LUND UNIVERSITY
School of Economics and Management

Department of Business Administration

FEKH89

Bachelor Thesis in Corporate Finance

Autumn 2021

The Key to a Safe IPO

A study on the implications of lock-up agreements on the Nordic market

Authors:
Adolfsson, Elsa
Bergström, Hugo
Truedsson, Oskar

Supervisor:
Gårdängen, Maria

Abstract

Title	The Key to a Safe IPO
Seminar date	2022-01-13
Course	FEKH89: Bachelor Thesis in Corporate Finance, Undergraduate Level, 15 credits
Authors	Adolfsson Elsa, Bergström Hugo and Truedsson Oskar
Advisor	Gårdängen, Maria
Key words	Lock-up agreement, Initial public offerings, Initial return, Long-term Performance, Nasdaq Nordic, Oslo Børs
Purpose	The purpose of the study is to examine the implications of a lock-up agreement for the first day return and long-term performance on the Nordic markets, during the years of 2010-2021. The study aims to contribute new insights to investors and stakeholders about lock-up agreements' implication and role in initial public offerings.
Methodology	The authors of this study have chosen to use a quantitative method and a deductive approach as methodology for this study.
Theoretical perspectives	The study is conducted on the basis of previous research regarding lock-up agreements, long-term performance and initial public offerings. This is combined with theories of efficient markets, information asymmetry and the agent-principal problem.
Empirical foundation	The empirical data consists of information from 326 initial public offerings. Information and firm prospectus has been gathered through FactSet and the firm's websites.
Conclusions	Findings conclude that lock-up agreements and its length have no significant effect on the initial return and long-run performance of IPOs in the Nordic region. Rather it is suggested that the characteristics of the Nordic market in terms of shareholder protection and high level of corporate governance undermines any potential impact of a lock-up agreement. Thus, it can not be used as an indication for the success of an IPO in terms of an investor's perspective.

Acknowledgements

The authors of this study would like to express gratitude towards our supervisor Maria Gårdängen for guiding us through these months and giving us advice and inputs. Also, a special thanks to Anamaria Cociorva for taking the time to answer our questions concerning econometrics and Eviews.

Elsa Adolfsson **Hugo Bergström** **Oskar Truedsson**

Lund, 2022-01-11

List of Definitions

Agency costs	The costs that occur for a firm due to the discrepancies following information advantage for firm insiders in regards to its investors.
Buy-and-hold abnormal return “BHAR”	A way to measure abnormal return of stocks in comparison to a decided benchmark.
Initial Public Offering “IPO”	The process of offering shares of a private company to the public for the first time.
Initial return “IR”	The difference between the IPO offer price and the closing price on the first day of trading.
Insiders	An entity, director, senior officer or individual with high ownership stake in a company.
Lock-up agreement	An agreement that prevents company insiders from selling shares after an IPO during a specific period of time.
Lock-up length	The set period for which the insiders are unable to sell their securities
Nordic Market	Referred to in the study as all the stock exchanges in the Nordics which were included in the sample.
Underwriter	Financial specialists that are hired by the issuing firm to conduct a valuation, determine the offer price and lead the IPO process.

Table of Contents

List of Tables

List of Figures

List of Equations

1. Introduction

The introducing chapter provides the background and the problem statement of the study. Furthermore, it presents the purpose, research questions, target group, limitations and scope and lastly the outline of the study.

1.1 Background

The process of becoming a publicly traded company is complex and costly. One of the most important factors to consider in order to have a successful IPO is the information discrepancy between the insiders of the issuing firm and potential investors (Brav & Gompers, 2003). Thus, a mechanism that is frequently implemented is a lock-up agreement which is established between the current shareholders and the underwriter. The agreement prohibits the existing shareholders during a definite period of time from selling a fixed amount of their stocks without the underwriter's approval. The lock-up agreement serves as a bonding mechanism that ties the insider of the firm to the company and offers investors a sense of long-term commitment (Arthurs et al, 2009).

Information regarding lock-up agreements is stated in the prospectus which is published prior to the IPO. According to the efficient market hypothesis presented by Fama (1970), all the available information, including the look-up agreements, is incorporated into the price of the securities. Therefore, the implications of lock-up agreements of particular interest since previous research have demonstrated that lock-up agreements are not incorporated into the price. For example, the conundrum of price decline at the expiration date for lock-up agreements has been noted several times (Field & Hanka, 2001; Brav & Gompers, 2003; Bradley et al., 2001; Brau et al., 2005; Hakim et al., 2012; Espenlaub et al., 2001), which contradicts the efficient market hypothesis. However, the same studies have failed to reach a consensus on what can explain their findings due to differences in methods, time periods, theories and markets.

Furthermore, a region that is seldom subject to empirical studies regarding lock-up agreements is the Nordic, which strikes as rather surprising considering that the Nordic countries since 2014

have accounted for one-third of all the IPOs in Europe (Factset, 2020). Despite the many regulatory differences regarding IPOs and lock-up agreements among countries, the Nordic countries have similar legislation regarding IPOs and the lock-up agreements are optional in all of the countries. Furthermore, the Nordic countries are in a comparable phase of their financial and economic development, and the stock returns in the Nordic countries are highly correlated with each other (Kuosmanen et al., 2015). Moreover, there are also established interdependencies between the Nordic markets, indicating that the Nordic stock exchanges are influenced and affected by one another (Dengjun, 2014). Lastly, what differentiates the Nordic countries from other markets is the high level of law and shareholder protection (La Porta et al., 1997; Lekvall 2014, p.27).

To conclude, due to the unique characteristics of the Nordic market compared to other markets, it is of great interest to research the implications of lock-up agreements since the market conditions are different from previous research on the subject. Moreover, it is of interest for individuals interested in investing in Nordic IPOs as well as academics to receive a greater understanding of this particular market.

1.2 Problem Statement

The rationale behind including lock-agreements in initial public offerings differ. One explanation is the need to mitigate information asymmetry and signal firm quality for outside investors (Allen & Faulhaber, 1989; Leland & Pyle, 1977; Corteau et al., 1995; Brau et al., 2005). Others argue that it is the need to address moral hazard dilemmas and mitigate these risks by commitment in the form of lock-up agreements (Brav & Gompers, 2003; Gao & Siddiqi, 2012).

Although there is a considerable amount of research regarding the lock-up implications on initial public offerings, a unanimous conclusion is yet to be reached and the findings are contradictory. Brav and Gompers (2003) found that firms with a greater agency cost use lock-up agreements as a commitment device to decrease the probability of moral hazard issues by imposing longer lock-up periods. In the same research, little evidence was found for the signaling theory, meaning that firms use lock-up agreements to signal the quality of the firm to outside investors. However,

Brau et al. (2005), claimed that Brav and Gompers model was flawed and that there in fact, was evidence for the signaling theory.

A problematic aspect of previous empirical studies is that they examine different countries with dissimilar lock-up regulations. For some markets the lock-up agreements are mandatory (Rashid et al., 2014), and in some optional (Hoque, 2014; Chao et al., 2017). Consequently, the inclusion of lock-up agreements has a dispersed effect on the initial public offerings initial return and long-term performance depending on the market.

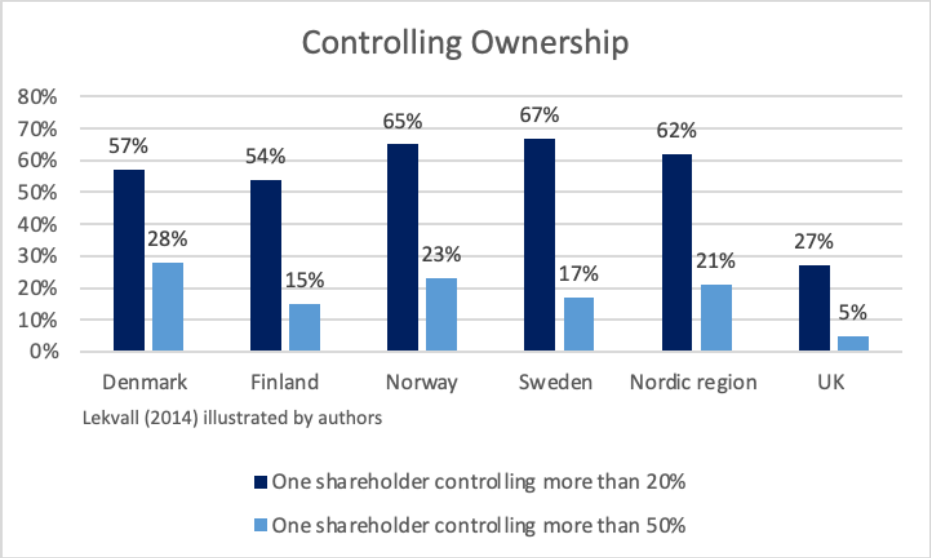
Hoque's (2014) findings of IPOs in the UK imply that high information asymmetry firms have longer lock-up length, a higher ownership concentration and ultimately lower underpricing. These findings are in contrast to Chao et al. (2017), who found that American IPOs with longer lock-ups appear to have lower underpricing in comparison to firms with shorter or no lock-up agreement. Rashid et al. (2014) study of Malaysian IPOs has suggested contradicting conclusions, as longer lock-up periods are shown to reflect a higher risk which results in higher initial returns.

Furthermore, relatively little research has been done on lock-up agreements' effect on the long-term performance of an issuing company. The previous research has been conducted on the separate markets such as the U.S, UK and Australia, and the findings are inconsistent (Gao & Siddiqi; 2012; Ahmad, 2015; Chalmers et al., 2017). Consequently, this would indicate that in order to fully understand lock–up agreements' implication on a certain market, that specific market needs to be studied. Applying findings from different markets may lead to inaccurate conclusions due to their many differences in regards to lock-up agreements.

Nordic firms are generally characterized by a high level of ownership concentration and boards mostly consist of non - executive directors, which strengthen the integrity of the board in relation to the executive management. This serves as an important factor in shaping the Nordic markets, (Lekvall 2014, p.17), but would also indicate high information asymmetry according to Hoque (2014). Needless to say, the Nordics differ remarkably more in comparison with the UK and the

European market which is generally characterized by spread ownership of listed firms (Lekvall 2014, p.24).

Figure 1. Ownership concentration in the Nordic countries.



Since a majority shareholder has the potential to exploit minority shareholders for its own benefits, a high level of controlling ownership could be seen as a risk factor for private investors (Lekvall 2014, p.24). To decrease the effect of this agency problem, Levis and Vismara (2014) states that lock-up agreements are used at IPOs in order to establish a common ground between new investors and firm's insiders; and identifies that its utilization has increased for both developed and emerging markets. However, Nenova (2003) finds that the incentive for controlling owners to misuse their power at other shareholders' expense for private benefits is almost non-existent in the Nordics; indicating that lock-up agreements should not have an effect on mitigating an agency problem as Brav and Gompers (2003) depicts, and is instead used to signal firm quality in accordance with Brau et al. (2005).

In conclusion, the Nordic markets offer a unique opportunity to research the potential implications of a voluntary lock-up agreement for a market characterized by high levels of shareholder protection and owner concentration, while simultaneously having a high level of corporate governance. This would be contrarian to prior research where markets either suffered from mandatory lock-ups (Rashid et al., 2014), a low level of ownership protection (i.e.

emerging), or dispersed ownership (i.e. developed). Hence, the study can be motivated as relevant in order to broaden the empirical evidence on lock-up agreements and its potential effect on both the initial return and long-run performance.

1.3 Purpose

The purpose of this paper is to broaden the scope of empirical research regarding lock-up agreements implication on IPO long-run performance and underpricing in the Nordic markets between 2010-2018 and 2010-2021 respectively. Furthermore, this study aims to understand what function a lock-up agreement serves on markets that are characterized by a high level of corporate governance and shareholder protection. Thus, this study contributes to the empirical research on implications followed by a lock-up agreement, and provides further insight for international, as well as domestic investors in the budding Nordic IPO market.

1.4 Research Questions

1. What are the implications from the presence of a lock-up agreement on the initial return and long-run performance of Nordic IPOs?
2. What are the implications from the length of a lock-up agreement on the initial return and long-run performance of Nordic IPOs?

1.5 Limitations and Scope

This study examines IPOs in the Nordic Region, and more specifically companies that became public through Nasdaq OMX Stockholm, OMX Nordic Copenhagen, OMX Nordic Helsinki and Oslo Børs. Furthermore, Nasdaq First North in Sweden, Finland, Denmark are included as well as Oslo Axess in Norway. Nasdaq First North and Oslo Axess are markets for small- and medium sized companies. Although a part of the Nordic Region, OMX Nordic Iceland was excluded considering it only provided the study with a total of eight IPOs during the selected period. A limitation concerning the time scope is implemented with a requirement of the first trade date being after 1-jan 2010 with an end date of 31-dec 2018 and 27-nov-2021 for the long-run and initial return respectively. The time frame also provides the paper with up-to-date and trustworthy data. Information on older prospects tends to be limited and bears the risk of contributing with inadequate data to the paper, hence it was not included.

1.6 Target Group

This paper's ambition is to provide useful information towards students with basic knowledge in business administration as well as academics with an interest in financial economics. Additionally, investors in the Nordic markets could find the study useful in order to maneuver the recent spike of IPOs in the region.

1.7 Structure

The ensuing part of this paper adheres to the guidelines from Bryman and Bell (2017) for structuring quantitative studies.

Theory

Relevant and leading theories regarding the broad IPO subject and lock-ups are introduced and explained. Prior studies conducted in a similar field concerning lock-up agreements are presented in order to comprehend the premises of this paper.

Method

The author's process of conducting the study is explained, as well as decisions made regarding data extraction and assortment. Furthermore, selected variables of interest and measures for control based on prior studies are presented, followed by a method discussion.

Results

The results of the regressions and measures taken to certify the validity of the regression is presented.

Analysis and Discussion

In this part of the paper the previously presented results are analyzed and discussed according to relevant theories and prior results from studies in the same field; this is made in order to answer the research questions.

Conclusion

The research questions are answered through the summarization of results and its subsequent analysis.

2. Theory and Development of Hypotheses

This chapter presents a broad overview of IPOs, lock-up agreements and introduces the theories on which the study is based upon. Furthermore, previous empirical studies of lock-up agreements' purpose and implications are reviewed. In addition, reasons for underpricing and long-run abnormal performance are presented as well. Lastly, the previous research is critically discussed and summarized; laying the foundation for the presentation of hypotheses.

2.1 Initial Public Offerings in the Nordics

The definition of an initial public offering is when shares of a company are sold to the public for the first time (Ritter, 1998). Ritter and Welch (2002) explains that the primary firms go public is the desire to raise equity as well as create a public market where shareholders and founders realize their initial investments. The diversification of public investors for the firm also lowers the cost of capital and as a result increases the profitability of future capital investments for the firm (Jen et al. 2003, p. 389).

In an IPO process there are three main parties involved; the issuer, the underwriter and the investor. The issuer in the IPO process is the firm, or more correctly, the management of the firm going public. The main responsibilities for the issuing firm is to provide shares for the issuing and to hire a suitable underwriter and other industry professionals to support during the IPO process (Jen et al. 2003, p.392).

Lastly, the Nordic IPO market is one of the most prominent in Europe, and has since 2014 accounted for one-third of all the IPOs in Europe (Factset, 2020). The process of becoming a publicly traded company on the main stock exchanges in the Nordics such as Nasdaq OMX Nordic, Nasdaq First North, Oslobørs and Oslo Axess is comprehensive and subject to extensive regulation (Nasdaq, 2021a; Oslobørs, 2021a). Moreover, after the listing, the issuing firm has to comply with extensive regulations. Individual rights for shareholders, majority vote requirements, and high level of transparency towards the society, shareholders and the capital markets; are all factors that define the Nordic market (Lekvall 2014, p.92).

2.2 Information asymmetry

Information asymmetry in terms of initial public offerings relates to the discrepancy of information between the investor and the issuing firm (Brav and Gompers, 2003). Firms prior to the IPO are oftentimes relatively unknown by the public and thereby uninformed investors are less inclined to invest in the firm. Therefore it is of great importance for issuing firms to mitigate this information gap and convince investors in order to have a successful IPO. However, since investors rarely assume to be fully informed regarding the state of a firm, despite underwriters efforts to communicate the quality via the prospectus, most IPOs are underpriced to compensate investors for this information asymmetry (Allen and Faulhaber, 1989).

2.3 Moral hazard

As the insiders of a firm possess superior information and internal decision-making, it creates the risk of insiders not acting in the best interests of their shareholders. CEOs, directors or other insiders may not be incentivized to maximize shareholder wealth if presented with opportunities or investments that inflate their own wealth or importance rather than benefit the investors (Brav & Gompers, 2003). Furthermore, insiders know that investors partially base their judgment regarding the firm prior to the IPO on the information presented in the prospectuses. Thus, they may restrain from presenting negative information to convey the firm in a more favorable manner to attract investors. These dilemmas that corporate executives are faced with when the individual gain is greater than those of the shareholder is called moral hazards.

2.4 Lock-Up Agreements

The inclusion of lock-up agreements in IPOs is common; it exists on markets where it is imposed by law but also on markets where they are optional (Goergen et al., 2006). Characteristics of the agreement may however vary among markets as the laws regarding lock-up agreements are not unanimous across global markets. In the US and the UK along with the Nordic countries, lock-up agreements are optional (Goergen et al., 2006). Meanwhile countries such as Malaysia, the Netherlands, Germany and France have made it obligatory to implement the agreement but with variations of its minimum length (Hoque, 2011; Rashid et al., 2014). However, it is also common practice within the EU region to include a lock-up period as part of the IPO. Although the length of the contract varies, the most common period is 180 days (Goergen et al., 2006).

Levis and Vismara (2014), presents possible reasons for the usage of lock-up agreements in their *Handbook of Research on IPOs*. They suggest that agreements are primarily used in order to establish common ground between the new investors and firm's insiders for the length of the agreement; this is due to the fact that the IPO causes dilution of ownership and potentially conflict of interest between the shareholders. Levis and Vismara further point out that the limited supply of shares that enters the market due to the lock-up offers a helping hand to the underwriters' effort of price support.

2.5 Implications of Lock-Up Length

As previously mentioned, the length of the lock-up period may vary depending on which market a firm is going public. However, Brav and Gompers (2003) presented two explanations that could explain the difference in the length of the lock-up period, information asymmetry and moral hazard. Information asymmetry is elaborated to what is called the *Signaling theory* which builds upon research by Allen and Faulhaber (1989) and Courteau (1995). Moral hazard is developed into a theory called the *Agency theory* which stems from the principal-agent problem. While Brav and Gompers only found support for moral hazard to be the explanation and thereby the agency theory, other researchers have criticized their conclusions and established rebuttal in favor of the signaling theory (Brau et al., 2005; Rashid et al., 2014). Considering the contradictory findings regarding the implication of these kind agreements and their purpose, both theories are presented in order to allow for a deeper understanding of what lock-up agreements and its length may signal to investors.

2.5.1 Signaling theory

According to the signaling theory, the usage of lock-up agreements originates from the information asymmetry between the insiders of the issuing firm and the potential investors. Due to the limited information regarding the firm prior to the IPO, high quality companies are concerned that the proceeds of the IPO may not be maximized, as investors are unaware of the high quality and therefore not inclined to invest (Allen & Faulhaber, 1989; Brav & Gompers, 2003). Consequently, high quality firms choose to incorporate a longer lock-up agreement to mitigate this discrepancy and better signal the quality of the firm to outside investors (Leland &

Pyle, 1977). The lock-up agreement thereby functions as a signaling device that firms can use to showcase the quality of the firm to investors as only high quality firms are equipped for the illiquidity and commitment it requires. In addition, it is too burdensome for low quality firms to adopt long lock-ups as it is too costly for them to keep up the front of being a high quality firm as it demands expensive investments and insiders reluctantly have to sacrifice their liquidity. Therefore, by implementing longer lock-up periods, firms can signal higher quality and better differentiate themselves from less prosperous firms (Courteau, 1995).

Although Brav and Gompers (2003) consider the signaling theory to be a possible explanation, they find no empirical evidence that supports its relevance and therefore dismiss the idea that information asymmetry as the reason behind longer lock-up agreements. However, Brau et al. (2005) opposes the explanation for lock-ups presented by Brav and Gompers (2003) by challenging their conclusions and the rejection of the signaling theory. According to Brau et al. (2005) and Rashid et al. (2014) lock-up agreements are shown to be a signaling mechanism to lessen the information asymmetry rather than a commitment device to lessen moral hazard risks, as suggested by Brav and Gompers (2003).

2.5.2 Agency theory

According to Brav and Gompers (2003), the agency theory differs from the signaling theory as it emphasizes the probability of moral hazard to be the reason behind longer lock-up agreements. Moral hazard stems from insiders of a firm that are not naturally inclined to act in the best interest of the shareholders and potentially even exploit the less informed principal, which are the investors. Since the information regarding an issuing firm prior to the IPO is limited, investors can not determine whether the aforementioned issues are present or even if the insiders have beautified the company in the prospectus. As a measure to mitigate the uncertainty of the inventors incentives, firms can commit to a lock-up agreement, meaning that insiders reduce their ability to take advantage of the shareholders; thereby making investors more willing to participate in the offering as they are protected during that period of time (Brav & Gompers, 2003; Gao & Siddiqi, 2012). Brav and Gompers (2003) presented evidence in favor of the agency theory as they established that firms with a greater risk of moral hazard use longer periods of lock-up. Furthermore, as a firm that incorporates a long lock-up agreement initially

reveals a presence of moral hazard, investors' perception of the firm at the end of the lock-up period is ultimately decided by the information regarding the firm insiders that has evolved during the period, and its efforts to reduce the probability of moral hazard (Gao & Siddiqi, 2012).

2.6 Efficient Market Hypothesis

Fifty years ago, the efficient market hypothesis was first presented and widely accepted by financial economists. Fama (1970) demonstrated that the securities market efficiently reflected information about the market. Hence, the possibility for an investor to systematically achieve excess return in a strongly efficient market would not exist. Furthermore, Fama (1970) presented three categories of efficiency depending on how the market price reflected all available information. In a strong-form efficient market, the securities market price would reflect all available information, including insider information. In a semi-strong-form efficient market, the securities market price would reflect all the public information available such as quarterly reports and press releases from a firm. Lastly, in a weak form of market efficiency, the securities market price would only reflect the historical data, such as its price.

