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Underpricing and Long-Run Performance Patterns of Nordic Private Equity-Backed and Non-Private Equity-Backed IPOs

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Underpricing and Long-Run Performance Patterns of Nordic Private Equity-Backed and Non-Private Equity-Backed IPOs

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Abstract

This paper investigates the initial returns and long-run performance of initial public offerings (IPO) using a sample of 78 private equity-backed IPOs, 42 venture capital-backed IPOs and 199 non-sponsored IPOs in the period 2002-2015 on the four major Nordic stock exchanges. We find that private equity-backed firms outperform non-private equity backed firms in the long-run and experience less underpricing on average. The results reveal that PE-backed IPOs are larger on average, have more underwriters participating in the transaction and use a more prestigious investment bank as global coordinator. PE-backed IPOs experience more underpricing in high activity periods, but we find no evidence that PE or VC firms that sells a larger equity stake in the IPO yields lower underpricing. PE-backed firms significantly outperform their industry peers over a three-year period, but we find no evidence that firms listed in hot markets versus cold markets experience long-run underperformance as documented in previous literature.

Keywords: Nordic IPOs, private equity, underpricing, long-run abnormal returns

JEL classification: G15**,** G30, G32 & G39

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Table of Contents

1.0 Introduction 5

1.1 Motivation 7

2. Literature Review 8

2.1 IPO underpricing *8*

2.1.1 Information asymmetry 8

2.1.2 Hot market issues 9

2.1.3 Selling shareholders' incentives 9

2.1.4 Underwriter reputation 10

2.1.5 Syndicate members 10

2.1.6 Previous findings 10

2.2 Performance after listing *12*

2.2.1 Long-run performance 12

2.2.2 Semi-rational hypothesis 12

2.2.3 Underwriter Reputations 12

2.2.4 Previous Findings 13

2.3 Private Equity *14*

2.3.1 Underpricing 14

2.3.2 Performance after Listing 14

3. Industry Overview 16

3.1 Structure *16*

3.2 Life Cycle *17*

3.2.1 Organising/Fundraising 17

3.2.2 Investment 17

3.2.3 Management 18

3.2.4 Harvest/Exit 18

3.3 The Nordic Private Equity Market *18*

4. Research question and objective 20

4.1 Research question *20*

4.2 Research hypotheses *20*

4.2.1 Underpricing hypotheses 20

4.2.2 Long-run performance hypotheses 21

5. Data collection and descriptive statistics 23

5.1 Data collection process *23*

5.2 Initial sample generation *23*

5.3 Classification of initial public offerings *25*

5.3.1 Private equity and venture capital classification 25
5.3.2 IPO cyclicality 27
5.3.3 Industry classification 28
5.3.4 Underwriter classification 29
5.4 Data collection for underpricing and long-run performance *30*
5.5 Data Source Criticism *31*

6. Methodology 33
6.1 Underpricing *33*
6.1.1 Initial returns 33
6.1.2 Statistical tests for hypotheses testing 35
6.1.3 Multivariate regression model for robustness checking 35
6.2 Long-run performance *37*
6.2.1 Time regime 37
6.2.2 Abnormal return metrics in event time 39
6.2.3 Abnormal return metrics in calendar time 40
6.2.4 Benchmark 41
6.2.5 Statistical tests for long-run performance 43
6.2.6 Multivariate regression model for robustness checking 44

7.0 Results and analysis 46
7.1 Underpricing results *46*
7.1.1 Distributional properties of first-day returns 46
7.1.2 First-day returns 47
7.1.3 Underpricing differences and IPO cyclicality 49
7.1.4 OLS regression for robustness checking of first-day returns 51
7.2 Event time results *53*
7.2.1 Distributional properties of abnormal returns 54
7.2.2 Abnormal returns 55
7.2.3 Performance differences 60
7.2.4 Industry performance 62
7.3 IPO Cyclicality *63*
7.3.1 Calendar time results 63
7.3.2 IPO cyclicality in event time 65
7.4 OLS regressions for robustness checking on long-run performance *68*

8. Conclusion 71

9. References 73

10. Appendices 80
Appendix 1 – Inflation adjusted market capitalisation *80*

Appendix 2 - Benchmarks *81*
Appendix 3 – Equal-weighted BHAR and CAR in event time *83*
Appendix 4 – Industry specific CARs in event time *85*
Appendix 5 – Test of difference in 36-month CARs between HMA and LMA *85*
Appendix 6 – Underwriter reputation *85*
Appendix 7 – IPO sample *88*
Appendix 8 – Ownership Pre- and Post IPO *94*
Appendix 9 – Abbreviations *95*

List of Tables and Figures

Table 2.1 ..... **11**
Table 2.2 ..... **13**
Figure 3.1 ..... **16**
Figure 3.2 ..... **17**
Table 5.1 ..... **26**
Table 5.2 ..... **27**
Table 5.3 ..... **29**
Table 5.4 ..... **30**
Table 7.1 ..... **47**
Table 7.2 ..... **48**
Table 7.3 ..... **50**
Table 7.4 ..... **50**
Table 7.5 ..... **53**
Table 7.6 ..... **54**
Table 7.7 ..... **56**
Table 7.8 ..... **57**
Figure 7.1 ..... **58**
Figure 7.2 ..... **59**
Table 7.9 ..... **61**
Table 7.10 ..... **61**
Table 7.11 ..... **63**
Table 7.12 ..... **65**
Table 7.13 ..... **66**
Table 7.14 ..... **67**
Table 7.15 ..... **68**
Table 7.16 ..... **70**
Table 10.1 (Appendix) **80**
Table 10.2 (Appendix) **81**
Table 10.3(Appendix) **82**
Table 10.4 (Appendix) **83**
Table 10.5 (Appendix) **84**
Table 10.6 (Appendix) **85**
Table 10.7 (Appendix) **85**
Table 10.8 (Appendix) **87**
Table 10.9 (Appendix) **88**
Table 10.10 (Appendix) **94**

1.0 Introduction

The Nordic initial public offering (IPO) markets have experienced a remarkable activity growth over the past few years, and 2017 were yet another record year on NASDAQ's Nordic markets with 115 new listings across the Nordics raising EUR3.8bn in capital, beating the previous record from 2015 (Nasdaq, 2017). The current Nordic IPO market has benefitted from favourable stock market conditions, a low interest rate environment and high valuation levels. As a result, several firms in the Nordics have taken advantage of the attractive pricing of stocks by raising capital in the equity market at all-time high levels. Private equity firms are known to take advantage of these peaks by exiting their investments through IPOs to maximise their returns (Berger and Udell, 1998). However, as private equity firms are frequent participants in the equity markets, they arguably have considerable reputational capital at stake in the IPOs of portfolio firms. Thus, private equity firms have an inherent incentive only to do reasonable IPOs. Hence, this thesis aims to shed some light on private equity firms' ability to take advantage of higher valuation levels, but also whether this impacts the firms' aftermarket performance. In our view, the aftermarket performance is very important for larger institutional investors' as they are frequent participants in the equity markets and significant contributors in book building processes. Consequently, this thesis investigates whether PE-backed IPOs in the Nordics outperform both the market and non-PE-backed IPOs longer-term and whether PE-backed transactions display a lower degree of underpricing than the latter.

The thesis' final sample consists of 319 initial public offerings listed on the stock exchanges in Sweden, Finland, Norway and Denmark from January 2002 to December 2015. In line with previous research, we find that Nordic IPOs in aggregate experience an average underpricing of 8.3%. However, the results reveal that private equity-backed IPOs are less underpriced when compared to venture capital-backed and non-sponsored IPOs which are in line with previous research. We also find that PE-backed IPOs are on average larger in terms of inflation-adjusted market capitalisation, have more underwriters participating in the transaction and use a more prestigious investment bank as global coordinator when compared to traditional IPOs. Further, larger firms appear to experience more underpricing which contradicts both the literature and our expectations. We note our sample is similar to other regions, like Europe, as our average inflation-adjusted

market capitalisation is cEUR243, in-line with medium-sized European IPOs that usually ranges between EUR100-500m (Schuster, 2003) arguably making our sample comparable across countries when looking at size. Also, we find that PE-backed IPOs experience a higher degree of underpricing in hot markets versus cold markets which contradict other papers. We find no evidence that PE or VC firms that sell a larger equity stake in the IPO yields lower underpricing as one would expect, supporting the view that PE firms are frequent participants in the capital markets and must maintain a satisfactory reputational capital. Lastly, we find that more underwriters' leads to lower underpricing and that the healthcare sector is experiencing the highest average first-day returns.

Looking at long-run performance, we find that all firms tend to underperform applicable country total return indices as one would expect based on previous findings. However, PE-backed firms report a median -4.2% 36-months buy and hold abnormal return and significantly outperform non-sponsored and venture capital-backed IPOs in the aftermarket in line with our expectations. Our analysis also reveals that PE-backed firms significantly outperform their industry peers, but we find no evidence that firms listed in hot markets versus cold markets experience long-run underperformance as documented in previous articles. Further, firms that are listed using prestigious underwriters tend to outperform other IPOs in the long-run. This supports our findings that PE-backed IPOs outperform other listings as PE firms tend to use more prestigious underwriters. That said, we find no evidence that PE and VC firms that sell a larger equity stake in the IPO show weaker long-run performance.

In the following section we briefly discuss our motivation and the thesis contribution to the literature. In Chapter 2, we present relevant literature on both underpricing and IPO long-run aftermarket performance, while Chapter 3 contains an industry overview starting with a short introduction to the Nordic private equity market. Chapter 4 presents our two main research questions along with our eight main hypotheses. The two next chapters' includes a summary of our data collection process as well as an overview of the relevant methodology used in the thesis. Lastly, Chapter 7 presents our results and discussion, while Chapter 8 outlines the main conclusions of the study. We also discuss some limitations of the study as well as suggesting some topics for further investigation.

1.1 Motivation

The Nordic market has experienced a surge in IPO activity in recent years and has reached pre-financial crisis levels. This has been a hot topic in the mainstream financial media over the past year. For instance, Stockholm's main market broke a European record with 5 listings in a single day in 2017 creating several headlines in Scandinavia (Business Insider, 2017). Interestingly, as recent research shows that most IPOs are underpriced (Booth and Chua, 1996), the IPO leaves a lot of money on the table. This implies that newly listed companies could have raised more capital in the initial public offerings. To us, it is puzzling that offer prices are not set higher to minimise the amount of money left on the table from the perspective of the issuers and selling shareholders. As private equity firms use IPOs, amongst other techniques, as exit strategies when realising fund returns, an interesting conflict of interest reveals itself. Private equity firms would want to maximise their returns by exiting at the highest possible offer price (i.e. leaving less money on the table), while underwriters want to maximise the initial returns for their largest institutional investors by lowering the offer price (i.e. leaving more money on the table). However, private equity firms also want institutional investor to participate in future IPOs initiated by the PE firm (i.e. leaving more money on the table), while underwriters want to be hired by unlisted firms when they intend to go public (i.e. by leaving less money on the table). Hence, sponsors and underwriters face an interesting paradox when pricing the IPOs. Thus, a main motivational driver has been to investigate this issue further.

Furthermore, IPO underpricing has been a subject of a lot of academic research with well-known articles and theories. However, albeit there exists some research on the Nordic market after the financial crisis on the topic, most literature is using pre-financial crisis data with the tech bubble as their main hot market period. Given our Nordic background, we want to investigate both underpricing and long-run performance on the Nordic stock exchanges with a dataset including post-financial crisis data. Also, as most papers focus on IPOs in aggregate, we want to investigate whether the pre-IPO ownership structure has any impact on both underpricing and aftermarket performance.

2. Literature Review

2.1 IPO underpricing

Several researchers try to explain IPO underpricing with theories developed by studying different financial markets during various time intervals. The most relevant theories for this thesis are elaborated in the next sub-chapters and may answer some of our hypothesis regarding IPO underpricing. It is worth mentioning that the theories presented are not mutually exclusive and may complement each other.

2.1.1 Information asymmetry

Information asymmetry may emerge between outside investors ("outsiders"), underwriter, and management or initial shareholders of the company ("insiders"). When a company is listed on a stock exchange, this information asymmetry can lead to underpricing. The insiders tend to have superior information about the firm that they can exploit in the listing of the company (Booth & Smith, 1986). Thus, insiders may wealth themselves and behave opportunistically at the expense of the outsiders. Therefore, outsiders may reduce the price they are willing to pay for the offering because they question the insiders' motivation (Booth & Smith, 1986).

Another reason why information asymmetry may lead to IPO underpricing is because of the costs of producing information for outsiders. Firstly, the issuing firm produces common value information by using known underwriters and firm-commitment contracts. Then investment bankers promote the issue, and investors investigate the issue and produce private value information. The private value information about the issuing firm is costly to produce, and thus "*these information costs are offset through initial underpricing*" (Booth & Chua, 1996, p.1). Thus, the final issue price is a function of the investment banker's best estimate of value, subtracted by total information costs for all the potential investors (Booth & Chua, 1996).

Lastly, information asymmetry may occur between underwriters and the insiders. The underwriters are considered to be knowledgeable for the demand of the IPO and the market conditions (Baron, 1992). Thus, underwriters may be encouraged to offer investors some initial positive return through purposeful underpricing (Loughran & Ritter, 2004).

2.1.2 Hot market issues

IPO activity has shown to be very cyclical over time (Ibbotson & Jaffe, 1975). Schöber (2008) argues that this cyclicality may occur because of the business cycle, market-timing of IPO firms concerning investor sentiment, information externalities, "pseudo market timing" of IPO firms and adverse selection costs. The cyclicality of first day returns and IPO activity was first documented by Ibbotson and Jaffe (1975) and Ritter (1984). The authors define "cold issue markets" as periods where new issues yield below average returns, and "hot issue markets" as periods when new issues pay abnormal high returns. Ritter's study shows that the average underpricing during the period 1977-1982 was 16% (Ritter, 1984), while the underpricing was 48% during a 15-month period from January 1980 to March 1981 (Ritter, 1984). This suggests that the 15-month period from January 1980 was a "hot issue market". Ibbotson et al. (1994) also document that, on average, larger offerings are underpriced to a lower degree.

Ritter and Loughran (2004) document the same trends during the dot-com bubble in contrast to the latter period. In the "hot" dot-com years of 1999-2000 the average underpricing was 65% on the New York Stock Exchange (Ritter & Loughran, 2004), while during the "colder" IPO period of 2001-2003, the average underpricing were 12%. Loughran, Ritter & Rydqvist (1995) finds in their research a correlation between market returns and IPO underpricing, which implies that "hot issue markets" tend to follow periods of high stock market returns. "Hot issue markets" can be reinforced by investors who are acting irrational (Ljungqvist, Nanda & Singh, 2006).

2.1.3 Selling shareholders' incentives

The selling shareholders' incentives may also explain IPO underpricing. IPOs may be more underpriced due to the initial shareholders have fewer reasons to care about the underpricing (Habib & Ljungqvist, 2001). Shareholders who sell fewer shares suffer marginally by underpricing, compared to shareholders who sell a larger fraction of their shares. Hence, the more shares they sell, or the higher fraction, the larger incentive shareholders should decrease underpricing (Habib & Ljungqvist, 2001). This is also explained by Ritter & Loughran (2002) and is called "The realignment of incentives hypothesis". Empirical evidence from Habib & Ljungqvist (2001), and Ritter & Loughran (2002) support this hypothesis.

2.1.4 Underwriter reputation

The reputation of the underwriter may explain IPO underpricing, as engaging a "renowned" underwriter may serve as a trustworthy signal to the stock market. Empirical evidence developed by Carter and Manaster (1990) shows that underpricing and the underwriter's prestige is negatively correlated. Similar results are found by Michaely and Shaw (1994). Their study finds that IPOs managed by high prestige investment bankers tend to be less underpriced than other IPOs. However, some researchers argue that underwriters may be incentivised to underprice IPOs to reduce risk and marketing cost (Baron, 1982).

2.1.5 Syndicate members

Another factor that may determine IPO underpricing is the syndicate size of underwriters in the offering. Corwin and Schultz (2005), finds that the larger the syndicate size, it is more likely with an upward offer price revision in the price range. They argue further that larger underwriter syndicates will decrease IPO underpricing. If the non-managing syndicate members and co-lead managers reduce information asymmetry (as discussed in section 2.1.1) or help to certify an offering´s quality, this will decrease the IPO underpricing (Corwin & Schultz, 2005).

2.1.6 Previous findings

Summary of estimated first day returns of Initial Public Offerings from earlier studies is summarised in Table 2.1. The pattern is that Private Equity-backed IPOs are on average less underpriced than the non-sponsored offerings. However, this is across several studies in different markets, geographies and time periods.

Table 2.1 - Summary of previous literature on underpricing

The table shows a summary of initial public offerings from earlier studies. We report the first-day return calculation method for each study, the sample period, the estimated average underpricing (mean), the market studied (country/region) and the classification of each IPO. The classification "All" represents all IPOs listed regardless of ownership structure, "NS" represents non-sponsored IPOs, "VC" represents venture capital-backed IPOs, "PE" represents private equity-backed IPOs, and "BO" represents buyout-backed IPOs which includes both VC and PE-backed IPOs. We note that the BO classification also included studies on reverse leveraged-buyouts (RLBOs). The studies are categorised with respect to each subgroup and by year of publication.

Study	Sample Period	First-day return calculation	Estimated Underpricing (mean)	Market	Classification
All IPO types					
Reilly & Hatfield (1969)	1963 - 1966	First Friday's price after IPO	9.9 %	US	All
McDonald & Fisher (1972)	Q1 1969	First day close after IPO	28.5 %	US	All
Ibbotson (1975)	1960 - 1969	First end of month price after IPO	11.4 %	US	All
Ibbotson & Jaffe (1975)	1960 - 1970	First end of month price after IPO	16.8 %	US	All
Ritter (1984)	1960 - 1982	First closing bid price after IPO	18.8 %	US	All
Ritter (1984)	1977 - 1982	First closing bid price after IPO	26.5 %	US	All
Ritter (1984)	1980 - 1981	First closing bid price after IPO	48.4 %	US	All
Beatty & Ritter (1986)	1981 - 1982	First closing bid price after IPO	14.1 %	US	All
Chalk & Peavy III (1987)	1975 - 1982	N/A	21.7 %	US	All
Miller & Reilly (1987)	1975 - 1982	N/A	9.9 %	US	All
Ibbotson et al. (1988)	1960 - 1987	Bid price end of the month after IPO	16.4 %	US	All
Ibbotson et al. (1994)	1960 - 1992	Bid price end of the month after IPO	15.3 %	US	All
Ibbotson et al. (1994)	1960 - 2006	First closing bid price after IPO	18.7 %	US	All
Booth & Chua (1996)	1977 - 1988	First day close after IPO	13.1 %	US	All
Van der Geest & Van Frederikslust(2001)	1985 - 1998	First day close after IPO	16.0 %	Netherlands	All
Lowry & Schwert (2002)	1985 - 1997	First day close after IPO	13.9 %	US	All
Schertler (2002)	1997 - 2000	First day close after IPO	49.2 %	Germany	All
Schertler (2002)	1997 - 2000	First day close after IPO	9.2 %	France	All
Loughran & Ritter (2004)	1990 - 1998	First day close after IPO	15.0 %	US	All
Loughran & Ritter (2004)	1999 - 2000	First day close after IPO	65.0 %	US	All
Loughran & Ritter (2004)	2001 - 2003	First day close after IPO	12.0 %	US	All
Westerholm (2006)	1991 - 2002	First day close after IPO	17.0 %	Nordic	All
Hesjedak (2007)	2004-2006	First day close after IPO	3.2 %	Norway	All
Vu & Laird (2008)	1996 - 2007	First day close after IPO	57.8 %	Australia	All
Ferretti & Meles (2011)	1998 - 2008	First day close after IPO	4.7 %	Italy	All
Levis (2011)	1992 - 2005	N/A	18.6 %	UK	All
Falck (2013)	2001-2012	First day close after IPO	3.2 %	Norway	All
Shulzhuk & Ismanova	1993-2008	First day close after IPO	4.5 %	Norway	All
Non-sponsored IPOs					
Hamao et al. (2000)	1989 - 1994	N/A	12.7 %	Japan	NS
Van der Geest & Van Frederikslust(2001)	1985 - 1998	First day close after IPO	17.0 %	Netherlands	NS
Bergström et al. (2006)	1994 - 2004	First day close after IPO	14.7 %	UK	NS
Bergström et al. (2006)	1994 - 2004	First day close after IPO	9.5 %	France	NS
Vu & Laird (2008)	1996 - 2007	First day close after IPO	70.7 %	Australia	NS
Ferretti & Meles (2011)	1998 - 2008	First day close after IPO	6.6 %	Italy	NS
Levis (2011)	1992 - 2005	N/A	21.1 %	UK	NS
Venture capital-backed IPOs					
Vu & Laird (2008)	1996 - 2007	First day close after IPO	32.1 %	Australia	VC
Levis (2011)	1992 - 2005	N/A	14.9 %	UK	VC
Private equity-backed IPOs					
Hamao et al. (2000)	1989 - 1994	N/A	19.2 %	Japan	PE
Van der Geest & Van Frederikslust(2001)	1985 - 1998	First day close after IPO	13.0 %	Netherlands	PE
Schertler (2002)	1997 - 2000	First day close after IPO	52.0 %	Germany	PE
Schertler (2002)	1997 - 2000	First day close after IPO	16.0 %	France	PE
Bergström et al. (2006)	1994 - 2004	First day close after IPO	10.3 %	UK	PE
Bergström et al. (2006)	1994 - 2004	First day close after IPO	4.2 %	France	PE
Vu & Laird (2008)	1996 - 2007	First day close after IPO	39.6 %	Australia	PE
Ferretti & Meles (2011)	1998 - 2008	First day close after IPO	1.9 %	Italy	PE
Levis (2011)	1992 - 2005	N/A	9.1 %	UK	PE
Buyout-backed IPOs					
Muscarella & Vetsuypens (1989)	1983 - 1987	First day close after IPO	2.0 %	US	BO
Holthausen & Larcker (1996)	1983 - 1988	First day close after IPO	2.0 %	US	BO
Cook & Officer (1996)	1983 - 1991	N/A	1.9 %	US	BO
Hogan et al. (2001)	1986 - 1998	First day close after IPO	7.6 %	US	BO
Ang & Brau (2002)	1981 - 1996	First day mean bid ask price after IPO	5.5 %	US	BO
Schöber (2008)	1990 - 2006	First day close after IPO	9.9 %	US	BO
Cao & Lerner (2009)	1986 - 2002	N/A	15.4 %	US	BO

2.2 Performance after listing

2.2.1 Long-run performance

Various studies document the underpricing phenomenon, and several researchers have developed acknowledged theories within this field. The performance after the initial listing is also a well-documented research field of interest. A study with a sample that consists of 1,526 US companies over the period 1975-1984 finds that the 3-year performance of the newly listed companies is outperformed by a set of comparable firms (Ritter, 1991). This study match the companies industry and size. The average holding period for the companies after they went public was 3 years, and their return was 34.47%. However, the return for the comparable, listed companies was 61.86% over the same period (Ritter, 1991). Similar results are found in a study done by Carter, Dark & Singh (1998) on the American stock market, and by Gompers & Learner (2003) on Nasdaq. Thus, there exists evidence displaying IPOs´ underperformance in the aftermarket.

2.2.2 Semi-rational hypothesis

Two semi-rational hypotheses may explain the long-run underperformance of IPOs. If there are constraints on shorting IPOs, Miller (1977) assumes that investors have heterogeneous expectations regarding the valuation of a company and that the most optimistic investors invest in the IPO. However, the variance of opinions will decrease over time, and the marginal investor´s valuation will converge towards the mean valuation. Hence, the stock price will fall (Miller, 1977). Empirical evidence shows that this explanation is consistent with the price fall after the lockup period (Miller, 1977).

Schultz (2003) argues that this long-term underperformance occurs because more IPOs follow successful IPOs. Hence, the last large group of IPOs will underperform (Schultz, 2003). If underperformance is measured so that all companies are weighted equally, the last large group will be a considerable portion of the sample. Thus, this may result in underperformance, on average (Schultz, 2003).

2.2.3 Underwriter Reputations

The underwriter´s reputation has been discussed as a determinant for IPO underpricing. However, several researchers have examined the prestige of the underwriters' effect on the long-term performance after the company´s listings. Carter, Dark & Singh (1998) finds that the underperformance is lower for IPOs with

more prestigious underwriters, compared to IPOs with less prestigious underwriters. Chemmanur & Fulghieri (1994) argues that this better performance for listings with high underwriter reputation may be due to the investment banks´ ability to act as credible information producers. Thus, the underwriter seems more credible in the offers´ with less information asymmetry (Chemmanur & Fulghieri, 1994).

2.2.4 Previous Findings

Table 2.2 below shows the estimated long-term returns of Initial Public Offerings from earlier studies.

