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Mispricing of Private Equity-Backed Initial Public Offerings

Navn:	Henrik Larsson Rodvang, Steffen Grue Ulsrud

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Steffen G. Ulsrud & Henrik L. Rodvang

Supervisor: Espen Henriksen

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Abstract

This thesis investigates whether private equity-backed initial public offerings (IPOs) are systematically less underpriced than non-private equity-backed IPOs, whether the lower underpricing can be accounted for by lower post-IPO dispersion in returns and whether the lower dispersion in returns may be related to the quality of the leading private equity firm. By researching these questions we have aimed at finding an explanation for why investors can be indifferent between investing in private equity-backed IPOs and non-private equity backed IPOs. We found that private equity-backed IPOs on average are less underpriced than non-private equity-backed IPOs and the dispersion in the returns of buyout-backed IPOs is smaller than for non-private equity-backed IPOs. Further, we find that the average return of IPOs, where a high quality private equity firm is the leading private equity shareholder, was more underpriced than the average non-private equity-backed IPO.

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Contents

1 Introduction **1**

1.1 Testable Implications 4

2 Theory and Litterature Review **6**

2.1 Private Equity 6

2.1.1 Structure 6

2.1.2 Life Cycle of a PE Fund 8

2.1.3 Exit Through an IPO 8

2.1.4 The Nordic PE Market 9

2.2 Initial Public Offering 9

2.2.1 The Structure of an IPO 9

2.3 IPO Mispricing 10

2.3.1 Previous Findings on Mispricing 10

2.3.2 Ex-ante Uncertainty Hypothesis 14

2.3.3 Information Asymmetry 14

2.3.4 "Hot" Market Issues 15

2.3.5 Speculative Bubble Hypothesis 16

2.3.6 Underwriter's Incentives and Reputation 16

2.3.7 Selling Shareholder's Incentives and Reputation 17

2.3.8 Reversed LBO 18

2.3.9 Mean-Variance Relation 18

3 Data and Methodology **20**

3.1 Data Collection 20
3.1.1 Key Variables 20
3.1.2 Outliers 22
3.1.3 PE Detection and Classification 23
3.1.4 Sample Selection Bias 24
3.1.5 Survivorship Bias 25
3.1.6 Omitted Variable Bias 25
3.2 Initial Return 26
3.2.1 Mispricing 26
3.2.2 Offer to First Day Close 27
3.2.3 Offer to First Month Excess Market Return 28
3.3 Market Capitalization 28
3.3.1 Value Weighted Return 29
3.4 Equity Offered in the IPO 30
3.4.1 Shares Sold by Leading Shareholder 30
3.4.2 Total Shares Offered to New Shareholders 30
3.5 Univariate Testing and Descriptive Statistics 31
3.5.1 Hypothesis Testing 31
3.6 Multivariate Testing 32
3.6.1 Regression Models 32

4 Empirical Analysis and Results **36**

4.1 Mispricing Results 36
4.1.1 Distribution 36

4.1.2 First Day Return 39

4.1.3 First-month Excess Return 42

4.2 OLS: Univariate t-testing 44

4.2.1 First Day Return 45

4.2.2 First Month Excess Return 48

4.3 OLS: Multivariate t-testing 51

4.4 Firm Specific Results 53

5 Discussion and Conclusion **59**

References **62**

A Appendices **68**

A.1 Jarque Bera Test for Normality 68

A.2 T-testing for Hypothesis 68

A.2.1 T-statistics 68

A.2.2 Weighted T-statistics 68

A.2.3 Levene's Test for Equality of Variances 69

A.2.4 Welch Test for Unequality of Means 69

A.3 Python codes 70

A.4 Probability Density Function 78

A.4.1 Results of Jarque Bera Test 80

A.5 Nordic Inflation Rates 81

A.5.1 Cumulated Inflation Rates 81

A.6 PE Firms 82

A.7 Non-Backed IPOs Sample 83

A.7.1 Return Sample 83

A.8 PE-Backed IPOs Sample 92

A.8.1 Return Sample 92

A.8.2 Principal Shareholder 96

Index of Abbreviations

APT	Arbitrage Pricing Model
AUM	Assets Under Management
BO	Buyout
CAPM	Capital Asset Pricing Model
CPI	Consumer Price Index
CSE	Copenhagen Stock Exchange
EW	Equal Weighted
GP	General Partner
HSE	Helsinki Stock Exchange
IR	Initial Return
IPO	Initial Public Offering
LBO	Leveraged Buyout
LP	Limited Partner
MSCI	Morgan Stanley Capital International
NB	Non-PE-backed
OLS	Ordinary Least Squares
OSE	Oslo Stock Exchange
PE	Private Equity
PDF	Probability Density Function
RLBO	Reverse Leveraged Buyout
SD	Standard Deviation
SSE	Stockholm Stock Exchange
VC	Venture Capital
VW	Value Weighted

List of Tables

1 Prior Research on IPO Underpricing 11

2 Prior Research on BO-/VC-backed and Non-PE-backed IPOs 13

3 Size Statistics 21

4 Fraction Sold Statistics 22

5 Yearly Observations of IPOs and Offer Sizes 24

6 Number of IPOs by Market 39

7 Average First Day Return of IPOs by Market 40

8 Descriptive Statistics First Day Return 41

9 Average First Month Excess Return of IPOs by Market 42

10 Descriptive Statistics of First Month Excess Return 43

11 OLS First Day Return 46

12 Variance Comparison First Day Return: Levene's Test 47

13 Mean Comparison First Day Return: Welch Test 48

14 OLS First Month Excess Return 49

15 Variance Comparison First Month Excess Return: Levene's Test . . 50

16 Mean Comparison First Month Excess Return: Welch Test 50

17 Multivariate Regression: Model 1-4 53

18 Descriptive Statistics for the Most Active PE Firms on IPOs 58

19 Number of IPOs by Market 80

20 Inflation Rates 81

21 Deflator 81

22 PE Firms 82

23 Non-PE-Backed IPOs Sample 83

24 PE-Backed IPOs Sample 92

25 Principal PE Firms IPOs Sample 96

List of Figures

1 Private Equity Structure 7

2 Typical Stages of a PE Fund 8

3 Distribution of the Sample: First Day Return and First Month Excess Return 37

4 Density Subplots: First Day Return and First Month Excess Return . 38

5 Boxplot: First Day Return and First Month Excess Return 44

6 Density Plot: PE-backed 78

7 Density Plot: BO-backed 79

8 Density Plot: VC-backed 79

9 Density Plot: All IPOs 79

1 Introduction

In this thesis we present three closely related questions. First we ask whether private equity (PE) backed initial public offerings (IPOs) are systematically less underpriced than non-PE-backed (NB) IPOs? Then we ask whether lower expected post-IPO returns on PE-backed relative to NB IPOs can be accounted for by lower post-IPO dispersion in returns? And lastly we ask whether lower return dispersion from PE-backed IPOs may be related to repeated smaller information asymmetries, interaction and reputation of PE firms.

The underpricing of IPOs is a well-documented empirical phenomenon in the financial markets. In the period 1960-1982, average underpricing in the U.S. markets was 18.8%, and in the period 2001-2015 13.90% (Ritter, 2016). In the Nordic markets Pukthuanthong et al. (2013) finds an average underpricing of 7.48% from 1995-2002. Several studies find similar results and thus provide solid empirical documentation for this market anomaly. One explanation behind this phenomenon is that most companies go public only once, and an IPO is viewed as successful only if the first day return is positive (Ibbotson et al., 1988, pp. 38-39). When a company goes public, the pre-IPO owner, which only does this once, may be willing to leave money on the table to ensure that the IPO is perceived as a success. This despite the fact that IPO underpricing is equivalent to a wealth transfer from the pre-IPO owner to the new shareholders.

What if private equity firms do not take the same view on the success of the IPO? They are mainly focused on the possible destruction of their reputation if they overprice the offering, while they at the same time want the highest possible price to maximize their profit. We find support that PE-backed IPOs to some extent have experienced a smaller degree of underpricing. Our ambition is therefore to find evidence of systematic differences in the return dispersions and then find an explanation as to why the difference exists.

PE firms take companies public many times, and build competence as they have repeated interaction with both investment bankers and investors. We therefore investigate whether PE-backed IPOs are systematically different from NB IPOs. Numerous previous studies suggest that initial public offerings, with a private eq-

uity fund as the leading selling shareholder, return on average less than offerings without private equity involvement. Barry et al. (1990), among others, have tested return distributions for PE-backed IPOs and report lower average first day return than researcher who do not characterize issues to financial sponsors. Our thesis divide private equity into buyout (BO) and venture capital (VC), where previous studies shows that IPOs backed by a BO firm seem to have on average even lower underpricing. When Muscarella & Vetsuypens (1989) specifically examined the ones that were BO-backed they found evidence that these offerings were less underpriced than IPOs in general. Levis (2011) goes even further (in the UK market) and say that BO-backed IPOs are priced more accurately than NB- and VC-backed IPOs on average. That said, this thesis seek to test with an empirical approach whether there is a systematical difference in the Nordic market, on more recent data, and try to explain why IPOs related to financial sponsors (backing) experience different return expectations.

A closely related question is how differences in expected returns may be supported in highly competitive financial markets? In other words, why would any investor buy shares in a PE-backed IPO if the expected returns are systematically lower then for NB IPOs. Is there, for example, empirical evidence of PE-backed IPOs being consistently more accurately priced than NB IPOs? One explanation, if we assume an efficient market, is that the returns of PE-backed and NB IPOs reflect the level of uncertainty. Meaning that the risk premium is higher for the more risky NB IPOs than for the less risky PE-backed IPOs. Muscarella & Vetsuypens (1989) examines in their paper whether IPO underpricing derives from the asymmetric information hypothesis. They argue that PE-backed IPOs should expect lower underpricing because there is more available information on these issues than for the other IPOs. Megginson & Weiss (1991) mentions with their results, the certification effect as one explanation for the reduced underpricing, justified that issues backed by a private equity firm has a lower level of uncertainty. This implies that PE-backed IPOs is considered as less volatile, which is also in consensus to what Levis (2011) reports, namely that PE-backed IPOs experience lower post-IPO variance than NB IPOs.

What are potential theories supporting more accurate pricing, hence lower risk compensation, for PE-backed IPOs? As mentioned, PE firms are repeating

the IPO process as they want to divest new portfolio companies. Lee & Wahal (2004) describes how private equity firms allow themselves to "carry the cost", due to underpricing, to retain or establish their reputation for future trades. If the PE firm has a track record of multiple correctly priced offerings, the uncertainty can be categorized as low, and hence will investors require a smaller risk premium relative to other IPOs. In addition, Levis (2011) find results that PE-backed IPOs are larger in terms of e.g. market capitalization and amount raised, and they experience lower variations in terms of post-IPO returns. This will in turn imply lower degrees of uncertainty and thus a lower risk premium. Investors are rewarded for taking risk, that derive from the disequilibrium of information between the parties involved in the offering (Bergström et al., 2006). Smaller information asymmetries due to closer collaboration between the issuer and the underwriter, may result in the underwriter setting a more correct offer price. Therefore it is interesting to test whether repeated interaction by private equity firms and different degrees of uncertainty contributes as an explanation behind different return dispersions.

The contribution of this thesis is our findings of the risk and return from BO-backed IPOs, especially the risks. While previous researchers have focused mostly on the average returns, our thesis contributes with a more detailed analysis of the return dispersion as an explanation behind the returns. Our results for the mispricing, both the first day and the first month excess return, are similar to that of others and what we expected to find. By researching the BO-backed IPOs we find that they are less risky than the other IPOs, as well as yielding a higher average first day return. This is interesting and puzzling, as it contradicts financial theory and hence what we expected to find. We extend our analysis to look at some of the most frequent users of an IPO as an exit route, and find that IPOs backed by a high quality BO firm are less risky and more underpriced than the other IPOs. To the best of our knowledge, we are the first to do such an analysis in the Nordic markets.

1.1 Testable Implications

Since our thesis wish to empirically answer the questions above we need to implement our analysis with a statistical approach. Therefore we have formulated several testable hypothesis that shall provide support to answer why PE-backed IPOs are systematically less mispriced than NB IPOs. Prior research is consistent in concluding that IPOs are, on average, underpriced. This has been covered in greater detail in the literature review.[1] We want to start by checking and quantifying this, with updated data in the Nordic market.

Hypothesis 1: On average, IPOs in the Nordic region experience underpricing in prior to an IPO.

In addition to the assumption that the average IPO is underpriced, we will investigate whether the average PE-backed IPO is systematically less mispriced than the average NB IPO. Previous research seems to find lower average first day returns for PE-backed IPOs than the average first day return for all IPOs.[2] We will categorize IPOs as being either PE-backed or NB, with the aim of answering whether there is a statistical difference in the samples due to backing, and how large that difference is. To answer this we have formulated hypothesis 2:

Hypothesis 2: On average, PE-backed IPOs in the Nordic region experience a lower degree of mispricing than NB IPOs.

We will also categorize the PE-backed IPOs into BO-backed and VC-backed, and check if there is a difference between the average mispricing between those IPOs. We have formulated hypothesis 3 to answer this:

Hypothesis 3: On average, BO-backed IPOs in the Nordic region experience a lower degree of mispricing than VC-backed IPOs.

Further, we argue that the relatively lower underpricing of PE-backed IPOs derive from the relatively lower level of uncertainty than the NB IPOs. We have formulated

[1] See table 1 for more information on previous research.

[2] See table 2 for more information on previous research.

a hypothesis that investigates the variation in the post-IPO returns for the different samples, see hypothesis 4:

Hypothesis 4: PE-backed IPOs experience a lower dispersion in post-IPO returns than NB IPOs.

If we assume an efficient market, then investors should be indifferent between investing in risky companies or less risky companies, since all investments lie on the efficient set (Markowitz, 1952). Recall, that we assume larger companies to be less risky than smaller companies, since the size of the company normally has a connection to what phase the company is in. Therefore we will test if the size of a company has an effect on the mispricing and have therefore formulated the following hypothesis:

Hypothesis 5: A company's market capitalization has an effect on the degree of mispricing.

Finally, we will investigate whether the amount sold by the principal PE-owner have had an effect on the empirical mispricing. We measure the amount sold as the fraction, of the original holdings, sold by the principal PE owner. There is no previous research on this specific issue. Hypothesis 6 aims to test and answer this question:

Hypothesis 6: The fraction sold by the principal PE owner has an effect on the degree of mispricing.

As we have now introduced our question at hand, we will progress with the rest of this paper. It follows a standard setup starting with a theory and literature review. This section will cover private equity and initial public offerings. Following this, we have a data and methodology part, where the purpose is to present our data and the methodology used in our analysis. After this we present our results and conduct the analysis, in the part referred to as empirical analysis and results. Lastly, the text ends with a part containing our conclusions and discussions of these.

2 Theory and Litterature Review

The aim of this literature review and theory part is to shed light on previous research that have formed our research questions and that will be used as background and support for our research. The empirical research on our topic will thus be presented in the following parts. The section will be divided into two parts. The first topic will focus on private equity. It will start by presenting in general what PE firms do, how a fund typically is structured, the life cycle of av PE fund, highlight some empirical research on the IPO as an exit route and finally the activity of PE firms in the IPO market. In the second subsection, we will turn the focus to IPOs. It will start with an overview of why and how IPOs are done and then continue with IPO mispricing, where both previous empirical research and theories that aim to explain why IPOs are mispriced will be presented.

2.1 Private Equity

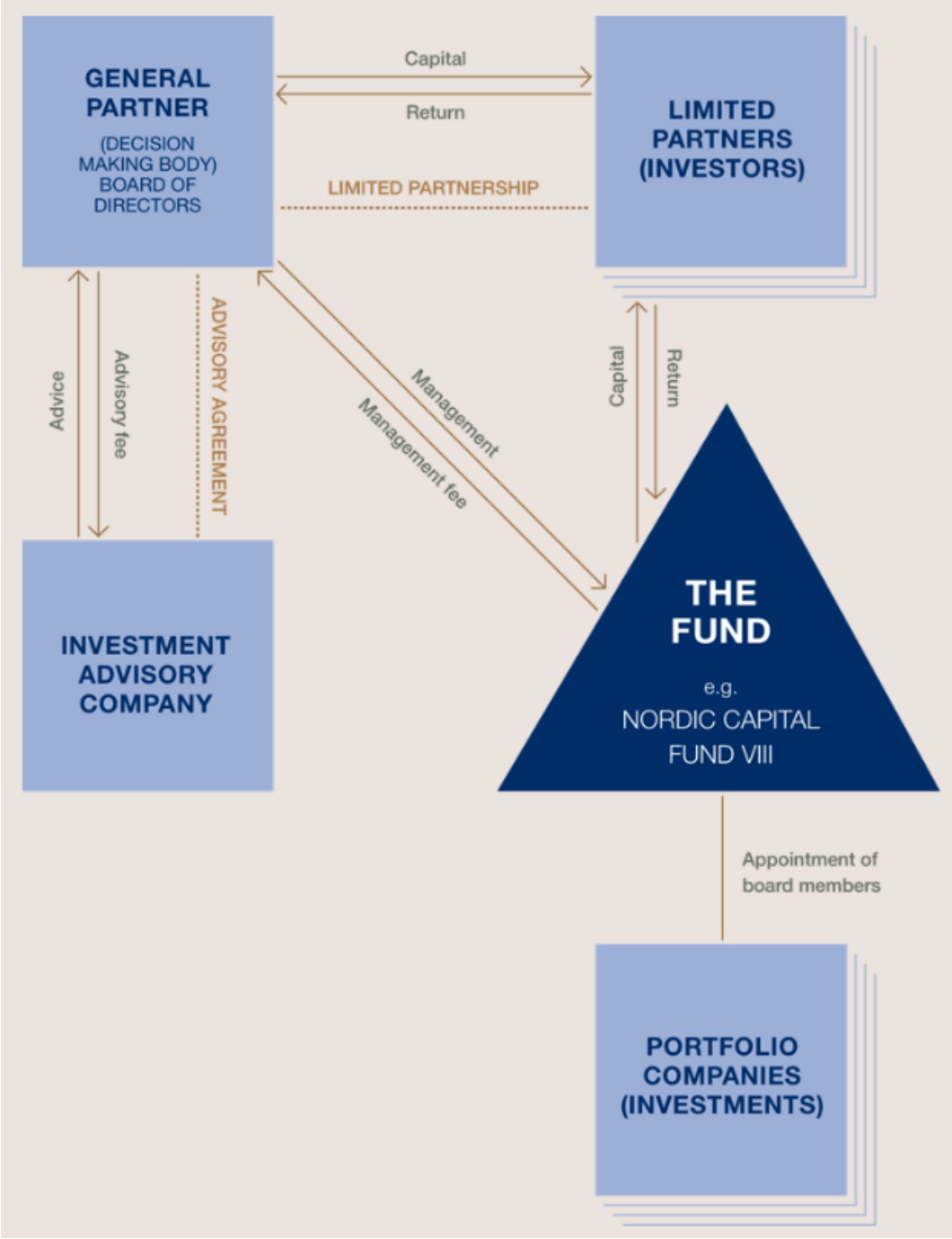
There are many definitions of PE. Cendrowski et al. (2012) defines it as follows: "PE is a medium or long-term equity investment that is not publicly traded on an exchange". They highlight that PE mainly consists of venture capital and buyout transactions but that hedge funds, fund of funds, debt securities and other securities also can be considered as PE. Given that the focus of our research is IPO's, we will solely focus on PE firms investing in equities. We will separate between two major types of PE-strategies, namely buyout (BO) and venture capital (VC). The two types of categories will be covered in the next chapter. PE firms (especially BO) usually takes concentrated positions in the portfolio company and get more involved in the specific firm, with the aim of influencing the management (Barry et al., 1990). This often includes appointing a representative from the PE firm as a member of the board of directors. The overall goal of the PE firm is to improve the company's financial results with the aim of (re)selling the company at a later point in time, where one available route of exiting the investment is through an IPO.

2.1.1 Structure

A typical structure of a PE-fund consists mainly of; the limited partners, the general partners and the fund itself. The limited partners refers to the investors

committing capital to the fund. The funds objective is to own the capital, while the board and the manager of the fund is referred to as the general partner. I.e. the general partner being the PE firm. See more details in the figure below (Nordic Capital, 2019b).

Figure 1: Private Equity Structure



2.1.2 Life Cycle of a PE Fund

The average lifetime of a PE fund is normally about 10 years (NVCA, 2019). The different stages of the PE fund's lifetime is illustrated in figure 2 (Cendrowski et al., 2012).

Figure 2: Typical Stages of a PE Fund

The first stage is to organize the fund. During this period the PE firm recruits investors and determines the strategy. After the "framework" has been determined, there follows a three step process. Firstly, in a period spanning from one to four years, the capital is being employed. After the investment has been done the PE firm's focus is to manage the portfolio company and implement the desired changes. As mentioned, a PE fund normally has a predefined maximum lifetime of approximately 10 years, and will thus need to realize all the holdings as the fund approaches the end of the lifetime.

2.1.3 Exit Through an IPO

There exists different opportunities when it comes to exiting an investment for a PE firm. One is to sell to an strategic buyer or an financial investor, and another is to sell to a broader group of investors (the public) through an IPO. Results from the North American market shows that the average duration on a PE firm's initial investments to IPO is about 2.45 – 2.95, during the period of 1991 – 2004. Research also shows that IPOs was the most common exit route for VC funds in the early 90s in the U.S. market, but have become less common since. It is still a very popular exit route, because it appears to generate the highest profit (Folus & Boutron, 2015). Kaplan & Stromberg (2009) has the same findings with their research on LBOs in the U.S. market. In the period 1970-1984 as much as 28% of exits were done through an IPO, while in their whole period of investigation (1970-2007) only 14% of exits was IPOs. More recent, and in the Nordic market, Argentum (2018) finds that 14% of exits were done through an IPO and 48% through a trade sale in 2017. Hence, it seems that fever exits are done through an IPO.

2.1.4 The Nordic PE Market

According to Spliid (2013), the Nordic PE market started in the 1990s and PE funds have over the past years grown to be one of the most important investor groups in the region. From Argentum (2018) we find that, in 2017, a total of 8.6 billion was invested into Nordic companies through PE funds, where 7.95 billion was invested in buyout transactions and 647 million in venture companies. In each year, in the period 2011-2017, there has been completed between 100-130 buyout transactions and 220-290 venture capital transactions. In the same period there has been raised an average of 4-5 billion in BO and VC funds each year. In 2017 there was a total of 24 PE-backed IPOs, representing 14% of the total of 170 exits done by PE funds this year. A complete overview of the PE firms that have done exits through an IPO between the years 2005-2018 can be found in appendix A.6. The following section will, as stated in the introduction to this theory and literature part, focus on IPO mispricing. We start by presenting the previous empirical research and continue with theories explaining IPO underpricing.

2.2 Initial Public Offering

An Initial Public Offering (IPO) is the process where the owner(s) of a company sells shares in a company to new shareholders and lists the shares on a stock market (Goedhart & Wessels, 2015). As mentioned above, 14% of PE exits in 2017 were done through an IPO (Argentum, 2018). Jenkinson & Ljungqvist (2001) describes the process of going public in a five step model, which will be described below. Companies can in connection with an IPO also raise additional capital by issuing new shares, and the access to the capital markets is important, espesially for smaller growth companies (Ibbotson et. al., 1988, p. 37). In an IPO there are, roughly speaking, three parties involved; the current owner(s), the investment banker and the new investors. The participants' roles and incentives will be covered in the following part. The underpricing that arises due to their different incentives will be covered later in the theory part.

2.2.1 The Structure of an IPO

Firstly, the owner(s) needs to initiate the process of selling their shares. This means that the owner(s) needs to choose how to divest its subsidiary. There are

several potential ways of doing this where our research will focus on those choosing to exit through an IPO. In the first process, the company also needs to choose one or more underwriter(s) and consider where to list the subsidiary's shares. Secondly, the prospectus needs to be produced before the company can present "the investmentcase" to the market. This is a phase where the role of the investment bank(s), chosen as underwriter(s), is very important. Also, in the third part the investment bank(s) plays a crucial part. This is the marketing-phase where the company and the underwriter(s) present the investment opportunity to potential investors. After this, the fourth phase begins, which is the pricing and allocation part. Lastly, Jenkinson & Ljungqvist (2001) highlights the fifth step as; after the IPO. Once the price is determined and the shares are allocated, the trading usually starts within a couple of days. In this phase, the underwriter(s) again plays a crucial part through an over-allotment/greenshoe option).[3]

2.3 IPO Mispricing

The pricing of an IPO is difficult for two main reasons. Firstly, there is often no observable market price for the company. Secondly, many of the companies being listed are more immature companies with limited operating history, making it difficult to estimate the future cash flows. As we will see later this is not necessarily the case for every IPO since some of them are RLBOs, meaning that the company has previously been listed prior to an LBO. If the price is set to low, the selling shareholder(s) "leave money on the table" and the issuer is not able to fully take advantage of its ability to raise capital. If the price is set to high, the potential new investors will choose not to participate in the offering (Ibbotson et al., 1988).

2.3.1 Previous Findings on Mispricing

The fact that the ordinary variety of IPOs are underpriced is well documented, and provides a puzzle to the efficient market hypothesis. Empirical research has shown abnormal returns to investors purchasing shares in an IPO. Table 1 presents the empirical underpricing found in different research studies.

[3] An over-allotment allows the underwriter(s) to participate in the post-IPO trading on the market, with the intent to stabilize the price of the shares.

Table 1: Prior Research on IPO Underpricing

The table reports a summary of previous empirical research on the topic of IPO underpricing. We report the market where the research has been conducted, the period being researched, the sample size (number of IPOs) and the mean underpricing found in the research. The studies are sorted wrt. to the ending year of the period being researched, thus showing the latest research in the bottom of the table.

Authors	Market	Period	Sample size	Underpricing (mean)	Comment
Hatfield & Rielly (1969)	US	1963-1966	53	9.90%	Price first Friday after offering
McDonald & Fisher (1972)	US	1969	142	28.50%	Offer to price one week after offering
Ibbotson et al. (1994)	US	1960-1969	2,661	21.25%	End of calender month bid price
Ibbotson & Jaffe (1975)	US	1960-1970	128	16.83%	Bid price end of month after IPO
Ibbotson et al. (1994)	US	1970-1979	1,658	8.95%	End of calender month bid price
Ritter (1984)	US	1960-1982	1,028	18.80%	First day closing bid price
Ritter (1984)	US	1977-1982	-	26.50%	First day closing bid price
Ritter (1984)	US	1980-1982	-	48.40%	First day closing bid price
Beatty & Ritter (1986)	US	1981-1982	545	14.10%	First day closing bid price
Miller & Reilly (1987)	US	1982-1983	510	9.87%	First day closing bid price
Dark & Carter (1993)	US	1979-1984	1,212	10.60%	First day closing price
Ibbotson et al. (1988)	US	1960-1987	-	16.4%	Bid price end of month after IPO
Loughran & Ritter (2004)	US	1980-1989	1,982	7.30%	First day closing price
Ibbotson et al. (1994)	US	1980-1989	5,155	15.18%	End of calender month bid price
Ibbotson et al. (1994)	US	1990-1992	1,152	10.85%	End of calender month bid price
Van Frederikslust et al. (2001)	Netherlands	1985-1998	106	16.00%	First day closing price
Loughran & Ritter (2004)	US	1990-1998	3,396	14.80%	First day closing price
Ljungqvist & Wilhelm (2003)	US	1996-2000	2,178	35.70%	First day closing price
Schertler (2002)	France	1997-2000	71	16.00%	First day closing price
Schertler (2002)	Germany	1997-2000	257	49.20%	First day closing price
Loughran & Ritter (2004)	US	1999-2000	803	65.00%	First day closing price
Westerholm (2006)	Nordic	1991-2002	247	17.11%	First day closing price
Pukthuanthong et al. (2013)	Global	1995-2002	6,025	29.33%	Price on the 15th calender day after offering
Pukthuanthong et al. (2013)	Nordic	1995-2002	94	7.48%	Price on the 15th calender day after offering
Loughran & Ritter (2004)	US	1980-2003	6,391	18.70%	First day closing price
Lowry et al. (2010)	US	1965-2005	11,734	22.00%	Price one month after offering
Levis (2011)	UK	1992-2005	1,595	18.6%	First day closing price
Hahn et al. (2013)	Global	1988-2009	2,693	27.80%	First day closing price
Ritter (2016)	US	2001-2015	1,664	13.90%	First day closing price

From table 1 we see that there has been conducted multiple studies that find that IPOs are underpriced, on average. With the U.S. stock market being the largest in the world, it is natural that the majority of studies focus on this market, and for this reason it is interesting for us to focus on the Nordic market. There is one study that investigates the Nordic market and find an average underpricing of 7.45% in the period 1995-2002 (Pukthuanthong et al., 2013). But, this study does not measure the underpricing as the return after the first day of trading, which we will. We will like to remark that some of the studies report a spectacular underpricing, like e.g. (Ljungqvist & Wilhelm, 2003) which finds a first day return of 35.7%. This has to been seen in light of the time period being investigated. The dot-com bubble at

the beginning of this millennium was an extraordinary "hot" period in the market. There has been several such comparable market environments in the history and the theory of "hot" market issues will be covered later.

