Go Big or Go Home:

A quantitative study on the role of institutional cornerstone investors in Initial Public Offerings and their relationship to IPO underpricing

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Abstract

This study examines the correlation between institutional investors as cornerstone investors and the underpricing of initial public offerings (IPOs) in Sweden. The study analyzes a total sample of 371 observations between 2015 and 2022, including 165 observations backed by institutional cornerstone investors, 163 observations backed by non-institutional cornerstone investors and 43 observations without cornerstone investors. Using two-sided t-tests, the results of this study confirm that both IPOs in general and institutionally cornerstone-backed IPOs, in particular, have been underpriced during the examined period, with an average underpricing of 8.7% and 17.7%, respectively. Moreover, with support from regression models, the analysis reveals that IPOs backed by non-institutional cornerstone investors have been significantly more underpriced than the average IPO. The study offers complementary evidence supporting previous theories on IPO underpricing and provides novel insights into the mechanisms of IPO underpricing in Sweden.

Table of contents

1 Introduction

1.1 Background

2021 was a record year in Sweden with regard to companies making their debut on the Swedish stock exchanges, but the attractive listing climate came to an abrupt end in 2022 due to several macroeconomic factors (Earnst and Young, 2022). The topic of going public is commonly discussed internally at some point in a company's development, driven by various factors such as the need to raise funds for expansion or the desire of owners to sell parts or all of their shares. A common way to pursue the process is through an initial public offering (IPO), in which existing or newly issued shares are sold in connection to the listing. One of the challenges that arise during an IPO is determining the most appropriate price for the stock. The challenge typically results in situations where the market price turns out to be substantially higher than the issuing price, commonly referred to as IPO underpricing.

IPO underpricing has been a long-standing research topic, with various theories attempting to explain it. A recent concept that has emerged is that of cornerstone investors, who commit to purchase a significant share of the IPO offering at the offer price and are mentioned in the IPO prospectus. The first cornerstone-backed IPO took place in 2014 with the introduction of Lifco (Dagens Industri, 2015). Since then, it has become increasingly popular to include cornerstone investors in IPOs, and during the period from 2015 to 2022, almost 90% of all IPOs had at least one cornerstone investor present (Nasdaq, 2023). Due to the recent emergence, the amount of historical data and previous research on the topic is limited, making it an interesting area for research.

Even though previous studies have investigated the relationship between cornerstone investors and IPO underpricing both globally and in Scandinavia, most research has covered the differences between cornerstone backed IPOs and non-cornerstone backed IPOs. Since anyone can act as a cornerstone investor, the potential differences in their characteristics become an interesting subject for investigation. The study aims to fill this gap by examining how institutional investors, acting as cornerstone investors in Swedish IPOs, are related to IPO underpricing.

1.2 Definitions

Term	Explanation/Definition
Cornerstone investor	An investor who agrees to purchase a pre-determined number of shares in the IPO, before the shares are offered to the general public
Initial public offering (IPO)	The process when a private company offers its shares to the public for the first time and starts trading on a stock exchange
IPO underpricing	The percentual difference between IPO offer price and the closing price on the first day of trading
Institutional investor	Companies in the following categories: funds, insurance companies, banks and publicly traded investment companies
Leaving money on the table	In the context of IPOs it refers to the issuing firm getting less money for their shares than they could when going public
Prospectus	A legal document that provides information about the company and the offering before a listing
Subscription price	The price that someone participating in an IPO pays per share. The subscription price is the same for cornerstone investors and investors participating later in the process
Underwriter	Financial institution or investment bank that helps a company go public. Leads the process of valuation, production of prospectus and contact with investors

1.3 Delimitations

The first Swedish cornerstone-backed IPO took place in late 2014 and this paper subsequently studies the period from 2015 to and including 2022. Further on, only Swedish firms listed on

the Nasdaq Main Market Stockholm and Nasdaq First North Growth Market Stockholm have been included as they are the only marketplaces that consistently introduce companies of relevant size and with cornerstone presence. Due to the relatively new dynamic of cornerstone presence in Swedish IPOs, the sample size has been limited. Even though the study includes all IPOs during the period, the sample size is relatively small which could lead to inaccurate or inconclusive results.

In regards to earlier research, several variables have been tested and proven significant for having an effect on the level of underpricing (Borg and Engberg, 2016), (Johansson and Rosberg, 2020), (Butler et al., 2014) and (Loughran and Ritter, 2004). In this study, some of them have been actively disregarded, partly because of time, resources, and data availability. Furthermore, with regard to the thorough process and professionality of underwriters, many factors are expected to already be accounted for. Nevertheless, this study includes some factors that focus on the conditions that underwriters may not account for in their valuation.

In the study, a large share of the data collection has been done manually. Consequently, there is a risk of human errors. As an attempt to counteract this, each data point has been double-checked after collection to ensure higher reliability. In the case that human error would have created any extreme outliers, the sample has also been winsorized. Consequently, the error would have a limited effect on the results. Some prospectuses have not been available due to missing data. This has led to the exclusion of some observations, as each prospectus is necessary for information on potential cornerstone participation. Moreover, the generic but strict classification of institutional investors could lead to biased or inaccurate outcomes of the study.

2 Literature Review and Theoretical Framework

The concept of cornerstone investors in IPOs is a fairly new phenomenon and previous studies have just partly covered their impact on IPO underpricing. Further on, the relationship between the type of cornerstone investor and IPO underpricing has not yet been studied. This chapter will present earlier research on the topic along with explanatory theories and the concepts of cornerstone and institutional investors. Lastly, this paper's contribution, research question, and hypotheses will be presented.

2.1 Previous Research on IPO Underpricing

The first studies on IPO underpricing were made by Reilly (1973) and Ibbotson (1975), both performed on the US market. Although they indicate different levels of underpricing, both confirm the presence of underpricing in the average IPO. Reilly measured underpricing in relation to industry averages and found an average of 9.9% between 1963 and 1965, while Ibbotson (1975) measured the risk–adjusted returns on IPOs between 1960-1969 and concluded an average underpricing of 11.4%.

Corresponding research has been made on the Swedish stock exchanges. Wiklund (2018) measured a mean underpricing of 13.8% on Nasdaq Stockholm based on a sample of 90 listings between 2002-2017 (2018) and Bruzgyte (2016) found a mean underpricing of 4.7% at Nasdaq First North based on 83 listings between 2009 and 2015.

2.2 Theories Explaining IPO Underpricing

The presence of underpricing implies that issuing firms are not realizing the full potential value of their shares in IPOs, thus leaving money on the table to investors. To explain the phenomenon, several theories have been developed, which can be classified into four main groups: 1) asymmetric information, 2) institutional reasons, 3) control considerations, and 4) behavioral approaches (Ljungqvist, 2007). Since underpricing depends on two variables, the offer price and the closing price, it can increase through a lower offer price or a higher closing price. Academic theories explaining underpricing focus on the former, assuming that the closing price is fixed at the fundamental value of the shares. The underpricing, however, can

depend on factors occurring both prior to and after setting the subscription price, depending on which explanatory framework that is used.