Table 2.2 - Summary of previous literature on IPO long-run performance

The table shows a summary of long-run aftermarket performance of initial public offerings from earlier studies. We report the sample period, the abnormal return metric/method used in the study, the holding period for each study, the benchmark index/method used, the mean (%) and median (%) return for the respective holding period, the market of which the study is conducted and lastly the classification of ownership structure prior to the offering. The classification "All" represents all IPOs listed regardless of ownership structure, "NS" represents non-sponsored IPOs, "VC" represents venture capital-backed IPOs, "PE" represents private equity-backed IPOs, and "BO" represents buyout-backed IPOs which includes both VC and PE-backed IPOs. We note that the BO classification also included studies on reverse leveraged-buyouts (RLBOs). The studies are categorised with respect to each subgroup and by year of publication.

Study	Sample Period	Abnormal return metric/method	Holding period	Benchmark	Mean (%)	Median (%)	Market	Classification
All IPO types								
Ritter (1991)	1975 - 1984	CAR	3 Years	CRSP value-weighted NASDAQ index	-29.1	n.a.	US	All
		BHAR	3 Years	CRSP value-weighted AMEX-NYSE index	-27.4	-55.2	US	All
Loughran & Ritter (1995)	1970 - 1990	BHAR	5 Years	CRSP value-weighted NASDAQ index	-50.7	-55.0	US	All
Schuster (2003)	1988 - 1998	BHAR	3 Years	Value-weighted Dow Jones STOXX size indices	8.4	n.a.	Europe	All
Carter et al. (2006)	1979 - 1991	BHAR	3 Years	CRSP value-weighted AMEX-NYSE index	-19.9	-50.7	US	All
Brav et al. (2000)	1975 - 1992	CAR	5 Years	S&P 500 index	-38.3	n.a.	US	All
		BHAR	3 Years	S&P 500 index	-12.1	-30.5	US	All
Gompers & Lerner (2003)	1935 - 1972	CAR		CRSP value-weighted index	-4.5	n.a.	US	All
		BHAR	3 Years	CRSP value-weighted index	-16.7	n.a.	US	All
Eckbo & Norli (2005)	1972 - 1998	BHAR	5 Years	Matching firms (MCAP & Book-to-market)	-28.8	n.a.	US	All
Westerholm (2006)	1991 - 2002	BHAR	5 Years	All-Share market index	4.54	-3.13	Nordic	All
Zheng (2007)	1980 - 1997	BHAR	5 Years	CRSP value-weighted AMEX-NYSE index	-28.2	n.a.	US	All
Gregory et al. (2010)	1975 - 2004	BHAR	3 Years	Matching firms (Size-Decile control portfolio)	-16.4	46.1	US	All
Levis (2011)	1992 - 2005	BHAR	3 Years	FTSE All-Share Index	-13.5	n.a.	UK	All
		BHAR	3 Years	Industry-adjusted FTSE indices	13.7	n.a.	UK	All
Non-sponsored IPOs								
Brav & Gompers (1997)	1975 - 1992	BHAR		S&P 500 index	-49.3	n.a.	US	NS
Levis (2011)	1992 - 2005	BHAR	3 Years	FTSE All-Share Index	-20.2	n.a.	UK	NS
		BHAR	3 Years	Industry-adjusted FTSE indices	21.7	n.a.	UK	NS
Van der Geest & Van Frederikslust (2001)	1985 - 1998	CAR	3 Years	Market weighted CBS index	-15.6	n.a.	Netherlands	NS
Bergström et al. (2006)	1994 - 2004	CAR	3 Years	FTSE All-Share Index	-72.9	n.a.	UK/Frace	NS
Venture capital-backed IPOs								
Brav & Gompers (1997)	1975 - 1992	BHAR		S&P 500 index	-20.7	n.a.	US	VC
Levis (2011)	1992 - 2005	BHAR	3 Years	FTSE All-Share Index	-3.9	n.a.	UK	VC
		BHAR	3 Years	Industry-adjusted FTSE indices	-4.8	n.a.	UK	VC
Private equity-backed IPOs								
Van der Geest & Van Frederikslust (2001)	1985 - 1998	CAR	3 Years	Market weighted CBS index	2.0	n.a.	Netherlands	PE
Bergström et al. (2006)	1994 - 2004	CAR	3 Years	FTSE All-Share Index	-28.6	n.a.	UK/Frace	PE
Levis (2011)	1992 - 2005	BHAR	3 Years	FTSE All-Share Index	13.8	n.a.	UK	PE
		BHAR	3 Years	Industry-adjusted FTSE indices	21.8	n.a.	UK	PE
Buyout-backed IPOs								
Schöber (2008)	1990 - 2006	CAR	5 Years	S&P500 index	3.1	19.1	US	BO
		BHAR	5 Years	S&P500 index	3.2	-37.0	US	BO
Cao & Lerner (2009)	1981 - 2003	BHAR	3 Years	S&P 500 / NYSE/Amex/Nasdaq index	13.5	0.4	US	BO

2.3 Private Equity

2.3.1 Underpricing

There exists some research on the field of IPO underpricing and private equity-backed IPOs. A study on the London Stock Exchange and Paris Stock Exchange conclude that the PE-backed IPOs is underpriced to a lower degree than non-sponsored listings (Bergström et al., 2006). This study consists of a sample of 1,370 non-sponsored and 152 PE-backed IPOs from 1994 to 2004. The same results are also discovered on the French market and the Amsterdam Stock exchange by Bourrat & Wolff (2013) and by Van der Geest & Van Frederikslust (2001), respectively. The results are summarised in Table 2.1 in section 2.1.6.

2.3.2 Performance after Listing

Levis (2011) looked at the long-term performance of private equity-backed listings at the London Stock Exchange. His main findings are that private equity-backed IPOs outperforms other listings (e.g. VC-backed or non-sponsored IPOs) over a three-year holding period (Levis, 2011). These results are consistent with Bergström et al.´s (2006) findings on the London Stock Exchange and Paris Stock Exchange and in contrast to the highly documented underperformance of IPOs in general. One possible explanation for this can be that private equity companies have higher levels of leverage, closer monitoring and management expertise which arguably are key value drivers that the private equity industry exploits (Jensen, 1989). This may lead to higher value creation in the long run and thus making private equity-owned companies more profitable in the long run. Also, even though these benefits can fade away a while after the listing, it is reasonable to assume that they will exist for some years after the IPO and thus contributes to value creation (Levis, 2011).

A study done on the French market shows that private equity-backed IPOs outperform other listings over a three-year period (Bourrat & Wolff, 2013). This is in line with Levis' results from 2011. However, the study was done on the London Stock Exchange also display that the private equity-backed IPOs outperformed not just other listings, but the stock market in general (Levis, 2011). This is a contradiction to the French results, as the private equity-backed IPOs underperforms compared to the stock market in general (Bourrat & Wolff, 2013).

Cao & Lerner's (2009) study on reverse leveraged buyouts (RLBOs) has shown that RLBOs appears to outperform IPOs and the stock market as a whole,

with statistically and economically meaningful positive returns. As buyout companies typically hold large equity ownership in forms before their IPOs and continue to retain large ownership stakes after the offerings, the post-IPO long-run performance of RLBOs will have substantial wealth implications for the private equity investors (Cao & Lerner, 2009).

Cao (2011) finds that buy-out specialists' take advantage of beneficial IPO market conditions for new listings of leverage buyouts (LBOs), yet not to sell equity that is overpriced. This is in line with Schultz (2003) and Pastor and Veronesi (2005) results. If immature companies are listed because of buy-out specialists' market timing, this may lead to financial distress and destroy value (Cao, 2011). However, "*the IPO timing does not affect the sponsors´ exit strategies and monitoring post IPO*" (Cao, 2011, p. 1). Thus, these two factors may affect the aftermarket performance of LBOs in different directions.

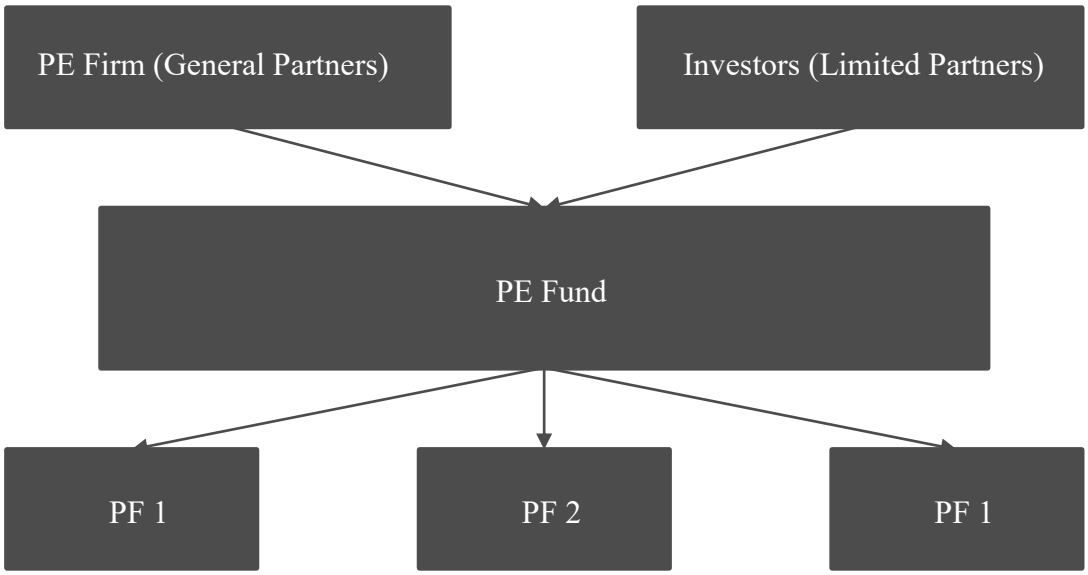
3. Industry Overview

Private equity (PE) is a type of unlisted equity investment and can be defined as "*medium or long-term equity investments that is not publicly traded on an exchange*" (Cendowski et al., 2012, p4). There exist two main categories for private equity transactions, whereby the first are buyout transactions and the second are venture capital (VC) (Metrick & Yasuda, 2010). Venture capital invests in early-stage companies, typically start-ups and high-growth firms. The typical target for VC investments is often within the technology or healthcare sector (Metrick & Yasuda, 2010). Buyout transactions invest in more mature firms, which is mid- to large capitalisation companies. (Cendowski et al., 2012). Buyouts include private-to-private and public-to-private transaction (Fenn et al., 1997), and they often acquire a controlling stake (Schöber, 2008). In case of a public-to-private transaction the PE fund delists the company during the holding period. However, in Norway, the most common case is when a private firm is sold to the PE fund (Bienz, 2016). Due to the large difference between buyouts and venture capital transactions, we have chosen to analyse PE as BO separately from VC, which is in line with previous studies.

3.1 Structure

Private equity funds are usually organised with limited duration. The average lifetime is 10 years, and normally ranging between 8 and 12 years (Cendrowski et al., 2012). There are three main parts of private equity funds; General Partners (GPs), Limited Partners (LPs), and Portfolio Firms (PF).

Figure 3.1 – Structure of Private Equity Firms/Funds (Cendowski, et al., 2012)



The general partners are responsible for managing the fund and tries to improve the target investments with operational efficiencies or other value-add enhancements to the target. Compensation to the GPs is usually pre-determined fees of the capital invested and some proportion of the performance of the fund (Cendowski et al., 2012). The limited partners (LPs) are the investors of the fund, and they are not involved in the day-to-day operations of the PE fund. Usually, these investors are institutional investors as pensions funds, sovereign wealth funds, or other types of investors as high net-worth individuals (Metrick & Yasuda, 2010). Portfolio firms are the companies that the private equity funds are investing in. Usually, these are unlisted companies, and the holding period is typically 2 to 7 years before divestment (Cendowski et al., 2012). However, these firms can be listed companies before the acquisition from the PE fund, as earlier mentioned. Active ownership is a typical characteristic of private equity funds' corporate governance concerning the portfolio firms, as they try to add value to the targets (Investeurope, 2018).

3.2 Life Cycle

As earlier mentioned, the usual lifetime of a private equity fund is 8 to 12 years, with an average of 10 years. Furthermore, through a funds lifetime it will go through four phases or stages: "Organising/Fundraising", "Investment", "Management", and "Harvest/Exit" (Cendrowski et al., 2012).

Figure 3.2 – Lifecycle of Private Equity Funds (Cendowski et al., 2012)

3.2.1 Organising/Fundraising

The organising/fundraising phase usually occurs over the first 18 months of a fund's lifetime. Establishing an investment focus and a strategy is important in this stage (Cendrowski et al., 2012). This phase can be challenging, especially during turbulent macroeconomic periods as capital markets are less liquid during these periods (Cendowski et al., 2012). When the fund reaches the predetermined size, it closes for other investors.

3.2.2 Investment

The second phase is the investment stage. This phase lasts typically from year one to four, and consists of the general partners exploring the market for deals and investment opportunities (Cendrowski et al., 2012). The investment opportunities

are both listed and private companies, and the investments depend on the fund's strategy and focus.

3.2.3 Management

From year 2 to 7 is typically the management phase (Cendrowski et. al., 2012). This is normally the phase where the GPs of the private equity firm implements new strategies, operational efficiencies, add new capital structures, and other enhancement to the firms. (Metrick & Yasuda, 2010). This is done to add more value to the investments and generate a higher selling price when they liquidate their positions (Metrick & Yasuda, 2010).

3.2.4 Harvest/Exit

The harvest/exit period lasts from the fourth year until liquidation of the fund. The fund strives to realise all the investments before the liquidation of the fund (Cendrowski et al. 2012). Several exit strategies such as sale to financial sponsors (secondary buyouts), sale to strategic buyers (trade sales), or an initial public offering (Schöber, 2008) are used to liquidate their investments. Choosing an exit strategy seems to be determined on a case by case basis, and several elements such as market capitalisation, market timing and competitiveness of the sector matters (Schöber, 2008). In the Nordic market, trade sales were the most popular exit route in 2015 and accounted for approximately 50% of the exits (Argentum, 2016).

Due to the cyclicality of the IPO market, which can be linked to the theory of "hot" and "cold" IPO markets (Ritter, 1984), the number of IPOs as an exit strategy might vary over time. Schöber argues that "*the financial sponsors are more (less) inclined to consider an exit through the public equity markets when the valuation multiples for IPOs are high (low), respectively rising (falling)*" (Schöber, 2008, p. 107). Thus, with high activity in the IPO market PE funds might consider IPOs as a better exit route, compared to periods with lower activity. In 2015, private equity-backed IPOs reached an all-time record in the Nordics, capturing 11 out of 18 listings on the Nasdaq Stockholm (Argentum, 2016).

3.3 The Nordic Private Equity Market

The private equity industry came to the Nordics at the beginning of the 1990s and has grown to be one of the Nordic's most important investor groups (Spliid, 2013). Due to the limited size of the Nordic countries, the private equity funds need to attract international investors to grow (Spliid, 2013). However, this forces the private equity firms to offer offshore setups to adapt the different tax regulations

for the investors. This can lead to issues with the fundraising, as the Nordic governments are doubtful of offshore structures (Spliid, 2013).

The Nordic private equity sector raised ~16% and ~8% of the funds in the European private equity-industry in 2015 and 2016, respectively (Investeurope, 2018). Thus, the Nordic market is an important market in a European perspective. In 2017, ~93% of the capital raised in the Nordic private equity market were related to buyout transactions, and ~7% to venture capital (Argentum, 2017; Argentum, 2018). Combining buyout and venture capital, the total amount of capital raised in 2017 was EUR8.6bn in the Nordics (Argentum, 2018).

4. Research question and objective

This section starts with a presentation of this thesis' two main research questions, followed by the paper's main hypothesis regarding both IPO underpricing and IPO aftermarket performance.

4.1 Research question

Our research question will limit the thesis to the already mentioned field of study. The main objective in this thesis is to check whether private equity-backed IPOs are less underpriced compared to non-private equity-backed IPOs and whether there is any difference in the long-run performance of the two aforementioned IPO types. Hence, we have two main research questions:

1) *Does PE-backed IPOs in the Nordics outperform the market longer-term?*
2) *Does PE-backed IPOs in the Nordics display lower degrees of underpricing and higher longer-term performance compared to non-PE-backed IPOs?*

4.2 Research hypotheses

4.2.1 Underpricing hypotheses

Prior research identifies three principal characteristics of initial public offerings, with the majority focusing on first-day returns, aftermarket performance and cyclicality effects. As presented in section 2.1, the lion's share of research on IPO underpricing document that the average newly public firm experience significant underpricing, irrespectively of the country of origin. Thus, our first hypothesis is:

Hypothesis 1: *All new listings as a group will experience underpricing on the Nordic stock exchanges.*

Despite general expectation that the average IPO is experiencing underpricing, there exists evidence that PE-backed IPOs are less underpriced when compared to non-sponsored IPOs[1]. Hence, our second hypothesis is:

[1] *See Table 2.1 (section 2.1)*

Hypothesis 2: *Private equity-backed IPOs will be less underpriced compared to non-private equity-backed IPOs on the Nordic stock exchanges.*

Further, prior scholars have found that the degree of underpricing is higher in market conditions characterised by high IPO activity ("hot" markets), and lower during low IPO activity years ("cold" markets). However, the difference in underpricing during "hot" and "cold" markets have been more marked for non-sponsored IPOs relative to PE-backed IPOs (as e.g. found in Levis, 2011). This could be explained by financial sponsors using IPOs as an exit strategy and consequently have incentives to lower the degree of underpricing to maximise returns. In addition, one should expect the number of PE-backed IPOs to cluster during high IPO activity periods when equity markets tend to be favourably priced (Schöber, 2008). Hence, our third and fourth hypotheses are:

Hypothesis 3: *All IPOs will experience a higher degree of underpricing during "hot" markets versus "cold" markets, irrespective of being PE-backed, VC-backed or non-sponsored.*

Hypothesis 4: *PE-backed IPO's degree of underpricing will be less affected by "hot" and "cold" markets compared to non-sponsored IPOs.*

4.2.2 Long-run performance hypotheses

As summarised in section 2.2, the IPO long-run underperformance phenomenon is widely documented in the literature. Some of the most profound theories explaining the IPO underperformance in general are overoptimistic investor sentiment, pseudo market timing, pre-IPO window dressing and lack of adequate measurement issues. However, one should also note that previous literature has also documented that there exist variations depending on the pre-IPO ownership structure. For instance, PE-backed IPO seems to outperform non-sponsored IPOs (Bergström et al., 2006; Cao & Lerner, 2009; Levis, 2011). Thus, one should expect PE-backed IPOs to experience less underperformance compared to other IPOs in the long-run. Hence, we formulate the following hypotheses:

Hypothesis 5: *All IPOs in total will experience underperformance in the long-run, irrespective of abnormal return metric used.*

Hypothesis 6: *Private equity-backed IPO companies will perform better in the long-run versus VC-backed and non-sponsored IPO companies, irrespective of the abnormal return metric used.*

Furthermore, empirical evidence has shown that the degree of underperformance of IPOs in general is higher in market conditions characterised by high IPO activity. As a result, one should expect that companies listed during "hot" markets should experience a higher degree of aftermarket underperformance. Thus, we formalise our seventh hypothesis below:

Hypothesis 7*: All IPOs will experience a higher degree of long-run underperformance if listed during market periods of high IPO activity than in other periods, irrespective of being PE-backed, VC-backed or non-sponsored.*

Lastly, recent literature has found that issuers try to time the market by going public when the stock market valuations of companies in their industry are high (Schöber, 2008). Hence, one interpretation of this is that firms tend to take advantage of high valuations of their industry when timing their IPO. Albeit there is no clear consensus among previous papers, there exists some evidence that PE-backed IPOs performs equally or better than non-sponsored IPOs in general when their long-run returns are benchmarked against industry-specific indices[2]. Thus, our final hypothesis is:

Hypothesis 8: *Private equity-backed IPOs will perform better in the long-run when benchmarked against an industry-specific index compared to VC-backed and non-sponsored IPOs.*

[2] *For instance, Levis (2011) document that PE-backed IPOs outperforms VC-backed and non-sponsored IPOs, using 12, 24 and 36-month BHAR as abnormal return metric.*

5. Data collection and descriptive statistics

5.1 Data collection process

The thesis' final sample consists of 319 initial public offerings listed on the stock exchanges in Sweden, Finland, Norway and Denmark from January 2002 to December 2015. To capture the 36 months aftermarket performance, daily adjusted stock prices[3] were collected from January 2002 to February 2018 for each IPO. We have excluded the smallest market, Iceland, from our study because of its limited size (only 16 stocks listed as of May 2018[4]) and data were limited. Our study also excludes the alternative market places for smaller companies such as Aktietorget AB, the Norwegian OTC market and Nya Marknaden in Sweden. The geographical and market exclusions follow a similar approach as found in Westerholm (2006). Additionally, Westerholm argues that it is plausible to analyse the Nordic markets in the same context as three of these markets (Sweden, Denmark and Finland) have merged into OMX-integrated markets and all operate within the cooperation network Norex, which harmonises systems and regulations between stock exchanges.

The data are collected from Dealogic's comprehensive database on initial public offerings, Bloomberg, factbooks from the relevant stock exchanges, individual firm prospectuses and company annual and quarterly reports. Due to missing prospectus or low quality on individual company reports, missing data have been collected from Nordic financial newspapers, company press releases, Bloomberg and other financial information channels available online[5].

5.2 Initial sample generation

The data is based on an initial gross sample of public listings, follow-ons and convertibles from January 2002 to December 2015 downloaded from the Dealogic database. This gave us a gross sample of 391 initial public offerings, 1,832 follow-ons and 73 convertibles for a total of 2,301 observations. To end at our final sample of 319 IPOs, we excluded the following listings:

i. Secondary listings, unless the listings were made concurrently

[3] *Daily stock prices adjusted for cash dividends, stock dividends and stock splits (both reverse and regular stock splits)*

[4] *See www.nasdaqomxnordic.com*

[5] *For instance, www.nyemissioner.se*

ii. Listings on smaller exchanges other than the main markets listings (e.g. Oslo Børs, Nasdaq Stockholm, Nasdaq Copenhagen, Nasdaq Stockholm)
iii. List transfers into main lists (for instance listings from Oslo Axess to Oslo Børs or Stockholm First North to Stockholm main market)
iv. Companies with missing ownership structure pre-IPO
v. Listings of Norwegian savings banks that issued equity certificates (instead of common equity)

The rationale behind exclusion criterion i. and iii. is that the shares of these listed companies already are priced in the market, which could distort and create bias in our comparison on first-day trading returns. To get a sample with coherent profitability, size, accounting requirements and trading liquidity, we implemented criterion ii. Furthermore, we excluded companies with missing ownership structure pre-IPO, as we wanted to reduce the bias in our comparison of private equity, venture capital and non-private equity-backed initial returns and aftermarket performance. Due to the difference between equity certificates and common share (e.g. ownership rights on the company's assets), we chose to exclude Norwegian savings banks that issued equity certificates in their initial offering.

The final sample of IPOs is divided into three different groups depending on their pre-listing ownership structure. The pre-IPO ownership structure was primarily obtained from each individual firm's prospectus. When prospectuses were unavailable, we used company press releases, financial supervisory authorities of the listings respective country, financial news channels and Bloomberg. In some cases, annual or quarterly reports prior to the listing were available as the companies had bonds listed on the Nordic exchanges (and thus included ownership structure pre-listing). When none of aforementioned information sources was available, post-IPO annual reports were used as a proxy for pre-IPO ownership. We note that when private equity or venture capital firms had ownership stakes in the listed company post-IPO, we cross-checked with contemporary articles in the financial press and Bloomberg before classifying the IPO in one of the three categories. If pre-IPO ownership structure still were unknown or uncertain after this comprehensive analysis, the offering was excluded from the sample. When companies had both VC and PE ownership at the time of the IPO, we used the largest shareholder to classify the IPO (i.e. if a PE firm was the largest owner the IPO is classified as a PE-backed IPO and vice versa).

5.3 Classification of initial public offerings

5.3.1 Private equity and venture capital classification

The classification of private equity-backed (PE-backed) and venture capital-backed (VC-backed) IPOs remains a challenge. This is due to the combined effect of limited publicly available information for private companies and the overlapping nature of the sponsors' involvement in both venture capital and private equity transactions (Levis, 2011, p. 258). One of the main reasons for the blurred boundaries between venture capital and private equity is that PE firms that typically make buyout investments also have made venture capital investments in the past, or vice versa (Cao & Lerner, 2009).