Before we move on to the different theories of IPO mispricing we will present previous findings on IPO underpricing which separates between the different types of backing. The main focus for our research is to study the differences in underpricing of the issuers that are PE-backed versus the ones that are not PE-backed. There exists multiple studies on this topic as well, and again most of them are focused on the U.S. market. A summary of the studies are presented in table 2.

Table 2: Prior Research on BO-/VC-backed and Non-PE-backed IPOs

The table reports a summary of previous empirical research on the topic of IPO underpricing wrt. to the type of backing. Some studies separate between IPOs being BO-backed, VC-Backed or both, denominated as PE-backed. In addition we report some studies that look at the IPOs that are not backed by a PE firm. We report the market where the research has been conducted, the period being researched, the sample size (number of IPOs) and the mean underpricing found in the research. All studies measure the underpricing as the difference between the offer price and the closing price at the first day of trading. The studies are firstly sorted wrt. the type of backing and secondly wrt. the ending year of the period being researched, thus showing the most latest research in the bottom of the table for the different type of backing. RLBO refers to LBOs that were publicly traded prior to the buyout.

Authors	Market	Period	Sample size	Underpricing (mean)	Comment
PE-backed					
Hadass et al. (2005)	UK	1985-1997	-	8.90%	-
Van Frederikslust et al. (2001)	Netherlands	1985-1998	38	13.00%	-
Schertler (2002)	France	1997-2000	44	16.00%	-
Schertler (2002)	Germany	1997-2000	118	52.0%	-
Bergström et al. (2006)	France	1994-2004	506	4.22%	-
Bergström et al. (2006)	UK	1994-2004	1016	10.29%	-
Levis (2011)	UK	1992-2005	204	9.1%	-
Ferretti & Meles (2011)	Italy	1998-2008	66	1.9%	-
BO-backed					
Ainina & Mohan (1991)	US	1983-1987	92	2.07%	RLBO
Muscarella & Vetsuypens (1989)	US	1983-1987	74	2.04%	RLBO
Holthausen & Larcker (1996)	US	1983-1988	90	2.0%	RLBO
Cook & Officer (1996)	US	1983-1991	111	1.9%	RLBO
Hogan et al. (2001)	US	1986-1998	232	7.64%	RLBO
Ang & Brau (2002)	US	1981-1996	334	5.47%	-
Cao & Lerner (2009)	US	1981-2003	526	12.88%	RLBO
Schöber (2008)	US	1973-2007	461	11.56%	-
VC-backed					
Barry et al. (1990)	US	1978-1987	433	8.43%	-
Megginson & Weiss (1991)	US	1983-1987	320	7.10%	-
Francis & Hasan (2001)	US	1990-1993	415	17.98%	-
Lee & Wahal (2004)	US	1980-2000	2,383	26.82%	-
Levis (2011)	UK	1992-2005	250	14.9%	-
Non-PE-backed					
Van Frederikslust et al. (2001)	Netherlands	1985-1998	68	17.00%	-
Bergström et al. (2006)	France	1994-2004	506	9.45%	-
Bergström et al. (2006)	UK	1994-2004	1016	14.7%	-
Ferretti & Meles (2011)	Italy	1998-2008	160	6.6%	-
Levis (2011)	UK	1992-2005	1,141	21.1%	-

In resemblance with the general underpricing seen in table 1, we observe that PE-backed IPOs also are underpriced. However, they seem to be less underpriced. Especially those IPOs that are backed by a BO firm seems to yield a low return to investors after the first day of trading. Researchers are congruent in concluding that there exists an IPO puzzle, and that PE-backed IPOs seem to be less underpriced than NB IPOs. This is documented in table 1 and 2 respectively. Now that this has been presented, we will in the next sections explain different theories

for why the mispricing of IPOs exists, and specifically why they are underpriced and not overpriced, and discuss possible explanations for why the degree of mispricing depends on the type of backing.

The following sections will turn the focus to the different theories that aims to explain why the average IPO is underpriced, and why there is a difference in the degree of mispricing due to the type of backing. A prominent explanation for the underpricing of IPOs relies on the uncertainty investors have about the value of the issuer (Muscarella & Vetsuypens, 1989). In addition, Ainina & Mohan (1991) argues that the more uncertain the value of the company, the higher the discount/underpricing must be. Another theory for the phenomenon of inefficiency in the IPO market was provided by Rock (1986), where he separates between informed and uninformed investors. The theory related to the uncertainty associated with an offering and IPO mispricing due to information asymmetry, will be covered in the two following sections.

2.3.2 Ex-ante Uncertainty Hypothesis

The dispersion in returns and the degree of underpricing can, as mentioned, be attributed to the uncertainty about the true value of the issuer (Muscarella & Vetsuypens, 1989). I.e. the higher the uncertainty, the higher the risk premium. Beatty & Ritter (1986) argue that there "is an equilibrium relation between the expected underpricing of an IPO and the ex-ante uncertainty about the issuer" (Beatty & Ritter, 1985, p. 213). What they mean is that the greater the ex-ante uncertainty, the greater the expected underpricing. For the issuer to avoid this, the issuing firm may be incentivised to voluntarily disclose information to reduce the ex-ante uncertainty regarding the offering.

2.3.3 Information Asymmetry

There has been developed two categories of information asymmetries in the IPO literature. One is the information asymmetry between the issuer and the underwriter, presented by Baron (1982). The other one is the information asymmetry between the informed and the uninformed investor, presented by Rock (1986). Regardless of the type of information asymmetries, both explain the underpricing of IPOs by an inefficiency in the underwriting process (Muscarella & Vetsuypens,

1989).

In the model from Baron (1982) the investment banker(s) is assumed to have greater knowledge about the current market conditions than the issuer. Because issuers are not as knowledgeable about the likely market reactions of the issue as the underwriter(s), Baron argues that the issuer optimally delegates the offer price decision to the underwriter. Further, it is argued that the underpricing occurs particularly due to the issuers "inability to perfectly monitor the underwriter's level of distribution effort", which results in a price which is lower than if there were no information asymmetry (Muscarella & Vetsuypens, 1989).

The Rock (1986) model assumes that the investors are either informed or not informed, and that the informed investors rationally choose to gather information about the security offered while the uninformed investor choose not to delegate resources on information-gathering. Informed investors will then choose only to bid for shares in IPOs that are underpriced, causing these offering to be rationed among all investors. Uninformed investors who purchase shares in all offerings will end up with a disproportionately large fraction of overpriced IPOs and a small fraction of underpriced IPOs in their portfolios, i.e. the uninformed investor faces the winner's curse[4]. To compensate the uninformed investors for their expected loss and to ensure their continued participation in new offerings Rock's model predicts that IPOs will be underpriced, on average (Muscarella & Vetsuypens, 1989).

2.3.4 "Hot" Market Issues

Another inefficiency in the IPO market is reffered to as the theory of "hot" market issues. Ibbotson & Jaffe (1975) was among the first to document the cyclicality in the IPO market and the notion of "hot" market and "cold" market issues. "Hot issues usually refer to particular stock issues that have risen from their offering prices to higher than average premia in the aftermarket" (Ibbotson & Jaffe, 1975, p. 1027). After Ibbotson & Jaffe's study, Ritter (1984) tested the effect and found that the mean underpricing of IPOs was 48.4% in a 15-month period commencing in January 1980. More recent, Loughran & Ritter (2004) finds an average underpricing of 65% during the dot-com bubble from 1999-2000, while it was only

[4]Winner's curse: "if one is allocated the requested number of shares, one can expect that the initial return will be less than average" (Beatty Ritter, 1985, p. 215).

12% in the following "colder" years from 2001-2003. Ibbotson & Jaffe (1975) notes that it appears to be no rational explanation for the "hot" market issue. Despite this, Loughran & Ritter (2004) finds a strong positive correlation between the underpricing of IPOs and the market return, i.e. that investors experience abnormal IPO-returns when the general stock market conditions are positive. Ljungqvist et al. (2006) argues that the "hot" issue markets could be explained by irrational investor behaviour, i.e. that investors' tolerance for risk changes with the market conditions. Such an irrationality could be explained by the speculative bubble hypothesis.

2.3.5 Speculative Bubble Hypothesis

Another theory that is related to the irrationality of investors is the speculative bubble hypothesis. Under this hypothesis, the excess return due to post-IPO appreciation of the share price is attributed to the shareholders that were not allocated shares in the offering. In such a scenario, even though the offer price is consistent with the economic value of the company, the speculation in the market (post-IPO) temporary push the price above its intrinsic value (Tinic, 1988). The result of this is that the investors who were allocated shares in the offering can profit from selling their shares to the investors who were not allocated shares and have to purchase them in the post-IPO market.

2.3.6 Underwriter's Incentives and Reputation

Underwriters advise the issuer on the pricing both at the time of issuing a preliminary prospectus and at the pricing meeting when the final offer price is set. There are two reasons why the investment bank is incetivised to underprice the offering. First, if the underwriter is compensated from both the issuer (through the gross spread[5]), and investors (through commission), then the underwriter will be incentivised to recommend a lower offer price than if the sole compensation was the gross spread. The reason being that they want to attract investors for the next time they are underwriting an offering and that they expect investors to generate commission in return for leaving money on the table (Loughran & Ritter, 2004).

The risk averse underwriter hypothesis is another theory explaining why

[5]The compensation to the underwriter. A percentage of the issue size (European Central Bank, 2005).

underwriters are incentivised to underprice an offering. The hypothesis states that underwriters purposely underprice new issues to reduce their risk and costs of underwriting. In other words, underpricing is an method of reducing the probability that the IPO is unsuccessful, i.e. that the return for the investors participating in the offering is negative (Tinic, 1988). Due to the underwriter's repeated interaction in the IPO market they will be incentivised to underprice the offering. The reason is that investors would be unwilling to purchase shares in an offering from an investment bank with a record of overpriced offerings (Ibbotson et al., 1988).

In contrast, the underwriter's reputation incentivises the underwriter not to underprice the offering. Beatty & Ritter (1986); Booth & Smith (1986) discuss how the reputation of the underwriter can certify the pricing of the offering. Underwriters have repeated interaction with the market through multiple issues and their reputational capital is at stake. Hiring a prestigeous underwriter may therefore provide a trustworthy signal, since these underwriters may be incentivised to maintain their reputation through low levels of mispricing (Schöber, 2008). This theory is quantified by Carter & Manaster (1990) which finds that IPOs with prestigious underwriters experience a lower degree of mispricing than other IPOs.

2.3.7 Selling Shareholder's Incentives and Reputation

In addition to the underwriters incentives, the selling shareholders incentives may also help with explaining why IPOs are underpriced. The sellers of a firm would naturally prefer to sell the shares at a highest possible price, thus realizing the highest possible profit. Nevertheless, Habib & Ljungqvist (2001) highlights why this is not always the case. Shareholders who do not sell all their shares will be more willing to leave some money on the table. Further, Habib & Ljungqvist (2001) argues that the lower fraction the pre-IPO shareholder sells, the more willing will that shareholder be to underprice the offering. This effect is also explained by Loughran & Ritter (2002) and is denoted as the realignment of incentives hypothesis.

In the same way as the underwriter can be a certification of the offering being of a high quality, a selling PE firm that has a good reputation can have the same certification effect. The following research has focused on VC-sponsors, but the arguments should hold for BO-sponsors as well. Firstly, Barry et al. (1990); Megginson & Weiss (1991) argues that VC firms have repeated interaction with the

capital markets and therefore have developed an expertise in monitoring their investments. Further, Barry et al. (1990) argue that VC-sponsors may be incentivised to accurately price the offering to maintain their reputation, as underpricing is costly for the VC firm and the entrepreneur. Barry et al. (1990); Megginson & Weiss (1991); Lee & Wahal (2004) finds that underpricing tends to be connected with the quality of the VC-sponsor, i.e. finding proof of the certification hypothesis.[6] Habib & Ljungqvist (2001), on the other hand, argues than one can not conclude that VC-sponsors have certifying effect on IPOs based on the evidence found by Barry et al. (1990); Megginson & Weiss (1991). They state that owners of VC-backed IPOs on average sell more shares than owners of non-VC-backed IPOs, and that the VC firm for this reason have a greater incentive to reduce the underpricing. In addition, Schöber (2008) emphasis that he cannot find sufficient empirical evidence confirming the certification hypothesis, in his investigation of BO-backed IPOs.

2.3.8 Reversed LBO

Above we have presented theories for why the underpricing exists, but we have not directly covered any theoretical explanations as to why there could be a systematical difference in the degree of misprising due to the type of backing. As mentioned earlier, there are two reasons as to why there is uncertainty about the value of the issuer. Firstly, in many IPOs there is no observable market price and secondly, many times the issuer has a limited operational history. This is not the case for reverse leveraged buyouts.[7] Such a company has previously had an observable market price, which will be used as a basis for the new valuation. Secondly, the company is normally quite mature and will have a relatively long operational history. The company was previous subject to requirements wrt. financial reporting as well, which will certify the quality of the data.

2.3.9 Mean-Variance Relation

Another explanation for the difference in the degree of mispricing, due to the type of backing, is the different levels of uncertainty in the IPOs. As we have

[6] Quality is measured based on the following terms: age, experience, number of previous IPOs and ownership share held by the PE firm.

[7] A RLBO refer to the reentry of a company, on a stock exchange, that has prior been subject to a leveraged buyout (LBO) (Hogan et al., 2001).

touch upon earlier, an explanation for the underpricing of IPOs relies on the uncertainty investors have about the value of the issuer (Muscarella & Vetsuypens, 1989). We argue that larger companies are less uncertain/risky investments than smaller companies, since they typically are more mature companies with a longer operational history. Given this reasoning, the risk premium on the larger companies should be lesser than for the smaller companies, given the theoretical framework provided by Levy & Markowitz (1979). If the investor assumes that the market is mean-variance efficient and that all information is available, all investments will lie on the efficient set and the ratio between risk and return is equal for all IPOs. Further, we know that VC funds target smaller companies than BO funds do, and hence should BO-backed IPOs be less underpriced (smaller risk premium) than the more riskier VC-backed IPOs. I.e. will investors be indifferent between investing in PE-backed IPOs and non-PE-Backed IPOs since the expected return efficiently reflects the associated risk. According to the mean-variance theory, investors can leverage the less risky investment up to a level where the risk and expected return of the leveraged investment corresponds to the unleveraged risk end expected return of another more risky investment.

On the other hand, there exists empirical findings which implies that small companies, measured by market capitalization, have larger returns than large companies also after adjusting for their riskiness. Victor Reinganum discovered what is referred to as the "Small-firm effect", which contradicts the risk-return relationship presented above. The theory has its origin from papers by Reinganum (1980, 1981) who tested stock returns and market capitalization with risk models such as the CAPM[8] and the APT model[9], which resulted in comparable findings. On the other hand, Roll (1981) argues that the "Small-firm effect" is biased because of econometrical problems. He argues that trading infrequency appear to bias the risk measurements when using short-term data when applying the mentioned risk models. Hence, mathematical adjustments justified an possible explanation for why small firms experience larger excess returns on average.

[8]Capital Asset Pricing Model.

[9]Arbitrage Pricing Model.

3 Data and Methodology

In this data and methodology part we include important metrics used to capture the mispricing in IPOs and also the statistics we use to test our hypothesis'. First, we will present an overview of our data collection process, data computation and relevant potential biases. Then we go through the data handling process and methods used for empirically testing.

3.1 Data Collection

As mentioned, we start by presenting the data collection process behind our empirical analysis. We will explain which data we use, where we find it, and how we use it. Then we focus on potential biases that may lead to spurious results.

3.1.1 Key Variables

Since our thesis purpose is to illuminate IPO mispricings in the Nordic region, we have included offerings from Sweden, Norway, Denmark and Finland. We decided to exclude Iceland due to few observations. Our data sample-size then comprises 614 observation (before outlier detection) gathered from Bloomberg Terminal's IPO data. We customized the output to contain effective date, which is the first trading date, issuer ticker and company name. We included primary exchange and country ISO code to further sorting purposes. For financial key figures, we included offer sizes, market capitalization at offer, offer prices, offer to first close and offer to first month. Lastly, we included the first, second, third, fourth and fifth largest selling shareholders for detection of principal owners. We defined our sample to consist of IPOs that were conducted between 1. January 2005 and 31. December 2018.

Since this thesis also aim to test the mispricing one month after the listing, i.e., the first month excess return, we gathered benchmark return within the same period and added one month. We decided to use MSCI Nordic Contries Index as benchmark, because this index is construced of the largest companies in Sweden, Norway, Denmark and Finland and covers 85% of the free-float-adjusted market capitalization in each country (MSCI, 2018). Bloomberg's excel add-in provides daily return data of the benchmark, where we downloaded data between 1. January

2005 and 1. February 2019.

Because of the time differences between the listings, we have taken time value into account. Therefore we constructed a deflator out of CPI[10] rates that we also downloaded from Bloomberg's Excel Add-in. These inflation rates are between 31. December 2004 and 31. December 2018 and contain the CPI for each individual country.[11] Offer prices, market capitalization and offer sizes were given in local currencies. Therefore, we also needed to download currency-data from Bloomberg's Excel Add-in within the same timeframe as the IPO data. Table 4 display some descriptive statistics from our data about issuers size, in terms of market capitalization and offer sizes. We see that our metrics are in consensus with previous researchers when it comes to size patterns. Our data confirm that issuers backed by PE, are on average larger both in market capitalization and offer size.

Table 3: Size Statistics

The table reports the mean and median for the different samples in terms of market capitalization and offer sizes. Both market capitalization and offer size have been deflated, and is converted into NOK. These results show quite large differences between mean and median, especially for VC. This indicates that the samples consist of some very large observations.

	BO	VC	PE	NB
Mean				
Market Cap	6483.02	4050.24	5570.73	3586.23
Offer Size	2578.48	3248.80	1461.27	1091.17
Median				
Market Cap	2837.14	379.98	1490.31	383.59
Offer Size	586.26	1219.62	127.53	98.12

In our empirical analysis, we are testing whether the fraction sold by the principal PE owner have any affect on the degree of mispricing. We were not able to get access to any data-libraries that offered data about this. Therefore, we gathered this information manually by viewing the prospectus' of the different IPOs that were backed by a PE firm. This was done by first matching PE firms to their issuer. Then we searched all prospectus' for how many shares they held before and after the IPO. We have considered if the over-allotment option were exercised in partial

[10] CPI: Consumer Price Index

[11] For more detailed information on CPI rates, see appendices A.5.

or in full. This was a time consuming task, where many issues had lack of information about their offering. We found some prospectus' for the Norwegian market with Oslo Børs NewsWeb[12]. Another database for stock exchange notice is GlobeNewsWire[13], who provided more prospectus' for issues listed in the other Nordic countries. In cases where these search bases couldn't help, company's investor relation pages was quite helpful. In the cases where we didn't find information on the web, we sent emails directly to the PE firms asking for holdings before and after listing. Table 4 display the mean and median of fraction sold by principal PE owner during the IPO period.[14] From these findings we see that BO-firms sell off more of their holdings during the offering, both in terms of mean and median. VC-firms are on average doing a partial exit and sell on average 14.83% of their pre-IPO holding, although median tells us that VC-firms are expected to stay with the issuer after listing.

Table 4: Fraction Sold Statistics

The table reports the the amount in percentages of how many shares the principal PE-owner sold during the IPO. We have illustrated this both in terms of mean and median. The table also distinguishes between BO, VC and PE-backed.

Statistics	BO	VC	PE
Mean	0.3923	0.1483	0.2944
Median	0.4838	0.0000	0.2374

3.1.2 Outliers

One issue when analyzing IPO return samples, is that some extreme observations will violate results. As Loughran & Ritter (2004) mentions, there should be some underpricing so that investors are willing to invest in risky assets in the IPO market, meaning that our IPO-data distribution should in theory be right-tailed. Nevertheless, some post-IPO returns deviates way beyond what is normal and then creates a problem when analyzing averages. To obtain data with representative dis-

[12]Oslo Børs NewsWeb: https://newsweb.oslobors.no/.

[13]GlobeNewsWire: https://www.globenewswire.com/Search.

[14]Because of difficulties finding some prospectus' we did not manage to estimate a fraction of shares sold for Karo Pharma Norge AS, CellCura ASA, Virogates A/S, Aerowash AB, DIBS Payment Services ASA and Funcom NV. We have therefore not included these observations in multivariate regression analysis later in the analysis.

tribution without outliers like this, we have trimmed our sample to exclude observations that lies outside an upper and lower quartile, which should be useful when the data is not perfect normally distributed. The way we remove these outliers is by calculating a zscore for both offer to first close and offer to first month close.

$$zscore_i = \frac{X_i - \bar{X}}{\sigma_i} \tag{3.1}$$

We run a zscore function (equation 3.1) integrated in Python and since return can both be positive and negative we take the absolute value of this zscore. We removed the 1% most extreme observations by excluding all zscores above 5. After adjusting for outliers we are left with 608 total observations, meaning that we removed 6 extreme observations from the sample.

3.1.3 PE Detection and Classification

An essential challenge for this thesis has been to correctly identify and categorize the different types of backing into BO-backed and VC-backed. This is mainly due to the question that we want to answer about the mean-variance relation related to the different distributions. When extracting IPO-data from the Bloomberg Terminal, they classify private equity involvement into "PE-backed" and "VC-backed". Unfortunately, the classification done by Bloomberg is not complete, and we therefore had to do some manual work. Private equity associations like SVCA[15], NVCA[16], DVCA[17] and FVCA[18] depicts memberlist with classification and was used. For the remaining PE firms who weren't on the list we searched on their own websites.

Table 5 present the different samples that consist of 440 NB offerings, 97 BO-backed offerings and 71 VC-backed offerings. In total, PE-backed IPOs constitute 27.6% of the whole sample. The table also presents the distribution of the IPOs, in terms of the different samples during the testing period, and display average deflated offer sizes for the samples with the purpose of illustrating the size of the funds raised. We see that although NB dominates wrt. the number of IPOs, PE still raise as much as 47.8% of total new capital.

[15]Swedish Private Equity and Venture Capital Association: www.svca.se.

[16]Norwegian Private Equity and Venture Capital Association: www.nvca.no.

[17]Danish Private Equity and Venture Capital Association: www.dvca.dk.

[18]Finnish Private Equity and Venture Capital Association: www.fvca.fi.

Table 5: Yearly Observations of IPOs and Offer Sizes

The table reports the distribution of listings (IPOs) and the average offer sizes during the testing period. The offer sizes are deflated to current value and is in norwegian kroner. At the bottom we present the sum and share of listings and the total sum of deflated offer sizes given the different samples.

	IPOs					Offer Sizes				
Year	BO	VC	PE	NB	All	BO	VC	PE	NB	All
2005	8	5	13	26	39	1079	300	779	2658	2032
2006	7	3	10	38	48	1655	330	1258	2453	2204
2007	5	4	9	41	50	1086	255	717	1066	1003
2008	0	0	0	18	18	0	0	0	165	165
2009	0	0	0	4	4	0	0	0	322	322
2010	4	2	6	27	33	5402	251	3685	886	1395
2011	1	1	2	18	20	457	388	422	553	540
2012	0	0	0	10	10	0	0	0	269	269
2013	2	2	4	13	17	3213	192	1702	977	1148
2014	10	1	11	25	36	3149	1123	2965	1103	1672
2015	20	6	26	34	60	3184	216	2499	922	1605
2016	13	9	22	65	87	4328	4062	4219	817	1677
2017	16	28	44	73	117	7152	1669	3663	258	1539
2018	11	10	21	48	69	1909	160	1076	1864	1624
2005-2018	97	71	168	440	608	341003	92093	433097	479889	906051
Percentage	*16.0%*	*11.7%*	*27.6%*	*72.4%*	*100%*	*37.6%*	*10.2%*	*47.8%*	*52.2%*	*100%*

3.1.4 Sample Selection Bias

Heckman (1979) discuss the sample selection bias when dealing with data samples that are not perfect normally distributed. The bias arises when there exist some missing data in our data sample and may be due to self-selection of data or to sample selection decisions we make during the process. Since the IPO market is not perfectly transparent there may occur some issues in our data sample, e.g. the data for offer prices, returns and deal sizes. Bloomberg have provided all necessary data, but some observations have been a cases of missing data for offer to first day close and offer to first month close. In those cases we manually calculated returns based on data from Yahoo Finance.[19]

Another issue is to correctly identify PE-backed IPOs. As earlier mentioned, Bloomberg provides detailed information on IPOs and the PE-backing is marked. Unfortunately, we have observed several observations that is not marked as PE-backed, but after further investigation seems to be PE-backed. To deal with

[19] https://finance.yahoo.com/.

this bias, we have cross-check with previous research on the topic. We have also downloaded data that consist of the five largest selling shareholders at the offer, and further we have manually gone through the whole list and cross-checked with their respective prospectus'.

3.1.5 Survivorship Bias

Ritter (1991) mentions survivorship bias as a potential issue when studiyng IPOs long-term performance, the reason being that companies that have been delisted tends to perform poorly and then pulls down the averages. Since we are focusing on the short-term perspective on investing in IPOs, this bias should not affect our results appreciable. We include all IPOs, including companies that have been delisted, but we do not have any observations where a company have been delisted already one month after the offering, i.e. our first month excess return is not affected. By including delisted companies we are able to avoid survivorship bias.

3.1.6 Omitted Variable Bias

Omitted variable bias is an issue when an important factor is neglected from a regression model. This bias affects our analysis when we present our multivariate testing. This may also be the most relevant potential bias in our analysis since we do not include some variables that previous researchers have found to explain the degree of underpricing. Our multivariate regression model has the purpose to add robustness to our result against different degrees of mispricing related to backing. We have therefore included a PE-dummy and a HQPE-dummy to capture when a private equity firm is involved in the IPO. We also want to test if market capitalization can explain some of the uncertainty which causes different degrees of expected returns. Therefore, we have included a market capitalization variable. Lastly, we have included a variable that shows the fraction of shares sold, by the principal PE owner, in the offering. We will cover these factors in more detail in section 3.6. The main issue that may cause a bias is that we have decided not to include any variable that say something about the underwriter, e.g. the number of underwriters or the underwriters reputation.

3.2 Initial Return

In this section, we start by presenting methods for evaluating IPO performance and mispricing. First we define initial return, which will characterize our analysis as we look at return dispersion between samples. Further we define the term "mispricing" and divide initial return into different time aspects.

When evaluating performance during an IPO, initial return is a fundamental metric when capturing fluctuations relative to the offer price. The time frame to consider when measuring returns is to a certain extent discussed by researchers, and the aspect of adjusting returns to a benchmark is another topic within the field of research, and that is something we have taken into consideration. We can simply explain the metric of initial return as the percentage change between offer price and the first day closing price. Mathematically described as follows, in equation 3.2:

$$IR_i = \frac{P_{i,t+1} - P_{i,t}}{P_{i,t}} \tag{3.2}$$

Where $P_{i,t+1}$, is the closing price for stock i at time $t+1$ and $P_{i,t}$ is the offer price for stock i at time t. To answer the questions regarding whether or not one should invest in an IPOs based on the type of backing we are analyzing means and variances of the return samples. In addition, to capture any size differences we have conducted value weighted returns which will be covered more in detail later.

