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**The underpricing and the performance of Nordic private equity-backed
IPOs**

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Abstract

This study examines the pricing of initial public offerings (IPOs) and the long-term performance of the IPOs on the Nordic market. Therefore, the study focuses in particular on the impact of the ownership, the pricing and long-term performance of IPOs. There are a number of reasons for a company to go public, such as acquiring equity to finance growth, to create liquidity, or to realize all or part of the owners' current holdings. The last mentioned is a common reason for private equity (PE) companies to exit their portfolio companies. Private equity investment stands for a situation where a PE-company invests capital to the target company in return for a stake of the company. Private equity can be roughly divided into two parts. Buyout investors invest in a majority stake or buy an entire company, after which they begin to develop the company to make it more valuable, while minority investors invest in a minority stake to finance early stage growth and offer their own expertise to the growing the company and helping them to create contacts among the business world.

This study examines 236 new IPOs during 2005-2016, which have been divided into private equity-backed and non-sponsored companies at the time of listing. The reason why the Nordic market is currently a very interesting market is the significant increase of private equity investments in the recent years. For this reason, this study will increase the understanding of the Nordic IPO market and the impact of private equity investors on a company's pricing and long-term performance. The IPOs performance have been compared to the MSCI Nordic Index.

The results show that new IPOs are underpriced during the first trading day, which is consistent with IPOs in other similar developed markets. There are many reasons for underpricing, such as asymmetrical information, behavioral factors and attracting new investors. The results also show evidence of higher underpricing during hot periods compared to other periods. In the long-term, buyout-backed IPOs performed significantly better on average than other companies using the BHAR method and F-test. On the other hand, venture capitalist-backed IPOs are the only group which performed poorly, leading to significant underperformance in the long-term. Furthermore, buyout- and non-sponsored IPOs outperformed compared to the benchmark index in the long-term. Similar findings of buyout-backed IPOs' long-term success have been reported in previous studies and the same pattern applies in the Nordic level.

Key words: IPO, Private equity, venture capital, underpricing, long-term performance

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1. Introduction

Going public is one of the most important decisions a company can make during its life cycle. In short, this means that the company offers shares for the first time to other investors on the public stock exchange. There are many reasons why companies want to go public, such as raising equity capital from investors to grow their business or to expand to new markets, to create liquidity or to increase the investor base. For investors, especially institutional investors, the benefit of an initial public offering (IPO) is that they can build a sizeable position in a stock that can be expensive in the secondary market. In addition, IPOs are often subject to discounts, which make them attractive compared to listed peers and may lead to better returns. Listing is also a way for current owners who have invested in the early stages of the company to make a full or partial exit to repatriate their profits. (Espinasse 2014: 1; Helwege & Liang 2004.)

Early stage companies are usually in a need of financing in order to innovate new products or services. These companies are usually young and may not have a stable cash flow or needs financing for marketing purposes or for expansion into new markets. This can lead to difficulties in accessing financing alternatives, for instance loans or the owner's savings. The difficulties relate to, among other things, companies potentially high values, uncertainty, the quality of the companies' assets and the current status on the relevant market. (Basha & Walz 2001.)

The lack of stable cash flow, which can lead to difficulties in maintaining growth while meeting the financial institutions' fixed instalments are a challenge to owners wanting to expand their business further while the operating and financial costs are high. The solution is often to seek capital from the private equity industry. During the last decades, venture capital and private equity have become a growing source of company financing. This type of financing results in higher economic growth. Some of the world's fastest growing companies, including Amazon, Apple, Google and Facebook have all enjoyed

the benefits of venture capital in their early growth stages. (Demaria: 9; Gompers 2007: 483; NVCA 2015.)

The private equity (PE) industry has become a key player in the global financial markets over the last decades, especially in the early stages of financing growth companies and startups. The private equity industry plays a major role in the mergers and acquisitions (M&A) market, provides capital to companies and also serves an important role in publicizing companies through IPOs. (Cendrowski, Martin, Petro & Wadecki 2013: 3-5, 69-71.) In addition, the industry enjoys popularity, especially among young finance or operational excellence employees, making it possible for private equity companies to recruit top talents. Studying the impacts of the private equity industry is a current research topic, especially as interest rates today are at record low and investment funds are full of *dry powder* trying to seek potential investments.

The target for the private equity investors is simply to gain value and to gain high returns through the value creation and further the listing process. Private equity investors seek for companies where they see growth or turnaround potential and develop them during their hold period, trusting that they can sell the company with higher valuation in the divestment process. During the hold period, highly skilled private equity managers develop and optimize the portfolio company's operational processes, gives muscles to grow with the capital they provide and through experienced management drives the company with a new strategy towards the goals. The value creation is often called a *hands on* approach, which means that the owners are involved widely in the development and life of the portfolio company. (Jensen 1986; Levis 2011; Demaria 2013: 239-240.)

When market conditions are favorable for higher valuations, the number of IPOs also increases. The above-mentioned phenomena can be called as a hot IPO market when listing activity is high and the investor sentiment are more optimistic regarding the future performance and the underwriter's valuation of the company. The IPO cycles

come in waves when hot periods are taking place during times of bullish market and cold periods during times of bearish market. The timing of the listing is important to attract investors to attend in the listing to make it possible for the listing to be successful, especially for private equity investors to maintain good track record. Moreover, the current owners achieve significant returns for the first time as a result of developing the company for many years. Therefore, it is important to make the issue in times when owners are willing to divest the company for the valuation they would like to get. (Helwege & Liang 2004; Ibbotson & Jaffe 1975.)

The IPO market has been hot due to various new issues in the recent years, and the Nordic private equity market has achieved capital more than ever and the investment volumes for growth companies and startups are record high. Due to the low interest rates and the *dry powder* that big funds try to invest in order to achieve positive returns in challenging market conditions, this study is relevant for the time to understand the characteristics of an IPO and to examine the aftermarket performance of IPOs in the Nordic market.

1.1 Purpose of the study

The aim of the study is to determine whether IPOs sponsored by the private equity industry perform better than the non-sponsored companies, and how the new listed companies perform against the benchmark index. In addition, this study aims to explain reasons for IPO underpricing anomaly. Previous studies offer many different explanations for why IPOs are underpriced. This study examines Nordic IPOs during 2005-2016 and investigates whether there are underpricing between different market cycles and the performance of the new IPOs against the benchmark. Furthermore, this research provides information on underpricing and long-term performance between sponsor-backed and non-sponsored IPOs.

Most of the private equity-backed IPO studies are focusing on the US and UK markets, which are the main markets in the private equity industry. That makes it interesting to see how the Nordic markets behaves correspondingly. Moreover, the investment volumes in the Nordic countries have increased significantly in recent decades to support the growth of early stage companies. (Westerholm 2006; FVCA 2018a, 2018b.)

1.2 Hypotheses

The hypotheses have been formed based on the theory of the IPOs and the aftermarket performance. There are many theories trying to explain these phenomena's, but the current state is far from unanimous in all aspects. In this study, the hypotheses supported in previous studies are implemented into the Nordic markets in order to study whether the same characteristics holds. Hypotheses covers all aspects from IPO's first-day underpricing to long-term performance and the difference between the pre-listing ownership, which might be interesting for investors operating in the Nordic markets.

The first hypothesis relates to initial public offerings (IPOs) and a well-documented phenomenon of the first-day underpricing. Many theories are proposed to explain the phenomenon but the academical consensus is still rather mixed. (Ibbotson 1975; Ritter & Welch 2002.) The first hypothesis is presented as follows:

H_1 : New IPOs tend to be underpriced during the first trading day when companies going public.

The hot and cold market theory was presented at the first time by Ibbotson and Jaffe (1975). The hot market can be defined when IPO volumes are high, and IPOs are over subscribed. The other view relates to companies which tend to use over optimistic investor sentiment during the hot markets. Based on the above-mentioned hypothesis the second hypothesis is presented as follows:

H_2 : During the hot period, the first-day underpricing returns are higher in the Nordic markets.

The third hypothesis is based on the theory that the companies going public tend to underperform against the benchmark index in the long-term. Similar findings have been suggested by Ritter (1991), Loughran and Ritter (1995), Levis (2011) and Aggarwal and Rivoli (1990). Ritter (1991) suggest that investing into the IPOs and holding those for three years lead to negative returns compared to benchmarks. The third hypothesis is presented as follows:

H_3 : Companies going public in Nordics underperform against their listed benchmark in the long-term.

Superior performance of the buyout-backed IPOs against the other IPOs have been documented in past researches by Cao and Lerner (2009), Holthausen and Larcker (1996) and Levis (2011). The evidence is still rather mixed of the PE-backed and non-sponsored IPO's long-term performance. The fourth hypothesis is presented as follows:

H_4 : Buyout-backed IPOs experience better long-term performance than venture capital- and non-sponsored-backed IPOs.

Purnanandam & Swaminathan (2004) suggest that IPOs are more than 10% underpriced due to the fact overvaluation of the listing company compared to industry peer price multiples. The overvalued IPOs tend to have high first-day returns but low long-term performance. The fifth hypothesis can be presented as follows:

H_5 : First-day returns, and the long-term performance have a negative relationship in the Nordic market.

1.3 Motivation

The main reason for this thesis is to investigate the strong Nordic private equity market as well as the sophisticated Nordic stock markets, which gives a strong incentive for the private equity and venture capital companies to divest their portfolio companies through IPOs. The Nordic markets have been very favorable to private equity- and venture capital companies in recent years. Finnish Venture Capital Association (FVCA) identified investment volumes by comparing buyout- and venture capital investments between the different European countries in proportion to the respective country's GDP. (FVCA 2018a, 2018b.)

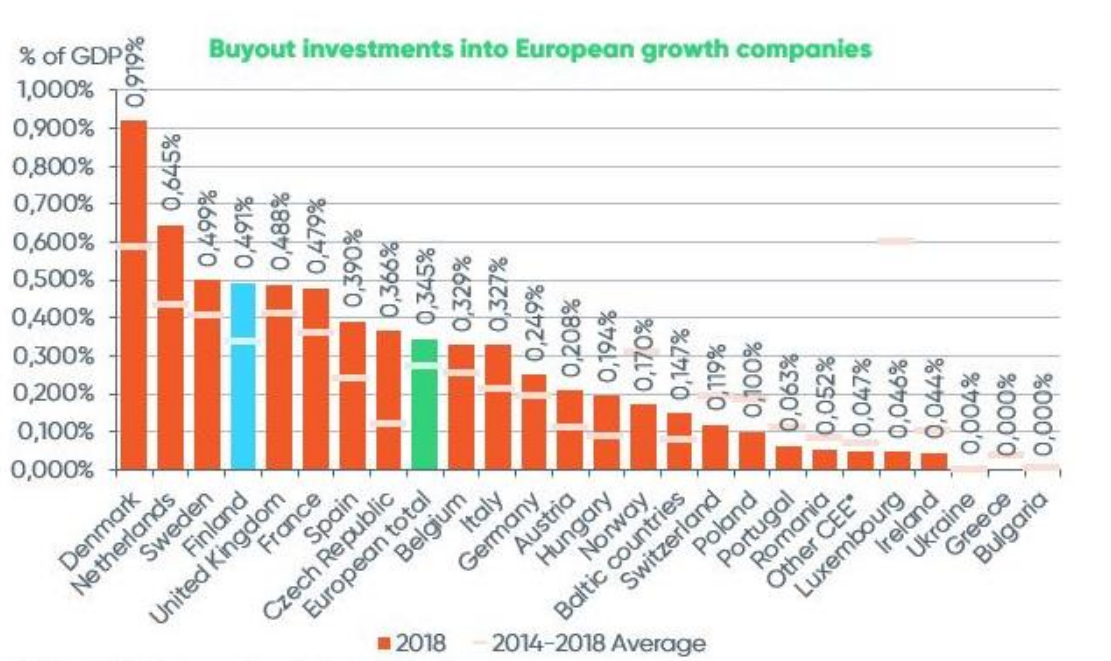


Figure 1. Buyout investments into European growth companies. Buyout can be described, when a private equity company has a majority ownership after the investment (FVCA 2018a).

Danish growth companies received on average the largest amount of buyout investments between the years 2014 and 2018. In view of the average European countries in 2018, Danish companies received three times as much buyout investments than average European countries. Other Nordic countries also attracted a large amount

of private equity financing, with Swedish companies receiving on average the third largest amount, followed by Finnish companies in the fourth place. The Norwegian companies, on the other hand, attracted lower private equity than the European average. The figure 1 can be summarized as the Nordic region has been very attractive for the buyout sector in recent years and no slowdown is visible. (FVCA 2018a.)

