockholm	2019	EQT AB	Bookbuilding	no	34,61 %	
Nasdaq OMX Stockholm	2020	Readly International AB	Fixed price	yes	10,42 %	
Nasdaq OMX Stockholm	2020	Wästbygg Gruppen AB	Fixed price	yes	11,60 %	
Nasdaq OMX Stockholm	2020	Nordic Paper Holding AB	Bookbuilding	no	-2,08 %	
Oslo Børs	2014	Vardia Insurance Group	Bookbuilding	no	-14,76 %	-97,90 %
Oslo Børs	2014	RenoNorden	Bookbuilding	no	-1,48 %	-83,00 %
Oslo Børs	2014	African Petroleum Corporation	Bookbuilding	no	-25,20 %	-77,75 %
Oslo Børs	2014	Scanship Holding	Bookbuilding	no	-13,29 %	-75,88 %
Oslo Børs	2014	Havyard Group	Bookbuilding	no	-2,29 %	-62,45 %
Oslo Børs	2014	Avance Gas Holding	Bookbuilding	no	0,31 %	-7,64 %
Oslo Børs	2014	Tanker Investments	Bookbuilding	no	-1,16 %	-1,03 %
Oslo Børs	2014	Entra	Bookbuilding	no	-0,88 %	29,02 %
Oslo Børs	2014	Next Biometrics Group	Bookbuilding	yes	-18,46 %	31,74 %
Oslo Børs	2014	Zalaris	Bookbuilding	no	8,99 %	41,80 %
Oslo Børs	2014	Scatec Solar	Bookbuilding	no	2,29 %	72,18 %
Oslo Børs	2014	XXL	Bookbuilding	no	7,17 %	94,42 %
Oslo Børs	2014	Serendex Pharmaceuticals	Bookbuilding	no	-21,47 %	
Oslo Børs	2015	Hugo Games	Fixed price	no	7,27 %	-98,60 %
Oslo Børs	2015	Europris	Bookbuilding	no	-4,99 %	-24,40 %
Oslo Børs	2015	Multiconsult	Bookbuilding	no	19,03 %	8,55 %
Oslo Børs	2015	Kid	Bookbuilding	no	-4,08 %	14,90 %
Oslo Børs	2015	Skandiabanken	Bookbuilding	no	-5,97 %	49,14 %
Oslo Børs	2015	Nordic Nanovector	Bookbuilding	no	7,96 %	185,05 %
Oslo Børs	2016	Arcus	Bookbuilding	no	-1,10 %	-33,10 %
Oslo Børs	2016	B2Holding	Bookbuilding	no	3,99 %	6,17 %
Oslo Børs	2017	BerGenBio	Fixed price	yes	-0,07 %	-36,35 %
Oslo Børs	2017	Self Storage Group	Fixed price	no	-3,65 %	42,00 %
Oslo Børs	2017	Unified Messaging Systems	Fixed price	no	19,55 %	
Oslo Børs	2017	Komplett Bank	Bookbuilding	yes	2,45 %	-52,59 %
Oslo Børs	2017	Infront	Bookbuilding	no	9,96 %	-18,45 %
Oslo Børs	2017	EVRY	Bookbuilding	no	-9,12 %	-7,99 %
Oslo Børs	2017	SpareBank 1 Nordvest	Bookbuilding	no	1,95 %	-6,60 %
Oslo Børs	2017	Sparebank 1 Østlandet	Bookbuilding	no	1,71 %	-5,56 %
Oslo Børs	2017	Webstep	Bookbuilding	no	10,10 %	-2,61 %
Oslo Børs	2017	Crayon Group Holding	Bookbuilding	no	-4,74 %	190,79 %
Oslo Børs	2017	Saferoad Holding	Bookbuilding	yes	-0,08 %	
Oslo Børs	2018	PoLight	Fixed price	yes	-0,45 %	90,83 %
Oslo Børs	2018	Shelf Drilling	Bookbuilding	no	-0,62 %	-83,84 %
Oslo Børs	2018	Elkem	Bookbuilding	no	-2,75 %	-29,78 %