To further substantiate this study, an interview has been held with an employee at the Corporate Finance department at Erik Penser Bank. Besides general information on IPO underpricing, the interview also covered the theories that will compose the theoretical framework of the study. The interview further gave basic insights into the negotiation process between underwriters and investors, and how the dynamics can change depending on the investor in question. By combining the practical insights of a professional with existing theories, the relevance of the framework was validated.

2.2.1 Asymmetric Theories

The subscription price is negotiated between the firm going public, the underwriter, and eventual cornerstone investors. Naturally, they have different access to information, causing information asymmetry, with the implication that more information asymmetry results in more underpricing. Rock (1986) suggests that some investors possess an informational advantage, and subsequently only participate in IPOs with favorable pricing. Informed investors will crowd out uninformed ones in discounted IPOs and withdraw in overpriced IPOs, resulting in overall negative returns for uninformed investors. This is referred to as the winner's curse and issuing firms therefore have to price their stock at a discount in order to also get uninformed investors to subscribe for shares.

Allen and Faulhaber (1989) propose a theory of asymmetric information where high-quality firms use underpricing as a signaling mechanism to attract investors. By deliberately underpricing their stock, high-quality companies can send a credible signal of their quality to investors, which low-quality firms cannot easily imitate. High-quality firms expect their stock to appreciate and are thus willing to allow underpricing as it enables them to issue new shares at favorable terms in the future. The same will not be possible for low-quality companies with anticipated negative share price development, resulting in an efficient signaling action for high-quality companies.

2.2.2 Institutional Theories

Underpricing of IPOs may have a tax advantage, as argued by Rydqvist (1997) in the context of Swedish IPOs. Prior to 1990, Sweden heavily taxed employment income relative to capital gains, incentivizing firms to allocate appreciating assets, such as underpriced stock, to employees instead of salaries. However, Swedish tax authorities have since then imposed taxes on such gains similar to that of income. Consequently, the tax benefits from underpricing ceased to exist, decreasing the average underpricing from 41% in 1980-1989 to 8% in 1990-1994 (Rydqvist, 1997).

2.2.3 Control Theories

Brennan and Franks (1997) suggest that issuing companies use underpricing strategically to protect their private benefits and non value-maximizing behavior within the company. Underpricing the stock implies that the company will receive high interest in the issue and thus be able to allocate small stakes to many investors. This reduces external monitoring and the risk of being scrutinized and is thus a preferred action by the management as it increases agency costs.

Stoughton and Zechner (1998) present a different perspective from Brennan and Franks and argue that underpricing is preferred by the management as it increases rather than reduces monitoring. Given that management could be co-owners, obtaining few shareholders with large stakes could be favorable, as monitoring is considered beneficial for all shareholders. Accordingly, managers would want to increase demand through underpricing and allocate large stakes to single shareholders in order to encourage monitoring.

2.2.4 Behavioral Theories

Behavioral theories suggest that underpricing in IPOs can be caused by irrational investors bidding up the price of the stock above its true value. It may also be attributed to factors that restrict issuing companies from exerting pressure on investment banks to decrease underpricing.

Both theories can be explained through the concept of "information cascades" (Welch, 1992) occurring when investors make investment decisions sequentially. In such instances, investors base their bids on the bids of earlier investors, regardless of the signals of their own private information. This behavior creates a momentum effect, either upward or downward, depending on the sentiment among past investors. Cornerstone investors in IPOs are therefore in a favorable negotiating position as their investment can start a positive information cascade. Awareness of this effect can convince issuing companies to underprice their shares during an IPO, as they anticipate that the increase in stock price may exceed the initial loss incurred from the IPO underpricing.

2.3 Definition and Description of Cornerstone Investors and Institutional Investors

In this paper, the terms "cornerstone investor" and "institutional cornerstone investor" are used frequently, and their distinction is crucial for the purposes of this study as they will be treated separately.

Cornerstone investors, sometimes also referred to as anchor investors, are granted the right to subscribe to a specific quantity of shares before the public offering, and their names are included in the prospectus. This sets them apart from other participators in the offering who register their interest to subscribe for a number of shares, whereafter they are allocated an amount depending on the overall demand. Although cornerstone investors are allocated their shares earlier than retail investors, the subscription price is always the same for the two groups. For the purpose of this paper, we will consider an investor to be a cornerstone investor if they are:

1. Committed to buying a prespecified number of shares in the IPO at the same price as other investors.
2. Presented in the IPO prospectus as a cornerstone investor or subscription undertaker.

Anyone can act as a cornerstone investor in an IPO, and the most commonly occurring participants are institutional investors, private companies, and private individuals. For the purpose of this study we will classify cornerstone investors into two district groups. The first

group consists of institutional investors who manage money on behalf of other investors and typically have access to more resources and information. For the purpose of this study, the following groups will be classified as institutional investors:

1. Funds
2. Insurance companies
3. Banks
4. Publicly traded investment companies

The second group of cornerstone investors will be defined as non-institutional, including all cornerstone investors that are not classified as institutional. The group consists of private individuals, private companies, foundations, etc.

2.4 Previous Research on IPO Underpricing and Cornerstone and Institutional Investors

In Europe, the first cornerstone-backed IPO of considerable size was the introduction of Glencore to the London Stock Exchange in 2011 (Practical Law Magazine, 2015), whereafter the frequency increased. In Sweden, the first cornerstone-backed IPO was made in 2014 with the introduction of Lifco to Nasdaq Stockholm (Dagens Industri, 2015). Studies have been conducted on how the presence of cornerstone investors affects IPOs, however, most of them in Asian markets (Daily et al., 2003) and (Hu et al., 2021). Gulbrandsen (2021) found significant results of the relationship between cornerstone investors and underpricing. The study concluded that in Scandinavia, cornerstone backed IPOs had 6.6% higher underpricing on average (Gulbrandsen, 2021).

While studies involving institutional investors in IPOs are lacking in the Scandinavian markets, it has been studied in the US market. Hanley and Wilhelm (1995) found that institutional investors are recipients of a large fraction of the short-term profits from a company going public. The study further finds a "quid pro quo" relationship between institutional investors and underwriters. This relationship puts pressure on institutional investors to participate in both overpriced and underpriced IPOs. However, their allocated

share tends to be considerably larger in underpriced IPOs and vice versa. In other words, the benefit of getting access to underpriced IPOs outweighs the costs of participation in overpriced IPOs.

2.5 The Potential Relationship between Institutional Cornerstone Investors and IPO Underpricing

Previous research has identified several effects that explain why cornerstone investors may have an impact on IPO underpricing. Some of these theories are particularly relevant when analyzing cases involving institutional cornerstone investors, as their specific capabilities may affect the relationship. The following categories of theories have been found relevant for the relationship in previous research, and mentioned during the interview.

