15/05/2018

Private Equity-Sponsored IPOs in the Nordics

An empirical study of IPO long-run abnormal stock performance

Master's Thesis by:

Johan Thybo
Cand. Merc. Applied Economics and Finance
Student ID: 35138

&

Jannick Bendtner
Cand. Merc. International Business
Student ID: 5444

Supervisor: Thomas Einfeldt
Copenhagen Business School, 2018

No. of pages: 101 (Characters: 192,252 ≈ 85 normal pages)

Abstract

This thesis examines whether Nordic private equity sponsored initial public offerings (IPOs) achieve superior long-run abnormal stock performance post-IPO compared to non-sponsored IPOs. We conduct an empirical analysis of a sample of 158 Nordic IPOs that went public during the period 2005-2014. First, we group the sample into PE-backed, VC-backed, and non-sponsored IPOs and conduct a cross-sectional analysis of firm characteristics across the three IPO groups. Then, using size- and industry-adjusted benchmark groups we present the aftermarket stock performance using the measures Buy-and-Hold Abnormal Return (BHAR) and Cumulative Abnormal Returns (CAR). To calculate these abnormal returns, we propose a new method of constructing unique benchmark portfolios that lock-in the weights of delisted stocks. This method resembles the way that the IPO groups are weighted and result in less underperformance of the IPO groups. Furthermore, we examine the isolated effect of the type of IPO-sponsorship in a series of multivariate regressions with the abnormal stock performance as the dependent variable.

In contrast to the reviewed literature, we have not been able to find substantial evidence of the Nordic PE-backed IPOs exhibiting superior long-run abnormal stock performance. Surprisingly, we find that the group of non-backed IPOs achieved the best long-run abnormal performance on an equally weighted basis. However, this result is not persistent to robustness checks of IPO size and leverage ratio. In the regression models, we find that the PE-backed IPOs are slightly associated with abnormal performance, however, this relationship is statistically insignificant. We find no signs of a relationship between VC-sponsorship and long-run abnormal stock performance in the regression models.

Moreover, our study shows that the PE-backed IPOs maintain superior operating performance in the post-IPO years compared to the non-sponsored IPOs. Furthermore, we find positive first-day returns and negative long-run abnormal performance across all IPO groups.

Table of Contents

List of Tables

List of Figures

Chapter 1 – Introduction and Research Design

Introduction

While it is widely accepted that Private Equity (PE) funds add value to their portfolio companies during the holding period, what happens to the portfolio firms after the exits of the PE-sponsors has been less researched. A stream of recent literature including Bergström, Nilsson, & Wahlberg (2006), Katz (2009), and Levis (2011) have shown that private equity-sponsored initial public offerings (IPOs) achieve better long-run abnormal stock performance in the years after listing than the IPOs without a sponsor. However, we find these results puzzling as they conflict with the theory of efficient capital markets, which states that abnormal returns should not be predictable.

Prompted by our curiosity of the results of recent literature, our purpose with this study is to examine whether the surprising result of superior PE-performance can be replicated in a different setting. Hence, we will conduct an empirical study of all PE-, VC-, and non-sponsored IPOs on the main Nordic stock exchanges during the period 2005-2014, as there is sparse evidence regarding the aftermarket performance of PE-backed IPOs in these counties. By studying these IPOs, we could either find new support for the result of superior returns of PE-backed IPOs or indicate that it seems to be a temporary market anomaly.

We will thoroughly assess the results' sensitivity to using different methodologies, as previous studies including Brav, Geczy, & Gompers (2000) and Loughran & Ritter (2000) have found that the long-run abnormal performance measures are highly sensitive to the applied methodology. Furthermore, we will try to isolate the effect of an IPO-sponsorship by conducting a multivariate regression model, which includes the type of sponsorship and other IPO-characteristics as control variables.

Research Question

As mentioned in the introduction, we find the studies by Bergström et al. (2006), Katz (2009), and Levis (2011) peculiar. Their results are unexpected, as predicting abnormal stock

performance by using public information should not be possible according to conventional capital market theory. It remains unanswered why the PE-backed IPOs achieve superior performance and whether this effect is persistent across time and markets. Therefore, we want to examine whether this finding is consistent when extending the research area to a sample of Nordic IPOs between 2005-2014. This leads us to the following research question:

Do Nordic PE-sponsored IPOs exhibit superior long-run abnormal stock performance post-IPO compared to non-sponsored IPOs?

To answer this research question, we will conduct an empirical study of a retrieved sample of 158 Nordic IPOs between 2005-2014, which we classify into three groups: PE-backed, VC-backed, and non-sponsored IPOs. Throughout the paper, we will have extensive focus on methodology and how sensitive the results are to different approaches.

We will conduct a cross-sectional analysis of the characteristics of the three IPO groups, which could be associated with stock performance. Then, we will examine the long-run abnormal stock performance of the three IPO groups using size- and industry-adjusted benchmarks and two different measures long-run performance. Finally, we will conduct a multivariate regression to assess whether the potential differences in aftermarket performance are caused by the PE/VC-sponsorship or other characteristics.

We contribute to the existing literature by studying the aftermarket performance of IPOs in other countries and from a newer period than the main sources of reviewed literature. We also study the effect on aftermarket performance of a series of IPO characteristics in line with Levis (2011). We expand this approach by also examining the ownership levels of the PE- and VC-sponsors pre- and post-IPO, which we believe could be related to the aftermarket performance. Furthermore, we propose a new way of constructing more comparable benchmark groups, by creating unique benchmark portfolios that “lock-in” portfolio weights.

Structure

This paper is organized into seven chapters. While this chapter introduces the subject and research design, Chapter 2 provides background theory and presents the findings of related literature. Chapter 3 describes the methodology used in this study and how the data has been retrieved. The following three chapters, Chapter 4, 5, and 6, analyze the sample and present the results. Chapter 4 focuses on the cross-sectional characteristics of the three IPO groups, their operating performance, and the first-day returns. In Chapter 5, the main results of the long-run abnormal stock performance across the three IPO groups are presented, and the impact of using different methodologies is discussed. Chapter 6 combines the findings of Chapter 4 and 5 in a multivariate regression model, which tries to isolate the aftermarket performance-effect of being PE- or VC-sponsored. Finally, Chapter 7 summaries the key conclusions of the paper and provides perspectives on future research.

Research Design

The outset of the methodology is rooted in the choice of paradigm. Guba & Lincon (1994) argue the question of research methods are secondary to the choice of paradigm in which the research is conducted. The paradigm contains assumptions about the way this study will view the world and underpin the research approach and subsequently the method of this study.

This study is conducted within the neo-positivism paradigm, also called post-positivism (Guba & Lincon, 1994). The ontology, i.e., what is real, of the paradigm is called critical realism, e.g., there is one objective truth to any question or subject, but the truth can only be approached and never entirely be found due to the basic flaws in human intellect (Guba & Lincon, 1994). As such, this paper is written in the belief that there is one truth to answer the research question but that we can only find the best approximate solution due to our limitations and not a final truth on the subject. Further, the results of this paper are influenced by the applied methodology and data limitations. While both qualitative and quantitative methods can be applied to neo-positivism, we will focus on using the quantitative research methods.

We make use of a deductive research strategy in this paper. This approach is described as a linear and top-down approach, as it set off in existing theory and knowledge, followed by a deducted hypothesis, testing the hypothesis, rejecting or validating the hypothesis, and finally, if necessary, modifying existing theory or knowledge accordingly (Saunders & Lewis, 2007).

The research design of this study is in line with the deductive approach. The initial interest was sparked by reports of the superior long-run abnormal stock performance of PE-sponsored IPOs, which we found to be peculiar taking conventional capital market theory into account. To examine if the reports were indeed true and reflected a general trend, we first examined existing theory and literature to formulate a suitable hypothesis and gain further knowledge within the subject. Secondly, we collected the data needed to test the hypothesis. Finally, using the collected data, we conducted empirical research and compared the results to similar studies on abnormal long-run stock performance and theory to reject or validate the hypothesis of the superior stock performance of PE-backed IPOs.

Delimitation

As discussed above, we seek to examine whether the PE-sponsored IPOs are associated with superior long-run abnormal stock performance in the Nordic market. Our empirical research builds on a collected sample of initial public offerings of the main stock exchanges of Sweden, Denmark, Norway, and Finland from January 1st, 2005 to December 31st, 2014. To focus on the different types of ownership at the time of the listing, this paper classifies the IPOs into three groups: PE-backed, VC-backed, and non-sponsored IPOs. The data will be analyzed in an objective and statistical way to shed light on the potential stock-market performance that can be attributed to the type of owner at the time of the listing. However, this study will not focus on trying to develop a trading strategy from an investor viewpoint.

As part of validating the results of the aftermarket performance across the three IPO groups, we will try to determine the key drivers of stock performance, which include firm characteristics and operational performance. Thus, we will briefly examine operating performance both pre- and post-IPO. However, we will not try to provide empirical evidence

of how the VC- and PE-funds are able to achieve potentially better operating performance, as we focus on abnormal stock returns. Instead, we will base the discussion of superior operating performance on a theoretical background of private equity ownership and value creation. This theory will be presented in Chapter 2.

The statistical models in Chapter 6 can only include a limited number of value-driving variables, as there are not accessible data for all the potential value drivers. Furthermore, to limit the number of variables, this research chooses to rely on certain key performance indicators, which could be decomposed into multiple components. For instance, the financial ratio *EBITDA-margin* is assessed as a reliable indicator of profitability, even though the EBITDA-margin could be decomposed several times and ultimately down to some of the documented value-drivers of private equity. The effects of the variables on stock-performance will be researched on an aggregate level.

As described, this paper seeks to provide further empirical evidence of whether there is a persistent market anomaly of PE- or VC-backed IPOs outperforming the long-run abnormal stock performance of non-sponsored IPOs. However, if a persistent market anomaly is found, we will only briefly discuss the underlying reasons, as it not our focus not to examine investor expectations.

Chapter 2 – Background Theory & Literature Review

In this chapter, we will provide background theory of private equity funds, capital market theory, and IPO pricing. In addition, we will present the results of related literature that study the first-day returns and the long-run aftermarket stock performance of private equity- and venture capital-backed IPOs.

Introduction to Private Equity Funds

This section will shortly present the evolvement of Private Equity funds and their value-creation practices. In the following, we shortly introduce the structure of PE-funds and the existing theory of how modern PE-funds create value in their portfolio companies.

Shift in Competitive Advantages among PE Firms

The private equity environment has changed significantly since the growth of PE-activity in the 1980s. At the beginning of the private equity era, one of the greatest challenges was to raise enough capital to do leveraged buyouts (Klier, Welge, & Harrigan, 2009). Thus, it was one of the main success criteria to be able to raise equity and get a high level of debt financing.

However, as described by Klier et al. (2009), it has become increasingly easy to access capital as institutional investors, and private investors have embraced private equity as an investment opportunity. The increased supply of capital combined with the substantial number of new players on the market has led to "the pure skill of increasing leverage to drive returns has been commoditized and is no longer a distinguishing factor in the private equity world." (Klier, 2009).

To compete with other PE-companies, it is not sufficient only to be able to increase the leverage of the acquired companies in the market today. Klier et al. (2009) find that *Interventionists*, which is characterized as a modern form of private equity that engage in active ownership and the strategy of portfolio firms, have consistently outperformed the *Financial Investors,* which are the companies doing traditional private equity focusing on

financial engineering without taking active ownership. According to Klier et al. (2009), there are five success factors that are in common with the Interventionists. Interventionists act as 1) active shareholders, 2) align interests, 3) exploit advantages of *Portfolio Relatedness*, 4) avoid costs of *Corporate Infrastructure* and 5) invest in selling. The value-creation of active ownership will be elaborated on the subsections regarding.

The Structure of Private Equity Funds

Private equity firms are organized as either a partnership or as a limited liability corporation, in which partners of a PE management firm serve as general partners (GPs), and investors as the limited partners (LPs). The LPs typically include institutional investors, pension funds, endowment and insurance companies and high net-worth individuals who provide the funds and in return receive a return from the PE fund (Fenn, Liang, & Prows, 1995).

The PE-funds usually have a fixed life-span of ten years, but the life-span can be expanded three additional years if market conditions are unfavorable at the time of closing. The private equity firm typically spends up to five years investing the committed capital, and an additional five to eight years on developing the investments. In the fixed life-span of the PE funds, LPs have little influence on how GPs invest and manage the capital and related investments (Kaplan & Strömberg, 2008).

The funds usually purchase a controlling stake in a company. The purchases are typically financed through a combination of equity and high level of debt. PE funds typically invest in stable and mature companies that generate high operating cash flow. After the purchase, the PE fund further creates value through increased corporate governance, operational performance, and high leverage (Berg et al., 2007). This will be elaborated on in the following section.

Value Creation of Private Equity

Jensen (1989) predicted that privately held organizations would eventually become the dominant corporate organizational form. He argued that the private ownership of the portfolio firms by PE-funds create high incentives for the PE professionals, and subsequently an efficient organization. The efficiency is gained through aligned incentives, highly leveraged capital structures, and corporate governance. Jensen argued that these structures were superior to those of a typical public company with dispersed ownership, little financial leverage, and weak corporate governance.

Agency Costs and Value of Active Ownership

Agency costs arise from the separation of ownership and control, as in publicly listed companies. Shareholders own the company through their equity, while it is controlled by management. The motivation for the separation between ownership and control is that the capital providers need human capital to manage their funds, and the managers of the firm need external capital to finance business operations (Shleifer & Vishny, 1997).

The magnitude of agency costs in the firm depends on the degree of discretion in managerial decisions, the degree of misalignment between the interests of managers and owners, and the degree that management maximizes their own wealth rather than maximizing shareholder value (Shleifer & Vishny, 1997). Contracts can prevent agency costs, but it is very difficult and costly to write contracts that are sufficient to any ex-ante conflicts between owners and management. As a result, dealing with agency issues is a trade-off between costs and gains, and the owners must accept that some agency problems will remain (Grant, 2013).

The direct ownership following the purchase of a firm by a PE fund allows the fund to take advantage of agency costs reduction mechanisms, which can lead to improved operating performance of the portfolio firm (Jensen, 1989). These mechanisms will be examined further in the following.

The use of leverage to mitigate agency costs

One of the tools that a PE-fund apply, is to increase the level of debt in their portfolio companies. Abundant free cash-flow can be a source of agency costs in companies not owned by management. The management is more prone to engage in non-value-maximizing behavior if the company have excess liquidity.

Jensen (1989) emphasized how a high level of debt can help mitigate inefficient use of free cash flow by forcing managers to run the business efficiently to service the debt rather than spending abundant cash inefficiently. Further, the burden of debt forces managers to strive for profitable operations, as they want to avoid the bankruptcy and subsequently lose their jobs and stain their reputation (Jensen, 1986). As a result, increased default risk can create incentives for managers to work harder, make better investments, and spend less on perquisites. Thus, debt can be a tool to further align the interest between management and the owners (Berg, Gottschlag, & Oliver, 2007).

A secondary effect of debt is the increased governance from the external financial providers, as they also have incentives to monitor the management and make sure the firm can meet its obligations (Baker & Montgomery, 1994).

Incentive alignment

If managers do not possess any equity in their firms, they do not necessarily carry the financial consequences of their actions, which can lead to moral hazard (Jensen, 1986). Private equity funds, in general, increase the incentive alignment between owners and management through implementations of upside and downside mechanisms. After the acquisition of a new portfolio firm, the PE-fund provides incentive schemes to align the interests of managers and owners to reduce agency costs (Jensen, 1989). Managers are strongly encouraged to increase their equity share in the company. The managers can also be offered a stake in the company or incentivized by options or bonuses based on financial performance (Berg et al., 2007).

The change in status from manager to co-owner of a company can increase performance, as the managers are further incentivized to increase value-adding activities. By owning shares,

the managers will also experience an economical downside if the company does not perform well. The management is less inclined to spend money on unnecessary perks as this behavior will have a direct effect on their own wealth (Smith, 1990). In addition, Baker & Montgomery (1994) argue that PE funds have the right tools for incentivizing managers, as they own the company for a limited period and have extensive experience with incentive programs.

Monitoring

Another substantial factor of agency costs is the degree of monitoring and control exercised by the owners. Firms with dispersed ownership can be exposed to free-rider problems. Free-rider behavior can be seen when minority shareholders have little or no incentive to initiate active ownership because the cost is paid by the minority shareholder, but the gains are shared with the all other stockholders. (Thomsen & Conyon, 2012).

PE-funds change the governance structure and is often the largest shareholder with a controlling stake and therefore remove the free-rider problem. When the greater part of equity is in the hands of active owners, it increases monitoring, control, and controlling owner representation on the board of directors (Smith, 1990).

PE-funds are more active in the governance of their portfolio firm, and typically the fund aims to have at least one member from the fund present in the company's board. The representative of the PE fund often has expert knowledge and advanced monitoring experience (Berg et al., 2007).

Mentoring and Parenting

Mentoring effects, or parenting advantages as it is also called, is the board range positive spill-over effects of PE ownership on portfolio companies. The portfolio company will, as a part of the PE fund, have access to their resources and knowledge. Even though PE funds are active in managing their portfolio on different levels, they support the value creation in various ways through mentoring dependent on the needs of the firm (Berg et al., 2007).

The fund ownership of portfolio firms often promotes an entrepreneurial spirit. Before the acquisition, many companies have been found lack entrepreneurial spirit due to, e.g., lack of attention to non-core units, lack of resources, and risk aversion (Berg et al., 2007). The acquisition creates a new structure and governance to the company, which makes managers feel released from bureaucracy and subsequently achieve greater influence, as the PE-fund keep their influence at a strategic level. The managers are encouraged to act as entrepreneurs and to make independent decisions. Researchers have dubbed this effect as "LBO fever" because management is highly motivated and willing to act to make the buyout a success (Berg et al., 2007).