Grossman et al. (1980) argues that gathering information is costly, and therefore the prices can not fully reflect all the information available. In an efficient market would those who spent resources gathering valuable information not receive any compensation. According to Grossman et al. (1980) there is a fundamental conflict between the incentives to acquire information and how efficient the market is to distribute it.

2.6.1 Efficient Market Hypothesis and Lock-Up Agreements

In accordance with Fama (1970), the implications of a lock-up agreement would be implemented in the valuation of a firm at IPO, during the agreement, and as well as at the expiration date. Hence, the lock-up agreement would not have any effect on the initial return or the long-run performance. However, the conundrum of price decline at the expiration date has been noted several times (Field & Hanka, 2001; Brav & Gompers, 2003; Bradley et al, 2001; Brau et al., 2005); with similar findings outside of the US Market (Hakim et al., 2012; Espenlaub et al., 2001). Despite these findings, Georgen et al. (2006) found no such occurrences as he studied the European market during 1996-2009, which supports the efficient market hypothesis.

Nevertheless, as research on the area of lock-up agreements primarily has been made concerning negative abnormal return around the expiration date, it could further imply that it is not taken into account at IPO nor the long-run performance.

2.7 Underpricing

Ibbotson (1975) was the first to thoroughly document and research the underpricing of initial public offerings (IPOs). Since then, several theories have been presented to explain the IPO underpricing phenomenon, focusing on the various aspects of the relationships between issuers, investors and investment banks and the rationales behind taking companies public. The definition of underpricing is the difference between the offer price and the closing price of the share on the first day of trading. Underpricing is a frequently researched phenomenon because it contradicts the efficient market hypothesis, which argues that prices of the securities fully reflect the relevant information available (Fama, 1970).

The research regarding underpricing in the Nordics is limited. However, Dreher and Hoppa (2013) researched 24 different markets during 1988-2005 and found that the underpricing differs between continents and countries due to differences in market characteristics, legal aspects and regulations concerning the investors. The highest level of average underpricing was found in India with 96,7%. The lowest level of underpricing was discovered in New Zealand with 6,1%. The underpricing could be seen as more modest when it comes to the Nordic countries. For example, the underpricing in Finland was as low as 10,9%, in Norway 10,1%, and lastly, Sweden where the corresponding percentage was 17,4% (Dreher and Hoppa, 2013).

2.7.1 Reasons for Underpricing

The *winner's curse* is one of the most recognised and discussed phenomenons for underpriced IPOs. Rock (1986) presented a model to explain the winner's curse phenomenon that uninformed investors face when placing IPO shares orders. It occurs when the offering price is fixed and there is rationing due to high demand for the shares in the IPO. When an IPO is priced above its value, the informed investors decide to withdraw from the market. Uninformed investors are then more likely to receive the full allocation of shares when the offering is overpriced and a rationed allocation when it is not, leading up to a scenario when underpricing is used to compensate

uninformed investors. Congruent with the phenomena, Abrahamson et al. (2011), which examines underpricing in Sweden, provides findings that institutional investors are deemed to better identify IPOs with higher initial return than individual investors.

Another theory regarding underpricing is the *signaling theory.* Underpriced IPOs can be seen as more interesting and attract more investors, which opens up opportunities for the companies and insiders to sell future offerings for a higher price than otherwise would have been possible (Ritter, 1998). Moreover, the underpricing of high-quality companies' IPOs adds signaling costs for low-quality companies, stressing them to reveal the true quality of the issuing to a greater extent, and can therefore work as a way to navigate a competitive market (Welch, 1989).

Furthermore, Baron (1982) has developed a model to examine underpricing based on *the principal-agent theory* and the relationship between underwriters and issuers. According to his findings, the issuers are less informed than the underwriters, which results in that the issuers are unable to supervise the underwriter's activity without further costs. For the issuer to be able to receive the advantages of the underwriter's superior information about the investor demand, they can give the underwriter the right of pricing the IPO. This leads to a situation where issuing firms willingly leave money on the table for the underwriters to gain from underpriced shares and act in the best interest of the issuers (Baron, 1982). Underwriters and underpricing have been further examined by Carter et al. (1998) which suggests that a better reputation of underwriters is related to lower initial returns. On the other hand, evidence has been presented that firms who hire reputable underwriters experience a higher level of underpricing (Flagg & Margetis, 2008). Furthermore, Loughran and Ritter (2004) also states that more prestigious underwriters are associated with higher underpricing, especially durings periods with high number of IPOs.

Findings of Ritter (1981;1991) indicates that issuers, in certain years with high concentration of IPO volumes, i.e. hot markets, take advantage of the overvalued securities by timing their IPO. Ritter (1981;1991) defines a hot market as a month in which the average first-day return is higher than the median month's average first-day return, leading to oversubscribed IPOs (Ritter, 1984). IPOs during these periods with high market and investor optimism tend to have higher underpricing and poorer long-run performance (Ritter, 1981;1991).

Megginson and Weiss (1990) investigates the certification role of venture capitalists, which builds on the notion that a VC's investment in an issuing firm certifies quality and reputational capital. Subsequently they find that VC-backed IPOs have lower underpricing which supports VC's certification role since lower underpricing equals lower costs of going public. However, the findings of Brav and Gompers (2003) contradicts Megginson and Weiss (1980) as they instead find that VC-backed initial public offerings tend to have higher underpricing.

Lastly, there are other factors that affect the amount of underpricing. Bergström et al. (2006) researched underpricing for private equity and non-private equity backed IPOs. Findings from the empirical research showed that private equity-backed IPOs exhibit lower degrees of underpricing. Furthermore, they found that larger IPOs in terms of issue size had less underpricing. According to Bergström et al. (2006), one possible explanation is that larger fund based IPOs may have less informational asymmetries due to a greater amount of marketing and publicity prior to the initial public offering.

2.7.2 Empirical evidence of Lock-Up Agreements and Underpricing

Rashid et al. (2014) examine lock-up agreements' effect on the initial returns. Two key factors are identified and further analyzed, the lock-up ratio and the lock-up length. The lock-up ratio is the percentage of shares that are restricted from being sold under a certain period, which is decided by the lock-up length. The authors use a sample size of 384 IPOs listed on the Malaysian Bursa during 2000-2012, where lock-up agreements are mandatory. In contrast to Brav and Gompers (2003) argument that lock-up ratios as a key element in understanding IPO returns in developed countries, Rashid et al. (2014) find a positive but no significant relationship between lock-up ratio and underpricing. On the other hand, the length of the lock-up was significantly positive in correlation to the initial returns of an IPO.

Gao et al. (2017) examines the impact of IPO lock-up removal using a sample of Chinese IPOs. A regulatory change in 2012 removed an IPO lock-up for institutional investors, which previously mandated institutional investors to hold newly acquired shares in an IPO for at least three months. The finding suggests that IPO lock-up removal has an impact on the bidding

behavior of institutional investors in the book-building stage, as well as increasing the IPO offer price, thus decreasing the IPO first day return.

Chao et al. (2017) examines the endogenous relation between underpricing and lock-up duration of 3753 U.S IPOs between the years of 1988-2004. The empirical results show a significant negative correlation between the length of a lock-up period and the magnitude of underpricing. Therefore it appears that firms with lock-up have lower underpricing compared to firms without lock-up. Furthermore, Hoque (2014) analyzes the signaling role of lock-ups and its effect on underpricing and suggests that lock-up agreements' intentions are to mitigate moral hazards in UK IPOs. The findings indicate that lock-up length and underpricing are negatively correlated; thus, IPOs with high underpricing have shorter lock-ups and vice versa.

2.8 Long-Run Performance of IPOs

Noted by Ritter (1991), the performance of IPOs were predominantly researched as a phenomena for a shorter period of time. However, Ritter established that newly listed companies, on average, also underperformed their comparable counterparts during a time frame of three years. Furthermore, the underperformance found by Ritter (1991) could be partly reflected by younger firms going public during high volume years, as well as undergoing an IPO without venture capital financing or association with a high-quality underwriter. In order to fully understand the phenomena, the theories behind long-run performance of newly listed companies must be examined.

2.8.1 Reason for Long-Run Abnormal Returns

Ritter (1991) concluded that the investors in IPOs were simply too optimistic about the growth potential of the firm. Eventually Ritter (1998) summarized his results and concluded three potential reasons for this phenomena.

The first reason presented by Ritter (1998) stems from Miller's (1977) *divergence of opinion hypothesis*, in which the investors with the most optimistic attitude towards a pending IPO consequently are the buyers. This stems from the uncertainty regarding IPO valuation, in which the optimistic investors value it at a higher price compared to the more pessimistic investors.

However, as time passes and information on the IPO becomes more readily available, the possible divergence of opinion that exists between the optimistic and pessimistic investor is limited; thus, the price of the stock drops which motivates the long-run underperformance.

The focal point of the second hypothesis can be heavily linked to the underpricing made by the investment bankers. Hence, referred to as the impresarios by Ritter (1998). Due to fads in the market for IPOs and the phenomena of underpricing, investment bankers can create an impression of excess demand, alluring more investors to the newly issued stock. This event continues to drive up the stock price and add to the momentum effect. However, Ritter (1998) predicts that IPOs with the highest initial return are set to achieve the lowest return in the long term as a consequence of the described event.

The last hypothesis, named the *Windows of Opportunity Hypothesis*, revolves around companies harnessing the additional proceeds provided by an optimistic investor sentiment. Ritter (1998) noticed that companies are attempting to go public during periods with prominent optimism for growth potential of IPOs; generating large cycles of volume that, according to Ritter, deviates from the normal business cycle activity. During these periods of time, the hypothesis anticipate that the likelihood of firms being overvalued, are greater than other IPOs. In conclusion, these IPOs should, according to Ritter's pattern, have the lowest long-run return.

Although prior research on the subject had been made, Ritter's research and explanations incited further studies concerning the long-run underperformance of IPOs with various explanations for the reasons behind its existence. Levis (1993), who examined the UK market instead of the highly studied US market, also found that newly listed companies underperformed their peers over a period of 36 months. Levis however, took the size of the offering into account and highlighted it as the most important element for its subsequent performance, stating that the larger issues outperformed smaller ones during the same period which contradicts the findings of Banz (1981) who found that smaller firms performed better than larger ones following an IPO. Levis (1993) findings are further strengthened by Ritter (1991), who explains that larger issues are usually issued by more established firms, and that they outperform younger and smaller firms that have higher market to book ratios. Lastly, Levis (1993) noted in accordance with Ritter’s

(1998) second hypothesis that IPOs with a higher initial return have a tendency to accumulate a worse aftermarket performance. Loughran and Ritter (1995) findings of examining the U.S market aligns with the findings of Levis (1993) since they showed that firms demonstrated negative returns the following three and five years after becoming public.

Brav and Gompers (1997) found further indications of long-run underperformance in the US market during 1972-1992. However, they could also disclose that the appearance of venture capital backing IPOs had a mitigating effect on the long-run performance. Eventually leading to them outperforming their counterparts. The previously mentioned notion that outside capital affects long-run performance is further strengthened by Bergström et al. (2006), as their research shows that private equity backed IPOs outperform non-private equity backed IPOs. In addition, IPOs during years of high volume had the most severe underperformance, which according to Bergström et al. (2006) is applicable to the windows-of-opportunity hypothesis. The larger IPOs also tended to perform, on average, comparably better than smaller IPOs, which may be because they are subject to less overoptimistic expectations from investors.

Carter et al. (1998) evaluated the implications that prestige and association with prestigious underwriters had on the long-run performance of US IPOs. The authors found that IPOs with a prestigious underwriter had a less negative long-run performance. Revolving back to the divergence of opinions regarding the valuation at IPO, Hogue et al. (2001) confirms Ritter's findings of long-run underperformance. While examining the uncertainty and IPO firm quality of 2025 IPOs from the US market, they find that the greater uncertainty about an IPO eventually culminates in long-run underperformance.

However, conflicting evidence to the general assumption that IPOs underperform the market over an extended period of time have been presented. Contradictory to divergence of opinions theory and Hogue et al. (2001), various findings suggest that higher initial return has a positive relation to the subsequent long-run performance (Alvarez & Gonzalez, 2005; Lee et al., 1996; Belghitar & Dixon, 2012). In this case, the authors argue that greater initial return indicates higher quality of issuing firm.

Moreover, findings from the Greek and Australian market (Thomadakis et al., 2012; Da Silva Rosa et al., 2003; Bird & Yeung, 2010) identifies abnormal positive returns, or indications that no significant underperformance exists. Overperformance of IPOs have also been observed and summarized by Ritter (1998) in the US, Malaysian, Korean and Swedish market, where the abnormal returns vary from 1.2% to 17,9%. Abukari and Vijay (2011) and Ahmad-Zaluki et al. (2007) provide evidence for overperformance of IPOs in the previously mentioned Malaysian and US market. However, the authors highlight that the findings are inconsistent depending on measures of stock performance and the study's methodology.

On the basis of methodology being the factor for inconsistent results regarding both positive and negative abnormal returns, Schultz (2003) states in contradiction to all previous research that the IPO market is in fact efficient, and that deviations from the market return is not unusual in an efficient market. Schultz (2003) suggests that this can be explained by clustering in the IPO market during higher stock prices, as well as the previous researchers have measured the underperformance of IPOs through event-time studies. Subsequently, the IPO underperforms the expected return even if the market performs poorly afterwards, naming this phenomenon as pseudo market timing. Schultz (2003) instead opts to use calendar-time returns and finds no evidence that the market would be inefficient.

2.8.2 Empirical Evidence of Lock-Up and Long-Run Abnormal Returns

Several studies have been conducted that examines the price fluctuations around the expiration date of lock-ups, noting a negative abnormal return during these periods (Chen & Mohan, 2001; Field & Hanka, 2001; Brav & Gompers, 2003; Bradley et al., 2001; Brau et al., 2005). However, the body of research that addresses the general assumption of long-run performance of IPOs in regards to lock-up agreements is not as extensive.

The notion stated above is highlighted by the previously mentioned authors Gao and Siddiqi (2012). They express concerns on the conflicting results around information asymmetry and agency costs regarding lock-ups, and seek to investigate its long-term implications. Using a sample size of 3980 IPOs in the US between 1989 and 2004, Siddiqi (2012) investigates why the lock-up lengths differ between IPO firms. By examining long term stock returns the authors aim

to establish tests that provide a better distinction between the signaling and agency models. Gao and Siddiqi's (2012) findings strongly supports the agency model as firms with a longer lock-up period have a significantly worse return over a three year period. The authors further reinforces their results as they add established variables with proven effect on IPOs long-term return such as initial return (Houge et al., 2001), firm age (Ritter, 1991) and underwriter (Michaely and Shaw, 1995; Megginson and Weiss, 1991). Despite controlling for the mentioned variables, the previous results remain valid. Subsequently, Gao and Siddiqi's (2012) findings of poor long-run performance association with longer lock-ups culminates in the authors finding no support for the signaling theory, instead the authors advocate for the agency theory.

Ahmad (2015) investigates the importance of the possible impact of lock-up characteristics, in particular lock-up length in explaining the long-run performance of IPOs on the London Stock Exchange (LSE). Ahmad examined 580 IPOs issued between 1990 - 2006, dividing the IPOs in three groups depending on the lock-up period in either 0-12 months, 13-24 months, or greater than 24 months. By dividing the IPOs in two groups based on the median lock-up length and a top and bottom quartile, Ahmad (2015) found that longer lock-up length relative to shorter is positively related to the three year IPO returns; which is a conflicting conclusion in regards to the study done by Gao and Siddiqi (2012).

Chalmers et al. (2017) have researched lock-ups, long run returns and growth opportunities for Australian 571 IPOs on the ASX during 2003 - 2007. Apart from the US and UK stock exchanges that adopt a market approach free from mandatory lock-ups on insider sales, the Australian regulatory setting imposes mandatory lock-ups on inside shares for the issuing firms that do not satisfy the requirements after profit and assets tests. Therefore, the IPO policy in Australia means that firms with mandatory lock-ups (ML) and firms with no mandatory lock-ups (NML) co-exist. Chalmers et al. research the five-years returns for ML and NML firms and how they differ. The findings show that ML firms have lower long run returns than NML firms but that the growth opportunities are higher for ML firms. When analyzing long run returns, the investors receive lower returns for ML firms compared to NML firms, in line with the perceived higher risk associated for firms with weaker financial performance and position. Furthermore,

Chalmers et al. (2017) also find that good corporate governance has a positive effect on long-run returns for all lock-up IPO firms with no significant difference depending on lock-up type.

2.9 Previous Research

The previous research regarding the existence of the phenomenon of underpricing is consistent, with the level of underpricing varying between countries. However, the research regarding the underlying reasons behind underpricing are many and rather ambiguous. Rock (1986), Welch (1989), Brav and Gompers (2003), Brau et al. (2005), Baron (1982), Sheerman et al. (2002), Megginson and Weiss (1990), (Carter et al. (1998) and Ritter (1991; 1998) among others, all point to different factors and their findings are even contradictory at times.

The previous research regarding long-run performance are ambiguous as well considering Ritter (1991;1998), Loughran and Ritter (1995), Levis (1993), Banz (1981), Brav and Gompers (1997), Bergström et al. (2006), Carter et al. (1998), Hogue et al. (2001) all suggest various factors that can affect an IPO long-term performance. In addition, there has also been a proven overperformance of IPOs (Bird & Yeung, 2010; Ritter, 1998; Ahmad-Zulaki et al., 2007; Da Silva Rosa, Velayuthen & Walter, 2003).

Hoque (2014), Rashid et al. (2014), Gao et al. (2017) and Chao et al. (2017) have contradictory findings as they all examine underpricing on different markets with various lock-up regulations. Hoque (2014) and Chao et al. (2017) examine two different markets where lock-up agreements are optional, the US and UK. However, they both find a negative correlation between lock-up length and underpricing which aligns with the previously mentioned agency theory. On the contrary, Rashid et al. (2014) study the Malaysian market where lock-up is mandatory and the length of the lock-up period has a positive correlation with the level of underpricing. Gao et al. (2017) examines the Chinese market and the implications of removing the before obligatory lock-up agreement. The finding suggests that IPO lock-up removal decreases the initial return.

Gao and Siddiqi (2012), Ahmad (2015) and Chalmers et al. (2017) all explore lock-up agreements and long-run performance but on the separate markets; U.S, UK and Australia. Gao and Siddiqi (2012) argues that firms with longer periods of lock-up are correlated with a negative

abnormal return. Ahmad (2015) however states that longer lock-up is correlated to a three year positive return when compared to a benchmark. Lastly, Chalmers et al. (2017) examines Australian firms with mandatory lock-ups (ML) and firms with no mandatory lock-ups (NML). The authors suggest that ML firms have poorer long-run performance than NML and that a solid corporate governance has a positive effect on long-run returns for all lock-up IPOs regardless of lock-up type.

2.9.1 Criticism of Previous Studies

The chosen literature and previous empirical studies have been selected from various reputable scientific journals and books. Sources have been assessed on the basis of its relevance, methods and impartiality. To ensure the quality of the literature, the authors used Scimago Journal and Country Rank (SCImago, n.d.), which ranks articles based on authority and citations. As a result, many of the older articles used in this paper remain highly ranked and relevant due to their influentiality and large number of citations.

Furthermore, articles and books with payment requirements are not included in the study, and therefore the hypotheses and the results could have turned out differently with inclusion of these potentially important sources. Conclusively, the currently included sources in the study are, according to the authors, trustworthy and reliable since they are conducted by prominent researchers in the field. The information collected can therefore be seen according to the authors as reliable.

Throughout this chapter, the overall conclusion regarding previous research is that it is of utmost importance to examine a specific market in order to understand the implications of lock-up agreements within that region on underpricing and long-term performance. This due to differences in the researched countries regarding market regulations, selected time periods, mandatory and non-mandatory lock-up agreements, and findings. Hence, no assumptions can be made of an unexplored market based on one or several previous researches alone, solely because they would not be fully applicable. Since the aim of this research is to investigate the rather unexplored Nordic market, the previous research therefore serves as a guide and source of information for the study but is not used nor considered as the impeccable truth.

2.9.2 Literature Overview

Table 1. Literature overview

Subject Area					
Initial Return					
Authors and publishing year	Time period	Sample size	Market	Lock-Up Regulations	Findings
Ibbotson (1975)	1960-1969	2 796	U.S	Optional	Positive initial performance of new issues implies underpricing, without departures from efficiency in the aftermarket.
Rock (1986)	1986	-	-	-	Coined the term "Winner's Curse" which regards the phenomenon of underpricing which exists to compensate less informed investors.
Megginson & Weiss (1990)	1983-1987	320 backed and non VC-backed	U.S	Optional	VC certification and a correlation between VC-backed firms and less underpricing.
Ritter (1998)	1960-1996	13 308	33 countries	-	Presents the signaling theory, meaning issues are underpricing due cycles in volume which are taken advantage of by firms
Loughran & Ritter (2004)	1980-2003	6 391	U.S	Optional	Reputable underwriter is positively correlated with higher initial returns, especially during periods of high IPO frequency.
Bergström, Nilsson & Wahlberg (2006)	1994-2004	1 370	UK & France	Optional	A correlation between larger IPOs in terms of issue size and less underpricing.
Dreher & Hoppa (2013)	1988-2005	500	24 different markets	-	Underpricing is higher in countries with stronger protection of outside investors and reduced with stronger law enforcement and accounting information
Lock-Up Agreements and Initial Returns					
Hoque (2014)	1999-2006	831	UK	Optional	A negative correlation between longer lock-up periods and underpricing.
Rashid, Abdul-Rahim and Yong (2014)	2000-2012	384	Malaysia	Mandatory	Demonstrated a positive significant relation between lock-up length and initial returns.
Gao, Shenghao, Liu, Jinzhao, Chan, Kam (2017)	2010-2012	474	China	Mandatory/ Optional	Found that removed lock-ups for institutional investors lowers underpricing which implies that lock-up agreement increases underpricing
Chao, Huang & Liao (2017)	1988-2004	3 753	U.S	Optional	Significant negative correlation between lockup length and underpricing. Furthemore, firms with higher underpricing set shorter lockup periods

Long-Run Performance					
Ritter (1991)	1975-1984	1 526	U.S	Optional	First to document the phenomenon of new issues and subsequent long-run underperformance. Presented multiple explanations for this occurrence.
Levis (1993)	1980-1998	712	UK	Optional	Presented evidence of three year negative abnormal returns and that larger sized IPOs tend to have better long-run performance than smaller.
Loughran & Ritter (1995)	1970-1990	4 753	U.S	Optional	Evidence of three and five year negative abnormal returns.
Brav & Gompers (1997)	1975-1992	934 backed and 3407 non VC-backed	U.S	Optional	Long-run underperformance of listed companies. Venture-backed IPOs have a higher three year return compared to non-venture backed IPOs.
Alvarez & Gonzalez (2005)	1987-1997	112	Spain	Mandatory	Higher initial returns is positively correlated with firms long-run performance
Bird & Yeung (2010)	1995-2004	688	Australia	Mandatory/ Optional	Positive abnormal return suggesting long-run overperformance.
Lock-Up Agreements and Long-Run Performance					
Gao & Siddiqi (2012)	1989-2004	3 980	U.S	Optional	Longer lock-ups are associated with poorer long-run performance. Also the significance of underwriters reputation.
Ahmad (2015)	1990-2006	580	UK	Optional	A longer period of lock-up is associated with a higher long-run return. Lock-up agreements are divided into dummy groups.
Chalmers, Haman & Fang (2017)	2003-2007	571	Australia	Mandatory/ Optional	Firms with mandatory lock-up have lower long-run returns than non-mandatory lock-up firms. However, the deciding factor is the level of corporate governance.