2.5.1 Monitoring Effect

Institutional investors are acknowledged to reduce the agency problem between shareholders and management, in terms of earnings management (Jensen and Meckling, 1976), (Shleifer and Vishny, 1986) and (Hartzell and Starks, 2003). The two main arguments behind the superior monitoring abilities of institutional investors compared to retail investors are;

1. Institutional investors have access to internal capacity in the form of professional researchers, traders, and portfolio managers, helping them to detect problems in earnings management in the first place
2. Institutional investors have access to additional information which combined with their internal capacity generates efficient monitoring

The monitoring effect suggests that IPOs backed by institutional cornerstone investors should generate more underpricing than other IPOs, as their monitoring ability provides shareholder value.

2.5.2 Negotiation Effect and Information Cascades

The theory of information cascades (Welch, 1992) describes investment behavior as a sequential process where investors base their investment decisions on the investments of previous ones. Investors are irrational in the sense that they disregard their own information when making investment decisions. In the context of IPOs, the presence of cornerstone investors implies that some of the shares in an offering are pre-subscribed. This would offset the sell side surplus and through the concept of information cascades, potentially result in future bids from other investors. The theory of information cascades could be related to a negotiating effect regarding the bargaining power of investors. It indicates that underpricing is a consequence of certain investors utilizing awareness of their informational cascades to obtain beneficial offer terms in negotiations.

The information cascades and negotiation theory suggests that offerings with the participation of cornerstone investors will be related to a higher level of IPO underpricing, and vice versa. The character of the cornerstone investors should by definition not be determinant for this effect as informational cascades theoretically rely on the behavior of any investor.

2.5.3 Cherry Picking Effect

The cherry picking effect in IPOs refers to the ability of professional investors to successfully select and participate in underpriced IPOs. It is a combination of the opportunity to invest earlier than other investors and the skill to select the best offers. These investors have an advantage in accessing IPO opportunities and the ability to identify the most promising ones, leading to a greater likelihood of participating in underpriced IPOs.

Empirical evidence suggests that when underwriters and institutional investors interact repeatedly in IPOs, they can reduce the cost associated with acquiring information (Hanley and Wilhelm, 1995). This can be attributed to the fact that repeated interaction fosters an environment of trust and mutual understanding. In such a situation, investors need to carefully consider the potential consequences of their actions, as being dishonest for a one-time benefit could weaken the trust and future relationship (Cornelli and Goldreich, 2001) and (Ljungqvist, 2007).

The prioritization of contacting institutional investors is confirmed by the held interview, and IPOs backed by institutional investors should therefore be positively correlated with IPOs that are underpriced. The effect is further confirmed by Abrahamsson and De Ridder (2015) suggesting that institutional investors are able to identify underpriced companies to a greater extent than individual investors.

2.5.4 Supply and Demand Effect

The supply and demand effect refers to the limitation of available shares that remains when cornerstone investors have subscribed to a part of the offering before the public is offered to subscribe (Ritter, 2002). Cornerstone investors typically take up a significant portion of the offering and as a result, unallocated investors may instead purchase shares on the open market during the first trading day. This dynamic could result in a higher price for the stock driven by the principles of supply and demand.

The supply and demand effect suggests that there is a positive correlation between cornerstone investors and underpricing, regardless of the cornerstone character, as underpricing should be affected by the number of shares available for retail investors.

2.6 Research Questions and Hypotheses Development

2.6.1 Research Questions

Earlier research on IPO underpricing in the Scandinavian markets has indicated that the participation of cornerstone investors significantly increases the underpricing on average (Gulbrandsen, 2021). Given the characteristics and features of institutional investors and identified theories explaining underpricing in general, it is predicted that institutional cornerstone investors will lead to a higher underpricing than IPOs without cornerstone investors. Given this prediction, the following research question has been defined, which the paper aims to answer.

1. Do institutional cornerstone investors have a significant relationship with IPO underpricing in the Swedish market?

It is further predicted that the homogenous treatment of cornerstone investors used in previous studies, disregarding their individual capabilities and characteristics, has misallocated the effect. In line with explanatory theories and the idea that an investor of institutional type fulfills the implied characteristics more accurately, a second research question has been developed. The second research question aims to investigate whether the relationship that earlier has been confirmed between cornerstone investors and underpricing, actually should be attributed to institutional cornerstone investors.

2. Do IPOs backed by institutional cornerstone investors have a stronger relationship with IPO underpricing than IPOs backed by non-institutional cornerstone investors?

2.6.2 Hypothesis Development

Based on our research questions, five null hypotheses have been defined. The first three hypotheses aim to see whether underpricing is present in the whole dataset and among the two subsets of cornerstone investors.

The first hypothesis tests whether underpricing is present in the whole dataset:

H01: There has been no underpricing in Swedish IPOs between 2015 and 2022.

The second hypothesis tests whether underpricing is present among the observations where cornerstone investors of any type are present:

H02: There has been no underpricing in Swedish IPOs backed by cornerstone investors between 2015 and 2022.

The third hypothesis tests whether underpricing is present among the observations where exclusively institutional cornerstone investors are present:

H03: There has been no underpricing in Swedish IPOs backed by institutional cornerstone investors between 2015 and 2022.

Given the assumed existence of underpricing in the datasets, the following hypotheses aim to investigate whether there are significant differences in the mean of underpricing between the subsets, that are based on the presence of cornerstone investors and their type, being either institutional or non-institutional.

The fourth hypothesis aims to contribute to the first research question and tests whether IPOs backed by institutional cornerstone investors are more underpriced than those that are not, including both non-institutional cornerstone investors and IPOs with the absence of cornerstone investors:

H04: Swedish IPOs backed by institutional cornerstone investors have not been more underpriced than IPOs, excluding institutional investors, between 2015 and 2022.

The fifth hypothesis aims to contribute to the second research question of this study by testing whether IPOs with presence of institutional cornerstone investors are more underpriced than the IPOs with presence of non-institutional cornerstone investors:

H05: Swedish IPOs backed by institutional cornerstone investors have not been more underpriced than non-institutional cornerstone backed IPOs between 2015 and 2022.

2.7 Research Gap and Contribution

Previous research has explored the relationship between the presence of cornerstone investors and IPO underpricing and has suggested a positive relationship between the two (Gulbrandsen, 2021). However, as the first Swedish cornerstone backed IPO took place in 2014, there exists a need to explore the phenomenon further, especially with a newer and larger dataset.

This study aims to contribute to previous research on IPO underpricing and cornerstone investors by utilizing a more extensive dataset, including 371 observations between the years 2015 and 2022. Within the sample of this study, 165 observations include institutional cornerstone investors, 163 observations include non-institutional cornerstone investors and 43 observations are without cornerstone investors. The first contribution of this study is thus:

1. By using a larger data sample than previous research we can derive a better description of underpricing on the Swedish market.

The study also puts focus on the separation of institutional and non-institutional cornerstone investors. This enables a more comprehensive analysis of the relationship between the presence of cornerstone investors and IPO underpricing in the Swedish market. Additionally, previous research has treated the presence of cornerstone investors as a homogeneous variable, thereby neglecting the differences in characteristics between different types of cornerstone investors. As such, the second contribution of this study is:

2. By studying the specific impact of institutional cornerstone investors on IPO underpricing, this study examines a factor that has not yet been investigated in the existing literature.

By identifying and separating the effects of institutional and non-institutional cornerstone investors, the dynamics of IPOs with cornerstone investors will be recognized from a novel perspective.