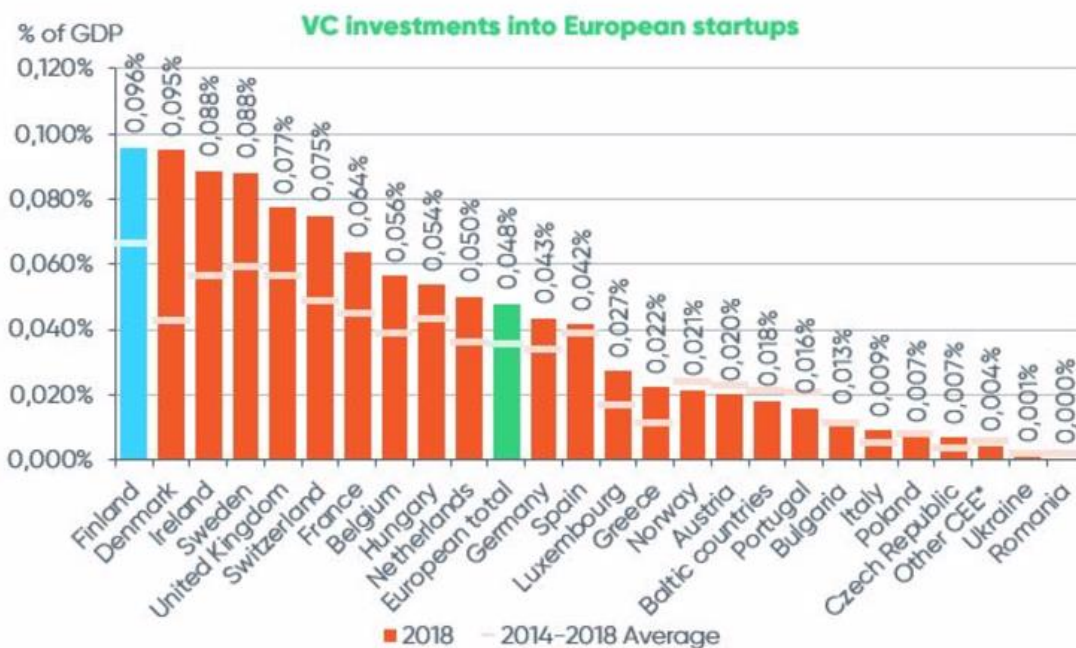


Figure 2. Venture capital investments into European startups (FVCA 2018b).

The above figure is showing the percent of venture capital investments of the country GDP between European countries during the years 2014 and 2018. In 2018, Finnish startups received on average the largest amount of venture capital financing. In view of the European average during this period, Finnish companies received twice as much venture capital funding compared to the European average. Companies in the other Nordic countries also attracted a large amount of venture capital investments, with Danish companies receiving the second largest amount of investments during 2018, followed by Swedish companies in the fourth place. The Norwegian companies, as in the previous buyout investments table, attracted lower venture capital than the European

average in 2018. The both figures show similar pattern that the companies in Nordic markets are attracting more capital when comparing to peers in other European countries. (FVCA 2018b.)

1.4 Structure of the study

This thesis has been divided into six main chapters to give comprehensive idea of the subject. This chapter presents the subject of the initial public offering and why private equity industry is a key player in this field. Also, the reason for this study to examine the Nordic market is presented under the motivation title in the first chapter. In the following chapter, the listing process and the basics of the initial public offerings will be presented. In addition, it will be explained why companies and their owners want to list their shares on the public exchange. In addition, concepts of private equity and venture capital are presented, due to it being important to understand why the private equity companies invest money to portfolio companies and take the risk of losing money. The third chapter present the previous studies and findings which are used as a reference for the results of this study. The fourth chapter explains the data, variables and the methodology used in this study for the empirical part. After that, the fifth chapter presents the empirical results of the research. In the final chapter, conclusions of the research are discussed and ideas for further research are provided as well as the limitations of the study.

2. Theoretical background of IPOs and private equity

The purpose of this chapter is to combine the main academic literature relating to why companies go public and the structure of private equity. In addition, the aim of this section is to give an understanding on the factors behind the IPOs underpricing. Furthermore, this section presents a brief explanation on private equity and venture capital structure, exit channels and the private equity value creation model.

2.1 Explanation of Initial public offering

Ritter and Welch (2002) defined initial public offerings as a situation in which a private company establishes itself in public trading by listing on a public stock exchange. There are many reasons why companies go public, for instance to raise equity capital or to convert shareholders' current wealth into cash (Ritter & Welch 2002). Going public is a big step for a company in their lifecycle and brings publicity over the company. IPO can be considered as a pricing method of the company and a way to create liquidity and acquiring equity capital. When companies are listed, there are requirements for transparency and disclosures for keeping investors informed. The listed company is accountable to a large group of investors who will vote with their feet, if the company does not perform as expected or the management make bad business decisions. For the investors, the initial public offering can be seen as an opportunity to become an owner of the company or with the purpose of trading the company's shares with the idea of making profit. (Ljunqvist 2007: 378; Espinasse 2014: 1.)

The IPO is the most important and prestigious divestment for a company, as it signals that the owners of the company have succeeded in their investments or development. In the private equity sector, every divestment is a major milestone for a company. For each successful investment, it proves easier for private and venture capital companies to attract investors and their capital and thereby establish new funds. In addition, the

current trend is to invest larger funds with an excellent track record of previous investments. (Cendrowski et al. 2013: 23-25, 69-83; Gompers 1996.)

2.2 IPO process

The IPO process includes many phases and require knowledge of the capital markets from the current owners as well as good communication between the management and the investment bank. The IPO process can vary a lot depending on the market environment, but as shown in figure 3, the estimate of the IPO timetable is set to last for approximately 6 to 9 months, providing everything goes smoothly. However, if the listed company is not well prepared (e.g. information-wise) or the market fluctuates a lot, the duration of the IPO can easily be much longer. (Espinasse 2014: 77-85.)

When the decision of going public has been done, the process starts with the due diligence work with various advisers, who compile all the financials and draft the agreements and the prospectus. The due diligence phase takes several months and is very detailed and requires a lot of resources from all parties included in the process. After the prospectus is almost finished, it will be sent to the market regulator or the stock exchange. After receiving approval of the prospectus, the marketing phase starts. First the management and investment bank present the investment case to the research analyst, who makes their initial reports. This is basically done to determine and secure the price range of the IPO. In addition, the management and the investment bank can take a pre-marketing tour to meet potential institutional investors to discuss the investment case. (Espinasse 2014: 77-78.)

After the initial offer price has been determinate, the actual roadshow starts, and the investment case is presented to all investors. The offering is often divided in two separate parts, the institutional offer and the public offer (in practice individuals). In addition, sometimes the personnel are offered a chance to participate in the offering, giving them a lower price in order to make the employees motivated and committed to

develop the company further. An IPO can be oversubscribed in situations where there are more interested investors than there are shares distributable. Correspondingly, an IPO can be undersubscribed in situations where the investment case is not getting enough interest among investors. If the offer price is way too high or the company prospects do not attract investors, the IPO process can be interrupted or put in hold to make amendments and come up with ways to make the investment more attractive to investors. When all the steps of the IPO process have been completed and the actual listing day comes, the company's shares are traded for the first time on the public market. The movement of the share price can be volatile during the first-days or even the first weeks, and the fluctuation can be stabilized by one of the participating banks in the weeks or months following the listing. (Espinasse 2014: 80-85.)

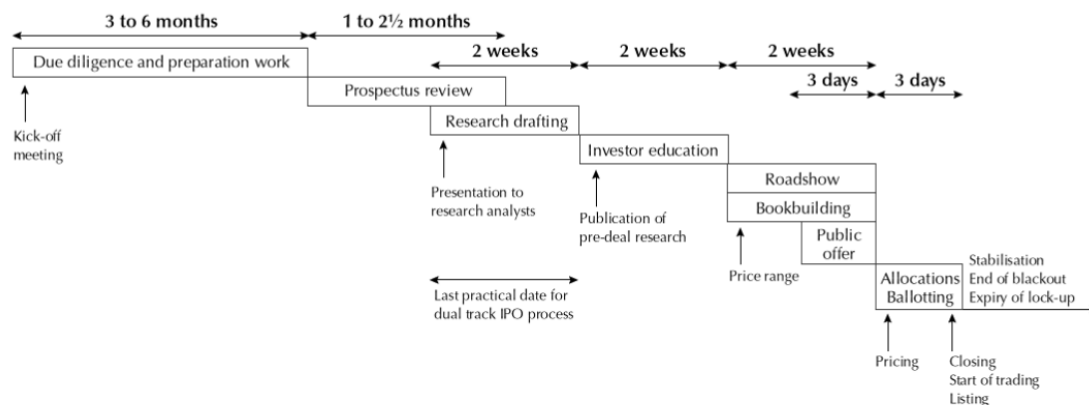


Figure 3. IPO timetable (Espinasse 2014: 85).

2.3 IPOs underpricing and performance

The general trend of underpricing new IPOs is a phenomenon which has been observed in many previous studies in different markets worldwide (Ritter & Welch 2002; Ibbotson 1975; Hopp & Dreher 2013; Tinic 1988). Loughran & Ritter (2002) states that when companies are going public, they tend to leave a lot of money on the table, resulting in the fact that the companies are not raising the maximal amount of equity possible. From

another perspective, new shareholders gain returns through underpriced IPOs (Loughran & Ritter 2002). Several explanations have been given for underpricing, however there is still no consensus on the explanation of this phenomena among scholars.

In general, the international evidence regarding IPOs points out remarkably large positive returns on the first-day of trading. On the other hand, the performance of post-IPO shows significant underperformance against benchmarks. IPOs characteristics, the sponsors behind the new listing, market overreaction or different types of information asymmetries are often reasons behind positive first-day returns. The long-term underperformance is related to times when firms go public and investors are overly optimistic about the market or the industry on which such firms are operating. (Levis 2011.)

The underpricing is calculated as a percentage of the price at which the shares were sold to the investors in the time of the IPO ("Offer Price") compared to the price the shares subsequently traded on the market. In well-developed capital markets, and without restrictions on price fluctuation from day to day, the underpricing appears fairly quickly. This is shown by the end of the first trading day at the latest, thus the most studies use the first-day closing price to calculate underpricing. In less developed markets or in situations where there are restrictions on the price fluctuations, the price stabilization may take longer. (Ljungqvist 2007: 381-383.) In this study, underpricing has been calculated as the change between the offer price and the first-day closing price, as Ljungqvist (2007) suggests.

2.3.1 Asymmetric information models

Asymmetric information refers to a situation where one of the parties holds more information than the others in a financial transaction. Many studies see this information asymmetry as one of the biggest drivers of IPO underpricing. Asymmetric information

can be found in two different stages, between the issuing firm and the investment bank that arranges the IPO ("Underwriter"), as well as between different investors. The later mentioned exists when some investors have more information than the others. (Katti & Phani 2016.)

Rock (1986) presents the Winner's Curse theory, which has proven to be the best-known asymmetric information model explaining the IPO underpricing. Rock assumes that some investors are better informed of the true value of the shares in the IPO than other investors, the underwriting bank or the issuing firm. Informed investors only take part in attractively priced IPOs, while the uninformed participate in all listings without having knowledge on which of the listing are particularly attractive. This puts the "winner's curse" on uninformed investors. In unattractive offerings, they get all the shares they bid for, while in attractive offerings their demand may be displaced by the informed investors. In the worst case, the uninformed investors get the full portion of the overpriced IPOs, leading to negative average returns, while informed investors gain high returns of the profitable IPOs. (Rock 1986.)

According to Baron's (1982) findings, the underwriter of the share issue has more information regarding the true value and demand of the company's shares than the owners of the company. The greater the uncertainty regarding the correct price and demand for a share, the greater the need for the owners to rely on the investment bank's pricing expertise. This results in the owners having to let the investment banks to set the listing price for the share. The underwriter has an incentive to price the share below the real price in order to reduce the marketing effort needed and to avoid the overpricing. Underpricing ensures that the investors will trade the share at the offering. The more uncertainty on the market regarding the true share price and the demand, the greater is the underpricing. The owners of the issuing company give the compensation to the underwriter for the information, marketing and arranging the listing. (Baron 1982.)

Baron's hypothesis has been criticized by Muscarella and Vestuypensin (1989), who tested the functionality of the Baron model in investment bank listings, where the investment bank also acts as an underwriter. Theoretically, underpricing should not occur in these IPOs because the investment bank itself sets its own IPO. However, the results suggested that the underpricing of investment banks' own IPO is in line with other IPOs, which contradicts to Baron's hypothesis. On the other hand, Ritter and Welch (2002) suggested that an investment bank might underestimate its own listing as a way to improve the corporate image of prospective clients. This is intended to give future clients the idea that underpricing is a mandatory cost of the IPO. (Muscarella & Vestuypensin 1989; Ritter & Welch 2002.)