Another benefit of mentoring is the improved, and direct communication between the managers of the portfolio firm and their counterparts at the PE firm. The heightened communication can also utilize synergies (Kester & Luehrman, 1995). The PE firm has the role as an active advisor and brings different perspectives, management experiences and industry knowledge they gained from portfolio relatedness (Berg et al., 2007). In addition to being supportive, the PE firms do also invest heavily in selecting the right management and replace those who do not perform well. Further, the PE firm creates an ambitious work environment and set high financial targets (Baker & Montgomery, 1994).

Efficient Market Theory and Information Asymmetry

It is essential to know the basic capital market theory when measuring abnormal stock performance. Thus, the following will present the theory of efficient capital markets and the three degrees of market efficiency, weak, semi-strong and strong market efficiency as presented by Fama (1970). Further, information asymmetry, market timing, and window dressing will be examined.

Efficient markets

In the weak form of market efficiency, future prices cannot be predicted by analyzing past stock performance, i.e., abnormal returns in the long-run cannot be realized by using investment strategies based on historical data and information. Thus, investors cannot

systematically earn excess returns as stocks prices are random and don't reflect any information (Fama, 1970).

The semi-strong market efficiency is the most universally accepted form of market efficiency (Brealey, Meyers, & Franklin, 2016). In the case of semi-strong market efficiency, all accessible public information is reflected in the stock price, and new information will rapidly and in an unbiased way adjust the prices accordingly. Thus, is it not possible to predict abnormal returns by any analysis of public information. Investors can only achieve abnormal returns with non-public information, also called insider information (Fama, 1970).

In the strong form, share prices reflect all information, both public and private. Hence, in the case of strong market efficiency, it is not possible, even as an insider, to beat the market and gain abnormal returns as share prices reflect all available information. Thus, all traded equity will always be correctly valued (Fama, 1970).

Information asymmetry

As presented above, in the case of semi-strong market efficiency, abnormal returns can only be gained through insider information (Fama, 1970). Naturally, in the context of IPOs, there is information asymmetry between the owners, management of the firm and the outside investors who are considering buying shares of the firm going public.

The scenario of an IPO is subject to what Akerlof (1970) refers to as a lemon problem. Leland & Pyle (1977) argues that the lemon problem exists because of moral hazard of insiders. The owners are interested in achieving as high an opening price as possible, why they might want to be strategic about the information they share with the public. For instance, they could try to drive up the opening price by exaggerating the qualities of the firm or by suppressing information about the potential downsides of the company. Thus, there is information asymmetry between seller and buyer of an IPO (Leland & Pyle, 1977).

Market timing

The information asymmetry can be exploited by insiders to time the IPO to take place at a time when the market conditions are favorable, e.g., when firm's operations are at peak or when the market is in an upturn. The latter is called, *windows of opportunity*, which are periods where the investors are over-optimistic about the new prospects and stock prices are generally high (Coakley, Hadass, & Wood, 2007) (Ritter, 1991). Skilled managers can utilize these market conditions to maximize the value of the offering stocks. While

Firms typically choose to go public when their operational performance is impressive, (Fama, 1998) and (Ritter, 1991) find that the operational performance of IPOs tends to converge to the average level of the industry over time. Thus, the market may overprice the IPO initially but over time realize that the firm was not able to maintain the great operational performance in the long-run growth why the stock price will decline.

The managers can further exploit the information asymmetry and influence the price of the issue by using earnings management, which is also called window dressing.

Window dressing

As mentioned earlier, owners and management of firms going public have the incentive to maximize the gains from the IPO and therefore might present information in a favorable way. One way for managers to gain the desired effect is through *window dressing*.

Window dressing is the practice of influencing the firm's financial statements strategically to give the best possible impression of the firm's financial performance before the IPO (Jenkinson & Ljungqvist, 2001). Improving accounting accruals can be achieved in numerous ways of aggressive accounting methods, e.g., register earnings that will occur in the future, postpone costs, or changing the accounting practices in a way that benefits the short-term results. However, doing these practices will negatively affect future accounting performance.

Jenkinson & Ljungqvist (2001) argue that window dressing would not result in long-run underpricing of IPOs if there is no information asymmetry and outsiders can correctly assess

the performance of the firm. However, there generally is asymmetric information between the issuer and of an IPO and investors, why window dressing could result in mispricing.

Literature Review

This section will review the findings of related empirical studies of IPO performance and the impact of PE- and VC-sponsorship. First, we will review the studies examining the first-day returns of IPOs and the differences between IPO-sponsorship groups. Then, we will discuss the empirical research of long-run abnormal stock performance post-IPO. Throughout the remaining part of the paper, we will compare our findings to the reviewed literature.

First-day Pricing

As discussed in the theory section above, venture capital and private equity funds can generate additional value by constructing well-functioning corporate governance structures, increasing leverage and improving the operating efficiency of its portfolio firms. Thus, the PE-backed or VC-backed IPOs are often well-performing firms at the time they go public. A reason for the good performance might be because a professional and experienced fund has owned the firms before the IPO. Several studies show that the first-day returns and aftermarket performance are associated with IPO characteristics, such as the listed firm's market cap, leverage ratio, and owner-type at the time of the listing. Thus, there could be differences in first-day pricing across PE-backed, VC-backed and non-sponsored IPOs.

Schuster (2003) studied IPOs from seven European countries during 1988-1998 and found evidence of IPOs being significantly underpriced in the short-run in all seven countries. The magnitude of IPO underpricing was cyclical in some of the countries including Germany, but there were consistent positive returns throughout the sample.

First-day returns of sponsored IPOs

There are certain characteristics of PE- and VC-backed IPOs that differ from non-sponsored IPOs and might impact the offer price and first-day stock return. Megginson & Weiss (1991) found that VC-funds have often been involved in other IPOs within a few years. Therefore,

they might have built relationships with top-tier underwriters, auditors and institutional stakeholders. This finding can explain why the VC-fund and the underwriter have an added incentive to provide all information about the new listing genuinely.

By studying American IPOs from 1983 through 1987, Megginson & Weiss (1991) also find that VC-backed IPOs are significantly less underpriced than the control group of non-sponsored IPOs. Therefore, the VC-fund can extract more value from an IPO and thereby maximize the net funds to the firm being listed. Interestingly, the study also finds that VC-funds on average retains 26.3% of their share ownership after the listing – which corresponds to no more than an 8.0-percentage-point drop (Megginson & Weiss, 1991). Thus, the fact that the venture capital firm holds on to a substantial equity share imply expectations of the high operating and market performance of the newly listed firms.

In line with the findings of VC-backed IPOs, Bergström et al. (2006) found in a study of UK and French IPOs between 1994-2004, evidence of PE-backed IPOs being less underpriced on the first-day than the control group of non-sponsored IPOs. Bergström et al. (2006) also found that PE-backed IPOs are in general larger regarding issue size, which can partly explain why PE-backed IPOs are less underpriced.

In a comprehensive study of aftermarket performance of 1,595 British IPOs from 1992-2005, (Levis, 2011) finds sizeable differences of first-day returns across three groups; PE-backed, VC-backed and non-sponsored IPOs. The equal-weighted average first-day return of all IPOs were 18.6%, but this is primarily driven by the non-sponsored IPOs with an average of 21.1%. IPOs sponsored by a PE or VC fund, on the other hand, exhibited significantly more modest first-day returns. The IPOs backed by venture capital funds had equal-weighted mean gains of 14.9%, and the PE-backed IPOs were by far the less underpriced with an average first-day return of 9.1%. Levis also finds exciting results regarding the long-run performance across these three groups, which will be presented in the following section.

Long-run IPO Performance

There is a vast amount of literature that examines the long-run stock performance of IPOs, across different groups classified by type of ownership structure pre-IPO. Typically, the studies differentiate between three groups; PE-backed/sponsored IPOs, VC-backed IPOs and non-sponsored IPOs.

Aftermarket performance all IPOs

In an extensive study of 1,526 IPOs in the US from 1975-1984, Ritter (1991) found an anomaly in the pricing of initial public offerings. The studied IPOs were displaying significantly poor long-run abnormal stock returns. While other studies have documented substantial positive first-day returns of IPOs, Ritter (1991) found that IPOs, in general, appear to be overpriced in the long-run.

In Europe, other studies recognize the same picture of general IPO long-run underperformance. In the previously mentioned research by Schuster (2003), all seven European countries delivered negative average excess returns from the end of the first-day of trading to the three following years, when assuming monthly rebalancing. The underperformance was significant at the 0.01 alpha level in France, Italy and Spain.

Long-run performance of VC-backed IPOs

Some studies primarily focus on the correlation between venture capital ownership and aftermarket stock performance. One of the most extensive studies on this topic was initiated by Brav & Gompers (1997), who examined a large dataset of 934 VC-backed IPOs and 3,407 non-VC-backed IPOs in the United States from 1972-1992.

They found that VC-backed IPO listings had significantly better returns than the non-backed counterparts when weighting returns equally. These superior market returns could be due to the corporate governance structure of the VC-backed IPO firms, or the screening process of the VC-fund, as it is commonly known that VC-funds prioritize to invest in younger firms with high potential for long-term value creation.

In other countries than the US, there is no clear pattern of VC-backed IPOs outperforming non-sponsored IPOs. For instance, (Hamao et al., 2000) did not find any statistically significant difference in aftermarket performance of VC-backed and non-backed IPOs in a sample set of 355 Japanese IPO listings from 1989-1994.

Aftermarket performance of PE-backed IPOs

While there are mixed empirical results of VC-backed IPOs outperforming the market, there is more substantial evidence of PE-backed IPOs achieving superior aftermarket performance.

To understand the differences in post-IPO performance of three different ownership groups, Levis (2011) resonates that the efficiency instruments implemented by the private-equity owner continue to drive value after the holding period. For instance, it is likely that the improved management of the firm, capital structure, and financial practices will be maintained for at least a few years after the exit of the PE fund. Furthermore, Levis (2011) argues that the PE funds do not entirely dismiss their involvement in the portfolio company when it becomes listed, as there may be performance incentives or other agreements tying the PE fund's wealth to the performance of the IPO.

Levis (2011) found that the PE-backed IPOs significantly outperform the market-benchmark, VC-backed and non-sponsored IPOs over a 3-year period. The PE-backed IPOs had a 3-year buy-and-hold abnormal return (BHAR) of 13.84%, and the VC-backed had a BHAR at 3.92%. However, the VC-backed IPOs still had considerably better 36-months performance than the non-sponsored group of IPOs, which were found to have a BHAR of -20.20%, although the VC-backed result was statically insignificant (Levis, 2011).

The above findings are in line with (Katz, 2009), who studied PE-backed IPOs relative to non-backed in the US, Katz finds that companies with larger PE-sponsors display better aftermarket stock price and operational performance relative to firms owned by management.

Additional support for the superiority of PE-backed IPOs is provided by Bergström et al. (2006), who examined 1,522 IPOs from London- and Paris Stock Exchange from 1994-2004. In alignment with other studies, Bergström et al. observed evidence of long-run underperformance of IPOs in general. Additionally, they also found that private-equity-backed IPOs outperformed non-PE-backed IPOs across all measured time horizons (Bergström et al., 2006).

PE-sponsored IPOs in Scandinavia

There is sparse evidence regarding the aftermarket performance of PE-backed IPOs in Scandinavia, which is this paper's focus. Three small studies by corporate authors have been found and will be discussed in the following.

In an analysis report conducted by the Swedish Private Equity & Venture Capital Association (SVCA, 2015), 50 Swedish IPOs on the main Stockholm Stock Exchange from 2001 to 2014 were categorized into two groups; PE-backed IPOs[1] and Non-PE IPOs. This study indicates a correlation between the previous owner and market performance in Sweden. The group of PE-backed IPOs achieved substantial better absolute market returns relative to the non-PE IPOs over 1-, 3- and 5-years and 10-years. However, when comparing excess returns, the non-PE group of IPOs achieved slightly higher 5-year performances, while the PE-group had substantial higher excess returns across the three other periods.

A very similar study was conducted was conducted by KPMG (2016), which extended the dataset by SVCA to October 2016, reaching a total of 74 IPOs. Thus, this study is connected to the SVCA study, since it in part relies on the IPOs screened by SVCA. This study confirmed that the group of Swedish PE-backed IPOs demonstrated better absolute and excess market returns than the non-sponsored IPOs in the 1-, 3- and 5-year horizons, while the 10-year horizon had ambiguous results.[2]

[1] The *PE-backed IPOs* group of the SVCA (2015) study includes both PE-sponsored and VC-sponsored IPOs

[2] The 10-year horizon analysis is based on a small sample size. The group of non-PE IPOs (n=11) had a superior absolute average return, while the PE-IPOs (n=8) had a better absolute median return.

In Denmark, there is a limited number of IPOs, but the Danish VC and PE association DVCA (2017) found that a portfolio comprising of seven PE-backed Danish IPOs from 2010-2017, achieved a superior return compared to the C20-index benchmark.

We found limited evidence of PE-backed IPOs outperforming non-sponsored IPOs in Scandinavia. The three reviewed studies can be critiqued since they are performed by private equity associations that might have interest in PE-backed IPOs perform well. Thus, the studies might not be completely objective and could have been biased in the applied methodology, i.e., in selecting which non-backed IPOs to include in the dataset. The studies have relatively small sample sizes and do not assess the statistical significance of the results. In addition, these three studies use the broad stock index as benchmark, which is not ideal, as it may lead to misleading results. This will be discussed further in Chapter 3.

Literature Review Conclusion

In conclusion, most of the reviewed literature reveal that IPOs, in general, have positive first-day returns, but perform worse than the market in the years following the listing (the aftermarket). Furthermore, several studies find that PE-backed IPOs, in fact, achieve better long-term abnormal stock returns than non-sponsored IPOs. The results were more mixed regarding the aftermarket performance of VC-backed IPOs.

The relationship between PE-sponsors and superior aftermarket performance indicates that the type of owner at the time of the IPO can impact stock performance. Furthermore, the reviewed studies showed that the abnormal stock performance of PE-backed IPOs is present across multiple markets including the US and several European counties. The fact that the reviewed PE-studies have involved IPOs from 1992 to 2016 and multiple countries could indicate that the outperformance of PE-backed IPOs is not a temporary or local effect. However, there is sparse evidence regarding Scandinavian IPOs, which this study examines, and some of the reviewed studies use a methodology that could lead to misleading results.

There could be several explanations, why the PE-backed IPOs demonstrate better market results. As some studies suggest, it could be that some of the characteristics of PE-backed

IPOs - such as market cap and leverage ratio - are associated with higher post-IPO performance. Perhaps PE-backed IPOs are associated with some risk-factors that are not included in the performance models of the reviewed literature. Levis found evidence that PE-backed IPOs were being offered at relatively low-priced long-run valuations, but achieve smaller first-day results than the other groups, which is likely due to high debt-levels at the time of the IPO and widespread market perception of aggressive IPO-pricing by private equity funds (Levis, 2011). Levis (2011) also discovers that PE-funds can drive better operational performance in its portfolio companies and that the operational efficiencies continue in the years following the IPO – which Levis argues may surprise investors. In conclusion, there are several indications of superior abnormal returns among PE-backed IPOs, but there is no consensus of why they achieve better abnormal stock returns. Thus, whether this market anomaly of superior PE-backed stock returns is persistent in the long-run, and the underlying explanations why it exists, are yet to be discovered.

Chapter 3 – Data and Methodology

This chapter will outline the applied methodology of this paper and the retrieved data. Studies of long-run abnormal returns are sensitive to the applied methodology (Brav et al., 2000). It is crucial to closely consider the methodology and data steps that might affect the results to conduct objective research of the long-run stock performance. Thus, we will thoroughly examine the methodology of this paper and how it relates to previous studies on long-run stock performance.

Methodology

Benchmarks

To examine the stock returns of the IPOs in the data sample, we need to compare the absolute stock returns with the market benchmark to correct for the IPO timing and market trends. Accordingly, this paper examines abnormal returns rather than absolute stock returns. However, to correctly calculate the abnormal returns of the IPOs, the market benchmark needs to be as comparable to the studied IPOs as possible.

We do not use a broad stock exchange index, such as the S&P500, as the benchmark, as this has been criticized by other researchers. Loughran & Ritter (2000) argue that the benchmark used must exclude all the companies in the sample. Otherwise, if the applied benchmark contains many firms that are also the subject of the test, *Benchmark contamination* will occur. Benchmark contamination leads to biased statistical results towards lower or no abnormal returns (Loughran & Ritter, 2000).

Brav et al. (2000) found that the conclusions regarding IPO long-run abnormal performance are very sensitive to the applied benchmarks. They suggest that the researcher should match the risk-related characteristics of the benchmark portfolio-companies to those being examined in the sample set (Brav et al., 2000). In other words, the group of companies in the benchmark should be as comparable to the sample as possible.

Levis (2011) uses four different benchmarks, where the first is the broad UK index, the second adjusts for the market cap of the companies, the third adjusts for the industry, and the last benchmark adjusts for the size and book-to-market. The portfolio returns of the benchmarks in the Levis (2011) study were calculated on a monthly basis and rebalanced twice a year. In line with the findings of Brav et al. (2000), the results of the Levis (2011) were sensitive to the applied benchmark. The 36-month abnormal returns varied in magnitude, significance and even in sign direction dependent on the applied benchmark. Levis (2011) found that the average stock performance of the sample IPOs was negatively affected by the small IPOs, which showed substantial underperformance relative to large firms. Similar results of underperformance among small firms were found in a study of US listings by Ritter (1991), who also found the average stock returns differed across industry classification. Thus, related literature has found evidence of both company size and industry affecting long-run stock performance. Hence, a study of abnormal stock performance should take these factors into account, i.e., through constructing adjusted benchmarks to get as unbiased results as possible.