3.2.1 Mispricing

Before we progress to define the first day and first month excess return, we will highlight the concept of mispricing. The return, both first day and first month, is calculated for each of the IPOs in our sample. The price at the ending of these periods is viewed to be the markets view on the correct price of the company's shares. If the IPO price is set lower than the pricing in the market, then the periods return is positive and we refer to such a scenario as underpricing. If, on the other hand, the periods return is negative, then the offer price was set higher than the markets view on the valuation and this IPO is referred to as being overpriced. Finally, the IPO is correctly priced if the market agrees on the price set in the offer, i.e. that the return over the period is 0%.

3.2.2 Offer to First Day Close

The larger part of previous researchers of IPO underpricing use first day returns[20] (Hatfield & Rielly, 1969; Ritter, 1984; Beatty & Ritter, 1986; Dark & Carter, 1993; Loughran & Ritter, 2004; Hahn et al., 2013). Beatty & Ritter (1986) argues that when dealing with first day returns, there is no reason to adjust for market returns, since market returns are on average very small intraday. Hence, we use first day gross returns in our analysis and do not measure the first day return in excess of any benchmark. Ritter (1984) finds significant underpricing of 26.50% on average, measured as first day return, for the U.S. market between 1960-1982. Loughran & Ritter (2004) examined underpricing between 1990-1998, also in the U.S. market, and reported 14.80% return first day. A more recent publications by Ritter (2016) finds an average first day return of 13.90%, with a testing period from 2001-2015.

Recall, table 2 in the theory part. When investigating whether PE-backed IPOs experience any difference in return dispersion than NB IPOs, previous researcher are in great consensus about using first day return to measure underpricing. Barry et al. (1990) investigates the U.S. markets between 1978-1987 and find statistical support for lower underpricing when a PE firm is involved. This is in line with several colleagues who study IPOs related to financial sponsors (Megginson & Weiss, 1991; Schertler, 2002; Bergström et al., 2006; Levis, 2011). Further, studies shows evidence that BO-backed IPOs experience even lower degree of underpricing. Cao & Lerner (2009) aruges with their paper that BO-backed IPOs are on average significantly larger in terms of size and leverage, they are more profitable and collaborate with more reputable underwriters. Schöber (2008) confirm that BO-backed IPOs only are moderately underpriced, and significantly less underpriced than NB IPOs. He explain why this occur with three arguments. First, because BO-backed issuers are under pressure by a demanding financial sponsor, and files a price more within a range for what is the fair value. Secondly, he argues that BO-backed IPOs benefit from smaller information asymmetries because of prior trading history. Last, BO-backed issuers benefit from the certification effect.[21]

[20] Defined as the return from the offer price to the closing price after the first day of trading.

[21] Certification effect, earlier mentioned in section 2.3.6 and 2.3.7.

3.2.3 Offer to First Month Excess Market Return

Although, the larger part of researchers on IPO underpricing are using first day returns, there are some researchers that measure the return for other time aspects as well. Lowry et al. (2010) points out that one should use monthly returns when testing for underpricing, to circumvent noisy returns due to price stabilization by the underwriters. Unlike the first day returns, we have adjusted these returns with a market index to generate excess market returns. Since we are analyzing the whole Nordic region we will be using the MSCI Nordic Index as the market return.[22] We subtract the market index return from the specific company's first month initial return during the same timeframe within a month after the IPO entry. This have been done by computing codes with Python where we have created functions that merge the one month market return to each entry date.[23] Then we subtracted the market return from the offer to first month close. Mathematically we define first month excess return by equation 3.3 after computation of initial returns.

$$R^{ex}_{i,month} = IR_{i,month} - IR_{benchmark,month} \tag{3.3}$$

3.3 Market Capitalization

In this section, we present the methodology used for dealing with market capitalization as the size measure for issuers. The first concern is about converting local currencies in different time. Secondly, firm-sizes gathered from Bloomberg are not inflation adjusted. After necessary computations we have an eligible variable for size which proxy for less mispricing. Then we are able to compute value weighted returns.

We computed the market capitalization for each issue by multiplying offer prices with the total shares outstanding after the IPO. To convert market capitalization from local currencies into Norwegian kroner, we used the Bloombergs Excel add-in to extract daily cross-currencies[24] within the same timeframe as our IPO data. From here, we constructed a Python function that matches IPO dates to currency spot price dates and then applies a new column where market capitalization is

[22] "MSCI indexes facilitate the construction and monitoring of portfolios in a cohesive and complete manner, avoiding benchmark misfit".

[23] See appendices A.3 listing 4 for python code.

[24] SEK/NOK, DKK/NOK and EUR/NOK.

multiplied with the correct spot price.[25] Since our IPOs are conducted at different points in times, we need to take the time value of money into account to be able to compare them. We have therefore adjusted market capitalization for inflation. After downloading yearly inflation rates for Sweden, Norway, Denmark and Finland we were able to cumulate the CPI rates and we set 2018 as a baseline equal to 1 ($cpi_0^{cum} = 1$).[26]

$$cpi_t^{cum} = \sum_{t=1}^{n} cpi_{t-1}^{cum} \times (1 + cpi_{t-1}) \tag{3.4}$$

We run equation 3.4 on each country's CPI rates, which results in a matrix that contain the 2018-value of NOK 1.00 in each year from 2005-2018. The fact that NOK 1.00 today is worth more than NOK 1.00 tomorrow, due to interest, tells us that the value of one sum received today is greater than receiving the same sum in the future. We can turn the expression if we set the baseline to 2018 and say that e.g, SEK 1,000 in market cap in 2005 would in 2018 be worth to SEK 1,190.[27] Hence, we rather revise market capitalization upwards like all IPOs were done in year-end 2018. Mathematically we can express this as follows.

$$cap_{t,i}^{deflated} = cap_{t,i} \times \frac{cpi_t^{cum}}{365 \times d} \tag{3.5}$$

Where $cap_{t,i}^{deflated}$ is the deflated market capitalization for company i at time t, $cap_{t,i}$ is the market capitalization for company i at time t, cpi_t^{cum} is the cumulative CPI at time t and d is the accrued days from the beginning of the year.[28]

3.3.1 Value Weighted Return

Levis (2011) used value weighted returns when examining differences between PE-backed IPOs and NB IPOs. Hence, to test whether size matters to mispricing we have calculated value weighted return based on the deflated market capitalization.

$$R_{vw,i} = \sum w_i \times IR_i \tag{3.6}$$

Equation 3.6 present the method for calculating the value weighted return and we did this calculations for each sample, meaning that each company have been given

[25] For more detailed information on python codes, see the appendices section A.3.

[26] For more detailed information on CPI-rates, see appendices section A.5.

[27] =1,000×1.19. This example use number from table A.5.1 in the appendices.

[28] Deflator is defined as within statistics as a value that adjust data over time through a given period with often with consumer price indexes.

weight relative to its comparable backing-types. Equation 3.7 shows how we defined the weights (w_i).

$$w_i = \frac{v_i}{\sum_{i=1}^{n} v_i} \tag{3.7}$$

3.4 Equity Offered in the IPO

Here, we define two different metrics used to capture the effect of shares being sold in the IPO. We start by defining shares sold by principal shareholder. Then we define a metric of percentage of shares offered.

3.4.1 Shares Sold by Leading Shareholder

Hypothesis 6 aim to answer whether shares sold by principal PE-owner affect degrees of mispricing. Hence, we need a metric that express how many shares that were sold during the IPO process, i.e., including the stabilization period regarding the over-allotment option.[29] We define the fraction of shares sold during the IPO as the percentage change of holdings to the principal PE-owner.

$$\Delta Shares_i = \frac{Holding_i^{preIPO} - Holding_i^{postIPO}}{Holding_i^{preIPO}} \tag{3.8}$$

The variable for the fraction of shares sold is denominated as $\Delta Shares_i$ and is calculated for each issuer that is backed by a PE firm. Pre- and post shareholdings have been gathered manually and is defined as total shares held before and after the IPO entry. Since leading shareholder both may sell or even buy more shares during the IPO, we will define this variable in a range of [-1,+1], where +1 indicates that the PE firms has done a full exit and -1 means that the PE firm has bought shares and did not own any shares prior to the IPO.

3.4.2 Total Shares Offered to New Shareholders

Further, in the analysis part, we will highlight a metric that explains how much of the total outstanding shares are offered to new investors. The reason is that we want to see how a low of high supply of shares affect the degree of underpricing. If a shareholder is selling a very large fraction of the pre-IPO shareholding, then the shareholder may have to reduce the price of the shares (sell at a discount) to meet the demand. In addition, Habib & Ljungqvist (2001) argues that when an investor

[29] See appendices section A.8.2 for detailed information about principal PE and fraction sold.

sells a relatively small fraction of the shareholding, the investor may be willing to underprice the offering.

$$SharesOffered(\%) = \frac{OfferSize^{deflated}}{MarketCapitalization^{deflated}} \tag{3.9}$$

Equation 3.9 defines our metric for shares offered in the IPO. Offer Size represents, as stated above, the value of the shares being offered to the market, while market capitalization represents the value of the total equity of the issuer. This ratio then represent the percentage of the issuers total outstanding shares being sold in the offering.

3.5 Univariate Testing and Descriptive Statistics

For the question of whether investors should be indifferent between investing in PE-backed IPOs and NB IPOs, we start by conducting several statistical metrics'. We want to find evidence that the different types of backing experience contrasting distributions due to diverse means and variances.

When we investigate hypothesis 1, we run an univariate regression model and use a two-tailed t-test to check whether the first day return and first month excess return is significantly different from zero.[30] Our aim is to test whether PE-backed IPOs are systematically priced more accurate than NB IPOs. Hence, whether these sample distributions experience different post-IPO return dispersion and whether it is testable with statistical significance. To test if BO-backed IPOs is less mispriced than VC-backed IPOs, we test whether there exist a significant difference between the two distributions.

3.5.1 Hypothesis Testing

When testing for mispricing it is common to use t-statistics to test the significance of the results. Since our research question relies on investment decisions between PE-backed IPOs and NB IPOs we want to start by testing if the different types of backing returns are significantly different from zero and then compare the means. We are providing these means with t-statistics where we look up in the t-tables to see if the probability of achieving that t-value is greater (Gujarati &

[30]This regression model is without a constant term, i.e., estimate coefficient measure the sample mean.

Handelsh, 2011). Our empirical testing aim to find evidence of systematic difference in the post-IPO returns. First, we conduct a Levene's Test to examine whether samples holds equal variances (Levene, 1960). This part of our analysis is crucial when concluding about the different return dispersions as further explains different return expectations. Last, we present results from Welch' T-test for unequality of means. To compare sample mean-variance, we also need to compare the different distributions for unequal averages and Welch (1938) developed this test especially for samples with unequal variances.

Levene's Test and Welch Test is conducted for the first day return and the first month excess return, both in EW- and VW terms. We have provided a more mathematically structure of these tests in the appendices.[31]

3.6 Multivariate Testing

In addition to the statistical analysis described above, we have constructed several multivariate regression models. Mainly for two reasons. Firstly, for robustness checking purposes. This is meant to supplement our analysis with estimate coefficients that hopefully points in directions towards lower mispricing. Secondly, we need to answer how the fraction sold by principal PE owners affect the degree of mispricing.

3.6.1 Regression Models

From previous research we see that there exist some regular variables that are used as the explanatory variables. We separate regressions for both first day and first month excess return (r_{1D} and r_{1M} respectively), resulting in four different models. First we present measures that proxy for more precisely value of the issue.

1. **PE** is a dummy variable that equals one if the issuer has a private equity firm as one of the larger selling shareholders, zero otherwise. Since PE normally has much information about the issuer, the shares should be more accurately priced if that information is shared to the underwriters, causing smaller information asymmetries. Since previous studies show consensus in overall underpricing, we expect this also to apply for the Nordic markets, and there-

[31] See appendices section A.2.3.

fore resulting in positive alpha. Hence, we expect PE estimate coefficient to be negative as PE involvement should decrease the level of underpricing.

2. **HQPE** is a dummy variable that equals one if the issuer is backed by a reputable PE firm that is experienced with divesting through IPOs as an exit route. Technically, we scored each PE firm in our sample with zscores related to completed IPOs, firm age, sum capital raised through IPOs and average market capitalization on their issues. These factors were given different weights, where our focus is about repeated interaction and therefore we gave completed IPOs 50% weight, while the remaining factors with 16.67% each. This resulted in 5 different PE firms with 51 listing together. Recall, our research question, we want to test whether repeated interaction in the IPO market by PE firms lead to lower return dispersion and therefore lower expected risk and return. Hence, we except HQPE's estimate coefficient to point in the direction of less mispricing.

3. **Year 2008** is a dummy variable that equals one if the entry date set place within January 2008 and June 2009, zero otherwise. The purpose is to capture what effect a financial downturn has for the IPO market and in addition to avoid omitted variable bias at some extent. The financial markets between 2007-2009 experienced a heavy bearish sight as stock exchanges all over the world fell dramatically. We therefore expect this estimate to be quite negative.

4. **log(size)** is the logarithm of the issuers deflated market capitalization. We convert market capitalization to log size due to circumventing the large variations in this data. Previous researchers disagree to some extent when it comes to capturing size. Offer sizes are often used but we find support for including market capitalization as proxy for lower mispricing. The issuers size correlates to the company's maturity, and we therefor expect this estimate to be negative as larger size implies less uncertainty.[32] Hence, lower underpricing.

5. **ΔShares** is the percentage change of what the principal PE-owner sold off his original holdings. As mentioned earlier we have included the over-allotment option to get the signal value of expected shares sold in the stabilization period. Higher amount of shares being offered requires selling shareholders to

[32] Recall, "Small-firm effect", described in section 2.3.9.

sell at some discount, therefore we expect this estimate to be positive.

Our multiple regression models may be exposed to omitted variable bias due to missing explanatory variables, according to previous studies. Schöber (2008) for instance, included underwriter rank, which is an official ranking by Carter-Manaster on the lead underwriters. He also included a dummy variable that equaled one if the issuer had been listed before to capture the effect of information asymmetries. We have also discovered that a numerous of previous researchers use offer sizes as explanatory variables (Schöber, 2008; Bergström et al., 2006) while Lowry et al. (2010) used shares offered on a logarithmic form. Levis (2011) on the other hand, included market capitalization and explains this inclusion with that the market capitalization correlates positively with the financial sponsor's level of reputation. Size differences also exist within the PE-segment, recall table 4. BO-backed IPOs are close to twice as large as NB and also significantly larger than VC-backed IPOs, in terms of both the mean and median. Further, we saw in table 4 that BO firms on average sells off more than twice as much of their pre-IPO shareholding than VC firms. Since we only have measured that fraction of shares sold within PE-backed IPOs, we will only include this variable as an addition to equation (3.10) and (3.11).

$$r_{1D} = \alpha + \beta_0[PE] + \beta_1[HQPE] + \beta_2[log(size)] + \beta_3[Year2008] \tag{3.10}$$

$$r_{1M} = \alpha + \beta_0[PE] + \beta_1[HQPE] + \beta_2[log(size)] + \beta_3[Year2008] \tag{3.11}$$

Model 1 (equation 3.10) tempt to throw light at hypothesis 2 and give robustness to our findings.[33] Whether there is underpricing or overpricing in general, throughout the market, depends on which direction the constant term points. Since we expect the whole market to be on average underpriced, PE contributes to lower underpricing if its estimate coefficient turns out to be negative. Further, the model tests whether size matter to post-IPO return dispersion. We want to find support for hypothesis 5 that larger companies imply smaller return dispersion.[34] Model 2 (equation 3.11) is an identical regression model as model 1 in terms of explanatory variables, but is rather subject to the first month excess return. Both models also include HQPE, with the purpose of trying to explain the degree of mispricing by the

[33]Hypothesis 2: On average, PE-backed IPOs in the Nordic region experience a lower degree of mispricing than NB IPOs.

[34]Hypothesis 5: A company's market capitalization has an effect on the degree of mispricing.

fact that some shareholders have more experienced from listing companies.

$$r_{1D} = \alpha + \beta_0[HQPE] + \beta_1[log(size)] + \beta_2[\Delta Shares] \tag{3.12}$$

$$r_{1M} = \alpha + \beta_0[HQPE] + \beta_1[log(size)] + \beta_2[\Delta Shares] \tag{3.13}$$

Model 3 (equation 3.12) is only including PE-backed IPOs as we are trying to capture the effect of shares sold by principal owner. First of all, we excluded the Year 2008 factor, since there were none PE-backed IPOs during this period.[35] The model is constructed that a dummy variable equals one if the issue is backed by one of the most experienced PE firms in the Nordic market, zero otherwise. It also includes the size factor, to examine whether market capitalization can explain the level of mispricing. Model 4 (equation 3.13) is an identical model, except that it is subject to first month excess return as dependent variable. Finally, we extend the models by including a variable for fraction of shares sold. We will further in the analysis part come back with the results from these regression models, in the section where we go through multivariate regression results.

[35] Recall, table 5, there were none IPOs backed by any private equity firms.

4 Empirical Analysis and Results

In this section we present the results and interpretations of our analysis. The analysis will be divided into four parts. Firstly, we will focus on the returns/mispricing both wrt. the first day and first month excess return. We will analyze the distribution of our data and then the return in the different markets and the return for the different types of backing. Secondly, we will present the univariate t-tests, again for the first day return and the first month excess return. Thirdly, the focus will be turned to the results of the multivariate t-tests, which applies the regression models presented with equation (3.10)-(3.13) in section 3.6.1. Fourth, and lastly, results from some of the most experienced PE firms will be presented.[36] This section aims to investigate whether high quality PE firms, which have repeated interaction with the capital markets through multiple IPOs, possess the necessary experience to price the offering more accurately than the average IPO.

4.1 Mispricing Results

Recall, section 3.2.1 in the methodology part, where we present the term mispricing. We refer to the IPOs with a 0% return as being correctly priced. The ones that have a positive return are denoted as underpriced and the ones with negative returns are denoted as overpriced. We will now, as described above, start by investigating the distribution of our data.

4.1.1 Distribution

In figure 3 we see the histogram for both the first day and the first month excess return. At first glance we can observe that both samples are tailored in the positive direction of the return specter, with the first month excess return experiencing the most extreme values. A Jarque Bera test rejects the null hypothesis' that our samples follow a normal distribution at any significance level.[37] For the first day return we report a kurtosis of 7.67 and skewness of 1.35, while for the first month excess return we report a kurtosis of 8.23 and skewness of 2.22. The kurtosis contributes to explain the probability distribution on how the sample data is distributed between the extremes, where values larger than 3 can be considered as excess kur-

[36] Experience in terms of the number of exits through an IPO.

[37] Jarque Bera: More detailed information about the test see appendices section A.1.

tosis.[38] Large extreme values, such as our data provides, may be evidence of "fat tails" and results in a leptokurtic distribution. Supplementary, skewness explains the symmetry of the probability distribution where values close to zero indicates that the sample is symmetric. The extensive values in skewness can be explained by some of the extremely large observations in NB. We find a maximum of 147.33% for the first day return and 210.74% for the first month excess return.[39] These particular findings can be found in the row "Max %" in table 8 and 10. From table 8 and 10 we observe that BO-, VC- and PE-backed IPOs have levels of kurtosis and skewness that indicates that these samples are more alike the normal distrbution. However, all fails to accept the null hypothesis when we conduct a Jarque Bera test.[40] As Ritter (1984) mention, investors should get rewarded by taking risk when investing in newly issued firms. This would indicate that the majority of the observations should be concentrated around a mean which is larger than zero. This is, in fact, what we find in our sample and the histogram in figure 3 depicts no big surprise to what we should expect. The mean underpricing will be investigated further in the next section, following figure 4, which displays the density functions for the different types of backing.

Figure 3: Distribution of the Sample: First Day Return and First Month Excess Return

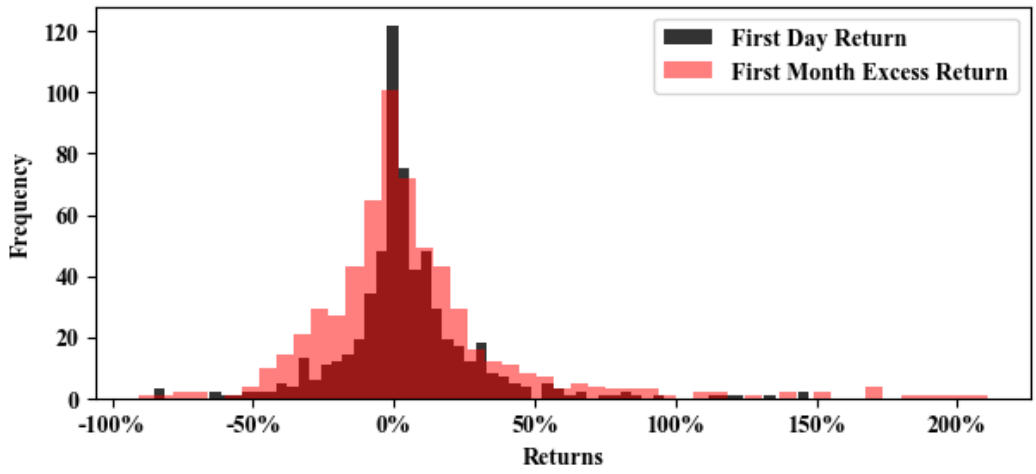


Figure 4 displays four different density functions. The reason for highlighting these subplots is to provide some additional insight in addition to figure 3. If we

[38] A "tail" that is in excess of the normal distribution.

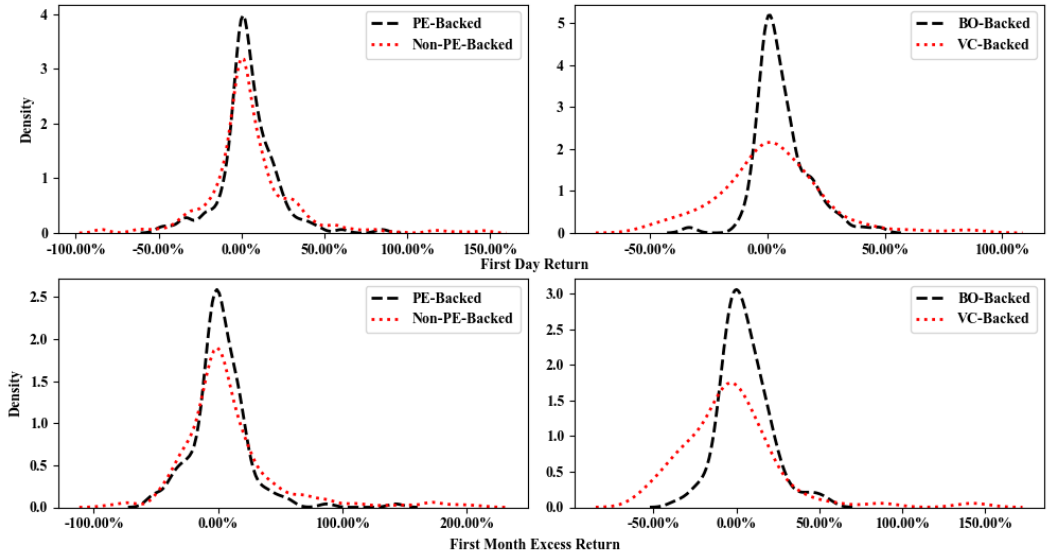
[39] Crunchfish AB and The Marketing Group PLC respectively.

[40] For test results see appendices section A.4.1.

first focus on the density function for the PE-backed versus the NB IPOs, we can graphically observe that the difference in the distribution is relatively small, especially for the first day return (subplot 1). Further, the difference in the distributions for the first month excess return (subplot 3) is somewhat larger. Hence, these subplots do not confirm hypothesis 4.[41] However, we see that NB IPOs experience a lot greater return dispersion in terms of more leptokurtic distributions. Unlike subplot 1 and 3 we observe larger differences in subplot 2 and 4. Subplot 2 and 4 shows that the distribution of BO-backed IPOs are to a larger degree concentrated around the mean, i.e. there are relatively fever extreme observations, than for the VC-backed IPOs. From these four subplots we observe that the distribution for the VC-backed IPOs are the most fragmented. This is closely connected with the variance in the returns, which we will comment on later.

Figure 4: Density Subplots: First Day Return and First Month Excess Return

Subplot 1 and 3 displays the density functions for the return of the PE-backed and non-PE-backed IPOs wrt. the first day return and the first month excess return, respectively. Subplot 2 and 4 shows the density functions for the return of the BO-backed and VC-backed IPOs, for the first day return in subplot 2 and the first month excess return in subplot 4.



[41] Hypothesis 4: PE-backed IPOs experience a lower dispersion in post-IPO returns than NB IPOs.

4.1.2 First Day Return

As a background for the underpricing results that will be presented, we will first highlight table 6. The table displays the number of IPOs in our sample. It also separates between the type of backing and to which market the shares were listed on. This table reviles that most of the IPOs are NB and that most of the PE-backed IPOs are backed by BO firms, rather than VC firms. This is consistent across the four markets. Sweden is the largest market in terms of total number of IPOs, followed by Norway, Denmark and Finland respectively.

Table 6: Number of IPOs by Market

	Sweden	Norway	Denmark	Finland
All	361	145	53	49
NB	257	112	36	35
PE	104	33	17	14
BO	53	23	13	8
VC	51	10	6	4

Looking further at the different Nordic markets, we present table 7 which displays the average underpricing of the IPOs in our sample. The table separates between the type of backing in the four Nordic markets. The result shows that there is an average underpricing in all markets across all types of backing, represented by positive numbers in all cells. This is consistent with research presented in table 1, and our first hypothesis.[42] Overall, the average underpricing is largest in Sweden (6.15%), followed by Denmark (5.57%), Finland (3.81%) and Norway (1.14%). Looking further at the table, we observe relatively large variations in terms of return between the different types of backing and variation between the different countries. There seems to be no clear pattern explaining the degree of mispricing with the type of backing across these markets. The next section will continue with focusing on the underpricing, but will separate between the types of backing rather than the different markets.

[42]Hypothesis 1: All sample IPOs in the Nordic region experience underpricing in prior to an IPO.

Table 7: Average First Day Return of IPOs by Market

	Sweden	Norway	Denmark	Finland
All %	6.15	1.14	5.57	3.81
NB %	6.66	1.23	4.43	4.80
PE %	4.90	8.45	8.42	1.73
BO %	8.84	1.03	11.87	0.64
VC %	0.80	0.42	3.81	5.28

The return data is presented in table 8, were we report some key statistical metrics for the different types of backing for the first day return. The whole IPO sample, with the 608 different observations, reports a mean and median of 4.70% and 1.81% respectively. This is in line with the observed positive skewness viewed in figure 3. The results are also consistent with previous researchers, such as Ritter (1984); Dark & Carter (1993); Ljungqvist & Wilhelm (2003), in terms of showing a positive first day return/underpricing. However, the degree of underpricing in our sample is lower than what has been found in previous research. From table 1 we observe that none of the previous studies reported an underpricing that is lower or as low as 4.70%, such as our findings. However, it is important to note that the majority of research presented in table 1 has been done in the US markets and on data prior to year 2005. Moving on to the different types of backing, we find that NB averages 4.94% and have a median of 1.43%. At the same time, PE experience a more narrow relation between the mean and median (4.07% and 2.44% respectively), which is also supporting less dispersion in first day returns and adds as support to studies by Barry et al. (1990); Megginson & Weiss (1991); Bergström et al. (2006); Levis (2011). This is emphasized by the maximum and minimum values for the samples. We see that NB undoubtedly have larger extreme values than PE, where closed intervals comprise [-85.21%,147.33%] and [-49.43%,85.00%] respectively. When it comes to post-IPO return dispersion, we see that NB sample deviates more than PE, reporting a standard deviation of 27.00% while PE varies to a lesser extent with a reported standard deviation of 17.03%. This is consistent to what (Levis, 2011) found in his paper where he reported NB as the most volatile investment, followed by VC and last BO-backed IPOs as the least risky choice to subscribe shares with.