2.3.2 Market-timing theories

Ibbotson and Jaffe (1975) define hot markets as a period in which the average monthly returns on a listed stock is abnormally high. The number of listings is also used as a measure in the context of a hot listing market. (Ibbotson & Jaffe 1975.) The supporting evidence was found by Loughran and Ritter (2004), who tested hot markets during the dot-com bubble and the following period of cold years. They found that during the hot period, underpricing was on average over 50% higher compared to the following cold period. The main reason behind is that investors tend to be overoptimistic and act irrational during hot periods. (Loughran and Ritter 2004.) The fear of missing out is an interesting behavior that tend to increase the first-day returns significantly during the hot periods. Ritter (1991) states that the volumes of the IPOs varies over time. The high-volume periods are associated with lower long-term performance, thus indicting that the issuer has timed the issue successfully and taken the advantage of the “window of opportunity”. (Ritter 1991.)

2.3.3 Other explanations

Tinic (1988) states that one of the institutional explanations for underpricing is to avoid a litigation. IPOs could be intentionally underpriced and the underpricing acts as an insurance for litigation. Lawsuits requires management time and resources and may incur potential high litigation costs for the listing company. In addition, the lawsuits will damage reputational image of the company or the investment bank involved in the IPO. Moreover, litigation may lead to higher capital costs and can have a detrimental effect on applying for financing in the future. (Tinic 1988.)

Hanley, Kumar & Seguin (1993) stated that one institutional explanation for the underpricing is the price stabilization provided by the investment bank. Price stabilization requires the commitment of the issuing investment bank to keep the stock price above the issue price by repurchasing shares as necessary (Hanley et al. 1993). Ljungqvist (2007: 405) state that the IPOs are priced to market value, but if the listings whose prices are expected to fall below the offer price, the price stabilization can be performed in after-market trading. The price stabilization eliminates the negative returns and lead to a positive price jump (Ljungqvist 2007: 405).

One of the behavioral factors explaining the underpricing is the investor sentiment. Emotional or non-rational investors can be considered to have a strong influence on the price of the share, especially in the case of IPOs, as there are no comprehensive historical data on the listing companies, and they are difficult to value (Ljungqvist 2007: 414). Cornelli, Goldreich & Ljungqvist (2006) found that pre-listing market sentiment is strongly positively correlated with first-day returns in the US. In particularly over-optimistic views of small-scale investors are pushing prices up after the IPO (Cornelli et al. 2006).

There are also studies that show the negative aspects of the IPO procedure. This has mainly to do with agent problems between the investment bank and the issuing company, for example, the investment bank rewards other investors by underpricing

IPOs, which means less profits for the issuer. Another example is when the bank gives underpriced allocations for example to company managers or certain institutions with the hope of winning future transaction mandates. (Ljungqvist 2007: 396-397.)

Dong, Michel and Pandes (2011) suggest that short- and long-term performance is also influenced by the reputation of the underwriter in the IPO. The reputation is especially influenced by the marketing capabilities of reputable underwriters and price stabilization measures. The results support that a good underwriter helps listing companies to perform better in the aftermarket. The reputation of the underwriter has an even greater impact on long-term performance than on short-term performance, based on the findings. (Dong et al. 2011.)

2.4 Explanation of private equity

When a company needs financing for growth or development, there are many different options to solve the need, but the most common options are stock exchange or bank loans, or in other words equity or debt. Moreover, the stock exchange is a limited solution, since it will only provide financing to medium- and large-sized companies that meet certain criteria. On the other hand, borrowing conditions for the debt financing are also strictly defined. Companies must guarantee their ability to pay back the debt to the bank on time, which means that they must demonstrate a certain existence, cash flow stability, healthy activity and also a limited indebtedness. If the financing need is not funded by the stock exchange or by the banks, the solution is usually the private equity. Private equity firms provide financing for the exchange of ownership of the target company. (Demaria 2013: 9.)

There are many definitions of private equity, although at the simplest level it can be explained as a medium to long-term equity investment that is not traded on the public stock exchange. The term “private equity” is used to refer to equity which is not listed and not regulated. (Demaria 2013: 9; Cendrowski et al. 2012: 4.)

Private equity and venture capital companies are also called as financial sponsors, which are investing capital into the portfolio companies. The difference between these two types of investments relate to the maturity of the target companies and the ownership percentage of the portfolio company. Venture capital refers to equity investments to non-public companies in their early stages in order to finance the early development. Due to early financing, venture capitalists mostly finance only a minority part or give the seed money without change of control of the company. On the contrary, BO-firms purchase all or most of a company shares during the transaction by using equity from a small group of investors combined with a huge amount of debt. This could also be called as a buyout investment (BO). The general belief that the private equity firms use mostly debt in acquisitions is partly wrong, as only buyout investments use debt as the main element to finance the acquisitions. (Kaplan & Strömberg 2009; Fraser-Sampson 2011: 7-10.)

According to Jensen (1986, 1989), the operational efficiencies are achieved by experienced management, increased leverage and better corporate governance, which can be consider as main value drivers in developing the portfolio company. In addition, high incentives to private equity company managers lead the portfolio company to efficiency and maximum profitability. It is often assumed that such characteristics will generally occur during the hold period, but it is also reasonable to assume that the management and financial practices adopted at that time will persist after the divestment process in listing. This is especially true because private equity companies are responsible for the structure, terms and timing of the listing. PE-companies mostly retain significant ownership after listing for notable period of time, although the ownership decreases in the IPO process. The reasons why PE-companies stay involved in the issued company are the lock-up agreements, performance incentives and liquidity considerations. This ongoing involvement of the private equity firms facilitates closer monitoring and reduces information asymmetry. This can lead to superior aftermarket performance. (Levis 2011; Jensen 1986, 1989.)

Similar findings were found by Kaplan and Stromberg (2009), who explained the term of buyout (BO) as a situation where a private equity company or a fund buys the majority ownership of the target company from the previous owners. After the transaction, the company will be included in the new owner's portfolio, leading to changes in the company and its management. The capital structure, management incentives and corporate governance will similarly go through changes. (Kaplan & Stromberg 2009.)

Private equity investments could be divided in two different types, capital invested in funds (fund investment) and capital invested in portfolio companies (direct investment). There is a clear line in the PE-industry between the companies who invest in funds and those who make the investments into companies. For instance, a pension fund seldom invests capital directly into the portfolio companies, although there are some exceptions. Instead, pension fund managers tend to focus on their fund investing activities to invest capital in private equity funds which act as designated managers between the pension fund and the portfolio company. Private equity funds, on the other hand, use capital to make direct investments into the portfolio companies. (Cendrowski et. al 2012: 5; Kaplan & Strombeg 2009; Fraser-Sampson: 3.) The structure of the PE fund is shown below.

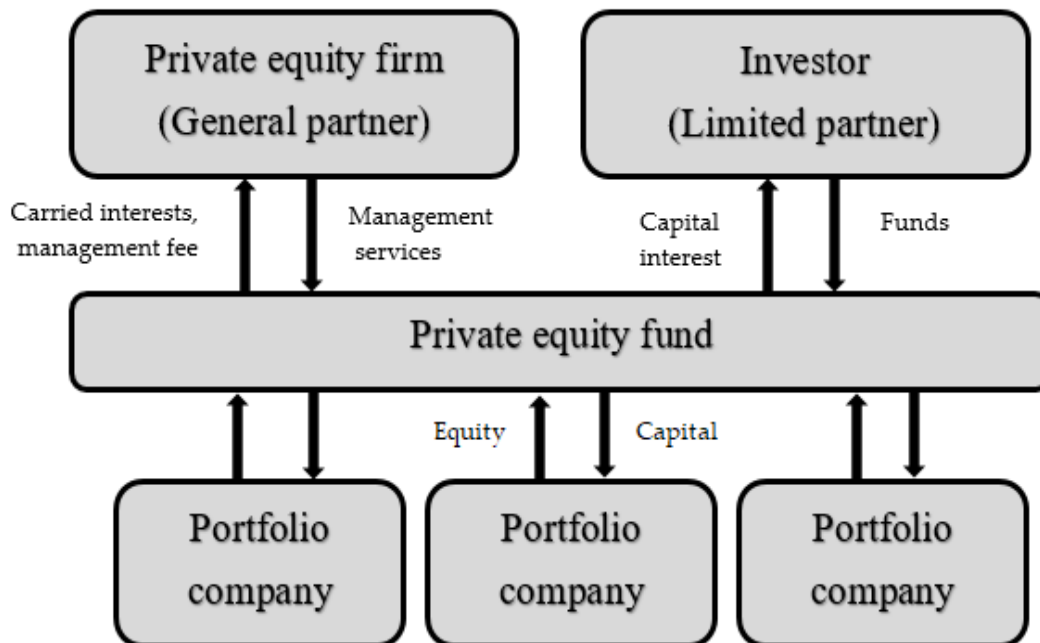


Figure 4. Private equity fund structure based on Stowell (2013: 319-321) and Kaplan & Strömberg (2009).

2.5 Private equity value creation

Private equity companies try to make profit with the investment. The bigger the profit, the more pleased are the owners. After the purchase, the private equity firm, or more precisely, the general partner, begins to increase the value of the company through operations, management as well as through allocating capital to the development. Guo, Hotchkiss and Song (2011) tested 192 LBOs during 1990 to 2006 and compared the sample to buyout issues which have completed in the 1980s. Guo et al. (2011) state that there are some significant changes in the type of more recent issues in terms of that the recent buyout issues are priced more conservatively than the companies in the 1980s and as well as leverage levels are significantly lower in recent transactions. In addition, Guo et al. (2011) found that, on average, the total value of companies increased after the buyout. This can be explained that the increase in value is due to the fact that

companies are selling of non-performing assets by maximizing the efficiency of the remaining assets, rising the value of a company (Guo et al. 2011). Several studies have explained that the value creation is based on the better operative performance, which is result of better corporate governance, reducing costs, using the capital more efficiently or making value-increasing acquisitions (Guo et al. 2011; Kaplan & Strömberg 2009; Cotter & Peck 2001; Jensen 1986, 1989).

Sørensen (2007) suggests that the more experienced venture capital companies are, the more likely they go public. There are two value creation mechanisms of venture capital companies, either through *influence* or through *sorting*. Sørensen (2007) means that the added value for a company is inherent in the reputation and experience of venture capital firms. Sorting can be defined as a situation where more experienced VCs are screening the market, leading to a situation where experienced VCs invest in better companies. Influence impact on the other hand can be defined as a situation where the venture capital firms' reputation can provide access to a broader market of clients, suppliers and better management than less experienced venture capital firms. More experienced venture capital firms are also better to monitor and control their portfolio companies. (Sørensen 2007.)

Hsu (2004) shows that the early stage companies would accept the offers of the most reputable venture capital firms at the expense of economically more attractive offers. This influence allows venture capital firms with more experience and reputation to have better companies in their portfolio. The high-reputation VCs acquire future portfolio companies at a 10-14% discount and are three times more likely to be accepted. (Hsu 2004).

2.6 Private equity exit strategies

The exit or divestment is the time during which the private equity company sells its stake of the initial investment or the portfolio company, fully or partially. The selling process

and the choice of the divestment strategy requires time and judgment in order to achieve maximum returns and incentives. Private equity companies have knowledge and professionals that tend to successfully exit companies at the right time, which in turn leads to high returns. The selling process can be difficult, since the investments are normally illiquid and cannot be sold as quickly and easily as the public equity via stock exchanges. (Povaly 2006.)

The private equity companies have the power to influence on major decisions in the portfolio companies as they usually hold the majority control. In addition, they often have the right to influence the divestment strategy to be used in the divestment of the portfolio company. After investors have invested capital to fund, the limited partners have no rights to say how the capital should deploy the capital. (Kaplan & Strömberg 2009.) The average holding period in the private equity industry varies between three to ten years. Venture capital funds will stay longer as owners than the buyout funds, due to early stage investments and start-ups which require more time to grow (XU 2004).

Gompers, Kovner, Lerner and Scharfstein (2008) identified three successful divestment types available to private equity and venture capital investments. The first exit strategy is a trade sale in which the portfolio company is sold to a strategic buyer, typically a competitor or a supplier, with the potential to achieve synergies, e.g. with similar products or technology. The second option is a secondary buyout, in which a portfolio company is sold to another PE firm. The third successful divestment option is to list the company to the public exchange through an IPO process. This is the only divestment type where the portfolio company will be publicly traded after the exit. (Gompers et al. 2008.)

Cumming & MacIntosh (2003) in turn add two different exit channels. Buyback is defined as a situation where the management or the entrepreneur buys the company back from the PE-firm. Last alternative is to write-off the initial investment, when the PE-company or the VC-fund decide that the investment has no significant upside in the future.