2.10 Development of Hypotheses

Based on the theories presented in this chapter, several hypotheses can be established with the aim to answer the purpose of this paper. Previous research findings serve as a guide as to what factors regarding lock-up agreement are of interest to examine on the rather unexplored Nordic market.This culminates into the following hypotheses.

2.10.1 Lock-Up and Initial Returns

Lock-up agreements and its effect on the initial return of newly listed companies have previously been examined, but the amount of research regarding specifically the existence of the agreements is somewhat limited. Research by Gao et al. (2017) suggests that a removal of lock-ups lowers the initial return, which further indicates that the presence of lock-up agreements is a factor that potentially can affect the initial return of an IPO by merely existing. As the Nordic countries all have relatively strict IPO regulations, but the incorporation of lock-up agreements is optional, it differs from previous research. Thus, the authors construct the following hypotheses:

- H_0 1: The existence of a lock-up agreement does not affect the initial return.
- H_1 1: The existence of a lock-up agreement does affect the initial return.

As to lock-up length and its effect on initial returns of IPOs, considerably more research has been conducted. Although substantial evidence has been presented that the length affects the initial return, the results are contradicting (Rashid et al., 2014; Hoque, 2014; Chao et al., 2017). To examine what implications the length might have on the Nordic market, the following hypotheses are constructed:

- H_0 2: The length of a lock-up agreement does not affect the initial return.
- H_1 2: The length of a lock-up agreement does affect the initial return.

2.10.2 Lock-Up and Long-Run Abnormal Returns

As to the existence of a lock-up agreement and its implication for the long-run performance, the previous research is rather scarce, only suggesting that differences in terms of implications depends on market specific regulations (Gao & Siddiqi, 2012; Chalmers et al., 2017). Therefore, the third hypothesis is as follows:

- H_0 3: The existence of a lock-up agreement does not affect the long-run performance.
- H_1 3: The existence of a lock-up agreement does affect the long-run performance.

For the length of the lock-up agreement and its implication, there are three relevant studies that all suggest different outcomes for the long-run performance of an IPO. Either the length has no significant effect at all (Chalmers et al., 2017), leads to a superior long-run performance (Ahmad, 2015) or vice versa (Gao & Siddiqi, 2012). This culminates in to the last hypotheses for this study:

- H_0 4: The length of a lock-up agreement does not affect the long-run performance.
- H_1 4: The length of a lock-up agreement does affect the long-run performance.

3. Methodology

In this chapter, the process of conducting the study is explained thoroughly. First, the research approach is presented followed by the assortment made in order to reach the final sample. Then the variables are presented and motivated for. After this the statistical method and test commences, and ultimately a critical discussion regarding the methodology is held.

3.1 Research Approach

From the previously presented theory, lock-up agreements are frequently used devices to mitigate possibilities of moral hazard and information asymmetry between firms and their investors. This evidence suggests that the existence of a lock-up agreement would alleviate potential uncertainties regarding the IPO valuation. Considering that this study aims to investigate statistical significance in the conducted regressions to either not reject, or reject the null hypotheses, a quantitative method with a deductive approach is chosen in accordance with Bryman and Bell (2017, p.44). A deductive approach uses previous and existing theory to form hypotheses, then collect data to investigate the phenomenon and later tests the hypothesis in question. Through extensive literature review, the theories that are suitable and applicable to examine lock-up agreements' effect on IPO underpricing and long-run performance are selected. On the premises of the selected theory, the collection of quantitative empirical data and analysis lays the foundation to answer the hypotheses.

3.2 Sample Selection

Nasdaq OMX Stockholm, Copenhagen, Helsinki and Oslo Børs as well as Nasdaq First North and Oslo Axess are all regulated markets from which the sample selection of initial public offerings is gathered. The following chapter specifies further criterias for the sample, which resulted in 341 for initial return and 237 for long-run performance.

3.2.1 Selected Time Frame

Data extraction for information regarding newly listed companies is restricted to a period from 2010-01-01 to 2021-11-27 for the investigation regarding lock-up and its initial returns. Regarding lock-up and long-term performance, the selected time period is 2010-01-01 to 2018-12-07. As previously mentioned, information and access to the older firm's prospectus is limited. Thus, to avoid contributing with inadequate information as well as being able to verify the trustworthiness of the data, prior IPOs are not included. Furthermore, Ritter et al. (2013) show that after a common peak around 2006 for IPOs in Europe, there was a dramatic decline in the IPO volume after the financial crisis during 2007 - 2008 and the following Eurozone crisis. To avoid potential skewness in the regressions, the IPOs from the years of the financial crisis are not included.

3.2.2 Country Selection

The Nordic countries (i.e Norway, Sweden, Denmark and Finland) are selected because of how they differentiate from other financial markets in terms of the high level of market and shareholder protection institutionalized by law (La Porta et al., 1997; Lekvall 2014, p.13). Furthermore, the lock-up agreements are optional across the Nordics, which is not the case in several other financial markets (Goergen et al., 2006). The Nordic countries are also in a comparable phase in terms of their financial and economic development, and stock returns for the markets are highly correlated with each other (Kuosmanen et al., 2015).

3.2.3 Stock Exchanges

The selected stock exchanges for the research are Nasdaq OMX Stockholm, Nasdaq OMX Copenhagen, Nasdaq OMX Helsinki, and Oslo Børs. Nasdaq Nordic controls Stockholm, Helsinki and Copenhagen among four other stock exchanges (Nasdaq, 2021b). Oslobørs differs from the rest as it is an independent stock exchange that as of 2019 is controlled by Euronext (Oslobørs, 2021b) To support the thesis with a substantial amount of IPOs for the empirical study, Nasdaq First North in Sweden, Finland, Denmark are included as well as Oslo Axess in Norway. Nasdaq First North and Oslo Axess are the markets for small- and medium sized companies (Nasdaq, 2021b; Oslobørs, 2021b).

Other alternative stock exchanges such as Merkur Market in Norway, Spotlight and Burgundy in Sweden and similar stock exchanges in Denmark and Finland respectively are excluded. This since they operate under less comprehensive markets and listing requirements. Furthermore, these exchanges are subject to smaller initial public offerings and therefore not meeting the requirements and the legitimacy set out for this research by the authors.

3.2.4 Stock Prices

For the initial return the unadjusted end of day close price and offering price are collected, as possible dividends or splits are unlikely to occur on the first trading day. As the study also applies a buy and hold model, there is a need to incorporate eventual dividends in the analysis of abnormal returns as well as adjustments for splits. In order to do this the data extracted from FactSet is split-adjusted with the inclusion of dividends, also known as the true return.

3.2.5 Omitted Listings

Only newly listed companies are included in this study. Secondary listings, spinoffs and mergers is thus not a part of this study's sample. The reasoning behind this is that for these companies, prior information and market knowledge is rather extensive in relation to exclusively new listings. Special purpose acquisitions companies, also known as SPACs, are also excluded since they are listed with the sole purpose of raising capital in order to acquire an existing company; hence, they do not have any existing business operations. As the study examines the signaling effects of a potential lock-up agreement for new listings in regards to uncertainty from an investors perspective, these listings run the risk of skewing the results and are therefore not included in the sample.

3.2.6 Data Extraction

The data material is primarily derived from FactSet, where data such as price history, gross proceeds from IPO, offer price, underwriter, VC/PE-backed and existence of a lock-up agreement is gathered. If additional information would be needed the firm prospectus is reviewed.

3.3 Dependent Variables

As the study examines both the short-term and long-run performance of IPOs, the authors are now present how calculation of initial return and long-run abnormal returns is conducted.

3.3.1 Calculation of Initial Return (IR)

One of two dependent variables is the initial return, which is investigated for the entire sample during the time frame. The initial return is measured as the difference between the offer price (P0) and close price (P1) for the stock during the first day of trading.

$$IR = \frac{P1 - P0}{P0} \tag{1}$$

Higher initial return is expected to be followed by poorer returns. Hence, in accordance with Ritter (1998) and Levis (1993), the variable is further implemented as a dependent variable for the long-run performance.

3.3.2 Calculation of Long-Run Performance (BHAR)

The second dependent variable is the market-adjusted buy and hold abnormal return, further referred to as BHAR. The used period of time is 720 trading days. This is calculated in a three-step model. The first step is to calculate the return of a specific firm (BHRi). Secondly, a similar return is calculated for the benchmark (BHRmkt) during the same period.

$$BHRi = \frac{P1 - P0}{P0} \tag{2}$$

Lastly, the benchmark return is deducted from the calculated return of a specific firm as depicted by the formula used by Barber and Lyon (1997).

$$BHAR(i,T) = \prod_{t=1}^{T}[1 + Rit] - \prod_{t=1}^{T}[1 + E(Rit)] \tag{3}$$

3.3.2.1 BHAR Benchmark

For the benchmark return, the market index for each Nordic country is used as a proxy for market return and therefore included to calculate the expected return. The indexes used for this are OMX Stockholm All-Share Gross Index, OMX Copenhagen Stock Exchanges All-Share Gross Index, Oslo Børs All-Share Gross Index and OMX Helsinki All-Share Gross Index. These indexes include all the shares listed on the three OMX exchanges and Oslo Børs and are gross indexes where dividends are reinvested, which gives a more truthful return compared to a price index.

3.4 Independent Variables

The independent variables are chosen and included based on relevance in previous research for explaining the lock-up agreements' impact on initial returns and long-run performance. The independent variables are categorized to either be variables related to lock-up agreements or control variables. The variables related to lock-up agreements are Lock-up dummy, Lock-Up Length (LuL) and the Lock-Up Length divided into three classes (LuL3). These are critical to be able to answer the purpose of this paper and is further explained in the next section. In addition, Number of Issues (NOI), Offer Size (lnSIZE), Firm age (lnAGE), Underwriter Reputation (UR) and VC/PE are used as control variables. The selected control variables are included in the study with the purpose to control for factors that affect the dependent variables and thereby avoid systematic errors in the data. However, not all variables are included in the both regressions, which is clarified in chapter 3.5, Statistical Methods.

3.4.1 Lock-Up Dummy (LuD)

To answer the question if lock-up agreements have significant correlation with the initial return and long-run performance, a lock-up dummy is used in the regression. If there exists a lock-up agreement in the IPO, it is assigned the number 1, if not the number 0.

3.4.2 Lock-Up Length (LuL)

In line with Brav and Gompers (2003) findings that firms with a greater risk of moral hazard use longer periods of lock-up as a commitment device to mitigate moral hazard dilemmas, the lock-up period in terms of actual days are included in the regressions.

3.4.3 Lock-Up Length (LuL3)

The variable for lock-up period is divided into three classes in accordance with Rashid et al. (2014), and takes on the number of 0 for a period less than 180 days, 1 if 180 days and 2 if any longer.

3.4.4 Number of Issues (NOI)

In accordance with Ritter (1991), this paper uses the number of IPOs as a measurement of cyclicality. Years with a large number of listings are defined as high volume years. IPOs during these periods with high market and investor optimism tend to have higher underpricing (Ritter, 1991). The variable is calculated by dividing the number of issues per year with the total number of issues for the selected time period.

$$NOI = \frac{Number\ of\ issues\ per\ year}{Total\ number\ of\ issues\ \ 2010-2021} \quad (4)$$

3.4.5 Offer Size (lnSIZE)

As a way to control the impact of information asymmetry, gross proceeds raised at the IPO is used as a proxy for firm size in accordance with Brau et al. (2005). Hoque (2014) identifies firms with information asymmetry as those smaller in offer size. Thus, the proceeds are used as a control variable to investigate if there is a negative significance between IPO offer size and initial returns as well as long-run performance. The amount of gross proceeds is calculated upon the amount sold shares at missing times the offer price, including exercised overallotment options in accordance with Ritter (1991). As the offer size varies among the firms this variable is logarithmically transformed in order to mitigate potential skewness and improve the distribution. Further explanation is presented in chapter 3.5.5 Logarithmic Transformation.

3.4.6 Firm Age (lnAGE)

The age of a firm is suggested by Muscarella and Vetsuypens (1990) to indicate a lower operational risk and less information asymmetry pre-IPO, which previously had been proposed

by Ritter (1984). Leone et al. (2006) also present findings that strengthen this notion, as well as an indication of less underpricing for the older firms. Thus, it is expected that firms with an older age to have less underpricing, and as appropriate information is presented pre-IPO, no new information released should cause the firm to lag the market. For the same reason as the variable size, age is logarithmically transformed due to the extensive span of the sample. Further explanation is presented in chapter 3.5.5 Logarithmic Transformation. In accordance with Leone et al. (2006), the firm age is defined below.

$$Firm\ age\ =\ ln\,(1\ +\ (IPO\ year\ -\ Incorporation\ year)) \tag{5}$$

3.4.7 Underwriter Reputation (UR)

According to Carter and Manaster (1990), prestigious underwriters are associated with less risky IPOs with lower returns, as the empirical results imply that there is a significant negative relation between underwriter prestige and the price run variance of the IPOs. In accordance with Megginson and Weiss (1991), the quality of each underwriter is measured as the underwriter's market share of the total gross proceeds of all the initial public offerings brought to the market during the timeframe 2010 - 2021.

$$Underwriter\ Reputation\ =\ \frac{Gross\ proceeds\ (inc\ overllotment)}{Total\ gross\ proceeds\ in\ the\ market\ 2010-2021} \tag{6}$$

The data is gathered from the FactSet league tables in each Nordic country, respectively. The underwriters calculated gross proceeds is the total amount from the offering by the issuing company, including exercised over-allotment options. For multi-tranche deals, the value is the summation of gross proceeds across all tranches, as displayed in FactSet underwriter league table for each Nordic country. If the underwriter market share exceeds 10% it is considered as a prestigious underwriter and assigned the number 1, and if not, the number 0 (Appendix 4). Moreover, to give a more nuanced view of underwriter reputation, the underwriters with market shares that exceed 10% in Europe are considered prestigious underwriters; thus, including firms with internationally recognized brand names.

3.4.8 VC/PE-backed (VC/PE)

A VC/PE variable is included due to empirical findings having been made of the mitigating effects for private- and venture capital-backed firms on initial returns and long-run performance (Bergström et al., 2006; Brav & Gompers, 1997). In accordance with (Brau et al., 2004; Field & Hanka, 2001; Hoque, 2011) private equity and venture capital-backed firms (VC/PE) and non VC/PE-backed firms are separated by a dummy variable. VC/PE-backed firms are assigned the number 1 and non VC/PE-backed firms assigned the number 0.

3.5 Statistical Methods

The aspiration of this study is to investigate the initial returns and long-run performance of IPOs in regards to the implications followed by a lock-up agreement and its length. In order to further examine the potential relationship, this study implements a multiple regression to answer the hypotheses.

3.5.1 Regressions for Initial Return

The three regression applied to investigate the initial return are the following:

$$IR = \beta LuD + \beta lnSize + \beta lnAge + \beta NIO + \beta UR + \beta VC/PE + \varepsilon \quad (7)$$

$$IR = \beta LuL + \beta NIO + \beta lnSize + \beta lnAge + \beta UR + \beta VC/PE + \varepsilon \quad (8)$$

$$IR = \beta LuL3 + \beta NIO + \beta lnSize + \beta lnAge + \beta UR + \beta VC/PE + \varepsilon \quad (9)$$

3.5.2 Regressions for Long-Run Performance

The three regressions applied to investigate the long-run performance are the following:

$$BHAR = \beta LuD + \beta IR + \beta lnSize + \beta lnAge + VC/PE + \varepsilon \quad (10)$$

$$BHAR = \beta LuL + \beta IR + \beta lnSize + \beta lnAge + VC/PE + \varepsilon \quad (11)$$

$$BHAR = \beta LuL3 + \beta IR + \beta lnSize + \beta lnAge + VC/PE + \varepsilon \quad (12)$$

3.5.3 Significance Level

Depending on the results from the regression, the null hypothesis is either not refuted, or refuted, depending on the probability value (i.e. p-value). The norm within the statistical field is to apply a p-value of 1%, 5% or 10% when conducting the hypothesis tests. The lower the p-value, the higher is the significance of an observed difference (Brooks 2019, p.123). This study uses a p-value of 5% as a criterion for refuting the null hypothesis.

3.5.4 Ordinary Least Squares

In order to fit the multiple regression model, this study uses the ordinary least squares approach, which is one of the most commonly used linear regression models (James et al., 2013, p.21). The approach fits the data to the best fitting line through minimizing the sum of squared deviations of the residuals. Subsequently, this is later used to interpret the potential relationship between the variable of interest and the independent variables.

For the model, the previously presented independent variables are implemented with the purpose of establishing the internal validity of the data; which is critical for the study being able to dismiss alternative explanations for a potential relationship (Brook 2019, p.147). Furthermore, a number of assumptions need to be considered in regards to the analysis being viewed as reliable and valid, Brooks (2019, p.107) presents five assumptions that need to be held.

1. Average value of the errors should be zero

This notion entails that the parameters implemented while using the ordinary least squares method are linear. However, if a constant in the form of an intercept is included, this assumption is always upheld (Brooks 2019, p.148). Since the regressions are implementing a constant, there is no further test needed to examine this assumption.

2. The variance of the error terms are constant.

This condition is referred to as homoscedasticity if upheld. In contrast, if there is not a constant variance among the errors, it would be heteroscedastic. A White's test is performed by the recommendation of Brooks (2019, p.187) to detect any level of heteroscedasticity.

3. The errors are uncorrelated with one another.

Under this condition, the covariance between the error terms is zero during studies over a period of time. Thus, uncorrelated to each other. On the contrary, if the residuals are correlated to one another, they could be described as serially correlated. In this state the r squared (R2) is likely to be lower than expected as the regression underestimates the true residual variance. Hence, the authors are particularly meticulous of including explanatory variables previously used in prominent research with a proven effect on the response; this without including too many variables that may create a model which overfits the data.

4. There is no correlation between the dependent variable and the corresponding error.

According to Brooks (2019, p.106), this assumption can be disregarded as long as assumption number one holds. This is due to the fact that the left side value of the equation is determined outside of the model, hence any autocorrelation could not exist.

5. The error term is normally distributed.

In order to conduct a hypothesis test the variables are assumed to be normally distributed. This is to control for extreme outliers who run the risk of skewing the results, and should thus be excluded. To determine this a Jarque-Bera test is performed.

Given that all conditions are upheld, the regression would be referred to as the Best Linear Unbiased Estimator, also known as BLUE. In this case, Brooks (2019, p.107) states that the regression, underlying observations and subsequent inferences drawn are to be considered valid.

3.5.5 Logarithmic Transformation

Logarithmic transformation can be used to mitigate possible skewness of the data material as it rescales the data thus the variance becomes more constant (Brooks 2019, p.190). It also enhances the possibility of mitigating effects of heteroscedasticity (Brooks 2019, p.190). In accordance with previous research on the subject (Leone et al., 2006; Georgen et al., 2006; Chao et al., 2010), the variables size and age are logarithmically transformed as previously mentioned.

3.6 Model Validation

In this chapter the previously mentioned tests to ensure model suitability is presented. The test results are given in chapter 4.4 Regression Diagnostics, and the exact values can be found in Appendix 3.

3.6.1 White's Test

White's test is conducted to examine the level of heteroscedasticity. In accordance with Brooks (2019, p.129), a 5% critical value of significance is used; and if the p-value is more than 0.05, the null hypothesis of homoscedasticity is rejected. However, if White´s test does not reject the null hypothesis, Brooks (2019, p.190) recommends rescaling the data for extreme observations such as measures of size by logarithmically transforming. Lastly, if logarithmic transformation does not resolve the issue, measures for robustness must be taken. In this case, heteroscedastic-consistent standard error estimates should be employed.

3.6.2 Multicollinearity

When two or more explanatory variables are highly correlated, a problem known as multicollinearity occurs (Brooks 2019, p.213). This is undesirable as a change of value for one variable could affect the coefficient of another variable, making it harder to interpret the isolated predictive power for the variable of interest. To examine if multicollinearity is apparent for the selected variables, a correlation matrix is constructed where variables should be excluded if the correlation exceeds 0.8. Furthermore, a Variance Inflation Factor (VIF) is conducted for all regressions, which estimates the degree to which variables are correlated. VIF values that exceed five are deemed to be problematic (James et al., 2013).

3.6.3 Jarque-Bera

A Jarque-Bera test is a necessity in order to examine whether the residuals of the observations have a normal distribution (Brooks 2019, p.209). This test expects a systematic distribution around the mean without any skewness as well as coefficient kurtosis of 3. The kurtosis, which is how fat the tails of the distribution are, have however been proven by Fabozzi et al. (2012) to be leptokurtic for measures of financial performance. For sufficiently large sample sizes such violations are inconsequential (Brooks 2019, p.209), but demands a watchfulness while making inferences if extreme outliers are present.

3.6.4 Ramsey Reset Test

To derive a valid regression one must examine if a linear regression is the most appropriate way of describing the relationship between the dependent and independent variables. This is done using the Ramsey RESET test (Brooks 2019, p.217) which uses a combination of non-linear approaches in an attempt to explain the response variable. The level of significance should be greater than 5% in order for the original form of the regression to be deemed correct (Brooks 2019, p.217). As the study logarithmically transforms the variables of size and age, the model is expected to have a linear association.