Benchmark Groups

Based on the literature discussion, this paper chooses to exclude all the sample IPO companies from the stock index. Furthermore, to make the benchmark as comparable to the examined IPOs as possible, this paper chooses to decompose the stock indices into individual benchmark groups based on industry and market value. To identify industry across the benchmarks and sample, we use the Datastream's *Level 2 sector code*, which consists of 10 overall sectors; Basic Materials, Consumer Goods, Consumer Services, Financials, Healthcare, Industrials, Oil & Gas, Technology, Telecommunications, Utilities.

To categorize the IPOs regarding size, market cap at the time of the listing will be used as a proxy for company size. Nasdaq segments the companies into three groups depending on their market cap following the official Nordic market cap segmentation. The listed companies with a market cap exceeding EUR 1 billion are categorized as *Large Cap*, while *Mid Cap* consists of the stocks with a market cap between EUR 150 million and EUR 1 billion, and *Small Cap* is companies with a market cap below EUR 150 million (Nasdaq, 2017). In line with the

Nasdaq market segmentation, this paper will likewise classify companies into the three size segments.

The ten industries and the three market cap segments yield a total of 30 different adjusted benchmarks as seen in Table 1. In addition, to examine the effect of using adjusted benchmarks, this study will also present the data of abnormal returns using a Nordic unadjusted benchmark.

Table 1 – Size- and Industry-Adjusted Benchmark Groups

Benchmark groups	Small	Mid	Large
Basic Materials	S1	M1	L1
Consumer Goods	S2	M2	L2
Consumer Services	S3	M3	L3
Financials	S4	M4	L4
Healthcare	S5	M5	L5
Industrials	S6	M6	L6
Oil & Gas	S7	M7	L7
Technology	S8	M8	L8
Telecommunications	S9	M9	L9
Utilities	S10	M10	L10
Nordic non-adjusted	ALL		

In theory, the benchmarks would be even better for measuring abnormal performance if they were further decomposed into groups that also took the stock-exchange country or the market-to-book ratios into account. However, when adding more criteria to adjust benchmarks, the number of different benchmarks quickly becomes out of scope. For instance, if the study should also adjust for countries, there would be 120 individual benchmarks. Besides, we assess the markets in Denmark, Sweden, Norway and Finland to be quite homogenous regarding size, taxation, political risks, and opportunities, why we find it acceptable to consider the market as one.

Event and Calendar Time

The majority of empirical work on long-run performance following IPO´s is based on event-time returns. The performance of the individual stocks is considered in separation and calculated across the stocks from the time of the event, the IPO. The event-time approach

weights events separately. An alternative approach is a calendar-time approach, where the performance of the stocks is considered with a focus on the period, e.g., each month. This approach weights months equally, although researchers have found IPO´s to cluster in time (Schultz, 2003). The event-time approach has been found to increase underperformance of IPO´s relative to measuring returns using the calendar-time method (Schultz, 2003). Loughran & Ritter (2000) also find IPO stock performance to be lower using the event-time method than calendar-time. Furthermore, they argue that issuers can time the offering to make the most of market mispricings and this would be captured in event-time but not in calendar-time. As a result, they argue that tests using the event-time approach have more power than tests using the calendar-time approach.

Schultz (2003) further argue the event-time measure is the most appropriate measure, as IPO´s cluster in time as firms to go public more frequently when equity is expensive, consequently IPO´s cluster in time. Hence, an event-time study the most suitable approach for this study as it considers the performance of stocks separately and disregards clustering of IPO´s in time.

Based on the above this study finds an event-time focus is most suitable to examine long-run performance and the characteristics of each offering are of interest. The choice of event-time is further supported by the majority of related literature on the long-run performance of IPO´s who apply this method (Levis, 2011) (Schultz, 2003) (Ritter, 1991) (Goergen et al., 2007).

Operating performance or stock market returns

The majority of previous studies of the long-run performance of IPO´s have focused on either operating performance or stock performance. The difference in the two measurements of performance does coincide but also have crucial differences. Operating performance is an accounting based measurement on past performance of the firm where stock performance is based on investor´s expectations on future earnings of the firm. Hence, stock prices contain more information than accounting measures and are a better measurement of performance.

In line with the majority of prior studies on the subject of this paper, see, e.g. (Levis, 2011) and (Ritter, 1991), and the considerations above. This paper will focus on stock returns as a measurement of long-run performance.

Defining long-run performance

When assessing the stock-price performance of IPOs, there are found notable differences in how to define long-run performance across different IPO studies. While some studies including (Bergström et al., 2006) consider the long-run performance across multiple horizons, the predominant part of the literature measures long-run performance as the first 36-months post-IPO. Levis (2011) uses the 36-month period but excludes the first calendar month of the IPO. To get valid results on long-run performance, it is important to exclude the first month, as previous research has found substantial first-day gains among IPOs. Considering the above and further to be able to compare the results of this paper to the other empirical studies, this paper chooses to define the long-run in the same way; the 36-month stock return excluding the remaining days of the calendar month of IPO.

Equal and value weights

In most related literature including Levis (2011) and Bergström et al. (2006), the long-run stock returns of the different IPO groups have been presented on both an equal and value-weighted basis. The most straightforward way is to present the results using equal weighting, where the stock returns are assigned an equal weight regardless of their size relative to the portfolio. The other method of *value weighting* uses the stock's relative size of the portfolio to weight the stock returns. Levis (2011) uses the market cap at the time of the IPO to weight the returns. As discussed by Loughran & Ritter (2000), choosing how to weight the portfolios has a substantial impact on the results and statistical tests.

Brav et al. (2000) argue that the equal weighting method might be preferable if the alternative hypothesis proposes that small stocks differ from large stocks regarding IPO mispricing and the long-run abnormal stock returns. However, if the study seeks to examine the investors' change in wealth, they deem the value weighting as more suitable.

Based on the discussion above, this paper will calculate the long-run performance on both the equal and value weighted basis, as comparing the results of each weighting method can generate additional interpretations. In line with Levis (2011), the market cap at the time of the listing will be used to weight the monthly IPO returns.

Measures of Abnormal Returns

Prior literature has applied a variety of methods for measuring the long-run performance of IPO´s. The two most common are the cumulative abnormal returns (CAR) and buy-and-hold abnormal return (BHAR). As opposed to CAR, BHAR resembles the real buy-and-hold experience and are a more precise measure of an investor's return (Lyon, Barber, & Tsai, 1999). However, some researchers argue that CAR produces better statistical test and are less likely to yield false rejections of the null hypothesis (Fama, 1998) (Mitchell & Stafford, 1998). Some studies apply both measures, e.g. (Goergen, Khurshed, & Mudambi, 2007) while others only use BHAR, e.g. (Levis, 2011). In this paper, both methods will be applied and reported as they both add value to the study.

BHAR

Mitchell & Stafford (1998, p. 296) define BHAR returns as "The average multiyear return from a strategy of investing in all firms that complete an event and selling at the end of a prespecified holding period versus a comparable strategy using otherwise similar non-event firms". Thus, BHAR is the Buy-and-Hold Abnormal Return, which is the difference between the absolute buy-and-hold return of the IPO group and the normal buy-and-hold return of the benchmark group. The mathematical definition of the weighted BHAR is as follows:

$$BHAR = w_i \sum_{i}^{N} \left[\prod_{t=1}^{T} (1 + R_{i,t}) - \prod_{t=1}^{T} (1 + R_{b,t}) \right]$$

where

$$w_i = \frac{1}{N}, \qquad w_i = Mcap_i / \sum_{i}^{N} Mcap_i$$

W_i is the weight of the firm using either equal weights, as in the first equation, or value weights based on the market cap. $R_{i,t}$ and $R_{b,t}$ is respectively the return of the individual firm *i* and the benchmark *b* in at time *t*.

The distribution of BHAR returns poses a problem to test statistics. Over a long horizon, BHAR tends to be right skewed, even after adjusting for a benchmark. The skewness is due to the lower bound of returns is -100% while there is no upside bound (Kothari & Warner, 2004). Brav (2000) also concluded that the right-skewed distribution of abnormal returns conveys the Student t-distribution to be asymmetric with a mean smaller than zero. To address the issue, Lyon et al. (1999) make use of a bootstrapped skewness adjusted t-statistic (t_{sa}), which is calculated as it follows:

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

where

$$S = \frac{\overline{BHAR_T}}{\sigma(BHAR_T)}$$

and

$$\hat{\gamma} = \frac{\sum_{i=1}^{N}(BHAR_{iT} - \overline{BHAR_T})^3}{n\sigma(BHAR_T)^3}$$

Where $\overline{BHAR}$ is the sample mean, $\sigma(BAHR)$ is the cross-sectional sample standard deviation, and *n* is the number of sample firms. The $\hat{\gamma}$ coefficient is a measure of the skewness, while $\sqrt{n}S$ is the conventional t-statistic (Lyon et al., 1999).

CAR

CAR is calculated as the cumulative benchmark-adjusted returns from event month *q* to event month *s* in summation of the average benchmarked returns. In other words, it is the sum of each month´s average abnormal return. The mathematical definition of the weighted CAR is as follows:

$$CAR_{q,s} = \sum_{t=1}^{T} w_i \sum_{i}^{N} (R_{i,t} - R_{b,t})$$

where

$$w_i = \frac{1}{N}, \qquad w_i = Mcap_i / \sum_{i}^{N} Mcap_i$$

W_i is the weight of the firm using either equal weights, as in the first equation, or value weights based on the market cap. $R_{i,t}$ and $R_{b,t}$ is respectively the return of the individual firm *i* and the benchmark *b* in at time *t*.

To assess the statistical significance of CAR this paper will apply the Crude Dependence Adjusted t-test developed by Brown & Warner (1980) and applied by Goergen et al. (2007). The test takes into account a cross-sectional dependence in the performance measure, in this case, the CAR. Cross-sectional dependence in the sample can arise from clustering of events in calendar time. Consequently, the number of firms with independent event months will decrease and affect the test (Brown & Warner, 1980). The mathematical definition of the Crude Dependence Adjusted t-test is as follows:

$$t_{stat} = \frac{CAR_t}{\sqrt{t * \left[\sum_{t=1}^{T} (\overline{AR_t} - \left(\frac{CAR_{36}}{36}\right))^2\right] / (35)}}$$

Where CAR_t is the sample cumulative abnormal return till month t, CAR_{36} is the cumulative abnormal return for the 36 months after the IPO and $\overline{AR_t}$ is the average abnormal return in the month t.

Data

This section will present the dataset of Nordic IPOs used in this study. The sample used in this study is comprised of companies that were publicly listed in Denmark, Sweden, Norway or Finland from January 1st, 2005 to December 31st, 2014. Since this study examines the 36-month stock returns of IPOs, the companies in this dataset must have been listed at least

three years ago, which is why ultimo 2014 has been chosen as the end date. Thus, it leaves us with a ten-year period of listings across four countries.

Databases

We have had limited access to financial databases, why we have used the ones available through Copenhagen Business School, which includes *Bloomberg*, *Zephyr,* and *Datastream*. It has been a challenge to identify and classify the IPOs due to variations across the databases. At first, the *Bloomberg IPO function* was used to identify a broad list of 314 public listings. Then a similar export of IPOs has been conducted using the Zephyr database. Surprisingly, there was discovered large discrepancies between these two databases. Several Zephyr IPOs were not found through the Bloomberg export, and likewise, Zephyr was missing around a fourth of the IPOs discovered through Bloomberg. Thus, both databases were lacking lots of information, which is why none of the databases could be relied upon on its own. To include as many valid IPOs as possible, the two datasets were merged to one large excel sheet comprising all the unique listings found by the two databases. We have not found any systematic patterns of missing data from the databases. Therefore we assess that the two databases are incomplete but not biased.

Exclusion of IPOs

Many the listings retrieved through the databases have been excluded, as they do not live up to the criteria set by the authors. We only include the IPOs that fulfill the following criteria:

1) The company must have been listed on the country's main stock exchange. Thus, we exclude all listings on the secondary markets including Oslo Axess, AktieTorget, and the First North exchange.
2) The IPO firm must be incorporated in Denmark, Sweden, Norway or Finland. We use the companies ISIN codes to assess this. We exclude all IPO of firms with ISIN codes not starting with DK, SE, NO or FI
3) The IPO must be a first-time listing. Thus cross-listings, secondary listings, spin-offs and demergers have been excluded.

4) Listings in industry sectors where PE/VC-firms are not active have been excluded. This includes asset managers, investment companies, and PE-funds going public

In addition, we excluded the IPOs of which we were not able to retrieve returns using *Datastream*.

Assessment of Selection Bias

Due to the missing reliability of the two databases used, it cannot be rejected that some IPOs are missing in the dataset. If there are missing IPOs in the dataset, then these are likely to be some of the smaller IPOs, since the financial databases typically contain information of all large companies. Furthermore, three IPOs have been excluded due to missing stock-price information. These IPOs had small initial market caps and were prior to 2008. Hence, we do not have a completely random dataset due to data limitations. Our sample set will thus contain selection bias to some extent. The excluded companies are likely to have been traded for a short period of time, with small market caps which have been associated with poor post-IPO performance by Levis (2011). Thus, the selection bias in this sample is expected to bias the average IPO performance slightly upwards. However, it is assessed that our dataset is objective and comprehensive enough to run statistical tests, but that we should be cautious when making conclusions of long-run stock performance as suggested by Kothari & Warner (1997).

Stock Price Data

Datastream's Time Series Request is used to retrieve stock performance data. Datastream can find unadjusted and adjusted stock prices for all of the 158 remaining IPOs. However, to calculate the long-run stock performance, the adjusted stock prices cannot be used, as it does not take potential dividends into account. Instead, the time series datatype, *Total Return Index*, is used. This datatype provides the theoretical growth in value of a stock holding, assuming that the dividends are reinvested to purchase additional units of the stock.[3]

[3] Datastream, Total Return Index description

We believe the *Total Return Index* is the most suitable measure for calculating the long-run stock performance, as it includes both capital gains and dividend income. In addition, it assumes that the dividends are re-invested, which makes it comparable across companies with different dividend policies.

The Total Return Indices are retrieved from 01/01/2005 to 01/01/2018 on a monthly frequency (157 months). For each listed company, the first observation marks the return of the partial first month that the company was traded. For instance, the first available Total Return Index for Matas A/S is on the date 01-07-2013 with a Total Return Index of 98.74. Matas was listed on 28-06-2013, which is why this data point shows us that Matas' stock price dropped by 1.26% during the first three days of trading. The first partial month of each company is notated as *Month-0*. Thus, Month-0 always include the first-day of trading, which is known to be very volatile as described in the literature review. For Matas A/S, the Total Return Index at *Month-36* (01-07-2016) had risen to 110.5. Since the partial first month is excluded in the 36-month long-run performance, we can calculate the 36-month absolute total return as the relative percentage between the Total Return Index at the end of *Month-0* and *Month-36* as: $\frac{110.5}{98.74} - 1 = 11.91\%$.

Market capitalization

In the same fashion, Datastream is used to retrieve the Market Capitalization of each IPO. The market cap is retrieved on a daily basis to collect the market cap on the opening day. However, it has not been possible to access the market cap at the exact time of the IPO opening through Datastream, why the market cap at the end of the first-day of trading is used instead. This is assessed as an acceptable proxy of the opening market cap, even though the related literature has shown that the stock prices typically rise the first-day. Thus the market cap in our dataset is expected to be slightly biased towards larger market caps than the actual opening market cap.

Benchmark Stocks

Datastream is used to retrieve all the companies publicly traded on the exchanges in Stockholm, Oslo, Copenhagen, and Helsinki. While Datastream was able to find industry data

for all of the 158 IPOs in the sample set, industry information are missing for around 10% of the benchmark companies, why these have been excluded. Furthermore, the companies listed on the exchanges with non-Scandinavian ISIN codes have also been excluded, as they were also excluded from the list of IPOs.

Unfortunately, Datastream does not provide any information on whether the stocks are listed on the main market or one of the secondary stock exchanges such as *Aktietorget*. With around 3,000 stocks, a manual selection phase is out of scope, why this study chooses to use the market cap as a proxy for whether the stock is listed on the main or secondary market. The market value requirement for a listing on a main Nordic market is surprisingly no more than EUR 1 million according to official sources (Nasdaq, 2018). However, in a published Q&A session with the CEO of Aktietorget, the average market cap of the companies listed on Aktietorget is said to be around SEK 100 million, which corresponds to around EUR 9.6 million (Aktietorget, 2018). Assuming that most companies on the Nordic secondary markets have market caps around the Swedish average, it is expected that the majority of the stocks on the secondary exchanges have a market cap below EUR 20 million. Thus, this paper chooses to exclude all stocks with a market cap below EUR 20 million from the Small Cap segment, why the benchmark Small Cap segment have market caps in the range of EUR 20-150 million.

Calculating BHAR and CAR

Since this paper conducts an event-study of IPOs, it must combine event-time absolute returns from the IPOs with calendar time performance for the corresponding benchmark stocks, which makes the calculations a bit challenging. When the event-time absolute returns of the individual IPOs are calculated, the abnormal return of a specific month is calculated by subtracting the benchmark group's absolute returns of the corresponding calendar month.

Delisted IPOs

Around 85% of the studied IPOs were still traded 36 months are its public offering. Thus around 15% of the IPOs were delisted before it had been traded for 36 months, due to

bankruptcies, like the case of Danish OW Bunker, or due to acquisitions or private-takeovers. When a company delists, its monthly returns are fixed at 0% for the rest of the examined return period. If assuming that the IPOs in general exhibit positive absolute returns, then keeping the delisted IPOs throughout the 36-month event period would reduce the average return, since the 0%-returns of the inactive companies would still be weighted in line with the other active firms of the IPO group.