According to Cumming & MacIntosh (2003), write-off could be done fully or partially, even though they highlight that partial write-off often leads to poor quality remaining in the portfolio. (Cumming & MacIntosh 2003.)

Trade sales, buybacks and the secondary buyouts are full exits whereas IPOs are usually partial exits, at least for a while. PE-companies sell its ownership in stages due to lock-up agreements with underwriters, liquidity considerations and performance incentives. In addition, IPOs are not as common as trade sales, as the IPO process is costly and time consuming. (Levis 2011.)

Kaplan and Strömberg (2009) suggest that the most common exit channel is the trade sale to a strategic buyer. Kaplan and Strömberg (2009) studied 17,171 leveraged buyout transactions during 1970 to 2007. The trade sale exit occurs in 38 percent of all exits. The second most common exit route was a secondary buyout to another private equity firm. Initial public offerings, where private equity list the portfolio company was in third place by 14 percent of all exits. Moreover, Kaplan and Strömberg (2009) add that private equity firms are accused of preferring to “flip” their investment in short-term rather than maintaining the ownership for a longer period. The “flip” means that the private equity company takes the exit during the first 24 months. In their analysis, Kaplan and Strömberg (2009) saw no evidence of *flips*, instead they found that holding periods have increased. (Kaplan & Strömberg 2009.)

3. Evidence of previous literature of IPOs underpricing and post-IPO performance

This chapter presents relevant literature on the initial issue's underpricing and long-term performance as well as previous research on private equity-backed IPOs which will be the reference frame for this thesis. The chapter includes research from Europe and US and the rest of the world to provide a view on how different markets behave in terms of underpricing and long-term performance.

3.1 Previous literature of IPOs underpricing

Ibbotson (1975) was one of the first people to document the underpricing phenomenon. The results showed that average initial performance was positive by 11.4% leading to that the new issues are underpriced, although attending to the IPO there is an equal chance for gain or loss (Ibbotson 1975). Ljungqvist (2007: 378, 383) states that the underpricing before the 20th century was on average close to 20%, differing significantly over the decades and adds that during the hot periods, IPOs' underpricing were much higher. For instance, in 2000, the average underpricing was 57% in the US. Ibbotson, Sindelar and Ritter (1988) studied the IPOs' underpricing in the US during 1960-1987 and found the average underpricing to be 16.4%. The academic literature is unanimous on the fact that the new IPOs are underpriced, but the degree of underpricing depends on the timing and the market.

Loughran and Ritter (2002) state that the average IPO left 9.1 million dollars on the table, thus the pre-IPO owners are not collecting the maximal potential from the IPOs. The total value of the IPOs during 1990 to 1998 was amounting to 27 billion dollars. The returns that investors gain during the first-day comes from the company and pre-IPO owners pocket. (Loughran & Ritter 2002.)

Hopp and Dreher (2013) investigated 29 different markets during the period of 1988 to 2005 and found that the underpricing differs significantly in different markets and even on continents, depending on the market and country characteristics, especially on the legal aspect and protection of the investors. The lowest level of underpricing was found in New Zealand 6.1% and the highest from India, where it was 96.7%. An interesting finding is that in the Nordic countries underpricing is much more moderate compared to the other countries in the study. For instance, the underpricing in Finland is as low as 10.9%, in Denmark the corresponding figure is 9.6% and in Norway 10.1%, whereas in Sweden the percentage is 17.4%. This shows that underpricing is highly dependent on market characteristics, meaning that the underpricing on similar markets act in the same way. This reinforces the view that similar countries can be examined together, meaning that the Nordic countries for example can be considered as one market. (Hopp & Dreher 2013.)

Engelen and van Essen (2010) studied the impact of the country-specific characteristics, for instance the impact of legal and institutional framework. The data sample includes 2920 IPOs in 21 different countries. Engelen and van Essen (2010) suggest that the country-specific characteristics explain 10% of the variation in underpricing. The more developed the legal framework in the country, the more it reduces the underpricing. From this can be concluded that investors are more secured in these countries. (Engelen & van Essen 2010.)

Cao and Lerner (2009), found that the buyout-backed companies are bigger and more profitable, and the IPOs are arranged by more well-known investment banks. Cao and Lerner (2009) adds also that the buyout-backed IPOs were underpriced on average by 15.4% in the US market. Similar findings were found by Bergström et al. (2006), stating that the IPOs which are not backed by PE-companies tend to be more underpriced than the others. PE-backed IPOs were underpriced on average by 9.3% and non-sponsored by 12.9%. The study consists of IPOs from the London and Paris stock exchanges during the period of 1994 to 2004 (Bergström et al. 2006).

Meggison and Weiss (1991) found that the VC-backed IPOs tend to have significantly lower underpricing on the first day due to VC certification, which leads to reduced information asymmetry between the issuing company and the investors. In the study, the authors tested 320 VC-backed companies in the US market (Meggison & Weiss 1991). Similar findings to support lower first-day underpricing on VC-backed IPOs was found by Brav and Gompers (1997), suggesting that the reputation of the VC is overall enough to give the confidence to investors to take part of the IPO, leading to lower underpricing (Brav & Gompers 1997).

On the other hand, Francis and Hasan (2001) found that VC-backed IPOs are experiencing, on average, higher first-day returns than the non-venture-backed group. According to the results, VC-backed IPOs suffer premarket pricing inefficiency, leading to higher first-day returns as the offer price has not been at the correct level. (Francis & Hasan 2001.) Similar results were found by Lee and Wahal (2004), who found that VC-backed IPOs tend to have higher first-day returns than the other groups. Based on the results, the higher underpricing leads to larger future cashflows of capital into VC-funds. Thus, the positive relationship between underpricing and future fundraising exist, which is constant with the Gompers (1996) grandstanding hypothesis, that young VC-firms publish companies via IPOs earlier than older VC-firms, to secure future fundraising of the new funds. (Lee & Wahal 2004; Gompers 1996.)

Bessler and Siem (2012) found that the average underpricing between 1996 to 2010 was 8.4%. During the hot periods, the underpricing was up to 20% in the first wave during 1998 to 2000 and during the second hot market period between the 2006 to 2007 the underpricing was lower. The tested sample consist of over 500 VC-backed IPOs in the European market, including two IPO waves and the financial crisis. (Bessler & Siem 2012.)

3.2 Previous literature of IPOs performance

The first studies of long-term performance were made by Aggarwal and Rivoli (1990), when they examine one-year aftermarket performance using sample of 1,589 IPOs on the US market. They found that IPOs show negative performance of 13.7% compared to market performance. The negative performance can be explained by investors optimism or initial overestimation of IPO valuation (Aggarwal & Rivoli 1990). Similar findings observe by Ritter (1991) and Loughran and Ritter (1995) stating that the IPOs tend to underperform in the long-term compared to benchmarks. Investors need to invest 44% more when investing in issuing companies instead of non-issuers to achieve same wealth level after five years (Ritter 1991; Loughran & Ritter 1995). Ritter (1991) documents that investing in an IPO on the end of the first day and keeping it for 3 years, the value of the investment dropped by 17%. In addition, Ritter (1991) states that young companies and companies going public during the hot market tend to be even more underperformed in the long-term. Ritter (1991) mentions that one explanation for the long-term underperformance is that during high IPO volumes investor sentiment is high and investors are overoptimistic on the firm's outlook. (Ritter 1991.)

Levis (2011) documented evidence from the UK market when studying PE- (in this study buyout-backed) and VC-backed IPOs compared to non-sponsored IPOs. The result shows that PE-backed IPOs have superior performance compared to others. PE-backed IPOs achieve positive and significant returns in both equal- and value-weighted terms for the whole 36-month period in the aftermarket. The other groups VC- and non-sponsored-backed IPOs performed poorly. Levis (2011) suggests that the superior performance is due to fact that PE-backed IPOs have higher leverage ratios and the fact that PE-companies remain a proportion of the company after flotation, which increase the confidence of the investors. (Levis 2011.)

Bergström et al. (2006) suggest that PE-backed companies outperform to their non-sponsored counterparts in all time horizons. This is in line with the findings of Ritter (1991) and Loughran and Ritter (1995). In addition, Bergström et al. (2006) state that

IPOs issued during the high-volume period show the worst underperformance in the long-term. This is strong evidence on the view that issuers are using the windows of opportunity when they are considering the timing of the IPO. The authors added that many of the private equity investors use the IPO market as an alternative route to exit in BO and VC investments. (Bergström et al. 2006.)

Brav and Gompers (1997) studied the long-term performance of VC-backed and non-sponsored IPOs. The authors gathered a comprehensive data set, covering over 4000 new listings from 1972 to 1992 in the US market. Brav and Gompers (1997) found that VC-backed IPOs outperform compared to non-sponsored IPOs using the equal-weighted returns, on the other hand, the value-weighting reduces the performance differences. Brav and Gompers (1997) explain that the VC-backed companies do not significantly underperform, while the smallest non-sponsored companies experience significant underperforming. However, the underperforming is not an impact of the IPO, as the similar small companies perform poorly as well. The second explanation relates to investor sentiment as the institutional are more confident to invest VC-backed IPOs, since they have more information through their investment in VC-funds. (Brav & Gompers 1997.)

Krishnan, Ivanov, Masulis and Singh (2011), studied the VCs involvement to the long-term performance. The results explain that the VC's reputation has a significant impact on the long-term performance. Reputable VCs select better companies in terms of quality and the VCs are taking more active role in the corporate governance in post-IPO period. This post-IPO involvement leads to better aftermarket performance. (Krishnan et al. 2011).

Katz (2009) explains how the ownership structures impact to the aftermarket performance and earnings quality. Katz (2009) findings show that PE-backed companies have higher earnings quality than those without the PE-sponsor, that they engage less in earnings management, and report more conservatively both before and after the IPO.

Moreover, PE-backed companies that are majority-owned (in this study buyout-backed) exhibit superior performance in the aftermarket compared to others. The results show that the professional ownership, closer monitoring and reputation of the sponsor lead to better aftermarket performance. (Katz 2009.)

Purnanandam and Swaminathan (2004) tested more than 2000 IPOs and found that the offer price of the median IPO was significantly overvalued based on the industry multiples. This overvaluation varies from 14% to 50%, depending on the matching criteria. The results show that overvalued IPOs provide high first-day returns and low long-term returns. Purnanandam and Swaminathan (2004) explain this with the fact that the overvalued companies have higher growth forecasts and lower profitability and that the investors are more focused to the first mentioned. (Purnanandam & Swaminathan 2004.) Similar finding was found by Lewis (2011), who states that a negative relationship exists between high first-day returns and long-term IPO performance leading to underperformance in the long-term, although the relationship between BO-backed IPOs and the long-term performance is positive (Lewis 2011).

4. Data and methodology

This paragraph explains the details on how the sample data have been formed using different data sources. In addition, the methodological choices are presented in this chapter. The focus on this research is to study underpricing of the IPOs, examine the long-term performance of new IPOs and compare the performance differences between buyout-, venture- and non-sponsored-backed IPOs. The sample consists of Nordic IPOs, including new initial issues in Sweden, Norway, Denmark and Finland. The reason for selecting the Nordic region is the lack of research in the region and the increased importance of Nordic private equity market.

4.1 Sample identification

The Nordic IPOs have been searched from SDC Platinum's New Issue Database, which has also been used to collect ownership type, regardless of whether the IPO is buyout-, venture- or non-sponsored-backed. In previous studies, researchers have recommended to review data and cross-check the information from other online databases and possible alternative sources. Due to limited access to other online databases, the IPO type cross-check has been carried out through IPO prospectuses, public announcements of BO- and VC-firms' and other information provided by local exchanges and associations. The classification has been a time-consuming process that has taken more time than expected in order to build a comprehensive data set. Without access to several databases that provide data on M&A transactions and without receiving information directly from PE- and VC-firms, the data used have been checked manually, trusting that the available data is correct. After checking the whole sample, the original data set were almost correct. The changes mainly concerned the type of the sponsor, regardless of whether the sponsor backing was either a buyout- or venture capital firm. Moreover, the quality of the data was initially good enough and cross-checking made it even more accurate.

As mentioned previously, the identification of PE- and VC-backed IPOs was challenging due to limited information publicly available from private companies, especially regarding the early part of the sample. The similarity of the sponsors in the Nordic market in order to ensure the correct sponsoring type has also been a challenge during the identification process. The IPO sponsoring data provided by the Finnish Venture Capital Association (FVCA) has helped a lot to confirm the ownership type of IPOs that have been sponsored prior to the listing. In addition, detailed information on IPOs in Finland, Sweden and Denmark has been provided by NASDAQ. The result is a unique, hand-made data set, with a large number of sponsored and non-sponsored IPOs in the Nordic market over a large period of time, reaching from 2005 to mid-2016. The extensive timeframe used in this study makes it possible to examine the effects and the performance of IPO underpricing under different market conditions. The unique data set consist of 236 IPOs in the Nordic market during 2005 to 2016.