In Levis' (2011) study, a PE-backed IPO is defined as a company where the PE sponsors(s) has a controlling interest acquired at the time of the buyout. In the same article, VC-backed IPOs are defined as companies that have received start-up, development, or expansion VC backing at some point before going public. A more general definition by Schöber (2008) defines a buyout-backed IPO as a company in which financial sponsors obtained a 'substantial equity interest' through a buyout-type investment. In the article, a 'substantial equity interest' is defined as a combined pre-IPO percentage equity stake in the company of at least 10%. In this thesis, we follow Schöber (2008) and use a 10% ownership stake as the threshold for both PE and VC ownership classification at the time of the IPO. Furthermore, we define a PE-backed IPO as all offerings that were sponsored by a private equity firm pre-listing. Similarly, a VC-backed IPO is defined as all offerings that were sponsored by a venture capital firm pre-listing. To determine whether the shareholders are either a private equity firm or a venture capital firm at the time of the IPO, we rely on the membership lists and classifications provided by the Swedish (SVCA), Norwegian (NVCA), Danish (DVCA), and Finnish (FVCA) Venture Capital Associations. When classifications were unavailable (e.g. because the sponsor had merged with another sponsor or the company has been dissolved), we manually classified the companies as PE or VC based on their company websites. As mentioned above, companies that we have not been able to classify have been excluded from the sample. A summary of pre-IPO ownership for PE and VC-backed IPOs can be seen in Table 5.1 below.

Table 5.1 - Pre-IPO Ownership

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges.

Panel A. PE Ownership Pre-IPO						
Percentile	**0 %**	**20 %**	**40 %**	**60 %**	**80 %**	**100 %**
Ownership (%)	10	32	52	76	93	100
Number of firms	16	15	16	15	8	8
Cumulative number of firms	16	31	47	62	70	78
Panel B. VC Ownership Pre-IPO						
Percentile	**0 %**	**20 %**	**40 %**	**60 %**	**80 %**	**100 %**
Ownership (%)	10	12	21	27	39	76
Number of firms	9	8	8	8	8	1
Cumulative number of firms	9	17	25	33	41	42

After excluding firms based on our five criterions above or due to insufficient data to determine pre-listing ownership, our final sample consists of 319 listings. Further, the sample constitutes 199 non-sponsored IPOs, 78 private equity-backed IPOs and 42 venture capital-backed IPOs. Looking at the historical distribution (see Table 5.2), the number of IPOs saw peaks pre-financial crisis from 2005-2007 and 2014-2015. In contrast, the number of IPOs was particularly low in the years following the technology bubble and during the financial crisis of the late 2000s. Furthermore, the total inflation-adjusted market capitalisation[6] in the sample follows a similar pattern with ~70% of the IPOs market cap coming during 2005-2007 and 2014-2015. One should note that the private equity-backed IPOs display a resembling pattern with ~73% of market capitalisation being in the same period. In terms of relative size, private equity-backed IPOs, on average, have more than 2.3x and 7.1x the inflation-adjusted market capitalisation at listing when compared to non-sponsored and venture capital-backed IPOs, respectively.

[6] *Calculation of inflation-adjusted market capitalisation is described in Appendix 1.*

Table 5.2 - Annual distribution of IPOs by number and total market capitalisation

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. Total market capitalisation is adjusted back to January 2002 using annual CPIs and represents the first-day closing price times the corresponding number of shares outstanding at the time of the IPO.

	Number of firms listed				Inflation adjusted Market Cap (NOKm)			
Year	**All firms**	**PE**	**VC**	**NS**	**All firms**	**PE**	**VC**	**NS**
2002	7	4	1	2	16,980	16,221	497	263
2003	3	0	1	2	1,214	0	440	775
2004	16	2	3	11	47,910	15,631	1,675	30,604
2005	40	10	9	21	102,944	17,224	5,243	80,477
2006	54	10	5	39	140,438	79,361	3,316	57,761
2007	37	8	3	26	61,615	19,887	5,867	35,860
2008	10	1	0	9	2,998	186	0	2,813
2009	1	0	0	1	401	0	0	401
2010	16	5	2	9	94,026	46,460	1,833	45,733
2011	10	1	1	8	13,888	768	1,084	12,036
2012	3	0	0	3	3,209	0	0	3,209
2013	20	3	3	14	31,833	9,435	482	21,916
2014	35	10	4	21	104,032	61,150	1,820	41,062
2015	67	24	10	33	119,584	76,321	3,838	39,424
Total	**319**	**78**	**42**	**199**	**741,073**	**342,644**	**26,094**	**372,335**
Average	23	6	3	14	52,934	24,475	1,864	26,595
Median	16	4	3	10	39,871	15,926	1,379	26,260

Both in terms of the relative size of the PE-backed IPOs, the surge of activity pre-financial crisis and slowdown post the tech bubble between 2003 and 2004 observed in the sample are broadly consistent with the UK pattern described in Levis (2011). Additionally, the total historical distribution of listings follows the same general cyclical boom and bust pattern as described in Loughran & Ritter (2004), Ritter (2006) and Ritter (1991). Also, Schöber (2008) analysis on buyout-backed IPOs in the US market from early 1980 to 2006 shows resemblance to our sample both in terms of both volumes, relative size and in the number of IPOs pre-financial crisis.

5.3.2 IPO cyclicality

To examine whether IPO underpricing or/and long-run performance are affected by when the companies decide to go public, we label each year as either a high market activity (HMA) or low market activity (LMA) as suggested by Scböber (2008). As highlighted by Ritter & Welch (2002, p. 1800), "*high IPO activity may follow high underpricing because underwriters encourage more firms to go public when public valuations turn out to be higher than expected and because underwriters discourage firms from filing or proceeding with an offering when public valuations*

turn out to be lower than expected". Thus, we classify HMA as the period between 2005-2007 and 2014-2015, because of these years' experience a significantly higher IPO activity versus the other years in our sample (see section 5.3.1). Consequently, the remaining years are labelled as LMA. Lastly, to check whether there is any difference among our three sub-groups, we classify the PE-backed, VC-backed and non-sponsored IPOs in a similar manner into six sub-samples.

5.3.3 Industry classification

The industry classification for each IPO follows Nasdaq's Industry Classification Benchmark (ICB) and is a widely used global standard for company classification with four levels of granularity (Nasdaq, 2018c). At the top level, there are ten industries which are used to classify the 319 IPOs in our sample. To further measure the impact of pre-IPO ownership and industry, the IPOs has been classified as private equity, venture capital and non-sponsored IPOs within the ten industries. Table 5.3 gives an overview of the industry composition of the sample. For the sample in aggregate, most IPOs is found in the industrials, financials, healthcare and oil & gas sector. As a result, most of the inflation-adjusted market capitalisation stems from these sectors (roughly 63% of the total sample). That said, when looking at private equity-backed IPOs in isolation, 56% of the PE-backed listings originate from the industrial and consumer goods sectors (representing 59.2% and 88.7% of total inflation-adjusted market capitalisation within these two sectors, respectively). These two sectors also represent 54% of the total inflation-adjusted market capitalisation within the private equity sub-segment, while technology and health care represent 16.6% and 11.7%, respectively.

Table 5.3 - Industry composition of IPOs by number of firms listed and market capitalisation

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. Total market capitalisation is adjusted back to January 2002 using annual CPIs and represents the first-day closing price times the corresponding number of shares outstanding at the time of the IPO.

	Number of firms listed				Inflation adjusted Market Cap (NOKm)			
Sector	**All firms**	**PE**	**VC**	**NS**	**All firms**	**PE**	**VC**	**NS**
Oil & Gas	36	7	3	26	118,181	12,575	427	105,180
Basic Materials	12	3	0	9	21,820	3,818	0	18,001
Industrials	62	22	5	35	144,738	85,684	6,153	52,901
Consumer Services	23	7	0	16	45,633	16,533	0	29,099
Consumer Goods	37	22	2	13	111,839	99,175	1,425	11,239
Health Care	43	7	16	20	57,238	40,124	8,520	8,593
Financials	61	4	1	56	144,551	9,453	678	134,420
Technology	32	4	12	16	69,872	56,890	6,843	6,140
Telecommunications	7	1	3	3	12,483	9,832	2,049	603
Utilities	6	1	0	5	14,720	8,560	0	6,160
Total	**319**	**78**	**42**	**199**	**741,073**	**342,644**	**26,094**	**372,335**

5.3.4 Underwriter classification

To measure the underwriter reputation at the time of the IPO, we use four performance and reputational criterions. The first criterion is based on the underwriters' total inflation-adjusted market capitalisation involvement in the period 2002 to 2015, calculated by adding up the total proceeds of each IPO the underwriter is involved in. It has been suggested that more prestigious underwriters are able to market larger offerings of equity (Carter & Manaster, 1990). Thus, the underwriters that are involved in larger equity transactions consequently get a higher rank and vice a versa. The second variable used is the number of IPO transactions the underwriter is involved in from January 2002 to December 2015. Similarly, the third variable measures the number of times the underwriter is acting as a lead underwriter often referred to as 'global coordinator'. Lastly, to capture the overall quality of the underwriter, we use TNS Sifo Prospera's annual sell-side rankings. More specifically, we use the 'Domestic Equity'[7] ranking for each country from 2002 to 2015. The ranking reports the clients' overall performance regarding perceived quality, client demands and competitive performance in a wide number of aspects (Prospera, 2018). The report ranks the top 5 institutional underwriters for each year and country (Norway, Sweden, Denmark and Finland).

Like the approach pioneered by Carter & Mannaster (1990), we rank each underwriter by assigning an integer rank, zero to nine, based on the underwriters' relative position compared to its peers within the four criterions. The most

[7] *We note that before 2011 this ranking was named 'Stockbroker ranking' for each country*.

prestigious underwriters are awarded a rank of nine, while the least prestigious underwriters are assigned a rank of zero in each category. As an example, the top 90% percentile in each category is awarded rank nine, while the worst 10% (10% percentile or below) receives a rank of 0. The overall rank is then the simple average of the four metrics. A more detailed outlay of underwriter reputation can be found in Appendix 6.

Interestingly, we find that private-equity firms tend to use more prestigious underwriters as can be seen from Panel A below. According to our ad-hoc ranking system, PE-backed IPOs have an average rank of 7.9 versus VC and NS-backed IPOs having 6.9 and 6.5, respectively. Additionally, PE firms tend to have more underwriters with an average of 2.9 investment banks versus VC and NS of 1.9.

Table 5.4 - Number of underwriters and rank

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges.

Panel A. Underwriter Rank				
IPO Type	**All**	**PE**	**VC**	**NS**
Average	6.9	7.9	6.9	6.5
Median	8.1	8.5	8.1	8.1
Observations	319	78	42	199
Panel B. Number of underwriters				
IPO Type	**All**	**PE**	**VC**	**NS**
Average	2.2	2.9	1.9	1.9
Median	2.0	2.0	2.0	1.0
Observations	319	78	42	199

5.4 Data collection for underpricing and long-run performance

The daily stock price development for each IPO is collected from January 2002 to February 2018 at a total return basis (i.e. adjusted for cash dividends, stock dividends, and stock splits), according to common practices (e.g. Loughran & Ritter (1995), Levis (2011)). Daily unadjusted stock prices over the same time period are also collected to calculate first-day returns. To make an accurate comparison between benchmark returns and stock returns post-IPO, several Nordic daily total return stock indices are collected over the same period (most notably the MSCI total

return indices for each of the four Nordic countries within the scope of this thesis). Similar indices have been collected for each of the 10 sectors mentioned in section 5.3.3, and a more detailed outline of benchmark selection is outlined in Appendix 2. Furthermore, market capitalisation[8] immediately after listings is calculated for each firm and has been inflation adjusted back to January 2002 using the country-specific consumer price indices' (CPIs) for each IPO to increase the comparability across time[9]. All the market values are converted to Norwegian Krone (NOK) to make value-weighting feasible. The adjusted and unadjusted stock prices, market capitalisation and total return indices are obtained from Bloomberg, while the issue prices are collected from Dealogic's database. Also, issue prices have been cross-checked with IPO prospectuses (when available) and with contemporary articles. A list of IPOs can be found in Appendix 7.

5.5 Data Source Criticism

Despite the comprehensive sample selection process and verification efforts we have undertaken, our dataset might suffer from some deficiencies. Firstly, we might have missed some of the IPOs in the period 2002-2015 as we only used Dealogic's database to create our gross sample. For instance, we could have used databases such as Zephyr or manually checked the different stock exchanges own collections of IPOs. However, as these sources often only report the closing price after the first day of trading and not the actual issue price, we argue that this method would be highly time-consuming and most likely not worth the efforts. That said, to mitigate the incompleteness of our sample, we complemented the initial dataset and identification of pre-IPO shareholder structure by adding IPOs listed on the sponsors' homepages when we found IPOs that were not included in the sample.

Secondly, and likely the most serious criticism against our dataset is an erroneous classification of IPOs to one of the three main subgroups. The problem is largely due to limited information about shareholder structure before the IPO, a problem which could distort the subgroup analysis and results. We note that this problem was most evident in the earlier IPOs (pre-financial crisis) as this is the part of the sample with the most missing prospectuses. That said, to mitigate the incompleteness of our sample, we examined the PE and VC firms' homepages to identify the shareholder structure prior to the IPO, mainly through press releases.

[8] *Defined as close price after first day of trading times total shares outstanding*

[9] *Detailed calculations can be found in Appendix 1*

However, due to the vague distinction between private-equity and venture capital players (as discussed in section 5.3.1), some IPOs might be wrongfully classified and thus create a bias towards either PE or VC-backed IPOs.

Lastly, the industry classification might suffer from some biases. This was mainly a problem for firms listed in Norway, as we found some deviations between Oslo Stock exchange's industry classification versus the classification suggested by Nasdaq. To remove some of this bias, we manually looked up each firm and read through the company descriptions to determine which sector the company most likely where are part of. To supplement this, we used Nasdaq's methodology description for each sector index as a guideline. That said, we note that this problem was not evident for firms listed on the Stockholm, Helsinki or Copenhagen stock exchanges as these companies had already been classified in line with Nasdaq's Industry Classification Benchmark (ICB).

6. Methodology

The methodology section is split into two parts. The first part presents the underpricing methodology followed by the statistical tests used to evaluate our hypothesis introduced in chapter 4. The second part follows a similar outlay but includes a discussion on time regime and abnormal return benchmarks used in the thesis.

6.1 Underpricing

6.1.1 Initial returns

An important aspect in the measurement of initial return in prior studies on underpricing is the length of the time period following the IPO used to calculate initial returns, whether or not to adjust the initial returns for market movements (e.g. using market adjusted returns) and which stock price quote to use in the underpricing calculation.

In general, older research is characterized by longer periods than more recent studies (Schöber, 2008). However, some authors determine the end of the initial trading period in calendar time instead of event time so that its length varies within their sample[10] (Schöber, 2008). That said, as highlighted by Schöber (2008), a large body of previous empirical studies on IPO underpricing measure the degree of initial return relative to the offer price of the IPO. Similarly, most recent literature defines the initial return as the percentage difference between the offer price and the closing price on the first day of trading (Westerholm, 2006).

In the literature on IPO underpricing related to buyout-backed IPOs, only a few authors have adjusted returns for daily market movements. For instance, in Aninia & Mohan (1991) and Hogan, Olson & Kish (2001) studies of LBOs and RLBOs in the US market, daily returns were adjusted for the return on the NASDAQ Composite Index. However, most authors see such an adjustment as unnecessary since the daily return of the market is typically much smaller than the average initial return of an IPO (Schöber, 2008). As noted by Beatty & Ritter (1986), the average initial return on their portfolio was 14.1% for the second sub-

[10] *For instance, Ibbotson & Jaffe (1975) used the stock price at the end of the first month of trading when calculating initial returns.*

period, while the average daily market return was less than 0.1%[11]. Hence, none of our initial return calculations adjusts for market movements.

In the article by Ritter & Welch (2002), the authors state that the vast majority of empirical work on IPO underpricing has used the first-day closing price to measure the first-day return. More recent publications have employed this method (Loughran & Ritter (2004), Lowry & Schwert (2002), and Schöber (2008)), while some earlier studies have used the closing bid price to calculate initial returns (Ritter, 1984; Beatty & Ritter, 1986)). Also, there exist studies which use the mean between the bid and ask values (Schöber, 2008). That said, by the majority and the most recent literature on IPO underpricing, the degree of potential underpricing is defined as the difference between the offer price and the first-day closing[12] price relative to the offer price. Further, we will refer underpricing as the first-day return. First-day returns are calculated using the following formula:

$$R_i = \frac{P_{t+1,i} - P_{t,i}}{P_{t,i}} \tag{6.1}$$

Where R_i is the first-day return of IPO firm i, $P_{t+1,i}$ is the first day closing pricing of IPO firm i, and $P_{t,i}$ is the offer price of IPO firm i.

As mentioned in section 5.3.1, our sample is divided into four different groups, where one includes all the IPOs, and the three others are divided into PE-backed, VC-backed and non-sponsored (NS) IPOs. To capture any size differences between IPOs in terms of market capitalisation, the value-weighted average first-day return for the groups is also calculated using value-weights (VW). Weights are assigned to each IPO using their inflation-adjusted market capitalisation[13] with 2002 as the base year to make analysis across IPOs comparable. The following formula is used to calculate the average value-weighted returns:

$$R_{i,VW} = \frac{V_i}{V} * \frac{P_{t+1,i} - P_{t,i}}{P_{t,i}} \tag{6.2}$$

Where $R_{i,VW}$ is the value-weighted first-day return of IPO firm i, V_i is the inflation adjusted value of company i, V is the total inflation adjusted market capitalisation of the sample, $P_{t+1,i}$ is the first day closing pricing of IPO firm i, and $P_{t,i}$ is the offer price of IPO firm i.

[11] *Measured by the dividend-inclusive S&P500 index*

[12] *Like in Schöber (2008), we have used the unadjusted closing stock prices on the first day of trading which are obtained using Bloomberg as mentioned in section 5.4. This is done because these prices are not adjusted backwards for possible stock splits, stock dividends or cash dividends, and thus gives us a more accurate picture of the actual initial first-day return.*

[13] *See Appendix 1 for calculations.*

The sample is further divided into a high market activity (HMA) and low market activity (LMA) period. To capture any timing differences between the IPOs in terms of year of issuance, the underpricing in the different periods are calculated. The first-day returns are also calculated for each of the three sub-groups. The following formula is used to calculate the first-day returns for each period and sub-group:

$$R_{g,a}^{ew} = \frac{1}{n_{g,a}} \sum_{i=1}^{n_{g,a}} R_i \tag{6.3}$$

Where $R_{g,a}^{ew}$ is the equal weighted average first day return in each sample group, R_i is the first-day return of IPO firm i, $n_{g,a}$is the total number of firms in each sample group offered in a period.

6.1.2 Statistical tests for hypotheses testing

To test whether the different group in our sample shows evidence of underpricing, hypothesis 1, we use a two-sided t-test[14] where we test whether the first-day returns for the different groups in all market periods are different from zero. To test whether PE-backed IPOs are less underpriced than other groups (hypothesis 2), the difference between the equal-weighted average first-day return of PE-backed and non-sponsored IPOs, as well as the difference between PE-backed IPOs and VC-backed IPOs are statistically different from zero. Similarly, we test whether there is any difference between listing during periods of high IPO market activity and low IPO market activity by testing whether the difference between the sub-groups is significantly different from zero (hypothesis 3).

6.1.3 Multivariate regression model for robustness checking

For robustness checking and to supplement the statistical tests above, we use a multivariate regression model that includes the relevant variables in the scope of this thesis. Additionally, variables that captures the size effect of the transaction, the number of underwriters, the size of the equity stake sold by the sponsor in the IPO and the presence of a prestigious underwriter are included in the model. The additional variables are mainly included to reduce 'omitted variable bias', but also because scholars have documented that these variables could influence the degree of underpricing as discussed in Chapter 2.

The model uses a dummy variable which takes the value of 1 if the listing was made during the high market activity period, and 0 otherwise (HMA DUMMY). Similarly, the regression includes a dummy on whether the firms was

[14]*Test statistics for the mean being different from zero are used in Westerholm (2006)*

private equity (PE DUMMY) or venture capital (VC DUMMY) backed at the time of the IPO. To control for offer size, the natural logarithm of the inflation-adjusted market capitalisation is included in the model (FIRMSIZE). To capture any potential asymmetrical information issues, the number of underwriters in each transaction is included in the model (UNDERWRITERS), as well as the reputation of the lead underwriter (RANK). The ad-hoc ranking of prestigious underwriters can be found in Appendix 6 inspired by the Carter-Manaster ranking as pioneered by Carter & Manaster (1990). Further, the model includes a dummy variable reflecting the size of the equity stake sold in the IPO (for either VC or PE), taking 1 if the sponsors sells more than 24% of its equity stake and 0 otherwise (EQUITY). We exclude the over-allotment option as done in Schöber (2008). Lastly, we include a dummy reflecting the sector with the highest degree of underpricing, Health Care (HC), and the least underpricing, Consumer Services (CS). Although Basic Materials and Telecommunications shows a slightly lower degree of underpricing compared to Consumer Services, we chose not to include these due to the limited number of companies within these two sectors (only 3.8% and 2.2% of the total sample, respectively). Accordingly, we use the first-day returns as the dependent variable and form the following regression:

$$Underpricing_i = \beta_0 + \beta_1 * HMA\ DUMMY_i + \beta_2 * PE\ DUMMY_i + \beta_3 * VC\ DUMMY_i + \beta_4 * FIRMSIZE_i + \beta_5 * RANK_i + \beta_6 * UNDERWRITERS_i + \beta_7 * HC_i + \beta_8 * CS + \beta_9 * EQUITY_i \quad (6.4)$$

Like in Schöber (2008), we run the regression using White's heteroskedasticity-consistent standard errors for both regressions. Also, since we only were able to document the post-IPO equity-stake for the private equity and venture capital sponsors in 101 out of the 120 IPOs in scope[15], we chose to include a regression excluding the EQUITY variable for analytical purposes and to avoid potential distortion in the regression output. Hence, we also form the following regression:

[15] *Mainly due to lack of prospectus in PE and VC-backed IPOs pre-financial crisis (before 2007).*

$$Underpricing_i = \beta_0 + \beta_1 * HMA\ DUMMY_i + \beta_2 * PE\ DUMMY_i + \beta_3 * VC\ DUMMY_i + \beta_4 * FIRMSIZE_i + \beta_5 * RANK_i + \beta_6 * UNDERWRITERS_i + \beta_7 * HC_i + \beta_8 * CS_i \quad (6.5)$$

6.2 Long-run performance

6.2.1 Time regime

When choosing the study's time framework, the previous literature indicates that one must make choices regarding the time regime and the measurement period. Looking at time regime, one can conduct the study in event time or calendar time (Schöber, 2008).

Event studies, initially introduced by Fama et al. (1969), produce useful evidence on how stock prices respond to information. The initial task of conducting an event study is to define the event of interest and identify the period over which the security price of the firms involved in this event will be examined – the event window (MacKinlay, 1997, p. 14). The common time-span for the measurement period of long-run aftermarket performance is usually between one and five years (Schöber, 2008; Certo et al., 2009). In this study, the event window is set to three years or 36 months after the initial public offering to make our analysis comparable to previous papers on the topic (Ritter, 1991; Bergström et al., 2006; Levis, 2011). That said, the study also looks at periods of 12 and 24 months to understand the pattern of IPO aftermarket performance following the method in Levis (2011). As done by Ritter (1991), returns are calculated in two intervals;

i. The initial return period (normally 1 day), defined as the offering date to the first-day closing price
ii. The aftermarket period, defined as the 3 years after the IPO exclusive of the initial return period

In short, the initial return period is defined to be month 0, and the aftermarket period includes the following 36 months where months are defined as 21-trading day period relative to the IPO date[16]. One important reason for excluding the first day of trading is the difficulty for an investor to be able to consistently buy the shares at the offer price, due to the allocation procedure in the book building process, while buying stocks at the market prices allows for an implementable portfolio strategy

[16]*Hence, month 1 consists of event days 2-22, month 2 consists of event days 23-43, etc.*

(Loughran and Ritter, 1995). Also, note that if an IPO is delisted before its 3-year anniversary, the aftermarket period ends at the stocks last day of trading (Ritter, 1991). Furthermore, as many studies focus on returns in a short window (usually a few days), "*an advantage of this approach is that because daily expected returns are close to zero, the model for expected returns does not have a big effect on inferences about abnormal returns*" (Fama, 1998, p. 1).

However, as many studies within the long-run performance of IPOs points out, in reality, there is cross-sectional dependence among IPO stocks (Brav & Gompers, 1997; Brav, 2000; Gompers & Lerner, 2003; Schöber, 2008). The main reason for this cross-sectional dependence is that IPOs tend to cluster in time so that periods over which the returns of the IPO stock in the sample are measured overlap considerably in calendar time. Thus, common shocks influence returns the returns of several IPO firms, thereby creating cross-sectional dependence (Brav & Gompers, 1997). Therefore, t-statistics may be overstated in an event time regime and researchers might conclude that there is statistical inference when there is none. Hence, researchers have introduced the calendar time approach which tracks the performance of a portfolio of recent event firms in calendar time and thereby eliminates any cross-sectional dependence (Schöber, 2008). As advocated by Fama (1998), the calendar time approach follows two steps[17]:

i. In the first step, calculate the abnormal returns for all firms that completed an IPO in the prior t months[18]. This step is repeated for each calendar time month for which data is available.
ii. In the second step, the abnormal returns for each calendar month are averaged across the sample firms.