3.7 Method Discussion and Criticism

For this chapter, the authors are critically examinining and discussing the methodology that was used for this study.

3.7.1 Critique of Databases and Data Extraction

Beyond FactSet, Modular Finance was also considered to be a useful database. However, due to service of the lock-up agreement information not being fully constructed yet, it was not applicable for this research. Although FactSet was considered to be the most suitable database it had shortcomings. It was not possible to adjust stock prices that initially had been offered as units; nor highlighted by FactSet. Thus, the authors occasionally had to manually calculate the correct offer price using the prospectus where the equivalence of 1 unit in terms of stock offer price was given. Though this method was not optimal, all calculated prices were compared to the unit-stock ratio presented in the prospectus to ensure that the correct price was determined. It

should be highlighted that evident outliers from the original data set were cross-checked with the prospectus, but this does not conclude that all unit-stock prices were noticed. Moreover, for some firms no information regarding a lock-up agreement was registered on FactSet, in those cases the prospectus was reviewed to assure that the correct data was used. All firms given a 0 for the lock-up dummy were confirmed with the prospectus.

Furthermore, it is of importance to be critical towards all gathered data since it has been obtained as secondary data. The reason is that the authors were unable to control how FactSet collects and processes the data. However, since FactSet is frequently used and well-cited by industry professionals in their daily work, the authors consider the data collected to be reliable to the extent that it could be used in this study.

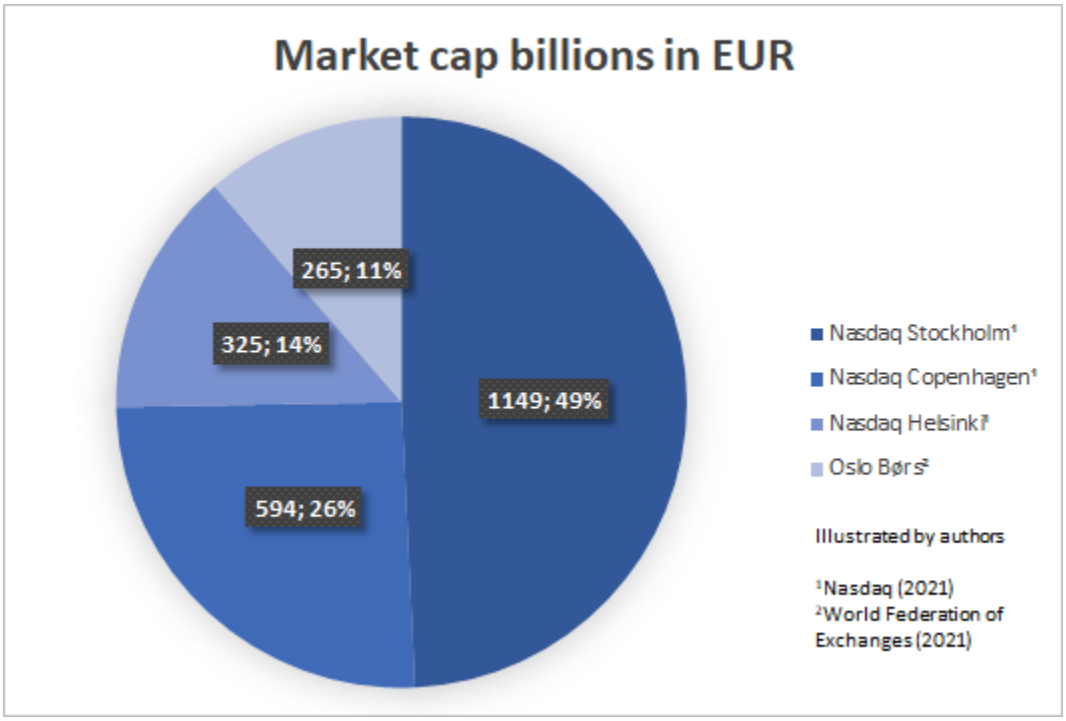
3.7.2 Missing Data Analysis

As previously mentioned the original sample for the study consisted of 341 IPOs for the initial return and 237 IPOs for the long-run performance. However, due to factors such as missing prices and/or prospectuses entirely written in Finnish, the final sample decreased to 330 IPOs for initial return and 229 IPOs for long-run performance. Thus, the total amount of missing data consisted of 19 samples which equals approximately 3% of the total sample. Since the missing data is only a small portion of the sample and no systemic bias was found, its impact was therefore considered to be insignificant.

3.7.3 Country/Market Selection

The Nordic markets are similar in several ways. Notably, the majority of the IPO samples are from the Swedish market. However, an explanation for the large IPO sample from Sweden is the size of the market and superior access to capital. As illustrated below in Figure 2, the market capitalization of Nasdaq Stockholm is almost the same size as the rest of the stock exchanges combined. When researching the Nordic market it is important to place the stock exchanges into context with each other. The skewness towards Swedish IPOs is understandable and the sample can therefore be seen as viable for the study.

Figure 2. Market capitalization of stock exchanges



3.7.4 Calculation of long-run performance - BHAR vs CAR

Unlike short-term models where discrepancies usually have a lesser impact, long-term models run the risk of diluting the calculation of abnormal return, hence deriving large errors. In general, researchers opt to either use cumulative average adjusted returns (CAR) or buy and hold average return (BHAR) (Brooks 2019, p. 580). While conducting a literature review, it became clear that the majority of the research selected the buy-and-hold model (Ritter, 1991; Levis, 1993; Barber and Lyon, 1997; Gao and Siddiqi, 2012; Chalmers et al., 2017). Lastly, Barber and Lyon (1997) highlighted that CAR aggregates a measurement bias over a longer period of time. And as a majority of previous research implemented the buy-and-hold abnormal return model, it was also chosen for this study.

3.7.5 Selection of Benchmark

The benchmark chosen in this paper is as previously stated the All-Share Gross Indexes from the selected stock exchanges in the four countries. There are however alternative approaches on how a benchmark can be established. Ritter (1991) created a benchmark by analyzing the characteristics of an IPO relative to a comparable firm, thus the benchmark of each issuing firm was tailored as they were compared to competitors with the same size and industry. On the other hand, this approach requires selecting comparable companies to every sample firm. Which increases the risk of subjectivity as the selection of a comparable firm was dependent on the authors if no suitable candidate could be found. Consequently, the benchmark used in this study was deemed to be the most suitable considering its trustworthiness and the time constraints of the paper. Moreover, by comparing all of the samples in the respective countries to the same benchmark, each firm was given the same conditions when examining their long-run performance.

3.7.6 Delistings

In accordance with Ritter (1991), companies that have been delisted within the three year time frame were also included in the model; thus, limited the influence of survivorship bias. In this instance the returns of the firm from first until last trade day were measured, and later benchmarked against the returns from the market during the same period. Since delistings are not foreseeable, a possible investor could not be able take it into consideration when evaluating a potential investment in an IPO. Hence, a removal of these occurrences from the sample would potentially affect the reliability of this study as it aimed to investigate all the new listings. There were a total of fifteen delistings for the BHAR sample which should not have skewed the result in a substantial way.

3.7.7 Lock-Up Length

In accordance with Rashid et al. (2014), the lock-up length was decided on the basis of where the majority of shares was situated. As a multitude of the companies used more than one lock-up length with the constituents being primarily selling/major shareholders or management, this had to be manually sorted. Since the finance application Holdings from Modular Finance could not

provide adequate data on the amount being subject to a certain number of days, this had to be decided based on the information provided through the prospectus; with the selling and major shareholders outweighing their managerial counterparts if no decisive information was provided. The manual decision making and generalization should however be highlighted.

3.7.8 Managing Extreme Outliers

Early results of both initial return and long-run performance concluded that the residuals were not normally distributed. Imposing Jarque Bera tests gave poor results which were caused by several extreme outliers that affected the regression. As the extreme outliers for both dependent variables departed from both ends of the distribution, the authors decided to winsorize the dependent variables at a 5%-level to reduce their influence and increase the robustness of latter inference. As winsorizing simply modifies the values for the outliers instead of excluding them from the data set, this makes it possible for the study to preserve the information from the outliers while also conducting measures of robustness. As a result of the winsorization, the Jarque Bera test eventually provided an efficiently low score, which is presented in chapter 4.1.1 Frequency Statistics.

There were also two extreme outliers in EQT AB and Flat Capital AB, where the lock-up length spanned all the way to 1825 days. The variable size further had two extreme outliers consisting of Volvo Cars and Dong Energy A/S. These observations were the second largest and largest IPO respectively in the history of the exchanges (FactSet, 2021), which dramatically influenced the Jarque Bera test. In order to draw reliable inferences, the authors decided to manually exclude these four from the regressions; the distribution before and after can be found in Appendix 1.

3.7.9 Presence of Heteroscedasticity

While conducting the White's test for heteroscedasticity with the included variables for all the multiple regressions, the null hypothesis of homoscedasticity could not be rejected. As previously mentioned the variables age and size had both been logarithmically transformed in accordance with Brooks (2019, s.190). However, further measures had to be taken in terms of robust standard errors. The Huber-White robust standard errors, which was available as an option

in Eviews, was applied for all regressions in order to adjust for the heteroscedasticity, allowing the authors to make consistent inferences of the results.

3.7.10 Presence of Multicollinearity

Furthermore, as can be seen in chapter 4.1.2 Distribution of Variables, the correlation for the variables size and underwriter reputation almost exceeded the threshold of 0.8, bearing the risk of limiting the interpretability of given results; and when included in the same regression for long-run performance it led to insufficient significance for the regression itself. As underwriter reputation has more empirical evidence of influencing the initial return, the authors decided to only include this variable for regression concerning initial return.

3.7.11 Reliability and Replicability

Reliability is about the consistency and conformity of the measures used to investigate a concept or phenomenon. Several steps are taken by the authors to ensure reliability. Firstly, the selection of the database FactSet and its shortcomings, as well as the exclusions of outliers from the sample, is thoroughly presented; hence, the sample used in this study would be similar for other researchers using the same timeframe and database. As previously discussed, there was some manual gathering of data which bears the risk of human error, but it has also been stated which factors that made the authors determine a unanimous value; such as for lock-up length if given more than two expiration dates. The authors therefore consider the data to be reliable, and the study to be replicated as all manual decisions have been properly motivated and explained.

3.7.12 Validity

Validity embraces the question of whether one or several factors developed to investigate a hypothesis or phenomenon, in reality, do so. The validity can be described from both an external perspective and internal perspective. Furthermore, validity presumes reliability (Bryman & Bell 2017, p.175). Internal validity aims to examine the causality among variables, whether the study in question can confirm if the independent variable is causing any changes in the dependent variable (Bryman & Bell 2017, p.69). The compiled hypotheses were developed and the variables were chosen based on several previous empirical studies conducted by prominent researchers within the field. Throughout the study, several statistical tests were performed to

ensure the quality and relevance of the regressions, and therefore assumptions of internal validity can be made according to the authors.

External validity encompasses the result from the sample and study as a whole, and if it can be generalizable and applicable to represent the total selected market (Bryman & Bell 2017, p.69). Due to measures taken regarding the purity of the data and the presented arguments why the Nordics can be researched as one market, one can argue that the results are applicable. However, due to varying regulations of lock-up agreements and different market conditions depending on the country and continent, the results from the Nordic market are only applicable to the Nordics.

4.0 Results

In this chapter, the results from the regressions and statistical test are presented in order to answer the study's research questions. The chapter starts with descriptive statistics followed by regression results, and lastly regression diagnostics.

4.1 Descriptive Statistics

The purpose of this chapter is to provide the reader with a comprehensive overview of the material used for statistical testing and analysis.

4.1.1 Frequency Statistics

As previously mentioned, the independent variables age and size suffered from extreme outliers which led to the exclusion of four companies. Hence, the sample size of 330 and 229 firms for initial return and long-run performance was finally adjusted to 326 and 225 firms respectively. Moreover, the dependent variables initial return and BHAR were winsorized due to presence of non-normality. The frequency statistics presented in Table 2 includes the sample before and after adjustments, allowing the reader to visualize the effect of the adjustment.

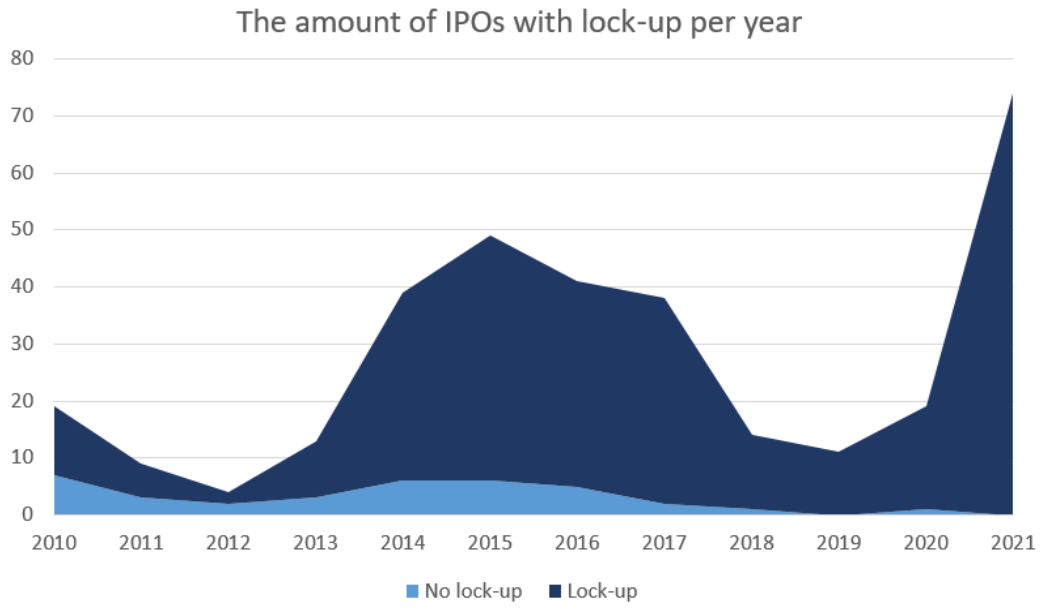
Table 2. Overview prior and after winsorizing

			Underpricing		
Initial Return (Pre Winsorizing)	No. of Firms	Average	Maximum	Minimum	Jarque Bera
With Lock-Up	284	6.127%	175.60%	-70%	
No Lock-Up	42	-3.236%	30.44%	-46.30%	
Total	**326**	**4.921%**	**-**	**-**	**2270,8**
Initial Return (Post Winsorizing - 5%)					
With Lock-Up	284	4.55%	38.60%	-31.17%	
No Lock-Up	42	-2.46%	30.44%	-31.20%	
Total	**326**	**3.65%**	**-**	**-**	**1.04**

		BHAR			
Long-Run Performance (Pre Winsorizing)	No. of firms	Average	Maximum	Minimum	Jarque Bera
With Lock-Up	187	24%	722.40%	-151%	
No Lock-Up	38	18%	583%	-111%	
Total	**225**	**23%**	-	-	**659.22**
Long-Run Performance (Post Winsorizing - 5%)					
With Lock-Up	187	15.75%	317.50%	-110.33%	
No Lock-Up	38	5.95%	317.50%	-110.33%	
Total	**225**	**14%**	-	-	**71.03**

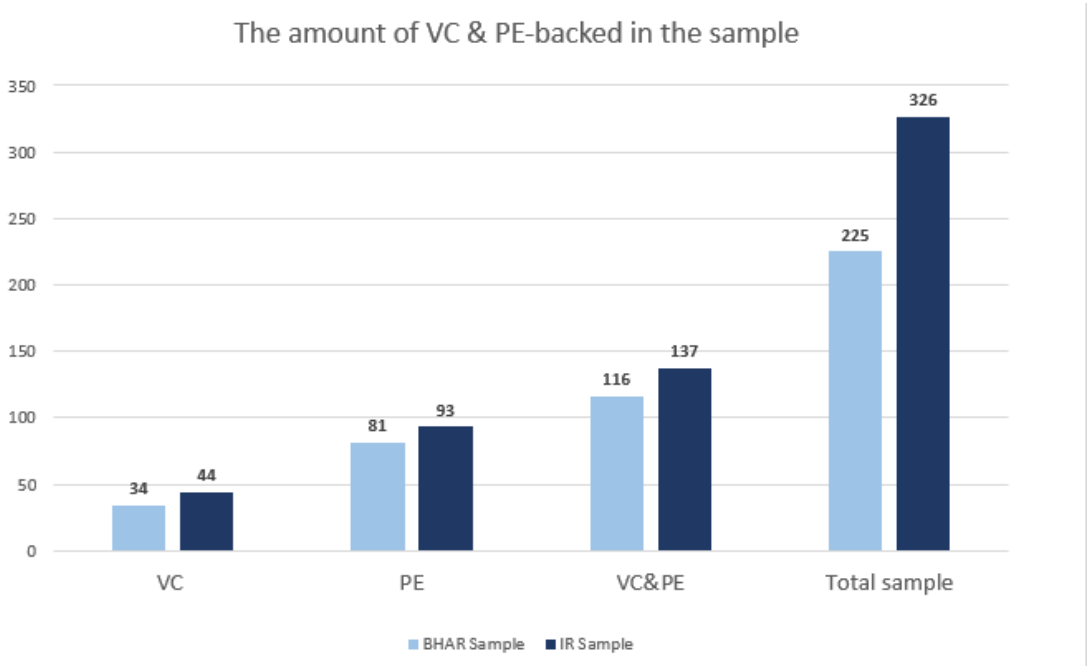
After adjusting for outliers the total amount of IPOs without a lock-up agreement amounted to 42 and 38 respectively. It can also be seen that companies implementing a lock-up agreement have a higher rate of underpricing and superior performance to their counterparts over the long-run. However, for all IPOs during the time frame, it could be proven that underpricing and long-run abnormal positive returns exists, which can be seen by the t-test in Appendix 2.

Figure 3. Frequency of IPOs



As can be seen from Figure 3 above, it is also clear that the utilization of a lock-up agreement has been increasing over the studied time frame. In addition, during the year 2021 there are so far no IPOs without a lock-up agreement.

Figure 4. The amount of VC - & PE- backed IPOs in the sample



As illustrated in Figure 4 above, the amount of PE-backed IPOs in the sample is higher compared to VC-backed. Conclusively, the amount of VC/PE - backed IPOs are common in this sample of Nordic IPOs.

4.1.2 Distribution of Variables

Table 3 showcases the final distribution of the sample firms and displays the maximum and minimum values for the independent variables. The mean and standard deviation for each variable are also included in the table. Before arriving at the presented final distribution, AGE and SIZE were logarithmically transformed since extreme outliers were present. It should be noted that several listings on First North, which demand a minimum of six months in operations (Bird & Bird, 2021) before listing, had an age of 1 (0+1); hence, when logarithmically transformed the minimum resulted in zero years. In addition, two outliers were removed from both SIZE and LuL. After the aforementioned measures, both the standard deviation and Jarque Bera dropped significantly to more reasonable levels, as can be seen in Appendix 1.

Table 3. Distribution of Variables

Variable	N	Minimum	Maximum	Mean	Standard Deviation
lnAGE	326	0.000	5.193	2.562	1.094
lnSIZE	326	1.506	9.554	5.703	1.822
LuD	326	0.000	1.000	0.871	0.336
LuL	326	0.000	720.000	236.718	137.546
NOI	326	0.012	0.222	0.126	0.063
UR	326	0.000	1.000	0.567	0.496
VE/PE	326	0.000	1.000	0.420	0.494

4.1.3 Correlation of Variables

To examine if multicollinearity was apparent, a correlation matrix was conducted. As apparent in the table, none of the selected variables had a correlation above 0.8. However, lnSIZE and UR had a high correlation of 0.770, which is intuitively due to the fact that larger IPOs usually have more prestigious underwriters. As the correlation is close to exceeding the threshold, the variables were not included together for the BHAR-regression, as mentioned in the method discussion. Furthermore, a VIF test was conducted for all regressions where none of the variables exceeded five, as can be seen in Appendix 3**.**

Table 4. Correlation of Variables

Variable	LuD	LuL	LuL3	lnAGE	lnSIZE	NOI	UR	VC/PE
LuD	-							
LuL	/	-						
LuL3	/	/	-					
lnAGE	0.060	-0.143	-0.127	-				
lnSIZE	0.225	-0.090	-0.085	0.340	-			
NOI	0.188	0.122	-0.129	-0.014	-0.104	-		
UR	0.182	-0.126	-0.114	0.275	0.770	-0.189	-	
VC/PE	0.031	-0.050	-0.040	0.072	0.141	-0.147	0.204	-

4.2 Regressions

In this chapter, the regressions concerning lock-up agreements influence on the initial return and long-run performance is presented and hypotheses are tested. The tables presented provides the p-value, variable coefficient, coefficient of determination (R2), number of companies and the Jarque-Bera score. As previously mentioned in chapter 3.7.9, the presence of heteroscedasticity was adjusted by heteroscedastic-consistent standard errors for all regressions. Lastly, a significance level of 5% is applied for all tests.

4.2.1 Regressions for Initial Return

The regressions and subsequent hypotheses regarding the implications of a lock-up agreement on the initial return is now be presented.

4.2.1.1 Regression with Lock-Up Dummy

For this regression the variable LuD gives the value of 0 to a firm without a lock-up agreement and 1 if it exists; this tests $H_0 1$.

Table 5. Regression results for initial return with lock-up dummy

Independent variable	P-Value	Coefficient
Regression	0.000	-
LuD	0.178	0.040
AGE	0.002	0.025
SIZE	0.501	0.006
NOI	0.332	0.157
UR	0.112	0.048
VC/PE	0.534	-0.012
Constant	**0.004**	**-0.137**
N	**326**	**-**
R Square	**0.087**	**-**
Jarque-Bera	**6.843**	**-**

The regression is significant at a 1%-level and the coefficient of determination receives a value of 0.087; hence, the explanatory variables explains 8,7% of the initial return. Most prominent is the variable for age with a p-value below 5%. Results from the regression show that the variable of interest, LuD, does not have a significant p-value (0.178). Therefore, hypothesis $H_0$1 can not be refuted, and a significant relationship between the existence of a lock-up agreement and underpricing can not be proven.

4.2.1.2 Regression with Lock-Up Length

For this regression, the variable of interest is LuL which is the length of a lock-up agreement in terms of days; this tests the second hypothesis. Another regression with the length of lock-up agreements divided into three classes is also applied to test the second hypothesis.

Table 6. Regression results for initial return with lock-up length in days.