Oslo Børs	2018	Sparebanken Telemark	Bookbuilding	no	4,24 %	31,81 %
Oslo Børs	2018	Salmones Camanchaca	Bookbuilding	no	6,89 %	72,15 %
Oslo Børs	2018	Fjordkraft Holding	Bookbuilding	no	-0,48 %	120,36 %
Oslo Børs	2019	Ultimovacs	Fixed price	yes	-2,34 %	
Oslo Børs	2019	Klaveness Combination Carriers	Fixed price	no	0,21 %	
Oslo Børs	2019	Sats	Bookbuilding	no	-6,96 %	
Oslo Børs	2019	Hafnia	Bookbuilding	no	-4,60 %	
Oslo Børs	2019	Okea	Bookbuilding	no	-4,55 %	
Oslo Børs	2019	Norske Skog	Bookbuilding	no	0,07 %	
Oslo Børs	2019	Norbit	Bookbuilding	no	8,83 %	
Oslo Børs	2019	Adevinta	Bookbuilding	no	14,65 %	
Oslo Børs	2020	Link Mobility Group	Fixed price	yes	15,74 %	
Oslo Børs	2020	Pexip	Fixed price	yes	41,74 %	
Oslo Børs	2020	BW Energy	Bookbuilding	no	-2,05 %	

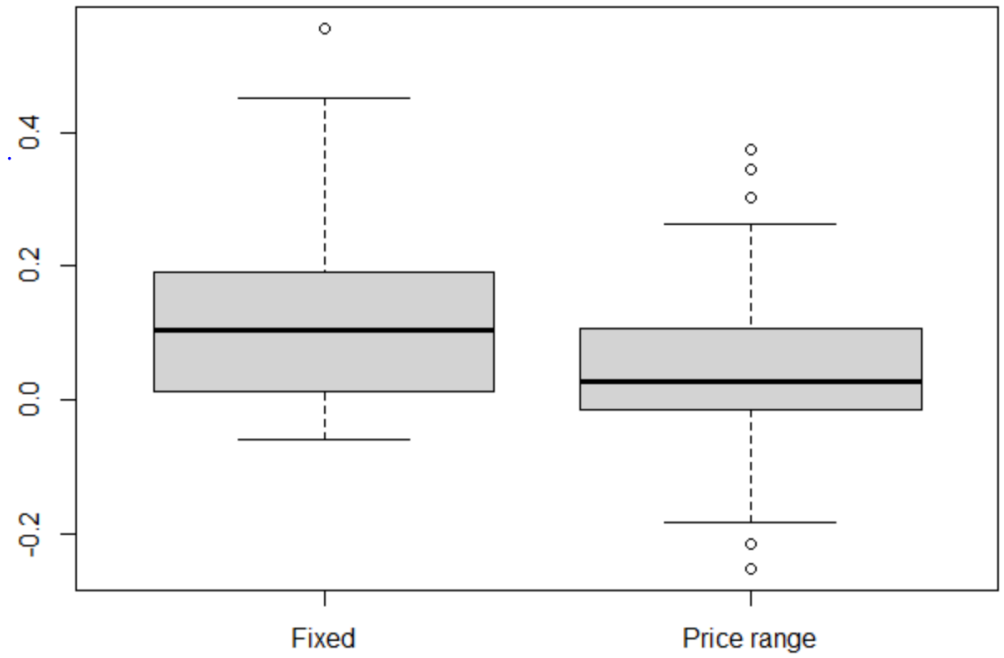
Appendix 2, Full regression output, 1-day