As further investigated in section 6.2.3, with the distribution of the portfolio in the calendar time regime one can obtain and investigate statistical inferences. However, as noted by Fama (1998), the calendar time approach can understate an anomaly due to events clustering in time (as is the case for IPOs). Also, according to some researchers, the calendar time fails to capture the investor's ultimate return (Kringman et al., 1999). Consequently, most studies of the long-run performance of IPOs focus on analysis in event time (Schöber, 2008). That said, this thesis

[17] *This approach follows Loughran & Ritter (1995), Brav and Gompers (1997), Gompers and Lerner (2003) and Schöber (2008)*

[18] *Thus, the portfolio is rebalanced in every calendar time month*

investigates the long-run performance of IPOs both in an event time and in a calendar time regime, with most focus on the former.

6.2.2 Abnormal return metrics in event time

Prior research investigating IPO long-run performance in an event time framework commonly uses three different abnormal return metrics (Schöber, 2008). We use two of out the three metrics that we define and discuss in the section below.

Among scholars within the IPO long-run performance literature (Ikenberry et al., 1995; Barber & Lyon, 1997; Kothari & Warner, 1997; Fama, 1998; Mitchell & Stafford, 2000) there exist longer discussions of the advantages and disadvantages of BHARs and CARs. The authors argue that one of the main advantages of BHARs relative to CARs is that they measure the exact return earned by investors who follow a buy-and-hold strategy. However, BHARs can produce more extreme results than CARs due to compounding. As a result, BHARs tend to include more extreme values over longer time periods and thus have fat right-hand tails (heavily right-skewed)[19]. In contrast, there is no compounding effect when utilising CARs and thus using this metric tend to result in less extreme observations versus BHARs. Hence, CARs have the advantage that their distributional properties make it easier to facilitate statistical tests of abnormality. That said, as noted by Schöber (2008) when using fixed weights (e.g. equal weights), CARs imply a rather unrealistic portfolio strategy. To maintain these weights, one has to rebalance the portfolio at monthly intervals which results in high trading costs. As these costs are not accounted for in the CAR calculation, the fixed weights suffer from an additional upward bias. Despite the different pros and cons of BHARs and CARs, previous studies have mainly employed either one of these two methods or both (Bergström et al., 2006). Hence, this analysis uses both BHARs and CARs as they answer different questions, but we follow previous literature and focuses on BHARs as they are arguably a more appropriate measure of investor experience.

Buy-and-hold abnormal returns (BHARs) for company i are the difference between the compounded returns of the IPO stock and the compounded return of the benchmark:

$$BHAR_i = \frac{1}{n}\sum_{i=1}^{n}[(\prod_{t=1}^{T}(1 + r_{i,t})) - (\prod_{t=1}^{T}(1 + r_{b,t}))\,] \qquad (6.6)$$

[19] *These properties can be problematic as they violate many of the assumptions of statistical test (e.g. regular t-tests). This topic is further discussed in section 6.2.5.*

Where $r_{i,t}$ is the returns of IPO firm i in month t, and $r_{b,t}$ is the simple return of the benchmark in month t and T is the holding period.

Following standard practice in long-run performance studies of IPO firms (Ritter, 1991; Loughran & Ritter, 1995; Brav & Gompers, 1997; Gompers and Lerner, 2003; Schöber, 2008), the BHAR for firms that delist prior to the end of the holding period is truncated accordingly[20].

Cumulative abnormal returns (CARs) for firm i is calculated using the following formula:

$$CAR_i = \sum_{t=1}^{T} (r_{i,t} - r_{b,t}) \tag{6.7}$$

Where $r_{i,t}$ is the returns of IPO firm i in month t, and $r_{b,t}$ is the simple return of the benchmark in month t and T is the holding period.

When computing CARs, we follow the methodology in Schöber (2008) to deal with firms that delist before the end of the holding period. Thus, following a firm's delisting, we set all monthly returns of the firm's stock and the benchmark equal to zero[21].

6.2.3 Abnormal return metrics in calendar time

The calendar time approach is conducted by calculating the 36 monthly aftermarket returns of all the IPOs in the sample, starting from the last trading day in the month after the IPO. In line with previous studies, the portfolio is rebalanced each month and includes all IPOs that went public within the past three years. Firms in the portfolio are either equal-weighted or value-weighted based on the inflation-adjusted market capitalisation. As opposed to the event time approach, companies that are delisted before its 3-year anniversary are consequently removed from the portfolio to avoid a distortion of the results (Schöber, 2008). The returns are calculated using the following formula:

$$R_{m,i} = \frac{TRI_{m,i} - TRI_{m-1,i}}{TRI_{m-1,i}} \tag{6.8}$$

Where $R_{m,i}$ is the return of IPO firm i, in calendar month m, $TRI_{m,i}$ is the total return index of IPO firm i in calendar month m, $TRI_{m-1,i}$ is the total return index of IPO firm i in calendar month m-1.

[20] *As an illustration, for a firm that delists in the middle of event month 20, the BHARs for months 21-36 are all equal to the (curtailed) BHAR for month 21.*

[21] *Hence, we implicitly assume a trading strategy where proceeds from firms that delist (if any) are invested in the market and thus yields zero abnormal returns.*

Further, to calculate the abnormal returns in calendar time, we subtract the respective benchmark index for IPO firm i using the following formula:

$$R_{m,b} = \frac{TRI_{m,b} - TRI_{m-1,b}}{TRI_{m-1,b}} \tag{6.9}$$

Where $R_{m,b}$ is the return of benchmark b, in calendar month m, $TRI_{m,b}$ is the total return index of benchmark b in calendar month m, $TRI_{m-1,b}$ is the total return index of benchmark b in calendar month m-1.

The annual return in each year is then compounded from January through December of these average monthly returns. Similarly, the value-weighted returns of the portfolio are compounded along with the monthly benchmark observations over the same period to get yearly calendar observations. We use the following formulas and weights:

$$\overline{R_{p,m}^{ew}} = \frac{1}{n_{p,m}} \sum_{i=1}^{n_{p,m}} R_{m,i} \tag{6.10}$$

$$w_{p,m}^{i} = \frac{mc_{i,m-1}}{\sum_{i=1}^{n_p} mc_{i,m-1}} \tag{6.11}$$

$$\overline{R_{p,m}^{vw}} = \sum_{i=1}^{n_{p,m}} w_{p,m}^{i} * R_{m,i} \tag{6.12}$$

Where $\overline{R_{p,m}^{ew}}$ is the equal weighted return of portfolio p in month m, $n_{p,m}$ is the number of observations in portfolio p in month m, $w_{p,m}^{i}$ is the value weight for IPO firm i in month m, $mc_{i,m-1}$ is the market capitalisation of IPO firm i in month m-1, and $\overline{R_{p,m}^{vw}}$ is the value weighted return of portfolio p in month m.

$$AR_Y^{ew} = \prod_{m=jan}^{Y} \left(1 + \overline{R_{p,m}^{ew}}\right) - \prod_{m=jan}^{Y} \left(1 + R_m^{p,b}\right) \tag{6.13}$$

$$AR_Y^{vw} = \prod_{m=jan}^{Y} \left(1 + \overline{R_{p,m}^{vw}}\right) - \prod_{m=jan}^{Y} \left(1 + R_m^{p,b}\right) \tag{6.14}$$

Where AR_Y^{ew} is yearly abnormal return compounded equal-weighted portfolio return in year Y, AR_Y^{vw} is yearly abnormal return compounded value-weighted portfolio return in year Y, $R_m^{p,b}$ is the return of benchmark b for portfolio p in calendar month m.

6.2.4 Benchmark

Although looking at buy-and-hold returns are interesting as it reflects the investors' returns when holding a stock over a certain period, general stock market movements influence them. Thus, the standard practice in empirical studies on IPO aftermarket performance is to adjust the returns of IPO firms with returns of a benchmark. Two types of benchmarks dominate in the literature concerning the long-run

performance of IPOs (Schöber, 2008). The first is a broad equity market index and the second type is either an individual listed comparable firm[22] or a portfolio of several of such matched firms. One advantage of the former is that it is easily implemented and allows for a comparison of the results with those of other researchers. On the contrary, one could argue that equity indices are not a suitable benchmark because they do not reflect the unique characteristics of IPO firms. However, Bergström et al. (2006) argue that benchmarks ideally have the same exposure to fundamental risks as IPO firms and capture their risk characteristics so that the risks determining expected returns are matched. Furthermore, as done by Levis (2011), several benchmarks can be used to capture firm or industry-specific characteristics[23].

However, an alternative to broad-based equity-indices is to compare the return of the IPO firms with the expected returns generated by an asset pricing model such as the capital asset pricing model (CAPM), the Fama and French model[24] or the four-factor model[25]. The advantage of using asset pricing models is that neither size (e.g. book-to-market) information nor a matching mechanism is required. However, as noted by Fama (1998), any asset pricing model is just a model and so does not completely describe expected returns. The author also noted that if an event sample is tilted towards small stocks, risk adjustment with the CAPM can produce spurious abnormal returns. As a result, when using an asset pricing model to calculate abnormal returns, one does not know whether the returns of the IPO firm indeed are abnormal or whether the model is producing flawed returns. Furthermore, researchers also complement the equity indices with benchmarks based on comparable firms (e.g. Ritter, 1991; Loughran & Ritter, 1995; Lyon et al., 1999; Levis 2011).

After carefully evaluating the different benchmark types, this study will use both a broad equity index to track the development of the Nordic stock market

[22] *For instance, matched by industry and size as done by Ritter (1991)*

[23] *Levis (2011) uses four different benchmarks to measure abnormal returns; 1) the FTSE All-Share index, 2) a size-adjusted benchmark, 3) an industry benchmark, and 4) a style benchmark matching the individual characteristics of the firm (e.g. size and book-to-market).*

[24] *In the Fama-French model one regress the post-IPO excess return of IPO firms on the excess returns of the market (including a size factor (SMB), a book-to-market factor (HML)). See Fama & French (1993).*

[25] *See Carhart (1997)*

(MSCI Daily TR Gross Nordic Index), four country-specific total return indices (MSCI Sweden, Norway, Finland and Denmark total return indices) and ten industry-specific benchmarks[26], following Levis (2011), to capture the different risk characteristics of each IPO firm. We shy away from using the matching firm technique (e.g. working with book-to-market matched firms) as we argue that although the technique is widespread and acknowledged by scholars, matching IPO firms with an industry-specific index captures many of the same risk characteristics (as done by e.g. Ritter (1991) and Levis (2011)). We also note that market indices as benchmarks are widely used in the previous literature (Brav & Gompers, 1997; Bergström et al., 2006; Levis, 2011).

6.2.5 Statistical tests for long-run performance

This thesis seeks to answer whether there are any abnormal returns related to the long-run performance of PE-backed, VC-backed, and non-sponsored IPOs, and whether there is any difference between these groups. As the 36 months BHARs and CARs are not normally distributed[27], we chose to test our hypotheses using a non-parametric test (which does not assume normality), rather than using other common tests (like a regular t-test). Hence, following the procedure in Schöber (2008), this thesis uses the Wilcoxon signed-rank tests[28] to check whether the median difference (i.e. the median BHAR and CAR) is significantly different from zero. To test whether there are any differences in abnormal returns related to the long-run performance between our three main sub-groups, we have used the Wilcoxon-Mann-Whitney test[29] which compares the median of two populations and can thus answer whether any of the two medians is significantly higher than the other. We note that these types of test have also been used to investigate abnormal returns in prior literature (e.g. Veld & Veld-Merkoulova, 2004; Schöber, 2008; Cao & Lerner, 2009). Also, as argued by Barber & Lyon (1997), the Wilcoxon signed-

[26] *See Appendix 2*

[27] *See section 7.1 for more details*

[28] *The Wilcoxon signed-rank test is a non-parametric statistical hypothesis test used to compare two related samples, matched samples or repeated measurements on a single sample to assess whether their population mean ranks differ.*

[29] *The Wilcoxon-Mann-Whitney test is a non-parametric statistical test which test whether it is equally likely that a randomly selected value from one sample will be less than or greater than a randomly selected value from a second sample.*

rank test is superior in the case of the existence of extreme outliers both when investigating CARs and BHARs.

6.2.6 Multivariate regression model for robustness checking

Like the analysis on underpricing, we supplement the statistical tests on long-run performance using a multivariate regression model for robustness checking. Although we have obtained the abnormal returns using common methods (e.g. benchmarking towards country indices), other factors have also been found to have a relationship with the long-run returns of newly listed companies, as well as with cross-sectional stock returns in general. For example, as discussed in Chapter 2, IPOs in periods of high IPO activity are related to lower long-run raw returns (Ritter, 1991). This is confirmed by Bergström et al. (2006), who also find that firms with relatively higher market capitalisation perform relatively better than small IPOs. Also, scholars have documented that IPO underperformance relative to the market for transactions handled by a prestigious underwriter is less severe (Carter et al., 1998).

To control for these factors, we perform several OLS regressions. The first model uses 36-month BHARs and CARs as dependent variables using the MSCI Country Total Return Indices as benchmarks to calculate abnormal returns. To control for "hot market" issues, the model uses a dummy variable which takes the value of 1 if the listing was made during the high market activity period, and 0 otherwise (HMA DUMMY). To test whether there are any difference in long-run aftermarket performance between the different subgroups, the regression includes a dummy on whether the firm was private equity (PE DUMMY) or venture capital (VC DUMMY) backed at the time of the IPO. To control for offer size, the natural logarithm of the inflation-adjusted market capitalisation is included in the model (FIRMSIZE). To capture any potential asymmetrical information issues, the number of underwriters in each transaction is included in the model (UNDERWRITERS), as well as the reputation of the lead underwriter (RANK), using the same ad-hoc ranking system as described in section 6.1.3. Further, the model includes a dummy variable reflecting the size of the equity stake sold in the IPO (for either VC or PE), taking 1 if the sponsors sell more than 24% of its equity stake and 0 otherwise (EQUITY). As done by Ritter (1991), we include control variables for the best and worst performing industries in the sample. Albeit telecommunication firms report the best performance in our sample, we believe it is redundant to control for an industry that only includes 7 of the 319 firms in the

sample (see section 5.3.3). Thus, we include the second-best performing industry, consumer services (CS), using a dummy taking the value of 1 if the observation is a company operating within the CS industry, and zero otherwise. Similarly, we include a dummy for firms in the healthcare industry (HC), reflecting the worst-performing industry in our sample. We also run the models using heteroscedasticity-consistent standard errors as pioneered by White (1980), following Schöber (2008). Hence, we form a general regression model using both 36-month BHARs and CARs are the dependent variable (using the common definition 'abnormal returns' in the model illustration):

$$
\begin{aligned}
&Abnormal\ returns_i \\
&\quad = \beta_0 + \beta_1 * HMA\ DUMMY_i + \beta_2 * PE\ DUMMY_i + \beta_3 \\
&\quad * VC\ DUMMY_i + \beta_4 * FIRMSIZE_i + \beta_5 * RANK_i + \beta_6 \\
&\quad * UNDERWRITERS_i + \beta_7 * HC_i + \beta_8 * CS_i + \beta_9 \\
&\quad * EQUITY_i
\end{aligned} \tag{6.15}
$$

Lastly, to check whether there is any relationship between long-run performance and underpricing, we include the first-day returns (UNDERPRICING) of each IPO as our final control variable. Thus, we form the following regression:

$$
\begin{aligned}
&Abnormal\ returns_i \\
&\quad = \beta_0 + \beta_1 * HMA\ DUMMY_i + \beta_2 * PE\ DUMMY_i + \beta_3 \\
&\quad * VC\ DUMMY_i + \beta_4 * FIRMSIZE_i + \beta_5 * RANK_i + \beta_6 \\
&\quad * UNDERWRITERS_i + \beta_7 * HC_i + \beta_8 * CS + \beta_9 * EQUITY_i \\
&\quad + \beta_{10} * UNDERPRICING_i
\end{aligned} \tag{6.16}
$$

7.0 Results and analysis

The result and analysis section divided into four main sections. First, we present the results from the underpricing analysis on a broad level as well as on a more detailed subcategory level. Secondly, we look at the long-run aftermarket performance of IPOs, with focus on the returns distributional properties, industry performance and the difference in subgroup abnormal returns. The section continues with the investigation of IPO cyclicality both using a calendar time approach and an event time approach. Lastly, the concluding analysis consists of a multivariate cross-sectional regression that captures the various factors which are supposed to influence the cross-section of the 36-month BHARs and CARs.

7.1 Underpricing results

7.1.1 Distributional properties of first-day returns

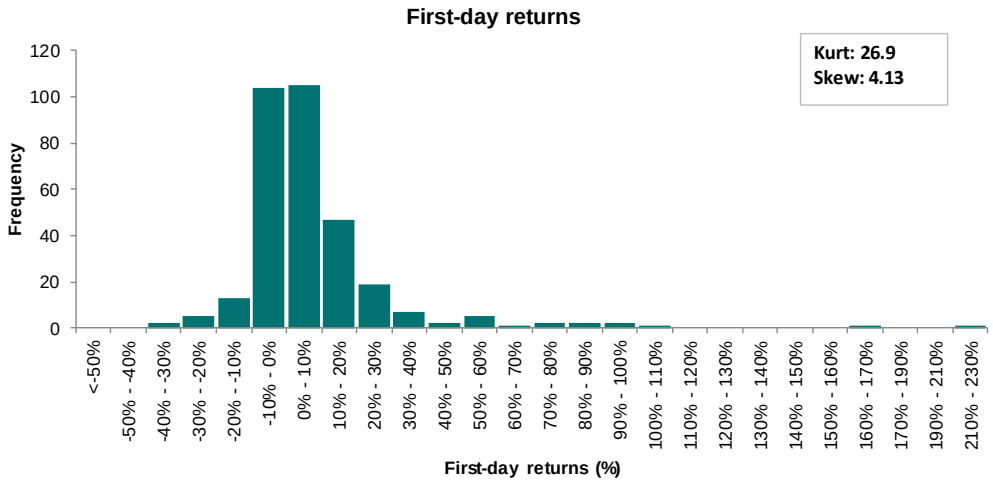
Table 7.1 shows the distribution of initial returns. As can be seen from the chart, the first-day returns are truncated on the left-hand side with a theoretical lower bound of -100%[30], reporting a kurtosis of 26.9 and skewness of 4.13. Accordingly, as discussed below, the mean initial returns are much higher than the median (8.3% versus 3%, respectively). A Jarque-Bera test confirms that the first-day returns are highly non-normal[31]. As noted by Schöber (2008), some buyout-backed issues might show extreme levels of underpricing and could indicate that the presence of a financial sponsor does not rule out that a lot of money may be left on the table. Consequently, the average initial returns may be distorted by a few very large positive values also in the PE and VC-backed subsamples. That said, despite such skewness, most of the previous literature focuses on the equal-weighted and value-weighted average of first-day returns (Beatty & Ritter, 1985; Ritter & Welch, 2002; Lowry & Schwert, 2002; Bergström et al., 2006; Levis, 2011). Consequently, this thesis will also focus on the averages to make the findings more comparable to previous literature.

[30] *The lowest initial return observed in the sample is -33%.*.

[31] *Significant at the 1% level.*

Table 7.1 - Frequency of first-day returns

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish, and Finnish stock exchanges. The returns are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this recalculated using the MSCI country total return index for either Sweden, Norway, Denmark or Finland depending on which stock presents 25% of the sample). The abnormal returns are calculated using the MSCI country total return index for either Sweden, Norway, Denmark or Finland depending on which stock exchange the listing was made.



7.1.2 First-day returns

Table 7.2 summarises the first day returns, i.e. the underpricing, with different measures for non-sponsored-, PE-backed- and VC-backed IPOs. At first glance, we note that all the first day returns are positive irrespective of return metric used, in line with most previous studies. For the entire sample (Panel A), we document that IPOs on an equal-weighted average basis experience a positive 8.3% first-day return. Similarly, we find that PE-backed, VC-backed and NS-backed IPOs experience 6.9%, 5.1% and 9.5% first-day returns, respectively. These results are also statistically significant at the 1% level (except for VC-backed which are significant at the 10% level). These results strongly support our initial expectations presented in hypothesis 1. Furthermore, when looking at the value-weighted average first-day return, another pattern emerges. In aggregate, IPOs report a 10.2% first-day return, while PE-backed IPOs experience a 12.3% first-day return. In contrast, VC-backed and non-sponsored IPOs report 6.8% and 8.5% first-day returns, respectively. That said, the PE-backed IPO sample is largely skewed by three larger firms (representing 33.4% of the total inflation-adjusted market

capitalisation) experiencing significant underpricing[32]. When adjusting for this, PE-backed IPOs report a 7.8% first-day return versus the total sample of 8.2%. However, we highlight that VC-backed IPOs experience the lowest degree of underpricing, both when looking at averages and medians.

Further, looking at the high activity period (Panel B) on an equal-weighted basis, we observe higher first-day returns for all groups relative to the low activity period (Panel C). However, we only document reasonable significance levels for the classifications 'all firms' and non-sponsored IPOs across the two periods. That said, PE-backed and VC-backed experienced 7.9% and 5.2% first-day returns in the high activity period (Panel B), statistically significant at the 1% and 10% level, respectively. We note that value-weighted averages document a similar pattern, regardless of metric in scope.

Table 7.2 - First day returns by IPO sub groups and time period

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. The high activity period extends between 2005-2007 and 2014-2015 while the remaining years are classified as low activity periods. The adjusted average value-weighted returns are calculated excluding three larger PE-backed firms representing 33.4% of the total inflation adjusted market capitalisation in the PE IPO sample. The equal-weighted averages are tested using a two-sided t-test under the null hypothesis that the averages do not differ from zero.

	All firms	PE	VC	NS
Entire time period				
Average (equal-weighted) %	8,3***	6,9***	5,1*	9,5***
Average (value-weighted) %	10,2	12,3	6,8	8,5
Adj. Average (value-weighted) %	8,2	7,8	6,8	8,5
Median %	3,0	4,9	0,0	2,4
Number of observations	*319*	*78*	*42*	*199*
High activity period				
Average (equal-weighted) %	9,0***	7,9***	5,2*	10,3***
Average (value-weighted) %	10,5	12,3	8,1	8,9
Number of observations	*233*	*62*	*31*	*140*
Low activity period				
Average (equal-weighted) %	6,4**	3,0	4,6	7,6**
Average (value-weighted) %	9,5	12,3	2,4	7,7
Number of observations	*86*	*16*	*11*	*59*

[32] *Pandora A/S (9% of MCAP) reported a 25.2% first-day return, ISS A/S (8.7% of MCAP) reported a 14.2% first-day return, while Renewable Energy Corp ASA reported a 23.2% first-day return (15.7% of MCAP).*

The observed underpricing for all the different sub-groups in the sample is highly consistent with earlier research and is summarised in table 2.1 (see section 2.1.6).

Furthermore, the lower underpricing experienced by private equity-backed IPOs compared to the non-sponsored IPOs are consistent with Levis' (2011) study on the London Stock Exchange. Lower underpricing for the PE-backed IPO may be attributed to the certification of private equity companies. This, in turn, results in reduced information asymmetry and lower compensation level for participants (Meggison & Weiss, 1991). Levis (2011) argues that private equity companies aim for more aggressive pricing for their listings, and thus achieves lower underpricing in their IPOs. Both these explanations are relevant and can be applied to the sample for this thesis, and thus explain lower underpricing than the non-sponsored companies. Another aspect is the market capitalisation of the listings. As reported in Table 5.2, the private equity-backed IPOs are larger regarding market capitalisation than non-sponsored listings (2.3 times larger on average). This is consistent with Levis´ (2011) findings on the London Stock Exchange and may affect the first day returns. Ibbotson et al. (1994) finds that larger offerings are less underpriced than smaller offerings. Hence, as private equity-backed IPOs are larger in terms of market capitalisation; this may also explain why private equity-backed IPOs are less underpriced than non-sponsored listings. Nevertheless, measuring underpricing by the median first-day return, private equity-backed offerings are more underpriced than non-sponsored listings.

Our findings that of VC-backed IPOs have lower first day returns than the non-sponsored companies. Megginson and Weiss (1991) reported the same patterns and argued that certification from the venture capitalist could reduce information asymmetry between new investors and underwriters. Then the level of compensation of these participants for acquiring information will be reduced, and thus reducing the underpricing in the offering (Megginson & Weiss, 1991). This can be attributed to this VC-sample and may explain the lower degree of underpricing for the venture capital-backed IPOs in the Nordics.