Independent variable	P-Value	Coefficient
Regression	0.000	-
LuL	0.182	0.0001
AGE	0.001	0.026
SIZE	0.416	0.007
NOI	0.243	0.184
UR	0.081	0.053
VC/PE	0.565	-0.011
Constant	**0.004**	**-0.141**
N	**326**	**-**
R2	**0.087**	**-**
Jarque-Bera	**6.303**	**-**

The regression is once again significant at a 1%-level, and the coefficient of determination receives a value of 0.087. Indicating that the explanatory variables explain 8,7% of the initial return, which is on par with the previous regression. As per the last regression, age is significant with p-values below 5%. However, the variable of interest, LuL, does not have a significant p-value (0.182). Therefore, hypothesis $H_0$2 can not be refuted.

Table 7. Regression results for initial return with lock-up length divided into three classes.

Independent variable	P-Value	Coefficient
Regression	0.000	-
LuL3	0.087	0.025
AGE	0.004	0.026
SIZE	0.409	0.006
NOI	0.270	0.175
UR	0.080	0.053
VC/PE	0.558	-0.116
Constant	**0.002**	**-0.149**
N	**326**	**-**
R2	**0.091**	**-**
Jarque-Bera	**6.036**	-

The regression remains significant at a 1% level when substituting the variable for lock-up length with the class divided counterpart. Furthermore, the coefficient of determination is now slightly higher and stands at 0.091, indicating that the explanatory variables explain 9,1% of the initial return. Age remains significant with p-values below 5%. Interestingly, the variable of interest, LuL3, is now given a p-value of 0.087 which is an improvement from the regression with solemn lock-up length in days. However, at a significance level of 5%, which this study applies, the second hypothesis must still be refuted.

4.2.2 Regressions for BHAR

The regressions and subsequent hypotheses regarding the implications of a lock-up agreement on the buy-and-hold abnormal return are now be presented.

4.2.2.1 Regression with Lock-Up Dummy

For this regression the variable LuD gives the value of 0 to a firm without a lock-up agreement and 1 if it exists; this tests the third hypothesis.

Table 8. Regression results for BHAR with lock-up dummy

Independent variable	P-Value	Coefficient
Regression	0.045	-
LuD	0.701	-0.075
IR	0.024	0.999
AGE	0.446	-0.054
SIZE	0.054	0.073
VC/PE	0.450	0.107
Constant	**0.577**	**-0.169**
N	**225**	**-**
R Square	**0.050**	**-**
Jarque-Bera	**89.96**	-

The regression for BHAR with a lock-up dummy is given a p-value of 0.045 and is significant at a 5% level. In regards to the regressions for initial return, the coefficient of determination has now decreased to 0.05, indicating that the explanatory variables explain 5% of the long-run abnormal return. The explanatory variables initial return is significant with a p-value below 5%, with the variable size edging just above. The variable of interest, LuD, receives a p-value of 0.701, and is therefore not significant. Hypothesis $H_0$3 can not be refuted.

4.2.2.2 Regression with Lock-Up Length

For this regression, the variable of interest is LuL, which is the length of a lock-up agreement in terms of days. This tests the fourth hypothesis. As per the regressions for initial return, another regression with the length of lock-up agreement divided into three classes is made.

Table 9. Regression results for BHAR with lock-up length in days

Independent variable	P-Value	Coefficient
Regression	0.046	-
LuL	0.740	0.002
IR	0.030	0.967
AGE	0.462	-0.052
SIZE	0.066	0.069
VC/PE	0.483	0.099
Constant	**0.412**	**-0.250**
N	**225**	**-**
R Square	**0.050**	**-**
Jarque-Bera	**91.31**	-

The regression is given a p-value of 0.046 and is significant at a 5% level. As per the previous regression, the coefficient of determination remains at 0.05, indicating that the explanatory variables explain 5% of the long-run abnormal return. Once again the only significant explanatory variable is initial return with a p-value of 0.030. Lock-up length has a p-value of 0.740 and is thus not statistically significant. Hypothesis $H_0$4 can not be refuted.

Table 10. Regression results for BHAR with lock-up length divided into three classes.

Independent variable	P-Value	Coefficient
Regression	0.047	-
LuL3	0.840	-0.021
IR	0.024	0.995
AGE	0.438	0.055
SIZE	0.065	0.069
VC/PE	0.456	0.106
Constant	**0.555**	**-0.182**
N	**225**	**-**
R Square	**0.050**	**-**
Jarque-Bera	**90.10**	-

The regression for BHAR with lock-up length divided into three classes is given a p-value of 0.047 and is significant at a 5% level. The coefficient of determination remains at 0.050 indicating that explanatory variables explain 5% of the long-run abnormal return. Initial return is still significant with a p-value below 5%. As the variable of interest, LuL3, remains at a high p-value (0.840). Hypothesis $H_0$4 can not be refuted.

4.3 Summary of hypotheses

Table 11. Summary of hypothesis

	Hypothesis	Refuted
$H_0 1$	The existence of a lock-up agreement does not affect the initial return	
$H_1 1$	The existence of a lock-up agreement does affect the initial return	X
$H_0 2$	The length of a lock-up agreement does not affect the initial return	
$H_1 2$	The length of a lock-up agreement does affect the initial return	X
$H_0 3$	The existence of a lock-up agreement does not affect the long-run performance	
$H_1 3$	The existence of a lock-up agreement does affect the long-run performance	X
$H_0 4$	The length of a lock-up agreement does not affect the long-run performance	
$H_1 4$	The length of a lock-up agreement does affect the long-run performance	X

4.4 Regression Diagnostics

In the following chapter results for the statistical tests presented in chapter 3.6 Model Validation is presented. Tests for multicollinearity have already been presented in chapter 4.1.3 Correlation of Variables, and VIF-test for all regression can be found in Appendix 3.

4.4.1 White's test

As previously mentioned in the chapter 3.9.6 Presence of heteroscedasticity, all regression models suffered from heteroscedasticity while conducting the White's Test (Appendix 3) and the null hypothesis of homoscedasticity was rejected. In accordance with Fabozzi and Francis (1980 cited in Brooks 2019, p.189), previous occurrences of heteroscedasticity have been noted while studying financial data such as stock returns. The Huber-White heteroscedasticity-robust standard errors were implemented for all regression in order for the study to be able to derive inferences of the results.

4.4.2 Ramsey RESET test

In order to examine whether a linear regression was the most appropriate model for the regressions, a Ramsey RESET test was conducted. As can be seen in Appendix 3, the test results for all regression surpassed the critical level of 5%. Hence, the null hypothesis which implies that a linear regression is the best approximation for the model can be refuted.

4.4.3 Jarque-Bera Test

As previously described in chapter 3.9.5 Managing Extreme Outliers, adjustments for four extreme outliers in the variables size and lock-up length was conducted to ensure normally distributed errors. Consequently, the Jarque-Bera test for both variables decreased significantly which can be seen in Appendix 1. As per the previously mentioned chapter, there were early indications in the regressions that both dependent variables, initial return and BHAR, suffered from extreme outliers. As a logarithmic transformation could not be conducted due to negative values, the authors decided to winsorize both variables at a 5%-level. Eventually, these adjustments resulted in sufficient improvements for the regressions concerning initial return, where the regressions with lock-up length refute the null hypothesis and the regression with a lock-up dummy receiving a p-value of 0.0417. Despite adjustments for the BHAR model, the regressions did not refute the null hypothesis and derived Jarque-Bera scores of 89-90. However, for a sufficiently large sample size, as the data material for this study, such violations of the normality assumption can be considered negligible (Brooks 2019, p. 210).

5.0 Analysis and Discussion of Results

The following chapter aims to answer the research question of this paper. Results from the regressions are analyzed, discussed and interpreted according to previous research.

5.1 Analysis and Discussion of Descriptive Material

After adjusting for extreme outliers and thereby removing four firms from each of the two samples, the final sample sizes amount to 326 firms for Initial Return and 225 for BHAR.

As per Table 2, which showcased the data material before and after winsorizing, the dependent variable initial return initially indicated that companies with no lock-up agreement suffered substantially at IPOs; as these firms had a mean negative initial return of -2,46% compared to 4,55% positive return for their counterparts. It was also significantly proven that underpricing existed during the years of 2010-2021 for the Nordic market; as the t-test refuted the null hypothesis at a 1% significance level (Appendix 2), thereby contradicting the efficient market hypothesis. The early periods of the time frame also had poorer stock returns and a limited number of IPOs, subsequently suffering from the scarce amount of capital being allocated in the market after the financial crisis 2007-2008. In addition, a majority of firms without a lock-up agreement were situated at the start of the decade (Figure 3), which also contained the largest negative outliers in terms of negative initial returns for the subsample. However, in contrast to the early indications, the following regressions did not indicate that the lock-up agreement nor its length had a significant impact on the subsequent initial return.

Continuing on the trend of increasing utilization of lock-ups, as shown in Figure 3, the incorporation of lock-up agreements have increased significantly and are present in almost every IPO in recent years. For the year of 2021, which contained 22,7% of all IPOs in the data material, no firm without a lock-up agreement was present. Thus, it indicates that the inclusion of lock-up agreements have become common practice despite being voluntary on the Nordic market.

A deviation from the norm of 180 days in terms of lock-up length could also be noted. Despite adjustments for extreme outliers, the companies in the Nordic countries had an average lock-up period of 236 days (Table 3). This would contradict previous research from Goergen et al. (2006), Chen and Mohan (2001) as well as Rashid et al. (2014), who investigated markets with mandatory as well as voluntary lock-up agreements. It could be argued that the inclusion of companies from the First North list, which includes smaller firms than the exchanges investigated by the authors, might have influenced the deviation. If that were to be the case, the increased length would, in accordance with Brav and Gompers (2003), indicate that smaller firms are perceived as riskier investment, thus implying greater probability of moral hazard. To mitigate this risk and being able to attract new investors, a longer lock-up period is implemented. This would be in accordance with Levis and Vismara (2014), as the lock-up agreement aligns the interest of firm insiders with the expectations of investors. On the other hand, the deviation from the norm could also indicate that firms are aware that lock-ups mitigate moral-hazard issues, and are thus implemented purposefully to relieve potential agency costs (Brav & Gompers, 2003; Gao & Siddiqi, 2012).

Furthermore, the increased utilization of lock-ups could be explained by investors interpreting lock-up agreements as a positive signal, which firms and advisors recognize and thereby choose to integrate it as part of the IPO to make the offering more attractive. This supports the signaling theory where a lock-up agreement and longer period is perceived as a positive signal of firm quality (Brau et al., 2005; Ahmad, 2015). This notion, although not significantly proven, is supported by the fact that IPOs including a lock-up agreement displayed a higher average underpricing, as can be seen in Table 2.

As the signaling theory argues that the lock-up agreement showcases firm quality, lock-ups should be correlated with higher initial return. However, since neither of the variables concerning the lock-up agreement were statistically significant, no correlation of lock-up, its length and underpricing was found. Thus, it can not be explicitly stated how the Nordic investors interpret lock-up agreements in regards to initial return, and thereby whether signaling or agency can motivate the long periods of lock-up.

Moreover, the study also conducted a two-tailed test and concluded that during the period of 2010-2018, the IPOs on the Nordic market derived abnormal positive returns when benchmarked against country specific all-share gross index. Although previous research has proven that such abnormal returns exists on the Nordic market (Loughran et al., 1994; Abrahamson et al., 2011; Dreher & Hoppa, 2013), the findings of this study are also contradictory to previous research which strongly suggest that IPOs suffer from long-run negative abnormal returns (Brav & Gompers, 1997; Bergström et al., 2006; Ritter, 1991; Levis, 1993).

Moreover, previous finding for abnormal return and lock-ups mainly examines price declines around lock-up expiration (Chen & Mohan, 2001; Field & Hanka, 2001; Brav & Gompers, 2003; Bradley et al., 2001; Brau et al., 2005). In addition, the body of research on lock-ups and long-run performance is not as extensive.

However, the scarce research could provide some useful indications to examine whether this abnormal return would be considered an anomaly or not. Gao and Siddiqi (2012) investigated the US market with voluntary lock-ups, and concluded that longer lock-up periods are significantly negatively correlated to long-run performance. On the contrary, Ahmad (2015) examines the correlation between lock-up length and and three year performance on the UK main list, concluding that IPOs with longer lock-ups does translate into greater long-run performance. Chalmers et al. (2017) examines the Australian market, where mandatory and voluntary lock-up co-exists. As lock-up is implemented by law if firms do not suffice profits or asset test, it differs from the Nordic Markets where all companies have to provide documented earnings capacity or enough working capital for the following 12 months post listing (Bird & Bird, 2021). Hence, the mandatory lock-up removes the possibility of smaller firms being able to mitigate moral hazard issues, which smaller firm's on the voluntary Nordic markets are able to do. However, since the implementation of lock-up was forced upon the firms, Chalmers et al. (2017) concluded that the existence of a lock-up agreement and its design in terms of length and clauses was not the determining factor for long-run underperformance. Instead Chalmers et al. (2017) highlighted that good corporate governance was significantly associated with positive long-run abnormal returns, and thus associated with firm value. The authors subsequently define chairman and CEO non-duality, independent board members and majority of board members not being part of the

senior management as good corporate governance. These are attributes is part of Nasdaq's general guidelines for listing (Bird & Bird, 2021), and is highlighted by Lekvall (2014, p.28) as vital components for the Nordic corporate governance model being prominent in regards to other markets in the world; indicating that the findings of Chalmers et al. (2017), where corporate governance translates to firm value, could be seen as the underlying explanation for the abnormal positive returns existing on the Nordic market.

In conclusion, the above average days of lock-up period in the Nordic markets and subsequent positive abnormal return contradict the majority of previous research. As no significant results could be proven for potential implications of a lock-up agreement and its design, no significant results can be presented that decisively supports previous empirical findings. Instead, the results have to be relayed back to Fama's efficient market hypothesis (1970), in which all readily available information about a firm is already incorporated into the stock price. However, since previous studies were conducted on markets with variations of lock-up regulations, corporate governance, ownership structure and inherently national laws, the non - significant results from the regressions could also imply that the research questions in fact have been answered; which was to investigate the implications of lock-up agreements on initial return and long-run performance. For the Nordic markets it seems to have no inherent effect. Rather the characteristics (Chalmers et al., 2017) of the Nordic firms, which differ from previous research on the subject of lock-ups, seems to be the underlying determinant factor for a firm's success at IPO and subsequent performance.

5.2 Insignificant Results

The previous research regarding the implications of lock-up agreements examines different financial markets where a lock-up agreement can be voluntary, mandatory or even a combination of both (Chalmers et al., 2017; Rashid et al, 2014; Hoque, 2014). In addition, the theories that are set out to interpret lock-up agreements are rather ambiguous and contradictory as a longer period of lock-up can signal firm quality but also risks of moral hazard (Brav & Gompers, 2003; Brau et al., 2005; Gao & Siddiqi, 2012). Thus, as lock-up agreements are viewed differently by investors if enforced by law or instead voluntarily implemented by firms (Chalmers et al., 2017), it is evident that theories and previous findings on lock-up implication must be examined and analyzed with caution as it varies depending on the subsequent market and its characteristics.

This paper concludes that underpricing exists in the Nordic countries (Appendix 2), but can not find the same significant explanations as in other markets. The authors present a positive long-run abnormal return which contradicts the thesis of long-run underperformance, but aligns with the previously established positive long-term return on the Nordic market (Loughran et al., 1994; Abrahamson et al., 2011). Furthermore, all except one variable used in both of the regression, AGE for underpricing and IR for long-run performance, prove to be insignificant in explaining the findings. Thus, it can be concluded that many of the factors that have been established to impact both long-run performance and initial returns in other markets can not be statistically reliable to have an effect on the Nordic markets. Hence, the ambiguity of this paper's result and what might have been the underlying reason is further discussed.

The variable of interest, LuL3, was given a p-value of 0.087 which therefore is statistically insignificant on a significance level of 5%. However on a significance level of 10%, which would demand more caution for analyzing its influence, it could be seen as having a positive correlation with higher initial returns. This would then align with the research of Rashid et al. (2014), as the authors use a variable which divides the lock-up length into three classes to distinguish firms that have a longer lock-up period than the necessary mean; and observe that those firms are correlated with higher initial returns.

However, the findings of this paper and Rashid et al. (2014) are opposite to the results presented by Hoque (2014). An explanatory factor to the difference in findings is the markets studied, Rashid et al. (2014) examines the Malaysian market where lock-up agreements are mandatory contrary to Hoque (2014) who examines the UK where it is optional. Although lock-up agreements are optional in the Nordic countries, it can be argued that it is more or less expected and thereby mandatory. This is because the Nordic market is characterized by a high level of shareholder protection and regulations that aim to ensure firm quality (La Porta et al., 1997; Lekvall 2014, p.17). This notion is supported by the increase in the usage of lock-up agreements and its presence for all IPOs in the year of 2021. Thus, the Nordic market has created a unique environment where lock-up agreements are not mandatory by law, but rather a result of investors' expectations, and a premise that probabilities of moral hazard among insiders is limited due to strong traditions of good corporate governance (Lekvall 2014, p.99). Subsequently, lock-up agreements within the Nordics may not necessarily have the same implication as suggested by previous research.

With the above-mentioned reasoning regarding lock-up agreements in the Nordics, it can be argued that the agency theory ought not to be the explanation of lock-up agreements' purpose, as it points to a probability of moral hazard issues being the reason for lock-up agreement (Gao & Siddiqi, 2012; Brav & Gompers, 2003). Shareholder protection is fundamentally incorporated into the Nordic financial markets, thus investors do not fear being exploited by insiders to the same degree as investors do in countries where shareholder protection is less apparent. Therefore, the rejection of the agency theory is motivated by the rather paradoxical question;

> - Why would firms voluntarily incorporate longer lock-up agreements, and suffer the subsequent costs, to mitigate the probability of moral hazard if it is a non-issue nor required by investors?

Instead, it is more likely that longer lock-up agreements serve as a device to signal firm quality, as suggested by the signaling theory (Allen & Faulhaber, 1989; Leland & Pyle, 1977; Corteau et al., 1995; Brau et al., 2005). In addition, the suggestion of signaling theory as most appropriate to explain lock-up agreements on markets where they are “mandatory” is supported by the only

previous research regarding lock-up agreements on a market on which they are mandatory (Rashid et al. (2014). The authors suggest that firms can deviate from the mandatory lock-up length to signal higher firm quality, congruent with the findings of this paper.

It must also be noted that several variables in the regression had opposite effects in relation to the prior research, which could have led to the study's insignificant results. Even though the concentration of IPOs were highly clustered for two periods of time (Figure 3), the variable for cyclicality, NOI, did not appear significant for the regressions concerning initial returns; receiving a p-value between 0.22-0.33, and thus contradicting Ritter's (1998) window of opportunity hypothesis. However, the initial returns for the time frame 2010-2021 was 4,9% (Table 2) on average prior to winsorizing the data. This is significantly lower than the first day returns noted in the Nordics by Dreher and Hoppa (2013) during 1988-2005, which spanned in the interval of 10,1-17,4%. Indicating that the decreased initial returns could be caused by further enforcement of law and the improved accessibility to accounting information; which Dreher and Hoppa (2013) deemed as two factors mitigating the underpricing and would further be in line with Lekvall (2014) notion that the Nordic markets should be seen as a global model for all corporations. Lastly, this would also be in accordance with the notion that environments in which information is costly, it would require a higher amount of underpricing to attract investors (Beatty & Ritter, 1986).

Furthermore, age was the only statistically significant variable for the initial return, and had a positive coefficient. This contradicts Muscarella and Vetsuypens (1989) findings in which older firms can provide a longer history of earnings, and therefore indicates lower operational risk, suggesting lower underpricing. However, this could also imply that previous findings of established and older firms outperforming younger smaller firms are more widespread (Levis, 1993; Ritter, 1991). Hence, firm age could be acting as a signaling device for higher quality and attracting more investors (Brau et al., 2005). This could be further supported by the results as the variable for initial returns had a significantly proven impact on the long-run performance; as well as size receiving constantly low p-values just above the 5% threshold. Which in that case would be in line with previous research suggesting that higher initial returns and firm size has a positive relation to the long-run performance (Bergström et al., 2006; Alvarez & Gonzalez, 2005; Lee et

al., 1996; Belghitar and Dixon, 2012; Levis, 2003). It would however contradict Miller's (1977) divergence of opinions hypothesis, in which initial return has a negative impact on long-run performance. Considering the amount of research on the conundrums on the financial markets, and the many variables used by prior researchers to explain initial returns and long-run performance, this study's results and significant explanatory variables could indicate that it should be interpreted with caution, which is highlighted in chapter 5.4.

5.3 Discussion of Prospectuses and the Design of Lock-up Agreements

As most theories regarding lock-up agreements focus on what is conveyed in prospectuses, whether a lock-up agreement is present and its length, a factor that is yet to be discussed is how lock-up agreements are structured and communicated to investors. The authors observed that many of the lock-up agreements in this study contain clauses that enable certain insiders to depart from the agreement and sell their shares before the intended lock-up period is over.

The information regarding the quantity of shares and which insiders that are included in these clauses are oftentimes not stated explicitly in all prospectus, which may only add to the already existing information asymmetry surrounding IPOs. Consequently, investors may perceive the lock-up agreements as puzzling and less trustworthy, therefore not considering it when evaluating IPOs. This would be in accordance with Grossman et al., (1980) arguments that gathering all relevant information regarding a stock is too costly and exhaustive, and therefore not reflected in the price. On that account, the ambiguity of lock-up agreements offers a possible explanation to this paper's findings, in which lock-up agreements do not have any significant effect on neither initial or long-run return.

As lock-up agreements are suggested to either signal firm quality or showcase commitment of the insider, if clauses are present in the agreement, it becomes increasingly more difficult for investors to interpret the signals of the agreement and the true intentions of insiders. From a standpoint of the agency theory (Brav & Gompers, 2003; Gao & Siddiqi, 2012), a clause could be interpreted as a signal that a probability of moral hazard is present since insiders are not willing to impose a lock-up agreement unless they can deviate from it. From the point of view of the signaling theory the inclusion of a clause disturbs the idea that longer lock-up agreements

signal higher firm quality. Thus, when firms structure the agreement so that it allows a departure from the commitments stated in the prospectus, it undermines the signals that the agreement is intended to have (Leland & Pyle, 1977; Corteau et al., 1995; Brav & Gompers, 2003; Brau et al., 2005).