3 Methodology

3.1 Data Collection and Sample Construction

The Nasdaq Nordic database has been used to gather a complete list of the IPOs historically completed on the Swedish market. The Nasdaq Nordic database has also been used for collecting closing prices for the first day of trading. For information about the participation of cornerstone investors, company-specific prospectuses that are published in combination with the IPO have been used. Prospectuses are published and accessible at the Swedish Financial Supervisory Authority's (Sv: Finansinspektionen) website and contain information on offer price and potential cornerstone investors. In cases where the prospectuses are missing from the Swedish Financial Supervisory Authority's website, the company's historical regulatory publications have been used. Given this, the following data has been collected for each observation:

1. Stock name
2. Market
3. IPO date
4. Cornerstone investors[1]
5. IPO offer price
6. Closing price on the first day of trading

From the collected data points, a variable for IPO underpricing has been constructed in line with the definition in 3.3.1. The definition is in line with how underpricing has been defined in the majority of previous studies, as well as in one of the first studies where the phenomenon of IPO underpricing was introduced (Beatty and Ritter, 1986).

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[1] *The cornerstone investors have thereafter been classified according to section 2.3 to create the dummy variables for whether they are 1) present, and 2) of institutional type.*

3.2 Sample Construction

From the Nasdaq database, information regarding 397 IPO transactions has been collected. From the original output, 10 IPOs of companies that transferred from another stock exchange were removed as their eventual underpricing would not be comparable to the rest of the data. Direct listings and shares of companies that were given to owners through dividends were also removed, as they do not share the same characteristics as other IPOs for the purpose of this study. Further on, observations had to be removed due to the absence of their prospectus, as the potential presence of cornerstone investors is unavailable to notice without it. Data on historical market index returns and market/exchange dummies was available for all observations, due to extensive data availability.

Table 3.1: Final sample

Data samples and exclusions	Number of observations
List of IPOs from Nasdaq database	397
Change of marketplace or direct listing	-10
Original data sample	**387**
Missing prospectus	-16
Final sample	**371**

In the final sample, as visualized in Figures 3.1 and 3.2, it is evident that the dataset contains some outliers. To account for this, winsorization is used to reduce the influence of some extreme outliers. The winsorization is performed at a 99% level, and the details can be found in section "5.3 Robustness tests".

Figure 3.1: The distribution of first-day IPO underpricing, before and after winsorization
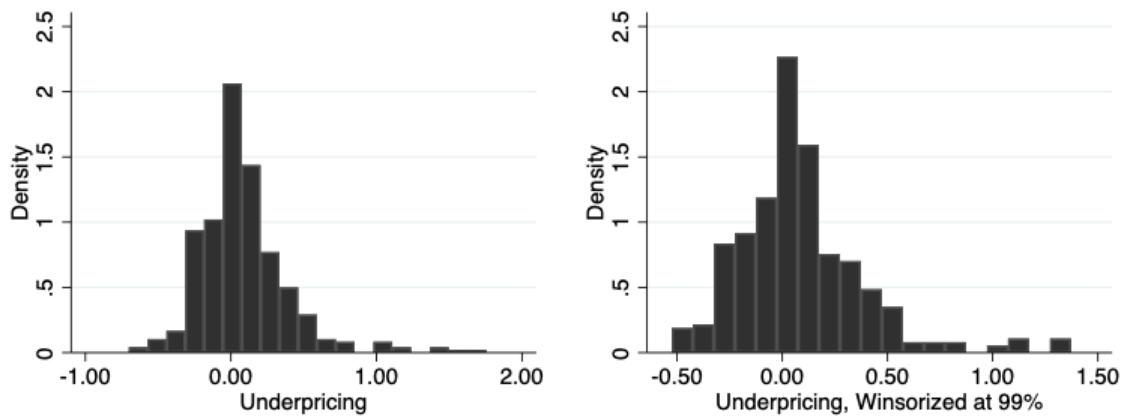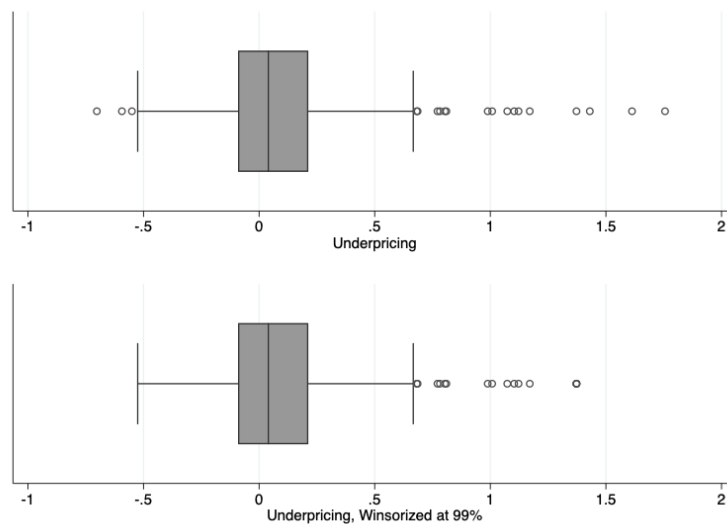

Figure 3.2: Box plot of data, including outliers, before and after winsorization

3.3 Research Design

This study aims to investigate the impact of institutional cornerstone investors on the level of underpricing observed in IPOs. To achieve this, a mixed-methods approach is employed.

T-tests are used to examine the presence of underpricing in the dataset and to compare the mean levels of underpricing across different groups, as it has proven itself useful in previous studies (Johnson and Miller, 1988). T-tests are also used to determine if the underpricing of IPOs with institutional cornerstone investors is significantly different from IPOs without, including IPOs backed by non-institutional cornerstone investors or no cornerstone investors at all.

To further explore the relationship between institutional cornerstone investors and IPO underpricing, OLS regression models are employed as it has been proven useful in similar research studies (Ritter, 2004) and (Butler et al., 2014). Multiple regressions are used to estimate the effect of overall cornerstone presence, as well as institutional cornerstone presence exclusively. In addition, three control variables are included in the regression models: the marketplace where the stock is listed, the market index return 30 days prior to the listing, and year-fixed effects.

The mixed-methods approach provides a comprehensive analysis of the implications of institutional presence among cornerstone investors in IPOs, while simultaneously controlling for other relevant factors.

3.3.1 Dependent Variable

The dependent variable is IPO underpricing. The *Underpricing* variable is measured as the percentage difference between the closing price on the first day of trading and the offer price, divided by the offer price. Mathematically, this can be expressed as:

$$Underpricing \ = \ \frac{(Closing\ price\ on\ the\ first\ day\ of\ trading - Offering\ price)}{Offering\ price}$$

As explained in the "Data collection" section, this is in line with earlier literature. A closing price on the first day of trading that is higher than the offering price implies the presence of underpricing.