The mean underpricing of PE-backed IPOs is 4.07%, while 4.95% for the

NB IPOs. This implies a weak, if any, support for hypothesis 2.[43] BO-backed IPOs has a mean underpricing of 6.14% and its median is lower at 3.48%, while VC-backed reports a mean and median at 1.25% and 0.83% respectively. This results does in somewhat degree contradict our hypothesis 3, that BO-backed should experience lower expected returns than VC-backed.[44] On the other hand, we can see that the minimum and maximum is more extreme for VC-backed [-49.43%,85%] than for BO-backed IPOs [-33.33%,47.50%]. As VC-backed investments are typically being early stage companies, Levis (2011) reports VC-backed IPOs holding higher risk than BO-backed, and our results shows that this also apply for the Nordic markets. VC-backed deviates significantly more with a standard deviation of 22.42%, while BO-backed reports a standard deviation of 11.31%. In terms of the first day return, the NB IPO seems to be the most risky in terms of volatility, measured as the standard deviation, followed by the average of all IPOs, then VC-backed, PE-backed and finally BO-backed as the least risky. This is also consistent with previous research done by Levis (2011) who reported significantly lower standard deviation for PE-backed than for NB, and also that BO-backed experienced lower variations in terms of standard deviation than VC. We will move on to look at the first month return data, highlighting the most important findings and compare these with the result from the previous section, which focused on the first day return.

Table 8: Descriptive Statistics First Day Return

	BO	VC	PE	NB	All
Obs	97	71	168	440	608
Mean %	6.14	1.25	4.07	4.95	4.70
Median %	3.48	0.83	2.44	1.43	1.81
Max %	47.50	85.00	85.00	147.33	147.33
Min %	-33.33	-49.43	-49.43	-85.21	-85.21
SD %	11.31	22.42	17.03	27.00	24.64
Kurtosis	2.8927	2.4633	4.0959	6.7975	7.6667
Skewness	0.7814	0.6452	0.4639	1.3641	1.3534

[43]Hypothesis 2: On average, PE-backed IPOs in the Nordic region experience a lower degree of mispricing than NB IPOs.

[44]Hypothesis 3: On average, BO-backed IPOs in the Nordic region experience a lower degree of mispricing than VC-backed IPOs.

4.1.3 First-month Excess Return

Table 9 display the same statistics for the first month excess return as table 7 does for the first day return, namely the mispricing for the different types of backing in the four Nordic markets that we investigate. Recall, that we measure the first month return in excess of the MSCI Nordic Countries Index. While table 8 disclose an underpricing across all the markets and the different types of backing, the results are more mixed when we extend the measure of return to the first month excess return. For the average IPO, independent of the type of backing, we observe a positive first-month return in Sweden, Denmark and Finland, but not in Norway. The excess return is slightly negative and it seems that there is, on average, no excess profit from purchasing shares in an IPO with the aim of selling it with a profit one month later, in Norway. The excess return is also low in Finland, while Sweden and Denmark stands out with relatively high returns. The returns for the different types of backing seems inconclusive across the different countries, i.e. there is no clear pattern.

Table 9: Average First Month Excess Return of IPOs by Market

	Sweden	Norway	Denmark	Finland
All %	9.57	-0.68	9.78	2.16
NB %	12.56	-0.51	11.94	3.23
PE %	2.18	-1.23	4.38	-0.10
BO %	7.71	-1.53	13.17	0.46
VC %	-3.56	-0.53	-7.35	-1.94

Looking further at the return data, we have table 10, which reports the first month excess return for the different types of backing rather than the different Nordic markets. The mean for all IPOs is 6.50% and the median is 0.78%, i.e. a slightly higher mean when measuring return after the first month than when measuring it after the first day of trading. This is less than what (Lowry et al., 2010) found in the US market in the period 1965-2005 (22% average first month return). We would argue that the lower first month return in the Nordic market is eligible, given that previous research finds lower first day returns in the Nordic market than in the global market. E.g. Pukthuanthong et al. (2013) finds a first day return of 7.48% in the Nordic market versus 29.33% in the global markets, between 1995-

2002. Measuring return over one month, we find support that PE-backed IPOs are less mispriced than NB IPOs, hence hypothesis 2.[45] Like Lowry et al. (2010) we find a high standard deviation in returns, i.e. the outcome of investing in the average IPO and selling the investment after one month is highly uncertain. They find a standard deviation of 55% versus our 37.10%. The average first month excess return from investing in BO-backed IPOs is 5.00%, -3.36% for VC-backed and as high as 8.42% for the NB. The average first month excess return, independent on the type of backing, is 6.50%. By looking at the basket of BOs and VCs, we find that the average PE-backed IPO gives a slightly positive excess return of 1.47%. This is an indication that the market, on average, agrees that the offer price is the correct price of the company. The variation in returns, as mentioned above, are high. We find that the NB IPOs have the highest standard deviation, followed by the average of all, VC-backed, PE-backed and finally BO-backed. Even though the standard deviations are at high levels, it seems that BO-backed IPOs are the least risky investments. This ordering of the level of risk from the different type of backings is identical for the first day return (presented in table 8) and the first month excess return. This provides us with a solid proof that confirms our fourth hypothesis.[46] The following section will continue with the second section of the analysis, i.e. the univariate t-testing.

Table 10: Descriptive Statistics of First Month Excess Return

	BO	VC	PE	NB	All
Obs	97	71	168	440	608
Mean %	5.00	-3.36	1.47	8.42	6.50
Median %	3.50	-3.42	-0.20	0.92	0.78
Max %	54.30	142.66	142.66	210.74	210.74
Min %	-35.75	-54.84	-54.84	-90.85	-90.85
SD %	15.08	30.36	23.11	41.07	37.10
Kurtosis	1.5943	7.4380	8.7688	6.5744	8.2372
Skewness	0.6308	1.8761	1.5061	2.0672	2.2186

[45] On average, PE-backed IPOs in the Nordic region experience a lower degree of mispricing than NB IPOs.

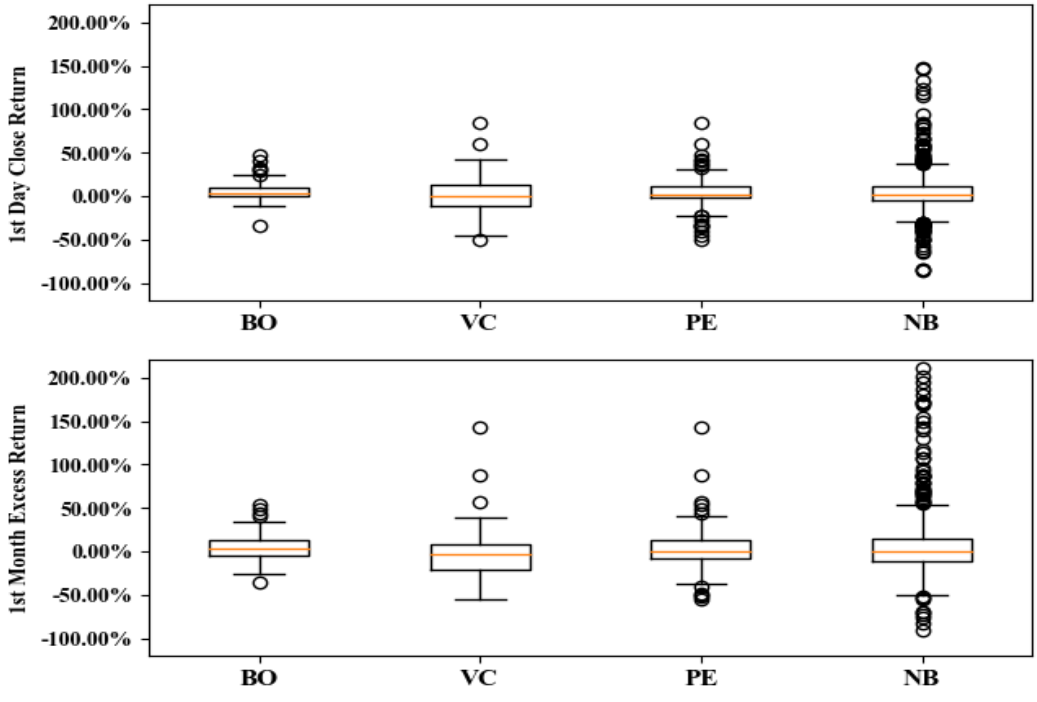
[46] Hypothesis 4: PE-backed IPOs experience a lower dispersion in post-IPO returns than NB IPOs.

4.2 OLS: Univariate t-testing

To start with, we want to focus on the variance in the returns. A graphical representation of the variance can be observed below, in figure 5, which shows the different distribution of returns in relation to its quartiles. From this graphical representation, it seems that NB experience a larger amount of extreme observations, which drives up the level of uncertainty in these IPOs. The PE-backed IPOs do not have the same extreme observations as NB, thus providing support for hypothesis 4.[47] This finding is to some degree supported by what Megginson & Weiss (1991) finds in their research, where they argue that PE involvement assures more certainty about the quality of the IPO investment, thus reducing uncertainties about the issue which then should materialize in a lower dispersion in returns. Hypothesis 3 also receives strength as we can see that BO-backed experience lower extremes than VC-backed.[48] Looking further at the returns, we will separate between Value Weighted (VW) and Equal Weighted (EW) returns.

Figure 5: Boxplot: First Day Return and First Month Excess Return

The orange line represents the mean, the box around the orange line displays the interquartile range (50% quartile), the boundaries represents the 95%-quartile and the dots are extreme values.



[47] Hypothesis 4: PE-backed IPOs experience a lower dispersion in post-IPO returns than NB IPOs.

[48] Hypothesis 3: On average, BO-backed IPOs in the Nordic region experience a lower degree of mispricing than VC-backed IPOs.

4.2.1 First Day Return

We can see from the past that the larger part of previous researchers have tested both equal weighted and value weighted averages when studying IPO returns (Levis, 2011; Beatty & Ritter, 1986; Bergström et al., 2006). In this part of our analysis we tend to use t-tests to emphasize our hypothesis and we have tested both EW- and VW return with t-statistics with the purpose of providing significance to our results. We have also performed mean comparisons between the samples with unequal variance as supplement to test whether we can tell if there exist differences in the distributions.

Levis (2011) examines the first day returns and find that PE-backed IPOs, both in EW- and VW terms, are less underpriced than NB and that BO-backed experienced lower underpricing than VC-backed IPOs. He describe this with the reasoning that IPOs which are backed by a PE firm implies lower risk in the offering, more contentious pricing and with higher assurance that the IPO investment is of a greater quality.[49] Further, when we investigate the mispricing with a t-test we focus both on first day return and first month excess return. The majority of previous studies have used first day returns, as mentioned earlier in table 1 and 2. Lowry et al. (2010) on the other hand, used first month excess returns when examining IPO underpricing and emphasized that IPOs on average are underpriced. He also argue that IPOs backed by VC tend to imply more volatility and involves a greater degree of information asymmetry than NB. However, he finds that VC-backed IPOs is more accurately priced, which contradicts his arguments.

Moving on to the results of our analysis, we find that both the EW- and the VW terms for the whole sample indicates underpricing and is significant at any level, again confirming hypothesis 1.[50] See table 11 for the results. PE is to a certain extent less underpriced than NB considering an average closer to zero. Meaning that PE-backed EW- and VW return is closer to zero than NB at 5% significance level and at 1% significance level, respectively. This tells us nothing about the differences between the sample distributions, only that their means is differently unequal from zero. Our analysis does not yield significant results regarding post-IPO return

[49] Support to certification effect.

[50] Hypothesis 1: All sample IPOs in the Nordic region experience underpricing in prior to an IPO.

for VC-backed IPOs, neither for the EW- and VW terms. One explanation for this may be the large dispersion of returns and a relatively small sample size. A further explanation may be due to the level of uncertainty associated with investments in companies within an early stage. Though statistically insignificant, VC-backed seems to experience lower expected return, both in EW- and VW terms, than the IPOs with the other types of backing. BO-backed is significantly less underpriced (at 10% significance level) than NB when it comes to VW return, but more underpriced in EW terms. The BO-backed VW return equals 1.86% which is less than 3.77% for NB, and the EW return equals 6.14% which is larger than 4.95% for NB. This results contradicts in some extent previous research and our third hypothesis, that BO-backed should expect less return relative to VC-backed.[51] On the other hand, as BO-backed issuers typically are more mature companies with larger market capitalization, and the VW-measure gives larger companies higher weights, we put more emphasis on the VW- than the EW measure when investigating hypothesis 5.[52] The result, from looking at the difference in the VW return for PE versus NB, adds support to hypothesis 5 that the size matters to the level of uncertainty and hence the return. Our results emphasizes some evidence to PE-backed IPOs being less mispriced than NB IPOs and is in consensus to findings by Hogan et al. (2001), among others, where they find patterns of lower degree of first day return if IPOs are PE-backed.

Table 11: OLS First Day Return

Backing Type	Obs	EW %	t-stat	VW %	t-stat
NB	440	4.95***	4.1935	3.77***	6.7474
PE	167	4.07**	2.1122	2.08***	2.6379
BO	97	6.14***	2.4224	1.86*	1.7323
VC	71	1.25	0.4196	0.23	0.2366
All	608	4.70***	4.7067	5.85***	12.9091

Two tailed t-values: * t_{10}:1.65, ** t_5:1.96, *** t_1:2.58

To compare post-IPO return dispersion for the different samples we have conducted the Levene's test. First we define a metric for comparison of variances,

[51] Hypothesis 3: On average, BO-backed IPOs in the Nordic region experience a lower degree of mispricing than VC-backed IPOs.

[52] Hypothesis 5: A company's market capitalization has an effect on the degree of mispricing.

θ_{σ^2}, which is a variance ratio between the samples. In table 12 we display the results of variance comparison for first day return both for the EW- and VW terms. To begin with, we find the ratio for EW NB/PE to be 2.52 and significant at any level. This implies that NB experience more than twice as much uncertainty as PE-backed. We also find statistical support that NB holds 5.74 times more variance than BO-backed, which is in line with our hypothesis'. VC-backed can be considered less risky than NB, but since we have no significant results both in EW- and VW terms, we cannot conclude that VC-backed is less volatile than NB. On the other hand, we find support that VC-backed IPOs holds 3.91 times more variance than BO-backed, which supports our third hypothesis.[53] For the VW term, we find some different results. First, we only find significant results for BO-backed being less risky than NB. We can see that the variance ratio for NB/PE is 1.32 but with no statistical support. NB/BO equals 1.23 and is significant at 10% level, while VC/BO equals 0.59 and is significant at any level. We find this a bit strange, as a VW variance ratio less than 1 implies that BO-backed have greater variance.

Table 12: Variance Comparison First Day Return: Levene's Test

	Obs	EW θ_{σ^2}	t-stat	VW θ_{σ^2}	t-stat
NB/PE	440/168	2.52***	9.21	1.32	0.51
NB/BO	440/97	5.74***	15.68	1.23*	3.12
NB/VC	440/71	1.47	0.13	2.09	1.13
VC/BO	97/71	3.91***	17.18	0.59***	10.78

Two tailed t-values: * F_{10}:2.71, ** F_5:3.84, *** F_1:6.64

In table 13 we present our findings for mean comparison of first day return. For EW return we find no statistically evidence for mean differences in the samples, i.e., that can statistically said to be significant at 10% level, except for BO-backed and VC-backed. Their averages differs with 489 bps[54] and is significant at the 10%-level. Though insignificant, we see that PE is 87 bps less underpriced than NB on average, while with VW return PE-backed is 169 bps less underpriced than NB. Looking further at the VW term, our overall findings is somewhat more statistically significant. NB and BO differs with 191 bps and is significant at 10%, same as

[53] Hypothesis 3: On average, BO-backed IPOs in the Nordic region experience alower degree of mispricing than VC-backed IPOs.

[54] bps: Basispoints. 100 bps equals 1 percentagepoint.

for NB and VC who differ with 354 bps and is also significant at 10%. The mean difference between BO and VC is significant at 1% where BO-backed is 163 bps less underpriced than VC-backed, which supports hypothesis 3 and previous research by Levis (2011) who also reports significant lower mispricing for BO-backed than VC-backed for both EW- and VW return.

Table 13: Mean Comparison First Day Return: Welch Test

	Obs	EW $\Delta\%$	t-stat	VW $\Delta\%$	t-stat
NB minus PE	440/168	0.87	0.4735	1.69	-0.9135
NB minus BO	440/97	-1.20	-0.6934	1.91*	-1.7800
NB minus VC	440/71	3.70	1.2503	3.54*	1.6463
BO minus VC	97/71	4.89*	1.6880	1.63***	2.9894

Two tailed t-values: * t_{10}:1.65, ** t_5:1.96, *** t_1:2.58

4.2.2 First Month Excess Return

Now that we have presented the results for the first day return, we will correspondingly continue with the results for the first month excess return. The results in table 14 implies that Nordic IPOs are on average statistically significantly underpriced with an EW average of 6.50% excess return. This contributes further to answer hypothesis 1, namely that IPOs on average are underpriced, and supports Lowry et al. (2010) studies on the field of IPO underpricing. This is also true for the VW return of 5.97% which is significant at any level. We find that PE-backed returns on average 1.47% and this is significant at 10%-level for EW, while for VW we see the same pattern with less underpricing than NB, but this is not statistically significant. For BO-backed we see that EW- and VW terms equals 5.00% and 2.18% respectively, but we do not find sufficient statistical support at the 10%-level. However, their estimated t-statistics is not far from 1.6449, which is required to accept the mean at 10% significance level. We find no support that VC should be more accurately priced than NB just like Lowry et al. (2010) reports in their paper. Rather that VC-backed on average are overpriced with 3.36% on EW term, but with no statistical significance. Neither does VW return, which also implies overpricing for VC-backed with no statistical support. Regardless, that the estimates for VC-backed is on average closer to zero than BO-backed (less mispricing), we cannot find sig-

nificant results that our results for the first month excess return gives supports to hypothesis 3, although we see that the t-statistics for VC-backed is considerably closer to zero, implying that VC-backed experience greater return dispersion between extremes.[55] This gives some support to the fact that VC-backing holds more uncertainty among investors regarding whether the correct offer price is set prior to the IPO.

Table 14: OLS First Month Excess Return

Backing Type	Obs	EW %	t-stat	VW %	t-stat
NB	440	8.42***	5.7441	4.04***	4.7762
PE	168	1.47*	1.7618	1.93	0.5041
BO	97	5.00	1.5143	2.18	1.3082
VC	71	-3.36	-0.2229	-0.26	-0.7520
All	608	6.50***	10.2885	5.97***	4.3186

Two tailed t-values: * t_{10}:1.65, ** t_5:1.96, *** t_1:2.58

For the first month excess return we find more significant results for different levels of variance, than for the first day return. As for the first day return, we have conducted the Levene's test, and the results are displayed in table 15. The first results that we highlight from the EW term is that all variance ratios are significant, except NB/VC where we do not find any statistical support. Nevertheless, NB/VC equals 1.85 and implies that NB experience compelling first month excess return dispersion than VC-backed. However, it is far from NB/BO that equals 7.48 and implies a large difference in return dispersion. Also NB/PE with variance ratio of 3.17 implies much more variation in returns for NB over PE-backed, and we see that VC-backed holds 4.03 times more variance than BO-backed. Finally, we find comparable result for VW terms, except NB/PE where Levene's t-statistics imply no evidence for unequal variance. Here as well, we see that VC/BO turns less than 1, with statistical significance at any level. These findings are proportionate to the results for the first day return and indicate that VW variance is greater for BO-backed than VC-backed.

[55] Hypothesis 3: On average, BO-backed IPOs in the Nordic region experience a lower degree of mispricing than VC-backed IPOs.

Table 15: Variance Comparison First Month Excess Return: Levene's Test

	Obs	EW θ_{σ^2}	t-stat	VW θ_{σ^2}	t-stat
NB/PE	440/168	3.17***	13.87	1.14	2.02
NB/BO	440/97	7.48***	17.31	1.12***	6.95
NB/VC	440/71	1.85	1.68	2.30	0.91
VC/BO	97/71	4.03**	4.04	0.48***	8.94

Two tailed t-values: * F_{10}:2.71, ** F_5:3.84, *** F_1:6.64

In table 16 below we have computed mean differences between the samples for the first month excess return and performed a mean comparison test to check if there exist some differences in the samples means. We calculated Welch t-statistics for samples with unequal variance to test the significance. When we look at EW average, we find PE-backed to be 695 bps less underpriced than NB and significant at any level. This adds support to answer hypothesis 2, that PE-backed IPOs experience lower degree of mispricing than NB IPOs. On the other hand, we do not find any statistical evidence at 10% significance that BO-backed average is any different from NB. NB differs 11.78 bps to VC-backed and is significant at any level. Lastly, our results show that BO-backed positively differs 836 bps to VC-backed and is significant at 5%. This contradicts hypothesis 3, that BO-backed should be less mispriced than VC-backed IPOs because of higher level of uncertainties related to VC-backed typically being early stage companies. Same for the VW term where BO-backed positively differ 244 bps to VC and is significant at any level. Unfortunately, hypothesis 2 do not receive further support from VW average comparison as our estimate do not seem to hold any statistical evidence. Following the table below we continue with the third section of our analysis, the multivariate t-testing.

Table 16: Mean Comparison First Month Excess Return: Welch Test

	Obs	EW $\Delta\%$	t-stat	VW $\Delta\%$	t-stat
NB minus PE	440/168	6.95***	2.6265	2.11	-0.4216
NB minus BO	440/97	3.42	1.3776	1.86*	-1.7214
NB minus VC	440/71	11.78***	2.8730	4.30**	2.6532
BO minus VC	97/71	8.36**	2.1347	2.44***	3.2172

Two tailed t-values: * t_{10}:1.65, ** t_5:1.96, *** t_1:2.58

4.3 OLS: Multivariate t-testing

The multivariate regression models (1-4) derived in section 3.6.1 have the purpose to help identify proxies that affect post-IPO returns. Table 17 shows the results after running these regression models.

From model 1 and 2 we find evidence suggesting that the Nordic IPO market experience underpricing, given the positive constant terms (α). However, model 1 reports a constant of 4.41% which is not statistical significant. Further, PE reports an estimate coefficient of -1.46%, which point in the direction of less underpricing when a PE firm are involved as leading shareholder. Nonetheless, model 1 give no statistical support saying that PE-backed IPOs means lower underpricing. We can say that a 1% change of market capitalization, the difference in the expected return equals 0.0012%. Although, with no statistical significance that market capitalization explaining the level of underpricing. Neither for the Year 2008 factor, which indicate negative returns for the offerings in this time period, we find statistical significant results. HQPE estimate coefficient points in the direction for more underpricing when a issuer is backed by a PE firm with more experience doing IPOs. However, the results are not significant and show no evidence of that repeated interaction explains post-IPO returns.

We see much of the same patterns in model 2 which reports statistical significant underpricing for the first month excess return, with a constant term of 9.05%. Also when it comes to PE-involvement we find statistical evidence for lower underpricing with PE estimate coefficient of -8.93%, pointing in the direction for less underpricing. On the other hand, we find no statistical support saying that market capitalization explain the level of underpricing in this model, although it points in the direction of less underpricing when size increase. Neither the Year 2008 factor have significant support. However, the estimate coefficient indicates that IPOs within a bearish period are considered overpriced. Same as model 1, this model's HQPE estimate coefficient imply with no significance larger underpricing when highly reputable PE firms are involved.

Further, we see that model 3 only holds 163 observations as we also seek

to capture the effect of shares sold by principal selling shareholders.[56] When examining PE-backed IPOs alone, we find results suggesting overpricing, given all other variables set to zero. However, we cannot say that it is significant at the 10%-level. The practice of overpricing decrease some as market capitalization increase, which indicates less mispricing and supports hypothesis 5.[57] More precisely we can say that a 1% increase in market capitalization, leads to an decrease in expected overpricing with 0.0148%. The fraction of shares sold estimate indicates that the more shares a principal PE firm sells, the lower is the overpricing. Unfortunately, we find no statistical significance at 10%-level. Neither does HQPE with estimate of -1.03%, although it points in the direction of more overpricing than for the remaining PE-backed IPOs.

Lastly, we report results for model 4, like model 2 also subject to the first month excess returns. In this regression results we find even more significant estimates indicating a practice of overpricing with a constant term of -16.77%. The overpricing will in turn decrease with 0.0225% as market capitalization increase with 1%, significant at 5% level. This means that larger size leads to less overpricing and add support to our fifth hypothesis. We find no statistical support for saying that HQPE set more accurately offer prices, but at least the estimate of 1.41% implies less overpricing. Neither the fraction of shares sold by principal selling shareholder is significant, but the estimate of 6.83% implies less overpricing when the principal shareholder sells a larger fraction of its shares. In sum, we find little support of hypothesis 6.[58]

[56] As earlier mentioned, we have only computed fraction of shares sold for PE-backed IPOs.

[57] Hypothesis 5: A company's market capitalization has an effect on the degree of mispricing.

[58] The fraction sold by the principal PE-owner has an effect on the degree of mispricing.

Table 17: Multivariate Regression: Model 1-4

The table reports the results from our multivariate regression models. Model 1 and 3 are for first day returns, while model 2 and 4 are for first month excess returns. T-stats are displayed in parentheses below its estimate and we mark the estimate with stars indicating significance. For further information regarding the regression models see methodology, section 4.6.1.

Independent variables	1	2	3	4
Constant (%)	4.41	9.19**	-7.43	-16.77**
	(1.4343)	(1.9955)	(-1.3524)	(-2.2578)
PE (%)	-1.46	-8.93**	-	-
	(-0.5263)	(-2.1441)		
log(size) (%)	0.0012	-0.0004	0.0148**	0.0225**
	(0.2455)	(-0.0529)	(1.9597)	(2.1985)
Year 2008 (%)	-3.76	-13.41	-	-
	(-0.6275)	(-1.4953)		
HQPE (%)	0.74	3.68	-1.03	1.41
	(0.18877)	(0.6304)	(-0.3826)	(0.3886)
ΔShares (%)	-	-	5.42	6.83
			(1.6759)	(1.5601)
Obs	608	608	163	163
R-squared	0.0011	0.0114	0.0525	0.0607

Two tailed t-values: * t_{10}:1.65, ** t_5:1.96, *** t_1:2.58

4.4 Firm Specific Results

In this fourth, and last section in our analysis part, we present data results for five specific PE firms. The five firms have been selected by virtue of being the most frequent users of IPOs as an exit, in the period 2005-2018 in the Nordic stock exchange markets.[59]

ALMI Invest AB stood for the most with 14 listings, followed by Nordic Capital AB and EQT Partners AB with 12 and 10 listings each, respectively. HealthCap Venture Capital stood for 9 listings, while FSN Capital Partners AS completed 6 IPOs within the testing period. Except for the venture capitalists ALMI Invest AB and HealthCap Venture Capital, we find these firms as highly reputable with recognition from PEI 300.[60] Actually, we find EQT Partners AB up in seventh place according to the ranking-list for 2019 (Private Equity International, 2019). Table 19

[59] A complete overview of the different PE firms can be found in appendix A.6.

[60] PEI 300: Private Equity International firm ranking

represents descriptive statistics where our aim is to try explaining the context with IPO mispricing related to repeated interaction and reputation by PE firms. We have also included estimates for fraction of shares sold by PE owner together with the shares offered.