However, when using the Buy-and-hold-abnormal-return (BHAR) measure, it is not possible to stop weighing the delisted firms, once they become delisted. In other words, it is not possible to weight only a part of the firm's traded period. This is due to the nature of the mathematical function of BHAR, where the individual firm's total BHAR throughout the total 36-month period is calculated *before* the firms are weighted on an equal or value weighted basis.

$$BHAR = w_i \sum_{i}^{N} \left[\prod_{t=1}^{T} (1 + R_{i,t}) - \prod_{t=1}^{T} (1 + R_{b,t}) \right]$$

Since it is not possible to remove only the part of the IPO's delisted period, the only option to avoid the BHAR-measure being influenced by the repeated months of zero returns would be to remove the delisted IPOs from the sample completely, but this is not preferable. If the exiting IPOs are completely removed from the sample, then the measured long-run performance would be an average of the 85% of IPOs that 'survived' the first 3 years of trading. This is known as *survivorship bias*, which is expected to bias the absolute stock-performance in a positive direction Kothari & Warner (1997).

When calculating CAR the IPOs are weighted monthly unlike the BHAR measure, why one, in theory, could choose to avoid weighting the zero returns once an IPO becomes delisted. However, to avoid the survivorship bias, we choose to keep the delisted IPOs in the dataset and weight them throughout the 36-month period for both BHAR and CAR, which is in line with the methodology of other studies including Levis (2011) and Bergström et al. (2006).

Constructing Benchmarks

As mentioned earlier, this study will construct multiple benchmarks, so that IPO returns will be compared to listed companies of similar industry class and market values. To get accurate and comparable industry data, the industry classifications have to be retrieved from a single database. Since Datastream is used to retrieve the Total Return Indices for the benchmark and IPO sample, Datastream will also be used to retrieve industry code.

An overview of the IPOs in the sample set across industry and market cap segmentation can be seen in Table 2. We notice that the majority of the IPOs are in the Small Cap majority, while only 14 IPOs became 1st time listed with a market cap exceeding EUR 1 billion. The dataset contains IPOs within all ten industries, but only a few IPOs are in the Telecommunications and Utilities sectors.

Table 2 – Sample Overview of Industry and Market Cap Segmentation

Industry / Market cap	Small Cap	Mid Cap	Large Cap	Total
Basic Materials	3	3	2	**8**
Consumer Goods	7	12	1	**20**
Consumer Services	9	9	1	**19**
Financials	7	4	2	**13**
Healthcare	15	7	1	**23**
Industrials	15	14	3	**32**
Oil & Gas	7	14	3	**24**
Technology	14	1		**15**
Telecommunications	2		1	**3**
Utilities	1			**1**
Total	**80**	**64**	**14**	**158**

Calculation of benchmark returns

In line with Loughran & Ritter (2000), all the IPOs in the dataset have been excluded from the list of benchmark companies to avoid benchmark contamination. This leaves us with 1,232 traded benchmark companies. First, the monthly returns of benchmark companies are calculated based on the Total Return Index in the same manner as mentioned with the IPO companies.

Having calculated the absolute returns of the 1,232 benchmark companies, the benchmark companies are distributed into the thirty different benchmark groups based on market cap and industry. While the industry classification is fixed, the benchmark companies are readjusted monthly accounting for changes in market capitalization.

A large portfolio weight matrix is constructed, which gives each stock a monthly benchmark group classification such as "S6" corresponding to the industry and market cap at the time. The portfolio matrix is in calendar time from 01-01-2005 to 01-01-2018 and is used for lookups to calculate the benchmark returns for the individual IPO stocks.

Benchmark average absolute returns

Finally, the monthly absolute returns of the benchmark groups can be calculated by multiplying the stock returns with the portfolio matrix and divide by the number of companies in the given portfolio. Thus, the absolute returns of the thirty benchmark groups are calculated in calendar time using equal weighting for simplicity due to the scope of this paper. However, most of the common stock indices are reported on a market-cap weighted basis, where the portfolio index return is very dependent on the return of the largest companies (Investopedia, 2018). There could potentially be significant differences from applying value- or equally weighted benchmarks, which is supported by Brav et al. (2000), who found that the cumulative returns of the S&P500 index were higher when applying equal weights than the value weights in their sample period. Nevertheless, being aware of the potential error, it is deemed as acceptable to use equal weighting only when calculating benchmark returns since the benchmark groups already account for market cap to some extent through the classification of three size groups. In addition, this study focuses on the differences in performance across the IPO groups rather than the measuring the magnitude of underperformance of the whole IPO sample. The average monthly returns throughout the entire return period can be seen in Table 3.

Table 3 – Benchmark Group Returns

Average monthly returns of the 30 benchmark groups from 2005-2018.
Source: Datastream

Avg. monthly return '05-'18	Small	Mid	Large
Basic Materials	1.31%	1.47%	1.32%
Consumer Goods	1.15%	1.55%	1.64%
Consumer Services	0.94%	1.31%	1.60%
Financials	0.89%	1.38%	1.51%
Healthcare	2.10%	2.11%	1.71%
Industrials	1.26%	1.79%	1.80%
Oil & Gas	0.67%	1.29%	1.98%
Technology	1.83%	2.26%	1.15%
Telecommunications	1.65%	1.11%	1.25%
Utilities	0.37%	1.64%	1.07%

From Table 3 we see that there are substantial differences in stock returns across industries and the company size. Companies of the same industry are expected to have similar levels of systematic risk and thus beta values. The Healthcare industry exhibits the highest average returns of the industries. It is also notable that the small stocks, in general, are performing worse than the stocks in the Mid- and Large-Cap segment. The fact that the average monthly benchmark returns range from 0.37% to 2.26% indicates the importance of using adjusted benchmarks rather than a broad stock index.

Delisted Benchmark Stocks

Methodology complications arise when considering how to deal with the portfolio weights of the stocks that become delisted during the return horizon. A substantial part of the benchmark companies has been delisted during the examined return period from 2005 to 2018. As with delisted IPOs, the monthly returns of a delisted companies are fixed at 0% for subsequent months. It is a problem to keep weighing the returns of the delisted benchmark companies since the benchmark portfolio will likely have more delisted firms at a given time than the IPO group. The IPOs are measured in event time, why they are all traded at least at month 1. But when assessing the benchmark portfolio of a single IPO, there might be multiple firms that were already delisted from the beginning of the 3-year event period. For instance, the Danish company Zealand Pharma A/S went public in November 2010 and is a part of the benchmark group M5. In this benchmark group, 4 out of 17 companies were already delisted

from the beginning of the 36-month period starting November 2010. If the delisted stocks are kept in the benchmark portfolios, the average monthly return of that portfolio would be shifted towards zero, which makes the IPO groups appear to be performing better.

Rebalancing Benchmark Portfolio Weights

One way to deal with the issue of delisting companies is to exclude the exiting companies from the benchmark portfolios by setting their portfolio weight to 0 for the remaining period once they become delisted. This method of rebalancing is used by Levis (2011), who rebalances the benchmark portfolios on a semiannual basis, and Ritter (1991) who use monthly rebalancing with the returns of delisted firms equally allocated to the surviving firms.

However, the rebalancing method leaves us with a consistency issue, as the delisted IPO companies are not excluded but kept in the sample and weighted throughout the 36-month to avoid survivorship bias. It is assessed, that this rebalancing methodology will lead to slightly higher benchmark returns than for the IPO group, why using this method will likely to some extent exaggerate the long-run underperformance of all IPOs. Thus, the long-run IPO underperformance documented by Ritter (1991) and Levis (2011) among others, might be due to their methodology of rebalancing the benchmark portfolios while the returns of the delisted IPOs are weighted throughout the sample period.

Individual Benchmark Groups with Locked-In Portfolio Weights

This study proposes an alternative method to deal with the issues of delisted stocks and the problems associated with rebalancing the portfolio weights of the benchmarks. To make the benchmark portfolio as comparable to the group of IPOs, we construct individually benchmark portfolios for each IPO by constructing a portfolio comprising of all the companies in the benchmark group that were actively traded at the time of the given IPO. Thus, all the companies in the benchmark groups are traded at event-month 0 like it is the case of the IPO groups. This portfolio of benchmark companies is then “locked-in” and not rebalanced for the 3-years that the IPO abnormal performance is measured. Since the company weights are

locked-in instead of rebalanced, the returns of benchmark companies that become delisted during the 36-month period will continue to be weighted like it is the case of the IPO groups.

In conclusion, this proposed model of individual and fixed benchmark portfolio weights resembles the way the IPO groups are weighted; all stocks are actively traded at month 0, but any delisted stocks will be kept in the portfolio. This method is believed to provide lower benchmark returns than the first method of monthly-rebalancing, where delisted firms are removed once they become inactive. Thus, this method should provide less underperformance (or increased outperformance) of the IPO groups.

To assess the effect of our proposed method of individual benchmark portfolios with locked-in weights, this study will calculate the long-run stock performance in two ways: using monthly rebalanced benchmarks that only weights active firms, and by determining unique benchmark portfolios to each IPO at the time of the listing and locking these weights for the subsequent three years.

Classification of IPO Groups

This paper classifies the IPOs of the sample into three groups; PE-backed, VC-backed and non-sponsored IPOs. The identification of PE-backed and VC-backed IPOs can be an issue due to the limited public information in the private equity and venture capital sector. Furthermore, overlaps between PE and VC sponsorship occur as some funds undertake both buyout and venture investments. Hence, we need clear criteria to determine the type of IPO-sponsorship. This paper will draw inspiration from Levis (2011) in setting up the criteria for selecting the kind of sponsorship. Levis defines an IPO as PE-backed if the PE fund acquired a controlling stake in the company at the time of acquisition. Likewise, Levis defines a VC-backed IPO as one where a VC-sponsor has acquired a minority stake.

We classify the IPOs based on the ownership data retrieved from Datastream and Zephyr. We use the ownership data at the time of the IPO and assess each IPO manually using the criteria discussed below.

We classify an IPO as PE-backed in our sample if it meets the following criteria. Firstly, the IPO must have an owner, which is defined as a PE fund by Zephyr, Bloomberg or Datastream. Secondly, the PE-fund or consortium of funds must have a controlling stake or own the majority of voting rights the time of the IPO. Thus, IPOs, where PE-funds own less than 50% at the time of the IPO, are not classified as PE-backed if the PE-funds do not own the majority of the voting shares. This method of using ownership data at the time of the listing is deemed as acceptable. However, it would be favorable to examine whether the PE-funds acquired a majority stake at the time they initially invested in the company going public, as this would be a better indication of whether it was a buyout transaction or not.

We classify an IPO as VC-backed if it satisfies two sets of criteria. Firstly, the IPO must be partially owned by a fund which is defined as a VC-fund by the used databases or Nordic Venture Capital Association (NVCA). Secondly, the VC-fund must hold a minority stake in the firm at the time of IPO.

We define the remaining IPOs, which could not be classified as PE- or VC-backed, as non-sponsored IPOs.

Our classification of IPOs follows the above criteria in an objective way, but the ownership data for a large share of the IPOs had to be retrieved on a case by case basis through reading the IPO prospectus. Due to this approach, there might be human errors, and there could be lacking ownership data, as some of the older and small IPOs had limited information. These potential errors should be taken in to account when analyzing the results.

Chapter 4 – Characteristics of the Three IPO Groups

This chapter will examine the differences in characteristics of the three IPO groups to get a better understanding of the sample. We will compare operational performance, ownership data and the first-day returns across the three groups. Some of these characteristics could have an impact on the abnormal performance in the aftermarket, which we will examine thoroughly in Chapter 5 and 6. At the end of Chapter 5, we will use the characteristics discussed in this chapter, to examine whether the results are robust when restricting the data set to certain IPO characteristics. In Chapter 6, we will conduct a multivariate regression, where we will take the characteristics discussed in this chapter into account by including them as control variables.

Sample Description across IPO Group, Time and Country

Using the method described in Chapter 3, we have identified a sample of 158 IPOs on NASDAQ Copenhagen, Helsinki, Stockholm and Oslo Børs in the period from 1st of January 2005 to the 1st of January 2015. Out of these 158 IPOs, we have classified 32 PE-backed, 16 VC-backed and 110 non-sponsored IPOs. The distribution of IPOs across IPO group, country, and year can be seen in Table 4.

Form Table 4 it is evident that the largest number of IPOs are listed on Oslo Børs counting 46% Norwegian IPOs. Furthermore, 32% were listed on the Stockholm exchange, 15% on Nasdaq Copenhagen and only 7% of the IPOs took place on the Helsinki exchange. However, the majority of PE-sponsored IPOs are Swedish with 59% of the sample issues while 19% is listed on Oslo Børs, Copenhagen counting 16%, and Helsinki 6%. No Finnish VC-backed IPOs have been identified, while six IPOs took place in both Sweden and Norway and only four VC-backed IPOs were listed in Copenhagen. The distribution of the PE- and VC- Sponsored IPOs indicates that Sweden and Norway have more developed PE/VC-markets than Denmark and Finland.

Table 4 – Distribution of Sample across PE-, VC- and Non-sponsored IPOs, Country and Year

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
PE-sponsored IPOs											
Denmark						2			1	2	**5**
Finland	1	1									**2**
Norway	1		2							3	**6**
Sweden	3	3	3			2	1			7	**19**
Total	**5**	**4**	**5**			**4**	**1**		**1**	**12**	**32**
VC-sponsored IPOs											
Denmark	1	1	1			1					**4**
Finland											
Norway	2	1	2						1		**6**
Sweden	1	2					3				**6**
Total	**4**	**4**	**3**			**1**	**3**		**1**		**16**
Non-sponsored IPOs											
Denmark	1	5	5		1		1	1			**14**
Finland	1	3	2					1	2		**9**
Norway	23	14	8	3		4	1	1	4	3	**61**
Sweden	2	3	2	2	2	7	1	1	2	4	**26**
Total	**27**	**25**	**17**	**5**	**3**	**11**	**3**	**4**	**8**	**7**	**110**
Total IPO sample											
Denmark	2	6	6		1	3	1	1	1	2	**23**
Finland	2	4	2					1	2		**11**
Norway	26	15	12	3		4	1	1	5	6	**73**
Sweden	6	8	5	2	2	9	5	1	2	11	**51**
Total	**36**	**33**	**25**	**5**	**3**	**16**	**7**	**4**	**10**	**19**	**158**

IPO Timing

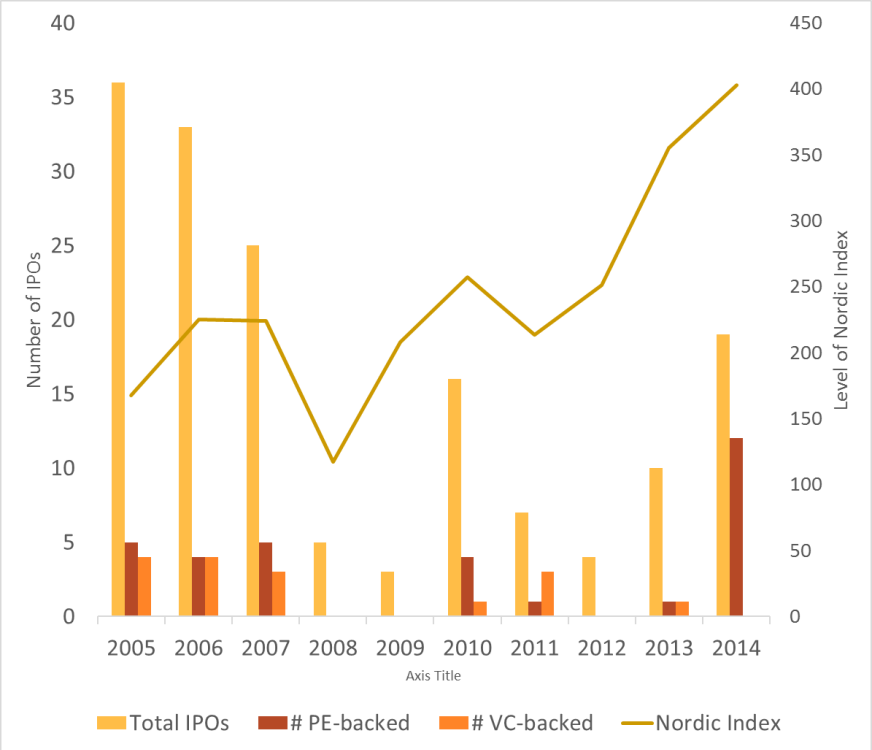
As seen from Table 4 and Figure 1, 94 IPOs were listed during the period 2005-2007, while there were only eight new listings in the two following years. This is a massive drop in IPO activity, which is a consequence of the European economic crisis (OECD, 2018). The IPO activity reestablished itself in 2010 with 16 new listings. However the crisis was not completely over, which can be seen on the drop in the Nordic index of Figure 1. Moreover, there was also low activity in 2011 and 2012 with seven and four IPOs respectively.

Interestingly, while there were a few non-backed IPOs in the years of lowest activity, there was no VC- or PE-backed IPOs in 2008, 2009 or 2012. This indicates that the managers of the

PE- and VC-funds are more strategic about market timing than the non-backed IPOs. As mentioned in Chapter 2, the issuing firm can try to maximize its gains by timing the IPO to take place when there are generally high market valuations – periods which are called windows of opportunity. We see from Figure 1 that PE-funds are more experienced in assessing when there is a window of opportunity. Thus, the PE-backed IPOs cluster in the years from 2005-2007, and in 2010 and 2014 when the Nordic market index is high.