3.3.2 Independent Variable

The sample consists of cornerstone backed IPOs and non-cornerstone backed IPOs, represented by a dummy variable. Among the cornerstone backed IPOs, the observations have been further classified depending on their type, represented by another dummy that determines the presence of institutional cornerstone investors. The subsetting of the sample has resulted in the two following independent variables:

1. *Institutional cornerstone investors*
2. *Non-institutional cornerstone investors*

The study aims to test five hypotheses by comparing the related underpricing across each subset. As both independent variables are dummy variables, they take the value 1 or 0 depending on the presence and type of cornerstone investor. To further illustrate, the IPO of Truecaller in October 2021 is used as an example.

Table 3.2: Exemplification of classification

IPO	Date	Marketplace	Cornerstone investors	Presence of cornerstone investor	
				Cornerstone	Institutional
Truecaller	08-10-2021	Nasdaq	Första AP-Fonden	1	1
			Handelsbanken fonder		
			Malabar Investments		
			WF Asian Reconnaissance Fund		
			Coeli Asset Management		

As at least one cornerstone investor (of institutional or non-institutional character) is present, the dummy variable for cornerstone investor takes on the value of 1. Further, as at least one of the cornerstone investors is of institutional type[2], the dummy for institutional presence takes on the value of 1. If the value of the dummy for the cornerstone presence is 1 but the dummy for institutional presence is 0, it would imply that the cornerstone investor is of non-institutional type.

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[2] In accordance with the definition specified in section "2.3 Definition and description of cornerstone investors and institutional investors".

3.3.3 Control Variables

To account for other factors that are known to influence IPO underpricing and may skew our findings, control variables are included in the regression analysis. To identify which control variables to use, previous literature on IPO underpricing and institutional investors has been reviewed and evaluated for the selection of variables. It is worth noting that in an IPO, professional underwriters manage the process of pricing and structuring the offering. As a result, many factors that may seem obvious to consider are likely already accounted for indirectly. Subsequently, the control variables are designed to take height for the effects that professional underwriters are not able to control for, as well as factors that from the perspective of this study could dilute the results. Below is a brief overview and rationale for each of our control variables.

Marketplace

A large number of studies that have been performed on IPO underpricing have targeted a single exchange, although in different markets. The logic behind the limitation to a specific exchange is built on the idea that different exchanges and marketplaces have different characteristics. As this study incorporates two exchanges, a dummy variable to control for marketplace differences has been incorporated.

$$Marketplace\_dummy \ = \ Market \ at \ which \ the \ company \ gets \ listed$$

Year-fixed effects

Year-fixed effects have been observed as a frequently used control variable in previous research (Engberg and Borg, 2016), (Ahl and Sameni, 2017) and (Johansson and Rosberg, 2020). Macroeconomic conditions, investor sentiment, the general listing climate, etc. may vary across different years and affect the level of IPO underpricing. In relation to the underwriter's ability to account for this in valuation, the market climate is often first recognized retroactively. Due to this, year-fixed effects have been controlled for.

$$YEAR \ = \ Year \ fixed \ effect \ for \ each \ of \ the \ observed \ years$$

Edelen and Kadlic (2005) controlled for the stock returns of listed peer companies in the US to control for industry-fixed market movements during the period from the offer going public to the first trading day. In this study, given the wide range of companies included and the limited sample size, the OMX Stockholm PI index[3] is utilised for the same purpose. As underwriters finish and publish prospectuses well ahead of the first trading day, the very recent market returns cannot possibly be taken into account when setting the price. Based on that, this control variable enables the study to capture the market condition between the prospectus publication date and the first trading day. The formula used for calculating the 30 calendar-day return is based on a division where the numerator is the index value for the first day of trading, and the denominator is the index value 30 days prior.

$$30 dayreturn \ = \ Return \ of \ OMX \ Stockholm \ PI \ 30 \ calendar \ days \ before \ IPO \ date$$

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[3] Weighted index of all shares listed on the Nasdaq Stockholm Stock Exchange.

4 Empirical results

4.1 T-Test results

4.1.1 *H01: There has been no underpricing in Swedish IPOs between 2015 and 2022*

The following table shows the output of a two-sided t-test that aims to investigate whether underpricing is present among the IPO observations in the dataset.

Table 4.1 - Two-sided t-test of the Underpricing variable

Variable	Observations	Mean	99% confidence interval		t	p
Underpricing	371	8.7%	4.6%	12.8%	5.4785	0.0001***

Results from a two-sided t-test on the equally-weighted mean on the Underpricing variable for the null hypothesis *Underpricing* $= 0$, for all IPOs in the dataset. The equally-weighted mean, 99% confidence interval, t-statistic and p-value are presented. The variable is winsorized at a 99% level.

*** represents statistical significance at the 1% level, ** at the 5% level and * at the 10% level

Table 4.1 shows that the mean underpricing in the entire dataset is 8.7%. It confirms that on average, underpricing is occurring for all IPOs present in the dataset. The first hypothesis can thus be rejected at a 1% significance level.

4.1.2 *H02: There has been no underpricing in Swedish IPOs backed by cornerstone investors between 2015 and 2022*

The following table shows the output of a two-sided t-test that aims to investigate whether underpricing is present among the cornerstone-backed IPO observations in the dataset.

Table 4.2 - Two-sided t-test of the Underpricing variable for IPOs backed by cornerstone investors

Variable	Observations	Mean	99% confidence interval		t	p
Underpricing	328	10.4%	6.1%	14.8%	6.1816	0.0001***

Results from a two-sided t-test on the equally-weighted mean on the *Underpricing* variable for the null hypothesis *Underpricing* $= 0,$ for all IPOs with any sort of cornerstone presence in the dataset. The equally-weighted mean, 99% confidence interval, t-statistic and p-value are presented. The variable is winsorized at a 99% level.

*** represents statistical significance at the 1% level, ** at the 5% level and * at the 10% level*

Table 4.2 provides evidence that among the IPOs backed by cornerstone investors, the mean underpricing is 10.4%. It confirms that on average, underpricing is occurring for IPOs backed by cornerstone investors. The second hypothesis can thus be rejected at a 1% significance level. By comparing the means from tables 4.1 and 4.2, the data also shows a higher mean for IPOs backed by cornerstone investors than the average IPO, 10.4% compared to 8.7%.

4.1.3 H03: There has been no underpricing in Swedish IPOs backed by institutional cornerstone investors between 2015 and 2022

The following table shows the output of a two-sided t-test that aims to investigate whether underpricing is present among the institutionally backed IPO observations in the dataset.

Table 4.3 - Two-sided t-test of the Underpricing variable for IPOs backed by institutional cornerstone investors

Variable	Observations	Mean	99% confidence interval		t	p
Underpricing	165	17.7%	11.9%	23.6%	7.898	0.0001***

Results from a two-sided t-test on the equally-weighted mean on the *Underpricing* variable for the null hypothesis *Underpricing* $= 0,$ for all IPOs with institutional cornerstone presence in the dataset. The equally-weighted mean, 99% confidence interval, t-statistic and p-value are presented. The variable is winsorized at a 99% level.