ALMI Invest AB is a swedish venture capitalist, who describe itself as the most frequent investor when it comes to early start-ups. Their portfolio of investments contains around 350 companies and possesses around SEK 3 billion in AUM[61]. ALMI limits their contributions between 1-10 million kroner per investment, meaning that they never take large positions in mature companies (ALMI Invest, 2019). Within 2005-2018, they listed 14 companies all in the swedish market. At first glance, IPOs backed by ALMI seems very uncertain. We see that 7 issues went up first day, while the remaining 7 went down. They report maximum first day return of 85% which is the highest for all VC-backed IPOs, simultaneously as their minimum is -45.45%. This indicates a very large return dispersion and therefore very large uncertainty about the offer price. Further, ALMI's mean and median first day return equals -1,90% and -5.83%, respectively. This implies a right-skewed distribution, since the mean is the largest of the two metrics. Finally, their IPOs holds large uncertainty in terms of volatility, reporting a standard deviation of 36.61%. The large volatility comes to light with significantly small market capitalization, and emphasizes ALMI's investment strategy involving companies in a very early stage.

Nordic Capital is on the other hand a pure buyout-firm. Nordic Capital invest primarily in the Nordic region within a broad specter of sectors and currently possesses approximately EUR 4.3 billion in AUM partitioned between 35 companies (Nordic Capital, 2019a). Between 2005-2018 they listed 12 companies as leading shareholder primarily in Sweden, but also in Norway and Finland. We see that of total 12 listing, 9 went up and only 1 went down the first day of trading. We can also see that 2 listings had zero first day return, implying that the offer price were correct. The maximum return is reported at 20.09%, while only -4.44% for the minimum indicates that expectations regarding return on IPOs backed by Nordic Capital is mainly positive. Expectations in terms of mean and median, reports to 5.42% and 4.87%, respectively, indicating a relatively symmetric distribution al-

[61] AUM: Assets under management.

though it only contains 12 observations. When it comes to uncertainty, listing by Nordic Capital varies to a small extent, with a volatility of 6.90%. That is also the lowest reported standard deviation among the mentioned PE firms.

Another highly reputable buyout-firm is EQT Partners AB and is considered as one of the largest PE firms in the world with approximately EUR 40 billion AUM partitioned between more than 240 different companies (EQT Partners, 2019). EQT have listed 10 companies since 2005 as leading shareholder where 7 wen up, 2 went down and 1 were had 0% return first day, indicating correctly set offer price. Most of their listing were done in Sweden while they also had 2 issues in Finland and 1 each in Norway and Denmark. The maximum reported first day return were 47.50%, while minimum return resulted in -4.85%. This imply an even larger return dispersion relative to issues backed by Nordic Capital. Also, we can see by the standard deviation that IPOs done with EQT experienced imply larger volatility of 14.76%. This result contradicts in some extent the theory saying greater reputation leads to less mispricing. EQT are the largest mentioned PE firm in terms of market capitalization and are ranked as one of the largest PE firms according to PEI300 (Private Equity International, 2019). In consonance with reported expected returns, we see that EQT leaves more money on table during the offering seen by the mean and median of 9.72% and 6.53%, respectively. We can of course not say that these expectation metrics have any statistical support due to few observations. Hovewer, it display some of the differences between BO-backed and VC-backed IPOs, and we see some similarities with EQT relative to Nordic Capital.

On the other hand, comparing VC-firms, HealthCap Venture Capital is more a early stage private equity firm with focus on investing globally in life sciences. They have since 2005 listed 9 companies in the Nordic market where 6 went up the first day, 1 went down, while the 2 remaining were correctly prices with 0% return. We see by the table that the maximum reported return equaled 16.89%, while the minimum reported to be -6.52%. As for a VC-firm, the return dispersion are relatively small, and the volatility is reported to be 7.53%. This is relatively low in terms of being categorized as VC, where our earlier analysis have shown evidence of completely different results for VC-backed IPOs. Return expectations reflect the variance which in terms of mean and median equals 6.10% and 7.81%, respectively. However, this indicates that the distribution is left-skewed with median larger than

mean. Anyway, it is important to specify as we already have mentioned, that these expectations have no significance as the small amount of observations.

Finally, we have FSN Capital Partners AS, a pure buyout-firm with the focus on controlling mid-large cap companies in the Northern Europe region. FSN funds have at current approcimately EUR 2.14 billions in AUM aggregated on 38 different companies (FSN Capital, 2019). FSN have listed 6 companies since 2005 as leading shareholder, where 4 went up and 2 went down in first day return. We can see that the maxixum return equaled 29.68%, while the minimum return equaled -11.57%. That implies a bit larger return dispersion than compatible's like Nordic Capital, and we also find the volatility to be considerable larger in term of reported standard deviation of 15.25%. This will in turn display the non-significant expected return in terms of mean and median reported to 9.71% and 10.72%, respectively. It is hard to draw conclusions for why FSN-backed IPOs seems more riskier than Nordic Capital, due to the few observations, but at least does the mean-variance relationship seems consistent.

The question are then whether lower return dispersion can be related to repeated interaction, information asymmetries and reputation? We can easily see that the BO-firms experience lower volatility, especially Nordic Capital. On the other hand, HealthCap stands out with reported standard deviation lower than for all VC-backed IPOs. We see no clear patterns with metrics such ass mean and median for market capitalization related to return dispersion. As we earlier mentioned, size is seen as a measure of reputation by the owner, where EQT clearly are the largest. Unfortunately, this doesn't result in lower degrees of mispricing. Nevertheless, ALMI sort out as a clear seed investor, investing in companies with remarkably low market capitalization.[62] This turns out on the distribution of returns with large volatility.

If we look at equity offered, we can see that both ALMI and HealthCap on average sell 4.92% and 2.95% of their shares during listings. Recall, table 4, where we saw that the average shares sold by VC was 14.83%, while 39.23% for BO. They both lie considerably below average when it comes to divest from the issue post-IPO. Nordic Capital, EQT and FSN are one average doing a larger exit

[62] Seed: Start-ups and very early stage companies.

when they are listing companies. Their averages lie around 50% which is above the average for all BO. The Shares Offered (%) indicates the fraction of the company that was offered to new investors. Here, too, ALMI and HealthCap stand out with the lowest averages on shares offered to new investor, while Nordic Capital's issues, on average, offers 79.80% of the total outstanding shares to new investors.

In spite of all, we find no patterns in this specific results for saying that repeated interaction in the IPO market explains the return dispersion. Neither does market capitalization and equity offered show patterns of explaining the mispricing. On the other hand, we can see that highly reputable PE firms such as Nordic Capital, EQT and FSN holds lower variance than for all PE firms, recall, PE-backed IPOs reported with SD 17.03%. In other words, this analysis are unable to illuminate any relationship between market capitalization as a reputation measure and mis-pricing results. Although, we find consisting results supporting BO-backed holds less volatility than VC.

Table 18: Descriptive Statistics for the Most Active PE Firms on IPOs

The table reports descriptive statistics of those PE firms that have completed the most IPOs during our testing period. These companies are: ALMI Invest AB, Nordic Capital AB, EQT Partners AB, HealthCap Venture Capital and FSN Capital Partners AS. The table reports different statistical metrics for first day returns, ment to explain mispricing results for issues backed by frequent users of secondary markets when divesting. Then we report deflated market capitalization in terms of mean and median to capture any reputation measure. Lastly, we report percentage change in holdings by the PE firm (ΔShares) and the faction of the total company being sold (Shares offered (%), i.e. offer size divided by market capitalization), both in terms of averages.

Statistics	ALMI	Nordic Capital	EQT	HealthCap	FSN Capital
IPOs	14	12	10	9	6
First Day Return					
N Up	7	9	7	6	4
N Zero	0	2	1	2	0
N Down	7	1	2	1	2
Max (%)	85.00	20.09	47.50	16.89	29.68
Min (%)	-45.45	-4.44	-4.85	-6.52	-11.57
Mean (%)	-1.90	5.42	9.72	6.10	9.71
Median (%)	-5.83	4.87	6.53	7.81	10.72
SD (%)	36.61	6.90	14.76	7.53	15.25
Market Capitalization					
Mean	116	6828	20125	1062	3893
Median	78	4711	7746	1074	2224
Equity Offered (Mean)					
ΔShares (%)	4.92	51.87	53.28	2.95	54.80
Shares Offered (%)	30.10	79.80	42.52	40.51	45.71

5 Discussion and Conclusion

This thesis provides evidence of mispricing results from the Nordic IPO market. The aim has been to answer three closely related questions regarding PE-backed versus NB IPOs. Firstly, we ask whether PE-backed IPOs are systematically less underpriced than NB IPOs. Based on previous research we expected to find that the average PE-backed IPO is less underpriced than the average NB IPO.[63] This is, in fact, what we found. PE-backed IPOs have on average a first day return of 4.07% versus 4.95% for the NB IPOs and a first month excess return of 1.47% for PE-backed IPOs versus 8.42% for the NB IPOs.[64] Looking further at the returns for the BO-backed IPOs, we find that these are more underpriced than NB IPOs, measuring return after the first day of trading. Measuring the return after the first month of trading, on the other hand, yields less underpricing for BO-backed IPOs versus NB IPOs. Recall table 2, where researchers have found lower underpricing of BO-backed than NB IPOs, our result that the BO-backed IPOs have a higher first day return than the NB IPOs contradicts what previous research has found and what we expected to find. From the Welch test, we find evidence, when measuring the first day returns, that BO-backed issues are systematic less underpriced than VC-backed issues. Concurrently, when we look at the first month excess returns, we find significant results for both that PE-backed IPOs seems to be consistently less underpriced than NB IPOs, and that BO-backed issues are systematically more correctly priced than issues with backing by VC sponsors.

The second question is whether lower expected post-IPO returns on PE-backed relative to NB IPOs can be accounted for by lower post-IPO dispersion in returns. We find evidence that PE-backed IPOs are less volatile than NB IPOs, wrt. the first day return, with SD of 17.03% and 27.00% respectively. We also find that BO-backed IPOs are less volatile than VC-backed, in terms of standard deviation, with 11.31% and 22.42% respectively. The results for the first month excess return are the same, with BO-backed as the least volatile, reporting a standard deviation of 15.08% for BO-backed and 30% for VC-backed IPOs. PE-backed IPOs are also less uncertain, with a standard deviation of 23.11% versus 41.07% for the

[63] Recall table 2 in the theory and literature part.

[64] Results are found in table 11 and 14, column "EW%".

NB IPOs. From the Levene's test we find significant results saying that NB IPOs have more than twice as much variance than PE-backed IPOs, both for the first day returns and first month excess returns. This is clearly illustrated in figure 5, which displays more extreme values for NB IPOs. At the same time, we find highly significant results when it comes to BO-backed IPOS as the least risky investment. Our analysis states that VC-backed IPOs have more than three times more variance than BO-backed both for first day return and first month excess return. Figure 4 displays this sufficiently, where we can see that VC-backed IPOs are much more uncertain with large variation in returns. This indicates that the post-IPO return dispersions are smaller especially for the IPOs that are backed by a buyout firm. Previous researchers has developed several explanations for why PE-backed IPOs should expect different returns. However, few have tried to explain it by the different variances. Levis (2011) reported volatility in terms of standard deviation between BO-backed, VC-backed and NB IPOs with similar end results as our thesis suggest. He argued that BO-backed IPOs are the least risky subscription and justified this by the continuing backing of PE firms and reduced debt after raising capital through an IPO. Hence, lower firm- and financial specific risk.[65] Simultaneously as PE brings robustness of managing their issues which drive to positive post-IPO returns. In this thesis, we find evidence of PE-backed issues to be larger than NB in terms of both market capitalization and offer sizes. Also, our empirical analysis find differences within PE, where we see that BO-backed issues are even larger than VC-backed issues, and patterns relating to the different post-IPO return dispersions.

Third, and lastly, we ask whether lower return dispersion from PE-backed IPOs may be related to repeated smaller information asymmetries, interaction and reputation of PE firms. As mentioned we find results which indicates that BO-backed IPOs are more underpriced than the average IPO.[66] Keeping in mind that the BO firms are among the most experienced of the PE firms and that they have done multiple IPOs, we expected that they would be able to price the IPOs more correctly than the average IPO. The average underpricing of 6.14% for BO-backed IPOs and corresponding underpricing of 4.95% for NB IPOs somewhat contradicts

[65] Firm risk can be related to both internal and external uncertainties of the operational management, while financial risk is about issues related to capital structure.

[66] Return from the offering to the closing of the first day of trading. The first month excess returns are inconclusive/not significant.

this expectation, which we find very interesting. If we would try to find an explanation for this, we first refer to table 18. From the ΔShares we observe that when a BO firms sells its shares in an IPO, the BO firm has sold approximately half of its pre-IPO shareholding. The Shares Offered (%) confirms that when a BO firm is involved in the IPO, a large fraction of the total outstanding shares in the portfolio company are offered to the market. Given this large supply, the price should go down to meet the demand, i.e. resulting in underpricing. While our regression models are not able to unambiguously confirm that the size factor is relevant for the mispricing, we find support for our findings from Bergström et al. (2006). They find that large IPOs perform better than small IPOs, and argues that this "may be attributable to larger IPOs possibly being less subject to overoptimistic investors adjusting their expectations" (Bergström et al., 2006, p. 42). To sum up, we are not able to unambiguously conclude that PE-backed IPOs are less underpriced than NB IPOs due to the smaller information asymmetries, repeated interaction and reputation of the PE firm. What we find, on the other hand, is that the risk (uncertainty) from investing in IPOs backed by the most reputable BO firms is significantly lower than the uncertainty in the other IPOs. Hence, our results seems to provide support for the certification effect when investing in IPOs that are backed by high quality PE firms.

Our analysis, to a large extent, has the same findings as previous empirical research, especially measuring the return after the first day of trading. Specifically, the degree of underpricing in PE-backed IPOs are lower than the underpricing in NB IPOs. What mainly separates our results and conclusion from others, is our focus on the risk associated with the IPOs. If we were to extend the analysis, we would continue focusing on the risk associated with the different types of backing. We would again emphasis that we need to be critical when interpreting the results, given that the number of observations are limited. Putting this aside, we do find that the BO-backed IPOs as less risky than the other IPOs and that they, in addition, have a larger average return.[67] These findings indicate that investors may not be rewarded with higher returns from taking higher risk, which we find puzzling.

[67] Return from the offering to the closing of the first day of trading. The first month excess returns are inconclusive/not significant.

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A Appendices

A.1 Jarque Bera Test for Normality

Jarque & Bera (1980, 1987) brought interest to test hypothesis for normality. In the classical linear regression model the assumption of normality stays important as residuals should be distributed with normality. In many economic studies eviction from normality may lead to biased results. Jarque & Bera (1987) define null hypothesis as the samples follows a normal distribution. The Jarque Bera t-statistcs (JB) can mathematically be expressed as follows.

$$JB = N \times [(\sqrt{b_1})^2/6 + (b_2 - 3)^2/24] \tag{A.1}$$

Where $\sqrt{b_1}$ represents the sample skewness, while b_2 represents the sample kurtosis. N is the sample size.

A.2 T-testing for Hypothesis

A.2.1 T-statistics

For the equal weighted average returns we test the means by running single model regressions without a constant term on the different samples with returns as dependent variable and for independent variable we use dummies to compute the means.[68] With the OLS-function in Python we can thereby gather the t-statistics from the regression model which is based on the following calcalutations (Gujarati & Handelsh, 2011).

$$t = \frac{\hat{\beta}}{SE(\hat{\beta})} \tag{A.2}$$

Where $SE(\hat{\beta})$ is the standard error and is defined by:

$$SE(\hat{\beta}) = SD \times \sqrt{\frac{1}{\sum(X_t - \bar{X})^2}} \tag{A.3}$$

(Brooks & Smith II, 2014)

A.2.2 Weighted T-statistics

Since we are also testing the value weighted returns on the different samples we need to use a t-statistics that count for weighted means and unequal variance.

[68] See appendices section A.3 listing 6-9 and 11 for more detailed presentation of OLS regression in Python.

Goldberg et al. (2005) presents a t-test for sample values where weights (w_i) are given differently:

$$t = \frac{\bar{X}}{\sqrt{\hat{\alpha}}} \tag{A.4}$$

Where $\hat{\alpha}$ can be calculated as followed:

$$\hat{\alpha} = \frac{\sum_{i=1}^{n} w_i \times (X_i - \bar{X})^2}{n} \tag{A.5}$$

(Goldberg et al., 2005)

A.2.3 Levene's Test for Equality of Variances

Levene (1960) derived this test to conclude whether k samples are with equal variances, what is called homogeneity of variance. We use this test to quantify whether post-IPO returns given different types of financial sponsor can be explained by unequal variance. Since we are going to further test for different means in the samples with unequal variance we start by concluding the assumption of equal variance with the Levene's test.

$$W = \frac{(N-k)}{(k-1)} \times \frac{\sum_{i=1}^{k} N_i(\bar{Z}_i - \bar{Z})^2}{\sum_{i=1}^{k}\sum_{j=1}^{N_i}(Z_{ij} - \bar{Z}_i)^2} \tag{A.6}$$

Eqaution 5.12 shows the t-statistics, where, $Z_{ij} = |Y_{ij} - \tilde{Y}_i|$ and $\tilde{Y}_i$ is the median of i. $\bar{Z}_i$ represent the mean of group Z_{ij} and the overall mean of Z_{ij} is defined as $\bar{Z}$. The Levene's Test was originially proposed only using mean but Brown & Forsythe (1974) exstended the test to also fit for samples with non-normally distributions by working with median and trimmed means. We used SciPy's integrated Levene's Test with Python to compute t-statistics and p-values where the null hypothesis is that the samples are with equal variances.[69]

A.2.4 Welch Test for Unequality of Means

We are comparing the means from the different samples and therefore we are using a t-stat to show the significance of the difference between the distributions.

$$t = \frac{\mu_A - \mu_B}{\sqrt{\frac{\sigma_A^2}{n_A} + \frac{\sigma_B^2}{n_B}]}} \tag{A.7}$$

Equation 5.13 shows the t-statistics from Welch t-test which is a well-known method for mean comparison between different distributions. The actual computation have

[69] SciPy provide Python with different statistical tools.

been done using an integrated function with Python.[70] The numerator in equation 6.12, $\mu_A - \mu_B$ is the mean difference between two samples with unequal variances (σ^2) and different sample sizes (n). The Welch t-test is especially preferred when testing for equality between means when the two distributions experience unequal level of variances (Welch, 1938). This testing will provide as a great supplement to answer whether we can say that the samples are different to each other.

A.3 Python codes

This appendix provides the essential Python codes for the implementation of our empirical analysis. We start by importing different tools we will need, then we import the data sample from an Excel file. Due to, sizes given in local currencies, we converted all metrics into NOK.[71] Further we provide coding for conducting all the different tests for first day return. We have not included codes for first month excess return, because they are identical except for the time aspect.

Listing 1: Import

```
import numpy as np
from scipy import stats
import pandas as pd
import statsmodels.api as sm
import datetime
import time
import sys
import scipy.optimize as opt
import matplotlib as mpl
import matplotlib.pyplot as plt
from matplotlib import style
```

Listing 2: Create sample

```
# Get IPO sample
df = pd.read_excel('sample_master.xlsx','to_python')

df['first_close'] = df['first_close'] / 100
df['month_close'] = df['month_close'] / 100

df = df[(np.abs(stats.zscore(df.first_close)) < 5)]
df = df[(np.abs(stats.zscore(df.month_close)) < 5)]
df['date'] = pd.to_datetime(df['date'])
df['date'] = df['date'].dt.strftime('%d-%m-%Y')
df = df.set_index('date')
```

[70] See code in appendices section A.3.

[71] See our currency converter function in listing 3.

```
print('___Number␣of␣observations␣is:␣'+str(len(df)))
```

Listing 3: Currency converter

```
def curradjmcap(row):
    if row["cty"] == 'SE':
        return row['seknok'] * row['mCap_adj']
    elif row["cty"] == 'DK':
        return row['dkknok'] * row['mCap_adj']
    elif row["cty"] == 'NO':
        return 1 * row['mCap_adj']
    elif row["cty"] == 'FI':
        return row['eurnok'] * row['mCap_adj']

df["mCap_adj_curr"] = df.apply(curradjmcap, axis=1)
```

Listing 4: Excess return

```
# Get market return sample
mkt = pd.read_excel('Market-Data.xlsx','to_python')
mkt['date'] = pd.to_datetime(mkt['date'])
mkt['date'] = mkt['date'].dt.strftime('%d-%m-%Y')
mkt = mkt.set_index('date')
mkt = mkt[['mkt_ret_1d','mkt_ret_1m']]

# Merge samples
df = df.merge(mkt, how='left', left_index=True,
                right_index=True)
df['abn_1m_ret'] = df['month_close'] - df['mkt_ret_1m']
df = df.merge(curr, how='left', left_index=True,
                    right_index=True)
```

Listing 5: Jarque Bera Test

```
######## Jarque Bera Test ########
JB_d = pd.DataFrame()
JB_d['Samples'] = 'All','NB','PE','BO','VC'
JB_d['JB'] = [stats.jarque_bera(df.first_close),
              stats.jarque_bera(non_backed.first_close),
              stats.jarque_bera(pe_backed.first_close),
              stats.jarque_bera(bo_backed.first_close),
              stats.jarque_bera(vc_backed.first_close)
             ]
```

Listing 6: Univariate testing 1D: Equal Weighted Return

```
# Univariate t-test: 1st Day Return
X_pe    = df['PE']
X_bo    = df['BO']
X_vc    = df['VC']
X_nb    = df['NB']
```

```
X_all  = df['constant']
y_1d   = df['first_close']
#X = sm.add_constant(X)

# Note the difference in argument order
reg0 = sm.OLS(y_1d, X_nb, missing='drop').fit()
reg1 = sm.OLS(y_1d, X_pe, missing='drop').fit()
reg2 = sm.OLS(y_1d, X_bo, missing='drop').fit()
reg3 = sm.OLS(y_1d, X_vc, missing='drop').fit()
reg4 = sm.OLS(y_1d, X_all, missing='drop').fit()

# Print out the statistics
res1 = pd.DataFrame()
res1['OLS'] = 'NB','PE','BO','VC','All'
res1 = res1.set_index('OLS')
res1['Average'] = [reg0.params.values[0],
                   reg1.params.values[0],
                   reg2.params.values[0],
                   reg3.params.values[0],
                   reg4.params.values[0]]

res1['t_stat'] = [reg0.tvalues.values[0],
                  reg1.tvalues.values[0],
                  reg2.tvalues.values[0],
                  reg3.tvalues.values[0],
                  reg4.tvalues.values[0]]
```

Listing 7: Univariate testing 1D: Value Weighted Return

```
# Value weighted 1st day return

# Print out the statistics
res2 = pd.DataFrame()
res2['OLS'] = 'NB','PE','BO','VC','All'
res2 = res2.set_index('OLS')
res2['Average'] = [non_backed['value_wht1D'].sum(),
                   pe_backed['value_wht1D'].sum(),
                   bo_backed['value_wht1D'].sum(),
                   vc_backed['value_wht1D'].sum(),
                   df['value_wht1D'].sum()]

res2['t_stat'] = [res2.Average[0]/ (np.sqrt((((non_backed.mCap_adj_curr
        / sum_cap_nb) * ((non_backed.first_close -
            non_backed.first_close.mean())**2)).sum()) /
                non_backed.first_close.count())),

res2.Average[1]/ (np.sqrt((((pe_backed.mCap_adj_curr / sum_cap_pe)
        * (pe_backed.first_close -
            pe_backed.first_close.mean())**2).sum()) /
                pe_backed.first_close.count())),
```

```
res2.Average[2]/ (np.sqrt((((bo_backed.mCap_adj_curr / sum_cap_bo)
        * (bo_backed.first_close -
            bo_backed.first_close.mean())**2).sum()) /
                bo_backed.first_close.count())),

res2.Average[3]/ (np.sqrt((((vc_backed.mCap_adj_curr / sum_cap_vc)
         * (vc_backed.first_close -
            vc_backed.first_close.mean())**2).sum()) /
                vc_backed.first_close.count())),

res2.Average[4]/ (np.sqrt((((df.mCap_adj_curr / sum_cap_df)
         * (df.first_close -
            df.first_close.mean())**2).sum()) /
                df.first_close.count()))
                ]
```

Listing 8: Univariate testing 1D: Welch T-test

```
############ WELCH 1M #############
# Welch t-stat EW 1D
x1 = non_backed.first_close
x2 = pe_backed.first_close
stats.ttest_ind(x1, x2, equal_var=False)

# Welch t-stat EW 1D
x1 = non_backed.first_close
x2 = bo_backed.first_close
stats.ttest_ind(x1, x2, equal_var=False)

# Welch t-stat EW 1D
x1 = non_backed.first_close
x2 = vc_backed.first_close
stats.ttest_ind(x1, x2, equal_var=False)

# Welch t-stat EW 1D
x1 = bo_backed.first_close
x2 = vc_backed.first_close
stats.ttest_ind(x1, x2, equal_var=False)

# Welch t-stat VW 1D
x1 = non_backed.value_wht1D
x2 = pe_backed.value_wht1D
stats.ttest_ind(x1, x2, equal_var=False)

# Welch t-stat VW 1D
x1 = non_backed.value_wht1D
x2 = bo_backed.value_wht1D
stats.ttest_ind(x1, x2, equal_var=False)

# Welch t-stat VW 1D
x1 = non_backed.value_wht1D
```

```
x2 = vc_backed.value_wht1D
stats.ttest_ind(x1, x2, equal_var=False)

# Welch t-stat VW 1D
x1 = bo_backed.value_wht1D
x2 = vc_backed.value_wht1D
stats.ttest_ind(x1, x2, equal_var=False)
```

Listing 9: Univariate Testing 1D: Levene's Test

```
############ LEVENE TEST ################
######### first day return EW ##########
s1 = non_backed.first_close # NON BACKED
s2 = pe_backed.first_close # PE BACKED
s3 = bo_backed.first_close # BO BACKED
s4 = vc_backed.first_close # VC BACKED

ltest1 = stats.levene(s1,s2)
ltest2 = stats.levene(s1,s3)
ltest3 = stats.levene(s1,s4)
ltest4 = stats.levene(s3,s4)

ltest_1d = pd.DataFrame()
ltest_1d['type'] = 'NBminusPE','NBminusBO','NBminusVC','BOminusVC'
ltest_1d['diff'] = [np.var(s1) / np.var(s2),
                    np.var(s1) / np.var(s3),
                    np.var(s1) / np.var(s4),
                    np.var(s4) / np.var(s3)]
ltest_1d['tstat'] = [ltest1.statistic,ltest2.statistic,
                 ltest3.statistic,ltest4.statistic]
ltest_1d['pval'] = [ltest1.pvalue,ltest2.pvalue,
                 ltest3.pvalue,ltest4.pvalue]


######### first day return VW ##########

def weighted_var(values, weights):

    average = np.average(values, weights=weights)
    # Fast and numerically precise:
    variance = np.average((values-average)**2, weights=weights)
    return (variance)

s1 = non_backed.value_wht1D # NON BACKED
s2 = pe_backed.value_wht1D # PE BACKED
s3 = bo_backed.value_wht1D # BO BACKED
s4 = vc_backed.value_wht1D # VC BACKED

r1 = non_backed.first_close
r2 = pe_backed.first_close
r3 = bo_backed.first_close
```

```
r4 = vc_backed.first_close

w1 = non_backed.mCap_adj_curr / sum_cap_nb
w2 = pe_backed.mCap_adj_curr / sum_cap_pe
w3 = bo_backed.mCap_adj_curr / sum_cap_bo
w4 = vc_backed.mCap_adj_curr / sum_cap_vc

ltest1 = stats.levene(s1,s2)
ltest2 = stats.levene(s1,s3)
ltest3 = stats.levene(s1,s4)
ltest4 = stats.levene(s3,s4)

ltest_1d = pd.DataFrame()
ltest_1d['type'] = 'NBminusPE','NBminusBO','NBminusVC','BOminusVC'
ltest_1d['diff'] = [weighted_var(r1,w1) / weighted_var(r2,w2),
                    weighted_var(r1,w1) / weighted_var(r3,w3),
                    weighted_var(r1,w1) / weighted_var(r4,w4),
                    weighted_var(r4,w4) / weighted_var(r3,w3)]

ltest_1d['tstat'] = [ltest1.statistic,ltest2.statistic,
                  ltest3.statistic,ltest4.statistic]
ltest_1d['pval'] = [ltest1.pvalue,ltest2.pvalue,
                  ltest3.pvalue,ltest4.pvalue]
```