Figure 1 – Number of IPOs and Nordic Stock Index over Time

The figure displays the total number of IPOs, and the number of PE- and VC-backed listings between primo 2005 and ultimo 2014. The line is the total return index of a constructed Nordic Index in the period. The Nordic index consists of all stocks from Danish, Swedish, Norwegian and Finish main markets.



As discussed in Chapter 2, VC- and PE-funds often have an option to expand the lifetime of the fund if the market conditions are unfavorable. If activating this option, then the managers can wait for times of better equity prices before exiting their acquired portfolio firms. Considering the fact that no Nordic PE- or VC-backed IPOs took place in 2008, 2009 or 2012, it is likely that the funds have used this option to postpone the fund in these years. This is supported by the finding that PE- and VC-backed IPOs account for a relatively high proportion of the total IPOs in 2010 and 2011, compared to the years before the financial crisis. Cao

(2011) also argues that the clustering of sponsored IPOs could be explained by VC- and PE-funds, which to a greater extent than the issuers of non-sponsored IPOs, wait for the market to improve before making their exit. Levis (2011) found a similar pattern of marketing timing among PE-sponsors and argued that the superior aftermarket-performance of the group of PE-backed IPOs' was partially due to the market timing effect.

Cross-Sectional Sample Description

As previously mentioned, the sample used in this study consists of a total of 158 IPOs, with 32 being PE-backed and 16 VC-backed. The sample size is relatively small compared to previous studies on the subject. Recent articles by Levis (2011) and Cao & Lerner (2009) examine the long-run performance of IPOs in the UK and EU, respectively. In order to compare our results to these other studies, we need to compare the sample characteristics, since there might be considerable differences across countries. Furthermore, discussing the sample characteristics will provide us with a better understanding of the relation between the absolute returns of the IPO groups and the abnormal returns that are size- and industry-adjusted.

Operational Differences across IPO Groups

From panel A in Table 5, we see that PE-backed IPOs are larger regarding market capitalization and total assets, compared to the VC-backed and non-backed IPOs. The VC-backed IPOs are by far the smallest concerning market cap with an average of 178 EUR million compared to the average PE-backed market cap of 820 EUR million. The difference between the size of PE-backed and VC-backed market cap is not surprising, as VC-funds generally seek to invest in riskier fast-growing companies with scaling potential than the PE-funds. The PE-funds generally seek to invest in larger and more mature companies. While Levis (2011) found that the PE-backed IPOs were largest in his UK-dataset, he also found that the VC-backed IPOs had market caps that were about twice as large as the non-backed IPOs, which contradicts with our sample. This finding can be of considerable importance when comparing the abnormal returns of our sample to other studies, as Levis (2011) found a slightly positive relationship between the initial market cap and BHAR.

The PE-backed IPOs have an average leverage ratio of 30%, which is more than the other IPO groups. While the group of non-backed IPOs has a leverage ratio of 22%, the VC-backed only have 6% leverage. It comes as no surprise that the PE-funds obtain more debt in their portfolio firms compared to non-backed companies. Increasing leverage is one of the value-creating tools that PE-funds use to drive returns (Klier et al., 2009). As described in Chapter 2, increasing leverage is a way of mitigating the agency costs that arise due to the separation of ownership and control (Jensen 1989). The low leverage ratio of VC-backed IPOs could be an indication of management choosing to finance operations with external equity rather than obtaining high levels of debt. It is likely harder for VC-backed companies to borrow money from the conventional banks, as VC-backed companies typically have more risky business profiles than mature companies. However, it should be noted that the sample only contains leverage data for five out of the VC-backed IPOs, why the results might be an imprecise representation of overall VC-backed leverage. The average leverage ratios in our sample are generally lower than in the data sets of Levis (2011) and Cao & Lerner (2009). This indicates that the Nordic banks in our examined period from 2005 -2014 were less willing to provide high debt-levels than in the UK from 1992-2005 and Europe from 1981-2003 respectively. This is likely because of the financial crisis in 2008 and 2009.

The operating performance also differs considerably between the groups. PE-backed IPOs have the largest average EBITDA and second-best EBITDA-margin. Non-sponsored have about 40% lower EBITDA than the PE-backed but a slightly better EBITDA-margin. While the other groups of IPOs are generally profitable, the VC-backed IPOs have a negative EBITDA-margin of -27%. This is a surprisingly negative margin indicating the poor operating performance of the firms using accounting measures. However, this negative margin is greatly impacted by two IPOs with extremely negative EBITDA-margins. These two IPOs are a part of the healthcare industry, which implicates that the healthcare industry also has a very negative average EBITDA-margin, as seen in Panel B. When excluding the healthcare industry, the restricted group of VC-backed IPOs has a positive EBITDA-margin of 4.5%. Thus, the large presence of healthcare significantly reduces the operating performance of the VC-backed IPOs across all measures of operational performance.

Table 5 – Cross-sectional Data Description

This table reports the sample data of all identified IPOs on the main Nordic exchanges between the January 2005 and December 2014. The first three columns report the total number of IPOs and the number of PE- and VC-sponsored IPOs. Following is the operational characteristics: Market Cap, Total Assets, Leverage (Total Debt to Total Assets), Revenue, EBITDA, EBITDA margin (EBITDA to Revenue), EBIT margin (EBIT to Revenue), Market Cap to EBITDA, Market Cap to Total Assets, Asset Turnover (Revenue to Total Assets). Panel A, splits the data across IPO groups. Panel B and C breaks the sample by industry and size. All balance sheet financials are from the first available quarter post-IPO. To avoid seasonality effects, all profit-and-loss statement financials are from first the annual report post the IPO. All financials are in EUR thousands. Source: Datastream (2018)

Panel A

IPO type	# of firms	# of PE-backed	# of VC-backed	Market Cap	Total Assets	Leverage	Revenue	EBITDA	EBIT	EBITDA margin	EBIT margin	Market Cap to EBITDA	Price to Book	Asset turnover
PE	32	32		820,248	620,080	30%	685,508	79,043	59,176	15%	10%	10.4	1.32	1.18
VC	16		16	177,698	137,195	6%	40,170	1,126	-2,209	-27%	-35%	157.8	1.30	0.54
Non	110			379,571	520,874	22%	388,977	47,014	34,649	18%	9%	8.1	0.73	0.79
Full sample	158	32	16	448,379	502,889	22%	424,236	48,934	35,928	13%	6%	9.2	0.89	0.85

Panel B

Industry	# of firms	# of PE-backed	# of VC-backed	Market Cap	Total Assets	Leverage	Revenue	EBITDA	EBIT	EBITDA margin	EBIT margin	Market Cap to EBITDA	Price to Book	Asset turnover
Technology	15	3	2	59,682	42,864	11%	48,831	4,188	2,493	8%	3%	14.3	1.39	0.97
Financials	13			609,983	1,727,000	16%	423,348	90,925	78,527	22%	20%	6.7	0.35	0.19
Oil & Gas	24	1	2	582,471	630,700	36%	1,004,684	92,242	66,540	29%	15%	6.3	0.92	0.68
Industrials	32	11	2	492,100	564,222	27%	610,335	53,773	40,062	15%	9%	9.2	0.87	1.22
Consumer Goods	20	6		598,457	401,221	25%	348,536	55,488	43,868	13%	8%	10.8	1.49	0.87
Basic Materials	8	1		973,711	657,470	17%	708,768	82,174	48,116	15%	9%	11.8	1.48	0.87
Healthcare	23	2	10	229,108	157,281	11%	69,215	7,390	2,326	-25%	-34%	31.0	1.46	0.42
Consumer Services	19	7		300,096	264,179	20%	205,102	31,640	25,388	23%	20%	9.5	1.14	1.28
Telecommunications	3	1		480,427	714,360	27%	194,688	76,987	21,046	26%	9%	6.2	0.67	0.85
Utilities	1			120,960	199,220	39%	5,867	3,553	-29	61%	0%	34.0	0.61	0.03

Panel C

Size	# of firms	# of PE-backed	# of VC-backed	Market Cap	Total Assets	Leverage	Revenue	EBITDA	EBIT	EBITDA margin	EBIT margin	Market Cap to EBITDA	Price to Book	Asset turnover
Large Cap	14	7		2,833,331	2,899,727	23%	2,933,170	315,068	249,818	17%	12%	8.99	0.98	1.03
Mid Cap	64	16	6	407,953	502,073	28%	309,234	42,791	28,494	21%	13%	9.53	0.81	0.86
Small Cap	80	9	10	63,353	93,547	17%	58,799	5,745	3,298	6%	-2%	11.03	0.68	0.82

As seen in panel A, PE-backed IPOs also outperform VC- and Non-backed IPOs on how efficiently they utilize their assets as seen by the asset turnover ratio of 1.18, 0.54 and 0.79 respectively. Thus PE-backed IPOs have superior operating performance both regarding the EBITDA-margin and asset turnover ratio compared to the VC-backed IPOs.

Interestingly, PE-backed IPOs have a higher *Market Cap to EBITDA* multiple than the non-sponsored IPOs. The difference indicates that the market expects that the PE-backed IPOs will have higher rates of profit growth, compared to the non-sponsored IPOs in the aftermarket. VC-backed IPOs have a much higher average *Market Cap to EBITDA* multiple than the PE-backed firms, which is not surprising considering that the VC-funds invest in firms that have more growth potential. However, the ratio in our sample is so high that it is presumed as non-meaningful due to the low average level of EBITDA. Levis (2011) also finds that VC-backed IPOs have the highest *Market Cap to EBITDA* multiple of the three groups with an average ratio of 14.

The market cap to total assets ratio of the non-sponsored IPOs is substantially below 1, which indicates that the non-sponsored IPOs have a higher book value of assets than its market value. On the other hand, both PE and VC exhibits values above one, meaning that investors are willing to pay more for the company than the assets are worth. Thus, investors believe that these companies have future positive NPV investments and are therefore willing to pay a premium.

Sub conclusion

In conclusion, VC-backed IPOs are smaller and younger companies with poor accounting performance but have high market cap multiples indicating high growth expectations. The PE-backed companies demonstrate excellent operating performance and are more leveraged than the VC- and non-sponsored IPOs. The solid operating performance by PE-backed IPOs is also reflected by the market cap multiples, which show that investors are willing to pay relatively more for the PE-backed IPOs than for the non-backed IPOs when taking the current asset- and EBITDA-level into account. Non-backed IPOs have the best EBITDA-margin, although they exhibit a substantially lower average turnover ratio than the PE-backed firms. Consequently, this explains the non-backed IPOs

low average *market value to total assets* multiple. In line with the empirical research by Jensen (1986), PE-backed firms have the highest average leverage in the sample.

Size and Industry Characteristics

Panel B of Table 5 presents the data categorized into industry sectors and show the distribution between the sample groups and Industrial sectors. Around a third of the PE-backed IPOs are in the Industrials sector which accounts for 34%, 22% are in the Consumer Services sector and 19% in the Consumer Goods industry. Levis (2011) also finds that most PE-backed IPOs appear in the three industries with a share of IPOs to be 25%, 31% and 17% respectively. Thus, the funds in this sample show a similar investment focus as the UK sample used by Levis (2011).

VC-backed IPOs, as mentioned above, cluster heavily in the Healthcare industry with 10 out of 16 of the VC-backed IPOs being in this industry. This majority of VC-backed healthcare IPOs does not resemble the sample used by Levis (2011), who found that the Healthcare industry was only the fourth most represented industry among the VC-backed IPOs, surpassed by Consumer Services, Technology, and Industrials. The other industries with VC-backed IPOs are Industrials, Oil & Gas, and Technology which each account for 12.5%. Healthcare is a R&D-intensive industry, which could explain why these companies have negative operating margins and high market cap ratios at the time of the IPO, as the as the pipeline of new products give high expectations for future value creation.

The last group, the Non-sponsored IPOs, is the only group that is represented in the Financial sector. In addition, non-sponsored IPOs are heavily represented in Oil & Gas industry accounting for 89% of the total IPOs in the sector. The low level of PE/VC-backed IPOs in the sectors is likely due to the heavy regulation in the Financial sector and the large capital requirements in the Oil and Gas sector, which are undesirable for investors and can lead to lower returns for the funds. Levis (2011) also find most Financial, and Oil & Gas sector IPOs are represented by non-sponsored IPOs.

The distribution between industries can heavily impact the average return of the IPO groups, as there are different risk profiles in each industry. It could be an issue to compare IPO groups of

different industries. However, we use size- and industry-adjusted benchmarks to adjust for the different required returns in the industries.

Size segments

There are also differences in size across the IPO groups, as seen in Panel C of Table 5. In general, there are mostly small and medium-sized IPOs with 51% and 41% respectively, while only 8% of the IPOs belong to the large-cap segment at the time of the listing. The PE-backed IPOs predominately are in the mid-cap segment with a few large-cap and small-cap listings. However, 63% of the VC-backed issues had initial market caps belonging to the small-cap segment with the remaining part being in the mid-cap segment. Thus, the sample contains no VC-backed large cap IPOs. The size distribution of PE- and VC-sponsored IPOs are in line with expectations, as VC-funds tend to invest in smaller and younger companies than the PE-funds, as discussed earlier.

The margins and asset-turnover ratio indicate that the small-cap companies have the worst operational performance. As earlier mentioned, there are a couple of small VC-backed healthcare IPOs with extremely negative EBITDA-margins, which significantly impacts the operating margins of the small-cap segment. Besides the impact of the outliers, the low margins of the small-cap segment could be explained by these companies being in a growth stage, where the primary focus is on growth and not on short-term operational performance. However, the average market cap to total assets-ratio is lower for the small-cap IPOs than for the larger segments, which contradicts the view of small-cap firms having higher growth potential.

Sponsor Ownership Levels Pre- and Post-IPO

In Table 6 the average ownership levels of the PE- and VC-sponsors are presented. As expected the PE-sponsors own a large share of the companies being listed than the VC-sponsors. In most cases, the PE-backed IPO is owned by a single PE-fund, as only 12.5% of the PE-backed IPOs have a secondary sponsor. Due to the few numbers of secondary sponsors, the average secondary sponsor ownership is 4.7% before the public offering. The average ownership share of the main PE-sponsors is 77.2%, which shows that the PE-funds hold a controlling stake of equity pre-IPO. Thus, the PE-

funds have been able to optimize the operations of their portfolio company in the holding period before the IPO. As mentioned in Chapter 2, these value increasing tools often include increasing financial leverage, changing the management, the corporate structure and providing strategy mentoring. These actions by the PE-funds could potentially continue to drive value in the years following the IPO, where the PE-funds give up their controlling stake. We will further discuss the aftermarket operational performance at the end of this chapter.

In contrast to PE-backed IPOs, we see that VC-sponsors on average holds a minority stake in their portfolio companies. Furthermore, the ownership is shared with a secondary sponsor to a greater extent. There is at least one secondary sponsor in 25% of the total VC-backed IPOs. The total VC-ownership is on average 32% before the IPO, substantially lower than the observed ownership levels of the PE-funds. While the VC-sponsors, as opposed to the PE-funds, have not had a controlling stake of their portfolio companies, they have still been able to influence the firm being listed through mentoring and contractual requirements.

Table 6 – Sponsor Ownership Levels

This table reports the share of ownership for PE- and VC-sponsored IPOs in the sample. The columns report: Total sponsor ownership, Ownership of Main sponsor (the share of ownership of the PE/VC fund with the largest share), Ownership of secondary sponsor (the share of ownership of the PE/VC fund with the second largest share), and Management ownership (defined as management, executives and key employees).
Source: Individual prospectus of sample companies

	Pre-IPO				Post-IPO			
IPO-sponsor	# of obs.	Ownership of main sponsor	Ownership of secondary sponsor	**Total sponsor ownership**	# of obs.	Ownership of main sponsor	Ownership of secondary sponsor	**Total sponsor ownership**
PE	26	72.5%	4.7%	**77.2%**	26	33.5%	2.8%	**36.3%**
VC	10	32.0%	9.0%	**41.0%**	9	20.9%	7.3%	**28.3%**

The level of total sponsor-ownership declines for both VC- and PE-funds as the IPOs take place. VC ownership declines slightly to 28%, while the PE-funds sell around half of their shares ending up about 36%. Levis (2011) found a similar pattern for UK IPOs. He found that PE- and VC-sponsors hold a stake of 59% and 34% respectively before the IPO. After the IPO, the PE-sponsor shares dropped to 23%, while the VC-funds hold on to 26% post-IPO. This pattern of PE-sponsors holding on to a

substantial share after the IPO is supported by Cao (2011), who found a similar result for reverse leverage buyouts in the US. The continued PE-involvement after the IPO could be explained by either lock-up contracts or positive expectations to the aftermarket performance. A lock-up contract prevents the sponsors from divesting their entire stake in a framed period, which typically is between 3 months to a year (Investopedia, 2018). While the high ownership post-IPO could be due to contractual reasons, it is also likely that the PE- and VC-sponsors would be interested in maintaining a large share of the company, if they have positive expectations to the aftermarket performance of the listed company. By maintaining a substantial ownership share, they still have substantial influence and could be able to drive additional value in the upcoming years. On the other hand, if the sponsor sells as many shares as possible, this could be indicating that the fund is skeptical about future performance. Perhaps, as the owner of the company, it is likely that the funds have inside information, which they choose to act on. If a fund has made use of window shopping, as described in Chapter 2, the fund would be interested in selling all of its shares. In Chapter 6, we will examine whether there could be a relationship between the fraction of sold ownership and the aftermarket stock return.