4.2 Descriptive data

The Thomson Reuter database provides historical stock market data for Nordic-based companies and it has been used in this study to compare the stock performance of the sample IPOs. The daily share prices of all sampled companies after the listing are gathered for 36 months. In addition, Thomson Reuters has been utilized by combining the company specific numbers of net sales and EBITDA margins, the total assets and total debts and the net operating assets and market values on an annual basis.

Table 1 presents the IPO volumes per country for a time period of 2005 to 2016. The financial crisis of 2008 led to a collapse of the new IPOs, which took several years before the market picked up in 2010, until the euro crisis in 2012 stopped new issues for a year. As can be seen from the below table, in Sweden almost half of all IPOs have been issued. Sweden can be considered to be the most advanced Nordic country in terms of private equity players and the activity in the M&A market, but the other countries are catching up quickly. This is partly explained by the fact that Sweden is the largest country in the

Nordic region in terms of GDP, population and number of companies. Finland's strength lies in the success of engineering and technology, which is reflected by the fact that most high-tech companies and IPOs are made in the Finnish market. Norway on the other hand, is well known for the health tech clusters. (Argentum 2018.)

Table 1. IPO volumes per country.

IPO Volumes					
Year	Denmark	Finland	Norway	Sweden	ALL
2005	2	2	12	5	21
2006	4	3	12	10	29
2007	5	1	16	13	35
2008	0	0	4	3	7
2009	1	0	0	0	1
2010	3	0	7	7	17
2011	1	0	4	7	12
2012	0	1	2	0	3
2013	1	2	8	1	12
2014	1	6	11	16	34
2015	1	11	6	32	50
2016	2	3	1	9	15
Total	21	29	83	103	236

2016 includes only 5 months.

When the listing time comes, the private equity sector is trying to make the issues during times when the markets are more optimistic and investor sentiment is high. A dramatic change can also be seen when comparing volumes before and after the financial crisis. The private equity sector has gained more capital during the past decade, which has also led to more exits. IPOs performed by the PE-industry are higher over the last three years than in the overall period. This can be seen from the below table 2.

Table 2. IPO volumes by ownership group. (2016 includes only 5 months)

Year	IPO Volumes				
	NS	PEALL	BO	VC	ALL
2005	10	11	5	6	21
2006	19	10	5	5	29
2007	24	11	4	7	35
2008	7	0	0	0	7
2009	1	0	0	0	1
2010	8	9	6	3	17
2011	9	3	2	1	12
2012	3	0	0	0	3
2013	9	3	1	2	12
2014	22	12	8	4	34
2015	22	28	21	7	50
2016	10	5	4	1	15
Total	144	92	56	36	236

2016 includes only 5 months.

Table 3 presents data on the company specific key figures. As shown in the table, buyout-backed companies are larger in terms of market value and total assets. When comparing the market values of companies, BO-backed companies are more than three times bigger than the VC-backed and even more when comparing to non-sponsored. BO-backed companies are not only larger in terms of size, but also in other operational figures.

BO-backed companies are also using more debt and have higher leverage than other groups. The total amount of debt is also ten times higher than the amounts in other groups. In terms of sales, BO-backed companies are significantly higher comparing to others. Sales figures are more than ten times higher than those without sponsorship or VC-backed. Thus, BO-backed companies are more mature and remarkably larger. BO-backed companies are also more effective in terms of asset turnover when comparing ratios in the table 3.

Table 3. Summary statistics of each IPO group used in this study.

Indicator	Measure	NS (144)	PEALL (92)	BO (56)	VC (36)
Market Value (MEUR)	Median	92.6	199.9	377.4	106.8
Net Sales (MEUR)	Median	39.6	133.1	421.7	29.1
Total Debts (MEUR)	Median	9.4	41.6	121.6	2.1
Total Assets (MEUR)	Median	87.1	171.5	332.1	58.2
Asset Turnover	Median	0.5	0.8	1.1	0.5
EBITDA (MEUR)	Median	6.1	19.3	38.1	3.1
EBITDA%	Median	12	10	10	7
Leverage%	Median	19	24	29	6

Table 4 shows the industries of the companies in the sample data. The data for the industry information has been retrieved from the Thomson Reuters database. As can be seen from the table, VC-backed IPOs dominate in the High Technology and Healthcare industries. PE backed companies on the other hand are concentrating more on Industrials and Retail industries. Moreover, non-sponsored IPOs appears more in traditional industries, such as in Financing and Real Estate. According to IPO volumes, the top three industries are Industrials, High Technology and Healthcare.

Table 4. Industry distribution of IPOs (as a percentage of IPO volume).

Industry	NS	PEALL	BO	VC	ALL
Consumer Products and Services	11.3	17.4	19.5	14.7	13.2
Energy and Power	10.6	8	4.9	11.8	9.8
Financial	11.3	4	4.9	2.9	8.9
Healthcare	13.1	17.3	9.8	26.5	14.5
High Technology	16.3	14.7	4.9	26.5	15.7
Industrials	17.5	18.7	29.3	5.9	17.9
Materials	1.9	0	0	0	1.3
Media and Entertainment	0.6	4	4.9	2.9	1.7
Real Estate	10.6	1.3	0	2.9	7.7
Retail	3.8	13.3	19.5	5.9	6.8
Telecommunications	3.1	1.3	2.4	0	2.6
Total	100	100	100	100	100

Moving into table 5, underpricing has been stable before the financial crisis, ranging from 3.5% to 5.4% with very little movement. The low volume is due to the financial crisis and the IPO market collision. The cold period after the financial crisis shows very low underpricing, even overpricing. The euro crisis in 2012 stopped the IPO market for a year but recovered quickly. Since 2013, the IPO volumes have grown steadily as well as underpricing, which can be explained by the hot market phenomena. The annual underpricing reached almost 15% in 2016, which is three times higher than before the financial crisis. The favorable IPO market has continued for years after the mid-2016, which is the end of the sample period used in this study. The results can be seen from the below table.

Table 5. Annual levels of underpricing between 2005 to mid-2016.

Year	Underpricing	Amount of IPOs
2005	4.18 %	21
2006	3.54 %	29
2007	3.53 %	35
2008	5.37 %	7
2009	-11.76 %	1
2010	-2.32 %	17
2011	2.10 %	12
2012	1.19 %	3
2013	-0.61 %	12
2014	2.61 %	34
2015	9.91 %	50
2016	14.75 %	15

2016 includes only 5 months.

4.3 The variables of the empirical study

The main focus is to study the impacts of the private equity industry involvement on the pricing of the initial issues and the long-term performance. In this study, to test the long-term performance using the buy-and-hold abnormal return (BHAR) method and OLS regression models to identify the impacts of the pre-IPO ownership. In addition, F-test has been used to compare the long-term performance between the groups. The returns are calculated by using the daily prices of each issue. The returns are compared to the MSCI Nordic index, which have been used as a benchmark. The variables of this study are presented in the next section, followed by a brief overview of the other variables used in the empirical study.

4.3.1 Measurement of the underpricing

The classic format of the IPO underpricing is usually defined in previous studies as initial return. In this study, the initial return is defined in the same way as Ljungqvist (2007: 381), where the initial return is the closing price after the first trading day subtracted and divided by the IPO's offer price. The initial return indicates as a percentage of how much the share price will rise or drop during the first trading day. The formula of underpricing can be presented as follows:

$$(1) \quad \text{Underpricing \%} = \frac{(P_{\text{first day closing price}} - P_{\text{offer price}})}{P_{\text{offer price}}}$$

where the underpricing is the first day closing price subtracted and divided by the offer price of the IPO. If the offer price is low and the closing price of the first day is much higher, the pre-IPO owners of the company have left "money on the table". The amount of the money, which is not collected at the offering, is twice as much as fees to investment banks to arrange the IPO. (Ljungqvist 2007: 381; Loughran & Ritter 2002).

In the previous studies of the IPO underpricing, only a few authors have used the adjusted returns. Most authors state that the adjustment is unnecessary, as the daily return of the market is typically much smaller than the average initial return of an IPO (Schöber 2007).

4.3.2 Measurement of the share performance

The second purpose of this research is to examine the share performance in short-, medium- and long-term return within different groups of IPOs. The buy-and-hold abnormal return method (BHAR) is used to measure the aftermarket risk-adjusted performance and the abnormal returns. The method is used to compare the return over a certain period of time against the benchmark index as a reference point. Previous studies by Ritter (1991), Loughran & Ritter (1995) and Lewis (2011), have identified a negative long-term BHAR return for companies that recently made an initial issue. BHAR has been calculated separately for each new issue. The dependent variable implies how a stock has been performed against the benchmark index, such as the MSCI Nordic index in this case.

As an alternative approach, the F-test and OLS regression have been used to test the results in aftermarket performance and as well as to ensure the robustness of results. The dependent variable is the BHAR for the 36-month period.

Previous researchers have not agreed on the best method to calculate the abnormal return of a share. In some studies, cumulative abnormal return (CAR) has been used as a measure for the aftermarket performance (Ritter 1991). Kothari and Warner (2007) state that there is no clear winner for the best method used, since all methods have low power to test economically interesting hypotheses and are not immune to misspecification (Kothari & Warner 2007). However, in the latest studies, BHAR has been the approach to measure the abnormal return. Equation 1 below presents the calculation process of buy-and-hold abnormal returns for each IPO in the sample:

$$(2) \quad BHAR = \frac{1}{N} \sum_{i=0}^n [(\prod_{t=1}^T (1 + r_{it})) - (\prod_{t=1}^T (1 + r_{bt}))]$$

where the r_{it} equals to raw return of each IPO and r_{bt} in turn equals to the raw market return of the selected benchmark at the event month t . To test the hypothesis, t-test is used to measure if the BHAR's average is equal to zero. To reject the null hypothesis, t-test should show that means are different from zero (Levis 2011). Lyon, Barber and Tsai (1999) suggest that when using the buy-and-hold approach, the results are biased due to skewness. To eliminate the bias, they suggest using the bootstrapped skewness-adjusted t-statistic, thus the method is applied also in this study. (Lyon et al. 1999.) The more advanced t-test based on Lyon et al. (1999) is shown below as:

$$(3) \quad t_{sa} = \sqrt{n} \left(S + \frac{1}{3} \hat{\gamma} S^2 + \frac{1}{6n} \hat{\gamma} \right),$$

where

$$(4) \quad S = \frac{\overline{AR_t}}{\sigma(AR_t)}, \text{ and } \hat{\gamma} = \frac{\sum_{i=1}^n (AR_{it} - \overline{AR_t})^3}{n\sigma(AR_t)^3},$$

where AR_{it} is the buy-and-hold abnormal return for IPO i at the event month t , $\overline{AR_t}$ is the sample mean and $\sigma(AR_t)$ the sample standard deviation of abnormal returns (Lyon et al. 1999).

4.3.3 Private equity variables

There is a lot of challenges in identifying different types of private equity-backed IPOs. The classification of the ownership status at the time of the IPO has been retrieved from the SDC Platinum database, and the information has been confirmed from the IPO prospectus and with company specific information provided by NASDAQ and FVCA.

There is no database where the identifications of the private equity-backed IPOs can be done reliably and easily, meaning that each IPO must be confirmed manually, which is a time-consuming process. The private equity companies have overlapping nature in the Nordics market, but the split between the buyout and the venture capital is based on the shareholding and the type of the private equity company. More work has been done to confirm the type of the IPO in the older issues in the sample, since the prospectus and the news or information have been removed from the company pages, especially if the company has gone bankrupt or has been involved in corporate reorganisations. The categorizing method has been performed based on the Schöber (2007) methodology.

BO is a dummy variable equal to 1 if the company has a private equity owner with majority ownership. VC in the other hand refers to venture capital or the business angel's ownership with a minority stake of the company. The VC-dummy variable uses the same logic as the BO dummy variable. The combined dummy PEALL is defined if the issuing company have a private equity company as an owner. If the IPO is backed by a venture capital or a buyout the variable equals to 1, otherwise to 0. The combined dummy has been built to study the whole private equity industry impact for the long-term performance.

4.3.4 Other variables

The first-day return variable explains the relationship between underpricing of the first trading day and the long-term performance. Purnanandam and Swaminathan (2004) reported that IPOs which are experiencing high first-day returns achieve lower returns in the long-term. The most overvalued IPOs tend to achieve the highest first-day returns instead of the most undervalued IPOs. Therefore, in the long-term, IPOs which have high first-day returns revert to fair value, leading to underperformance. (Purnanandam and Swaminathan 2004.)