*** represents statistical significance at the 1% level, ** at the 5% level and * at the 10% level*

Table 4.3 provides evidence that among the IPOs that were backed by institutional cornerstone investors, the mean underpricing is 17.7%. It confirms that on average underpricing is occurring for IPOs backed by institutional cornerstone investors. The third hypothesis can thus be rejected at a 1% significance level. By comparing the means from the first three tests (see Table 4.4), it is evident that the mean is higher for IPOs backed by institutional cornerstone investors than the average IPO. The mean underpricing IPOs backed by institutional cornerstone investors is also higher than the mean underpricing for IPOs backed by cornerstone investors of any type.

Table 4.4 - Summary of hypotheses H01, H02 and H03

Presence of underpricing	All IPOs	All IPOs with cornerstone investors	All IPOs with institutional cornerstone investors
Mean	8.7%	10.4%	17.7%
Significant underpricing	Yes	Yes	Yes
Significance level	***	***	***

*** represents statistical significance at the 1% level, ** at the 5% level and * at the 10% level

4.1.4 H04: Swedish IPOs backed by institutional cornerstone investors have not been more underpriced than IPOs, excluding institutional investors, between 2015 and 2022

The following table shows the output of a two-sided t-test that aims to investigate whether the underpricing among institutionally backed IPO observations is larger than the underpricing of the IPOs backed by non-institutional cornerstone investors or no cornerstone investor at all.

Table 4.5 - Two-sided t-test of the Underpricing variable for IPOs backed by Institutional Cornerstone Investors vs. IPOs backed by non-institutional cornerstone investors or no cornerstone investor at all.

Variable	Observations	Mean	99% confidence interval		t	p
0	206	1.4%	-4.0%	6.8%	-	-
1	165	17.7%	11.9%	23.6%	-	-
Combined	371	8.7%	4.6%	12.8%	-	-
Difference	-	16.3%	8.4%	24.3%	5.3182	0.0001***

Results from a two-sided t-test on the equally-weighted mean difference of the *Underpricing* variable, grouped by presence of institutional cornerstone investors. The equally-weighted mean, 99% confidence interval, t-statistic and p-value are presented. The variable is winsorized at a 99% level.

*** *represents statistical significance at the 1% level, ** at the 5% level and * at the 10% level*

Table 4.5 shows that the mean underpricing of IPOs backed by institutional cornerstone investors is higher than the mean underpricing for the IPOs backed by non-institutional cornerstone investors or no cornerstone investor at all. It confirms that the difference between the means of the distributions is 16.3 pp, and thus the fourth hypothesis can be rejected at a 1% significance level. The mean underpricing for IPOs backed by institutional cornerstone investors is 17.7%, and the mean underpricing for IPOs backed by non-institutional cornerstone investors or no cornerstone investors at all is 1.4%.

4.1.5 H05: Swedish IPOs backed by institutional cornerstone investors have not been more underpriced than non-institutional cornerstone backed IPOs between 2015 and 2022

The following table shows the output of a two-sided t-test that aims to investigate whether the underpricing among the institutionally backed IPO observations is significantly larger than the underpricing of IPOs backed by non-institutional cornerstone investors.

Table 4.6 - Two-sided t-test of the Underpricing variable for IPOs backed by institutional cornerstone investors vs. IPOs backed by non-institutional cornerstone investors.

Variable	Observations	Mean	99% confidence interval		t	p
0	163	3.0%	-3.2%	9.3%	-	-
1	165	17.7%	11.9%	23.6%	-	-
Combined	328	10.4%	6.1%	14.8%	-	-
Difference	-	14.7%	6.2%	23.2%	4.4762	0.0001***

Results from a two-sided t-test on the equally-weighted mean difference of the *Underpricing* variable, grouped by presence of institutional cornerstone investors and exluding observations where cornerstone presence is absent. The equally-weighted mean, 99% confidence interval, t-statistic and p-value are presented. The variable is winsorized at a 99% level.

*** *represents statistical significance at the 1% level, ** at the 5% level and * at the 10% level*

Table 4.6 shows that the mean underpricing of IPOs backed by institutional cornerstone investors is higher than the mean underpricing for IPOs backed by non-institutional investors. It confirms that the difference between the means of the distributions is 14.7 pp, and thus the fifth hypothesis can be rejected at a 1% significance level. The mean underpricing for IPOs backed by institutional investors is 17.7%, and the mean underpricing for IPOs backed by non-institutional cornerstone investors is 3.0%.

4.2 Regression results

Table 4.7 - Regression results of models 1-4 for testing H4 and H5

Underpricing = β₀ + β₁ Institutional Cornerstone + β₂ Non-institutional Cornerstone + γ

Control variables + ε

Underpricing	Model 1	Model 2	Model 3	Model 4
Institutional Cornerstone	0.164***	0.167***	0.146***	0.144***
Non-institutional Cornerstone			0.087*	0.091
Stock exchange		(0.012)		(0.002)
30-days prior market return		0.890**		0.908**
2016		(0.006)		(0.016)
2017		(0.028)		(0.044)
2018		(0.080)		(0.092)
2019		0.007		(0.002)
2020		(0.011)		(0.025)
2021		0.010		(0.015)
2022		(0.024)		(0.044)
Observations	371	371	371	371
R-squared	0.0644	0.0893	0.0740	0.0960
F	0.0001	0.0002	0.0001	0.0001

*** represents statistical significance at the 1% level, ** at the 5% level and * at the 10% level*

Table 4.7 shows that across all regression models, institutional cornerstone investors have a significant positive correlation with the level of underpricing. In models 3 and 4, the non-institutional investors provide no significant coefficients and subsequently show no correlation with underpricing in a context where institutional investors are present. As for the

control variables, both the dummy for the marketplace and the year-fixed effects show no sign of statistical significance. The control variable for the 30-days prior market return is however significant at a 5% level in both models 2 and 4. The R-squared value ranges between 0.0712 and 0.1007 for the four models, indicating that the models possess relatively low explanatory power in predicting the level of IPO underpricing.

5 Discussion

5.1 Interpretation of Results

The result of the first t-test (see Table 4.1) confirms that significant IPO underpricing occurred between 2015-2022 with a mean of 8.7%. For IPOs backed by any type of cornerstone investor, the mean underpricing is 10.4% (see Table 4.2). The third t-test proves that underpricing is present also in the subset of IPOs backed by institutional cornerstone investors, however with a substantially higher mean of 17.7% (see Table 4.3). The fourth t-test shows that the mean underpricing of institutionally backed IPOs is significantly higher than the mean underpricing of IPOs backed by non-institutional cornerstone investors or no cornerstone investors at all. The mean underpricing difference between the distributions is 16.3 pp and is statistically significant (see Table 4.5). The fifth and final t-test shows that among cornerstone backed IPOs, the ones backed by institutional cornerstone investors have a much higher mean of underpricing. The mean underpricing difference is 14.7 pp and is statistically significant (see Table 4.6).