Management ownership

In Table 7, we examine the level of management ownership, which includes ownership by management, executives and key personnel. The PE-sponsored IPOs on average have a larger share of management ownership pre-IPO, with management owning 6.7% of the equity. In comparison, the management of a VC-backed IPO on average owns 3.8% of the shares before the IPO. As discussed in Chapter 2, PE-sponsors often require managers to have an equity stake to incentivize the management, which contributes to a governance structure with fewer agency costs (Jensen, 1989). Although this is typically a requirement of VC-backed companies as well, our data indicate that PE-funds make more use of this strategy.

Table 7 – Management Ownership Levels

This table reports the Management ownership prior and post to the IPO. The management ownership variable includes ownership among management, executives and key employees.
Source: Individual IPO prospectus of the sample companies

	Pre-IPO		Post-IPO	
IPO-sponsor	# of obs.	Management ownership	# of obs.	Management ownership
PE	10	6.7%	20	4.1%
VC	3	3.8%	7	5.0%

Unfortunately, we have only been able to find management ownership information for a limited number of IPOs, as the IPO prospectuses rarely disclosed this information. Thus, our results are based on a small sample, why more data is needed to make firm conclusions. While it could be interesting to examine, whether there is a relationship between the management ownership level and aftermarket performance, we will not include the management ownership data in our regression model in Chapter 6, as it is assessed that we have too few observations pre-IPO.

Sub conclusion

In conclusion of the cross-sectional data analysis, our sample shows significant differences in operational performance, size and ownership levels between the three IPO groups, which reflects the different investment strategies of PE- and VC-funds. In line with Levis (2011), this study finds that the Nordic PE-backed IPOs are larger companies with stable operational performance, whereas VC-backed IPOs are smaller and have worse operational performance. Furthermore, the predominantly part of the VC-IPOs are companies in the healthcare sector with poor operational performance post IPO, which is likely due to heavy investments in R&D. In line with Levis (2011), this study also finds that the market expects VC-sponsored IPOs to have higher growth in earnings as indicated by the Market cap to EBITDA-ratio. Finally, this sample shows a pattern of PE- and VC-sponsors exhibiting more IPO timing than the non-sponsored IPOS, which is in line with Levis (2011) and Cao (2011). As anticipated, we found that the PE-sponsors on average owned a controlling stake of 72.5% before pre-IPO, which is a substantially large share than the VC-sponsors, who on average owned 36.3%. However, the post-IPO ownership levels showed that PE-sponsors sold around 50%

of their shares at the IPO, while the VC-sponsors retained a large part of their shares, as their pre-IPO ownership level only declined to an average of 28.3%.

Operational Performance of IPO Sample Pre- and Post-IPO

Having conducted the above cross-sectional data analysis of our sample, in the remaining part of this paper, we will examine how the IPO groups perform in the aftermarket. While the main focus of this paper is to examine the aftermarket abnormal stock returns of IPO groups, this section will briefly analyze the operational performance pre- and post-IPO.

While capital market theory provides models of efficient markets, where excess stock returns cannot be predicted (Fama, 1970). As discussed in Chapter 2, operational performance, on the other hand, is not dependent on market expectations. Thus, measuring operational performance is deemed as the best way to examine, whether the effect of a firm being PE- or VC-sponsored continues to drive value after the IPO-exit. Levis (2011) found that PE-sponsored IPOs in the UK displayed better operational performance in the years after the IPO, and argues that investors might be surprised by the continued value creation post-IPO by the PE-sponsors.

This section examines the operational performance pre- and post-IPO of the three IPO groups. Using Datastream five years of operational performance have been retrieved. The operating performance will be presented in event time using the following notation: t-1 is the latest year ended before the IPO, t0 is the financial year of which the IPO took place, t+1, t+2, and t+3 notate the three subsequent years to the IPO.

We use the Kruskal-Wallis (1952) H-statistics, denoted as the *KW-stat*, to test whether the differences in operating performance between the IPO groups are significantly different from the mean of the groups. This test is suitable for testing differences between two or more groups of an independent variable on an ordinal variable. However, this significance test report if there is a difference between the groups, but it cannot specify whether all three groups or only two of the groups are different (Kruskal & Wallis, 1952).

Table 8 presents the operational performance of the three groups displaying; Sales Growth, EBITDA-Margin, Asset Turnover Ratio, and Leverage Ratio.

As expected, the VC-backed IPOs have the highest growth rates in sales throughout the five years. As discussed in the previous section, the VC-backed firms are primarily in the Small Cap-segment and have a high Market cap to EBITDA-ratios due to the expectations of future growth. In contrast, the PE-backed companies have the lowest growth rates. This could be due to the PE-companies being larger and the typical PE-investment strategy of investing in mature companies.

Declining leverage ratios and margins

In line with the theory by Jensen (1989), we find that PE-funds undertake a higher debt level relative to the group of non-backed IPOs. At the time of the IPO, the average Leverage Ratio of PE-backed IPOs is much higher than the VC- and Non-backed IPOs. In line with the study of Levis (2011), we find a pattern of declining leverage ratios of the PE-sponsored firms after the IPO, so that the average leverage ratio almost becomes identical to the one of the non-backed IPOs. This reduction in financial gearing could indicate less influence by the PE-sponsors as they gradually exit the company.

The EBITDA-margins decline post IPO as well. It is noteworthy that the VC-backed IPOs still have a negative EBITDA three years post to IPO indicating that they have not yet reached profitable operations. This is contradictory to Levis (2011), who finds that VC-backed IPOs have positive margins, however, yet the lowest margins across the IPO groups. The poor VC-backed EBITDA-margins of our sample could be due to the outliers with extremely negative margins, and because of the heavy presence of Healthcare companies who still might have to invest a lot in R&D in the three years following the IPO.

Table 8 – Operating Performance Pre- and Post-IPO

Development in operational performance over time. The total sample consists of 158 IPOs of which 32 are PE-backed, 16 VC-backed and 110 Non-sponsored. The table reports the average growth in sales (year to year), EBITDA-Margin, Asset Turnover Ratio and the Leverage Ratio. t0 *is the year of the IPO. The right panel displays the data using t0 as index 100. Kruskal & Wallis (KW)(1952) values test for the median differences across the three IPO groups. Source: DataStream (2018)*

	t -1	t 0	t + 1	t + 2	t + 3
Sales Growth					
PE	21%	28%	11%	9%	12%
VC	86%	137%	67%	13%	24%
Non	64%	62%	42%	10%	18%
KW-stat	3.36	3.35	10.08***	0.93	0.83

	t -1	t 0	t + 1	t + 2	t + 3
Sales Growth - Index					
PE	76	100	40	32	43
VC	63	100	49	9	18
Non	103	100	67	17	29

EBITDA-Margin (EBITDA to Sales)					
PE	14%	15%	16%	11%	13%
VC	-94%	-27%	-26%	-77%	-67%
Non	13%	18%	15%	4%	6%
KW-stat	10.03***	9.48***	3.87	7.41**	2.26

EBITDA-Margin (EBITDA to Sales) - Index					
PE	97	100	107	75	88
VC	n.m.	n.m.	n.m.	n.m.	n.m.
Non	69	100	85	23	31

Asset Turnover Ratio (Sales to Total Assets)					
PE	139%	118%	120%	114%	114%
VC	91%	54%	64%	58%	60%
Non	94%	79%	87%	79%	82%
KW-stat	4.13	16.51***	11.58***	12.51***	10.71***

Asset Turnover Ratio (Sales to Total Assets) - Index					
PE	118	100	102	97	97
VC	170	100	120	109	113
Non	118	100	109	100	103

Leverage Ratio (Debt to Total Assets)					
PE	43%	30%	27%	31%	31%
VC	49%	6%	5%	6%	8%
Non	26%	22%	24%	25%	27%
KW-stat	15.08***	19.84***	15.99***	16.68***	12.78***

Leverage Ratio (Debt to Total Assets) - Index					
PE	144	100	91	104	105
VC	887	100	94	108	142
Non	119	100	110	117	125

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

Superior PE-performance

As seen from the right panel of Table 8, we find that PE-backed IPOs have the most stable margins with an index level of 88 at t3. This level is substantially higher than the EBITDA-margin of the group of non-backed IPO, which has declined to 31 at t3. The margins of the non-backed IPOs are almost equal to the PE-backed IPOs in t-1, t0, and t+1, but then drops to about one third in t+2 and t+3. This pattern is in line with Levis (2011), who also finds more stable margins for the PE-backed IPOs and a large decline the non-backed IPOs' margin after two and three years.

Compared to the other IPO groups, the PE-backed IPOs also have a significant higher Asset Turnover Ratio at the time of the IPO. While the Asset Turnover Ratios decline slightly across all groups from t-1 to t0, the group of PE-backed IPOs has almost 50% higher average Asset Turnover Ratio compared to the group of non-backed IPOs throughout the five year period.

From the above observations, it is clear that PE-backed IPOs exhibits the best operational performance in the aftermarket. Some critics of PE-funds have attributed the PE-outperformance to the increased leverage and thereby risk (Fisher, 2016). However, this study found that the leverage of the PE-backed IPOs is larger before the IPO but then decline to around the same level as non-backed IPOs. As the operating performance continues to better than the non-backed IPOs in the years with similar leverage, it suggests that the value creation of the previous PE-ownership is not solely due to leverage. Instead, the better operating performance could be due to the corporate governance structures and long-term strategies implemented by the PE-funds before the IPO. It is also likely that the PE-funds continue to perform monitoring and mentoring, as they do not sell all their shares at the time of the IPO as argued by Levis (2011), and supported by the post-IPO ownership data in our sample as seen in Table 6.

Another reason that might explain the superior operating performance of PE-backed IPOs could be the ownership structure. The PE-backed IPOs have less dispersed ownership compared to the VC- and non-backed IPOs. This is seen from Table 6, where the main sponsor of the PE-backed firms, on average owns 73% of the equity pre-IPO and 34% post-IPO. Thus, the PE-funds own a majority stake, which decreases agency cost and in general is a more efficient governance structure (Jensen, 1989) (Shleifer & Vishny, 1997). When there is a large blockholder, like it is the case of the PE-backed IPOs, the firm is generally being monitored more than when ownership and control are separated. For instance, the PE-funds actively manage their portfolio firms through board seats (Berg et al., 2007), (Thomsen & Conyon, 2012). Further, mentoring and parenting advantages of being PE-owned is likely to attribute to the operating performance as well (Berg et al., 2007). Furthermore, the high level of debt pre-IPO can reduce the inefficiencies of abundant liquidity, so that non-value maximizing behavior is avoided, due to the need of meeting the debt payments (Jensen, 1989)

(Shleifer & Vishny, 1997). Also, as seen in Table 7 management on average own 7% of the PE-backed firms, which secure that the management is incentivized and motivated to increase company value.

The PE-sponsors implement the value-driving activities before the IPO. Although these effects will diminish over time, this study shows that they are likely still contributing to the operating performance of the PE-backed IPOs for at least three years after the exit. Following the IPO, the corporate structure and many of the implemented initiatives are likely still present after three years, and some are probably deeply rooted in the company and will remain unchanged for several additional years. As seen from Table 6, the PE-main sponsor still owns on average 34% after the IPO, why the governance is still mostly intact, and the firm will continue to have a parenting advantage of being partly PE-owned. Importantly, the industry experience and knowledge obtained by the PE-fund are in the company for the first period of being publicly traded. Furthermore, the management also keeps a 4% stake in the company post-IPO, why they are incentivized. As earlier mentioned, the positive effects of leverage, however, are likely to vanish post-IPO as the average debt level declines to the one of non-backed IPOs.

IPO timing and window dressing

From the index numbers of the right panel, we see that the sales growth rates peaks in the year of the listing for the PE- and VC-backed firms, and that the sales growth rates decline sharply in the following years. The biggest decline in Sales Growth Rate is between t0 and t+1, which could indicate that the PE- and VC-management strategically time the IPO to take place when the firms' have the highest growth rates. Another explanation could be that growth in, general, is cash-consuming, why the firms need additional funds, which can be obtained through an IPO.

PE-funds have been critiqued and subject to allegations of how they supposedly squeeze out all value of their portfolio companies during the holding period and then exit the company in poor shape (Rasmussen & Burg, 2008). As discussed in Chapter 2, a way to maximize the gains from an IPO is through window dressing, where the accounting figures are influenced in a way that gives investors a better perception of the company. However, the average growth rate and EBITDA-margins of the non-backed firms decline a lot after the IPO compared to the stable level of the PE-

backed firms. The operational performance of PE-backed IPOs is more stable from t-1 to t+3 relative to the non-backed IPOs, suggesting that the PE-funds leave their portfolio companies in better conditions to perform well in the aftermarket. Thus, this sample does not find evidence of window dressing among the PE-backed IPOs.

Sub conclusion

In summary, we find that PE-backed IPOs have the most stable operational performance post-IPO and the highest levels of EBITDA-margin and Asset Turnover Ratio in the aftermarket. This suggests that the PE-ownership might be a better organizational structure as indicated by Jensen (1989) and that a PE-sponsorship on average contributes value for at least three years after the IPO. However, this does not necessarily translate into superior long-run aftermarket stock performance, as stock prices reflect investor expectations it the initial pricing. We did not find any indications of PE-sponsors making use of window dressing, as the PE-backed IPOs displayed the best operating performance in the aftermarket.

First-day Pricing of IPOs

Before moving on to the next chapter, where the long-run abnormal performance will be presented, we will examine the first-day returns of the three IPO groups. If an IPO has high first day returns it demonstrates that the market believed the opening offer was underpriced. As discussed in the literature review in Chapter 2, high first-day returns can be seen as a missed opportunity of the IPO issuer to extract value as it increases the higher total issuing costs of going public. The magnitude of the first-day returns provides insights of the market's initial expectations to the firm going public, why it could be related to the long-run stock performance. Thus, the first-day return will be used as an explanatory variable in the regression model of Chapter 6 to assess if there is a relationship.

Table 9 presents the first-day returns of the IPO groups and the average for the whole sample. We find that all IPO groups have positive first-day returns and that the average of the full sample exhibits a first-day price-jump of 9.2%. This indicates that the IPOs on average are undervalued, in

the short-term, at the time of IPO. The result is in line with Schuster (2003), who also found IPO listings in Europe to be significantly underpriced between 1988 and 1998.

Table 9 – First-day Returns across IPO Groups

This table reports the average equally-weighted and value-weighted first-day returns of IPOs from 2005 to 2014. The returns are calculated as the offer price to the 1st close price.
Source: Bloomberg (2018)

First-day-return	Non-backed	PE	VC	All
Average, equal-weighted	9.9%	8.6%	6.5%	**9.2%**
Average, value-weighted	10.1%	13.8%	5.5%	**11.2%**
Std. Dev	28.7%	9.8%	10.4%	**24.2%**
No. of IPOs included	88 (80%)	31 (97%)	13 (81%)	**132 (84%)**

The table displays that VC-backed IPOs are the most correctly priced IPOs in the sample, as they have the lowest first-day price-jump. In addition, the first-day returns of the VC- and PE-backed IPOs are less volatile than the non-backed IPOs with a standard deviation of about a third of the one of non-backed IPOs. Megginson & Weiss (1991) also found VC-sponsored IPOs to be significantly less underpriced relative to non-sponsored IPOs. They argue that the difference is due to VC-funds have experience with IPOs, as they have typically been involved in other listings. Thus, it is likely that they need to think about their future reputation to a greater extent than the issuers of the non-backed IPOs, why the VC-funds have large incentives to avoid window shopping or avoiding to disclose negative information. Further, the VC-funds often use the same underwriter, why the funds and the underwriter have additional incentive to share all information sincerely.

PE-sponsored IPOs are also relatively less underpriced relative to the non-sponsored using equal weights. The maturity and large size of the PE-backed firms may result in relatively low underpricing due to less market uncertainty. Bergström et al. (2006) also found that PE-backed IPOs were less underpriced in a study of UK and French IPOs between 1994 and 2004. Furthermore, they also found that PE-backed IPOs are larger and argue that the large firms have less volatile performance resulting in less underpricing. However, in conflict with this hypothesis, the value-weighted average

first-day return of this sample is 2% larger than the equal-weighted, which indicates that the larger firms on average are more underpriced than the smaller firms in the sample. Thus it is not the size of the IPOs that cause the relatively lower underpricing of PE-sponsored IPOs in this sample.

The differences in first-day returns between the IPO groups of our sample are also in line with Levis (2011). However, Levis found substantially higher first-day returns in his sample. For instance, we find an average underpricing of 9.2% across all groups, whereas Levis documented a first-day price-jump of 18.6%. Further, Levis found value-weighted returns to be lower than equal-weighted indicating the large firms in his sample are more precisely priced than in this sample.

In conclusion, we find positive average first-day returns across our sample of IPOs, indicating that the Nordic IPOs, in general, are underpriced in the short-run. Further, we find PE- and VC-sponsored IPOs to be relatively less underpriced than non-sponsored IPOs. In addition, the PE- and VC-sponsored IPOs have smaller standard deviations of the first-day returns than the non-backed listings. In contrast to other studies, we find that large IPOs are less underpriced in the short-run than the smaller listings.

Chapter 5 – Aftermarket Performance across IPO Groups

This chapter will present the long-run performance of the three IPO groups. Firstly, the absolute returns will be examined. Then, we will compare the difference between abnormal returns using the unadjusted all-share Nordic index and the size- and industry-adjusted benchmarks. The main focus of this chapter will be on the size- and industry-adjusted abnormal returns.

As discussed in Chapter 3, the methodology used can have a significant impact on the results of long-run performance. Consequently, we perform a thorough and critical examination of the results and the applied methodology considering the effect of the different benchmarks, weighting approaches, omitted variable bias, and finally, we conduct a robustness check of the results using IPO group characteristics.