Listing 10: PE-firm Identification

```
# Create a dataframes
pe_backed = df[df['PE'] > 0]
bo_backed = df[df['BO'] > 0]
vc_backed = df[df['VC'] > 0]
non_backed = df[df['NB'] > 0]

pe_firms = pd.DataFrame(pe_backed['principal_pe'].value_counts())
pe_firms = pe_firms.reset_index()
pe_firms = pe_firms.rename(columns={'index': 'principal_pe','principal_pe':'ipos'})
pe_firms = pe_firms.set_index('principal_pe')
pe_firms.to_excel('PE_firms.xlsx', sheet_name='sheet')
# We export the DataFrame to excel, for manually defining firm age
# Then we save the new file as "PE_firm2.xlsx" and import it back
dff = pd.read_excel('PE_firms2.xlsx','sheet')
dff = dff.drop(columns=['today','founded'])
dff = dff.set_index('principal_pe')

dff['age_score'] = stats.zscore(dff.Age)

df2 = pd.read_excel('data_mod.xlsx','sheet')

def curradjmcap(row):
    if row["cty"] == 'SE':
        return row['seknok'] * row['mCap_adj']
    elif row["cty"] == 'DK':
```

```
            return row['dkknok'] * row['mCap_adj']
        elif row["cty"] == 'NO':
            return 1 * row['mCap_adj']
        elif row["cty"] == 'FI':
            return row['eurnok'] * row['mCap_adj']

df2["mCap_adj_curr"] = df2.apply(curradjmcap, axis=1)

pe_backed = df2[df2['PE'] > 0]
pe_backed = pe_backed.set_index('principal_pe')
firm_ = pe_backed.groupby(pe_backed.index).mean()

firm_['size_score'] = stats.zscore(firm_.mCap_adj_curr)
firm_2 = firm_[['size_score']]
firm_2.sort_values(by=['size_score'],ascending=False).head()
firm_3 = firm_[['mCap_adj_curr']]

dfff = pe_firms.merge(dff, how='left', left_index=True, right_index=True)
dfff['ipo_score'] = stats.zscore(dfff.ipos)

dfff = dfff.merge(firm_3, how='left', left_index=True, right_index=True)

dfff = dfff.sort_values(by=['ipos'],ascending=False)

firm_list = dfff.index.values
firm_mean_1d = np.zeros(len(firm_list))
firm_mean_1m = np.zeros(len(firm_list))
for firm in range(len(firm_list)):
    name = firm_list[firm]
    firm_mean_1d[firm] = df.loc[df['principal_pe'] == name]['first_close'].mean()
    firm_mean_1m[firm] = df.loc[df['principal_pe'] == name]['abn_1m_ret'].mean()

dfff['1D␣mean'] = firm_mean_1d
dfff['1M␣ex␣mean'] = firm_mean_1m
Appendix = dfff[['ipos','Age','mCap_adj_curr','1D␣mean','1M␣ex␣mean']]
top_pe = dfff[dfff['ipos'] > 1][['ipos','Age']]
merge = firm_[['offerS_adj','mCap_adj_curr']].sort_values(by=['offerS_adj'],ascending=False)
top_pe = top_pe.merge(merge,left_index=True,right_index=True)

top_pe.to_excel('top_pe.xlsx', sheet_name='sheet')
```

Listing 11: Multivariate Testing

```
####### Multivariate t-test #######
df['log_mCap'] = np.log(df['mCap_adj_curr'])
df['log_exp'] = np.log(df['rating'])

top_pe = pd.read_excel('top_pe.xlsx','sheet')
top_pe = top_pe.set_index('principal_pe')
df['HQPE'] = df['principal_pe'].isin(top_pe.index)*1
```

```
# MODEL 1
df['constant'] = np.ones(len(df))

y1 = df[['first_close']]
X1 = df[['constant','PE','log_mCap','recession','HQPE']]

model_1 = sm.OLS(y1, X1, missing='drop').fit()

res1 = pd.DataFrame()
res1['Independent'] = X1.columns
res1['estimates'] = model_1.params.values
res1['t-stat'] = model_1.tvalues.values
res1['pvalues'] = model_1.pvalues.values

print('___F-statistics: '+str(model_1.fvalue))
print('___Rquared: '+str(model_1.rsquared))
print('___Observations: '+str(model_1.nobs))
res1[res1.columns[0:]]

# MODEL 2
y2 = df[['abn_1m_ret']]
X2 = df[['constant','PE','log_mCap','recession','HQPE']] #

model_2 = sm.OLS(y2, X2, missing='drop').fit()

res2 = pd.DataFrame()
res2['Independent'] = X2.columns
res2['estimates'] = model_2.params.values
res2['t-stat'] = model_2.tvalues.values
res2['pvalues'] = model_2.pvalues.values

print('___F-statistics: '+str(model_2.fvalue))
print('___Rquared: '+str(model_2.rsquared))
print('___Observations: '+str(model_2.nobs))
res2

# MODEL 3
y3 = df[['first_close']]
X3 = df[['constant','HQPE','log_mCap','frac']] #

model_3 = sm.OLS(y3, X3, missing='drop').fit()

res3 = pd.DataFrame()
res3['Independent'] = X3.columns
res3['estimates'] = model_3.params.values
res3['t-stat'] = model_3.tvalues.values
res3['pvalues'] = model_3.pvalues.values

print('___F-statistics: '+str(model_3.fvalue))
print('___Rquared: '+str(model_3.rsquared))
print('___Observations: '+str(model_3.nobs))
```

```
res3

# MODEL 4
y4 = df[['abn_1m_ret']]
X4 = df[['constant','HQPE','log_mCap','frac']] #

model_4 = sm.OLS(y4, X4, missing='drop').fit()

res4 = pd.DataFrame()
res4['Independent'] = X4.columns
res4['estimates'] = model_4.params.values
res4['t-stat'] = model_4.tvalues.values
res4['pvalues'] = model_4.pvalues.values

print('___F-statistics: '+str(model_4.fvalue))
print('___Rquared: '+str(model_4.rsquared))
print('___Observations: '+str(model_4.nobs))
res4
```

A.4 Probability Density Function

In this section of appendices, we present some figures which graphically visualizes the density distributions of the different samples. This part is an extension to section 5.1.1 in the empirical analysis and results. Brooks & Smith II (2014) explains normal distribution as: $\gamma \sim N(\mu, \sigma^2)$ where γ is normally distributed with mean μ and variance σ^2. Then the probability density function (x-axis) will be given by $f(\gamma)$ and can be expressed mathematically as:

$$f(\gamma) = \frac{1}{\sqrt{2\pi\sigma}} e^{(\gamma-\mu)^2/2\sigma^2} \tag{A.8}$$

Figure 6: Density Plot: PE-backed

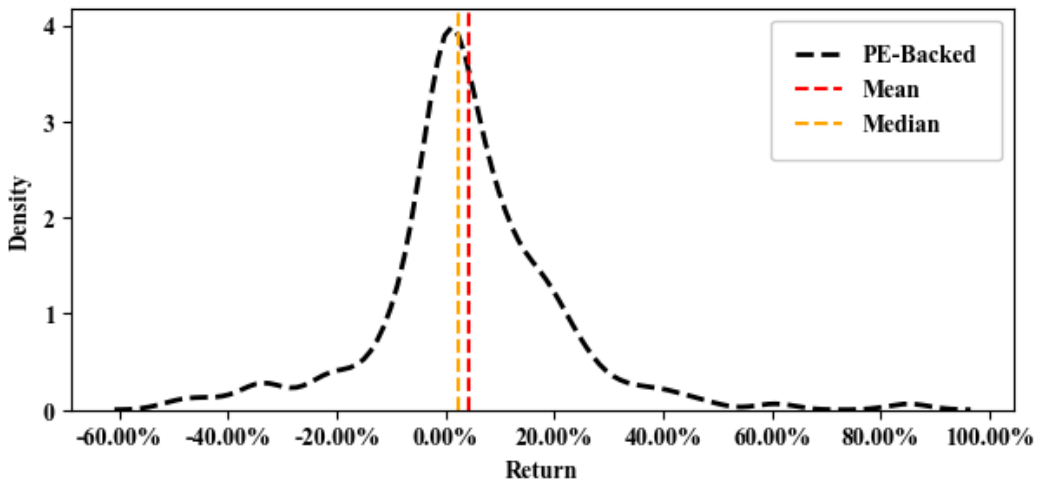


Figure 7: Density Plot: BO-backed

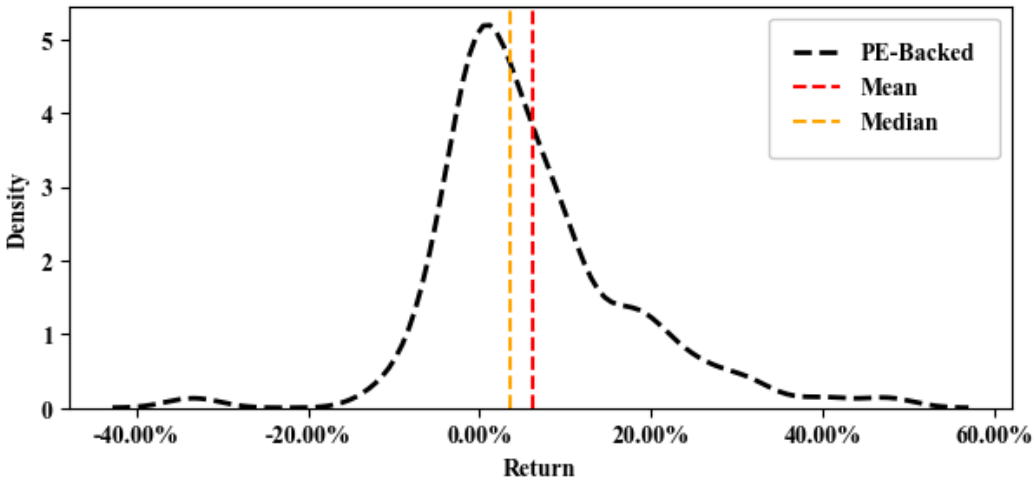


Figure 8: Density Plot: VC-backed

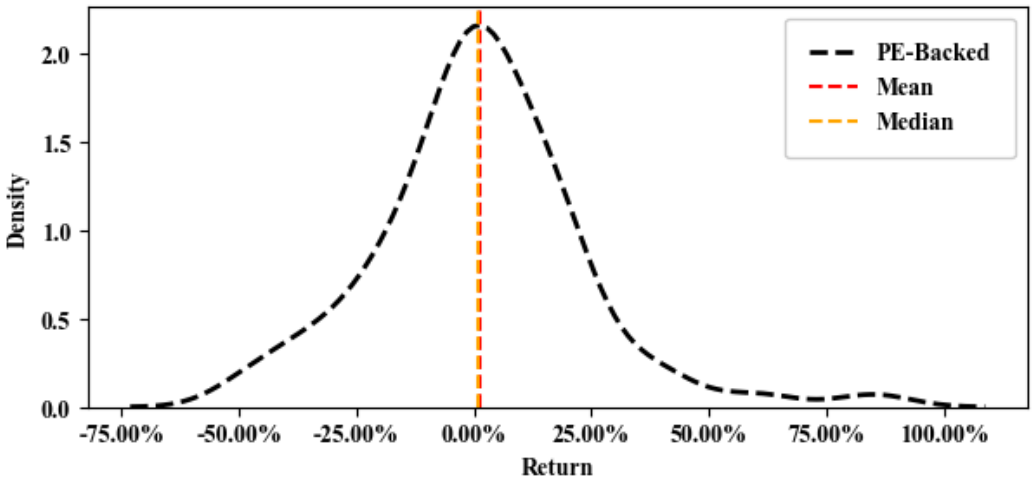
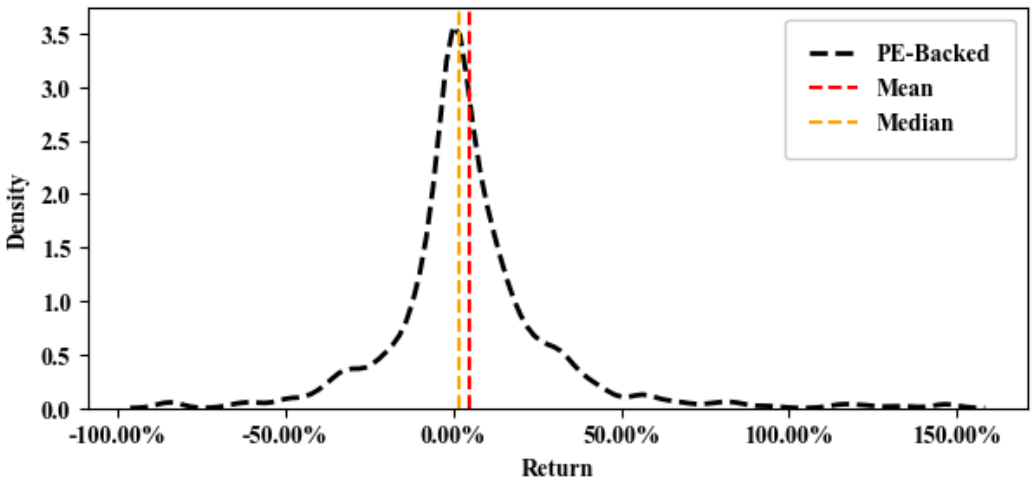


Figure 9: Density Plot: All IPOs



A.4.1 Results of Jarque Bera Test

Table 19 display the results from the Jarque Bera test, which is mentioned in the emprirical analysis part earlier. In short, We were not able to accept the null hypothesis from any sample that is given with normal distribution. A rejection of this null hypothesis imply that the sample is not with normmal distribution.

Table 19: Number of IPOs by Market

	JB	p-value	Reject/Accept H_0
First Day Return			
All	1645.63	0	Reject
NB	960.21	0	Reject
PE	114.55	0	Reject
BO	38.69	3.96-09	Reject
VC	19.17	6.89-05	Reject
First Month Excess Return			
All	2183.07	0	Reject
NB	1082.57	0	Reject
PE	565.10	0	Reject
BO	14.76	0.0006	Reject
VC	178.35	0	Reject

A.5 Nordic Inflation Rates

Table 20: Inflation Rates

Date	Sweden	Norway	Denmark	Finland
2004-12-31	0.3	1.1	1.2	0.13
2005-12-30	0.9	1.8	2.3	0.79
2006-12-29	1.6	2.2	1.8	1.28
2007-12-31	3.5	2.8	2.3	1.57
2008-12-31	0.9	2.2	2.4	3.91
2009-12-31	0.6	2.0	1.4	1.64
2010-12-31	2.3	2.8	2.8	1.69
2011-12-30	2.3	0.1	2.4	3.33
2012-12-31	-0.1	1.4	2.1	3.15
2013-12-31	0.1	2.0	0.7	2.21
2014-12-31	-0.3	2.1	0.4	1.23
2015-12-31	0.1	2.3	0.4	-0.15
2016-12-30	1.7	3.5	0.5	0.38
2017-12-29	1.7	1.6	1.0	0.84
2018-12-31	2.0	3.5	0.8	1.16
Mean	**1.173**	**2.093**	**1.500**	**1.544**

A.5.1 Cumulated Inflation Rates

Table 21: Deflator

Date	Sweden	Norway	Denmark	Finland
2004-12-31	1.186688	1.348913	1.234811	1.255573
2005-12-30	1.176103	1.325062	1.207049	1.245732
2006-12-29	1.157582	1.296538	1.185707	1.229988
2007-12-31	1.118436	1.261224	1.159048	1.210976
2008-12-31	1.108460	1.234074	1.131883	1.165408
2009-12-31	1.101849	1.209877	1.116256	1.146604
2010-12-31	1.077076	1.176923	1.085852	1.127548
2011-12-30	1.052861	1.175747	1.060402	1.091211
2012-12-31	1.053915	1.159514	1.038592	1.057888
2013-12-31	1.052862	1.136778	1.031372	1.035014
2014-12-31	1.056030	1.113397	1.027263	1.022438
2015-12-31	1.054975	1.088365	1.023170	1.023974
2016-12-30	1.037340	1.051560	1.018080	1.020097
2017-12-29	1.020000	1.035000	1.008000	1.011600
2018-12-31	1.000000	1.000000	1.000000	1.000000

A.6 PE Firms

Table 22: PE Firms

PE-firm	IPOs	Age	mcap	1D Mean Return (%)	1M Mean Return (%)
ALMI Invest AB	14	10	115.75	-1.90	-4.29
Nordic Capital AB	12	30	6828.47	5.41	8.77
EQT Partners AB	10	25	20125.48	9.72	9.91
HealthCap Venture Capital	9	23	1062.85	6.09	1.03
FSN Capital Partners AS	6	20	3893.79	9.71	12.56
Sunstone Capital A/S	5	12	2181.90	6.26	-1.13
New Equity Venture International AB	4	9	34.31	-17.58	-32.99
Northzone AB	4	23	829.62	9.23	13.07
CVC Advisers Ltd	3	38	7652.04	7.94	5.49
Altor Equity Partners AB	3	16	4023.35	14.37	12.07
Norvestor Equity AS	3	28	770.02	-1.50	-1.55
CapMan Oy	3	30	4990.42	-0.13	-2.78
IK Investment Partners Ltd	3	30	3572.89	13.49	13.66
Intera Equity Partners Oy	3	12	13712.72	6.10	6.20
NorgesInvestor	3	23	2079.05	0.18	-0.45
Sentica Partners Oy	3	15	8405.68	5.90	8.22
Reiten & Co AS	3	27	471.64	5.28	4.25
Ratos AB	3	86	4802.78	-0.88	2.35
Inveni Capital GmbH	2	12	3090.00	-16.23	-19.04
Investinor AS	2	11	871.88	2.21	6.23
Segulah Advisor AB	2	25	2013.20	7.80	-0.23
Verdane Capital	2	16	364.11	9.30	11.62
Apax Partners LLP	2	50	8999.13	-4.83	10.75
Capvest Partners LLP	2	20	1786.77	7.47	6.35
Bain Capital Private Equity LP	2	35	26749.61	2.08	4.10
BGA Invest AB	2	15	414.70	32.77	34.08
Kistefos AS	1	130	654.58	10.00	6.93
KKR & Co Inc	1	43	4684.45	10.00	8.62
SEB Venture Capital AB	1	3	380.50	-4.80	-14.95
Argan Capital LP	1	24	3469.11	19.35	13.29
Finha Capital Oy	1	52	255.52	-21.77	-24.77
Teknoinvest	1	35	1133.52	12.50	-2.50
Pegroco Invest AB	1	12	109.79	-49.42	-55.16
Pod Venture Partners AB	1	19	1111.22	2.83	-5.58
BC Partners Holdings Ltd	1	33	10536.69	9.56	6.65
Karolinska Development AB	1	16	2052.70	20.83	4.20
Tellacq AB	1	3	198.57	-20.83	-24.18
Ahlstrom Capital Oy	1	18	217.50	25.00	-20.31
Marin Forvaltning	1	0	574.08	-1.42	-2.89
Fouriertransform AB	1	10	194.80	2.20	14.69
Polaris Private Equity	1	21	475.73	-6.00	0.01
Bumble Ventures ApS	1	7	1784.87	25.92	30.56
TA Associates Management LP	1	51	1946.09	32.69	23.59
Monterro AB	1	7	805.98	4.16	12.46
Recipharm Venture	1	24	262.64	42.72	40.89

Amadeus Capital Partners Ltd	1	22	773.65	1.72	6.18
PAI Partners SAS	1	21	14396.01	5.55	11.24
Triton Advisers Ltd	1	22	3757.82	8.87	6.93
Alto Invest SA/France	1	18	230.73	-6.49	-16.93
3i Funds	1	74	3515.62	7.35	12.42
LMK Ventures AB	1	10	122.80	17.27	-3.63
Aggregate Stockholm AB	1	17	3332.90	14.68	9.66
Nokia Growth Partners Management Co Oy	1	14	1137.69	-5.68	-8.13
Castle Harlan	1	32	7269.56	-2.06	-14.35
Serendipity Ixora AB	1	15	1036.84	-16.44	-36.88
Cinven Ltd	1	42	3363.00	0.00	1.01
HitecVision	1	34	1604.45	4.76	4.71
Nordica Life Ltd	1	23	64.89	-11.11	2.22
Amiral Gestation SAS	1	16	2837.14	-0.45	-4.09
Trema International Holdings BV	1	2	79608.69	0.00	0.07
Vision Capital LLP	1	22	4560.60	-2.44	-7.38
Investcorp Bank BSC	1	37	16619.67	3.32	0.54
Yield Life Science AB	1	14	843.17	-6.89	-13.84
Hospitality Invest AS	1	29	676.59	5.00	-1.53
Chalmers Ventures AB	1	4	33.62	18.60	-1.15
Maturo Kapital AS	1	17	10.18	-23.00	-26.41
Bure Equity AB	1	27	625.94	8.00	-6.68
Loudspring Oyj	1	14	193.26	23.91	19.55
Herkules Capital AS	1	16	8297.51	3.47	4.43
Axcel Management A/S	1	25	1722.05	0.70	-3.89
Sothic Capital Management LLP	1	11	2774.11	-5.88	-5.34
R12 Kapital AB	1	10	1081.51	0.66	0.43
Didner & Gerge Fonder AB	1	25	4130.16	15.08	27.52
GU Ventures AB	1	24	61.37	23.97	11.72
Finda Oy	1	22	111276.55	-0.00	0.43
NB Capital	1	18	3669.48	7.04	15.87
Prometheus Investment Funding Ltd	1	19	33489.74	25.23	26.64
Gramtec Business Partner AB	1	25	89.22	-12.84	32.45
Noweco Partners	1	28	20.72	-2.30	-10.02
IDG Ventures Inc	1	23	11987.61	20.25	4.40
Rosetta Capital Ltd	1	19	460.58	-40.55	-41.19
Energivekst	1	12	1018.94	16.32	18.38
Stiftelsen Industrifonden	1	40	5759.81	1.00	0.52

A.7 Non-Backed IPOs Sample

A.7.1 Return Sample

Table 23: Non-PE-Backed IPOs Sample

Offer Date	Company	Country	1D Return (%)	1M Return (%)
12/12/2018	CAG Group AB	SE	-4.242424	-3.787879
12/10/2018	Azelio AB	SE	-29.545454	-42.227272

12/07/2018	Q-Linea AB	SE	-0.897059	-8.955882
12/07/2018	NeoDynamics AB	SE	-65.243904	-70.731705
11/30/2018	Oma Saastopankki Oyj	FI	2.142857	0.000000
11/30/2018	Nordic ID Oyj	FI	-14.629631	-46.111111
11/28/2018	Alzecure Pharma AB	SE	-21.428572	-40.864285
11/28/2018	S2medical AB	SE	31.034483	110.344826
11/20/2018	Viafin Service Oyj	FI	-5.828571	-20.642857
11/08/2018	Zenith Energy Ltd	NO	14.285716	11.428574
10/10/2018	Fellow Finance Oyj	FI	2.199224	2.587322
10/03/2018	Sparebanken Telemark	NO	3.508772	0.877193
08/17/2018	Risk Intelligence A/S	SE	-20.160000	0.000000
07/11/2018	Calmark Sweden AB	SE	-4.130433	0.000002
07/04/2018	Okeanis Eco Tankers Corp	NO	4.270787	-1.718881
07/02/2018	Odico A/S	DK	53.409088	190.909088
06/29/2018	Raketech Group Holding PLC	SE	-5.000000	-5.300000
06/28/2018	Ranplan Group AB	SE	-22.330099	-23.300972
06/21/2018	Midsummer AB	SE	39.814808	44.660488
06/20/2018	Dicot AB	SE	66.990288	20.388348
06/19/2018	Projektengagemang Sweden AB	SE	0.010638	1.063830
06/15/2018	Kojamo Oyj	FI	0.600000	8.235294
06/15/2018	Arion Banki HF	SE	11.538459	15.008181
06/14/2018	Freetrailer Group A/S	SE	11.111111	0.888889
06/11/2018	IA Industriarmatur Group AB	SE	-5.882353	0.588235
06/08/2018	TargetEveryOne AB	NO	0.000000	-6.666667
05/28/2018	I-Tech AB	SE	20.317074	36.585365
05/25/2018	Jondetech Sensors AB	SE	-30.325001	-30.625000
05/24/2018	Bodyflight Sweden AB	SE	-9.285714	-8.571428
05/18/2018	Ovzon AB	SE	10.857142	25.714285
05/04/2018	Africa Energy Corp	SE	-8.256884	-1.834865
04/26/2018	Happy Helper A/S	DK	-13.750000	-28.125000
04/24/2018	Enersense International Oyj	FI	-10.169493	-9.661018
04/20/2018	Infrea AB	SE	-13.636364	-23.181818
03/23/2018	Altia Oyj	FI	2.933333	9.600000
03/22/2018	Elkem ASA	NO	-4.137931	7.189655
03/22/2018	Agillic A/S	DK	12.855263	-1.631579
03/21/2018	Fjordkraft Holding ASA	NO	0.000000	4.516129
03/15/2018	Zutec Holding AB	SE	-1.250000	-18.333334
02/28/2018	OptiMobile AB	SE	-37.000000	-51.333332
02/23/2018	LIV Ihop AB	SE	0.000000	-3.333333
02/21/2018	Goldblue AB	SE	-32.478630	-35.897434
02/09/2018	Admicom OYJ	FI	9.183671	10.999998
02/02/2018	Salmones Camanchaca SA	NO	5.952381	10.714286
02/02/2018	Scandinavian Health Innovation	SE	-11.111111	-14.444445
01/17/2018	NPinvestor.com A/S	DK	-19.411764	-25.882353
01/15/2018	Infracom Group AB	SE	46.093746	60.937496
01/03/2018	Orgo Tech AB	SE	-2.666667	-21.666666
12/21/2017	24sevenoffice Scandinavia AB	SE	-12.307693	-15.076923
12/15/2017	Topright Nordic AB	SE	-27.179487	25.641026
12/14/2017	Flexqube AB	SE	2.333333	42.666668
12/13/2017	Atvexa AB	SE	13.000000	14.900000
12/12/2017	Lyko Group AB	SE	3.000000	23.000000