In line with the results from the t-tests, the regression models confirm both the relationship between institutional cornerstone-presence and IPO underpricing, as well as the difference between non-institutional cornerstones and institutional cornerstones (see Table 4.7). Not only having a lower coefficient, but non-institutional cornerstone investors also lack significance in the third and fourth regression models. A clear relationship can be observed for the control variable capturing the market return 30 days prior to the listing, confirming that the stock price should be correlated with market movements between the prospectus publication date and the first trading day. Regarding the coefficients in the regression models, it is worth mentioning that the 30 days prior to listing-variable provide a larger coefficient compared to institutional presence. This is due to the design of the variables, as institutional presence is binary meanwhile the 30 days prior to listing variable is continuous and has a mean of 0.006 with a standard deviation of 0.039 (see Appendix 8.3). As mentioned in section 4.2, the control variables for marketplace and year-fixed effects show no statistical significance, indicating that they do not serve as sufficient explanatory factors to the observed level of underpricing.

The R-squared values in all four regression models range between 0.0712 and 0.1007. This indicates that the explanatory power of the models is relatively low and thereby does not provide sufficient explanation for the level of IPO underpricing. Our statistical tests confirm a positive relationship between institutional presence and IPO underpricing, not how the specific return can be predicted in single observations. A high R-squared would imply that the actual level of underpricing is predictable, a target that was not the purpose of this study. Finally, the R-squared is in line with the levels of similar studies (Gulbrandsen, 2021).

5.2 Evaluation of Results

The results in our t-tests and regressions confirm the hypothesis that the presence of institutional cornerstone investors has a positive correlation with IPO underpricing. The mean underpricing for IPOs backed by institutional cornerstone investors is 17.7%, significantly higher than that for non-institutional cornerstone investors at 3.0%. As the potential causality and underlying factors behind the relationship are difficult to statistically evaluate, previous academia combined with the interview held with an employee at the Corporate Finance division at Erik Penser Bank serves as the best explanatory alternatives.

5.2.1 Effect of Institutional Cornerstone Investors

The cherry picking theory indicates that certain investors are superior in selecting good IPOs to participate in. According to the interview held with an employee at the Corporate Finance division at Erik Penser Bank, institutional investors are typically approached ahead of other investors and more frequently than non-institutional investors. They are thereby given the opportunity to invest in more well-performing IPOs than other cornerstone investors as they are presented with an abundance of IPOs to choose from. As indicated by the results, the theory thereby supports our hypothesis on the premise that institutional investors can distinguish attractive offers from non-attractive ones. The theory also provides a sufficient explanation for the difference in underpricing between non-institutional cornerstone investors and institutional cornerstone investors, as institutional investors generally have more resources and capacity to conduct a more thorough due diligence and analysis than other cornerstone investors. The above-mentioned theories indicate a positive relationship between institutional presence and underpricing.

The information cascades theory suggests that the decisions of earlier investors influence the decisions of subsequent ones. Issuing firms should thereby have a strong preference for cornerstone presence in their IPO and early investors should be in a favorable position to negotiate the offer terms. The theory implies different levels of underpricing between IPOs backed by cornerstone investors and IPOs without cornerstone investors. The results indicate a difference in underpricing between institutional cornerstone investors and non-institutional cornerstone investors. This contradicts the explanatory framework of the theory, as the results suggest that underpricing primarily is attributable to institutional cornerstone investors. The potential impact of this theory can however not be fully rejected, as the information cascade and following negotiating power could be influenced by the specific traits of each investor. Institutional investors are according to the cherry-picking theory suggested to have superior resource and information availability. This implies that their behavior could have a greater influence on private investors, resulting in a more significant information cascade than other investors, potentially resulting in a greater negotiating effect.

The monitoring effect states that institutional investors are acknowledged to reduce the agency problem between shareholders and management, in terms of earnings management. Their presence is thus expected to enhance shareholder value and increase underpricing. This theory is supported by the results and thereby serves as a potential explanation for the observed differences in underpricing. The supply and demand effect refers to increased demand on the first trading day in IPOs when cornerstone investors are present. Investors then tend to bid up the price, resulting in higher underpricing. The theory implies that there is a positive correlation between cornerstone investor presence and underpricing, despite the cornerstone investor's character, and is thus not supported by the results.

5.3 Robustness Tests

Earlier research on IPO underpricing has concluded that a time aspect can have a significant effect on underpricing as it is argued that issuing firms seek to go public in periods where valuations are high (Loughran and Ritter, 1994). In the sample of this study, there are sufficient observations across all years, although not evenly distributed (see Appendix 8.1).

To control for the possibility that the underpricing is a product of high-valuation timing, year-fixed effects are included in the regression analysis. T-tests, used as one method for testing the hypotheses, are generally quite robust as they are based on a comparison of distributions. In this study, the t-tests aim to investigate whether distributions are different from zero or each other. However, t-tests could imply potential complications in datasets with non-normality or the presence of outliers. To account for this, winsorization at a 99% level has been used to trim the underpricing variable, thus transforming the top and bottom 0.5% of the observations to equal the 0.5 and 99.5 percentile values (Reifman and Keyton, 2012). To further test the potential effect of outliers, Cook's distance test is run on the fourth regression model, where all variables are included, to detect influential data points that may have a large impact on the output (see Appendix 8.2). However, since none of the values exceed 0.05, it is concluded that no further outliers need to be overviewed.

Due to the design of our variables regarding the classification of cornerstone investors and institutional cornerstone investors, a risk for high multicollinearity is present. The risk lies in that all observations that are institutional cornerstones also fulfill the criteria for being any cornerstone, thus there is a risk of high correlation between them. To test for this, a VIF-test (variation inflation factor) is used for investigating the relationship between the variables (Shrestha, 2020). Since the variables are run together in regressions, low multicollinearity is critical in order to separately examine their relationship with underpricing. By running VIF tests (see Appendix 8.4 and 8.5), it is evident that the correlation between the two independent variables is low. In the context of this study, this further implies that there is no inflation of the coefficients created by a correlation between the variables.

6. Conclusion

6.1 Conclusion

The purpose of this paper has been to investigate the potential relationship between institutional cornerstone investors and IPO underpricing, and two research questions have been answered in order to thoroughly review that. The two research questions were stated as: *"Do institutional cornerstone investors have a significant relationship with IPO underpricing in the Swedish market?"* and *"Do IPOs backed by institutional cornerstone investors have a stronger relationship with IPO underpricing than that of IPOs backed by non-institutional cornerstone investors?"*. Throughout the paper, significant weight is put on the difference and distinction between institutional cornerstone investors and non-institutional ones. The importance of the distinction is based on the research questions and aims to highlight the hypothesis that earlier studies have mistreated the effect of cornerstone investors by treating them interchangeably, hypothesized to have misallocated the effect. In this paper, by keeping the two groups distinguished, the aim has been to re-allocate the effect correctly.

From our statistical tests, it can be concluded that the phenomenon of underpricing is occurring with statistical significance across all distributions, although with different magnitudes. Among a total of 371 observations ranging over the years 2015-2022, the average underpricing has been 8.7%, compared to 10.4% for the 328 observations with any cornerstone presence. Among the subset of 163 observations where non-institutional cornerstone investors have been present, the mean underpricing has been 3%. For the final subset of 165 observations, including institutional investors exclusively, the mean underpricing has been 17.7%. In order to control for other potential explanatory factors for underpricing, three control variables were tested. The control variable for 30 days prior market return served as the only one with statistical significance, confirming a relationship with market movements. The results confirm that institutional cornerstone investors to a larger extent than non-institutional cornerstone investors, are positively related to underpricing both in terms of magnitude and significance.