As mentioned in Chapter 3, this study proposes a method of constructing unique benchmark portfolios for each IPO and locking in the weights of the firms in the adjusted benchmark group. This study considers this method to be a more appropriate measure of the long-run performance than the method of monthly rebalancing. Hence, the results will be presented using this method unless specified otherwise.

The Importance of Benchmarks

Initially, the importance of applying an appropriate benchmark will be examined by comparing the absolute returns of the IPO groups to the abnormal returns using two different benchmarks. In addition, the cumulative returns over time will be examined.

To study the development in returns over time, we find CAR to be a more appropriate measure than BHAR. This is due to the difference in how the measures weight the portfolio companies. BHAR calculates the total 36-month buy-and-hold return of the individual firm before summarizing and weighing all the firms in the IPO group, while CAR is the cumulative return of the 36 individual months of IPO group performance.

The cumulative returns of the IPO groups over the event-time period of the first 36 months can be seen Figure 2. For comparison reasons, equal weighting has been used across the panels. As expected, we see large differences in the IPO performance, depending on which method is used.

As it is seen in Panel A, all the IPO groups have positive absolute returns after 36 months. However, the results change dramatically when considering abnormal returns, as all IPO groups display negative 36-month CARs, both when applying the unadjusted benchmark and the size- and industry-adjusted benchmarks, as we see from Table 10 and panel B and C of Figure 2.

Nordic Unadjusted All-Share Index

The group of private equity IPOs appears to be outperforming the other groups after 36 months of trading when considering absolute returns, as seen in Table 10 and panel A of Figure 2. However, on panel B of Figure 2, it is seen that when applying the non-adjusted benchmark the PE-sponsored IPOs becomes the worst performing group with a negative 36-month-CAR of 15.3%. In addition, the PE-backed IPOs is the poorest performing group throughout almost all of the 36 months. This isolated result is in sharp contrast to most of the reviewed literature including Levis (2011), who found superior performance among PE-backed listings.

The difference between panel A and panel B is initially surprising since all the IPOs are compared to the same group of companies without taking the risk profiles of each company into account. Thus, it was expected that the group with the highest absolute returns would also have the best abnormal performance when using the unadjusted benchmark. However, each IPO is compared to different benchmark returns, as the performance is measured in event-time. In other words, the benchmark returns are dependent on the IPO timing as well as the size and industry group. The abnormal return of each IPO is calculated by subtracting the benchmark returns of the 36 subsequent calendar months of the IPO date from the IPO's absolute return.

As the difference, between the absolute returns and the unadjusted abnormal returns, is largest for the group of PE-backed IPOs, we can conclude that the PE-backed IPOs' first 36 months of trading

on average have been in times of higher market returns, which in turn require higher absolute returns to outperform the market. This observation could indicate that the PE-sponsors are more strategic about the IPO-timing than the venture capital sponsors and the non-sponsored IPOs.

Table 10 – 36 months Post-IPO Cumulative Returns

The cumulative returns exclude the remaining days from the first calendar month of trading.

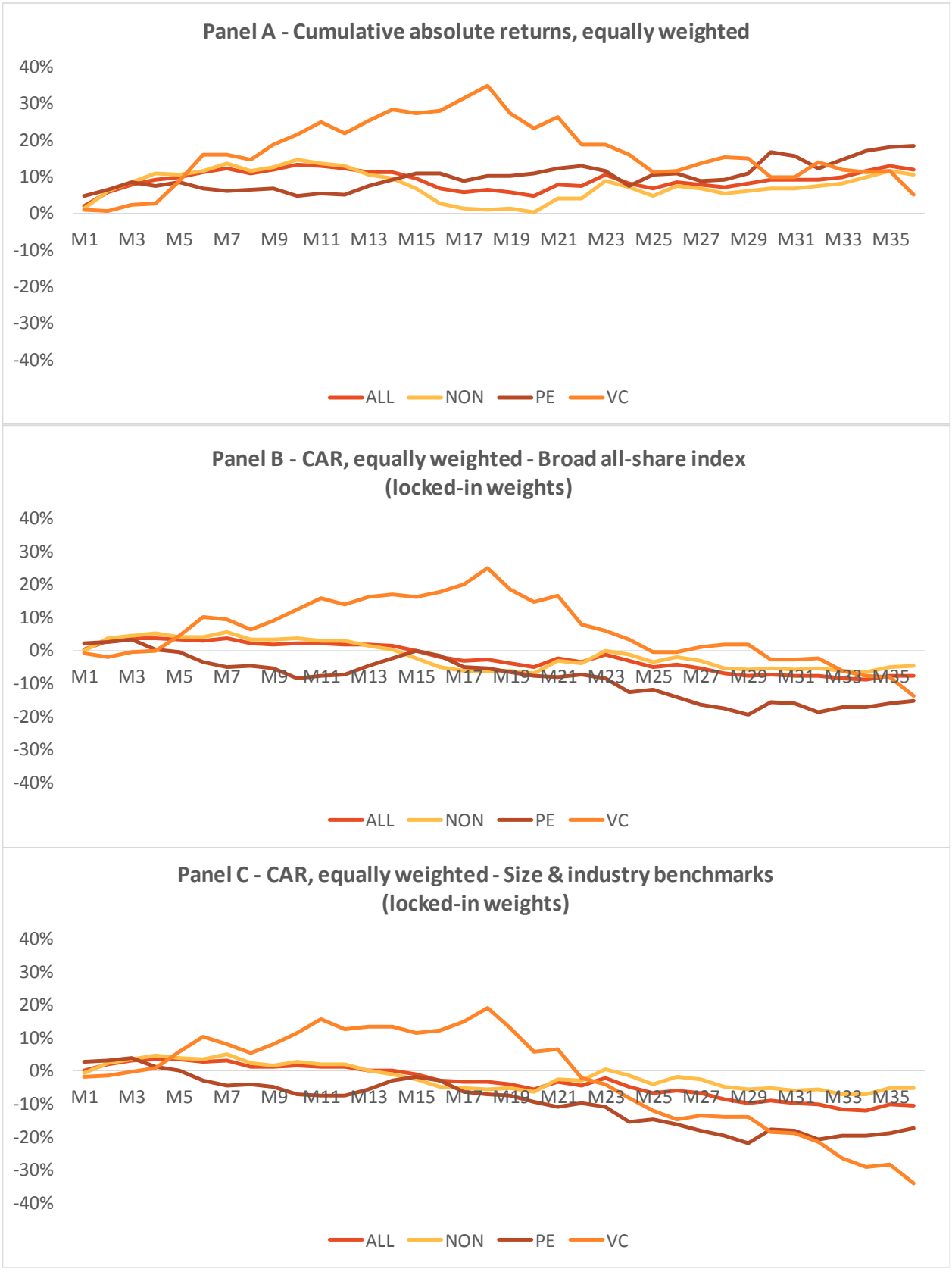
	Cumulative absolute returns	CAR - Broad Nordic all-share index	CAR - Size and industry adjusted bench.
Non-backed	10.8%	-4.7%	-5.5%
PE	18.6%	-15.3%	-17.5%
VC	5.0%	-13.9%	-34.4%
Full sample	12.0%	-7.8%	-10.9%

Size and Industry Benchmarks

As discussed earlier, the benchmark group should be as comparable as possible to the risk profiles of the IPOs. Therefore, we use size and industry adjusted benchmark. As seen in Panel C of Figure 2, the three IPO groups have more negative returns when using the size-and industry-adjusted benchmark. The results indicate that the traded peers of similar size and industry slightly outperform the market. The PE-backed listings are no longer the worst performing group, as the VC-backed IPOs now have the lowest CAR after 36 months. The result suggests that the venture-capital-sponsored IPOs are in industries with high performing peer, i.e. the VC-IPOs' benchmark companies must have substantially higher returns than the non-sponsored and PE-backed IPOs. The high benchmark returns are primarily due to 10 out of the 16 VC-sponsored IPOs are in the healthcare industry, which is the industry with the highest benchmark returns as seen in Table 3.

Figure 2 – Cumulative Returns across all IPOs and the Three IPO Groups

Panel (A) shows the absolute returns. Panel (B) shows the CAR of the IPO groups, when the broad all-share index is applied, while Panel (C) applies the preferred size & industry adjusted benchmarks. All IPO groups are equally-weighted, and locked-in benchmark weights are used.



Panel C of Figure 2 also illustrates the change in CAR over time for the three groups of IPOs. All groups have negative CAR after 36 months of trading, though the cumulated abnormal return of *all IPOs* is slightly positive after the first year of trading. The positive CAR after one year of trading is mainly due to the performance of VC-backed IPOs. The group achieved above 10% CAR until month 18, where the benchmark companies begin to get greatly outperformed the group and continues to do so the rest of the examined period. This indicates that the market has been reacting positively to the VC-backed IPOs during the first one and a half years of trading, but after this initial period, the investors seem to believe more in the traded peers than in the recent VC-IPOs, as the CAR of VC-backed IPOs drops considerably.

The result of positive adjusted CAR after the first year of trading is in line with Schuster (2003), who also found that IPOs experienced positive aftermarket performance during the 1st year of trading, but then ended with negative cumulative abnormal returns after 3 years.

As pointed out by Brav et al. (2000) the performance is sensitive to the applied benchmark. The point is also illustrated in this paper based on the different results of 36 month CAR and the applied benchmark across the three IPO groups.

In summary, when considering the size- and industry-adjusted CAR on an equally-weighted basis, the PE- and VC-backed IPOs demonstrate substantial underperformance compared to the non-backed IPOs, which is in sharp contrast to the findings of the reviewed literature. On the other hand, there is a pattern of underperformance across all IPOs, which is in line with expectations and the other studied reviewed including Levis (2011), Bergström et al. (2006), Ritter (1991), and Shuster (2003). However, before making any conclusions of long-run underperformance, we will also consider CAR as well as BHAR on a value-weighted basis and calculate the statistical significance of the long-run performance being different than zero.

Results of Long-run Abnormal Performance

This section will present the main results of the long-run abnormal stock performance across the three IPO groups using size- and industry-adjusted benchmarks.

The long-run performance of the three IPO groups and the full sample can be seen in Table 12. In line with the methodology applied by Levis (2011), the results exclude the remaining part of the first month of which the companies were listed. Thus, the long-run performance measures the abnormal returns of the 36 months after the first ended month of trading. The Buy-and-Hold-Abnormal-Returns (BHAR) and Cumulative-Abnormal Returns (CAR) are presented on an equal- and value-weighted basis, where the initial market cap of the IPOs are used as weights. To test whether the long-run performance of each group is significantly different from zero, we use adjusted t-statistics as discussed in the methodology section. The significance levels are evaluated by comparing the t-statistics to the critical values at the corresponding alpha-level and degrees of freedom. The critical values can be seen in Table 11.

Table 11 – Critical Values for Two-Sided t-statistics

		Critical values		
n	α	**0.10**	**0.05**	**0.01**
110		1.66	1.98	2.62
32		1.70	2.04	2.74
16		1.75	2.13	2.95
158		1.65	1.98	2.61

Panel A of Table 12 is using rebalanced benchmark portfolio weights, while panel B display the results using our proposed method of locking-in the benchmark portfolio weights, where the delisted benchmark companies are kept in the portfolio throughout the 36 months. Both panels use the size- and industry-adjusted benchmarks.

As seen in Table 12, there are strong indications of long-run underperformance across all IPOs. Each of the three IPO groups exhibits negative 36-month BHAR and CAR both on an equal- and value-weighted basis. Before further discussing the performance of the sponsor-backed IPOs and the

significance levels, we will first assess the impact of using our method of locked portfolio weights compared to the conventional method of rebalancing.

Table 12 – Long-Run Abnormal Stock Performance across IPO groups

Panel A display the equal and value weighed CAR and BHAR using the conventional method of rebalancing benchmark portfolio weights. Panel B A display the equal and value weighed CAR and BHAR using the proposed method of locking-in the benchmark portfolio weights.

Panel A - Rebalanced benchmark portfolio weights

		Size- and industry-adjusted							
		Equal weighted		Value weighted		Equal weighted		Value weighted	
IPO-group	# of firms	BHAR	t-stat	BHAR	t-stat	CAR	t-stat	CAR	t-stat
Non-backed	110	-12.1%	-1.40	-25.1%	-2.60 **	-7.4%	-0.74	-6.5%	-0.34
PE-backed	32	-23.1%	-2.27 **	-24.5%	-2.39 **	-20.6%	-1.84 *	-8.7%	-0.35
VC-backed	16	-51.4%	-1.30	-27.8%	-0.83	-36.6%	-1.75	-27.3%	-1.06
Full sample	**158**	**-18.3%**	**-2.48 ** **	**-25.0%**	**-3.21 *** **	**-13.0%**	**-1.74 * **	**-8.2%**	**-0.59**

Panel B - Locked-in benchmark portfolio weights

		Size- and industry-adjusted							
		Equal weighted		Value weighted		Equal weighted		Value weighted	
IPO-group	# of firms	BHAR	t-stat	BHAR	t-stat	CAR	t-stat	CAR	t-stat
Non-backed	110	-9.5%	-1.12	-23.4%	-2.45 **	-5.5%	-0.54	-5.1%	-0.27
PE-backed	32	-18.6%	-1.71 *	-23.1%	-2.08 **	-17.5%	-1.53	-7.8%	-0.31
VC-backed	16	-47.5%	-1.20	-26.6%	-0.79	-34.4%	-1.65	-26.3%	-1.02
Full sample	**158**	**-15.2%**	**-2.09 ** **	**-23.4%**	**-3.01 *** **	**-10.9%**	**-1.44**	**-7.0%**	**-0.49**

*** Indicates significance at the 0.01 level
** Indicates significance at the 0.05 level
* Indicates significance at the 0.10 level

Effect of Using Locked-in Portfolio Weights

As seen in Panel A and B of Table 12, the returns are consistently less negative when using this paper's proposed method of lock-in portfolio weights. The difference is in line with expectations, as the benchmarks with locked-in portfolio weights include the 0%-returns of delisted peers throughout the period, thereby resulting in lower absolute benchmark returns.

In Panel B, the equal-weighted BHARs are about 3-5 percentage points less negative than when using the conventional approach of rebalancing the weights monthly. However, the effect is smaller for the value-weighted BHARs, where the difference is below two percentage points. Thus, the

abnormal returns of IPOs with large market caps are less affected by this method. The difference indicates that there are fewer companies who become delisted in the Large Cap benchmark groups than in the Mid and Small Cap groups.

As expected, the difference in method affect the returns for the CARs in the same way as the BHARs. Further, there are no significant results of the cumulative abnormal returns, and PE-underperformance becomes less significant when applying our proposed method.

In short, we have shown that long-run IPO underperformance is likely to be exaggerated by the conventional method of rebalancing benchmark portfolios. Thus, if the method does not account for the delisted benchmark companies, then researchers can potentially make misleading conclusions on the long-run performance. As such, for the remaining part of this paper, we will focus on the results of Panel B.

Long-Run Underperformance of the Full sample

The full sample of the 158 IPOs has average buy-and-hold abnormal returns of -15.2% and -23.4% on an equally- and value-weighted basis respectively. The value-weighted BHAR implies that an investor, with a strategy of investing in all IPOs at the end of the first month of trading and then hold the stocks for 36 months, would yield only 76.6% of the value he could have gained from investing in the benchmark groups. A similar result of sizeable long-run underperformance is also found when using the CAR-measure, where the CAR is -10.9% on an equal-weighted basis and -7.0% using the market cap weights. Thus, the sample of IPOs demonstrates long-run aftermarket underperformance on a 3-year basis, which also implies that the IPOs seem overpriced when considering a long investment horizon.

The findings are as expected, as similar results of long-run IPO underperformance in the aftermarket was found in the reviewed studies including Levis (2011), Bergström et al. (2006), Ritter (1991), and Shuster (2003). While it is clear, that there is some degree of underperformance in our dataset, we need to assess the statistical significance of the findings to make any conclusions.

As seen in panel B, the value-weighted BHAR of the full sample is significantly different from zero at a 99% significance level, while the equal-weighted result is statistically significant at the 5% level. However, Brav et al. (2000) argue that BHAR can magnify underperformance due to the nature of compounding monthly returns, which is why cumulative abnormal returns are less likely to lead to false rejections. In our sample, it looks like BHAR does, in fact, magnify underperformance, as CAR for the full sample is not significant at the 10% level regardless of how the portfolio is weighted. Hence, while both BHAR and CAR strongly indicate underperformance, we cannot confidently reject the null hypothesis that IPOs have abnormal returns of zero, at a satisfying significance level. However, it is likely that CAR would also be significant if the sample size were larger because a large sample size implies lower confidence intervals and more reliable conclusions (Winter, 2013). Thus, it would be beneficial to have a larger sample in order to assess whether Nordic IPOs really exhibit significant underperformance in the aftermarket. Even though the results are not significant using CAR, the findings of this study add to the evidence of long-run underperformance of IPOs.

The Long-Run Performance across IPO Groups

In Chapter 2, the literature review provided mixed evidence of superior aftermarket performance of VC-backed IPOs (Brav & Gompers, 1997) (Hamao et al., 2000), while more substantial evidence of PE-backed IPOs outperforming non-backed IPOs both in the US and Europe was found (Levis, 2011) (Katz, 2009) (Bergström et al., 2006).