The role of leverage as an IPO performance driver has been investigated in previous studies, but the evidence of the relation is rather mixed. According to Levis (2011), there is a positive relationship between leverage and long-term performance in PE-backed IPOs as one the main driver to achieve better performance than other groups. As previously mentioned, the findings are rather mixed with the impact of leverage. In contrast, Cao and Lerner (2009) found a negative relationship between the leverage and the IPO performance, although the results were statistically insignificant. To understand the impact of leverage as a driver of the IPO long-term performance, Gomes and Schmid (2010) suggest that the impact of leverage and stock performance is more complex and depend on how the debt has been used in the company (Gomes & Schmid 2010).

The natural logarithm of total assets has been used to measure the company size. The total assets have been calculated by the number of shares multiplied with the share price at the time of issue. Bergström et al. (2006) and Brav, Geczy and Gompers (2000) found that larger companies tend to outperform in the long-term compared to smaller companies with low book-to-market ratios. Private equity-backed companies are, on average, larger than the non-sponsored peer companies according to previous findings as well as the companies included in this study. (Bergström et al. 2006; Brav et al. 2000.)

Moreover, the variables explaining operating performance have included in this study to test whether there are impacts of operational characteristics for the long-term performance. The variables included are asset turnover and EBITDA margin, which explain how well the company can use the assets to create revenue and how profitable the company is.

Hot and cold market dummy variables are showing the fluctuations in different market cycles. Ibbotson and Jaffe (1975) and Ritter (1984) show that in the hot IPO markets, volumes of new issues are high, and the issues are oversubscribed constantly. During a hot market, underpricing is powerful and the returns are higher than normal after a few

months of the IPO. Thus, the underpricing is higher during the hot markets than during cold markets. (Ibbotson & Jaffe 1975; Ritter 1984.)

4.4 Regression models

The regression models have been built after the IPO identification process to test the aftermarket performance in the long-term and the robustness of the results. The models are tested against dependent variable, which consist of the long-term performance measure of the initial issues. The idea is to first divide IPOs into two separate groups of private equity-backed and non-sponsored IPOs by using a dummy variable. After the first categorization, private equity-backed IPOs have been divided to BO and VC groups based on the ownership type. In order to test whether there are any differences in timing of the IPO, hot and cold market dummies are used to capture the effect. Several regressions have been built to find which variables explain the results.

Regression models use the BHAR in 36 months period as the dependent variable. The regressions can be seen below.

$$(5) \quad \begin{aligned} BHAR\ 36 = & \text{Intercept} + \beta_1 \text{First day return} + \\ & \beta_2 \log(\text{Total asset}) + \beta_3 PEALL + \beta_4 \text{Hot market} + \\ & \beta_5 \text{Cold market} \end{aligned}$$

$$(6) \quad \begin{aligned} BHAR\ 36 = & \text{Intercept} + \beta_1 \text{First day return} + \\ & \beta_2 \log(\text{Total asset}) + \beta_3 \text{Asset turnover} + \beta_4 \text{EBITDA\%} + \\ & \beta_5 \text{Leverage} + \beta_6 PEALL + \beta_7 \text{Hot market} + \beta_8 \text{Cold market} \end{aligned}$$

In the regression models (3) and (4), sponsored IPOs have been divided to BO- or VC-backed groups using dummy variables, reflecting the type of the private equity. As mentioned earlier, there are significant differences in investment strategies between

buyout and venture capital investments. Otherwise, the regression follows the same pattern as above.

$$(7) \quad \begin{aligned} BHAR\ 36 = & \text{Intercept} + \beta_1 \text{First day return} + \\ & \beta_2 \log(\text{Total asset}) + \beta_3 VC + \beta_4 BO + \beta_5 \text{Hot market} + \\ & \beta_6 \text{Cold market} \end{aligned}$$

$$(8) \quad \begin{aligned} BHAR\ 36 = & \text{Intercept} + \beta_1 \text{First day return} + \\ & \beta_2 \log(\text{Total asset}) + \beta_3 \text{Asset turnover} + \beta_4 \text{EBITDA}\% + \\ & \beta_5 \text{Leverage} + \beta_6 VC + \beta_7 BO + \beta_8 \text{Hot market} + \\ & \beta_9 \text{Cold market} \end{aligned}$$

5. Results of empirical study

This section presents the results of the empirical part of the study. First, the results of underpricing are presented for all groups and for different IPO cycles based on the IPO volumes. Secondly, abnormal short-, medium- and long-term returns of IPOs using BHAR method are presented as well as the F-test to examine the performance differences between the ownership groups. Finally, the results of OLS regression model for a long-term performance are presented to cover all the hypotheses in this study.

5.1 Results for underpricing and the IPO cyclicity

The results in table 6 show the underpricing returns for all groups with different IPO cyclicity periods. At first glance, all IPO groups tend to be underpriced throughout the period at both the equal- and value-weighted basis at the 1% significance level, except for underpricing of VC-backed IPOs, which are not statistically significant in the equal-weighted average method. The value-weighted average result, on the other hand, show underpricing at the 1% significance level, which can be seen as the bigger companies by market capitalization to be dragging up the underpricing average. Furthermore, the first section, which covers all IPOs for the entire period, equals to 4.6% of underpricing at the 1% significance level at the equal-weighted average and also with the same significance level, the underpricing is 9.8% at the value-weighted average. Underpricing percentage is in line with previous studies in the European market, to mention for example Gandolfi, Regalli, Soana and Arcuri (2018) and Bergström et al. (2006). Gandolfi et al. (2018) found that the underpricing in the most developed mainland European countries are just above 6%, while in France the underpricing is 6,4%, in Germany 5.3% and in Italy 6.1% (Gandolfi et al. 2018).

An interesting pattern can be seen by comparing the US and UK first-day returns with Nordic returns. Underpricing in US and UK appears to be higher when comparing all IPOs without the effect of the ownership type, e.g. Levis (2011) found the underpricing in the

UK market at 18.6% and Ritter in the US market at 21.1% between 2000 to 2017 (Ritter 2017). Thus, the Nordic underpricing seems to be at a lower level compared to the US and the UK market. Therefore, the hypothesis H1 is supported, since IPOs are underpriced on the first trading day significantly.

The result is surprising when comparing buyout-backed IPOs and non-sponsoring IPOs. Buyout-backed IPOs are more underpriced than non-sponsoring IPOs, which contradicts Levis (2011) findings in the UK market and Schöber (2007). The difference between buyout- and non-sponsoring IPOs is even greater with the value-weighted method. One explanation may be that although there have been private equity investors in the Nordic countries for a long time, the industry has grown significantly in the last decade, while in the US and in major European markets, private equity companies have played a more significant role, especially when listing companies through IPOs. Therefore, the *certification* of the PE-industry does not apply to the Nordic level based on this study.

Furthermore, when looking at the results of VC-backed IPO underpricing, it can be noted that the VC-backed IPOs experience the lowest degree of underpricing across the sample with equal-weighted average basis, which is in line with the findings of Megginson and Weiss (1991), although the results are not statistically significant. The result shows underpricing of 1.49% without statistical significance and 16.6% at the significance level of 1%. In all time periods, underpricing of the VC-backed IPOs are not statistically significant, although the entire period and hot period are statistically significant by value-weighted terms. Megginson and Weiss (1991) suggest that when a private equity company issue a new company on the public stock exchange, the degree of underpricing is lower due to a *certification* that the issued company has been managed by the private equity company, thus the investors are more confident to invest in those IPOs. Thus, the lower degree of underpricing in BO- and VC-backed IPOs cannot be confirmed in this study.

The findings from different IPO cyclicalities is also interesting especially from the perspective of the timing of private equity-backed IPOs. During the hot period, IPO volumes are higher as well as underpricing of IPOs in equal-weighted basis which is supported by the previous studies for instance Ibbotson and Jaffe (1975) and Ritter (1991). An exception can be detected during a neutral period where buyout companies experienced high underpricing of 16.4% using the value-weighted method, but the equal-weighted average basis underpricing follows the same pattern that during hot periods, IPOs experience higher underpricing than during other periods. This is in line with the hot and cold market theory of Ritter (1991) and Ibbotson & Jaffe (1975). During cold market period, IPO underpricing is negative in PE-backed IPOs, which shows that the investor sentiment is cautious leading to overpricing of IPOs, though the result is only significant at the 10% significant level. Moreover, underpricing during cold period is not showing any statistically significant results. Therefore, the hypothesis H2 is supported that the IPOs experience higher underpricing during hot periods in Nordic level.

Table 6. Underpricing of different ownership groups and the IPO cyclicity.

Underpricing	All	NS	PEALL	BO	VC
<i>Panel A. entire period</i>					
Equal-weighted average	4.6%*** (5.43)	4.59%*** (4.03)	4.6%*** (3.69)	6.61%*** (6.11)	1.49% (0.56)
Value-weighted average	9.78%*** (11.16)	7.03%*** (6.28)	11.78%*** (7.4)	10.62%*** (6.33)	16.16%*** (3.44)
Median	2.26 %	2.02 %	2.26 %	5.22 %	0.00 %
Observations	236	144	92	56	36
<i>Panel B. hot period</i>					
Equal-weighted average	5.99%*** (5.37)	5.52%*** (3.5)	6.66%*** (4.48)	7.78%*** (6.72)	4.66% (1.24)
Value-weighted average	11.01%*** (9.33)	9.91%*** (6.11)	11.56%*** (7.08)	9.71%*** (7.38)	17.82%*** (3.36)
Median	3.16 %	2.35 %	5.42 %	7.50 %	0.86 %
Observations	155	91	64	41	23
<i>Panel C. cold period</i>					
Equal-weighted average	1.72% (0.8)	3.69% (1.62)	-6.45%* (-2.01)	-5.36% (-1.08)	-7.26% (-1.83)
Value-weighted average	0.81% (0.4)	1.22% (0.55)	-0.52% (-0.32)	0.03% (-0.22)	-5.05% (-1.38)
Median	0.00 %	0.00 %	-0.43 %	0.00 %	-1.88 %
Observations	36	29	7	3	4
<i>Panel D. neutral period</i>					
Equal-weighted average	2.1% (1.56)	2.15% (1.22)	2.04% (0.99)	5.61%*** (4.45)	-2.72% (-0.83)
Value-weighted average	7.81%** (2.47)	3.66%* (1.95)	14.57%*** (-17.64)	16.39%*** (-37.44)	-0.28% (-0.13)
Median	1.67 %	1.85 %	0.23 %	4.01 %	0.00 %
Observations	45	24	21	12	9

The sample consists of 236 Nordic IPOs of which 144 are non-sponsored, 56 of buyout-backed and 36 of venture capital-backed. Returns are measured as percentage from the offer price to end of first trading day. Returns are non-adjusted. An asterisk refers to significance one at the 10% level; two at the 5% level; three at the 1% level. T-statistics are reported in the parentheses.

5.2 Nordic BHAR

The results of the Nordic buy-and-hold returns are presented in table 7 below, which is divided into two parts based on the calculation method. The first part is calculated using the equal-weighted average and the second part is calculated using the value-weighted average, where the inflation-adjusted market capitalization on the listing date has been

used. The IPO performance has been calculated for the first month and on a yearly basis thereafter. As previously mentioned, Lyon and Barber (1999) suggest that when using a buy-and-hold approach, the results are biased due to skewness. To eliminate the bias, the skewness-adjusted t-statistic has been used. At first glance, two observations can be seen immediately from the long-term performance over a 36-month period. First, the results show more positive than negative returns between different groups, and second, buyout-backed IPOs tend to outperform, while venture capital-backed IPOs underperform with significant results.

Table 7. Buy-and-hold abnormal returns in different time periods for each IPO group.

Window	Equal-weighted average (%)					Value-weighted average (%)				
	All IPO (236)	NS (144)	PEALL (92)	BO (56)	VC (36)	All IPO (236)	NS (144)	PEALL (92)	BO (56)	VC (36)
1M	-1.07%	-1.01%	-1.16%	-0.02%	-2.93%	-1.74%	-1.59%	-1.85%*	0.39%	-10.39%
	(-1.05)	(-0.66)	(-1.09)	(-0.01)	(-1.36)	(-1.63)	(-1.02)	(-1.7)	(0.36)	(-1.27)
12M	11.77%***	10.58%*	13.63%**	23.79%***	-2.17%	7.37%*	15.95%***	1.15%	-3.94%	20.48%**
	(2.89)	(1.94)	(2.35)	(2.95)	(-0.31)	(1.72)	(3.07)	(0.24)	(-0.2)	(2.11)
24M	8.77%	8.99%	8.43%	23.02%***	-14.27%	9.55%*	7.5%	11.03%	8.98%	18.8%
	(1.62)	(1.2)	(1.15)	(2.92)	(-1.01)	(1.77)	(1.00)	(1.51)	(1.07)	(1.47)
36M	8.05%	7.42%	9.03%	35.62%**	-32.34%**	16.06%**	8.87%	21.27%**	33.06%**	-23.52%*
	(1.11)	(0.82)	(0.84)	(2.54)	(-2.3)	(2.34)	(0.98)	(2.07)	(2.33)	(-1.87)

The sample consists of 236 Nordic IPOs of which 144 are non-sponsored, 56 of buyout-backed and 36 of venture capital-backed. MSCI Nordic index has been used as a benchmark index. Returns are measured as percentage returns from first day close to end of each period as in the window column. An asterisk refers to significance one at the 10% level; two at the 5% level; three at the 1% level. T-statistics are reported in the parentheses.