12/08/2017	Efecte Oyj	FI	-6.000000	2.527273
12/07/2017	Devport AB	SE	11.428572	8.571428
12/07/2017	Time People Group AB	SE	-9.473684	14.210526
12/06/2017	Tempest Security AB	SE	-9.090909	-15.454545
12/05/2017	Awardit AB	SE	36.428570	45.732143
11/24/2017	2cureX AB	SE	3.205126	-17.948719
11/22/2017	Touchtech AB	SE	15.217390	-16.666668
11/16/2017	Gofore Oyj	FI	7.086616	10.078742
11/16/2017	Seafire AB	SE	-33.333332	-35.000000
11/10/2017	Komplett Bank ASA	NO	2.162162	1.081081
10/27/2017	Ferronordic Machines AB	SE	7.333333	20.000000
10/27/2017	Self Storage Group ASA	NO	-2.857143	10.714286
10/27/2017	BibbInstruments AB	SE	146.153854	125.641029
10/19/2017	Global Gaming 555 AB	SE	27.272728	59.090908
10/13/2017	Climeon AB	SE	44.193550	103.225807
10/13/2017	Weareqiiwi Interactive AB	SE	93.750000	68.750000
10/12/2017	Fram Skandinavien AB	SE	56.500000	145.500000
10/09/2017	Titanium Oyj	FI	13.333331	5.040649
10/02/2017	SpareBank 1 Nordvest	NO	2.173913	0.869565
09/21/2017	Senzagen AB	SE	123.195877	119.587631
07/14/2017	Netmore Group AB	SE	-33.928570	-46.428570
07/14/2017	Realfiction Holding AB	SE	14.473685	64.473686
07/13/2017	NextCell Pharma AB	SE	-33.000000	-28.200001
07/13/2017	OmniCar Holding AB	SE	32.407406	151.851852
07/12/2017	Atlantic Sapphire AS	NO	7.142857	-8.928572
07/11/2017	Aspire Global PLC	SE	6.666667	36.000000
07/04/2017	Cimco Marine AB	SE	23.448277	52.413792
06/27/2017	Peckas Naturodlingar AB	SE	5.200000	0.000000
06/23/2017	Conferize A/S	DK	41.250000	78.750000
06/21/2017	Fastighets AB Trianon	SE	7.291667	4.687500
06/21/2017	Sedana Medical AB	SE	22.051283	11.282051
06/19/2017	Surgical Science Sweden AB	SE	64.285713	76.428574
06/16/2017	GreenMobility A/S	DK	-0.666667	-0.666667
06/16/2017	Nitro Games Oyj	SE	1.000000	-2.500000
06/14/2017	Grong Sparebank	NO	0.943396	1.415094
06/13/2017	Sparebank 1 Oestlandet	NO	1.282051	3.525641
06/12/2017	Paxman AB	SE	14.736842	17.368422
06/09/2017	TCECUR Sweden AB	SE	43.000000	13.500000
06/09/2017	Preservia Hyresfastigheter AB	SE	0.000000	14.500000
05/30/2017	Terranet Holding AB	SE	32.307693	106.153847
05/29/2017	Remedy Entertainment Oyj	FI	18.407078	11.504423
05/29/2017	Ayima Ltd	SE	1.428571	-23.809525
05/24/2017	Fjord1 ASA	NO	8.275862	10.344828
05/23/2017	Medicover AB	SE	16.964285	24.553572
05/19/2017	Mobiplus AB	SE	-0.000003	-23.287674
05/18/2017	Nexar Group AB	SE	-62.222225	-72.857147
05/15/2017	Integrum AB	SE	12.500000	0.500000
05/12/2017	Cloudrepublic AB	SE	-32.592594	-40.740742
05/11/2017	Secits Holding AB	SE	-27.789934	-11.013859
05/10/2017	Freedesk AB	SE	-56.571430	-69.428574
05/03/2017	Compare-IT Nordic AB	SE	-7.462684	-32.835819

04/24/2017	AcuCort AB	SE	-30.434784	-46.521740
04/19/2017	Annexin Pharmaceuticals AB	SE	-40.909092	-43.030304
04/10/2017	FM Mattsson Mora Group AB	SE	38.235294	35.294117
04/07/2017	Bergenbio ASA	NO	0.000000	-2.800000
04/07/2017	Intervacc AB	SE	-23.000000	-25.000000
04/06/2017	SSM Holding AB	SE	-0.847458	-2.118644
04/06/2017	Tangiamo Touch Technology AB	SE	-24.200001	-34.799999
04/04/2017	Fondia Oyj	FI	28.496731	30.980391
03/29/2017	Biovica International AB	SE	-4.400000	-0.800000
03/15/2017	Samtrygg Group AB	SE	-39.428570	-44.285713
03/03/2017	Spintso International AB	SE	-38.125004	-40.625004
03/02/2017	SARSYS-ASFT AB	SE	32.857143	34.285713
02/28/2017	Irlab Therapeutics AB	SE	-1.666667	-17.833334
02/06/2017	MenuPay AB	SE	-9.777778	-43.333332
01/12/2017	Multidocker Cargo Handling AB	SE	-2.000000	33.000000
01/09/2017	AcouSort AB	SE	58.181820	94.545456
01/06/2017	Unified Messaging Systems AS	NO	19.200001	0.800000
12/23/2016	Baltic Horizon Fund	SE	-5.084652	-6.348803
12/19/2016	Acarix AB	SE	-7.386365	22.159088
12/19/2016	Appspotr AB	SE	16.666666	173.333328
12/16/2016	Aino Health AB	SE	-9.230769	-5.384615
12/09/2016	Finepart Sweden AB	SE	58.119659	39.316242
12/07/2016	Smart Eye AB	SE	31.521740	31.521740
12/06/2016	Scandinavian ChemoTech AB	SE	-10.416667	-8.333333
12/05/2016	ByggPartner I Dalarna Holding	SE	0.270270	1.351351
12/01/2016	Adderacare AB	SE	53.333332	93.333336
11/24/2016	Serneke Group AB	SE	0.000000	-4.772727
11/22/2016	THQ Nordic AB	SE	35.000000	62.000000
11/18/2016	Gapwaves AB	SE	27.731096	177.310928
11/11/2016	Crunchfish AB	SE	147.333328	74.666664
11/10/2016	Heeros Oyj	FI	-9.677417	-18.387094
11/03/2016	CELLINK AB	SE	109.615387	273.076935
10/28/2016	Tobin Properties AB	SE	13.125000	4.062500
10/25/2016	Gasporox AB	SE	36.666668	67.777779
10/17/2016	Vincit Oyj	FI	45.238102	44.761909
10/11/2016	Index Pharmaceuticals Holding	SE	-16.666662	-28.571424
09/22/2016	Cyber Security 1 AB	SE	-26.400000	-27.400000
09/22/2016	WilLak AB	SE	35.000000	15.000000
08/23/2016	Sustainable Energy Solutions S	SE	-2.500000	31.250000
08/01/2016	PEN Concept Group AB	SE	6.521741	8.478263
07/29/2016	Maha Energy AB	SE	-24.000000	33.684212
07/29/2016	Expres2ion Biotech Holding AB	SE	-4.237290	21.186440
07/22/2016	A Uni-light LED AB	SE	-18.987343	20.253162
07/11/2016	SynAct Pharma AB	SE	-18.750002	-9.375001
07/06/2016	Quartiers Properties AB	SE	0.000000	0.000000
06/30/2016	Privanet Group Oyj	FI	-31.860468	-32.558144
06/29/2016	MaxFastigheter i Sverige AB	SE	5.277778	1.388889
06/27/2016	Provide IT Sweden AB	SE	22.222225	77.777786
06/22/2016	Cereno Scientific AB	SE	-16.666666	-21.333334
06/21/2016	Alelion Energy Systems AB	SE	-0.847459	49.152538
06/21/2016	Dignita Systems AB	SE	-25.416666	-30.833334

06/20/2016	Shortcut Media AB	SE	-9.090909	-10.363636
06/16/2016	GomSpace Group AB	SE	-30.400000	31.200001
06/15/2016	Redwood Pharma AB	SE	-29.444445	-34.444443
06/14/2016	TF Bank AB	SE	10.389610	1.948052
06/14/2016	SwedenCare AB	SE	28.571428	30.714285
06/13/2016	B3 Consulting Group AB	SE	3.500000	3.500000
06/10/2016	Enorama Pharma AB	SE	-39.230770	-42.307693
06/09/2016	Orsted A/S	DK	9.787234	7.659575
06/09/2016	PiezoMotor Uppsala AB	SE	-14.000000	-20.799999
06/09/2016	Marketing Group PLC/The	SE	23.000000	210.000000
06/08/2016	B2Holding ASA	NO	4.166667	0.000000
06/07/2016	Cyxone AB	SE	28.000000	-11.200000
05/31/2016	Paradox Interactive AB	SE	34.545456	56.818180
05/31/2016	Litium Affarskommunikation AB	SE	-11.000000	-34.000000
05/26/2016	Clean Motion AB	SE	29.375000	80.625000
05/24/2016	TalkPool AG	SE	28.181818	34.545456
05/03/2016	Vadsbo SwitchTech Group AB	SE	-0.555553	19.444448
04/28/2016	Lehto Group Oyj	FI	15.686276	22.941179
04/26/2016	Nepa AB	SE	1350.000000	1250.000000
04/22/2016	Simris Alg AB	SE	-25.675676	-15.135135
04/11/2016	Plejd AB	SE	81.102364	24.409451
03/31/2016	Suomen Hoivatilat Oyj	FI	14.999998	12.499998
03/22/2016	Xintela AB	SE	-16.600000	4.000000
03/16/2016	GARO AB	SE	39.726028	38.698631
03/10/2016	Dividend Sweden AB	SE	-4.000000	96.000000
03/09/2016	RhoVac AB	SE	66.867470	33.734936
02/29/2016	Invent Medic Sweden AB	SE	19.666666	46.000000
02/17/2016	Sjostrand Coffee Int AB	SE	-10.270271	174.324326
02/11/2016	Catena Media PLC	SE	21.818182	28.787878
02/10/2016	Scandinavian Tobacco Group A/S	DK	0.000000	6.200000
02/03/2016	Xbrane Biopharma AB	SE	-16.470589	-20.000000
01/15/2016	Sleepo AB	SE	-12.307693	-33.846153
01/11/2016	FastOut Int AB	SE	-10.000000	61.000000
01/08/2016	Raybased AB	SE	310.714294	337.500000
12/09/2015	Sparekassen Sjaelland-Fyn AS	DK	-5.000000	-8.500000
12/08/2015	Stillfront Group AB	SE	78.205132	133.974365
12/07/2015	Zenergy AB	SE	-11.250000	162.500000
12/03/2015	Camurus AB	SE	15.789474	29.824562
12/02/2015	Evli Bank PLC	FI	24.000000	21.333334
11/30/2015	EAB Group Oyj	FI	5.400000	-2.600000
11/23/2015	MoxieTech Group AB	SE	-15.333333	-14.000000
11/20/2015	Photocat A/S	SE	-12.172309	-20.446714
11/12/2015	Waystream Holding AB	SE	-0.454545	-31.818182
11/02/2015	Sbanken ASA	NO	-5.434783	-4.782609
11/02/2015	Kid ASA	NO	-3.548387	-4.193548
10/23/2015	Hamlet Pharma AB	SE	55.555557	196.666672
10/08/2015	CLX Communications AB	SE	27.118645	49.152542
10/02/2015	Capacent Holding AB	SE	24.074074	27.407408
07/22/2015	Oncology Venture Sweden AB	SE	21.621620	42.567566
06/26/2015	5th Planet Games A/S	NO	7.272727	-22.909090
06/18/2015	Pandox AB	SE	1.037736	5.188679

06/12/2015	Prime Living AB	SE	0.000000	-10.000000
06/11/2015	Talenom Oyj	FI	-7.880436	-13.722828
06/10/2015	Collector AB	SE	15.636364	17.272728
06/09/2015	Magnolia Bostad AB	SE	-0.789474	-5.526316
05/22/2015	Multiconsult ASA	NO	18.910257	23.717949
05/21/2015	Robit Oyj	FI	8.596495	5.263161
05/21/2015	Transtema Group AB	SE	32.894737	51.315792
05/04/2015	Vibrosense Dynamics AB	SE	-9.696966	-6.868683
04/30/2015	ICE Group AS	NO	32.756287	5.199239
04/09/2015	Hancap AB publ	SE	6.000000	9.714286
04/02/2015	Savosolar Plc	SE	-6.376007	-20.816282
03/25/2015	Hoist Finance AB	SE	13.965517	18.103449
03/20/2015	Evolution Gaming Group AB	SE	12.187500	28.750000
03/16/2015	Detection Technology Oy	FI	-2.499996	-1.923073
03/09/2015	Team Tankers International Ltd	NO	-15.079368	-2.777781
03/06/2015	NNIT A/S	DK	26.000000	27.600000
02/16/2015	OrganoClick AB	SE	5.147056	-0.735297
12/04/2014	NP3 Fastigheter AB	SE	12.666667	15.333333
11/24/2014	United Bankers Oyj	FI	5.454545	3.575758
11/21/2014	Lifco AB	SE	32.258064	45.161289
11/14/2014	Nexstim Oyj	FI	-2.362203	-4.094487
11/07/2014	RAK Petroleum PLC	NO	31.205669	20.567373
10/17/2014	Entra ASA	NO	3.076923	13.846154
10/15/2014	GWS Production AB	SE	-22.222219	-25.694443
10/10/2014	Granges AB	SE	2.352941	6.588235
10/02/2014	Scatec Solar ASA	NO	-0.526316	2.631579
08/05/2014	DDM Holding AG	SE	0.000000	9.500000
07/11/2014	Serendex Pharmaceuticals A/S	NO	-19.166666	-47.222221
07/01/2014	Havyard Group ASA	NO	-1.492537	-1.492537
07/01/2014	Cxense ASA	NO	-0.769231	-11.538462
06/19/2014	Bactiguard Holding AB	SE	-17.105263	-26.578947
06/12/2014	Besqab AB	SE	15.753425	15.753425
06/12/2014	Loudspring Oyj	FI	-12.307689	-32.307690
04/22/2014	Envirologic AB	SE	-42.222221	-33.333332
04/11/2014	Scanship Holding ASA	NO	-15.625001	-10.312501
04/09/2014	Hembla AB	SE	15.384615	21.025640
04/08/2014	Insr Insurance Group ASA	NO	-15.666667	-23.333334
04/04/2014	Verkkokauppa.com Oyj	FI	3.217391	-0.782609
04/03/2014	Recipharm AB	SE	9.935898	10.897436
03/21/2014	Hemfosa Fastigheter AB	SE	4.838710	13.978495
01/30/2014	Aurora LPG Holding ASA	NO	3.658537	0.000000
01/24/2014	Tanker Investments Ltd	NO	600.000000	610.000000
01/13/2014	BIMobject AB	SE	114.666664	201.333328
12/12/2013	Atlantic Petroleum P/F	NO	-0.714286	0.714286
12/12/2013	Link Mobility Group ASA	NO	-19.545454	-19.090910
12/03/2013	Ferronordic Machines AB	SE	5.400000	4.100000
11/29/2013	Platzer Fastigheter Holding AB	SE	5.283019	0.754717
11/28/2013	NoHo Partners Oyj	FI	8.043481	-0.217389
11/21/2013	BW LPG Ltd	NO	4.893617	17.553192
10/25/2013	Bulk Invest ASA	NO	-1.666667	5.000000
10/14/2013	Ovaro Kiinteistosijoitus Oyj	FI	-0.000002	0.388348

09/27/2013	Odfjell Drilling Ltd	NO	-2.380952	-2.857143
07/05/2013	Ocean Yield ASA	NO	2.592592	3.703704
05/02/2013	MultiClient Geophysical ASA	NO	0.000000	1.250000
03/26/2013	EAM Solar ASA	NO	-1.000000	-3.000000
01/02/2013	Recyctec Holding AB	SE	34.177212	183.544296
11/29/2012	STYLEPIT A/S	DK	20.833328	14.583329
10/18/2012	Borregaard ASA	NO	-1.428571	-13.333333
10/15/2012	Siili Solutions Oyj	FI	10.000000	3.285714
08/03/2012	FDT System Holding AB	SE	2.921353	2.247195
07/05/2012	Respiratorius AB	SE	-48.000000	-46.000000
06/19/2012	Gullberg & Jansson AB	SE	11.250000	-7.500000
06/14/2012	Selvaag Bolig ASA	NO	-5.000000	-0.500000
05/02/2012	Medfield Diagnostics AB	SE	-5.128208	-3.589746
02/03/2012	Brighter AB	SE	-0.000001	-5.000001
01/19/2012	Mobile Loyalty PLC	SE	-8.333333	-23.000000
12/27/2011	NordIQ Goteborg AB	SE	-50.000000	-5.000000
07/07/2011	Danske Andelskassers Bank A/S	DK	4.000000	-0.400000
07/05/2011	Hoegh LNG Holdings Ltd	NO	10.263158	5.263158
06/23/2011	Boule Diagnostics AB	SE	-4.285714	-1.020408
06/14/2011	Enzymatica AB	SE	117.647049	32.058819
05/26/2011	Moberg Pharma AB	SE	-1.034483	-22.068966
05/25/2011	AroCell AB	SE	3.124999	21.249998
05/21/2011	Bridge Energy AS	NO	-50.000000	-54.545456
05/03/2011	Sevan Drilling ASA	NO	-2.875000	-31.250000
04/15/2011	Karolinska Development AB	SE	0.000000	-3.750000
04/15/2011	FX International AB	SE	3.733333	-12.000000
04/04/2011	MediRatt AB	SE	-1.515150	-15.151514
03/29/2011	Norway Royal Salmon ASA	NO	3.809524	-0.952381
03/25/2011	Koggbron Fastigheter AB	SE	-0.000003	-1.176473
02/25/2011	Transocean Norway Drilling AS	NO	1.052632	3.684211
02/25/2011	Kancera AB	SE	-0.714286	-15.714286
02/02/2011	ECOMB AB	SE	133.333328	86.666664
01/31/2011	Umida Group AB	SE	48.148144	-1.851856
12/17/2010	WntResearch AB	SE	24.166666	66.666664
12/10/2010	Gjensidige Forsikring ASA	NO	-0.423729	-2.118644
12/01/2010	Floatel International Ltd/Old	NO	-2.142857	0.000000
11/29/2010	Hubbr AB	SE	-8.888886	-22.222219
11/10/2010	Novavax AB	SE	-8.620689	-26.896551
11/05/2010	Episurf Medical AB	SE	2.888889	12.222222
10/22/2010	Circle K AS	NO	3.846154	33.974358
07/08/2010	Lyyn AB	SE	42.857143	-4.000000
07/07/2010	Challenger Mobile AB	SE	-60.000000	-74.000000
07/06/2010	PharmaLundensis AB	SE	73.333336	29.777779
06/30/2010	Morpol ASA	NO	-10.454545	-8.181818
06/24/2010	Wallenius Wilhelmsen ASA	NO	-5.371904	-4.132235
06/16/2010	Mabi Rent AB	SE	-1.666667	-13.333333
06/15/2010	NetConnect ASA	NO	-3.125001	-16.875002
06/11/2010	EcoRub AB	SE	0.000000	-4.000000
06/04/2010	Parans Solar Lighting AB	SE	-1.666667	-31.666666
05/17/2010	True Heading AB	SE	-36.170212	-0.851060
05/17/2010	Layerlab AB	SE	-3.703704	-11.111111

05/05/2010	LunchExpress i Sverige AB	SE	-33.166668	-37.000000
04/27/2010	Ekomarine AB	SE	-5.555555	-27.222221
04/01/2010	Hartelex AB	SE	12.000000	28.000000
03/30/2010	Solvtrans AS	NO	0.000000	-8.800000
03/29/2010	Brandworld Sverige AB	SE	22.500000	72.500000
03/26/2010	Bakkafrost P/F	NO	10.967742	22.580645
03/24/2010	Arise AB	SE	-2.272727	-7.272727
03/02/2010	Sportjohan AB	SE	11.111114	16.666670
02/05/2010	North Energy ASA	NO	1.132075	-8.679245
12/01/2009	Cimber Sterling Group A/S	DK	-10.000000	-27.000000
09/30/2009	Polarcus Ltd	NO	-7.777778	-22.222221
08/10/2009	EXINI Diagnostics AB	SE	56.249996	18.749998
07/15/2009	Arctic Minerals AB	SE	10.000000	22.500000
07/10/2008	Prime Office A/S	DK	0.240964	-3.614458
06/26/2008	H1 Communication AB	SE	16.935488	5.645164
06/18/2008	PCI Biotech Holding ASA	NO	-10.000000	-45.000000
06/18/2008	Senzime AB	SE	14.666667	46.666668
06/16/2008	DGC One AB	SE	12.121212	-8.787879
06/09/2008	Hexpol AB	SE	26.094574	-8.931696
06/02/2008	World Class Seagull Internatio	SE	-1.818182	-37.090908
05/27/2008	Trygga Hem Skandinavien AB	SE	-1.898735	1.265822
05/22/2008	eWork Group AB	SE	16.578947	1.842105
05/19/2008	WeSC AB	SE	4.761905	-9.761905
04/25/2008	FormueEvolution II	DK	2.463054	3.448276
04/25/2008	FormueEvolution I	DK	2.463054	3.448276
04/16/2008	EgnsINVEST Ejd. Tyskland A/S	DK	0.956938	2.870813
03/26/2008	GlobalFun AB	SE	-12.903223	-19.354836
03/07/2008	European Wind Investment A/S	DK	0.492611	0.985222
02/04/2008	Cryptzone AB	SE	-25.714285	-31.428572
01/30/2008	NattoPharma ASA	NO	-17.250000	-19.250000
01/24/2008	Eriksson Development and Innov	SE	-7.000000	-20.000000
12/28/2007	Black Earth Farming Ltd	SE	-84.376709	-82.138435
12/20/2007	Trifork A/S	DK	-25.294117	-15.294118
12/17/2007	Philly Shipyard ASA	NO	2.608696	-2.608696
12/05/2007	Infratek AS	NO	-2.222222	7.222222
11/23/2007	Sparekassen Hvetbo A/S	DK	30.000000	25.000000
11/09/2007	Eastnine AB	SE	1.500000	-0.500000
10/30/2007	Copenhagen Capital Stam	DK	0.000000	-3.846154
10/12/2007	Systemair AB	SE	0.000000	-7.692307
10/12/2007	London Mining PLC	NO	11.764706	-0.588235
09/20/2007	German High Street Properties	DK	0.000000	-1.000000
08/03/2007	Amnode AB	SE	-20.000000	-30.400000
07/23/2007	C-Rad AB	SE	82.926834	32.926834
07/18/2007	Jojka Communications AB	SE	-30.666666	-40.000000
07/06/2007	Berlin IV A/S	DK	3.500000	3.000000
07/06/2007	Water Jet Sweden AB	SE	33.333332	21.428572
06/29/2007	Devicom AB	SE	-2.000000	-23.000000
06/28/2007	SeaNet Maritime Communications	SE	-7.200000	-18.400000
06/25/2007	EnergyO Solutions Russia AB	SE	-1.843318	-2.304147
06/21/2007	BankNordik P/F	DK	21.693121	28.306879
06/12/2007	SRV Group OYJ	FI	10.000000	10.666667

06/12/2007	Nordic Shipholding A/S	DK	9.411765	13.529411
06/12/2007	Hunter Group ASA	NO	5.937500	18.750000
06/01/2007	Novus Group International AB	SE	9.459458	-19.189190
05/31/2007	Grieg Seafood ASA	NO	0.000000	2.608696
05/25/2007	Protector Forsikring ASA	NO	7.142857	1.428571
05/25/2007	Arrow Seismic ASA	NO	1.428571	-3.571429
05/18/2007	Agromino A/S	SE	5.816745	3.909401
05/10/2007	ScanArc ASA	NO	6.250000	3.750000
05/08/2007	Salmar ASA	NO	0.000000	-6.153846
05/02/2007	Diabase AS	NO	16.000000	56.000000
05/02/2007	Y.C.O. BUSINESSPARTNERS AB	SE	26.000000	-0.666667
04/23/2007	EMAS Offshore Ltd	NO	12.302195	22.511484
04/03/2007	Terveystalo Healthcare OYJ	FI	12.962958	24.999994
03/30/2007	Electromagnetic Geoservices AS	NO	7.777778	-4.444445
03/27/2007	Algeta ASA	NO	-6.382979	-8.510638
03/19/2007	Obos Danmark AS	NO	2.000000	1.000000
02/21/2007	Yinson Production AS	NO	-3.703704	-3.703704
02/13/2007	Enalyzer	DK	-84.000000	0.000000
02/12/2007	Scandinavian Private Equity A/	DK	0.000000	-5.000000
01/31/2007	Dockwise Ltd	NO	31.889767	6.299214
01/29/2007	Tribona ASA	NO	0.000000	3.773585
12/18/2006	Aker BP ASA	NO	1.639344	3.278688
12/15/2006	Nordic Mines AB	SE	2.000000	-2.000000
12/15/2006	Tilgin AB	SE	-12.000000	4.400000
12/12/2006	Aker BioMarine ASA/Old	NO	0.000000	-6.666667
12/12/2006	Allenex AB	SE	-0.714286	-11.428572
12/08/2006	Faktor Eiendom ASA	NO	-3.428571	-14.571428
12/07/2006	Scirocco AB	SE	13.000000	46.333332
12/05/2006	Rovsing A/S	DK	17.370895	83.098595
11/28/2006	Radisson Hospitality AB	SE	0.000000	11.538462
11/23/2006	Team Tankers Management Holdin	NO	-6.071429	-10.714286
11/15/2006	Norwegian Property ASA	NO	7.943925	12.149532
11/10/2006	Det Norske Oljeselskap ASA/OLD	NO	7.500000	7.500000
10/27/2006	Formuepleje Merkur A/S	DK	2.103251	6.500956
10/19/2006	Codfarmers ASA	NO	-3.846154	0.000000
10/18/2006	Maritime Industrial Services C	NO	-16.666666	-23.333334
10/11/2006	Austevoll Seafood ASA	NO	2.051282	-5.128205
10/10/2006	Outotec OYJ	FI	2.960000	19.200001
09/15/2006	AlphaHelix Molecular Diagnosti	SE	2.189782	-9.854013
09/05/2006	Melker Schorling AB	SE	5.161495	5.698033
08/28/2006	RusForest AB	SE	7.000000	4.000000
07/03/2006	Petroleum Services Group ASA	NO	-2.127660	-0.851064
06/30/2006	Teekay Petrojarl ASA	NO	-4.651163	-7.209302
06/29/2006	Wirtek A/S	DK	9.090909	-5.227273
06/12/2006	Swedol AB	SE	10.500000	23.000000
06/01/2006	Curalogic AS	DK	5.333333	0.000000
05/31/2006	BW Offshore Ltd	NO	0.165564	-8.940396
05/22/2006	Dios Fastigheter AB	SE	-7.741935	-16.774193
05/09/2006	REC Silicon ASA	NO	23.157894	-16.052631
04/12/2006	Formuepleje Safe A/S	DK	-1.362980	1.506461
04/12/2006	FIM Group OYJ	FI	5.913043	20.869566

04/11/2006	Seabird Exploration PLC	NO	29.500000	84.000000
03/28/2006	Gant Co AB	SE	37.234043	39.007092
03/17/2006	BWG Homes ASA	NO	11.515152	9.090909
03/14/2006	Ahlstrom OYJ	FI	11.136364	10.863636
03/09/2006	Saipem Discoverer Invest SARL	NO	-85.208649	-85.485840
02/22/2006	cBrain A/S	DK	30.000000	35.000000
02/13/2006	Odfjell Invest Ltd	NO	6.707320	0.609758
02/08/2006	KapitalPleje AS	DK	0.500000	3.000000
12/14/2005	Norda ASA	NO	-1.000000	29.000000
12/12/2005	Agility Group AS	NO	30.555555	51.666668
12/08/2005	ICA Gruppen AB	SE	5.844156	17.532467
11/16/2005	NorGani Hotels ASA	NO	0.000000	-0.892857
11/08/2005	TradeDoubler AB	SE	0.000000	9.545455
10/25/2005	BW Gas AS	NO	-5.487805	-4.878049
10/21/2005	Aker Drilling ASA/Old	NO	-18.588871	-24.016279
10/21/2005	Wayfinder Systems AB	SE	-8.163265	-30.612246
10/14/2005	Tryg A/S	DK	10.869565	16.739130
10/13/2005	Unison Forsikring ASA	NO	-0.666667	15.000000
10/06/2005	Hemtex AB	SE	18.750000	21.428572
10/05/2005	Indutrade AB	SE	12.692307	15.769231
09/23/2005	Norstat ASA	NO	-4.545455	-9.090909
09/15/2005	Deep Sea Supply ASA	NO	3.478261	-17.391304
08/26/2005	Scorpion Offshore Ltd	NO	560.194153	566.666687
07/11/2005	American Shipping Co ASA	NO	1.538462	0.384615
07/08/2005	Wentworth Resources PLC	NO	-6.485675	-6.485675
06/17/2005	DOF Subsea AS	NO	40.000000	47.500000
06/07/2005	Seadrill X ASA	NO	9.375000	10.937500
06/07/2005	Nemi Forsikring AS	NO	4.642857	10.714286
05/25/2005	Allianse ASA	NO	6.250000	3.125000
05/25/2005	Havila Shipping ASA	NO	5.000000	16.250000
05/13/2005	Havfisk AS	NO	-0.344828	1.724138
05/03/2005	Oslo Areal AS	NO	1.886792	16.981133
04/18/2005	Neste Oyj	FI	7.866667	12.000000
03/09/2005	Exploration Resources ASA	NO	17.391304	43.478260
02/18/2005	COSL Holding AS	NO	10.000000	10.000000