The results of this study are supported by parts of the theoretical framework which subsequently serve as a good basis for answering our first research question. The cherry picking theory suggests that institutional cornerstone investors benefit from better internal resources and capacity and thus are able to pick the best IPOs. The implications are thereby in line with our results. Information cascades and negotiating effect derived by Welch (1992) imply that investors act in a sequential process and that any cornerstone investor should be related to positive underpricing. Although contradicting our findings, it could still be regarded as a relevant theory, given that institutional investors may possess greater influence over investors. For the monitoring effect, our results support the enhanced share value from superior monitoring among institutional investors, as suggested by the theory. The supply and demand theory is the only theory that is fully contradicted by our results, suggesting that any cornerstone should increase demand and thus also underpricing. Whether the underpricing is of causal nature cannot be concluded based on our results. Neither is it possible to confirm whether the relationship is due to an enhanced investor sentiment from the institutional presence or a result of their favorable negotiation, as the theoretical framework is ambiguous regarding the matter. It is however notable that market influence and negotiation power are interlinked as positive market influence results in better negotiation power and vice versa. This relationship is supported by the theories and by the interview with an employee from Erik Penser Corporate Finance, indicating that the answer likely is a combination of both. Nonetheless, the relationship between IPO underpricing and institutional presence is distinct.

Although the results are prominent, there still exist some limitations to the study. As the study is performed on the Swedish market, only 328 cornerstone backed IPOs have been available of which 165 have had institutional presence. This could be regarded as insufficient for drawing any general conclusions, especially concerning markets outside Sweden. The results are also dependent upon the local interplay between institutional investors and underwriters, as well as the mechanism of including cornerstone investors in IPOs.

6.2 Suggestions for Future Research

Although this study has provided new insights into the dynamics of the Swedish IPO market, it also brings light to areas that could be further explored. This study has classified

cornerstone investors into an institutional and a non-institutional subset. A similar study could be made based on the percentage share of the offering covered by respective cornerstone investors to highlight the potential effect of their relative participation. Another way of extending the research area would be to use a stricter classification of institutional investors, perhaps leading to stronger conclusions on which specific characteristics contribute to the difference in the level of underpricing between types of cornerstone investors.

This study further opens for investigations into the dynamics between institutional cornerstone investors, issuing companies, and the underwriters of an IPO, as a part of the explanations of our result lies in the negotiation between the three. A study on this could as a suggestion be completed with a qualitative methodology, as the mechanisms are difficult to evaluate statistically.

Finally, the outcome of this study is complementary to the results of earlier studies on the relationship between cornerstone presence and IPO underpricing. In the previous studies, no distinction between the non-institutional and institutional investors has been made. Due to the significance of our results, a last suggestion for future research would be to remake earlier studies and include a classification of cornerstone investors according to the one in this study to examine whether any novel relationships can be found.

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8. Appendix

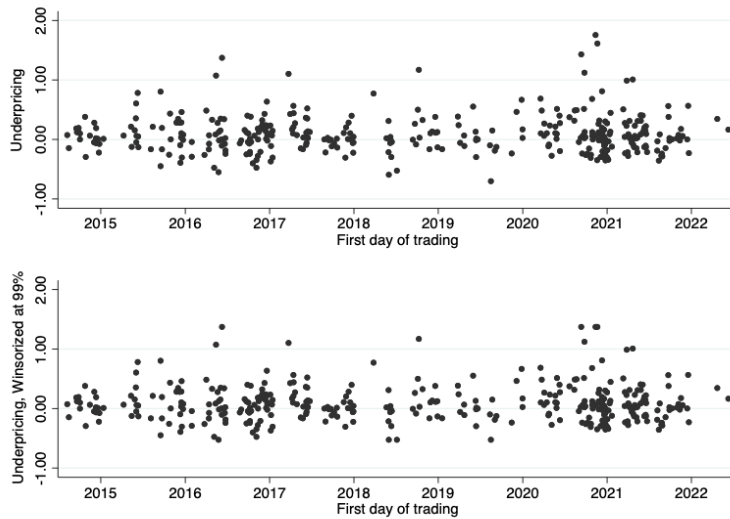**Figure 8.1: Underpricing plotted against the issue date before and after winsorization**
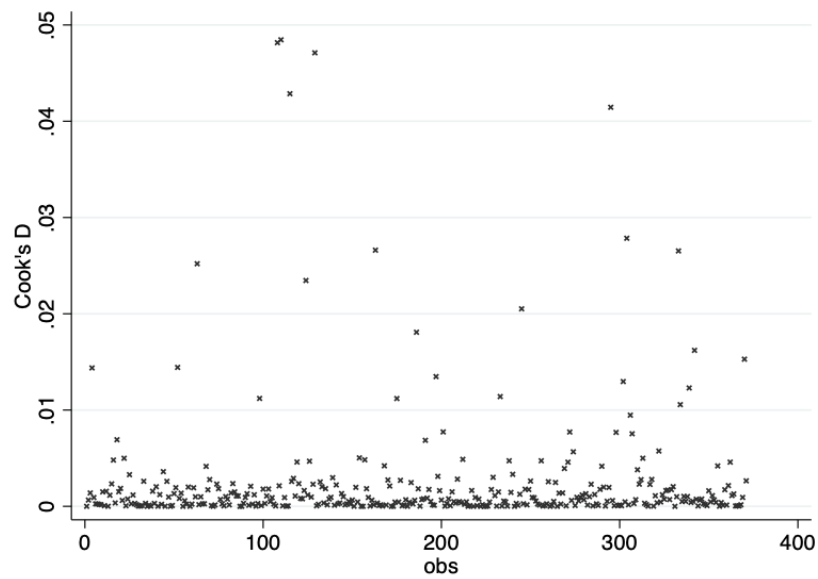

Table 8.2 Cook's Distance test for regression model 4

Table 8.3 Descriptive statistics of variables

Variable	Mean	St. dev.	Min.	Max.
Underpricing	0.087	0.305	(0.525)	1.372
Institutional cornerstone	0.445	0.498	0	1
Non-institutional cornerstone	0.884	0.321	0	1
Marketplace dummy	0.280	0.450	0	1
30-days prior market return	0.006	0.039	(0.164)	0.133

The variable underpricing is winsorized at a 99% level

Table 8.4: VIF values of variables in regression model 2

Variable	VIF
Institutional Cornerstone	1.26
Marketplace dummy	1.35
30-days prior market return	1.20
2016	2.11
2017	2.63
2018	1.83
2019	1.70
2020	1.80
2021	3.19
2022	1.81
Mean	1.89

Table 8.5: VIF values of variables in regression model 4

Variable	VIF
Institutional Cornerstone	1.44
Non-institutional cornerstone	1.26
Marketplace dummy	1.38
30-days prior market return	1.20
2016	2.12
2017	2.69
2018	1.85
2019	1.71
2020	1.82
2021	3.38
2022	1.84
Mean	1.88