7.1.3 Underpricing differences and IPO cyclicality

Even though the average first-day returns for the entire sample on an equal- and value-weighted basis share similarities, but there are notable differences on a subgroup level as mentioned in section 7.1.1. However, we find no statistical support when testing the difference in equal-weighted average returns between our three main subgroups (Table 7.3, Panel A). That said, we note that from an

economical perspective, the mean underpricing for PE-backed IPOs are 6.9% versus the non-sponsored IPOs of 9.5%, arguably supporting hypothesis 2 somewhat, in our view. Additionally, the results are in line with previous findings from the European market (see Bergström et al., 2006; Levis, 2011), which also documents lower underpricing in PE-backed versus non-sponsored listings.

Table 7.3 - Test of difference in the average first-day returns between selected subgroups

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian,Swedish, Danish and Finnish stock exchanges. Panel A test the hypothesis that the distribution of first-day returns in the two groups does not differ using a regular two-sided t-test and reports the corresponding p-values.

Subgroups	PE	NS	PE	VC	NS	VC
Panel A. Entire time period						
Number of listings	78	199	78	42	199	42
Mean (%)	6,9	9,5	6,9	5,1	9,5	5,1
P-value	*0,3964*		*0,5530*		*0,3133*	

Furthermore, the data reveals that the equal-weighted averages on first-day returns also differ depending on the market condition at the time of the IPO. In aggregate, each subgroup (including the entire sample) experience higher first-day returns during high market activity (HMA) periods versus low market activity periods (LMA). However, the differences are not statistically significant at any reasonable levels, except for PE-backed IPOs where we find significant results at the 10% level. Consequently, the data gives little to no support for hypothesis 4. That said, while the test did not yield any reasonable results in the average differences, first-day returns in HMA are higher across all categories in line with previous studies and during different time periods (Ibbotson & Jaffe, 1975; Loughran & Ritter, 2004; Bergström et al., 2006; Levis, 2011).

Table 7.4 - Test of difference in the average first-day returns between high activity periods verus low activity periods

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian,Swedish, Danish and Finnish stock exchanges. Panel A test the hypothesis that the distribution of first-day returns in the two groups does not differ using a regular two-sided t-test and reports the corresponding p-values.

Subgroups	HMA All	LMA All	HMA PE	LMA PE	HMA VC	LMA VC	HMA NS	LMA NS
Panel A. High activity period versus low activity period								
Number of listings	233	86	62	16	31	11	140	59
Mean (%)	9,0	6,4	7,9	3,0	5,2	4,6	10,3	7,6
P-value	*0,3743*		*0,0976*		*0,9272*		*0,5232*	

7.1.4 OLS regression for robustness checking of first-day returns

Table 7.5 shows the results from regression 6.4 and 6.5. At first glance, we note that the explanatory power of the two models is quite poor with an adjusted R-squared of 3.4%. Additionally, none of the models is statistically significant according to an F-test (F-value of 1.35 and 1.20, respectively). Thus, the results from the OLS regression fails to strengthen any of our four main underpricing hypothesis (1-4) statistically. However, we highlight that the coefficient estimate for the PE DUMMY is negative, in line with the lower degree of underpricing found in PE-backed IPOs in our sample. Additionally, some of the coefficients are statistically significant in both the regression models which could explain some of the underpricing observed in our sample, in our view.

For the first model (1), three of the eight independent variables (FIRMSIZE, UNDERWRITERS, and HC) are significant at the 10% level or better. The same variables are significant in model (2). Of those, FIRMSIZE (inflation adjusted market capitalisation) looks to have the most striking effect on underpricing. The positive coefficient suggests that the degree of underpricing tend to increase when the firms' market capitalisation rises. However, this is not in line with the previous literature which finds that larger offerings tend to be less underpriced than smaller offerings (e.g. Ibbotson et al., 1994). That said, as mentioned in the analysis on first-day returns, a few firms representing a large fraction of the inflation-adjusted market capitalisation is driving the first-day value-weighted average returns up significantly[33], likely creating some bias in the coefficient estimate.

Furthermore, the number of underwriters involved in the transaction looks to have a negative effect on the first-day returns. This is in line with Corwin & Schultz (2005) which documented that the issuer benefit from increasing the number of syndicate members and especially the number of co-managers who underwrite their IPO. One explanation for this can be that the number of syndicate members can lead to more information production and thus result in offer prices being more adjusted up (down) in response to positive (negative) information. According to Corwin & Schultz (2005), the issuers are more likely to bring up positive information during pricing negotiations. Thus, one should expect that information conveyed by co-managers[34] will more likely lead to upward than

[33] *See section 7.1.2.*

[34] *A concept often referred to as "whispering in the issuer's ear".*

downward price revisions. As a result, one should expect an IPO with more syndicate members to be less underpriced due to this asymmetrical relationship between issuers and co-managers, in line with our findings.

Lastly, companies in the Health Care sector looks to be systematically underpriced according to both models in Panel A. On the contrary; we find no evidence that firms in the Consumer Service sector tend to be less underpriced. However, the coefficient estimate is negative as one should expect, but not statistically significant at any reasonable level.

Table 7.5 - OLS regression with first-day returns as dependent variable

*The table reports the output from a regression of first-day returns with up to nine explanatory variables. HMA DUMMY is a dummy variable taking the value of 1 of the observation is within the high market activity period, and 0 otherwise. PE and VC dummy are dummies taking 1 if the IPO is either PE or VC-backed, and 0 otherwise. FIRMSIZE is the natural logarithm of the inflation-adjusted market capitalisation immediately after the listing. RANK is the reputaiton of the lead underwrtier in the transaction, while UNDERWRITERS is the number of underwriters in each transaction. HC and CS are industry dummies reflecting the highest and lowest degree of underpricing in the sample. Lastly, EQUITY reflects the size of the equity stake sold in the IPO for either PE or VC sponsors, taking 1 if the sponsor sells more then 24% of its equity stake, and 0 otherwise. *Represents signifciant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level. The coefficient of each variable and the p-values (in parentheses) are reported in Panel A. The t-statistics is calculated using the hetroskedasticity consistent method introduced by White (1980).*

Panel A. Underpricing

	First-day returns	
Variables	**(1)**	**(2)**
Constant	0,0350	0,0345
	(0,6026)	*(0,6026)*
HMA DUMMY	0,0140	0,0140
	(0,6503)	*(0,6433)*
PE DUMMY	-0,0199	-0,0136
	(0,5505)	*(0,7587)*
VC DUMMY	-0,0528	-0,0524
	(0,2063)	*(0,2113)*
FIRMSIZE	0,0503*	0,0504*
	(0,0776)	*(0,0772)*
RANK	-0,0076	-0,0077
	(0,2945)	*(0,2883)*
UNDERWRITERS	-0,0227**	-0,0224*
	(0,0443)	*(0,0502)*
HC	0,0650*	0,0656*
	(0,0997)	*(0,0998)*
CS	-0,0375	-0,0380
	(0,4589)	*(0,4543)*
EQUITY		-0,0115
		(0,8244)
Adjusted R-Squared	0,034	0,034
Observations	319	319
F-statistic	1,35	1,20

7.2 Event time results

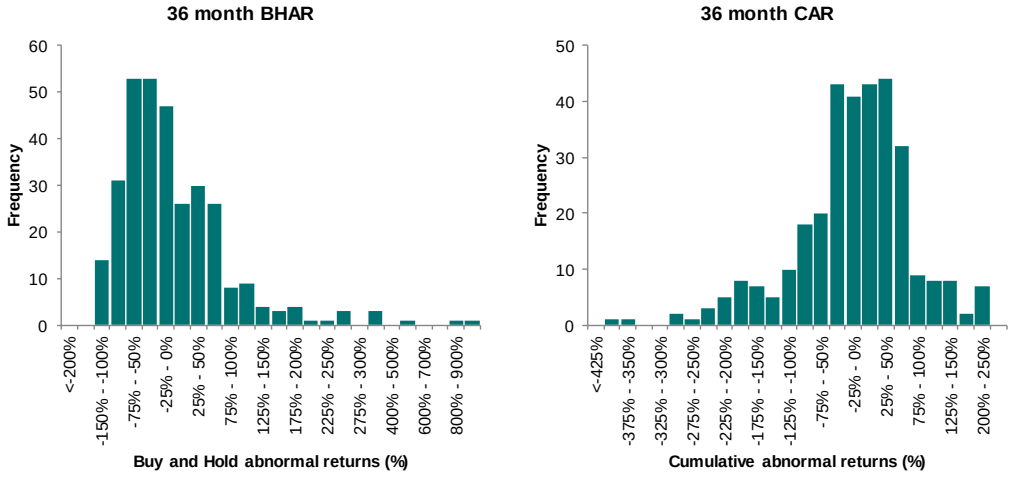
In the following section, the results using the event time approach is presented. The analysis starts by introducing the distributional properties of the sample in focus, followed by an in-depth analysis of abnormal returns. The section ends with a brief comparison of similar studies and our findings validity as well as reliability.

7.2.1 Distributional properties of abnormal returns

In Table 7.6, the distribution of the 36-month BHARs and CARs is plotted[35]. Looking at the 36-month BHARs (left), the distribution displays a significant fat right-hand tail and demonstrates a large positive skewness (reporting a kurtosis of 28.43 and skewness of 3.99). Although the 36-month CARs (right) does not exhibit the same positive skewness as the 36-month BHARs, the distribution looks to deviate from the normal distribution[36] with kurtosis of 5.02 and skewness of -0.54. To check for normality issues, a Jarque-Bera test is employed, and we reject the null hypothesis[37] for both samples at the 1% significance level. Thus, both distributions deviate from the normal distribution.

Table 7.6 - Frequency of 36 month BHARs and CARs in event time

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish, and Finnish stock exchanges. The returns are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this represents 25% of the sample). The abnormal returns are calculated using the MSCI country total return index for either Sweden, Norway, Denmark or Finland depending on which stock exchange the listing was made.



The observed properties of the two abnormal return metrics are in line with previous literature on the topic (e.g. Barber & Lyon, 1997; Kothari & Warner, 1997; Gompers & Lerner, 2003; Schöber, 2008; Cao & Lerner, 2009), where BHARs tend to have fat right-hand tails with large positive skewness and CARs with fat left-hand tails and a moderately negative skewness. As one can expect from the chart in

[35] *Calculating the abnormal returns using the MSCI country total return index for Sweden, Norway, Denmark or Finland depending on which stock exchange the listing was made.*

[36] *Normal distributions have a skewness of 0 and kurtosis of 3.*

[37] *The null hypothesis is a joint hypothesis of the skewness being zero and the excess kurtosis being zero.*

Table 7.6, the mean BHAR is dominated by a few stocks with exceptionally positive performance. As noted by Schöber (2008), one must be careful in interpreting mean BHARs (especially over longer holding periods) as they can be biased upwards due to the few extremely positive values. Also, as noted by Holthausen & Larcker (1996), the median BHAR contains information about whether similar results are likely to be observed in the future, whereas the mean BHAR can be relevant data point from a portfolio strategy perspective. Hence, in the analysis of BHARs we focus on medians rather than on means. Using similar arguments, this analysis also focuses on median CARs. That said, we briefly discuss the equal-weighted averages as a portfolio strategy (using both BHARs and CARs) in Appendix 3 of this thesis.

7.2.2 Abnormal returns

The price performance of PE-backed IPO firms in event time is ambiguous. It is worth noting that the conclusions to be drawn from the results presented below depend on which abnormal metric and which benchmark used. The results also depend on which holding period is in focus.

Table 7.7 reports the median and value-weighted average buy-and-hold abnormal return (BHARs) in event time for 12, 24 and 36-month holding periods for Nordic IPOs listed between January 2002 and December 2015, as well as for the three subgroups (i.e. new listings that were either PE-backed, VC-backed or non-sponsored). Our results document statistically significant long-run underperformance at the 1% level for all new listing combined using a 36-month period against both benchmark indices using the Wilcoxon signed-rank test. The long-run underperformance is also visible for the two sub-groups; VC-backed and non-sponsored IPOs, both significant at the 1% and 5% level, respectively. However, PE-backed IPOs shows no statistically significant long-run underperformance. In contrast, this subgroup reports positive median abnormal returns for 12 and 24-month holding periods, with the latter being statistically significant at the 10% level. Also, the group reports a 1.6% positive 36-month BHAR against the MSCI Nordic Total Return Index, albeit not statistically significant.

Table 7.7 - Buy and Hold abnormal returns (%) in event time

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. The value-weighted average is calculated using inflation-adjusted market capitalisation using the first-day closing price times the corresponding number of shares outstanding at the time of the IPO. The returns are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this represents 25% of the sample). The abnormal returns are calculated using two different benchmarks, the MSCI country total return index for either Sweden, Norway, Denmark or Finland depending on which stock exchange the listing was made, as well as the MSCI Nordic total return index across any of the Nordic stock exchanges. The 12, 24 and 36 month median BHARs is tested using a Wilcoxon signed-rank test that test whether the median BHAR does not differ significantly from zero.

	Median (%)				Value-weighted average (%)			
Months	**All firms**	**PE**	**VC**	**NS**	**All firms**	**PE**	**VC**	**NS**
Panel A. MSCI Country Total Return Indicies								
12 months	-2,2	10,0**	-20,2*	-6,4	7,3	-1,0	-5,1	15,8
24 months	-11,5	0,6	-34,0***	-16,3	7,5	-0,5	-12,9	16,4
36 months	-22,3***	-4,2	-50,0***	-24,2**	9,4	3,0	-28,3	18,0
Panel B. MSCI Nordic Total Return Index								
12 months	-4,7	6,3	-17,9	-9,6	7,1	-3,5	-1,7	17,4
24 months	-12,0	4,5	-28,9**	-15,8	10,1	1,8	-5,1	18,7
36 months	-20,4***	1,6	-50,7***	-20,9**	11,6	6,0	-22,2	19,2

*Note: *Represents signifciant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level*

Table 7.8 reports the median and value-weighted average cumulative abnormal returns (CARs) in event time for 12, 24 and 36-month holding periods. Although not statistically significant, Panel A and Panel B show that all new listings in aggregate shows long-run underperformance. Like BHARs, we document that VC-backed and non-sponsored IPOs shows longer-term underperformance versus both benchmarks[38]. On the contrary, PE-backed IPOs shows outperformance over the entire aftermarket period up to 36 months, but only statistically significant up to month 24.

[38] *However, the results are only statistically significant at the 10% level when using the MSCI country total return indices (Panel A).*

Table 7.8 - Cumulative abnormal returns (%) in event time

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. The value-weighted average is calculated using inflation-adjusted market capitalisation using the first-day closing price times the corresponding number of shares outstanding at the time of the IPO. The returns are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this represents 25% of the sample). The abnormal returns are calculated using two different benchmarks, the MSCI country total return index for either Sweden, Norway, Denmark or Finland depending on which stock exchange the listing was made, as well as the MSCI Nordic total return index across any of the Nordic stock exchanges. The 12, 24 and 36 month median CARs is tested using a Wilcoxon signed-rank test that test whether the median CAR does not differ significantly from zero.

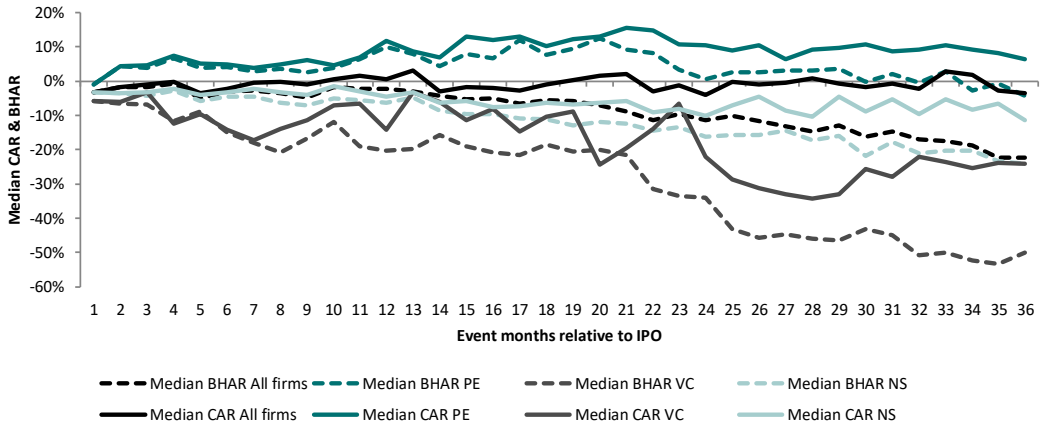
	Median (%)				Value-weighted average (%)			
Months	**All firms**	**PE**	**VC**	**NS**	**All firms**	**PE**	**VC**	**NS**
Panel A. MSCI Country Total Return Indicies								
12 months	0,5	11,6***	-14,1	-4,6	3,3	-3,1	-4,4	9,7
24 months	-4,1	10,6*	-22,1**	-10,2	2,2	2,5	-9,0	2,6
36 months	-3,6	6,3	-24,0*	-11,3*	4,0	14,7	-23,5	-4,0
Panel B. MSCI Nordic Total Return Index								
12 months	-1,4	10,9*	-5,0	-6,9	3,3	-5,1	0,5	11,3
24 months	-1,5	13,0*	-27,1*	-10,0	4,8	5,1	-1,3	4,9
36 months	-2,5	5,5	-15,9	-10,1	5,4	17,7	-20,1	-4,2

*Note: *Represents signifciant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level*

Figure 7.1 illustrates the striking divergence of the median BHAR and CAR with respect to the MSCI Nordic Country Total Return Index for all firms and the three subgroups.

Figure 7.1 - Median abnormal returns vs. MSCI Nordic Country Total Return (TR) Index

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian,Swedish, Danish and Finnish stock exchanges. The returns are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this represents 25% of the sample)



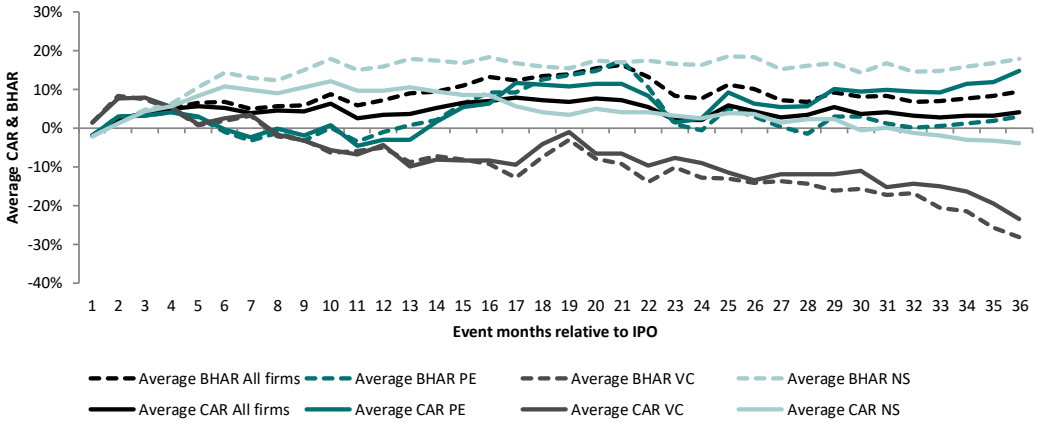
In contrast to the median BHARs and CARs, when looking at value-weighted averages, we find that all firms consistently outperform the benchmark across all event months. Similarly, looking at BHARs, both PE-backed and non-sponsored IPOs outperform the benchmark in the long-run. However, the striking difference between the value-weighted average and the medians are largely explained by a small number of larger firms dragging up the average. To illustrate, 7.8% of the total sample represented 50.3%[39] of the total inflation-adjusted market capitalisation and reported a value-weighted average BHAR of 12.9% versus the total sample's 9.4%. The difference is even larger for CARs, where the value-weighted average between the two groups is 15.2% for 50.3% of market capitalisation versus 4% for the total sample. Thus, although the findings are highly interesting from a portfolio strategy perspective[40], it is hard to make any significant inferences about the results as a small number of larger firms largely drives the average. As a result, this thesis will mainly focus on medians as argued in section 7.2.1.

[39] *25 firms of the total 319 in the sample.*

[40] *See Appendix 3 for a brief discussion on equal-weighted average BHARs and CARs*

Figure 7.2 -Value-weighted average returns vs. MSCI Nordic Country Total Return (TR) Index

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian,Swedish, Danish and Finnish stock exchanges. The returns are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this represents 25% of the sample)



The observed long-run underperformance of newly listed companies follows a wide range of prior research (Ritter, 1991; Loughran & Ritter, 1995; Gompers & Lerner, 2003; Bergström et al., 2006; Cao & Lerner, 2009; Levis, 2011). As documented by Ritter (1991), the IPO long-run returns using the CRSP value-weighted NASDAQ index and the CRSP value-weighted index of Amex-NYSE stocks[41] as benchmark showed negative 36-months equal-weighted average CARs. Similar results from the UK market is documented by Bergström et al. (2006) which also found significant long-run underperformance using CARs as a measurement instrument. This is in-line with the equal-weighted average CARs as documented in Appendix 3. Furthermore, Ritter (1991) finds that the 3-year period total return at the median was -16.67% versus the matching firm's total return of 38.54%, resulting in a 36-month median BHAR of -55.21%. Although this is significantly below our median 36-month BHAR of -22.4% and -20.4%, both samples indicate long-run underperformance[42]. For all firms, the underperformance relative to the MSCI Country Total Return Indices and the MSCI Nordic Total Return Index can be compared to the documented underperformance in the UK market against the FTSE All-Share Index of ~13.5% in Levis (2011). Similarly, Schuster (2003) reports that median BHARs over a 3-year period experience significant

[41] *Ritter (1991) highlighted that these two indices are nearly identical to the NASDAQ Composite and S&P500 index returns, respectively.*

[42] *We do however note that the author used a matching firm technique, while we solely used broad equity indices as benchmarks to calculate abnormal returns.*

underperformance against The Dow Jones STOXX broad-market index (excluding the UK). Looking at Nordic listings, our findings that all firms in aggregate tend to underperform the market in the long-run is in-line with Westerholm (2006), albeit the author uses a five-year event window. Hence, in aggregate, the overall underperformance documented in the sample is supporting hypothesis 5 that the entire sample is underperforming relative to the broad equity indices in the aftermarket.

7.2.3 Performance differences

As illustrated in Panel A, PE-backed IPOs have significantly higher 36-month BHARs with respect to the MSCI Country Total Return indices than both non-sponsored (NS) and VC-backed IPOs according to the Wilcoxon-Mann-Whitney tests, significant at the 5% and 1% level, respectively. Similarly, as shown in Panel B, PE-backed IPOs reports higher 36-month BHARs against the MSCI Nordic Total Return index versus NS and VC-backed IPOs, albeit statistically significant at the 10% and 1% level, respectively. The results support hypothesis 6 and indicate that PE-backed IPOs tend to outperform other listings in the aftermarket. The findings are somewhat similar to Bergström et al. (2006), Cao & Lerner (2009), and Levis (2011), whom also find evidence that buyout-backed IPOs yields less negative abnormal returns than non-sponsored IPOs. For instance, Levis (2011) finds that majority of underperformance stems from the non-sponsored and VC-backed IPOs, while the PE-backed IPOs reported a long-run outperformance of 13.8%. Cao & Lerner (2009), who compared the performance of reverse leveraged buyouts (RLBOs) in the US market[43] versus the NYSE/Amex/Nasdaq market index, reported a median 36-month BHARs of 0.44% compared to our sample -4.2% for PE-backed IPOs. Although our analysis includes all types of IPOs (not only RLBOs), we argue that the results are somewhat comparable as both samples share some key characteristics.

[43] *A sample of 526 RLBOs between January 1981 and December 2003 for 12, 24, 34, 36, 48 and 60 months after the IPO.*

Table 7.9 -Wilcoxon-Mann-Whitney test of differences of 36-month BHARs between listing groups

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian,Swedish, Danish and Finnish stock exchanges. Panel A and Panel B test the hypothesis that the distributions of 36-month BHARs in the two groups do not differ using a Wilcoxon-Mann-Whitney test and reports the corresponding p-values.

Subgroups	PE	NS	PE	VC	NS	VC
Panel A. MSCI Country Total Return Indicies						
Number of listings	78	199	78	42	199	42
Mean Rank	155.4	132.6	69.7	43.5	126.7	93.8
P-value	*0.0331*		*0.0001*		*0.0055*	
Panel B. MSCI Nordic Total Return Index						
Number of listings	78	199	78	42	199	42
Mean Rank	152.4	133.7	68.6	45.5	126.7	94.0
P-value	*0.0804*		*0.0005*		*0.0058*	

Looking at 36-month CARs, the picture is more nuanced as we only find statistical support for hypothesis 6 when comparing PE-backed and VC-backed IPO long-run performance. However, as illustrated in Table 7.10 (Panel A and B), we note that the p-values from the Wilcoxon-Mann-Whitney test between PE and NS 36-month CARs are 0.1191 and 0.1407, respectively. This is close to our minimum statistical level threshold of 10%.