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   -0.16198    0.06830  -2.372 0.019058 *
FlotationCode -0.02538    0.02537  -1.001 0.318774
CommitmentPC   0.18904    0.05106   3.702 0.000306 ***
AgeGroup       0.02397    0.00873   2.746 0.006827 **
ValueGroup     0.02074    0.01576   1.316 0.190230
PCSharesSold  -0.22862    0.06712  -3.406 0.000859 ***
FinalOfferPC   0.14531    0.06116   2.376 0.018855 *
DividendDummy  0.01753    0.02235   0.784 0.434314
LiquidityPC    1.11095    0.33458   3.320 0.001144 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1099 on 141 degrees of freedom
Multiple R-squared:  0.3238,    Adjusted R-squared:  0.2855
F-statistic: 8.441 on 8 and 141 DF,  p-value: 2.459e-09
```

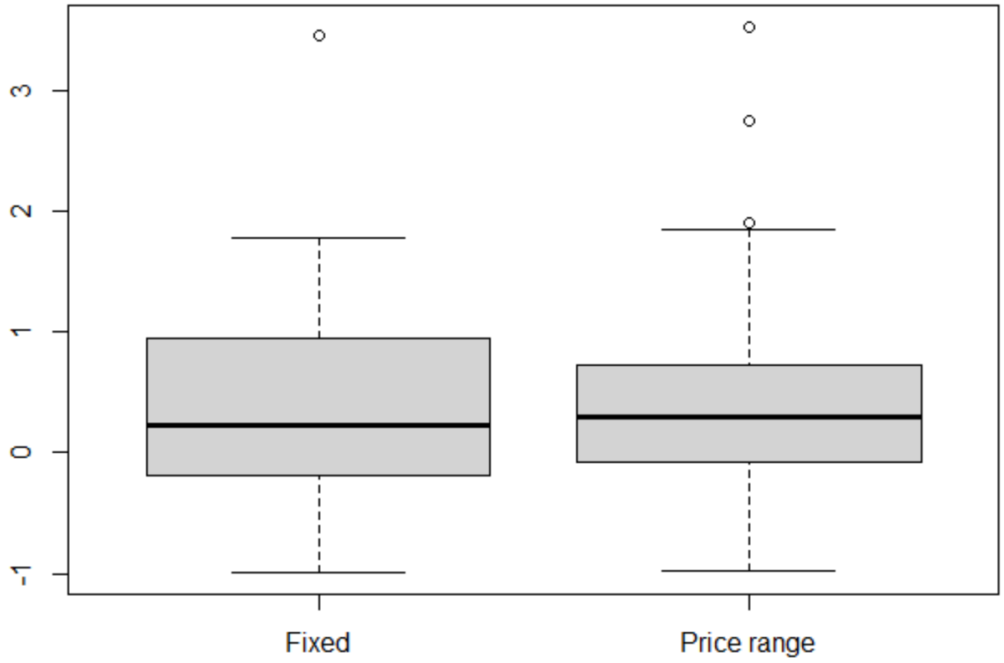
Appendix 3, Full regression output 2-year

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  -1.52815    0.53209  -2.872  0.00489 **
FlotationCode  0.04496    0.19358   0.232  0.81677
CommitmentPC   0.14164    0.37081   0.382  0.70322
AgeGroup       0.12277    0.06738   1.822  0.07113 .
ValueGroup     0.10443    0.11863   0.880  0.38061
PCSharesSold   0.26901    0.49906   0.539  0.59094
FinalOfferPC   1.23714    0.45293   2.731  0.00734 **
DividendDummy -0.28708    0.18856  -1.522  0.13073
LiquidityPC    2.44963    2.69342   0.909  0.36506
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.7256 on 111 degrees of freedom
  (30 observations deleted due to missingness)
Multiple R-squared:  0.1215,    Adjusted R-squared:  0.05816
F-statistic: 1.919 on 8 and 111 DF,  p-value: 0.06403
```

Appendix 4, 1-day returns fixed price vs bookbuilding



Appendix 5, 2-year returns fixed price vs bookbuilding



Appendix 6, Welch-test for difference in mean corner investment for fixed price vs bookbuilding

T	7,32
Df	78,34
Mean fixed price	35,18%
Mean Bookbuilding	10,80%
Significance, two-tailed	0