A.8 PE-Backed IPOs Sample

A.8.1 Return Sample

Table 24: PE-Backed IPOs Sample

Offer Date	Company	Type	Country	1D Return (%)	1M Return %)
12/06/2018	Lime Technologies AB	PE	SE	4.166667	12.486111
12/05/2018	Jetpak Top Holding AB	PE	SE	-6.000000	0.000000
06/25/2018	Shelf Drilling Ltd	PE	NO	-2.065797	-14.307572
06/19/2018	VMP OYJ	PE	FI	4.400000	6.380000
06/07/2018	Netcompany Group A/S	PE	DK	29.677420	49.451614

06/05/2018	NCAB Group AB	PE	SE	0.666667	0.413333
04/06/2018	Iconovo AB	PE	SE	-6.493506	-16.883118
03/27/2018	Bygghemma Group First AB	PE	SE	-11.578947	-22.094736
03/23/2018	Green Landscaping Holding AB	PE	SE	-0.571429	-2.380952
03/22/2018	Harvia Oyj	PE	FI	0.000000	0.000000
03/09/2018	Cibus Nordic Real Estate AB	PE	SE	-0.451418	-4.136770
11/24/2017	TCM Group A/S	PE	DK	-0.510204	0.000000
11/08/2017	Crayon Group Holding ASA	PE	NO	-4.516129	-10.322580
10/11/2017	Terveystalo Oyj	PE	FI	2.459014	4.918030
10/11/2017	Webstep AS	PE	NO	10.204082	4.081633
10/10/2017	Handicare Group AB	PE	SE	10.000000	-6.200000
10/06/2017	Balco Group AB	PE	SE	16.964285	11.607142
09/29/2017	Infront ASA	PE	NO	10.000000	6.956522
06/21/2017	Evry AS	PE	NO	-9.677420	-3.225806
06/09/2017	Silmaasema Oyj	PE	FI	10.144926	18.840578
05/29/2017	Saferoad Holding ASA	PE	NO	0.000000	-3.333333
05/19/2017	Munters Group AB	PE	SE	20.090910	42.000000
05/12/2017	Kamux Corp	PE	FI	5.000003	0.000003
05/11/2017	Instalco Intressenter AB	PE	SE	18.181818	23.636364
04/07/2017	Actic Group AB	PE	SE	0.990099	0.000000
03/31/2017	Ambea AB	PE	SE	10.000000	8.666667
12/09/2016	Edgeware AB	PE	SE	1.724138	6.206897
12/01/2016	Arcus ASA	PE	NO	0.000000	3.488372
11/30/2016	Volati AB	PE	SE	15.086206	27.586206
11/28/2016	Ripasso Energy AB	PE	SE	25.000000	-20.250000
10/28/2016	Ahlsell AB	PE	SE	21.739130	14.565217
09/29/2016	Internationella Engelska Skola	PE	SE	32.692307	23.557692
09/23/2016	Nets A/S	PE	DK	-3.333333	-13.000000
06/22/2016	Lauritz.com Group A/S	PE	SE	8.000000	-6.666667
06/15/2016	AcadeMedia AB	PE	SE	47.500000	25.000000
06/10/2016	Nordic Waterproofing Holding A	PE	SE	0.704225	-3.873240
04/29/2016	Resurs Holding AB	PE	SE	0.181818	0.000000
04/29/2016	Tokmanni Group Corp	PE	FI	0.000003	0.746272
03/22/2016	Humana AB	PE	SE	19.354839	13.306452
12/11/2015	Consti Yhtiot Oyj	PE	FI	3.157895	-0.210526
12/02/2015	Scandic Hotels Group AB	PE	SE	-4.850746	0.746269
11/30/2015	Attendo AB	PE	SE	40.000000	41.000000
11/25/2015	Dometic Group AB	PE	SE	15.416667	13.750000
11/09/2015	Minesto AB	PE	SE	30.357145	51.785717
10/16/2015	Bravida Holding AB	PE	SE	7.500000	21.250000
07/07/2015	Kotipizza Group Oyj	PE	FI	3.800000	0.200000
07/01/2015	Fit Biotech Oy	PE	FI	-33.333332	-33.333332
06/30/2015	Capio AB	PE	SE	0.000000	24.742268
06/19/2015	Europris ASA	PE	NO	-4.444445	-2.444444
06/19/2015	Pioneer Property Group ASA	PE	NO	5.000000	-1.500000
06/18/2015	Nobina AB	PE	SE	-5.882353	-5.294117
06/17/2015	Nordax Group AB	PE	SE	-2.444444	-7.333333
06/17/2015	Alimak Group AB	PE	SE	8.870968	6.989247
06/16/2015	Coor Service Management Holdin	PE	SE	0.000000	1.052632
06/04/2015	Pihlajalinna Oyj	PE	FI	9.523809	18.095238
03/27/2015	Asiakastieto Group Oyj	PE	FI	3.322034	0.542373

03/27/2015	Troax Group AB	PE	SE	19.318182	17.045454
02/13/2015	Dustin Group AB	PE	SE	17.000000	18.000000
02/06/2015	Eltel AB	PE	SE	7.352941	12.500000
12/16/2014	RenoNorden ASA	PE	NO	-2.553191	-1.702128
11/26/2014	Thule Group AB	PE	SE	11.428572	27.142857
10/03/2014	XXL ASA	PE	NO	6.896552	12.931034
09/26/2014	Inwido AB	PE	SE	-5.147059	-14.705882
06/27/2014	Scandi Standard AB	PE	SE	17.500000	14.500000
06/20/2014	Zalaris ASA	PE	NO	8.695652	8.695652
06/17/2014	Com Hem Holding AB	PE	SE	9.568966	6.637931
03/28/2014	OW Bunker A/S	PE	DK	20.689655	18.275862
03/13/2014	ISS A/S	PE	DK	14.187500	13.375000
02/21/2014	Bufab AB	PE	SE	6.521739	19.565218
12/10/2013	Geberit Production Oy	PE	SE	6.147541	21.721312
06/28/2013	Matas A/S	PE	DK	3.478261	4.347826
05/20/2011	Bulten AB	PE	SE	0.000000	-5.306122
10/05/2010	Pandora A/S	PE	DK	25.238094	26.666666
06/18/2010	MQ Holding AB	PE	SE	-0.625000	-6.250000
06/03/2010	Chr Hansen Holding A/S	PE	DK	5.555555	11.222222
06/02/2010	Byggmax Group AB	PE	SE	5.434783	0.000000
11/14/2007	Duni AB	PE	SE	0.000000	0.500000
10/19/2007	HMS Networks AB	PE	SE	-1.351351	-12.162162
10/11/2007	Pronova BioPharma ASA	PE	NO	3.478261	4.347826
05/16/2007	Nederman Holding AB	PE	SE	9.770115	4.885057
03/23/2007	NEAS ASA	PE	NO	-3.030303	0.000000
12/01/2006	Lindab International AB	PE	SE	2.500000	18.409090
11/24/2006	BE Group AB	PE	SE	4.838710	11.290322
11/10/2006	AKVA Group ASA	PE	NO	0.000000	-2.285714
10/12/2006	Marine Farms ASA	PE	NO	-1.428571	-2.857143
09/15/2006	Swedish Orphan Biovitrum AB	PE	SE	11.500000	13.000000
03/13/2006	Salcomp Oyj	PE	FI	-0.312501	1.249998
02/23/2006	KappAhl AB	PE	SE	4.910714	8.928572
11/04/2005	Biotec Pharmacon ASA	PE	NO	2.040816	-8.979591
10/24/2005	Cermaq Group AS	PE	NO	0.227273	11.590909
10/24/2005	Powel ASA	PE	NO	0.000000	8.000000
06/27/2005	Wintershall Norge AS	PE	NO	4.761905	4.761905
06/24/2005	Kongsberg Automotive ASA	PE	NO	3.260870	9.782609
06/09/2005	VIA Travel Group ASA	PE	NO	-1.724138	-3.793103
05/27/2005	Affecto OY	PE	FI	0.208329	-2.083337
04/26/2005	Polimoon AS	PE	NO	-1.395349	-2.325581
10/01/2018	poLight ASA	VC	NO	0.000000	-4.000000
06/29/2018	Calliditas Therapeutics AB	VC	SE	4.433333	16.444445
06/26/2018	Virogates A/S	VC	DK	-6.043956	-7.439560
06/08/2018	Better Collective A/S	VC	SE	25.925926	30.555555
05/31/2018	Africa Resources AB	VC	SE	-11.111111	2.222222
04/18/2018	Fluicell AB	VC	SE	1.333333	-18.666666
02/28/2018	BBS-Bioactive Bone Substitutes	VC	SE	-21.774654	-24.815521
02/26/2018	Smoltek Nanotech Holding AB	VC	SE	-12.849160	32.402237
01/09/2018	Cgit Holding AB	VC	SE	-8.000000	-24.799999
01/04/2018	ObsteCare AB	VC	SE	-18.157894	13.947370
12/14/2017	Bio-Works Technologies AB	VC	SE	13.636364	-9.100000

12/12/2017	Colabitoil Sweden AB	VC	SE	-45.454544	-50.151516
12/11/2017	Acconeer AB	VC	SE	35.200001	16.400000
12/08/2017	MAG Interactive AB	VC	SE	-5.681818	-8.102273
11/22/2017	IRRAS AB	VC	SE	-16.444445	-36.888889
11/16/2017	Orphazyme A/S	VC	DK	0.000000	-9.375000
10/12/2017	BioArctic AB	VC	SE	20.833334	4.166667
09/29/2017	Rovio Entertainment Oyj	VC	FI	0.000000	0.086957
09/28/2017	XSpray Pharma AB	VC	SE	42.727272	40.909092
09/28/2017	Inhalation Sciences Sweden AB	VC	SE	85.000000	144.000000
07/24/2017	Enrad AB	VC	SE	-12.499998	-37.142857
07/06/2017	Promore Pharma AB	VC	SE	-40.557938	-41.201714
06/21/2017	BoneSupport Holding AB	VC	SE	10.344828	0.689655
06/15/2017	Enersize Oyj	VC	SE	23.913042	19.565216
06/08/2017	Zaplox AB	VC	SE	17.272728	-3.636364
05/31/2017	Boozt AB	VC	SE	25.000000	33.870968
05/22/2017	BioServo Technologies AB	VC	SE	-20.833334	-24.166666
05/05/2017	Mantex AB	VC	SE	-49.425285	-55.172413
05/05/2017	Bambuser AB	VC	SE	-34.782608	-47.934780
04/26/2017	XmReality AB	VC	SE	6.204381	-10.583941
04/12/2017	Sonetel AB	VC	SE	2.230485	-5.576207
04/04/2017	Isofol Medical AB	VC	SE	-6.896552	-13.793103
03/27/2017	EatGood Sweden AB	VC	SE	-34.067799	-33.050850
03/23/2017	MIPS AB	VC	SE	11.956522	19.021740
03/23/2017	Next Games Oy	VC	FI	20.253162	4.430378
03/20/2017	Acosense AB	VC	SE	18.604647	-1.162795
03/15/2017	HemCheck Sweden AB	VC	SE	0.833333	-26.000000
02/22/2017	Oncopeptides AB	VC	SE	-6.521739	-8.695652
02/17/2017	Aerowash AB	VC	SE	-28.000000	-50.000000
12/22/2016	Curando Nordic AB	VC	SE	-32.931038	-33.793106
12/22/2016	SeaTwirl AB	VC	SE	-18.500000	-29.750000
12/21/2016	AAC Microtec AB	VC	SE	2.205879	14.705879
12/13/2016	Transiro Int AB	VC	SE	-22.857143	-25.714285
11/30/2016	DNA Oyj	VC	FI	-0.000004	0.495046
11/23/2016	Alligator Bioscience AB	VC	SE	17.230770	-0.307692
06/21/2016	BrandBee Holding AB	VC	SE	-11.500000	-31.500000
05/12/2016	Wilson Therapeutics AB	VC	SE	0.000000	-3.673469
03/17/2016	LeoVegas AB	VC	SE	14.687500	9.687500
12/16/2015	Toleranzia AB	VC	SE	23.972599	11.643833
12/01/2015	Immunovia AB	VC	SE	60.540539	83.783783
07/13/2015	Footway Group AB	VC	SE	1.000000	0.500000
06/02/2015	Scibase Holding AB	VC	SE	-4.800000	-15.000000
04/24/2015	Tobii AB	VC	SE	38.000000	56.400002
03/23/2015	Nordic Nanovector ASA	VC	NO	7.812500	11.875000
06/11/2014	Herantis Pharma Oyj	VC	FI	0.857143	-4.761905
12/06/2013	Napatech A/S	VC	NO	-0.431034	-16.551723
10/25/2013	REC Solar ASA	VC	NO	213.750000	297.500000
03/20/2013	Asetek A/S	VC	NO	-3.333333	-10.000000
05/27/2011	Transmode AB	VC	SE	2.830189	-5.660378
11/23/2010	Zealand Pharma A/S	VC	DK	-7.558139	-19.767443
10/06/2010	CellCura ASA	VC	NO	-23.000000	-26.400000
06/19/2007	Endomines AB	VC	SE	-2.307692	-10.000000

06/18/2007	DIBS Payment Services AB	VC	SE	13.611111	1.666667
06/15/2007	Aerocrine AB	VC	SE	12.000000	-0.400000
05/29/2007	Exiqon A/S	VC	DK	12.500000	-2.500000
11/13/2006	Veloxis Pharmaceuticals A/S	VC	DK	7.045455	15.909091
07/07/2006	Karo Pharma Norge AS	VC	NO	2.417583	-12.087913
07/05/2006	Trolltech ASA	VC	NO	9.375000	12.500000
12/13/2005	Funcom NV	VC	NO	-10.000000	0.000000
11/18/2005	ODIM ASA	VC	NO	5.000000	21.666666
11/09/2005	Orexo AB	VC	SE	0.000000	0.000000
06/10/2005	TopoTarget A/S	VC	DK	16.888889	2.666667
03/18/2005	APL ASA	VC	NO	16.326530	18.367348

A.8.2 Principal Shareholder

Table 25: Principal PE Firms IPOs Sample

Offer Date	Company	Principal PE	Type	Fraction Sold
12/06/2018	Lime Technologies AB	Monterro AB	PE	0.10
12/05/2018	Jetpak Top Holding AB	Polaris Private Equity	PE	0.05
06/25/2018	Shelf Drilling Ltd	Castle Harlan	PE	0.00
06/19/2018	VMP OYJ	Sentica Partners Oy	PE	0.00
06/07/2018	Netcompany Group A/S	FSN Capital Partners AS	PE	0.54
06/05/2018	NCAB Group AB	R12 Kapital AB	PE	0.62
04/06/2018	Iconovo AB	Alto Invest SA/France	PE	0.00
03/27/2018	Bygghemma Group First AB	FSN Capital Partners AS	PE	0.25
03/23/2018	Green Landscaping Holding AB	FSN Capital Partners AS	PE	0.54
03/22/2018	Harvia Oyj	CapMan Oy	PE	0.60
03/09/2018	Cibus Nordic Real Estate AB	Amiral Gestation SAS	PE	-1.00
11/24/2017	TCM Group A/S	IK Investment Partners Ltd	PE	0.95
11/08/2017	Crayon Group Holding ASA	Norvestor Equity AS	PE	0.50
10/11/2017	Terveystalo Oyj	EQT Partners AB	PE	0.87
10/11/2017	Webstep AS	Reiten & Co AS	PE	0.67
10/10/2017	Handicare Group AB	Nordic Capital AB	PE	0.18
10/06/2017	Balco Group AB	Segulah Advisor AB	PE	0.78
09/29/2017	Infront ASA	Kistefos AS	PE	0.66
06/21/2017	Evry AS	Apax Partners LLP	PE	0.22
06/09/2017	Silmaasema Oyj	Intera Equity Partners Oy	PE	0.62
05/29/2017	Saferoad Holding ASA	Nordic Capital AB	PE	0.32
05/19/2017	Munters Group AB	Nordic Capital AB	PE	0.42
05/12/2017	Kamux Corp	Intera Equity Partners Oy	PE	0.48
05/11/2017	Instalco Intressenter AB	FSN Capital Partners AS	PE	0.67
04/07/2017	Actic Group AB	IK Investment Partners Ltd	PE	0.36
03/31/2017	Ambea AB	KKR & Co Inc	PE	0.45
12/09/2016	Edgeware AB	Amadeus Capital Partners Ltd	PE	0.45
12/01/2016	Arcus ASA	Ratos AB	PE	0.61
11/30/2016	Volati AB	Didner & Gerge Fonder AB	PE	-1.00
11/28/2016	Ripasso Energy AB	Ahlstrom Capital Oy	PE	0.00
10/28/2016	Ahlsell AB	CVC Advisers Ltd	PE	0.31
09/29/2016	Internationella Engelska Skola	TA Associates Management LP	PE	0.29

09/23/2016	Nets A/S	Bain Capital Private Equity LP	PE	1.00
06/22/2016	Lauritz.com Group A/S	Bure Equity AB	PE	-1.00
06/15/2016	AcadeMedia AB	EQT Partners AB	PE	0.18
06/10/2016	Nordic Waterproofing Holding A	Axcel Management A/S	PE	1.00
04/29/2016	Resurs Holding AB	Nordic Capital AB	PE	0.93
04/29/2016	Tokmanni Group Corp	Nordic Capital AB	PE	0.37
03/22/2016	Humana AB	Argan Capital LP	PE	0.09
12/11/2015	Consti Yhtiot Oyj	Intera Equity Partners Oy	PE	0.70
12/02/2015	Scandic Hotels Group AB	EQT Partners AB	PE	0.50
11/30/2015	Attendo AB	IK Investment Partners Ltd	PE	0.68
11/25/2015	Dometic Group AB	EQT Partners AB	PE	1.00
11/09/2015	Minesto AB	BGA Invest AB	PE	-0.31
10/16/2015	Bravida Holding AB	Bain Capital Private Equity LP	PE	0.38
07/07/2015	Kotipizza Group Oyj	Sentica Partners Oy	PE	-0.72
07/01/2015	Fit Biotech Oy	Inveni Capital GmbH	PE	-0.58
06/30/2015	Capio AB	Apax Partners LLP	PE	-0.34
06/19/2015	Europris ASA	Nordic Capital AB	PE	0.45
06/19/2015	Pioneer Property Group ASA	Hospitality Invest AS	PE	0.00
06/18/2015	Nobina AB	Sothic Capital Management LLP	PE	0.47
06/17/2015	Nordax Group AB	Vision Capital LLP	PE	0.59
06/17/2015	Alimak Group AB	Triton Advisers Ltd	PE	0.48
06/16/2015	Coor Service Management Holdin	Cinven Ltd	PE	0.05
06/04/2015	Pihlajalinna Oyj	Sentica Partners Oy	PE	0.11
03/27/2015	Asiakastieto Group Oyj	Investcorp Bank BSC	PE	0.12
03/27/2015	Troax Group AB	FSN Capital Partners AS	PE	0.76
02/13/2015	Dustin Group AB	Altor Equity Partners AB	PE	0.51
02/06/2015	Eltel AB	3i Funds	PE	0.60
12/16/2014	RenoNorden ASA	Capvest Partners LLP	PE	0.54
11/26/2014	Thule Group AB	Nordic Capital AB	PE	0.30
10/03/2014	XXL ASA	EQT Partners AB	PE	0.29
09/26/2014	Inwido AB	Ratos AB	PE	0.77
06/27/2014	Scandi Standard AB	Capvest Partners LLP	PE	0.68
06/20/2014	Zalaris ASA	Reiten & Co AS	PE	1.00
06/17/2014	Com Hem Holding AB	BC Partners Holdings Ltd	PE	0.00
03/28/2014	OW Bunker A/S	Altor Equity Partners AB	PE	0.61
03/13/2014	ISS A/S	EQT Partners AB	PE	0.34
02/21/2014	Bufab AB	Nordic Capital AB	PE	0.78
12/10/2013	Geberit Production Oy	EQT Partners AB	PE	0.60
06/28/2013	Matas A/S	CVC Advisers Ltd	PE	0.61
05/20/2011	Bulten AB	Nordic Capital AB	PE	0.49
10/05/2010	Pandora A/S	Prometheus Investment Funding Ltd	PE	0.01
06/18/2010	MQ Holding AB	CapMan Oy	PE	0.50
06/03/2010	Chr Hansen Holding A/S	PAI Partners SAS	PE	0.12
06/02/2010	Byggmax Group AB	Altor Equity Partners AB	PE	0.12
11/14/2007	Duni AB	EQT Partners AB	PE	0.35
10/19/2007	HMS Networks AB	Segulah Advisor AB	PE	0.85
10/11/2007	Pronova BioPharma ASA	Herkules Capital AS	PE	0.33
05/16/2007	Nederman Holding AB	EQT Partners AB	PE	0.86
03/23/2007	NEAS ASA	Reiten & Co AS	PE	0.20
12/01/2006	Lindab International AB	Ratos AB	PE	0.50
11/24/2006	BE Group AB	Nordic Capital AB	PE	1.00

11/10/2006	AKVA Group ASA	Norvestor Equity AS	PE	1.00
10/12/2006	Marine Farms ASA	Marin Forvaltning	PE	0.00
09/15/2006	Swedish Orphan Biovitrum AB	Nordic Capital AB	PE	0.00
03/13/2006	Salcomp Oyj	EQT Partners AB	PE	0.33
02/23/2006	KappAhl AB	Nordic Capital AB	PE	1.00
11/04/2005	Biotec Pharmacon ASA	NorgesInvestor	PE	0.00
10/24/2005	Cermaq Group AS	NorgesInvestor	PE	0.00
10/24/2005	Powel ASA	Norvestor Equity AS	PE	1.00
06/27/2005	Wintershall Norge AS	HitecVision	PE	1.00
06/24/2005	Kongsberg Automotive ASA	FSN Capital Partners AS	PE	0.53
06/09/2005	VIA Travel Group ASA	NorgesInvestor	PE	1.00
05/27/2005	Affecto OY	CapMan Oy	PE	0.63
04/26/2005	Polimoon AS	CVC Advisers Ltd	PE	0.64
10/01/2018	poLight ASA	Investinor AS	VC	0.00
06/29/2018	Calliditas Therapeutics AB	Investinor AS	VC	0.00
06/26/2018	Virogates A/S	The Way Forward ApS	VC	NaN
06/08/2018	Better Collective A/S	Bumble Ventures ApS	VC	1.00
05/31/2018	Africa Resources AB	Nordica Life Ltd	VC	0.00
04/18/2018	Fluicell AB	ALMI Invest AB	VC	0.00
02/28/2018	BBS-Bioactive Bone Substitutes	Finha Capital Oy	VC	0.00
02/26/2018	Smoltek Nanotech Holding AB	Gramtec Business Partner AB	VC	-0.04
01/09/2018	Cgit Holding AB	New Equity Venture International AB	VC	0.00
01/04/2018	ObsteCare AB	ALMI Invest AB	VC	0.00
12/14/2017	Bio-Works Technologies AB	ALMI Invest AB	VC	0.00
12/12/2017	Colabitoil Sweden AB	ALMI Invest AB	VC	0.00
12/11/2017	Acconeer AB	BGA Invest AB	VC	-0.08
12/08/2017	MAG Interactive AB	Nokia Growth Partners Management Co Oy	VC	0.65
11/22/2017	IRRAS AB	Serendipity Ixora AB	VC	0.00
11/16/2017	Orphazyme A/S	Sunstone Capital A/S	VC	0.00
10/12/2017	BioArctic AB	Karolinska Development AB	VC	1.00
09/29/2017	Rovio Entertainment Oyj	Trema International Holdings BV	VC	0.38
09/28/2017	XSpray Pharma AB	Recipharm Venture	VC	-0.07
09/28/2017	Inhalation Sciences Sweden AB	ALMI Invest AB	VC	0.00
07/24/2017	Enrad AB	ALMI Invest AB	VC	0.00
07/06/2017	Promore Pharma AB	Rosetta Capital Ltd	VC	-0.01
06/21/2017	BoneSupport Holding AB	HealthCap Venture Capital	VC	-0.08
06/15/2017	Enersize Oyj	Loudspring Oyj	VC	0.00
06/08/2017	Zaplox AB	LMK Ventures AB	VC	0.00
05/31/2017	Boozt AB	Sunstone Capital A/S	VC	0.55
05/22/2017	BioServo Technologies AB	Tellacq AB	VC	0.00
05/05/2017	Mantex AB	Pegroco Invest AB	VC	-0.20
05/05/2017	Bambuser AB	ALMI Invest AB	VC	0.00
04/26/2017	XmReality AB	ALMI Invest AB	VC	0.00
04/12/2017	Sonetel AB	ALMI Invest AB	VC	0.00
04/04/2017	Isofol Medical AB	Yield Life Science AB	VC	0.00
03/27/2017	EatGood Sweden AB	ALMI Invest AB	VC	0.00
03/23/2017	MIPS AB	HealthCap Venture Capital	VC	0.50
03/23/2017	Next Games Oy	IDG Ventures Inc	VC	1.00
03/20/2017	Acosense AB	Chalmers Ventures AB	VC	0.00
03/15/2017	HemCheck Sweden AB	ALMI Invest AB	VC	-0.19
02/22/2017	Oncopeptides AB	HealthCap Venture Capital	VC	-0.13

02/17/2017	Aerowash AB	New Equity Venture International AB	VC	NaN
12/22/2016	Curando Nordic AB	ALMI Invest AB	VC	-0.05
12/22/2016	SeaTwirl AB	ALMI Invest AB	VC	-0.07
12/21/2016	AAC Microtec AB	Fouriertransform AB	VC	-0.17
12/13/2016	Transiro Int AB	New Equity Venture International AB	VC	0.00
11/30/2016	DNA Oyj	Finda Oy	VC	0.36
11/23/2016	Alligator Bioscience AB	Sunstone Capital A/S	VC	0.29
06/21/2016	BrandBee Holding AB	New Equity Venture International AB	VC	0.00
05/12/2016	Wilson Therapeutics AB	HealthCap Venture Capital	VC	-0.05
03/17/2016	LeoVegas AB	Aggregate Stockholm AB	VC	1.00
12/16/2015	Toleranzia AB	GU Ventures AB	VC	0.00
12/01/2015	Immunovia AB	ALMI Invest AB	VC	1.00
07/13/2015	Footway Group AB	Stiftelsen Industrifonden	VC	0.00
06/02/2015	Scibase Holding AB	SEB Venture Capital AB	VC	0.00
04/24/2015	Tobii AB	Northzone AB	VC	0.00
03/23/2015	Nordic Nanovector ASA	HealthCap Venture Capital	VC	0.00
06/11/2014	Herantis Pharma Oyj	Inveni Capital GmbH	VC	0.00
12/06/2013	Napatech A/S	Northzone AB	VC	0.34
10/25/2013	REC Solar ASA	Hafslund Venture	VC	0.00
03/20/2013	Asetek A/S	Sunstone Capital A/S	VC	0.14
05/27/2011	Transmode AB	Pod Venture Partners AB	VC	0.08
11/23/2010	Zealand Pharma A/S	Sunstone Capital A/S	VC	0.00
10/06/2010	CellCura ASA	Maturo Kapital AS	VC	NaN
06/19/2007	Endomines AB	Noweco Partners	VC	1.00
06/18/2007	DIBS Payment Services AB	Verdane Capital	VC	NaN
06/15/2007	Aerocrine AB	HealthCap Venture Capital	VC	0.00
05/29/2007	Exiqon A/S	Teknoinvest	VC	0.00
11/13/2006	Veloxis Pharmaceuticals A/S	NB Capital	VC	0.05
07/07/2006	Karo Pharma Norge AS	HealthCap Venture Capital	VC	NaN
07/05/2006	Trolltech ASA	Northzone AB	VC	1.00
12/13/2005	Funcom NV	Northzone AB	VC	NaN
11/18/2005	ODIM ASA	Verdane Capital	VC	1.00
11/09/2005	Orexo AB	HealthCap Venture Capital	VC	0.00
06/10/2005	TopoTarget A/S	HealthCap Venture Capital	VC	0.00
03/18/2005	APL ASA	Energivekst	VC	0.00