Looking at all IPOs, the results show weak evidence of aftermarket outperformance over a 36-month period. The equal-weighted average is 8.05%, although the result is statistically insignificant, and the value-weighted average in turn is 16.06% over a 36-month period. Therefore, the hypothesis H3 is not supported that the new issues overall underperform in the long-term compared to the benchmark. While the results of IPO

outperformance are only significant using the value-weighted average basis and there is no evidence of underperformance in the long-term, except for VC-backed IPOs. Moreover, the findings are in contrast with Levis (2011) and Ritter (1991), who found that in the UK and US markets, the IPOs tend to underperform compared to benchmark, although Levis (2011) found some outperformance in the long-term, when IPOs were tested to industry-adjusted benchmark. The positive aftermarket performance was also observed by Westerholm (2006) in the Nordic market. Westerholm (2006) found that IPOs in Norway and Denmark achieved positive returns, while returns in Sweden and Finland were negative when calculating the 5-year BHAR. Furthermore, an interesting point can be observed when looking at the aftermarket performance over a 12-month period. The results show that all groups are outperforming, except of VC-backed IPOs, with statistically significant results.

An interesting difference can be found when splitting the private equity-backed IPOs into buyout and venture capital groups. The results reveal superior performance of the buyout-backed IPOs, which experience an outperformance of 35.62% using the equal-weighted method, and 33.06% using the value-weighted method. The results are significant at the 5% significance level. BO-backed IPOs have significantly higher long-term performance than any other group. These findings are consistent with previous researches, e.g. Katz (2009), Levis (2011) and Schöber (2007).

Moving forward, the only group underperforming against the benchmark are the VC-backed IPOs, where significant underperformance is found in both equal- and value-weighted measures. Venture capital-backed IPOs are experiencing negative returns of over 30% using the equal-weighted method and more than 20% using the value-weighted terms. The findings of poor performance of the VC-backed IPOs are supported by previous studies, e.g. by findings of Levis (2011) in the UK market, as well as Brav and Gompers (1997) in the US market. On the other hand, the results partly contradict the findings of Bessler and Seim (2012). Bessler and Seim (2012) suggest that the performance of VC-backed IPOs is positive for at least one year, after which the returns

start to decrease, but the return remain positive until the third year until it turns negative. They suggest further that after a year, the lock-up period ends, and VC-firms can divest the remaining shares. This theory is supported by these results as the decrease in returns begins after 12 months, albeit the impact of the lock-up period cannot be confirmed, since the data are not including the information of the lock-up agreements. The same theory applies to BO-backed IPOs, but the evidence of the possible impact of the lock-up agreements cannot be confirmed as the returns of BO-backed IPOs are increasing after 12 months. In addition, Bessler and Seim (2012) state that VCs can time the issues to periods of high valuation and tend to over value the issues. This is constant with the findings of this study as VC-backed IPOs are less underpriced compared to all IPOs when using the equal-weighted average approach.

The F-test has been used in table 8 as an alternative approach to test the long-term performance during a 36-month period. When comparing the averages of the long-term performance of the different ownership groups, it can be seen that buyout-backed IPOs experience higher aftermarket performance than other groups. Furthermore, the results are significant when comparing to non-sponsor-backed IPOs at the 5% significance level and when comparing against venture capital-backed IPOs at the 1% level. In addition, comparing non-sponsor-backed IPOs to venture capital-backed IPOs the result is significant at the 1% level. All things considered, the hypothesis H4 can be supported, proving that the long-term performance differs between the groups. As shown, buyout-backed IPOs perform better in the long-term compared to other groups and respectively, non-sponsored IPOs perform better compared to venture capital-backed IPOs.

Table 8. F-test to compare long-term returns for 36-month period.

	<i>BO</i>	<i>NS</i>	<i>BO</i>	<i>VC</i>	<i>NS</i>	<i>VC</i>
Mean %	35.62%	7.42%	35.62%	-32.34%	7.42%	-32.34%
Listings	56	144	56	36	144	36
F	1.57**		5.01***		3.20***	
<i>p-value</i>	0.02		0.00		0.00	

An asterisk refers to significance one at the 10% level; two at the 5% level; three at the 1% level

5.3 Results of OLS regression model

The OLS regression has been used as an alternative approach to test the long-term performance. The regressions are run with the Newey-West's correction to adjust autocorrelation and heteroskedasticity, leading to robust t-statistics.

Table 9. OLS regression results for 36-month period with IPO cyclicity.

Variable	Regression (1)	Regression (2)	Regression (3)	Regression (4)
Intercept	0.259 (0.693)	0.223 (0.507)	0.474 (1.078)	0.544 (0.965)
First-day return	-0.231 (-0.514)	-0.433 (-0.871)	-0.346 (-0.745)	-0.511 (-0.993)
Log of total assets	-0.056 (-1.04)	-0.040 (-0.757)	-0.099 (-1.513)	-0.089 (-1.128)
Asset turnover		0.0544 (0.442)		-0.045 (-0.283)
EBITDA-%		0.002 (0.00)		0.002 (0.505)
Leverage		-0.357* (-1.823)		-0.428* (-1.888)
PEALL	0.015 (0.104)	0.013 (0.081)		
BO			0.376 (1.582)	0.401 (1.354)
VC			-0.515** (-2.468)	-0.521** (-2.345)
Hot market	0.148 (0.653)	0.166 (0.783)	0.130 (0.572)	0.163 (0.783)
Cold market	-0.082 (-0.262)	-0.057 (-0.183)	-0.104 (-0.321)	-0.083 (-0.256)
R2	0.01	0.02	0.05	0.06
Observations	236	236	236	236

The sample consists of 236 Nordic IPOs of which 144 are NS, 56 BO- and 36 VC-backed. MSCI Nordic index has been used as a benchmark index. Return is measured as percentage from first day close to end of the 36-month period. An asterisk refers to significance one at the 10% level; two at the 5% level; three at the 1% level. T-statistics are reported in the parentheses.

Table 8 summarizes the results of the regressions used in this study. Firstly, the results support some of the findings and hypotheses presented earlier in this study. The long-term outperformance of IPOs presented in table 7, the results of OLS regression models are giving support as the sign of the intercepts is also positive. As the results are

statistically insignificant for all IPOs as in table 7 and in addition, the regressions show the positive sign for the intercept. Thus, the first hypothesis H3 is still not supported and cannot be accepted, since there is no evidence that all sample IPOs underperform compared to benchmark.

The first-day return variable shows a significant negative relation between the first-day return and the long-term performance in all the regressions. The first-day return in all regressions show a negative relationship, although the results are not statistically significant. Thus, it can be said that there is a negative relationship between underpricing and long-term performance, but the evidence is not strong enough to make it statistically significant. In view of the above, the hypothesis H5 is not supported, since the negative relationship between underpricing and long-term performance is not statistically significant. Levis (2011) and Purnanandam & Swaminathan (2004) found the negative relationship in the long-term and explained that underpricing is not sustainable and the valuation of the company has been corrected in the long-term (Levis 2011; Purnanandam & Swaminathan 2004).

The table above shows significant underperformance of VC-backed IPOs at the 5% significance level, which is line with the findings of Chen and Liang (2016). After having studied 3,771 IPOs in the US market during a time between 1970 and 2007, Chen and Liang found that venture capital-backed IPOs underperform compared to other IPOs. The mains reasons for this were the weaker operating performance and the tendency of investors to overinvestment at the time of the offering. The result is consistent with table 7, which shows that venture capital -backed IPOs underperform significantly in the long-term. In addition, as discussed earlier in this study, BO-backed IPOs show the positive coefficient for the long-term performance, although the results are not statistically significant. The presented results are therefore consistent to the long-term performance of the buyout and venture capital-backed IPOs, even though for buyout-backed IPOs the results are not significant, but the positive sign of the variable support the findings of buyout-backed IPOs aftermarket performance.

The variable of leverage shows negative impact for the regressions (2) and (4) at the 10% significant level. The results are, on the one hand, in line with the findings by Cao and Lerner (2009) and on the other hand, the results contradict with the findings of Levis (2011) in the UK market. There is no academic consensus on how the leverage impact for the long-term performance.

In addition, the timing of the IPO does not appear to have an impact on the long-term performance, as the hot and cold period dummies are not showing any reasonable significant levels. As noted for hot and cold dummies, the coefficients for the remaining variables are not statistically significant at any reasonable level and can therefore not explain the performance of long-term performance. Although in previous studies, for example size and profitable variables has been able to explain the long-term performance, although the results have been rather mixed.

In summary, OLS regressions support venture capital-backed IPOs in the long-term, while the performance of all IPOs remains statistically insignificant as well as buyout-backed IPOs are not statistically significant with the OLS method, although the evidence is consistent of the positive performance of the all IPOs and buyout-backed IPOs in the long-term. However, the adjusted R-square is relatively low for the regression models, which indicate that the regression models have difficulties in explaining the long-term performance of the sample used in this study, although the results provide support and ensure the robustness in part of the main hypotheses.

6. Conclusions

The purpose of this study is to examine the pricing and the long-term performance of new initial public offerings (IPOs) in the Nordic market. This study focuses in particular on the impact of the pre-IPO ownership on the pricing and long-term performance. The IPOs are divided by the ownership type to three different groups, buyout- (BO), venture capital- (VC) and non-sponsored-backed (NS). Previous studies have found significant differences in the underpricing of IPOs and long-term performance across owner groups. Further, the study examines and tries to provide answers for questions on how the IPOs act in short- and long-term in the Nordic market compared to other major developed markets as well as which kind of role the ownership type plays, when companies are issued for the first time on public stock exchanges.

This study has used a sample consisting of 236 IPOs from 2005 to mid-2016 in the Swedish, Finnish, Norwegian and Danish markets. To test the underpricing and long-term performance of the sample IPOs, three different methods have been applied in this study. For each IPO, buy-and-hold abnormal return has been calculated to test the aftermarket performance, and for testing differences in the long-term between groups F-test has been utilized to support the results. In addition, OLS regression analysis have been used as an alternative approach to test long-term performance of all IPOs. The sample has been compared to MSCI Nordic Index, which has been used as a benchmark index to measure the aftermarket performance.

Private equity investments are popular at the moment and the IPO market is enjoying high IPO volumes for the first time after the financial crisis. The Nordic private equity industry has been attracting more and more capital during the last decade and the investment amounts to portfolio companies has grown rapidly in recent years. Individual Nordic countries are small compared to major economies, for instance the US, UK and the biggest European countries, but in the Nordic level, the size of the market is relevant, especially in the technology sector. When comparing the investment amounts that PE-

industry has made to the early stage companies during the past few years, the Nordic market has performed superiorly compared to other countries in Europe.

Buyout-backed IPOs tend to be larger and use more leverage than other sample IPOs. Moreover, the buyout-backed IPOs are three times bigger than the other IPOs in the sample. While buyout companies focus more on consumer goods and industrial sectors, venture capitalists are focusing more on high technology and the healthcare sector, including pharmacy sectors. Non-sponsored IPOs, on the other hand, are covering over several sectors.

According to previous studies, the phenomena of the first-day underpricing of the IPOs show similar patterns in the Nordic market than in other similar markets. The results of underpricing show significant returns for all groups when calculating with the value-adjusted method and also with the equal-weighted approach, except for VC-backed IPOs. As shown previously in this study, the first-day return is 4.6% for all IPOs with equal-weighted approach. Furthermore, based on previous studies, the first-day underpricing has shown lower returns in the developed markets than in the emerging markets and the results of this study is consistent with that finding. On the other hand, no evidence was found of lower underpricing for the PE-backed IPOs than for the non-sponsored IPOs. Thus, the IPOs experience underpricing on the first trading day and the same pattern which has been documented in other markets also applies in the Nordic market. Moreover, the first-day returns are lower in the Nordic market than in the US and UK markets, which is proven in previous studies. The explanation could relate to IPO volumes, which are higher in the US and UK markets, which could lead to more attractive valuations in order to make IPOs attractive and thus, leading to higher first-day returns.