Despite the aforementioned ambiguity regarding prospectuses of Nordic firms which highlights the relevant critique, they generally include thorough information concerning major shareholders and potential associations to other insiders of the firm. Furthermore, an issuing firm is required to be examined by an independent auditor, or present earnings capability as part of the process to be listed on Nasdaq OMX Nordic, Nasdaq First North, Oslobørs and Oslo Axess (Nasdaq, 2021a; Oslobørs, 2021a). This is aligned with the Nordic corporate governance model presented by Lekvall (2014, p.70), as prospectuses are more transparent with the purpose to give investors an accurate representation of the company. Furthermore, Chalmers et al. (2017) states that good corporate governance includes a non-executive chairperson of the board, a majority of independent board members, a CEO on the board and lastly an audit committee responsible for selecting an auditor. All of these attributes are often fulfilled and comprehensively communicated to investors in the prospectuses. As prospectuses are readily available for all investors, it decreases the information asymmetry prior to the IPO. Thereby, the relatively low level of underpricing in the Nordics compared to other markets, as suggested by this study (Table 2), could be explained by a reduced information gap due to prospectuses presenting important and trustworthy information. Subsequently, investors are more likely to invest and there is a lesser need for underpricing IPOs.

Furthermore, the consequences that might occur when a firm does not commit as signaled by the lock-up agreement is rarely mentioned in prior research. However, one of the outliers in terms of lock-up days, EQT, provides an example on the possible reactions from when this occurs. The firm deviated from the norm of fulfilling the lock-up agreement when they diverged from the lock-up agreement to sell a significant amount of current share capital, this prior to the first lock-up expiration date. Simultaneously, EQT imposed a longer lock-up period for the remaining shares (EQT Group, 2021a). As a consequence of this occurrence, the Swedish Regulatory Authority opened an investigation regarding market abuse due to failure to disclose insider

information on time (Finansinspektionen, 2021). Consequently, the stock price fell by 6% after the announcement of the opened investigation, indicating that the original signaling of firm quality in terms of longer lock-up period had been severely damaged. These repremendents could further be explained by Brau et al. (2005), as they highlighted that the signaling of a lock-up agreement primarily forces the insiders to “put their money where their mouths are, and keep it there”, something that EQT did not do. In a later press release, EQT stated that they, in their own opinion, had done everything in accordance with European market practice (EQT Group 2021b); which further highlights the ambiguity of lock-ups, its utilization and interpretation from both firm and investor perspectives.

As EQT swiftly imposed a longer lock-up period to regain the trust of investors after announcing the premature sales of shares (EQT Group 2021a), it aligns with the findings of Brav and Gompers (2003), that longer lock-up periods serve as a way to address moral hazard issues. Considering the negative attention EQT received regarding the matter, it also supports Nenova’s (2003) findings that the incentive for controlling owners to misuse their power at other shareholders' expense is almost non-existent in the Nordics. Lastly, this further strengthens Lekvalls (2014) corporate governance model, as these deviations do not belong to the norm in the Nordic markets, hence the disapproval from investors in terms of price reaction and investigation from financial authorities.

5.4 Cautionary of Inferences

As previously mentioned, it must be noted that several variables in the regression had opposite effects in relation to the prior research. The regressions also had to be adjusted with robust standard errors as there was presence of heteroscedasticity. Moreover, the residuals did not adhere to the normal distribution, which is however acceptable for a sufficiently large sample (Brooks, 2019, p.157). Although a leptokurtic distribution, which implies fatter tails, is not uncommon for research in the financial field (Fabozzi et al., 2012), it increases the probability of extreme outliers that do not adhere to the normal distribution. The upper limit for kurtosis is at 3, in which extreme outliers can cause extremely positive or negative results. As the regressions after winsorizing still had kurtosis from 2.8-4.4, this would imply that the results might have been affected. However, this could also be seen as a positive aspect, as IPOs with deviating performance had the opportunity to influence the results. Since an investor can not predict the performance of an IPO beforehand, a total exclusion of outliers would therefore not depict an accurate view of the Nordic IPO market.

It should once again also be highlighted that the authors had to manually extract data, and made broader generalizations based on previous research (Rashid et al., 2014) when deciding a unanimous lock-up period for all firms. This could have led to loss of information and might have had an effect on the results. Lastly, in accordance with Schultz (2003) and Zulaki et al. (2007), the BHAR model has earlier been proven to provide ambiguous results depending on the methodology and benchmark. Although the abnormal positive return has been examined in the Nordics previously (Loughran et al., 1994), using an alternative method could have culminated in contradictory results.

6.0 Conclusion

In the last chapter of this study, the results and drawn inferences are summarized. The discussion mainly focuses on previous findings, but also includes the perspective of the authors. Suggestions for future research is also be discussed.

The purpose of this paper was to examine the implications of lock-up agreements on initial returns and long-run performance of Nordic initial public offerings. For neither the existence of lock-up agreements nor its length, no statistically significant effect could be observed during the period of 2010-2018 for long-run performance and 2010-2021 for the initial return; even though the firms with no lock-up on average had lower initial returns and long-run returns. Hence, this study contradicts previous research which indicated that lock-up agreements affect both the initial return and long-run performance in terms of mitigating agency costs and signaling firm quality (Brav & Gompers, 2003; Brau et al. 2005; Gao & Siddiqi, 2012; Ahmad, 2015). The findings of this study instead suggests that the efficient market hypothesis holds true in regards to the implications of a lock-up agreement, as the information regarding the agreement is publicly available in the prospectus, and therefore ought to be incorporated into the price (Fama, 1970).

Throughout this study it became apparent that implications of lock-up agreements differ remarkably depending on the research subject. In support of this notion, the Nordic market differentiates itself from prior examined markets in terms of regulations, shareholder protection and stands out as a good model for corporate governance (La Porta, 1997; Lekvall 2014, p.13). Imperatively, this would be the underlying reason to understand why no clear support of prior research was provided in the results. Instead of the existence of a lock-up agreement and its subsequent design, it is rather the incremental corporate governance and market specific regulations that decides the implications of a lock-up (Chalmers et al., 2017). Hence, this would ultimately imply that the remaining possibility for signaling firm quality that a lock-up agreement would provide (Brau et al., 2005), is undermined by the already existing general consensus of firm quality and shareholder protection in the Nordics.

In conclusion, the presence of a lock-up agreement and its length can not be used by individual investors to predict the value of an individual IPO and its future returns. However, the inferences drawn from the insignificant results may be of interest for financial academics, as it provides a nuanced view for the implications of lock-up agreement and the characteristics that set apart the Nordic market from previous research.

6.1 Future research

The empirical research regarding lock-up agreements in the Nordics is limited, which opens up for opportunities to broaden the scope of empirical research.

Increasingly more firms in the Nordic market voluntarily decide to incorporate a lock-up agreement prior to an IPO, in which the amount included in each clause is not always stated explicitly. Thus, the comparison of performance at listing and long-run returns between opaque and transparent IPOs could further extend the empirical research on the subject. A dummy variable could be included in the regression that separates the firms apart depending on the information provided in the prospectus; and perhaps there could be an association between the decreased information asymmetry provided in the prospectus, and the frequency that firm's opt to deviate from its clauses.

Lastly, it would be of interest to do an event-study that compares the initial returns and long-run performance before and after the increased utilization of lock-up agreements in the Nordic market. As previously mentioned by the authors however, the prospectus of older IPOs were often harder to find or non-existent. But if it would be available through another database than FactSet, it might be able to clearly define if the lock-up agreements ever had any implication on the Nordic market at all.

References

Abrahamson, M., Ridder, A., & Råsbrant, J. (2011). Information Asymmetries among European Investors: Evidence from Swedish IPOs. *Swedish Network for European Research*, no.1, pp. 1-16

Ahmad, W. (2015). The Impact of Lockup Period on Survival, Long-run Performance and Earnings Management of IPOs in the UK. *University of Birmingham*.

Ahmad-Zaluki, N. A., Campbell, K., & Goodacre, A. (2007). The long run share price performance of Malaysian initial public offerings (IPOs). *Journal of Business Finance & Accounting*, vol. 34, no. 12, pp. 78-110

Allen, F., & Faulhaber, G. (1989). Signalling by underpricing in the IPO market. *Journal of Financial Economics*, vol. 23, no.2, pp. 303-323

Álvarez, S., & González, V. (2005). Signalling and the long-run performance of Spanish initial public offerings (IPOs). *Journal of Business Finance & Accounting*, vol 32, no. 1–2, pp. 325–350

Arthurs, J., Busenitz, L., Hoskisson, E. & Johnson, R. (2009) Signaling and initial public offerings: The use and impact of the lockup period. *Journal of Business Venturing*, vol. 24, no. 4, pp. 360-372

Banz, R. (1981). The relationship between return and market value of common stocks, *Journal of Financial Economics,* vol 9, pp. 3-18

Barber, F. & Goold, M. (2007). The Strategic Secret of Private Equity. *Harvard Business Review*. https://hbr.org/2007/09/the-strategic-secret-of-private-equity [Accessed 2021-12-04]

Barber, B. & Lyon, J. (1997). Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. *Journal of Financial Economics*, vol 43, no.3, pp. 341-372

Baron, P. (1982). A Model of the Demand for Investment Banking Advising and Distribution Services for New Issues. *The Journal of Finance*, vol. 37, no.4, pp. 955-976

Beatty, R. & Ritter, J. (1986). Investment Banking, Reputation, and the Underpricing of Initial Public Offerings. *Journal of Financial Economics*, vol. 15, no 1-2, pp. 213-232

Belghitar, Y. & Dixon, R. (2012). Do venture capitalists reduce underpricing and underperformance of IPOs? *Applied Financial Economics*, vol. 22, no.1, pp. 33–44

Bergström, C., Nilsson, D. & Whalberg, M. (2006). Underpricing and Long-Run Performance Patterns of European Private-Equity-Backed and Non-Private-Equity-Backed IPOs. *The Journal of Private Equity,* vol. 9, no.4, pp. 16-47

Bird & Bird. (2021). Comparisons of the Eligibility Criteria and Continuing Obligations for Listings Requirements. Available at: https://www.twobirds.com/~/media/pdfs/comparisons-of-the-eligibility-criteria-and-continuing-obligations-for-listing-requirements-lse--eur.pdf?la=en&hash=F6D788DB2BFF76F53F28A00D396535E2E6AFB6F5 [Accessed 2021-12-03]

Bird, R. & Yeung, D. (2010). Institutionalownership and IPO performance: Australian evidence. Working paper series.

Bradley, D. & Jordan, I. & H. Yi, (2001). Venture Capital and IPO Lockup Expiration: An Empirical Analysis. *Journal of Financial Research*, vol 24, no.4, pp. 465-493

Brau, J., Lambson, V. & McQueen, G. (2005). Lockups Revisited. *Journal of Financial and Quantitative Analysis*, vol 40, no.3, pp. 519-530

Brav, A. & Gompers, P. (2003). The Role of Lockups in Initial Public Offerings. *Review of Financial Studies*, vol 16, pp. 1-29

Brav, A. & Gompers, P. (1997). Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies. *The Journal of Finance*, vol. 52, no.5, pp. 1791-1821

Brooks, C. (2019). Introductory Econometrics for Finance, 4th Edition. Cambridge University Press.

Bryman, A. & Bell, E. (2017). Företagsekonomiska forskningsmetoder, 3rd edition. Stockholm: Liber.

Carter, R., Dark, F., & Singh, A. (1998). Underwriter Reputation, Initial Returns, and the Long-Run Performance of IPO Stock. *Journal of Finance*, vol. 53, no.1, pp. 285-311

Carter, R. & Manaster, S. (1990). Initial Public Offerings and Underwriter Reputation. *The*

Journal of Finance, vol 45, no.4, pp.1045-1067

Chalmers, K & Fang, V & Haman, J (2017). IPO lockups, long run returns, and growth opportunities. *Journal of International Financial Markets, Institutions and Money*, vol. 49, pp. 184-199

Chahine, S. (2008). Underpricing Versus Gross Spread: New Evidence on the Effect of Sold Shares at the Time of the IPOs. *Journal of Multinational Financial Management*, vol. 18(2), pp.180-196

Chao, C & Huang, C & Liao, T. (2010) The joint decision to signal through IPO underpricing and lockup. *Applied Economic Letters*, vol 17, pp.955-961

Courteau, L (1995). Under-Diversification and Retention Commitment in IPOs. *Journal of Financial and Quantitative Analysis*, vol 30, pp.487-517

Da Silva Rosa, R, Velayuthen, G & Walter, T. (2003). The sharemarket performance of Australian venture capital-backed and non-venture capital-backed IPOs, *Pacific-Basin Finance Journal*, vol 11, no.2, pp.197–218

Dengjun, Z. (2015). Interdependence between Nordic stock markets and financial cooperation. *Review of Accounting and Finance,* vol 14, no.2, pp.172-188

Espenlaub, S., Goergen, M., & Khurshed, A. (2001). IPO lock-in agreements in the UK. *Journal of Business Finance & Accounting,* vol 28, no. 9-10, pp. 1235-1278

EQT Group.(2021a). EQT AB announces share lock-up revision to strengthen long-term alignment - share sale launched by Partners. Available at: https://eqtgroup.com/news/2021/eqt-ab-announces-share-lock-up-revision-to-strengthen-long-term-alignment-share-sale-launched-by-partners [Accessed 2022-01-08]

EQT Group.(2021). Comments on the announcement of EQT's lock-up revision. Available at: https://eqtgroup.com/news/2021/comments-on-the-announcement-of-eqt-s-lock-up-revision [Accessed 2022-01-08]

Fabozzi, F., Kim, Y., Rachev., & Scherer., M. (2012). Approximation of skewed and leptokurtic return distributions. *Applied Financial Economics,* vol 22, no.16, pp. 1305-1316

Factset (2020) Why the Nordics continued to rule European IPOs in 2020. Available at:

https://insight.factset.com/why-the-nordics-continued-to-rule-european-ipos-in-2020 [Accessed 2022-01-05]

Fama, E. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, vol. 25, no.2, pp. 383-417

Flagg, D. & Margetis, S. (2008). What Characteristics of Underwriters Influence Underpricing? *The Journal of Private Equity*, vol 11, no.2, pp.49-59

Field, L. & Hanka, G. (2001). The Expiration of IPO Share Lockups. *The Journal of Finance*, vol 56, no.2, pp. 471-500

Financial Times (2021). Sweden's EQT hit by market abuse probe. Available at: https://www.ft.com/content/9e1a53f2-7772-45b0-a4eb-f513f52111ae [Accessed 2022-01-08]

Finansinspektionen (2021). FI öppnar en utredning mot EQT AB. Available at: https://www.fi.se/sv/publicerat/nyheter/2021/fi-oppnar-en-utredning-mot-eqt-ab/ [Accessed 2022-01-08]

Gao, F. & Siddiqi, M-A. (2012). The Rationale for IPO Lockup Agreements: Agency or Signaling? *Review of Pacific Basin Financial Markets and Policies*, vol. 15, no.3, pp. 1-18

Gao, S. & Jinzhao, L. & Kam, C. (2017). Does the removal of the IPO lockup matter in IPO pricing? *Finance Research Letters*, pp. 246-252

Goergen, M., Renneboog, L. & Khursed, A. (2006). Explaining The Diversity in Shareholder Lockup Agreements. *Journal of Financial Intermediation*, vol 15, no.2 pp. 254-380

Grossman, S. & Stigilitz, J. (1980). On the Impossibility of Informationally Efficient Markets. *The American Economic Review,* vol 70, no.3, pp. 393-408

Hakim, T., Lypny, G., Bharbra, H. (2012). IPO lockup expiration in the Middle East and North Africa. Journal of Multinational Financial Management, vol 22, no.5, pp. 252-262

Houge, T., Loughran, T., & Suchanek, Y. (2001). Divergence of Opinion, uncertainty, and the Quality of Initial Public Offerings. *Financial Management*, vol. 30, no.4, pp. 5-23

Hoppa, C. & Dreherm A. (2013). Do Differences in Institutional and Legal Environments

Explain Cross-Country Variations in IPO Underpricing?. *Applied Economics*, vol. 45, no.4, pp. 435-454.

Hoque, H. (2014). Role of Asymmetric Information and Moral Hazard on IPO Underpricing and Lockup. *Journal of International Financial Markets, Institutions and Money,* vol. 30, pp. 81-105

Hoque, H. (2011). The Choice and Role of Lockups in IPOs: Evidence from Heterogeneous Lockup Agreement. *Financial Markets, Institutions and Instruments*, vol 20, no.5, pp. 191-220

Ibbotson, R. (1975). Price Performance of Common Stock New Issues. *Journal of Financial Economics* vol. 2, no.3, pp. 235-272

Ibbotson, R. & Jaffe, J. (1975). "Hot Issue" Markets. *The Journal of Finance*, vol. 30, no.4, pp. 1027-1042

James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). An Introduction to Statistical Learning. Springer: New York.

Jen, F & Ogden, J & O'Connor, P (2003). Advanced Corporate Finance. Pearson Education LTD.

Kuosmanen, P., Nabulsi, N. & Vataja, J. (2005). Financial Variables and Economic Activity in the Nordic Countries. *International Review of Economics & Finance*, vol 37, pp. 368-379

La Porta, R., Lopez-De-Silanes, F. & Vishny, R. (1997) Legal Determinants of External Finance. *The Journal of Finance,* vol 52, pp. 1131-1150

Lee, PJ., Taylor, SL., & Walter, TS, (1996). Australian IPO pricing in the short and long run. *Journal of Banking & Finance*, vol. 20, no.7, pp. 1189–1210

Lekvall, P. (2014). The Nordic Corporate Governance Model, 1st edition. Stockholm: SNS Förlag

Leland, H. & Pyle, D. (1977) Informational Asymmetries, Financial Structure, and Financial Intermediation. *The Journal of Finance*, vol 32, no.2, pp. 371-387

Leone, A., Rock, S., Willenborg, M. (2006) Disclosure of Intended Use of Proceeds and Underpricing in Initial Public Offerings. *Journal of Accounting Research*, vol 45, pp. 53-111.

Levis , M. & Vismara, S. (2014). Handbook of Research of IPOs. Cheltenham: Edward

Levis, M. (1993). The Long-Run Performance of Initial Public Offerings: The UK Experience 1980-1988. *Financial Management*, vol. 22, no.1, pp. 28-41

Loughran, T. & Ritter, J. (2002). Why Don't Issuers Get Upset about Leaving Money on the Table in IPOs? *The Review of Financial Studies*, vol. 15, no.2, pp. 413-443

Loughran, T., Ritter, J. (2004). Why Has IPO Underpricing Changed Over Time? *Financial Management*, vol 33, no.3, pp. 5-37

Loughran, T., Ritter, J., & Rydqvist, K. (1994). *Pacific-Basin Finance Journal,* vol. 2, no.2-3, pp. 165-199

Megginson, W. & Weiss, K. (1991). Venture Capitalist Certification in Initial Public Offerings. *The Journal of Finance*, vol 46, no.3, pp. 879-903

Michaely, R. & Shaw, W. (1995). Does the Choice of Auditor Convey Quality in an Initial Public Offering? *Financial Management*, vol 24, no.4, pp. 15-30

Miller, E. (1977). Risk, Uncertainty, and Divergence of Opinion. *The Journal of Finance*, vol 32, no.4, pp. 1151-1168

Mohan, N. & Chen, C. (2001). Information Content of Lockup Provisions in Initial Public Offerings. *International Review of Economics & Finance*, vol 10 no.1, pp. 41-59

Muscarella, C.J. & Versuypens, M.R. (1989). A Simple Test of Barno's Model of IPO Underpricing. *Journal of Financial Economics*. vol 24, pp. 35-125

Nasdaq. (2021a). Nordic Main Market Rulebook for Issuers of Shares Available at: https://www.nasdaq.com/docs/2021/01/20/Nordic-Main-Market-Rulebook-for-Issuers-of-Shares_4-January-2021.pdf [Accessed 12 December 2021]

Nasdaq. (2021b). Available at: https://www.nasdaq.com/. [Accessed 22 December 2021]

Nenova, T. (2003). The value of corporate voting rights and control: A cross-country analysis. *Journal of Economics*, vol 68 pp. 325-351.

Oslobørs (2021a) Oslo Rulebook II - Issuer Rules Available at: https://www.euronext.com/sites/default/files/2020-11/Euronext%20Rule%20Book%20II_Oslo_EN%20112020.pdf [Accessed 12 December 2021]

Oslobørs.no (2021b) Available at: https://www.euronext.com/nb/markets/oslo [Accessed 22 December 2021]

Rashid, R. & Rahim. R & Yong, O. (2014). The Influence of Lock-up Provisions on IPO Initial Returns: Evidence from an Emerging Market. *Economic Systems*, vol. 3, no.4, pp. 487-501

Ritter, J. (1998). Initial Public Offerings. Contemporary Finance Digest, vol. 2, no.1, pp. 5-30

Ritter, J. & Welch, I. (2002). A Review of IPO Activity, Pricing, and Allocations. *The Journal of Finance*, vol 57, no.4, pp. 1795-1828

Ritter, J., Signori, A., & Vismara, S, (2013). Economies of scope and IPO activity in Europe. *Handbook of Research on IPOs*, pp. 11-34.