Table 7.10 -Wilcoxon-Mann-Whitney test of differences of 36-month CARs between listing groups

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian,Swedish, Danish and Finnish stock exchanges. Panel A and Panel B test the hypothesis that the distributions of 36-month CARs in the two groups do not differ using a Wilcoxon-Mann-Whitney test and reports the corresponding p-values.

Subgroups	PE	NS	PE	VC	NS	VC
Panel A. MSCI Country Total Return Indicies						
Number of listings	78	199	78	42	199	42
Mean Rank	151.0	134.3	65.3	51.7	122.9	112.1
P-value	*0.1191*		*0.0415*		*0.3617*	
Panel B. MSCI Nordic Total Return Index						
Number of listings	78	199	78	42	199	42
Mean Rank	134.6	150.3	64.5	53.1	122.7	112.8
P-value	*0.1407*		*0.0886*		*0.4041*	

Based on the results from Table 7.9 and 7.10 and as argued above, there seems to be a statistically significant difference between the long-run performance of PE-backed IPOs and the other subgroups, especially when looking at 36-month BHARs. As mentioned earlier, this thesis will put the most emphasis on BHARs[44]. Thus, we find support for hypothesis 6 in the data.

7.2.4 Industry performance

Table 7.11 reports the median 12, 24 and 36-month industry BHARs using the listings' corresponding industry-specific indices as a benchmark to calculate abnormal returns. Panel A documents that 7 out of 10 industries outperform their benchmark after 3 years, but only Consumer Services are statistically significant at the 5% level. Similarly, Panel B shows that PE-backed IPOs outperform their industry-specific index in 8 out of 10 industries. However, as mentioned in section 5.3.3, most IPOs in the PE-backed segment are within Consumer Goods, Health Care, Technology and Industrials sectors (~82% of total inflation-adjusted market capitalisation). In these sectors, PE-backed IPOs outperform their reference industry index, and we document 36-month BHARs of 18.1%, 31.9%, 49% and 13.1%, respectively, statistically significant at the 10% level or lower. Further, we find that PE-backed IPOs outperform non-sponsored IPOs in 8 out of 10 industries, and in all of the main segments mentioned above. Similarly, PE-backed IPOs outperform VC-backed IPOs in 5 out of 7 comparable industries, and in three out of the four main categories[45]. Hence, we find both statistical and economical support for hypothesis 8 in the data. The results are in line with Levis (2011) who also documented that PE-backed IPOs outperformed their reference industry index, as well as VC and non-sponsored IPOs.

[44] *See section 6.2.1.*

[45] *Consumer Goods, Technology, Health Care and Industrials*

Table 7.11 - Industry specific Buy and Hold abnormal return (BHAR)

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. The returs are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this represents 25% of the sample). The abnormal returns are calculated using 10 industry specific indices, where the IPO classification follows Nasdaq's Industry Classification Benchmark (ICB). The 12, 24 and 36 month median BHARs is tested using a Wilcoxon signed-rank test that test that the median BHAR does not differ significantly from zero.

Equal-weighted median (%)										
Months	**Oil & Gas**	**Basic Materials**	**Industrials**	**Consumer Services**	**Consumer Goods**	**Health Care**	**Financials**	**Technology**	**Telecom**	**Utilities**
Panel A. All firm IPOs										
12 months	-6,4	12,1	5,2	8,4	-2,1	-16,1	4,4	-11,0	7,9	-9,2
24 months	-9,5	-3,2	-2,4	29,8**	17,6	-31,9*	-1,4	-21,1	34,1	4,2
36 months	-19,0	15,3	13,1	29,4**	5,7	-47,7	-1,8	4,0	76,8	15,7
Panel B. Private equity-backed IPOs										
12 months	-34,6**	10,2	13,6**	25,1*	6,8	13,8	14,9*	30,0*	7,9	-101,1
24 months	-34,6*	13,0	18,8*	35,0	18,0**	13,2	7,5	40,0*	34,1	-66,7
36 months	-46,1*	18,8	13,1*	29,8	18,1**	31,9	21,1	49,0*	76,8	-86,0
Panel C. Venture capital-backed IPOs										
12 months	-21,3	N/A	2,2	N/A	-3,0	-30,2**	-61,9	6,0	51,1	N/A
24 months	69,6	N/A	-11,5	N/A	69,4	-61,8***	-77,4	-17,9	40,1	N/A
36 months	-55,8	N/A	-47,4	N/A	129,6	-80,4***	11,3	15,4	84,6	N/A
Panel D. Non-sponsored IPOs										
12 months	10,9*	14,1	-11,1	2,8	-12,3	-14,9	3,2	-29,6*	-24,6	2,4
24 months	-3,6	-8,6	-14,7	22,9*	-26,6	-17,7	-3,8	-33,0	21,6	33,2
36 months	-1,2	11,7	-32,6	23,2*	-34,7	-25,3	-2,6	-30,2	-1,3	59,4

*Note: *Represents signifciant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level*

Looking at 36-month CARs, we observe a similar pattern as described above with PE-backed IPOs reporting positive CARs in 8 out of 10 industries. In terms of outperformance, PE-backed IPOs outperform non-sponsored and VC-backed IPOs in 7 out of 10 and 5 out of 7 industries, respectively. A summary of CARs can be found in Appendix 3.

7.3 IPO Cyclicality

7.3.1 Calendar time results

Table 7.12 illustrates the yearly calendar time abnormal returns from 2002 to 2017 for each subgroup calculated using the MSCI Sweden, Norway, Finland and Denmark total return indices depending on which stock exchange the listing was made. Looking at the entire sample, the average median annual abnormal return is -4.7%. However, there are significant variations in terms of abnormal returns across years. 2002 and 2008 experience the largest underperformance of -65.1% and -70.3%, respectively. In contrast, the pre-financial crisis years (2005-2006) display solid abnormal returns in the range of 19.6-32.4%. Although we find similar patterns across the three subgroups, PE-backed IPOs reports a positive 5.8% average median abnormal return versus non-sponsored and VC-backed IPOs'

negative 10.9% and 13.3%, respectively. Further, PE-backed IPOs outperform the MSCI Nordic country indices in 12 out of the 16 years, versus only 5 and 6 out of 16 years for VC and NS, respectively. That said, one should note that the results are not statistically significant at any reasonable level.

There exist mixed results on PE IPO portfolio abnormal returns when using calendar time approach. Bergström et al. (2006), documents that PE-backed IPOs outperform non-private-equity-backed IPOs across all time horizons (1994-2003) on the Pars stock exchange, except for three years. They also document that private-equity backed IPOs outperform non-private equity-backed IPOs in the long-run on the London Stock Exchange[46]. In contrast, Levis' (2011) result on the UK market finds that PE-backed IPOs only reports positive abnormal returns in 6 out of 16 calendar years. Similarly, looking at general IPO calendar time performance, Gompers & Lerner (2003) finds negative annual abnormal returns, using both equal-weighted averages and medians from 1936 to 1976. In terms of return volatility, both Schöber (2008) and Gompers & Lerner (2003) experience significant fluctuation in their yearly abnormal returns, similar to the fluctuation observed in our sample.

In sum, the calendar time analysis reports fundamentally different results when looking at medians and value-weighted averages. Also, the yearly returns fluctuate heavily between years and within the subgroups. That said, albeit not statistically significant, PE-backed IPOs looks to outperform both VC and non-sponsored IPOs across most calendar years. Using medians, the PE-backed firms also experience lower abnormal return volatility reporting a standard deviation of 25.4 versus VC and non-sponsored IPOs' 38.7 and 33, respectively. Consequently, the analysis yields mixed results and we find it hard to draw any real conclusions from the table below.

[46] *The authors use equal-weighted averages with three to five year holding periods.*

Table 7.12 -Three year abnormal return in calendar time by MSCI Nordic Indicies

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. Total market capitalisation is adjusted back to January 2002 using annual CPIs and represents the first-day closing price times the corresponding number of shares outstanding at the time of the IPO. IPO firms are defined as firms that entered their aftermarket performance within the previous 36 calendar months. Portfolios are formed by calendar month and subgroup, with monthly rebalancing. The median annual returns are calculated by compounding each month's median abnormal return for each subgroup. A similar compounding is used to calculated the annual value-weighted average returns. The p-values reported for abnormal returns are from a regular t-test testing the null hypothesis that the average median annual returns are different from zero.

	Median (%)				Value-weighted average (%)			
Year	**All firms**	**PE**	**VC**	**NS**	**All firms**	**PE**	**VC**	**NS**
2002	-65,1	-16,4	-95,5	-95,9	-33,2	-18,5	-95,5	-108,2
2003	23,7	36,7	53,8	-36,0	34,0	34,2	53,8	-19,5
2004	12,0	9,1	64,3	13,8	18,9	0,3	81,9	38,5
2005	32,4	17,0	5,0	37,7	58,3	45,5	28,5	69,3
2006	19,6	24,0	11,4	23,8	33,6	45,3	37,9	28,8
2007	-11,4	-1,6	-25,9	-10,7	15,5	43,7	-19,0	-1,1
2008	-70,3	-67,3	-40,0	-73,2	-86,7	-100,3	-80,0	-77,3
2009	4,7	20,6	2,5	-2,8	35,1	47,8	24,5	26,9
2010	8,5	22,7	-19,8	2,8	25,7	16,6	11,7	31,8
2011	-32,9	-37,2	-48,7	-25,5	-31,5	-80,8	-12,4	9,9
2012	-3,2	21,9	17,4	-3,3	59,2	97,2	36,4	20,6
2013	19,8	22,4	0,0	14,4	48,8	56,8	4,4	38,8
2014	-9,7	10,8	-50,2	-9,3	1,8	7,1	0,2	0,4
2015	3,5	10,8	-24,3	6,7	28,1	32,5	33,5	22,8
2016	-3,1	11,9	-26,2	-9,9	8,8	9,8	2,2	7,8
2017	-4,5	7,7	-37,0	-6,5	15,0	15,6	-21,3	15,4
Average	**-4,7**	**5,8**	**-13,3**	**-10,9**	**14,5**	**15,8**	**5,4**	**6,6**
P-value	*(0,526)*	*(0,388)*	*(0,202)*	*(0,221)*	*(0,147)*	*(0,221)*	*(0,640)*	*(0,560)*
Std.dev	28,3	25,4	38,7	33,0	36,6	48,0	44,1	42,6
Median	**0,2**	**11,4**	**-22,1**	**-4,9**	**22,3**	**24,6**	**8,0**	**18,0**

In contrast to the analysis on median values above, the value-weighted average indicates that portfolios of IPOs in the Nordics, in general, outperform the market across all groups. We find that the entire sample has positive abnormal returns every year, except for 2002, 2008 and 2011. That said, PE-backed IPOs reported the highest average annual return of 15.8% versus VC and non-sponsored IPOs' 5.4% and 6.6%, respectively.

7.3.2 IPO cyclicality in event time

The results from the analysis of cyclicality and BHARs in event time is summarised in Table 7.13. In aggregate, all firms tend to underperform regardless of activity period in scope. For all firms, we find a negative -19.6% median BHAR in the high market activity period (Panel A) and -20.7% in the low market activity period (Panel B), with the former being statistically significant at the 1% level. Looking at subgroups, the picture is somewhat more nuanced as VC-backed, and non-

sponsored IPOs displays a higher underperformance in the high market activity (HMA) period versus the low market activity (LMA) period. The former reported a -51.9% median 36-month BHAR in HMA versus -46.4% in LMA, while the latter recorded a -24% BHAR in HMA versus -14.6% in LMA. That said, the results are only statistically significant for results in the high market activity period. On the contrary, for PE-backed IPOs, the analysis shows a 1.6% BHAR in the HMA versus -6.4% in LMA, albeit not statistically significant at any reasonable significance level.

Table 7.13 - Buy and Hold abnormal returns (%) in event time

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. The returns are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this represents 25% of the sample). The abnormal returns are calculated using the MSCI country total return index for either Sweden, Norway, Denmark or Finland depending on which stock exchange the listing was made. The high activity period is defined as 2005 to 2007 and 2014 to 2015, while the low activity period is defined as the remaining years. The 12, 24 and 36 month median BHARs is tested using a Wilcoxon signed-rank test that test that the median BHAR does not differ significantly from zero.

	Median (%)				Equal-weighted average (%)			
Months	**All firms**	**PE**	**VC**	**NS**	**All firms**	**PE**	**VC**	**NS**
Panel A. High activity period								
12 months	-0,6	12,6***	-11,2	-11,8	6,4	13,9	-4,3	5,5
24 months	-9,6*	14,2	-30,0**	-18,6**	5,6	27,9	-30,4	3,6
36 months	-19,6***	1,6	-51,9***	-24,0***	-2,4	23,1	-40,4	-5,3
Panel B. Low activity period								
12 months	-15,4*	-21,3**	-23,2	-2,6	-3,9	-22,9	-13,4	3,0
24 months	-14,8	-31,4	-1,4	-10,7	1,8	-14,6	-10,7	8,6
36 months	-20,7	-6,4	-46,4	-14,6	16,8	-5,3	-19,7	29,6

*Note: *Represents signifciant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level*

As illustrated in Table 7.14, the subgroups show a higher degree of long-run underperformance when floated in the HMA period versus the LMA period, except for PE-backed IPOs. Looking at medians, VC-backed and non-sponsored IPOs reports a -30.4% and -11% 36-month CAR in the HMA period, while documenting a 2% and -1.2% 36-month CAR in the LMA period, respectively. In contrast, PE-backed IPOs floated in HMA and LMA yields a positive 7% and 5.4% 36-month median BHAR, respectively.

Table 7.14 - Cumulative abnormal returns (%) in event time

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. The returns are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this represents 25% of the sample). The abnormal returns are calculated using the MSCI country total return index for either Sweden, Norway, Denmark or Finland depending on which stock exchange the listing was made. The high activity period is defined as 2005 to 2007 and 2014 to 2015, while the low activity period is defined as the remaining years. The 12, 24 and 36 month median CARs is tested using a Wilcoxon signed-rank test that test that the median CAR does not differ significantly from zero.

	Median (%)				Equal-weighted average (%)			
Months	**All firms**	**PE**	**VC**	**NS**	**All firms**	**PE**	**VC**	**NS**
Panel A. High activity period								
12 months	1,8	15,6***	-3,6	-7,6	4,5	12,6	2,9	1,2
24 months	-0,9	18,1***	-39,4	-10,5*	-3,0	14,6	-25,9	-5,8
36 months	-6,8	7,0	-30,4	-11,0	-15,0	2,1	-45,5	-15,8
Panel B. Low activity period								
12 months	-8,7	-19,7*	-7,9	-1,2	-9,0	-22,1	-22,9	-2,8
24 months	-14,8	-20,8	14,9	-4,7	-6,0	-13,2	-19,3	-1,6
36 months	0,9	5,4	2,0	-1,2	-3,4	-3,7	-2,7	-3,5

*Note: *Represents signifciant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level*

The mixed results are somewhat in contrast with previous literature (e.g. Ritter, 1991) which finds that firms going public in high market activity years are performing significantly worse in the aftermarket compared to floating in low market activity years. Although VC-backed and non-sponsored IPOs report a higher underperformance in the HMA period relative to the LMA period (regardless of performance metric used), the total sample shows little to no difference in long-run performance. Considering that we find that all IPOs except VC-backed IPOs are experiencing a higher first-day return in HMA years, one would expect this potential over optimising could lead to a sharp decline in the aftermarket as the investors reassess their expectations. However, this appears only to be the case for VC-backed and non-sponsored IPOs, while the opposite revealed for PE-backed IPOs.

We do however note that a potential explanation behind the difference in performance patterns between our analysis and previous research may be attributed to a different period of HMA in scope and the fact that our study examines different geography. Recent papers by Loughran and Ritter (2004), Bergström et al. (2006) and Levis (2011) defines the high IPO activity years around the IT-bubble from 1999-2000, whereas our sample uses the pre-financial crisis years (2005-2007) and the recent uptick in IPO activity observed in 2014 to 2015. Thus, there might be

different performance patterns depending on which high-activity period in scope. Therefore, high activity periods in the Nordics in the years succeeding 2000 might demonstrate another underperformance pattern compared to the low activity periods, as suggested by our results.

Furthermore, our results on private equity long-run performance are contrasted to Schöber (2008) and Cao (2011) who find that buyout-backed IPOs in high volume years are performing the worst among the IPO activity periods. As noted by Cao (2011), when facing favourable valuation periods or high industry valuations, buyout specialist tends to shorten the time to restructure leverage buyouts privately. Due to such IPO timing, RLBOs with shorter duration experience more deterioration in operating performance following their IPOs as a specialist are taking advantage of high valuations. Although not entirely comparable with our broader private equity focus (and not solely RBLOs), one can argue that PE-backed IPOs floated in the Nordics in 2005-2007 and 2014-2015 were not as hastily flipped but had reached the end of their holding periods with successful restructurings.

Table 7.15 - Test of difference in 36-month median BHARs between high activity periods verus low activity periods

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian,Swedish, Danish and Finnish stock exchanges. Panel A test that the distributions of 36-month BHARs in the two groups do not differ using a Wilcoxon-Mann-Whitney test and reports the corresponding p-values.

Subgroups	HMA All	LMA All	HMA PE	LMA PE	HMA VC	LMA VC	HMA NS	LMA NS
Panel A. High activity period versus low activity period								
Number of listings	233	86	62	16	31	11	140	59
Median (%)	-19,6	-20,7	1,6	-6,4	-51,9	-46,4	-24,0	-14,6
P-value	*0,7567*		*0,4393*		*0,3167*		*0,5889*	

To check whether we can infer any statistical inference on the results presented above, we employ a Wilcoxon-Mann-Whitney test to test whether firms floated in high market activity periods perform differently than those flowed during low market activity periods. As illustrated in Table 7.15, we find no significant difference between 36-month BHARs in any of the subgroups. Similarly, our analysis finds no significant difference in 36-month CARs for any of the subgroups (see Appendix 5). Consequently, the results yield no support for hypothesis 7.

7.4 OLS regressions for robustness checking on long-run performance

Table 7.16 summaries the results from regression 6.15 and 6.16. According to an F-test, model (1) and (2) are statistically significant at the 10% level, while model (3) and (4) are not. As a result, we will focus on the regression output from the two

former models. However, we highlight that the adjusted R-squared values are low for all models (0-3%), illustrating the difficulty in explaining the cross-sectional variation in 36-month BHARs and CARs among Nordic IPO firms.

In summary, the results give some statistical support for our main aftermarket performance hypothesis described in section 4.2.2. Firstly, we note that the private equity dummy (PE DUMMY) reports highly positive coefficients in all four models, supporting the positive abnormal returns observed in the analysis on PE-backed long-run performance discussed earlier in this chapter. However, the four coefficients are not statistically significant at any reasonable level. In contrast, the venture capital dummy (VC DUMMY) is highly significant in both model (1) and (2), confirming the severe underperformance observed by VC-backed IPOs (with BHAR as abnormal return metric) in our sample. Thus, we argue that the significant difference between the VC and PE coefficient yields some support for hypothesis 6 and are in line with the performance differences between the two groups documented in section 7.2.3. Secondly, the high p-values reported for the HMA DUMMY in the four models (0.48-0.62) supports the analysis on IPO cyclicality in event time, confirming that there is no significant difference between firms listed during HMA or LMA for the total sample. Lastly, the two industry variables (HC and CS) are not statistically significant. That said, CS is positive and yields some support to the industry performance analysis.

Among the other included control variables, the reputation of the lead underwriter (RANK) is significant at the 10% level in model (1) and (2). The coefficient estimate is positive indicating that higher reputation on lead underwriters yields less long-run underperformance. The findings are consistent with previous literature (Michaely & Shaw, 1994; Carter et al., 1998) which finds that, on average, the long-run market adjusted returns are less negative for IPOs brought to market by more prestigious underwriters. One possible explanation for the better long-run performance, as argued by Chemmanur & Fulghieri (1994), is that investors use the investment banks' past performance to assess their credibility. Thus, by marketing IPOs that have relatively better long-term performance, investment banks protect their reputation. Hence, the authors expected a positive coefficient, as observed in our analysis. The remaining control variables for model (1) and (2) are insignificant, but we note that underpricing coefficient is statistically significant at the 5% level for model (4). Surprisingly, the coefficient is highly positive, indicating that an IPO is experiencing high first-day returns also perform

well 3-years after the initial public offering. The findings is not in line with previous literature, which argues that issues floated during high market activity periods (characterised by higher underpricing) tend to perform worse in the aftermarket. That said, the analysis on IPO cyclicality in section 7.3 fails to confirm this, and we argue that the sample might be different from previous literature as discussed in the same section.

Table 7.16 - OLS regression with 36-month BHARs and CARs as dependent variable

*The table reports the output from a regression of 36-month BHARs and CARs with up to ten explanatory variables. HMA DUMMY is a dummy variable taking the value of 1 of the observation is within the high market activity period, and 0 otherwise. PE and VC dummy are dummies taking 1 if the IPO is either PE or VC-backed, and 0 otherwise. FIRMSIZE is the natural logarithm of the inflation-adjusted market capitalisation immediately after the listing. RANK is the reputaiton of the lead underwrtier in the transaction, while UNDERWRITERS is the number of underwriters in each transaction. HC and CS are industry dummies reflecting the highest and lowest degree of underpricing in the sample. Lastly, EQUITY reflects the size of the equity stake sold in the IPO for either PE or VC sponsors, taking 1 if the sponsor sells more than 24% of its equity stake, and 0 otherwise. UNDERPRICING reflects the first-day return of each IPO. *Represents signifciant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level. The coefficient of each variable and the p-values (in parentheses) are reported in Panel A. The t-statistics is calculated using the hetroskedasticity consistent method introduced by White (1980). The F-values are from a test that the model as a whole has statistically significant predicitve capability.*

Panel A. Long-run aftermarket performance

	36-month BHARs		36-month CARs	
Variables	**(1)**	**(2)**	**(3)**	**(4)**
Constant	-0,1235	-0,1353	-0,2249	-0,2451
	(0,7217)	*(0,6710)*	*(0,4747)*	*(0,4323)*
HMA DUMMY	-0,1071	-0,1113	-0,0675	-0,0746
	(0,5067)	*(0,4874)*	*(0,6146)*	*(0,5717)*
PE DUMMY	0,2344	0,2382	0,2042	0,2108
	(0,4481)	*(0,4425)*	*(0,2023)*	*(0,1910)*
VC DUMMY	-0,4130***	-0,3974***	-0,2130	-0,1864
	(0,0064)	*(0,0091)*	*(0,2517)*	*(0,3008)*
FIRMSIZE	-0,1045	-0,1207	-0,0328	-0,0605
	(0,5380)	*(0,4754)*	*(0,7910)*	*(0,6339)*
RANK	0,0632*	0,0661*	0,0246	0,0295
	(0,0850)	*(0,0688)*	*(0,4485)*	*(0,3650)*
UNDERWRITERS	0,0479	0,0530	0,0305	0,0422
	(0,3367)	*(0,2780)*	*(0,4385)*	*(0,2891)*
HC	0,0045	-0,0151	0,0109	-0,0227
	(0,9776)	*(0,9239)*	*(0,9548)*	*(0,9064)*
CS	0,3324	0,3440	0,2888	0,3088
	(0,3047)	*(0,2888)*	*(0,1675)*	*(0,1360)*
EQUITY	-0,2561	-0,2524	-0,1740	-0,1677
	(0,3768)	*(0,3858)*	*(0,3522)*	*(0,3810)*
UNDERPRICING		0,3046		0,5210**
		(0,1852)		*(0,0431)*
Adjusted R-Squared	0,024	0,025	0,000	0,012
Observations	319	319	319	319
F-statistic	1,86*	1,80*	0,99	1,40

8. Conclusion

In general, this thesis finds that private equity-backed IPOs in the Nordics outperform non-private equity-backed IPOs longer-term as we initially hypothesised in our second research question. However, we are not able to conclude whether PE-backed IPOs in the Nordics outperform the market long-term as the results are not statistically significant. That said, PE-backed IPOs in the Nordics displays a lower degree of underpricing when compared to non-PE-backed IPOs answering our second research question.

The thesis' final sample consists of 319 initial public offerings listed on the stock exchanges in Sweden, Finland, Norway and Denmark from January 2002 to December 2015. In line with previous research, we find that Nordic IPOs in aggregate experience an average underpricing of 8.3%. However, the results reveal that private equity-backed IPOs are less underpriced when compared to venture capital-backed and non-sponsored IPOs which are in line with previous research. We also find that PE-backed IPOs are on average larger in terms of inflation-adjusted market capitalisation, have more underwriters participating in the transaction and use a more prestigious investment bank as global coordinator when compared to traditional IPOs. Further, larger firms appear to experience more underpricing which contradicts both the literature and our expectations. Also, we find that PE-backed IPOs experience more underpricing in hot markets versus cold markets which contradict other papers. We find no evidence that PE or VC firms that sell a larger equity stake in the IPO yields lower underpricing as one would expect, supporting the view that PE firms are frequent participants in the capital markets and must maintain a satisfactory reputational capital. Lastly, we find that more underwriters' leads to lower underpricing and that the health care sector appears to be experiencing highest average first-day returns.