When the IPO has been done during a hot period, the underpricing tend to be higher. In other periods, the underpricing is lower, and during the cold market period even overpricing has been evidenced. Thus, it can be stated that underpricing is higher during

the hot period, which can be explained by the investor sentiment. In addition, the finding is line with previous studies, e.g. Ibbotson and Jaffe (1975).

The results of this study show evidence of the aftermarket outperformance of the IPOs in the long-term. All IPOs experience on average positive returns of long-term performance when calculating with the value-adjusted method. On the other hand, the evidence is not statistically significant when calculating with the equal-weighted method. The results are showing statistically significant returns for the buyout-backed IPOs. The impact is positive in the long-term when buyout-backed IPOs are, on average, outperforming. The buyout investment strategy focuses on larger and more mature companies. In contrast, for the venture capitalists specializing in early stage funding of the companies, the aftermarket performance is significantly negative. Thus, the evidence of the long-term underperformance can be only confirmed for VC-backed IPOs. However, the stock performance has been compared only to MSCI Nordic index and the sample size is not as large as Levis (2011) or other main studies on the subject, although in the Nordic level the sample size is comprehensive.

Furthermore, the buyout-backed IPOs experience better long-term performance, is supported as the results show that buyout-backed IPOs have statistically significant outperformance, and the venture capital-backed IPOs on the other hand, are performing poorly. The F-test has been used as an alternative approach to ensure the performance differences between groups, and the test support the findings. Moreover, non-sponsored IPOs are experiencing positive returns, although the results are not statistically significant. Further, the negative relationship between the first-day returns and the long-term performance exists, although the results are not statistically significant, albeit the evidence shows negative relationship.

This study has used the SDC Platinum's New Issue online database for retrieving the IPO sample data, which have been cross-checked with the company webpages and IPO prospectus where available. Some of the IPOs had to be excluded from the sample as

the information was not available. Therefore, the sample size somewhat decreased, but the total sample is still comprehensive in the Nordic level. In addition, there may be some issues in the sample relating to the dividing of the IPOs to three groups based on the sponsoring type, which could create a bias result. The Nordic sponsors have an overlapping nature when investing to the portfolio companies, which could be shown as some of the buyout-backed IPOs should be venture capital-backed and vice versa. Furthermore, country characteristic and macro variables have been left outside of this study, as the focus has been more to examine the impact of the ownership type of the IPOs.

For further researches, it would be interesting to understand the sponsors' impact on the IPOs in more detail, for instance if there are any impacts in situations where the sponsor is more experienced or has a better track record in issuing the companies via IPOs. Further, the difference between the BO- and VC-backed performance would be interesting to examine in order to understand which drivers are affecting that. Moreover, the private equity value creation is one thing which could be interesting to measure in more detail, especially in terms of operational performance and strategic choices during the ownership. This would be useful information for all investors attending IPOs in order for the investors to understand more precisely the drivers that are affecting the superior performance of the buyout-backed companies.

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Appendix: Sample IPOs

Issuer	Issue Date	Issuer	Issue Date
PetroJack ASA	2/23/2005	Boule Diagnostics AB	6/23/2011
Neste Oil Corporation	4/18/2005	Danske Andelskassers Bank A/S	7/7/2011
Aker Seafoods ASA	5/13/2005	Hoegh LNG Holdings Ltd	7/5/2011
Havila Shipping ASA	5/24/2005	Hofseth Biocare ASA	12/2/2011
AffectoGenimap Oyj	5/27/2005	Selvaag Bolig ASA	6/14/2012
TopoTarget A/S	6/10/2005	Siili Solutions Oyj	10/15/2012
Kongsberg Automotive ASA	6/24/2005	Borregaard ASA	10/18/2012
Eidesvik Offshore ASA	6/27/2005	Asetek A/S	3/20/2013
Revus Energy ASA	6/27/2005	EAM Solar ASA	3/26/2013
Indutrade AB	10/5/2005	Serodus ASA	4/9/2013
Hemtex AB	10/6/2005	Multicient Geophysical ASA	5/2/2013
TrygVesta A/S	10/13/2005	Matas	6/28/2013
Cermaq ASA	10/24/2005	Ocean Yield AS	7/5/2013
Powel ASA	10/24/2005	Odfjell Drilling AS	9/27/2013
Bergesen Worldwide Gas ASA	10/25/2005	Orava Asuinkiinteistorahasto O	10/14/2013
Biotec Pharmacon ASA	11/4/2005	Restamax Oyj	11/28/2013
TradeDoubler AB	11/8/2005	Platzer Fastigheter AB	11/29/2013
Orexo AB	11/9/2005	Napatech A/S	12/6/2013
ODIM ASA	11/18/2005	LINK Mobility Group ASA	12/12/2013
Hakon Invest AB	12/8/2005	Oscar Properties Holding AB	2/17/2014
Funcom A/S	12/13/2005	Bufab AB	2/21/2014
KappAhl AB	2/23/2006	ISS A/S	3/13/2014
Salcomp Oy	3/13/2006	Saniona AB	4/22/2014

Ahlstrom Paper Group Oy	3/14/2006	Hemfosa Fastigheter AB	3/21/2014
Block Watne AS	3/17/2006	Recipharm AB	4/3/2014
Electra Gruppen AB	5/4/2006	Verkkokauppa.com Oyj	4/4/2014
Renewable Energy Corp ASA	5/9/2006	D Carnegie & Co AB	4/9/2014
Dios Fastigheter AB	5/22/2006	Scanship Holding ASA	4/11/2014
BW Offshore Limited	5/31/2006	Herantis Pharma Oyj	6/11/2014
Insplanet AB	6/7/2006	Besqab AB	6/12/2014
Swedol AB	6/12/2006	Cleantech Invest Oyj	6/12/2014
Ability Group ASA	7/3/2006	Com Hem Holding AB	6/17/2014
Melker Schorling AB	9/5/2006	Bactiguard Holding AB	6/19/2014
Biovitrum AB	9/15/2006	Zalaris ASA	6/20/2014
Wirtek A/S	10/2/2006	Next Biometrics Group ASA	6/25/2014
Mondo A/S	10/13/2006	Scandi Standard AB	6/27/2014
Outotec	10/10/2006	cXense AS	7/1/2014
Austevoll Seafood ASA	10/11/2006	Havyard Group AS	7/1/2014
Marine Farms ASA	10/12/2006	Inwido AB	9/26/2014
Codfarmers ASA	10/19/2006	Scatec Solar ASA	10/2/2014
Eitzen Chemical ASA	11/2/2006	XXL ASA	10/3/2014
AKVA Group ASA	11/10/2006	Granges AB	10/10/2014
Veloxis Pharmaceuticals A/S	11/13/2006	Absolent Group AB	10/16/2014
Norwegian Property AS	11/15/2006	Entra ASA	10/17/2014
BE Group AB	11/24/2006	Nexstim Oyj	11/14/2014
Lindab International AB	12/1/2006	Lifco AB	11/21/2014
Faktor Eiendom ASA	12/8/2006	United Bankers Oy	11/24/2014
FirstFarms A/S	12/12/2006	Thule Group AB	11/26/2014
Tilgin AB	12/15/2006	B2Holding ASA	12/4/2014
Reservoir Exploration	12/21/2006	NP3 Fastigheter AB	12/4/2014
Simtronics ASA	1/5/2007	Nixu Oyj	12/5/2014
Enalyzer	2/13/2007	RenoNorden AS	12/16/2014

NEAS ASA	3/23/2007	Eltel AB	2/6/2015
Algeta ASA	3/27/2007	Dustin Group AB	2/13/2015
ElectroMagnetic GeoService AS	3/30/2007	The Lexington Co AB	2/18/2015
SalMar ASA	5/8/2007	NNIT A/S	3/6/2015
ScanArc ASA	5/10/2007	Piippo Oyj	3/10/2015
Fred Olsen Production ASA	5/11/2007	Detection Technology Oy	3/16/2015
NAXS	5/14/2007	Evolution Gaming Group AB	3/20/2015
Bouvet ASA	5/15/2007	Nordic Nanovector AS	7/8/2014
Nederman Holding AB	5/16/2007	Hoist Finance AB	3/25/2015
Dannemora Mineral AB	5/25/2007	Asiakastieto Group OYJ	3/27/2015
Protector Forsikring ASA	5/25/2007	Troax Group AB	3/27/2015
Exiqon A/S	5/29/2007	Savo-Solar Oy	4/2/2015
Badger Explorer ASA	6/12/2007	Tobii AB	4/24/2015
SRV Yhtiot Oyj	6/12/2007	Robit Oyj	5/21/2015
DIBS A/S	6/18/2007	Multiconsult AS	5/22/2015
Esoft Systems A/S	6/19/2007	SciBase Holding AB	6/2/2015
Grieg Seafood ASA	6/21/2007	Pihlajalinna Oy	6/4/2015
24SevenOffice ASA	6/22/2007	Magnolia Bostad AB	6/9/2015
Northern Logistics Property	6/22/2007	Collector AB	6/10/2015
EOS Russia	6/25/2007	Inission AB	6/10/2015
Cecon ASA	6/26/2007	Vistin Pharma ASA	6/10/2015
Pronova BioPharma ASA	10/11/2007	Talenom Oyj	6/11/2015
Systemair AB	10/12/2007	Prime Living AB	6/12/2015
HMS Industrial Networks AB	10/19/2007	A Group Of Retail Assets	6/15/2015
Vinovo AB	10/22/2007	Coor Svc Mgmt Hldg AB	6/16/2015
West International AB	10/26/2007	Hovding Sverige AB	6/16/2015
Avega AB	11/1/2007	Alimak Group AB	6/17/2015
East Capital Explorer AB	11/9/2007	Nordax Group AB	6/17/2015

Duni AB	11/14/2007	Nobina AB	6/18/2015
Malka Oil	11/20/2007	Pandox Ab	6/18/2015
Erria A/S	11/8/2007	Europris ASA	6/19/2015
Hafslund Infratek ASA	12/5/2007	Hugo Games A/S	6/26/2015
Trifork A/S	12/20/2007	Capio AB	6/30/2015
Aqua Bio Technology ASA	1/10/2008	FIT Biotech Oy	7/1/2015
NattoPharma ASA	1/30/2008	Kotipizza Group Oyj	7/7/2015
Thin Film Electronics ASA	1/30/2008	CLX Communications AB	10/8/2015
Trygga Hem Skandinavien AB	5/27/2008	Bravida Holding AB	10/16/2015
Senzime AB	6/18/2008	Kid ASA	11/2/2015
Spectrum ASA	7/4/2008	Skandiabanken ASA	11/2/2015
Global Health Partner AB	10/3/2008	Waystream Holding AB	11/12/2015
Cimber Sterling Group A/S	11/27/2009	Maxkompetens Sverige AB	11/23/2015
North Energy ASA	2/5/2010	Dometic Group AB	11/25/2015
Arise Windpower AB	3/24/2010	Attendo AB	11/30/2015
Solvtrans Holding ASA	3/30/2010	A City Media AB	12/2/2015
Jays AB	5/18/2010	Scandic Hotels Group AB	12/2/2015
Bridge Energy ASA	5/21/2010	Evli Pankki Oyj	12/2/2015
Byggmax Group AB	6/2/2010	Camurus AB	12/3/2015
Chr Hansen Holding A/S	6/3/2010	Stillfront Group AB	12/8/2015
MQ Holding AB	6/18/2010	Nilsson Special Vehicles AB	12/11/2015
Morpol ASA	6/30/2010	Consti Yhtiot Oy	12/11/2015
Pallas Group AB	7/7/2010	Nuevolution AB	12/17/2015
NetConnect ASA	7/12/2010	Scandinavian Tobacco Group A/S	2/10/2016
PANDORA A/S	10/5/2010	Garo AB	3/16/2016
Cellcura ASA	10/6/2010	LeoVegas AB	3/17/2016
Episurf Medical AB	11/5/2010	Humana AB	3/22/2016
Zealand Pharma A/S	11/24/2010	Suomen Hoivatilat Oyj	3/31/2016

Vendator AB	11/30/2010	Nepa AB	4/26/2016
Gjensidige Forsikring ASA	12/10/2010	Lehto Group Oyj	4/28/2016
Kancera AB	2/25/2011	Resurs Holding AB	4/29/2016
Norway Royal Salmon ASA	3/29/2011	Tokmanni Group Oy	4/29/2016
Karolinska Development AB	4/15/2011	Paradox Interactive AB	5/31/2016
Sevan Drilling ASA	5/3/2011	DONG Energy A/S	6/9/2016
FinnvedenBulten AB	5/20/2011	Nordic Waterproofing Hldg A/S	6/10/2016
AroCell AB	5/25/2011	B3IT Management AB	6/16/2016
Moberg Derma AB	5/26/2011	GomSpace Group AB	6/16/2016
Transmode Holding AB	5/27/2011	Norwegian Finans Holding ASA	6/17/2016