Ritter, J. (1984). Signaling and the Valuation of Unseasoned New Issues: A Comment. *Journal of Finance*, vol. 39, no.4, pp. 1231-1237

Ritter, J. (1991). The Long-Run Performance of Initial Public Offerings. *The Journal of Finance*, vol. 46, no.1, pp. 3-27

Rock, K. (1986). Why New Issues are Underpriced. *Journal of Financial Economics*, vol. 15, no.2, pp. 187-212

Schultz, P. (2003). Pseudo Market Timing and the Long-Run Underperformance of IPOs. *The Journal of Finance*, vol 58, no.2, pp. 483-517

SCImago. (n.d.). About us. Available at: https://www.scimagojr.com/help.php [Accessed 2 January 2022]

Sherman, A.E. & Titman, S. (2002). Building the IPO Order Book: Underpricing and Participation Limits with Costly Information. *Journal of Financial Economics*, vol. 65, no.1, pp. 3-29

Shostak, F. (1997). In defense of fundamental analysis: A critique of the efficient market hypothesis. *Review of Austrian Economics* 10, no.2, pp. 27-45

Tanda, A. & Manzi, G. (2019). Underpricing of Venture Backed IPOs: A Meta-analysis Approac*h. Economics of Innovation and New Technology*, vol. 29, no.4 pp. 331-348

Teoh, S., Welch, I., & Wong, T. (1998). Earnings Management and the Long-Run Market Performance of Initial Public Offerings. *Journal of Finance,* vol. 53, no.6, pp. 1935-1974

Thomadakis, S., Nounis, C., & Gounopoulos, D. (2012). Long-term performance of Greek IPOs. *European Financial Management*, vol. 18, no.1, pp. 117–141

Tinic, M. (1988). Anatomy of Initial Public Offerings of Common Stock. *The Journal of Finance*, vol. 43, no.4, pp. 789-822

Welch, I. (1989). Seasoned Offerings, Imitation Costs and the Underpricing of Initial Public Offerings. *Journal of Finance*, vol. 44, no.2, pp. 421-449

World Federation of Exchanges. (2022). Available at: https://www.world-exchanges.org/ [Accessed 22 December 2021]

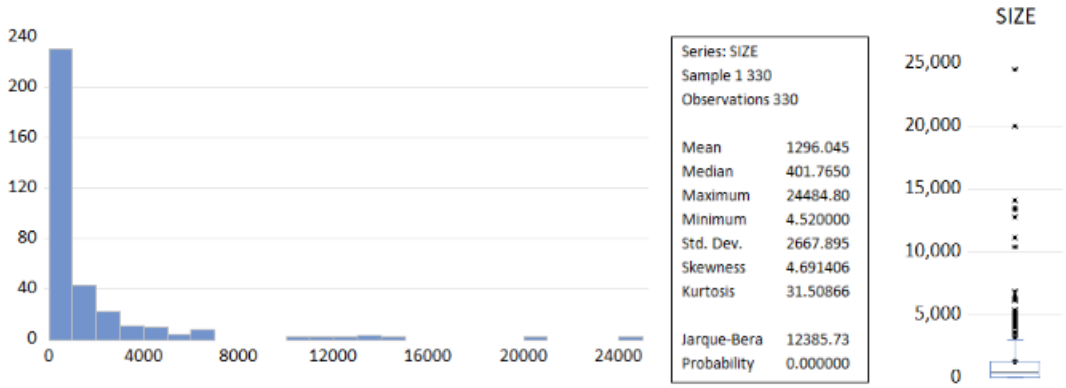
Yung, J. & Zender, F. (2010). Moral hazard, asymmetric information and IPO lockups. *Journal of Corporate Finance*, vol 16, no.3, pp. 320-332

Zider, B (1998) How Venture Capital Works. *Harvard Business Review*. Available at: https://hbr.org/1998/11/how-venture-capital-works [Accessed 21 December 2021]

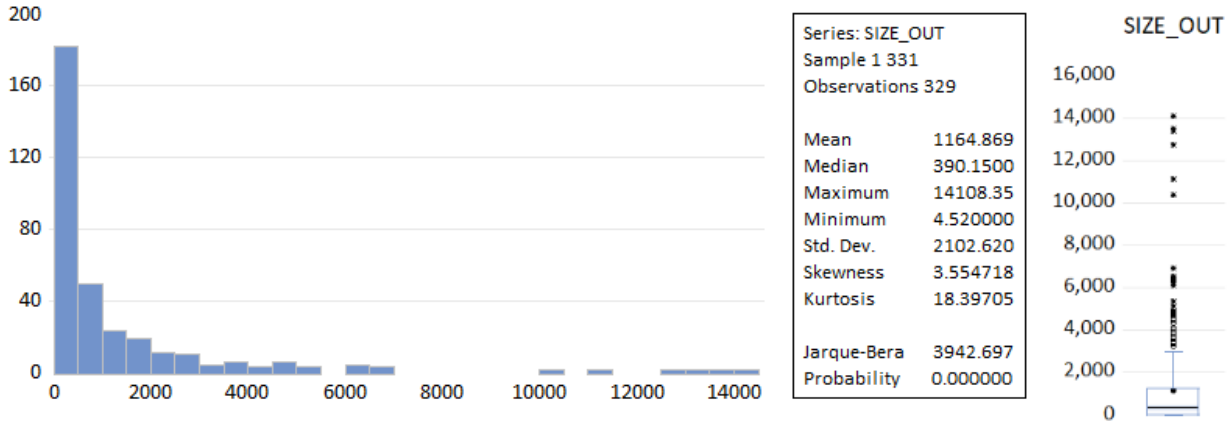
Appendices

Appendix 1 - Size, Lock-up Length

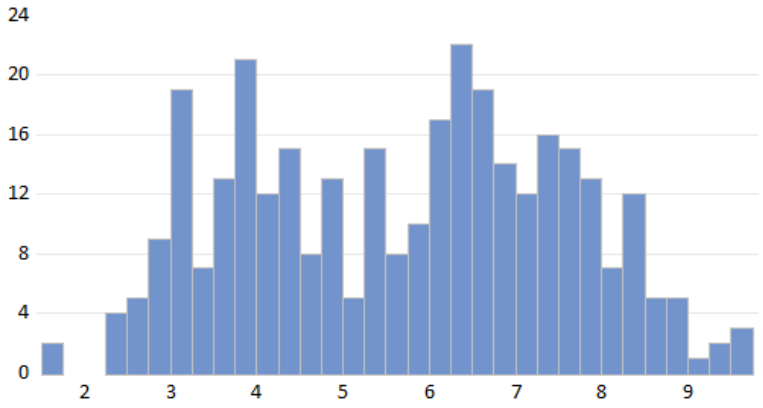
1.1 SIZE - Before adjusted for outliers



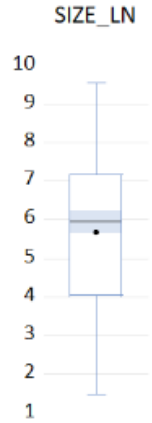
1.2 SIZE - After adjusted for outliers



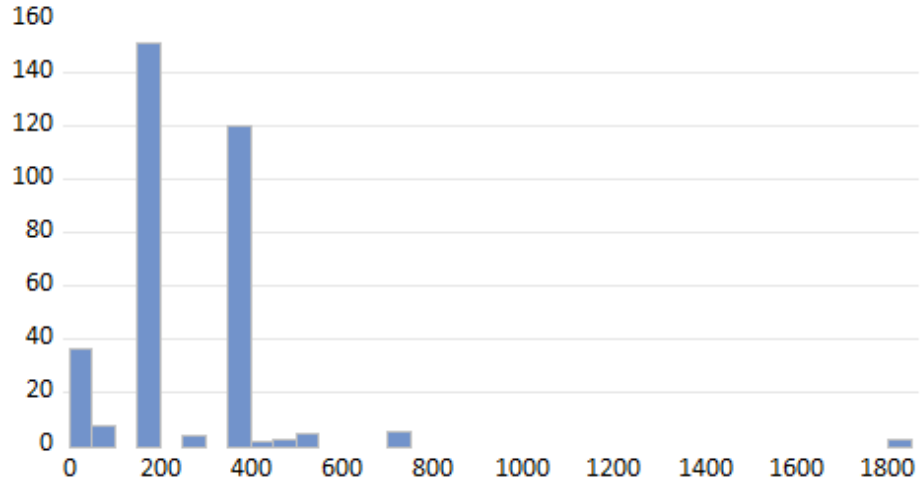
1.3 SIZE - After adjusted for outliers and logarithmically transformed



Series: SIZE_LN	
Sample 1 331	
Observations 329	
Mean	5.703964
Median	5.966531
Maximum	9.554522
Minimum	1.508512
Std. Dev.	1.830909
Skewness	-0.040518
Kurtosis	1.985436
Jarque-Bera	14.20055
Probability	0.000825

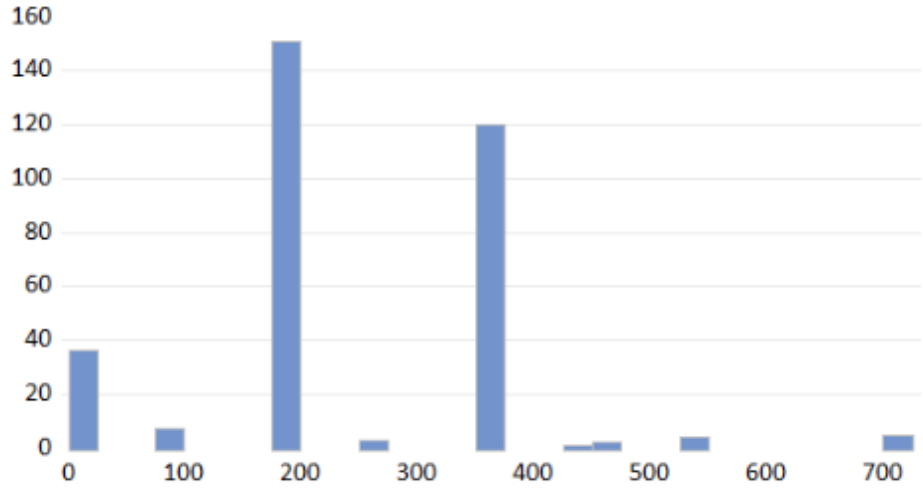


1.4 LuL- Before adjusted for outliers



Series: LUL	
Sample 1 331	
Observations 331	
Mean	250.1662
Median	180.0000
Maximum	1825.000
Minimum	0.000000
Std. Dev.	184.1624
Skewness	3.874075
Kurtosis	33.68004
Jarque-Bera	13809.58
Probability	0.000000

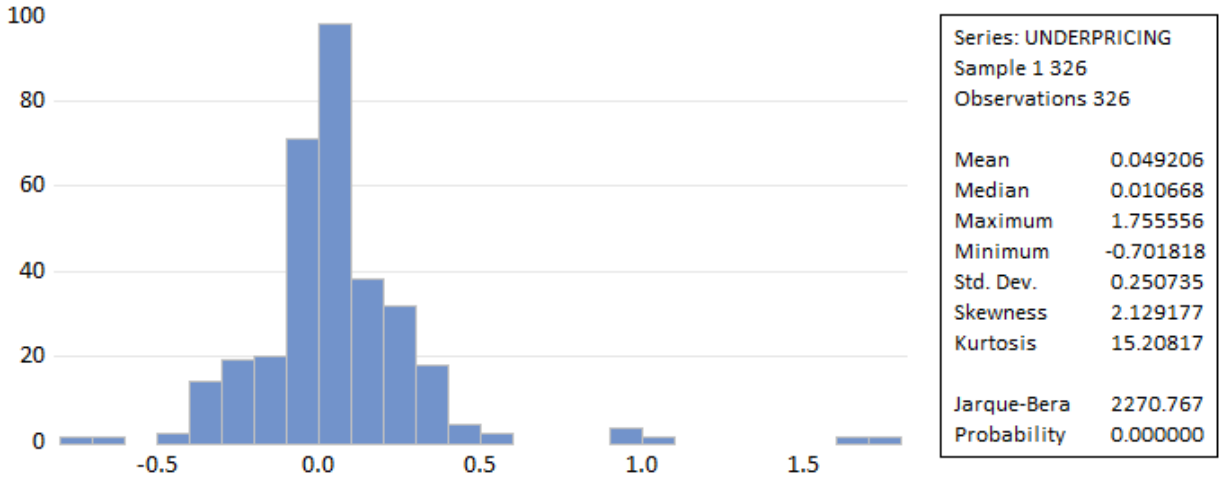
1.5 LuL- After adjusted for outliers



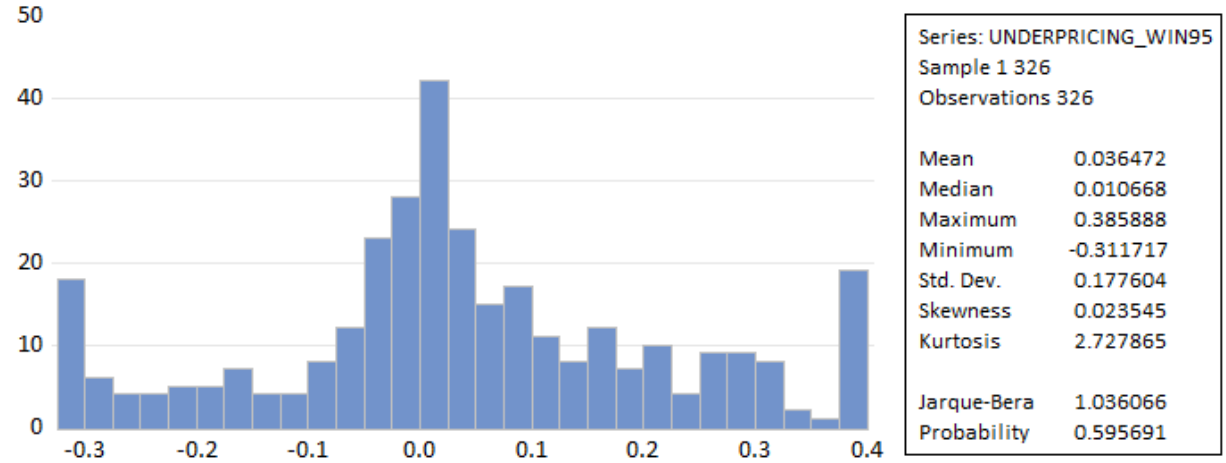
Series: LUL_OUT	
Sample 1 331	
Observations 329	
Mean	240.5927
Median	180.0000
Maximum	720.0000
Minimum	0.000000
Std. Dev.	137.5068
Skewness	0.399331
Kurtosis	3.882357
Jarque-Bera	19.41667
Probability	0.000061

Appendix 2 - IR and BHAR

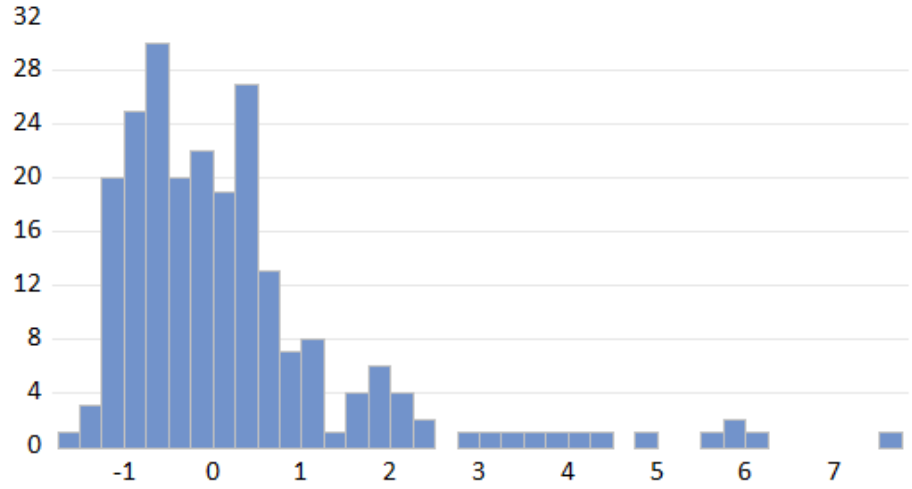
2.1 Initial Return - Pre Winsorizing



2.2 Initial Return - Post Winsorizing

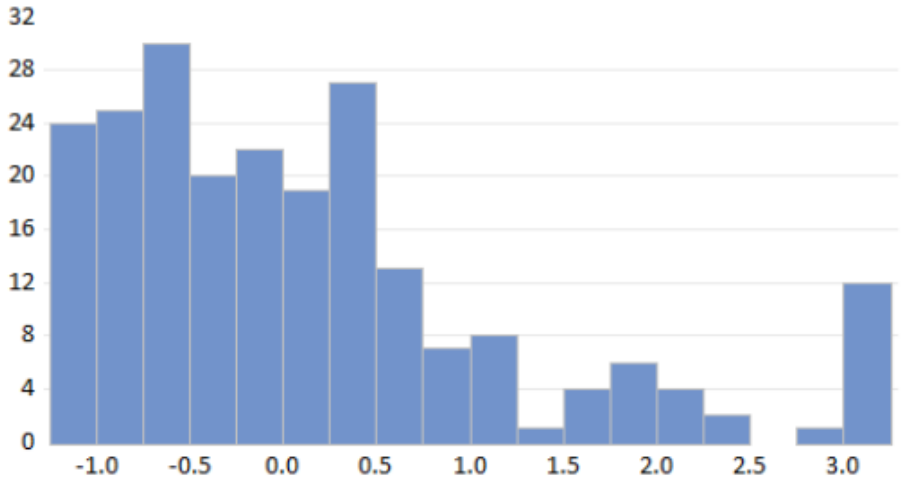


2.3 BHAR - Pre Winsorizing



Series: BHAR	
Sample 1 326	
Observations 225	
Mean	0.226578
Median	-0.084000
Maximum	7.724000
Minimum	-1.510000
Std. Dev.	1.431534
Skewness	2.350203
Kurtosis	9.944277
Jarque-Bera	659.2199
Probability	0.000000

2.4 BHAR - Post Winsorizing



Series: BHAR_WIN95	
Sample 1 326	
Observations 225	
Mean	0.140939
Median	-0.084000
Maximum	3.175000
Minimum	-1.103250
Std. Dev.	1.104325
Skewness	1.263056
Kurtosis	4.093527
Jarque-Bera	71.03478
Probability	0.000000

2.5 T-test Initial Return

Hypothesis Testing for UNDERPRICING
Date: 01/07/22 Time: 19:17
Sample: 1 326
Included observations: 326
Test of Hypothesis: Mean = 0.000000

Sample Mean = 0.049206
Sample Std. Dev. = 0.250735

Method	Value	Probability
t-statistic	3.543309	0.0005

2.6 Two Tailed T-test for BHRi and BHRm

Test for Equality of Means Between Series
Date: 01/07/22 Time: 19:23
Sample: 1 225
Included observations: 225

Method	df	Value	Probability
t-test	448	2.550708	0.0111
Satterthwaite-Welch t-test*	231.0490	2.550708	0.0114
Anova F-test	(1, 448)	6.506111	0.0111
Welch F-test*	(1, 231.049)	6.506111	0.0114

*Test allows for unequal cell variances

Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	6.942285	6.942285
Within	448	478.0342	1.067041
Total	449	484.9765	1.080126

Category Statistics

Variable	Count	Mean	Std. Dev.	Std. Err. of Mean
BHRI	225	0.563876	1.449488	0.096633
BHRM	225	0.315462	0.181841	0.012123
All	450	0.439669	1.039291	0.048993

Appendix 3 - Regressions and Test Results

3.1 Regression and test results for Initial Return with Lock-Up Dummy

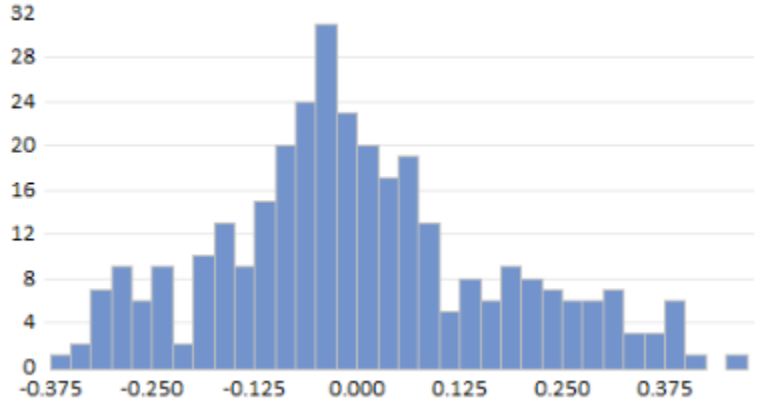
Dependent Variable: UNDERPRICING_WIN95
Method: Least Squares
Date: 01/07/22 Time: 08:12
Sample: 1 326
Included observations: 326
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.136955	0.047226	-2.900023	0.0040
LUD	0.040214	0.029798	1.349529	0.1781
LNAGE	0.024753	0.007892	3.136312	0.0019
LNSIZE	0.005764	0.008546	0.674515	0.5005
NOI	0.157829	0.162417	0.971750	0.3319
UR	0.048418	0.030355	1.595020	0.1117
VE_PE	-0.012373	0.019890	-0.622061	0.5343

R-squared	0.087053	Mean dependent var	0.036472
Adjusted R-squared	0.069881	S.D. dependent var	0.177604
S.E. of regression	0.171286	Akaike info criterion	-0.669721
Sum squared resid	9.359150	Schwarz criterion	-0.588407
Log likelihood	116.1645	Hannan-Quinn criter.	-0.637272
F-statistic	5.069638	Durbin-Watson stat	1.785624
Prob(F-statistic)	0.000055	Wald F-statistic	5.084573
Prob(Wald F-statistic)	0.000053		

Variance Inflation Factors
Date: 01/07/22 Time: 08:15
Sample: 1 326
Included observations: 326

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.002230	32.90996	NA
LUD	0.000888	10.85349	1.266982
LNAGE	6.23E-05	8.419348	1.053385
LNSIZE	7.30E-05	45.45398	2.373576
NOI	0.026379	5.892849	1.169920
UR	0.000921	9.987334	2.360737
VE_PE	0.000396	2.661336	1.160915



Series: Residuals
Sample 1 326
Observations 326

Mean	2.67e-17
Median	-0.016793
Maximum	0.457496
Minimum	-0.364993
Std. Dev.	0.169698
Skewness	0.335467
Kurtosis	2.768381
Jarque-Bera	6.843270
Probability	0.032659

Ramsey RESET Test
Equation: EQIR95_LUD
Omitted Variables: Squares of fitted values
Specification: UNDERPRICING_WIN95 C LUD LNAGE LNSIZE NOI UR VE_PE

	Value	df	Probability
t-statistic	0.961058	318	0.3373
F-statistic	0.923632	(1, 318)	0.3373
Likelihood ratio	0.945495	1	0.3309

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.027105	1	0.027105
Restricted SSR	9.359150	319	0.029339
Unrestricted SSR	9.332045	318	0.029346

LR test summary:

	Value
Restricted LogL	116.1645
Unrestricted LogL	116.6373

3.2 Regression and test results for Initial Return with Lock-Up Length

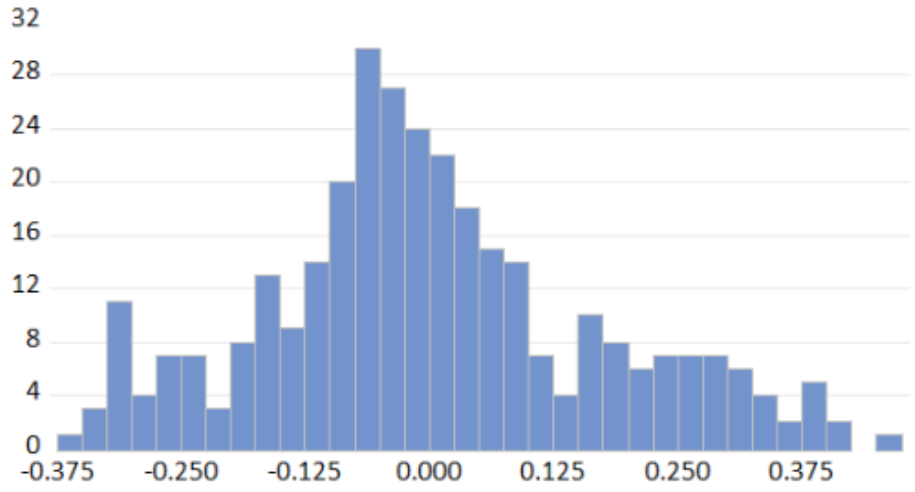
Dependent Variable: UNDERPRICING_WIN95
Method: Least Squares
Date: 01/07/22 Time: 08:29
Sample: 1 326
Included observations: 326
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.140914	0.048779	-2.888855	0.0041
LUL	9.73E-05	7.28E-05	1.337581	0.1820
LNAGE	0.026002	0.007963	3.265513	0.0012
LNSIZE	0.006863	0.008433	0.813873	0.4163
NOI	0.184106	0.157411	1.169592	0.2430
UR	0.053337	0.030498	1.748876	0.0813
VE_PE	-0.011452	0.019898	-0.575514	0.5653

R-squared	0.087308	Mean dependent var	0.036472
Adjusted R-squared	0.070141	S.D. dependent var	0.177604
S.E. of regression	0.171262	Akaike info criterion	-0.670000
Sum squared resid	9.356537	Schwarz criterion	-0.588686
Log likelihood	116.2100	Hannan-Quinn criter.	-0.637551
F-statistic	5.085900	Durbin-Watson stat	1.787067
Prob(F-statistic)	0.000053	Wald F-statistic	5.169449
Prob(Wald F-statistic)	0.000043		

Variance Inflation Factors
Date: 01/07/22 Time: 08:29
Sample: 1 326
Included observations: 326

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.002379	35.84080	NA
LUL	5.30E-09	4.650815	1.075126
LNAGE	6.34E-05	8.771891	1.078091
LNSIZE	7.11E-05	45.38902	2.295819
NOI	0.024778	5.588695	1.093331
UR	0.000930	10.28938	2.396914
VE_PE	0.000396	2.699844	1.163659



Series: Residuals
Sample 1 326
Observations 326

Mean	3.41e-17
Median	-0.019148
Maximum	0.459023
Minimum	-0.355968
Std. Dev.	0.169674
Skewness	0.329115
Kurtosis	2.824476
Jarque-Bera	6.303699
Probability	0.042773

Ramsey RESET Test
Equation: EQIR_LUL
Omitted Variables: Squares of fitted values
Specification: UNDERPRICING_WIN95 C LUL LNAGE LNSIZE NOI UR VE_PE

	Value	df	Probability
t-statistic	1.389464	318	0.1657
F-statistic	1.930610	(1, 318)	0.1657
Likelihood ratio	1.973195	1	0.1601

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.056462	1	0.056462
Restricted SSR	9.356537	319	0.029331
Unrestricted SSR	9.300076	318	0.029246

LR test summary:

	Value
Restricted LogL	116.2100
Unrestricted LogL	117.1966

3.3 Regression and test results for Initial Return with Lock-Up Length divided into three classes

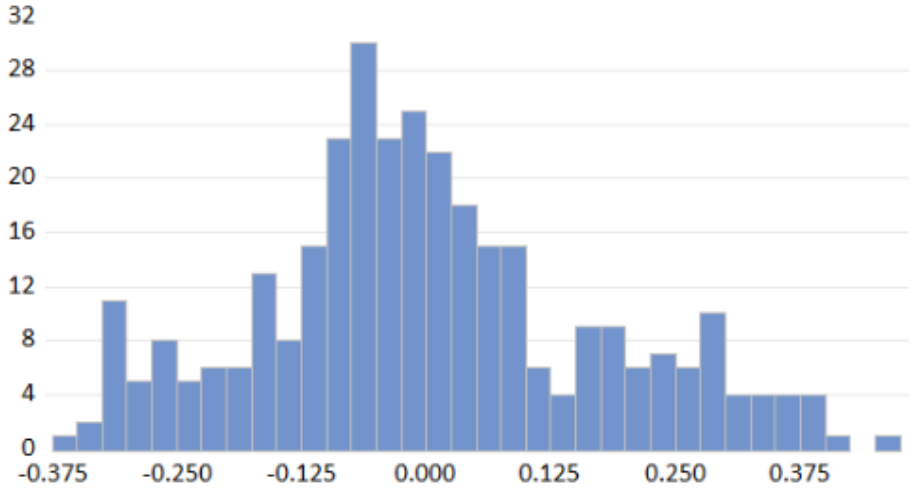
Dependent Variable: UNDERPRICING_WIN95
Method: Least Squares
Date: 01/07/22 Time: 08:54
Sample: 1 326
Included observations: 326
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.149774	0.047830	-3.131366	0.0019
LUL3	0.025284	0.014727	1.716862	0.0870
LNAGE	0.026205	0.007873	3.328391	0.0010
LNSIZE	0.006930	0.008379	0.827081	0.4088
NOI	0.175074	0.157990	1.108130	0.2686
UR	0.053407	0.030367	1.758697	0.0796
VE_PE	-0.011668	0.019913	-0.585960	0.5583

R-squared	0.090915	Mean dependent var	0.036472
Adjusted R-squared	0.073816	S.D. dependent var	0.177604
S.E. of regression	0.170924	Akaike info criterion	-0.673960
Sum squared resid	9.319561	Schwarz criterion	-0.592646
Log likelihood	116.8555	Hannan-Quinn criter.	-0.641511
F-statistic	5.317022	Durbin-Watson stat	1.789859
Prob(F-statistic)	0.000030	Wald F-statistic	5.562356
Prob(Wald F-statistic)	0.000017		

Variance Inflation Factors
Date: 01/07/22 Time: 08:54
Sample: 1 326
Included observations: 326

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.002288	34.54112	NA
LUL3	0.000217	5.447429	1.077928
LNAGE	6.20E-05	8.558678	1.066366
LNSIZE	7.02E-05	44.89444	2.285863
NOI	0.024961	5.639980	1.104215
UR	0.000922	10.23556	2.390163
VE_PE	0.000397	2.711006	1.179552



Series: Residuals
Sample 1 326
Observations 326

Mean	3.90e-17
Median	-0.019526
Maximum	0.453476
Minimum	-0.354696
Std. Dev.	0.169339
Skewness	0.319512
Kurtosis	2.810085
Jarque-Bera	6.036702
Probability	0.048882

Ramsey RESET Test
Equation: EQIR_LUL3
Omitted Variables: Squares of fitted values
Specification: UNDERPRICING_WIN95 C LUL3 LNAGE LNSIZE NOI UR VE_PE

	Value	df	Probability
t-statistic	1.404243	318	0.1612
F-statistic	1.971899	(1, 318)	0.1612
Likelihood ratio	2.015265	1	0.1557

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.057434	1	0.057434
Restricted SSR	9.319561	319	0.029215
Unrestricted SSR	9.262127	318	0.029126

LR test summary:

	Value
Restricted LogL	116.8555
Unrestricted LogL	117.8631

3.4 Regression and test results for BHAR with Lock-Up Dummy

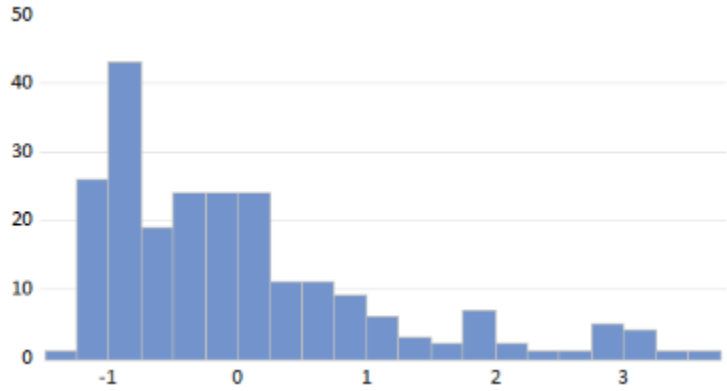
Dependent Variable: BHAR_WIN95
Method: Least Squares
Date: 01/07/22 Time: 11:02
Sample (adjusted): 1 229
Included observations: 225 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.169054	0.303101	-0.557750	0.5776
LUD	-0.075459	0.201919	-0.373709	0.7090
UNDERPRICING	0.999248	0.440817	2.266812	0.0244
LNAGE	-0.054382	0.071262	-0.763131	0.4462
LNSIZE	0.073406	0.037889	1.937373	0.0540
VE_PE	0.107101	0.141366	0.757616	0.4495

R-squared	0.050065	Mean dependent var	0.140939
Adjusted R-squared	0.028377	S.D. dependent var	1.104325
S.E. of regression	1.088543	Akaike info criterion	3.033862
Sum squared resid	259.4987	Schwarz criterion	3.124958
Log likelihood	-335.3094	Hannan-Quinn criter.	3.070628
F-statistic	2.308433	Durbin-Watson stat	1.919178
Prob(F-statistic)	0.045307	Wald F-statistic	2.234545
Prob(Wald F-statistic)	0.051954		

Variance Inflation Factors
Date: 01/07/22 Time: 11:25
Sample: 1 326
Included observations: 225

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.091870	19.34073	NA
LUD	0.040771	7.378079	1.081252
UNDERPRICING	0.194319	1.368541	1.273107
LNAGE	0.005078	10.09695	1.360425
LNSIZE	0.001436	13.03924	1.193288
VE_PE	0.019984	1.857094	1.003643



Series: Residuals
Sample 1 229
Observations 225

Mean	7.72e-17
Median	-0.252688
Maximum	3.631101
Minimum	-1.287719
Std. Dev.	1.076325
Skewness	1.370713
Kurtosis	4.442331
Jarque-Bera	89.96004
Probability	0.000000

Ramsey RESET Test
Equation: EQBHAR95_LUD
Omitted Variables: Squares of fitted values
Specification: BHAR_WIN95 C LUD UNDERPRICING LNAGE LNSIZE VE_PE

	Value	df	Probability
t-statistic	1.152848	218	0.2502
F-statistic	1.329058	(1, 218)	0.2502
Likelihood ratio	1.367569	1	0.2422

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	1.572472	1	1.572472
Restricted SSR	259.4987	219	1.184926
Unrestricted SSR	257.9262	218	1.183148

LR test summary:

	Value
Restricted LogL	-335.3094
Unrestricted LogL	-334.6257

3.4 Regression and test results for BHAR with Lock-Up Length

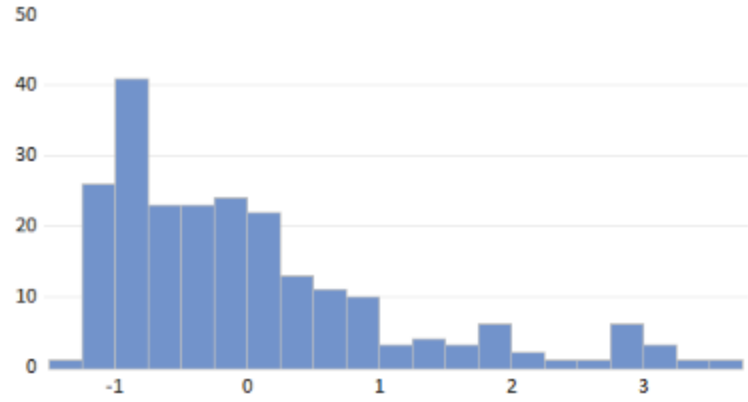
Dependent Variable: BHAR_WIN95
Method: Least Squares
Date: 01/07/22 Time: 11:37
Sample (adjusted): 1 229
Included observations: 225 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.250109	0.304291	-0.821940	0.4120
LUL	0.000186	0.000558	0.332734	0.7397
UNDERPRICING	0.967074	0.440498	2.195411	0.0292
LNAGE	-0.051715	0.070114	-0.737583	0.4616
LNSIZE	0.069331	0.037532	1.847238	0.0661
VE_PE	0.098980	0.140931	0.702330	0.4832

R-squared	0.049961	Mean dependent var	0.140939
Adjusted R-squared	0.028270	S.D. dependent var	1.104325
S.E. of regression	1.088603	Akaike info criterion	3.033972
Sum squared resid	259.5273	Schwarz criterion	3.125068
Log likelihood	-335.3218	Hannan-Quinn criter.	3.070739
F-statistic	2.303358	Durbin-Watson stat	1.913659
Prob(F-statistic)	0.045736	Wald F-statistic	1.876391
Prob(Wald F-statistic)	0.099532		

Variance Inflation Factors
Date: 01/07/22 Time: 11:38
Sample: 1 326
Included observations: 225

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.092593	19.50845	NA
LUL	3.11E-07	4.202043	1.069434
UNDERPRICING	0.194039	1.288818	1.197516
LNAGE	0.004916	9.763771	1.296211
LNSIZE	0.001409	12.81116	1.159064
VE_PE	0.019862	1.860293	1.006475



Series: Residuals
Sample 1 229
Observations 225

Mean	-7.46e-17
Median	-0.260915
Maximum	3.706178
Minimum	-1.288774
Std. Dev.	1.076385
Skewness	1.375650
Kurtosis	4.473058
Jarque-Bera	91.30833
Probability	0.000000

Ramsey RESET Test
Equation: EQBHAR95_LUL
Omitted Variables: Squares of fitted values
Specification: BHAR_WIN95 C LUL UNDERPRICING LNAGE LNSIZE VE_PE

	Value	df	Probability
t-statistic	1.572645	218	0.1173
F-statistic	2.473211	(1, 218)	0.1173
Likelihood ratio	2.538255	1	0.1111

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	2.911310	1	2.911310
Restricted SSR	259.5273	219	1.185056
Unrestricted SSR	256.6160	218	1.177138

3.4 Regression and test results for BHAR with Lock-Up Length divided into three classes

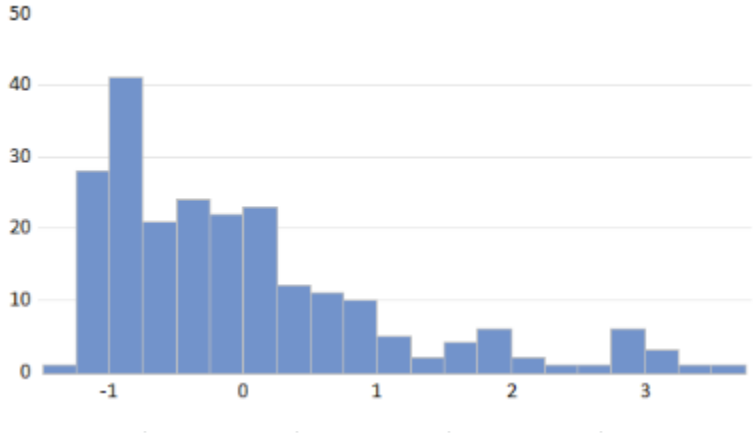
Dependent Variable: BHAR_WIN95
Method: Least Squares
Date: 01/07/22 Time: 11:46
Sample (adjusted): 1 229
Included observations: 225 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.181760	0.307354	-0.591371	0.5549
LUL3	-0.020944	0.101154	-0.207050	0.8362
UNDERPRICING	0.995214	0.437450	2.275037	0.0239
LNAGE	-0.054671	0.070419	-0.776369	0.4384
LNSIZE	0.069349	0.037360	1.856236	0.0648
VE_PE	0.105554	0.141391	0.746544	0.4561

R-squared	0.049641	Mean dependent var	0.140939
Adjusted R-squared	0.027943	S.D. dependent var	1.104325
S.E. of regression	1.088786	Akaike info criterion	3.034309
Sum squared resid	259.6148	Schwarz criterion	3.125405
Log likelihood	-335.3597	Hannan-Quinn criter.	3.071076
F-statistic	2.287824	Durbin-Watson stat	1.918272
Prob(F-statistic)	0.047075	Wald F-statistic	2.170665
Prob(Wald F-statistic)	0.058441		

Variance Inflation Factors
Date: 01/07/22 Time: 11:47
Sample: 1 326
Included observations: 225

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.094467	20.01853	NA
LUL3	0.010232	4.344911	1.078104
UNDERPRICING	0.191362	1.302728	1.220075
LNAGE	0.004959	9.909645	1.294440
LNSIZE	0.001396	12.71279	1.162371
VE_PE	0.019991	1.856738	1.005216



Series: Residuals
Sample 1 229
Observations 225

Mean	-8.91e-17
Median	-0.260846
Maximum	3.655626
Minimum	-1.302599
Std. Dev.	1.076566
Skewness	1.370122
Kurtosis	4.449886
Jarque-Bera	90.10416
Probability	0.000000

Ramsey RESET Test
Equation: EQBHAR95_LUL3
Omitted Variables: Squares of fitted values
Specification: BHAR_WIN95 C LUL3 UNDERPRICING LNAGE LNSIZE VE_PE

	Value	df	Probability
t-statistic	1.259831	218	0.2091
F-statistic	1.587173	(1, 218)	0.2091
Likelihood ratio	1.632203	1	0.2014

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	1.876492	1	1.876492
Restricted SSR	259.6148	219	1.185456
Unrestricted SSR	257.7383	218	1.182286

LR test summary:

	Value
Restricted LogL	-335.3597
Unrestricted LogL	-334.5436

Appendix 4 - Underwriter Scoring

4.1 Prestigious IPO Underwriters Sweden

Prestigous IPO Underwriters Sweden					
Rank Sweden	Bookrunner	Gross Proceeds (Inc. Over-allotment)	% of Total	No. of Transactions	Dummy - variable
1	Carnegie ASA	150 162,23	57,78	81	1
2	SEB	134 360,62	51,70	45	1
3	Nordea Bank Abp	110 861,31	42,66	30	1
4	Morgan Stanley	72 931,37	28,06	13	1
5	Goldman Sachs & Co.	71 256,68	27,42	10	1
6	JPMorgan Chase & Co	66 492,00	25,59	8	1
7	Danske Bank A/S	60 954,44	23,45	17	1
8	ABG Sundal Collier Holding ASA	50 905,89	19,59	25	1
9	DNB Bank ASA	41 231,33	15,87	15	1
10	UBS Group AG	36 388,32	14,00	7	1
11	BNP Paribas SA	36 266,58	13,96	3	1
12	Swedbank AB	30 205,35	11,62	14	1
13	Jefferies LLC	26 862,52	10,34	6	1

4.2 Prestigious IPO Underwriters Denmark

Prestigous IPO Underwriters Denmark					
Rank Denmark	Bookrunner	Gross Proceeds (Inc. Over-allotment)	% of Total	No. of Transactions	Dummy - variable
1	Morgan Stanley	83 078,53	71,62	9	1
2	JPMorgan Chase & Co	82 989,57	71,55	6	1
3	Danske Bank A/S	76 118,11	65,62	11	1
4	UBS Group AG	69 069,21	59,55	4	1
5	Nordea Bank Abp	59 206,25	51,04	6	1
6	Citigroup	26 053,82	22,46	2	1
7	Goldman Sachs & Co.	25 284,96	21,80	2	1
8	SEB	24 482,44	21,11	3	1
9	Deutsche Bank AG	22 610,93	19,49	3	1
10	DNB Bank ASA	20 263,34	17,47	1	1

4.3 Prestigious IPO Underwriters Finland

Prestigous IPO Underwriters Finland					
Rank Finland	Bookrunner	Gross Proceeds (Inc. Over-allotment)	% of Total	No. of Transactions	Dummy - variable
1	Nordea Bank Abp	17 191,16	46,12	9	1
2	Danske Bank A/S	13 537,91	36,32	11	1
3	Carnegie ASA	10 848,60	29,11	9	1
4	OP Financial Group	10 814,79	29,02	6	1
5	SEB	6 803,44	18,25	4	1
6	Goldman Sachs & Co.	6 518,83	17,49	2	1
7*	Consolidated Energy Ltd.	4 067,83	10,91	1	1
7*	Morgan Stanley	4 067,83	10,91	1	1

4.4 Prestigious IPO Underwriters Norway

Prestigous IPO Underwriters Norway					
Rank Norway	Bookrunner	Gross Proceeds (Inc. Over-allotment)	% of Total	No. of Transactions	Dummy - variable
1	ABG Sundal Collier Holding ASA	90 596,51	58,03	42	1
2	Carnegie ASA	58 654,59	37,57	27	1
3	Goldman Sachs & Co.	37 165,18	23,80	7	1
4	Citigroup	31 515,01	20,19	3	1
5	Morgan Stanley	30 691,07	19,66	4	1
6	DNB Bank ASA	28 076,00	17,98	21	1
7	SEB	27 795,83	17,80	15	1
8	Bank of America Merrill Lynch	27 462,86	17,59	4	1
9	Pareto AS	27 357,29	17,52	25	1
10	Jefferies LLC	25 051,59	16,05	2	1
11	JPMorgan Chase & Co	21 642,10	13,86	2	1
12	Arctic Securities AS	17 121,78	10,97	17	1

4.5 Prestigious IPO Underwriters Europe

Prestigous IPO Underwriters Europe					
Rank Europe	Bookrunner	Gross Proceeds (Inc. Over-allotment)	% of Total	No. of Transactions	Dummy - variable
1	Morgan Stanley	1 349 107,39	30,87	153	1
2	JPMorgan Chase & Co	1 291 133,23	29,54	182	1
3	Goldman Sachs & Co.	1 284 974,50	29,40	155	1
4	Bank of America Merrill Lynch	1 156 785,89	26,47	104	1
5	Citigroup	1 113 458,77	25,48	141	1
6	UBS Group AG	1 058 200,43	24,21	112	1
7	Deutsche Bank AG	981 320,41	22,45	120	1
8	Credit Suisse	888 220,82	20,32	108	1
9	BNP Paribas SA	720 724,83	16,49	101	1
10	Barclays Plc	702 588,64	16,08	80	1
11	HSBC Holdings Plc	530 584,82	12,14	64	1