Looking at long-run performance, we find that all firms tend to underperform applicable country total return indices as one would expect based on previous findings. However, PE-backed firms report a median -4.2% 36-months buy and hold abnormal return and significantly outperform non-sponsored and venture capital-backed IPOs in the aftermarket in line with our expectations. Our analysis also reveals that PE-backed firms significantly outperform their industry peers, but we find no evidence that firms listed in hot markets versus cold markets experience long-run underperformance as documented in previous articles. Further,

firms that are listed using prestigious underwriters tend to outperform other IPOs in the long-run. This supports our findings that PE-backed IPOs outperform other listings as PE firms tend to use more prestigious underwriters. That said, we find no evidence that PE and VC firms that sell a larger equity stake in the IPO show weaker long-run performance.

Although the findings in this thesis are broadly in line with previous literature, the paper does not investigate operating performance prior to or after the listing. Hence, it remains to be studied whether improvements in operational performance could help explain the large deviation in stock price performance between private equity and non-private equity-owned firms. In our view, a better understanding of post-listing operating performance is likely a large omitted explanatory variable in our study, e.g. by using equity analyst estimates as a proxy. Consequently, by shedding more light on operating performance post-IPO one could arguably explain some of the abnormal long-run returns of private equity listings as well as the observed lower underpricing.

9. References

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10. Appendices

Appendix 1 – Inflation adjusted market capitalisation

To calculate the inflation-adjusted market capitalisation we collected the yearly Consumer Price Index (CPI) for Norway, Sweden, Denmark and Finland from January 2002 to December 2015 using Bloomberg. Further, we used 2002 as a base year to calculate the inflation-adjusted market capitalisation for each IPO depending on which year and country the listing was made. However, although the returns in this thesis is measured monthly, the inflation adjustment is calculated using a daily frequency. As an example, Europris was listed on 19.06.2015 with an estimated market capitalisation of ~NOK7.18bn. Since Europris were listed 169 days into 2015, the market capitalisation is initially adjusted back to 1 of January 2015 using the 2015 Norwegian CPI or divided by $2.3\%^{\wedge(169/365)}$. The market capitalisation is then further adjusted back to 1 of January 2002 using each years' respective CPI yielding a ~NOK5.6bn inflation-adjusted market capitalisation for Europris in 2002 prices. This is done for every IPO in our sample. Thus, the total NOK846bn unadjusted market capitalisation ends up a ~NOK741bn inflation-adjusted market capitalisation in 2002 prices.

Table 10.1 -Annual country CPIs and market capitalisation

The unadjusted market capitalisation is caluculated for each firm immediatly after their listings using the close price after the first day of trading times total shares outstanding and then aggregated each year. The annual country specific consumer price indices (CPIs) are collected from Bloomberg and is reported at an annual basis. The market capitalisation has then been inflation adjusted back to January 2002 using each country specific CPIs for each IPO to make analysis comparable across time. All the market values are converted to NOK to make value-weighting feasible.

	Annual country specific CPI (%)				Market capitalisation (NOKbn)			
Year	**Norway**	**Sweden**	**Denmark**	**Finland**	**Unadjusted**	**Cumulative unadjusted**	**Inflation adjusted**	**Cumulative adjusted**
2002	2,7	2,2	2,5	2,0	17	147	17	146
2003	0,6	1,9	1,4	1,3	1	276	1	274
2004	1,1	1,0	1,2	0,1	50	315	48	309
2005	1,8	1,6	2,3	0,8	108	319	103	309
2006	2,2	1,2	1,8	1,3	151	336	140	323
2007	2,8	2,4	2,3	1,6	68	447	62	425
2008	2,2	1,6	2,4	3,9	3	448	3	417
2009	2,0	2,4	1,4	1,6	0	451	0	412
2010	2,8	2,3	2,8	1,7	112	519	94	469
2011	0,1	0,5	2,4	3,3	17	669	14	610
2012	1,4	1,0	2,1	3,2	4	778	3	707
2013	2,0	0,8	0,7	2,2	39	828	32	750
2014	2,1	0,5	0,4	1,2	129	829	104	742
2015	2,3	0,9	0,4	-0,2	147	846	120	741
Average	**1,9**	**1,5**	**1,7**	**1,7**	**60**	-	**53**	-
Median	2,1	1,4	2,0	1,6	44	-	40	-
Total	-	-	-	-	**846**	-	**741**	-

Appendix 2 - Benchmarks

Table 10.2 displays the five main MSCI Scandinavian total return indices used in this thesis as well as their annual year-over-year returns. A significant advantage using total return indices is that they track both the capital gains of the groups of stocks over time and assumes that any cash distributions (such as dividends) are reinvested back into the index. Further, as mentioned in section 5.1, this thesis primarily focuses on the four Nordic country-specific MSCI total return indices as we argue that benchmarking against country-specific indices yields the most accurate 'market return' to match the IPO portfolios long-run returns in the Nordic market. Although these indices do not account for different 'size effects' or industry characteristics, the Nordic stock exchanges are small in comparison to larger European exchanges and the US stock exchange. For instance, in terms of market capitalisation year-end 2017, the four Nordic stock exchanges' market capitalisations combined is only close to 7-8% of the New York Stock Exchange (NYSE) alone (Nasdaq, 2018a; NYSE, 2018; Oslo Stock Exchange, 2018). Thus, it is arguably harder to find a firm with the same relative size and firm-specific characteristics in the Nordic market as opposed to the larger international markets. In our view, this makes simple benchmarking against equity indices more sufficient compared to the 'matching firm' technique used in previous literature.

Table 10.2 - Nordic and country specific Indices with annual returns

The indices are collected from Bloomberg on a daily basis from January 2002 to February 2017 and are total return indices. This means they takes into account dividends, stock splits and stock dividends of the stocks included in the index. The index values in each year are year-end values. The returns are calculated on a year-over-year basis.

	MSCI Indices					MSCI Indices annual returns (%)				
Year	**Nordic**	**Norway**	**Sweden**	**Denmark**	**Finland**	**Nordic**	**Norway**	**Sweden**	**Denmark**	**Finland**
2002	5 853	2 355	9 904	4 166	731	-25,4	-27,9	-41,9	-28,5	-40,6
2003	8 467	3 382	13 583	5 220	732	44,7	43,6	37,1	25,3	0,2
2004	10 875	4 756	17 220	6 369	728	28,4	40,6	26,8	22,0	-0,6
2005	12 689	6 683	22 947	9 222	988	16,7	40,5	33,3	44,8	35,7
2006	17 816	8 993	28 538	11 503	1 158	40,4	34,6	24,4	24,7	17,2
2007	21 775	10 387	27 353	13 089	1 567	22,2	15,5	-4,2	13,8	35,4
2008	10 231	4 834	17 012	7 238	747	-53,0	-53,5	-37,8	-44,7	-52,3
2009	15 197	7 522	25 481	9 611	816	48,5	55,6	49,8	32,8	9,2
2010	19 154	8 464	32 344	13 495	973	26,0	12,5	26,9	40,4	19,3
2011	15 877	7 896	27 999	11 724	694	-17,1	-6,7	-13,4	-13,1	-28,7
2012	19 589	8 814	32 789	15 285	796	23,4	11,6	17,1	30,4	14,7
2013	24 772	10 607	40 796	18 414	1 127	26,5	20,3	24,4	20,5	41,6
2014	23 595	10 327	46 464	22 343	1 294	-4,8	-2,6	13,9	21,3	14,8
2015	24 305	10 457	48 039	31 033	1 486	3,0	1,3	3,4	38,9	14,9
2016	23 557	11 656	52 754	26 997	1 480	-3,1	11,5	9,8	-13,0	-0,4
2017	29 869	14 355	57 911	32 196	1 611	26,8	23,2	9,8	19,3	8,9
Average	**17 726**	**8 218**	**31 321**	**14 869**	**1 058**	**12,7**	**13,8**	**11,2**	**14,7**	**5,6**
Median	18 485	8 639	28 268	12 407	980	22,8	14,0	15,5	21,7	11,9

To capture the industry-specific characteristics and performance, we have found ten industry benchmarks reflecting the broad industry classification of each IPO in our sample. A detailed outlay of industry classification can be found in section 5.3.3. For 9 out of the 10 industries, we used the MSCI Nordic Industry Indices (e.g. the MSCI Nordic Energy Index) to calculate abnormal returns. However, to calculate abnormal returns for the consumer service (CS) segment we had to use the MSCI Europe Consumer Service Index as it does not exist a Nordic index with long enough return history. However, as CS only represents around 7% of the total sample, we argue that the effect is small and will not affect our results in any significant way.

Table 10.3 - Industry specific indices annual returns (%)

The indices are collected from Bloomberg on a daily basis from January 2002 to February 2017 and are total return indices. This means they takes into account dividends, stock splits and stock dividends of the stocks included in the index. The index values in each year are year-end values. The returns are calculated on a year-over-year basis.

	MSCI Indices annual returns (%)									
Year	**Oil & Gas**	**Basic Materials**	**Industrials**	**Consumer Services**	**Consumer Goods**	**Health Care**	**Financials**	**Technology**	**Telecom**	**Utilities**
2002	-9,0	-16,6	-27,6	-32,9	-21,7	-25,9	-27,9	-57,1	-30,9	N/A
2003	22,6	7,1	28,0	23,0	15,1	11,7	30,7	6,2	33,2	N/A
2004	38,8	10,0	16,6	9,9	22,9	35,2	24,0	4,5	4,2	66,5
2005	59,9	9,4	46,7	20,2	21,4	25,5	23,4	28,6	24,5	56,6
2006	22,5	27,8	31,4	14,7	25,8	29,6	25,6	2,4	44,3	36,1
2007	8,3	-11,5	12,6	-17,8	1,8	17,4	-10,5	21,0	13,0	42,9
2008	-55,5	-52,4	-54,6	-42,6	-43,1	-25,1	-57,3	-53,5	-56,2	-50,6
2009	58,4	41,2	49,1	17,5	57,0	25,9	66,5	-8,7	60,8	24,6
2010	8,8	32,5	50,0	27,3	29,8	70,5	23,5	4,6	25,5	18,8
2011	0,3	-25,1	-22,8	-14,3	-16,2	6,8	-20,6	-32,6	-0,4	-26,8
2012	4,2	11,5	22,3	27,0	10,1	38,7	29,7	-5,6	1,2	-14,2
2013	-5,8	9,2	6,6	24,8	20,6	8,1	37,4	40,7	13,2	17,5
2014	-32,3	16,0	4,2	20,5	4,8	22,7	5,7	12,4	-5,7	8,1
2015	-9,6	12,2	11,0	12,3	9,8	44,3	4,4	-1,0	-7,1	-22,5
2016	37,5	10,2	13,2	-6,5	-9,6	-29,0	5,5	-30,4	-11,6	6,3
2017	9,1	25,0	13,1	5,0	-20,0	19,8	1,1	-4,5	14,3	19,0
Average	**9,9**	**6,6**	**12,5**	**5,5**	**6,8**	**17,3**	**10,1**	**-4,6**	**7,6**	**13,0**
Median	8,5	10,1	13,2	13,5	10,0	21,3	14,6	0,7	8,6	18,1

Appendix 3 – Equal-weighted BHAR and CAR in event time

The results from an equal-weighted portfolio perspective paint a highly interesting picture when looking at PE-backed IPOs aftermarket performance. In Table 10.4, we document that PE-backed IPOs yields a 19.5% and 17.3% 36-month BHAR using the MSCI Country Total return and MSCI Nordic Total return indices, respectively. Also, all firms in aggregate and non-sponsored IPOs reports a positive BHAR across all months, while VC-backed IPOs shows severe underperformance (like the analysis on medians in section 7.2.3).

Table 10.4 - Buy and Hold abnormal returns (BHAR)

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. The value-weighted average is calculated using inflation-adjusted market capitalisation using the first-day closing price times the corresponding number of shares outstanding at the time of the IPO. The returns are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this represents 25% of the sample). The abnormal returns are calculated using two differnt benchmarks, the MSCI country total return index for either Sweden, Norway, Denmark or Finland depending on which stock exchange the listing was made, as well as the MSCI Nordic total return index across any of the Nordic stock exchanges.

	Equal-weighted average (%)				Value-weighted average (%)			
Months	**All firms**	**PE**	**VC**	**NS**	**All firms**	**PE**	**VC**	**NS**
Panel A. MSCI Country Total Return Indicies								
12 months	4,3	9,0	-8,3	5,2	7,3	-1,0	-5,1	15,8
24 months	2,4	19,0	-28,8	2,5	7,5	-0,5	-12,9	16,4
36 months	1,6	19,5	-37,0	2,7	9,4	3,0	-28,3	18,0
Panel B. MSCI Nordic Total Return Index								
12 months	3,2	6,3	-6,7	4,1	7,1	-3,5	-1,7	17,4
24 months	4,2	19,2	-25,3	4,6	10,1	1,8	-5,1	18,7
36 months	2,2	17,3	-35,0	4,2	11,6	6,0	-22,2	19,2

*Note: *Represents signifciant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level*

However, when looking at CARs, the long-run underperformance of all firms in total, VC-backed and non-sponsored IPOs shows a close resemblance to the analysis on medians. In contrast, PE-backed IPOs document outperformance across all months, albeit close to the benchmark index in the long-run with a mere 2.6% and 0.9% 36-month positive CAR (Table 10.5, Panel A and B).

Table 10.5 - Cumulative abnormal returns (CAR)

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. The value-weighted average is calculated using inflation-adjusted market capitalisation using the first-day closing price times the corresponding number of shares outstanding at the time of the IPO. The returns are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this represents 25% of the sample). The abnormal returns are calculated using two differnt benchmarks, the MSCI country total return index for either Sweden, Norway, Denmark or Finland depending on which stock exchange the listing was made, as well as the MSCI Nordic total return index across any of the Nordic stock exchanges.

	Equal-weighted average (%)				Value-weighted average (%)			
Months	**All firms**	**PE**	**VC**	**NS**	**All firms**	**PE**	**VC**	**NS**
Panel A. MSCI Country Total Return Indicies								
12 months	1,0	7,4	-5,4	-0,2	3,3	-3,1	-4,4	9,7
24 months	-6,5	7,7	-28,1	-7,5	2,2	2,5	-9,0	2,6
36 months	-12,2	2,6	-34,8	-13,2	4,0	14,7	-23,5	-4,0
Panel B. MSCI Nordic Total Return Index								
12 months	0,2	5,5	-3,8	-1,0	3,3	-5,1	0,5	11,3
24 months	-4,4	8,9	-24,1	-5,5	4,8	5,1	-1,3	4,9
36 months	-12,5	0,9	-34,3	-13,2	5,4	17,7	-20,1	-4,2

*Note: *Represents signifciant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level*

Appendix 4 – Industry specific CARs in event time

Table 10.6 - Industry specific cumulative abnormal return (CAR)

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. The returs are measured from the closing price after the first day of trading. If a firm is delisted within 36 months of its listing, we turncate its performance as of the delisting date (this represents 25% of the sample). The abnormal returns are calculated using 10 industry specific indices, where the IPO classification follows Nasdaq's Industry Classification Benchmark (ICB). The 12, 24 and 36 month median CARs is tested using a Wilcoxon signed-rank test that test that the median CAR does not differ significantly from zero.

Equal-weighted median (%)										
Months	**Oil & Gas**	**Basic Materials**	**Industrials**	**Consumer Services**	**Consumer Goods**	**Health Care**	**Financials**	**Technology**	**Telecom**	**Utilities**
Panel A. All firm IPOs										
12 months	1,7	14,5	11,7	9,1**	2,0	-9,8	5,6	-12,3	8,3	-6,0
24 months	-9,3	7,6	3,6	32,4**	20,2*	-6,7	4,1	-9,8	36,9	5,3
36 months	-13,1	31,9	3,1	32,4***	24,8**	-28,1	3,8	27,2	63,9	10,2
Panel B. Private equity-backed IPOs										
12 months	-39,9**	15,1	14,5***	31,1**	8,2	22,9	17,6*	36,0*	8,3	-149,1
24 months	-43,4*	25,9	24,0**	32,4	20,7***	13,6	15,6	47,8*	33,8	-255,6
36 months	-56,0*	25,9	20,5	28,9	27,6***	18,7	28,9*	64,6*	65,1	-219,2
Panel C. Venture capital-backed IPOs										
12 months	-1,9	N/A	23,9	N/A	2,1	-22,9*	-60,3	11,2	41,4	N/A
24 months	60,0	N/A	-9,7	N/A	65,4	-62,2***	-61,4	6,3	36,9	N/A
36 months	-32,3	N/A	-56,5	N/A	107,6	-115,2***	19,3	56,0**	63,9	N/A
Panel D. Non-sponsored IPOs										
12 months	13,1*	13,9	-4,2	5,8	-9,4	-5,6	4,3	-30,9*	4,1	10,3
24 months	-4,4	-11,2	-19,3	28,0**	-17,6	7,4	3,4	-31,5	61,1	42,8
36 months	5,1	37,9	-7,8	42,7**	-6,3	8,4	-6,5	-26,8	30,2	63,4

*Note: *Represents signifciant at the 10% level, ** represents significant at the 5% level, and *** Represents significant at the 1% level*

Appendix 5 – Test of difference in 36-month CARs between HMA and LMA

Table 10.7 - Test of difference in 36-month median CARs between high activity periods verus low activity periods

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian,Swedish, Danish and Finnish stock exchanges. Panel A test that the distributions of 36-month CARs in the two groups do not differ using a Wilcoxon-Mann-Whitney test and reports the corresponding p-values.

Subgroups	**HMA All**	**LMA All**	**HMA PE**	**LMA PE**	**HMA VC**	**LMA VC**	**HMA NS**	**LMA NS**
Panel A. High activity period versus low activity period								
Number of listings	233	86	62	16	31	11	140	59
Median (%)	-6,8	0,9	7,0	5,4	-30,4	2,0	-11,0	-1,2
P-value	*0,2542*		*0,7059*		*0,1788*		*0,3193*	

Appendix 6 – Underwriter reputation

To measure the underwriter reputation at the time of the IPO, we use four performance and reputational criterions. Similar to the approach pioneered by Carter & Mannaster (1990), we rank each underwriter by assigning an integer rank, zero to nine, based on the underwriters' relative position compared to its peers. The

most prestigious underwriters are awarded a rank of nine, while the least prestigious underwriters are assigned a rank of zero. As an example, the top 90% percentile in each category is awarded rank nine, while the worst 10% (10% percentile or below) receives a rank of 0.

The first criterion is based on the underwriters total inflation-adjusted market capitalisation involvement in the period 2002 to 2015, calculated by adding up the total proceeds of each IPO the underwriter are involved in. It has been suggested that more prestigious underwriters can market larger offerings of equity (Carter & Manaster, 1990). Thus, the underwriters that are involved in larger equity transactions consequently get a higher rank and vice a versa.

The second variable used is the number of IPO transactions the underwriter is involved in from January 2002 to December 2015. To measure this, we simply sum up the number of transaction each underwriter is involved and infer that a higher number of transactions yield a higher rank. Similarly, the third variable measures the number of times the underwriter is acting as a lead underwriter often referred to as 'global coordinator'. Thus, as illustrated in Table 10.8, we see that SEB has been involved in the most transactions, while Carnegie has acted most as lead underwriter.

Lastly, to capture the overall quality of the underwriter, we use TNS Sifo Prospera's annual sell-side rankings. More specifically, we use the 'Domestic Equity'[47] ranking for each country from 2002 to 2015. The ranking reports the clients' overall performance regarding perceived quality, client demands and competitive performance in a wide number of aspects (Prospera, 2018). The report ranks the top 5 institutional underwriters for each year and country (Norway, Sweden, Denmark and Finland). Thus, to measure the quality of each underwriter, we count the number of times the underwriter is awarded top 5 in each country and take the average across the 14 survey years. According to this approach, SEB is ranked as the most 'prestigious'.

To calculate the overall rank, we simply take the average rank received for each of the four performance measures discussed above. Thus, from Table 10.8 we see that SEB is perceived as the most prestigious with a rank of 8.9, while Macquarie Capital ranked as the least prestigious according to our ad-hoc ranking system.

[47] *We note that before 2011 this ranking was named 'Stockbroker ranking' for each country*.

Table 10.8 - Underwriter ranking

Company	Number of times as lead	Number of transactions	Market capitalisation	Prospera ranking	Total Rank
SEB	8,5	9,0	9,0	9,0	**8,9**
Carnegie	9,0	8,5	8,5	8,5	**8,6**
ABG Sundal Collier	8,5	8,5	8,5	8,5	**8,5**
Nordea	8,0	8,5	8,5	8,5	**8,4**
DNB Markets	8,5	8,5	8,0	8,0	**8,3**
Handelsbanken	8,5	8,0	8,0	8,5	**8,3**
Danske Bank	8,0	8,0	8,0	8,5	**8,1**
Pareto Securities	8,5	8,5	7,5	8,0	**8,1**
UBS	7,5	8,0	8,5	8,0	**8,0**
Swedbank	8,0	8,0	7,5	8,0	**7,9**
Arctic Securities	6,5	8,0	7,0	8,0	**7,4**
Alfred Berg	7,0	7,0	6,5	8,0	**7,1**
Deutche Bank	4,5	7,0	7,0	8,0	**6,6**
Morgan Stanley	8,0	8,0	8,5	0,0	**6,1**
Goldman Sachs	8,0	8,0	8,0	0,0	**6,0**
JP Morgan	7,5	7,0	8,0	0,0	**5,6**
Avanza Bank	7,5	8,0	6,5	0,0	**5,5**
Citigroup	7,0	7,5	7,5	0,0	**5,5**
Formuepleje A/S Fondsmæglerselskab	7,5	7,0	6,0	0,0	**5,1**
Credit Suisse	4,5	7,0	8,0	0,0	**4,9**
Lehman Brothers	6,5	6,0	7,0	0,0	**4,9**
Terra Markets	6,5	7,5	5,5	0,0	**4,9**
ABN AMRO	4,5	7,0	7,5	0,0	**4,8**
Fearnley Securities	7,0	7,0	5,0	0,0	**4,8**
Mangold	8,0	7,5	3,5	0,0	**4,8**
Pohjola Pankki Oyj	6,5	6,0	6,0	0,0	**4,6**
Advizer	6,5	6,0	5,5	0,0	**4,5**
Eik Bank	6,5	5,5	6,0	0,0	**4,5**
Bofa Merrill Lynch	4,5	6,0	7,0	0,0	**4,4**
Capinordic Bank	7,5	7,0	3,0	0,0	**4,4**
Erik Penser Bankaktiebolag	7,5	7,0	3,0	0,0	**4,4**
G&W Fondkommission	7,5	7,0	3,0	0,0	**4,4**
HQ Bank	7,0	6,0	4,5	0,0	**4,4**
Merrill Lynch	4,5	5,5	7,5	0,0	**4,4**
Öhman Fondkommission	6,5	5,5	5,5	0,0	**4,4**
Redeye Corporate Finance	7,5	7,0	2,0	0,0	**4,1**
Hagströmer & Qviberg	6,5	5,5	4,0	0,0	**4,0**
Sedermera Fondkommission	7,5	7,0	1,5	0,0	**4,0**
Vastra Hamnen Corporate Finance	7,0	6,0	3,0	0,0	**4,0**
Kaupthing Bank	6,5	5,5	3,5	0,0	**3,9**
EVLI	6,5	5,5	3,0	0,0	**3,8**
Jefferies	4,5	4,0	6,5	0,0	**3,8**
Norne Securities	7,0	6,0	2,0	0,0	**3,8**
Calyon	4,5	4,0	6,0	0,0	**3,6**
Davis Polk	4,5	4,0	6,0	0,0	**3,6**
Kempen & Co	2,0	6,0	6,5	0,0	**3,6**
UB United Bankers	6,5	5,5	2,5	0,0	**3,6**
BNP Paribas	4,5	4,0	5,5	0,0	**3,5**
Glitnir	4,5	5,5	4,0	0,0	**3,5**
Gudme Raaschou Bankaktieselskab	6,5	5,5	2,0	0,0	**3,5**
FIM	6,5	5,5	1,5	0,0	**3,4**
UB Capital	6,5	5,5	1,5	0,0	**3,4**
Barclays	2,0	4,0	7,0	0,0	**3,3**
BMO Nesbitt Burns	2,0	4,0	7,0	0,0	**3,3**
Haywood Securities	4,5	4,0	4,5	0,0	**3,3**
Remium	6,5	5,5	1,0	0,0	**3,3**
Alexander Corporate Finance Oy	4,5	4,0	4,0	0,0	**3,1**
Credit Agricole CIB	2,0	4,0	6,5	0,0	**3,1**
Eminova Fondkommisson	6,5	5,5	0,5	0,0	**3,1**
Thenberg & Kinde Fondkommission AB	6,5	5,5	0,5	0,0	**3,1**
Danske Andelskassers Bank	4,5	4,0	3,5	0,0	**3,0**
ING Bank	2,0	5,5	4,5	0,0	**3,0**
Oko Corporate Finance	4,5	4,0	3,5	0,0	**3,0**
Opstock	2,0	4,0	6,0	0,0	**3,0**
Stockholm Corporate Finance	6,5	5,5	0,0	0,0	**3,0**
Catella Corporate Finance	4,5	4,0	3,0	0,0	**2,9**
CIBC World Markets	2,0	4,0	5,5	0,0	**2,9**
Noaura	2,0	4,0	5,5	0,0	**2,9**
A. G. Edwards	2,0	4,0	5,0	0,0	**2,8**
Alm. Brand Bank	4,5	4,0	2,5	0,0	**2,8**
Cazenove	2,0	4,0	5,0	0,0	**2,8**
Fortis Securities	2,0	4,0	5,0	0,0	**2,8**
Raymond James, Simmons & Company International	2,0	4,0	5,0	0,0	**2,8**
RS Platou	4,5	4,0	2,5	0,0	**2,8**
Guggenheim Securities	2,0	4,0	4,5	0,0	**2,6**
LLC	2,0	4,0	4,5	0,0	**2,6**
Needam & Company	2,0	4,0	4,5	0,0	**2,6**
Summa Capital	4,5	4,0	2,0	0,0	**2,6**
Vator Securities	4,5	4,0	2,0	0,0	**2,6**
Beringer Finance	4,5	4,0	1,5	0,0	**2,5**
E. Öhman J:or Fondkommission AB	4,5	4,0	1,5	0,0	**2,5**
EFG Bank	2,0	4,0	4,0	0,0	**2,5**
Føroya Banki	2,0	4,0	4,0	0,0	**2,5**
Singer Capital Markets	2,0	4,0	4,0	0,0	**2,5**
Sparebank 1 Midt-Norge	2,0	4,0	4,0	0,0	**2,5**
Translink Corporate Finance Oy	4,5	4,0	1,5	0,0	**2,5**
EgnsInvest Capital Fondsmæglerselskab	4,5	4,0	1,0	0,0	**2,4**
GP Børsmæglerselskab A/S	4,5	4,0	1,0	0,0	**2,4**
HSH Gudme	4,5	4,0	1,0	0,0	**2,4**
Berenberg Bank	4,5	4,0	0,5	0,0	**2,3**
Car	4,5	4,0	0,5	0,0	**2,3**
Orion Securities	4,5	4,0	0,5	0,0	**2,3**
Wildeco	4,5	4,0	0,5	0,0	**2,3**
Argo Securities	2,0	4,0	2,5	0,0	**2,1**
Fondsfinans	4,5	4,0	0,0	0,0	**2,1**
Merasco	4,5	4,0	0,0	0,0	**2,1**
Pecunia Capital Management	4,5	4,0	0,0	0,0	**2,1**
Sparebank 1 Nord-Norge Securities	2,0	4,0	2,5	0,0	**2,1**
Trend Kapitalpleje	4,5	4,0	0,0	0,0	**2,1**
Spar Nord	2,0	4,0	2,0	0,0	**2,0**
Netfonds	2,0	4,0	1,0	0,0	**1,8**
Macquarie Capital (Europe) Limited	2,0	4,0	0,5	0,0	**1,6**

Appendix 7 – IPO sample

Table 10.9 - IPO sample

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. The IPOs are sorted by the date of the IPO and if they are classified as NS, PE or VC

Nordic IPOs (2002 - 2015)

Company	Country	Classification	Date
Vicore Pharma Holding AB	Sweden	NS	10.12.2015
A City Media AB	Sweden	NS	02.12.2015
Evli Bank plc	Finland	NS	02.12.2015
Immunovia AB	Sweden	NS	01.12.2015
TC TECH Sweden AB	Sweden	NS	30.11.2015
Elite Varainhoito Oyj	Finland	NS	30.11.2015
Maxkompetens AB	Sweden	NS	23.11.2015
Photocat A/S	Sweden	NS	20.11.2015
Waystream Holding AB	Sweden	NS	12.11.2015
Skandiabanken ASA	Norway	NS	02.11.2015
Kid ASA	Norway	NS	02.11.2015
Capacent AB	Sweden	NS	02.10.2015
Bonasudden Holding AB	Sweden	NS	03.07.2015
Hugo Games A/S	Norway	NS	26.06.2015
Kontigo Care AB	Sweden	NS	23.06.2015
Pandox AB	Sweden	NS	18.06.2015
Prime Living AB	Sweden	NS	12.06.2015
Talenom Oyj	Finland	NS	11.06.2015
Collector AB	Sweden	NS	10.06.2015
Inission AB	Sweden	NS	10.06.2015
Vistin Pharma ASA	Norway	NS	10.06.2015
Magnolia Bostad AB	Sweden	NS	09.06.2015
Gaming Corps AB	Sweden	NS	04.06.2015
Corline Biomedical AB	Sweden	NS	03.06.2015
Multiconsult ASA	Norway	NS	22.05.2015
Robit plc	Finland	NS	21.05.2015
SpiffX AB	Sweden	NS	27.04.2015
Industrial Vision Systems - IVISYS AB	Sweden	NS	13.04.2015
Hoist Finance AB	Sweden	NS	25.03.2015
Evolution Gaming Group AB	Sweden	NS	20.03.2015
Piippo Oy	Finland	NS	10.03.2015
NNIT A/S	Denmark	NS	06.03.2015
Lexington Co AB	Sweden	NS	18.02.2015
Lifco AB	Sweden	NS	21.11.2014
Sprint Bioscience AB	Sweden	NS	07.11.2014
RAK Petroleum plc	Norway	NS	07.11.2014
Entra ASA	Norway	NS	17.10.2014
Granges AB	Sweden	NS	10.10.2014
Scatec Solar AS	Norway	NS	02.10.2014
Italeaf SpA	Sweden	NS	04.09.2014
DDM Holding AG	Sweden	NS	05.08.2014
Serendex Pharmaceuticals A/S	Norway	NS	11.07.2014
Havyard Group AS	Norway	NS	01.07.2014
Cxense AS	Norway	NS	01.07.2014
Bactiguard Holding AB	Sweden	NS	19.06.2014
Hanza Holding AB	Sweden	NS	19.06.2014
Besqab AB	Sweden	NS	12.06.2014
ScandiDos	Sweden	NS	11.04.2014
Scanship Holding ASA	Norway	NS	11.04.2014
D Carnegie & Co AB	Sweden	NS	09.04.2014

Vardia Insurance Group ASA	Norway	NS	08.04.2014
Recipharm AB	Sweden	NS	03.04.2014
Hemfosa Fastigheter AB	Sweden	NS	21.03.2014
Oscar Properties Holding AB	Sweden	NS	17.02.2014
Link Mobility Group ASA	Norway	NS	12.12.2013
Platzer Fastigheter AB	Sweden	NS	29.11.2013
Restamax Oyj	Finland	NS	28.11.2013
BW LPG Ltd	Norway	NS	21.11.2013
REC Solar ASA	Norway	NS	25.10.2013
Western Bulk ASA	Norway	NS	25.10.2013
Orava Asuntorahasto Oyj	Finland	NS	14.10.2013
Odfjell Drilling Ltd	Norway	NS	27.09.2013
Ocean Yield ASA	Norway	NS	05.07.2013
Vivoline Medical AB	Sweden	NS	15.05.2013
Immunicum AB	Sweden	NS	22.04.2013
Serodus ASA	Norway	NS	09.04.2013
Arc Aroma Pure AB	Sweden	NS	03.04.2013
EAM Solar ASA	Norway	NS	26.03.2013
Borregaard A/S	Norway	NS	18.10.2012
Selvaag Bolig ASA	Norway	NS	14.06.2012
Avtech Sweden AB	Sweden	NS	20.02.2012
Hofseth BioCare AS	Norway	NS	02.12.2011
Danske Andelskassers Bank A/S	Denmark	NS	07.07.2011
Hoegh LNG AS	Norway	NS	05.07.2011
Moberg Derma AB	Sweden	NS	26.05.2011
Sevan Drilling ASA	Norway	NS	03.05.2011
Karolinska Development AB	Sweden	NS	15.04.2011
Norway Royal Salmon ASA	Norway	NS	29.03.2011
Aker Drilling ASA	Norway	NS	25.02.2011
Gjensidige Forsikring ASA	Norway	NS	10.12.2010
Floatel International Ltd	Norway	NS	01.12.2010
Statoil Fuel & Retail ASA	Norway	NS	22.10.2010
Morpol ASA	Norway	NS	30.06.2010
Wilh Wilhelmsen ASA	Norway	NS	24.06.2010
Solvtrans Holding ASA	Norway	NS	30.03.2010
P/F Bakkafrost	Norway	NS	26.03.2010
Arise Windpower AB	Sweden	NS	24.03.2010
North Energy ASA	Norway	NS	05.02.2010
Cimber Sterling A/S	Denmark	NS	01.12.2009
Investea Sweden Properties A/S	Denmark	NS	15.12.2008
Prime Office A/S	Denmark	NS	10.07.2008
Bergen Group ASA	Norway	NS	30.06.2008
NunaMinerals A/S	Denmark	NS	25.06.2008
PCI Biotech AS	Norway	NS	18.06.2008
DGC One AB	Sweden	NS	16.06.2008
eWork Scandinavia AB	Sweden	NS	22.05.2008
EgnsInvest Ejd Tyskland A/S	Denmark	NS	16.04.2008
Cryptzone AB	Sweden	NS	04.02.2008
Hafslund Infratek ASA	Norway	NS	05.12.2007
East Capital Explorer AB	Sweden	NS	09.11.2007
KlimaInvest A/S	Denmark	NS	31.10.2007
Systemair AB	Sweden	NS	12.10.2007
Eik Banki	Denmark	NS	11.07.2007
Griffin IV Berlin AS	Denmark	NS	06.07.2007
EOS Russia	Sweden	NS	25.06.2007
Det norske oljeselskap ASA - DETNOR	Norway	NS	22.06.2007
Foroya Banki P/F	Denmark	NS	21.06.2007
Grieg Seafood ASA	Norway	NS	21.06.2007
DIBS A/S	Sweden	NS	18.06.2007
Aerocrine AB	Sweden	NS	15.06.2007

Euroinvestor.com A/S	Denmark	NS	14.06.2007
Nordic Tankers A/S	Denmark	NS	12.06.2007
SRV Group plc	Finland	NS	12.06.2007
RomReal Ltd	Norway	NS	11.06.2007
DK Trends Invest A/S	Denmark	NS	06.06.2007
Flex LNG	Norway	NS	19.04.2007
Suomen Terveystalo Oyj	Finland	NS	03.04.2007
Scandinavian Property Development ASA	Norway	NS	19.03.2007
SJR in Scandinavia AB - SJR	Sweden	NS	06.03.2007
Allmanna Svenska Telefoniaktiebolaget - AllTele	Sweden	NS	01.03.2007
Fred Olsen Production ASA	Norway	NS	22.02.2007
Sea Production Ltd	Norway	NS	16.02.2007
Scandinavian Private Equity A/S - SPEAS	Denmark	NS	12.02.2007
New Nordic Healthbrands AB	Sweden	NS	23.01.2007
Aker Exploration ASA	Norway	NS	29.12.2006
Comendo A/S	Denmark	NS	27.12.2006
PV Enterprise AB	Sweden	NS	19.12.2006
ChemoMetec A/S	Denmark	NS	18.12.2006
Tilgin AB	Sweden	NS	15.12.2006
Nordic Mines AB	Sweden	NS	15.12.2006
LinkMed AB	Sweden	NS	12.12.2006
FirstFarms A/S	Denmark	NS	12.12.2006
Spits ASA	Norway	NS	12.12.2006
Faktor Eiendom ASA	Norway	NS	08.12.2006
Gymgrossisten Nordic AB	Sweden	NS	07.12.2006
Rovsing A/S (pre-2012)	Denmark	NS	05.12.2006
Sparekassen Himmerland A/S	Denmark	NS	01.12.2006
Rezidor Hotel Group AB	Sweden	NS	28.11.2006
Mediaprovider Scandinavia AB	Sweden	NS	14.11.2006
Pertra AS	Norway	NS	10.11.2006
Eitzen Chemical ASA	Norway	NS	02.11.2006
Formuepleje Merkur A/S	Denmark	NS	27.10.2006
Codfarmers ASA	Norway	NS	19.10.2006
Mondo A/S	Denmark	NS	13.10.2006
SCF Technologies A/S	Denmark	NS	13.10.2006
Outokumpu Technology Oyj	Finland	NS	10.10.2006
Formuepleje Limittellus A/S	Denmark	NS	14.09.2006
Melker Schorling AB	Sweden	NS	05.09.2006
Varyag Resources AB	Sweden	NS	25.08.2006
Drillcon AB	Sweden	NS	07.08.2006
Teekay Petrojarl ASA	Norway	NS	30.06.2006
Petrominerales Ltd	Norway	NS	29.06.2006
Norwegian Property AS	Norway	NS	19.06.2006
Formuepleje Epikur A/S	Denmark	NS	09.06.2006
BW Offshore Ltd	Norway	NS	31.05.2006
Dios Fastigheter AB	Sweden	NS	22.05.2006
Dolphin Interconnect Solutions ASA	Norway	NS	20.04.2006
FIM Group Oyj	Finland	NS	13.04.2006
Formuepleje Safe A/S	Denmark	NS	12.04.2006
SeaBird Exploration Ltd	Norway	NS	11.04.2006
Ahlstrom Oyj	Finland	NS	17.03.2006
Block Watne ASA	Norway	NS	17.03.2006
cBrain A/S	Denmark	NS	22.02.2006
Hakon Invest AB	Sweden	NS	08.12.2005
NorGani Hotels ASA	Norway	NS	16.11.2005
Rygge-Vaaler Sparebank	Norway	NS	01.11.2005
Bergesen Worldwide Gas ASA	Norway	NS	25.10.2005
TrygVesta A/S	Denmark	NS	14.10.2005
Bluewater Insurance ASA	Norway	NS	13.10.2005
Hemtex AB	Sweden	NS	06.10.2005

Media & Research Group AS	Norway	NS	23.09.2005
Deep Sea Supply plc	Norway	NS	15.09.2005
Aker American Shipping ASA	Norway	NS	11.07.2005
Eidesvik Holding AS	Norway	NS	27.06.2005
Norway Energy & Marine Insurance	Norway	NS	07.06.2005
Allianse ASA	Norway	NS	25.05.2005
Havila Shipping ASA	Norway	NS	24.05.2005
Aker Seafoods ASA	Norway	NS	13.05.2005
Awilco Offshore ASA	Norway	NS	11.05.2005
Oslo Areal ASA	Norway	NS	03.05.2005
Neste Oil Oyj	Finland	NS	18.04.2005
Wilson ASA	Norway	NS	17.03.2005
Exploration Resources ASA	Norway	NS	09.03.2005
Petrojack ASA	Norway	NS	23.02.2005
Sevan Marine ASA	Norway	NS	13.12.2004
Kemira GrowHow Oyj	Finland	NS	14.10.2004
Odfjell Invest Ltd	Norway	NS	11.10.2004
Camillo Eitzen & Co ASA	Norway	NS	28.06.2004
Note AB	Sweden	NS	23.06.2004
Teco Coating Services ASA	Norway	NS	22.06.2004
Unibet Group plc	Sweden	NS	08.06.2004
Medi-Stim ASA	Norway	NS	28.05.2004
Aker Kvaerner ASA	Norway	NS	02.04.2004
Yara International ASA	Norway	NS	25.03.2004
Ei Invest Nordisk Retail	Denmark	NS	10.02.2004
Norwegian Air Shuttle (NAS) ASA	Norway	NS	18.12.2003
Gudme Raaschou Vision A/S	Denmark	NS	25.06.2003
Active Capital AB	Sweden	NS	05.09.2002
QPR Software Oyj	Finland	NS	08.03.2002
Consti Yhtiot Oy	Finland	PE	11.12.2015
Camurus AB	Sweden	PE	03.12.2015
Scandic Hotels Group AB	Sweden	PE	02.12.2015
Attendo AB	Sweden	PE	30.11.2015
Dometic Group AB	Sweden	PE	25.11.2015
Minesto AB	Sweden	PE	09.11.2015
Bravida Holding AB	Sweden	PE	16.10.2015
CLX Communications AB	Sweden	PE	08.10.2015
Kotipizza Group Oyj	Finland	PE	07.07.2015
Capio AB	Sweden	PE	30.06.2015
Europris AS	Norway	PE	19.06.2015
Nobina AB	Sweden	PE	18.06.2015
Nordax Group AB	Sweden	PE	17.06.2015
Alimak Group AB	Sweden	PE	17.06.2015
Coor Service Management Holding AB	Sweden	PE	16.06.2015
Hovding Sverige AB	Sweden	PE	16.06.2015
Nilorngruppen AB	Sweden	PE	12.06.2015
Pihlajalinna Oy	Finland	PE	04.06.2015
Troax Group AB	Sweden	PE	27.03.2015
Asiakastieto Group Oyj	Finland	PE	27.03.2015
Detection Technology Oy	Finland	PE	16.03.2015
OrganoClick AB	Sweden	PE	16.02.2015
Dustin Group AB	Sweden	PE	13.02.2015
Eltel AB	Sweden	PE	06.02.2015
RenoNorden AS	Norway	PE	16.12.2014
Thule Group AB	Sweden	PE	26.11.2014
XXL ASA	Norway	PE	03.10.2014
Inwido AB	Sweden	PE	26.09.2014
Scandi Standard AB	Sweden	PE	27.06.2014
Zalaris ASA	Norway	PE	20.06.2014
Com Hem Holding AB	Sweden	PE	17.06.2014

OW Bunker	Denmark	PE	28.03.2014
ISS A/S	Denmark	PE	13.03.2014
Bufab Holding AB	Sweden	PE	21.02.2014
Sanitec Corp	Sweden	PE	10.12.2013
Matas A/S	Denmark	PE	28.06.2013
MultiClient Geophysical ASA	Norway	PE	02.05.2013
FinnvedenBulten AB	Sweden	PE	20.05.2011
Pandora A/S	Denmark	PE	05.10.2010
MQ Holding AB	Sweden	PE	18.06.2010
Chr. Hansen Holding A/S	Denmark	PE	11.06.2010
Byggmax AB	Sweden	PE	02.06.2010
Bridge Energy AS	Norway	PE	21.05.2010
WeSC AB	Sweden	PE	19.05.2008
Duni AB	Sweden	PE	14.11.2007
HMS Industrial Networks AB	Sweden	PE	19.10.2007
Camposol SA	Norway	PE	15.10.2007
Pronova BioPharma ASA	Norway	PE	11.10.2007
Master Marine AS	Norway	PE	24.05.2007
Trigon Agri A/S	Denmark	PE	18.05.2007
Nederman Holding AB	Sweden	PE	16.05.2007
Electromagnetic GeoServices ASA	Norway	PE	30.03.2007
Lindab AB	Sweden	PE	01.12.2006
Remedial Offshore Ltd	Norway	PE	28.11.2006
BE Group AB	Sweden	PE	24.11.2006
AKVA Group ASA	Norway	PE	10.11.2006
Biovitrum AB	Sweden	PE	15.09.2006
Ability Group ASA - AGR	Norway	PE	03.07.2006
Renewable Energy Corp ASA	Norway	PE	09.05.2006
Gant Co AB	Sweden	PE	28.03.2006
Salcomp Oy	Finland	PE	13.03.2006
KappAhl AB	Sweden	PE	23.02.2006
Grenland Group ASA	Norway	PE	12.12.2005
ODIM ASA	Norway	PE	18.11.2005
TradeDoubler AB	Sweden	PE	08.11.2005
Cermaq ASA	Norway	PE	24.10.2005
Indutrade AB	Sweden	PE	05.10.2005
Consafe Offshore AB	Norway	PE	26.09.2005
Revus Energy AS	Norway	PE	27.06.2005
Kongsberg Automotive Holding ASA	Norway	PE	24.06.2005
VIA Travel Group ASA	Norway	PE	09.06.2005
Polimoon AS	Norway	PE	26.04.2005
Findexa AS	Norway	PE	25.05.2004
Oriflame Cosmetics SA	Sweden	PE	24.03.2004
Ballingslov International AB	Sweden	PE	19.06.2002
Nobia AB	Sweden	PE	19.06.2002
Intrum Justitia AB	Sweden	PE	07.06.2002
Alfa Laval AB	Sweden	PE	17.05.2002
Nuevolution AB	Sweden	VC	17.12.2015
Nilsson Special Vehicle AB	Sweden	VC	11.12.2015
Stillfront Group AB	Sweden	VC	08.12.2015
FIT Biotech Oy	Finland	VC	01.07.2015
SolTech Energy Sweden AB	Sweden	VC	25.06.2015
SciBase Holding AB	Sweden	VC	02.06.2015
Tobii AB	Sweden	VC	24.04.2015
Savo-Solar Oy	Finland	VC	02.04.2015
Cantargia AB	Sweden	VC	17.03.2015
Intuitive Aerial AB	Sweden	VC	13.01.2015
Nexstim Oyj	Finland	VC	14.11.2014
Heliospectra AB	Sweden	VC	18.06.2014
Herantis Pharma plc	Finland	VC	11.06.2014

Verkkokauppa.com Oy	Finland	VC	04.04.2014
Napatech A/S	Norway	VC	06.12.2013
Mindmancer AB	Sweden	VC	23.10.2013
Asetek A/S	Norway	VC	20.03.2013
Transmode Holding AB	Sweden	VC	27.05.2011
Zealand Pharma A/S	Denmark	VC	23.11.2010
CellCura ASA	Norway	VC	06.10.2010
Black Earth Farming Ltd	Sweden	VC	28.12.2007
Exiqon A/S	Denmark	VC	29.05.2007
Algeta ASA	Norway	VC	27.03.2007
Kontakt East Holding AB	Sweden	VC	27.11.2006
LifeCycle Pharma A/S	Denmark	VC	13.11.2006
Clavis Pharma ASA	Norway	VC	07.07.2006
Trolltech ASA	Norway	VC	05.07.2006
Curalogic A/S	Denmark	VC	08.06.2006
NorDiag ASA	Norway	VC	14.12.2005
Funcom NV	Norway	VC	13.12.2005
Orexo AB	Sweden	VC	09.11.2005
Powel ASA	Norway	VC	24.10.2005
Artumas Group Inc	Norway	VC	08.07.2005
TopoTarget AS	Denmark	VC	10.06.2005
AffectoGenimap Oyj	Finland	VC	27.05.2005
International Maritime Exchange ASA	Norway	VC	04.04.2005
APL ASA	Norway	VC	18.03.2005
Mamut ASA	Norway	VC	10.05.2004
CATCH Communication ASA	Norway	VC	29.03.2004
Opera Software ASA	Norway	VC	11.03.2004
NextGenTel Holding ASA	Norway	VC	19.12.2003
Q-Free ASA	Norway	VC	02.04.2002

Appendix 8 – Ownership Pre- and Post IPO

Table 10.10 shows the private equity and venture capital funds ownership before and after the IPO in the newly listed companies. The PE and VC funds have a median ownership stake of ~62% and 24% before the IPO, respectively. Thus, PE owns a larger proportion of their portfolio companies than VC. After the IPO, this pattern persists with PE and VC having median ownership of ~34% and ~16%, respectively. This lower ownership percentage is due to the dilution after raising capital, and because the PE and VC funds sell some of their shares in the IPO. However, these statistics show that the PE- and VC-funds does exit their investments totally during the IPO but sells some of their equity on the stock exchange.

Table 10.10 - PE and VC Ownership before and after the IPO

The total sample of 319 IPOs is comprised of 199 non-sponsored (NS), 78 private equity-backed (PE), and 42 venture capital-backed (VC) IPOs from January 2002 to December 2015 listed on the Norwegian, Swedish, Danish and Finnish stock exchanges. Panel A shows the median and average ownership percentage of the PE and VC funds before the IPO, while Panel B shows the median and average ownership percentage after the IPO

Median (%)		Average (%)	
PE	**VC**	**PE**	**VC**
Panel A. Before the IPO			
61.7	24.8	62.7	26.9
Panel B. After the IPO			
34.4	16.2	33.7	19.2

Appendix 9 – Abbreviations

A lot of abbreviations has been used in this thesis. Below is a list of these abbreviations and their definition

PE: Private Equity
BO: Buy-Out
HMA: High Market Activity
IPO: Initial Public Offering
LBO: Leverage Buy-Out
LMA: Low Market Activity
NS: Non-Sponsored
NYSE: New York Stock Exchange
OSE: Oslo Stock Exchange
RLBO: Reverse Leverage Buy-Out
VC: Venture Capital