As seen in Table 12, our sample of Scandinavian IPOs between 2005 and 2014 is unable to contribute to the same conclusions of PE-backed IPOs outperforming the other IPO groups. As with the rest of the IPO groups, the PE-backed IPOs have negative abnormal returns across all four measures. Even though the sample only includes 32 private equity sponsored IPOs, the equal-weighted BHAR of -18.6% is significant at the 0.10 alpha level, while the value-weighted BHAR is even more negative (-23.1%) and significant (at the 0.05 alpha level). The value-weighted BHAR is slightly less negative for the PE-backed IPOs than for the other groups, while the equal-weighted BHAR and the two CAR results are considerably worse than non-backed IPOs. This is in sharp contrast to the findings of superior aftermarket performance amongst PE-backed IPOs in other countries including the UK (Levis, 2011) and the US (Katz, 2009). Thus, our dataset contradicts these studies and indicate that

PE-backed IPOs are not underpriced in the long-run compared to non-backed IPOs. A possible explanation for the finding can be that the PE-sponsors are not able to add additional value post the IPO, or because the investors already account for the expected increased operational performance of a PE-sponsorship.

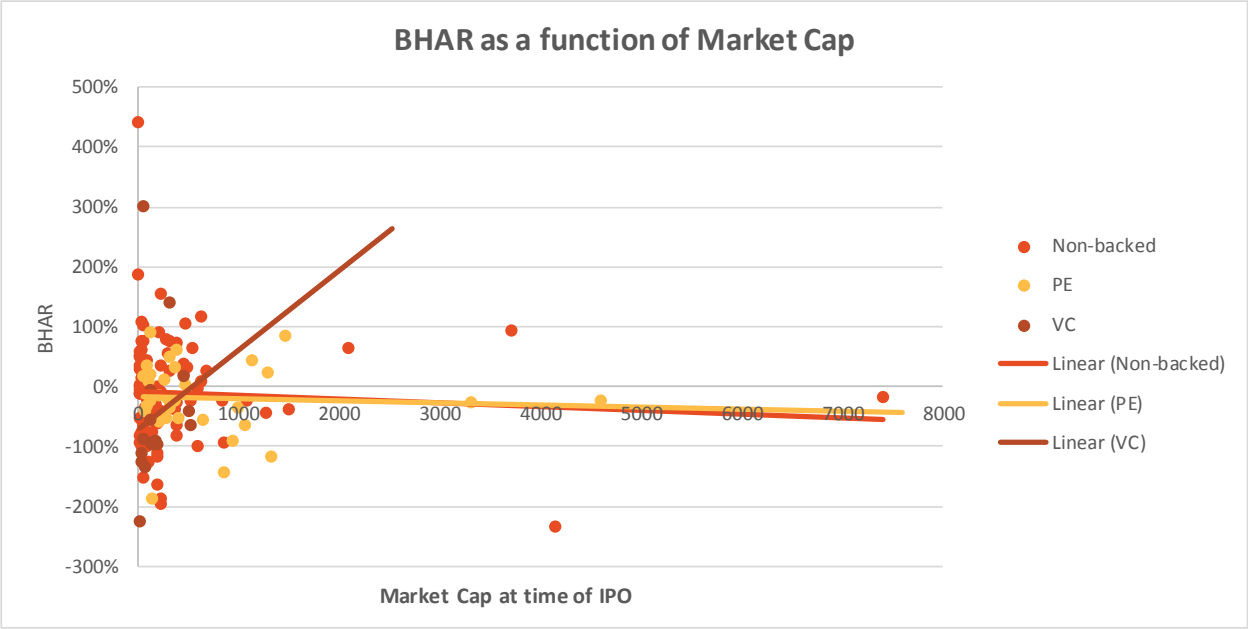
While there could be regional differences between the impact of a PE-sponsor in the US, the UK and Scandinavia, it is more surprising, that our results are opposite to the findings of the reports by SVCA (2015) and DVCA (2017). These reports also examined Scandinavian IPOs that were listed in recent years. It shows that the methodology being used is essential when assessing patterns in abnormal stock returns as discussed in Chapter 3. Thus, at first glimpse, our results are surprisingly contradictory to the SVCA and DVCA reports. It could indicate that these studies, which have been initiated by the venture capital and private equity associations may be, if not deliberately biased, then at least not fully considerate in the applied methodology. However, to validate our results and get a deeper understanding of them, we will conduct robustness checks in the following section. In addition, Chapter 6 will elaborate on a statistical regression that will try to isolate the effect of being PE- or VC-backed.

As seen in Table 12, the VC-backed IPOs are the worst performing group of IPOs regardless of BHAR or CAR on an equal- or value-weighted basis. Thus, our dataset contradicts the findings by Brav & Gompers (1997) of superior performance amongst VC-backed IPOs. However, none of the results is significant at the 0.1 level, which is due to the limited number of VC-backed observations. The group of VC-backed IPOs has a large difference in BHAR from -51.4% using equally weighting to -27.8% on a value-weighted basis. This large difference indicates that BHAR is positively related to market cap amongst the VC-backed firms, which can also be seen in the Figure **3** below.

The great difference in BHAR between the two weighting methods of VC-backed IPOs is primarily due to five small IPOs that exhibit substantial underperformance relative to its peers. From Figure **3**, we can also see that the IPOs cluster in the left side of the cart, as the majority of the IPOs had initial market caps below 1,000 EURm. The slopes of the PE and non-backed linear lines are negative. Thus, there is a slightly negative relationship between BHAR and market cap for these two IPO

groups, which is why the groups BHAR are more negative when applying value weighting than equal weights as seen in Table 12. This indicates that the firms with a large market cap on average have worse abnormal performance, which contradicts the findings of Levis (2011). However, there are a few very large IPOs in our sample, which could heavily impact the relationship between BHAR and market cap.

Figure 3 – IPO BHAR as a Function of Market Cap



Omitted Variable Bias

So far, we have assessed the effect of being PE-sponsored through comparing the aftermarket performance of the three IPO groups, while ignoring any differences in characteristics of the IPO groups. In other words, we have conducted a bivariate analysis with aftermarket performance measured as BHAR and CAR as one variable group and the type of IPO-sponsorship as the other variable group. This is a simple way to analyze the data and find patterns, but it may lead to misleading results due to omitted variable bias.

As we saw in Chapter 4, there were substantial differences in the IPO characteristics across the three groups, and the aftermarket performance may simply reflect some of these differences in

characteristics. Since the omitted IPO characteristics are correlated to the regressor being the type of IPO-sponsorship, then omitted variable bias will occur, if at least one of the operational characteristics is a determinant of the aftermarket stock performance (Stock & Watson, 2011). For instance, the PE-backed IPOs were larger and more leveraged than the other IPOs, which might impact the aftermarket performance.

To isolate the effect of IPOs being PE- or VC-backed, we will construct a multivariate regression model in the next chapter, which will include all the operational characteristics and ownership data from Chapter 4 as control variables. This multivariate regression allows us to determine the effect on aftermarket performance of PE- and VC-sponsorship while holding the control variables constant (Stock & Watson, 2011).

However, we will first address the potential omitted variable bias by conducting a series of robustness checks of the results in this chapter. The dataset will be divided into subgroups, to measure the abnormal performance of the IPOs, when restricting the dataset based on IPO characteristics. This is in line with the methodology of Cao and Lerner (2009) and Levis (2011) of which the latter found the superior performance of the PE-backed IPOs was very consistent across the robustness checks, while the underperformance of the VC-backed and non-backed IPOs in some extent was due to their size at the time of the listing.

Cross-Sectional Robustness Check

Levis (2011) could consistently document superior aftermarket performance of PE-backed IPOs. Hence, it is interesting to examine, whether our surprising result of underperformance among PE- and VC-backed IPOs relative to the non-backed IPOs will be consistent when restricting the sample based on operational characteristics. In the following, we make robustness checks and restrict the IPO groups by market cap, revenue, and leverage. We use equally valued BHAR and CAR, as a few very large IPOs heavily impact the value-weighted returns.

As seen in panel A of Table 13, there are 94 IPOs (59%) left in the sample, after excluding IPOs with an initial market cap below 100 EURm. The majority of the PE-backed and VC-backed IPOs are still

in the sample, but almost half of the non-backed IPOs have market caps below the threshold. The BHAR of the non-backed group of IPOs drops substantially from -9.5% to -18.0%, while the BHAR of the PE-backed IPOs decreases by 1.9% to -20.5%. The BHAR of the VC-backed IPOs increases considerably to -38.3%. Thus, when excluding the smallest listings, the difference in buy-and-hold performance between the non-backed and PE-backed IPO groups almost vanishes, while the VC-backed IPOs continue to exhibit underperformance.

Similar findings can be concluded from Panel B, which consists of the IPOs with sales above 50 EURm. The PE-backed IPOs are still performing slightly worse than the non-backed IPOs, but the underperformance among PE firms are smaller than in the full sample. Conversely, the VC-backed IPOs with sales above 50 EURm perform even worse, although only 3 VC-backed IPOs have revenues above the threshold, why it is difficult to make any reliable conclusions regarding this group.

The most surprising result from the robustness check is found in Panel C and panel D, which restrict the IPOs to the firms with a debt-to-asset ratio above 0.10 and 0.20 respectively. As seen in Panel C, 84% of the PE-backed have at least 10% leverage, while 42% of the non-backed IPOs are excluded. Remarkably, the PE-backed IPOs have substantially better BHAR and CAR than the group of non-backed IPOs.

When considering the companies with more than 20% debt in panel D, we see the same picture of PE-backed IPOs outperforming the non-backed IPOs considerably. Thus, our dataset reveals superior abnormal performance among PE-backed IPOs like the findings of many other studies, however, only when excluding the IPOs with no or little leverage.

Table 13 – Robustness Checks

Equal-weighted BHAR and CAR. Size and industry adjusted benchmarks with fixed portfolio weights.

Panel A - Market Cap > 100 EURm

	n	Included %	BHAR	CAR
Non-backed	56	51%	-18.0%	-11.5%
PE	28	88%	-20.5%	-19.4%
VC	10	63%	-38.3%	-39.2%
Full sample	94	59%	-20.9%	0.0%

Panel B - Sales > 50 EURm

	n	Included %	BHAR	CAR
Non-backed	54	49%	-12.2%	-4.6%
PE	28	88%	-16.6%	-16.3%
VC	3	19%	-65.1%	-39.4%
Full sample	85	54%	-15.5%	-9.7%

Panel C - Leverage > 0.10

	n	included %	BHAR	CAR
Non-backed	64	58%	-21.9%	-16.6%
PE	27	84%	-9.0%	-5.0%
VC	3	19%	45.8%	57.9%
Full sample	94	59%	-16.1%	-10.9%

Panel D - Leverage > 0.20

	n	included %	BHAR	CAR
Non-backed	50	45%	-22.6%	-20.6%
PE	26	72%	-12.8%	-8.1%
VC	1	13%	-39.7%	1.9%
Full sample	77	47%	-19.5%	-16.1%

Panel Z - Full sample

	n	included %	BHAR	CAR
Non-backed	110	100%	-9.5%	-5.5%
PE	32	100%	-18.6%	-17.5%
VC	16	100%	-47.5%	-34.4%
Full sample	158	100%	-15.2%	-10.9%

In conclusion, the results of Table 12 are not consistent across different measures of operational characteristics, which once again shows that the long-run abnormal returns are very sensitive to the methodology applied and that we should be cautious when making conclusions.

Having conducted the robustness checks, we see that the results are not consistent. The PE-backed IPOs went from having substantial lower abnormal performance than the non-baked IPOs in Table 12 to having similar BHARs in panel A and B of Table 13 to outperforming the non-backed

counterparts considerably in Panel C and D when the sample was restricted to the firms with leverage above 10% and 20%.

Thus, the robustness checks indicate that effect on the abnormal performance of being PE- or VC-backed cannot be estimated using only two variables. If the other IPO characteristics are not taken into account, and the researcher is not aware of omitted variable bias, it might lead to false conclusions of a causal relationship between IPO-ownership and aftermarket performance. Thus, there are limitations in a model with only one explanatory variable.

The findings of this chapter have shed light on the average abnormal performance of different IPO groups, although it is not clear why there is a difference. In other words, we are not able to conclude whether the abnormal performance is due to the type of ownership or due to other characteristics, not included in the model, such as operational characteristics. In our pursuit of measuring the effect of PE-sponsorship on stock performance, in the next chapter, we will try to isolate the PE-sponsorship effect through a multivariate regression that contains a series of other variables controlling for other factors which might be correlated to stock performance.

Chapter 6 – Aftermarket Performance and IPO Characteristics – Multivariate Regression

In this chapter, we will conduct a number of multivariate regression models on the long-run stock performance, BHAR. The robustness checks in Chapter 5 showed that the aftermarket performance is not consistent across different dimensions of IPO characteristics. As previously discussed, a multivariate regression can potentially mitigate the issue of omitted variable bias by including the variables that are correlated with the dependent variable and at least one of the explanatory variables. Hence, we will include several variables that are likely to impact the aftermarket performance.

Through the multivariate regression with control variables, it might be possible to measure the effect PE- or VC-sponsorship, while holding all other variables such as operational characteristics constant. Further, we will examine the effect of ownership-size through a second set of models. However, several complications arise, when constructing a multivariate regression model that predicts abnormal stock performance. These issues will be addressed in the following, before presenting the results of the regression.

Issues with the Multivariate Regression

Through a multivariate regression model, we can lessen the problem of omitted variable bias, but it is unlikely that it will be solved completely. To completely solve the problem, all variables, which influence the abnormal stock performance and are correlated with the type of sponsorship, should be included. However, we do not have access to all variables. We choose to include the variables discussed in the earlier chapters, as we deem these likely to explain some variation in stock performance. Besides, these control variables have been used by prior researchers including Levis (2011) and Cao & Lerner (2009). Thus, it cannot be rejected that our regression model omits other variables that ideally should be included to avoid biased coefficients.

Market Expectations and Efficiency

Another issue of the regression is that stock returns build on market expectations rather than true performance, why it is hard to find any strong or significant correlations. The theory of efficient capital markets, suggests that excess returns should be unpredictable since stock prices already represent all the available information at a given time (Stock & Watson, p. 532). For instance, if an IPO is expected to deliver superior abnormal performance in the aftermarket, the investors will buy the stock and drive up the share price to the point, where the expected abnormal performance is zero. Furthermore, if a listed firm exhibits decent operational performance, but was expected to be performing even better, the stock price will drop.

We are not able to directly include market expectations in our regression model. However, we can include financial multiples as a proxy for the investors' initial expectations such as the *market cap to total assets*-ratio.

Classical market theories on market efficiency, as discussed in Chapter 2, argue persistent long-run abnormal performance among a group of stocks with a specific characteristic should not exist (Fama, 1970). Thus, if PE-backed IPOs generate higher stock returns than other IPOs with similar risk profiles, then this is a market anomaly that should vanish in the long-run, as investors adjust their future expectations of similar IPOs accordingly.

If a group of IPOs consistently provided abnormal returns, then a given investor would be able to beat the market by using a simple investment strategy of investing in these listings. However, other investors would eventually catch on, and the abnormal returns would fade. Likewise, several studies have demonstrated that investors are not able to consistently beat the market, which indicates market efficiency (Sharpe, 1991) (Laurent et al., 2010).

Due to the discussion above, we do not expect the regression models to have high explanatory power, as our dependent variable, BHAR, measure abnormal performance and reflect a mix of company performance, market expectations, and the benchmark stock returns.

Endogeneity Problem and Non-Linear Variables

The models might face another problem, as some of the variables might be endogenous. As discussed in Chapter 2, private equity and venture capital funds run extensive screening processes before selecting which companies to invest in and typically choose targets with high growth and profitability potential. Also, as discussed in Chapter 4, the PE- and VC-fund also impact the operational characteristics of portfolio companies during their holding period. As we include both the type of ownership and operational characteristics as explanatory variables, we have endogeneity in our model.

Levis (2011) argues that this problem of endogenous variables makes the regression model unable to document evidence of causality between the explanatory variables and the dependent variable. Thus, we are unable to make any conclusions of causality between PE- and VC-funds sponsoring IPOs and abnormal aftermarket performance, but we can still study whether PE- and VC-backing are associated with superior long-run abnormal performance or not.

As we construct a multivariate linear regression, the model does not take potential non-linearity into account. If a control variable has a non-linear relationship with BHAR, then the control variable could be altered to increase the goodness of fit in the linear regression model. We have evaluated the distribution of observations of the control variables to check for non-linearity. We found a large standard deviation in the initial market cap of the IPOs. As a result of this, we transform the variable by taking the natural logarithm to the market cap, which we found to give a stronger linear correlation with the outliers impacting less. We did not find any clear non-linearity of any of the other variables.

However, when we look at the residuals of Modal 1.1, as seen in appendix 1, some of the variables including the Market-cap-to-Total-Assets ratio and asset-turnover-ratio have somewhat heteroscedasticity residuals. Thus, we apply White heteroscedasticity-consistent standard errors, as we cannot rely on the assumption of homoscedastic errors (White, 1980). Using White heteroscedasticity-consistent standard errors, we get more reliable t-statistics, which we use to assess the significance level of each parameter coefficient (White, 1980).

IPO-Sponsorship Regression Models

The first set of models will include all IPOs of the sample and a set of IPO characteristics as control variables to isolate the effect of a PE- or VC-sponsorship.

The dependent variable in the regressions is the size-and industry-adjusted 36-month BHAR, as presented in Chapter 5. Thus, we are predicting the long-run abnormal stock performance of a given IPO using the firm characteristics as explanatory variables.

As mentioned earlier, the multivariate model is made to find whether the type of IPO-sponsorship affects the aftermarket performance. Therefore, we create dummy variables of IPO-sponsorship. We create a dummy for the IPO being PE-backed or VC-backed IPOs, while the baseline is the IPO being non-sponsored. We only include two dummy variables, even though there are three groups, to avoid the variable trap. If all three dummy groups were included in the regression, there would be perfect multicollinearity between the three dummy groups, which makes the regression unable to estimate the parameter coefficients. No perfect multicollinearity is one of the key assumptions in the multivariate regression (Stock & Watson, 2011).

Before including the IPO-sponsorship dummies, we will first regress BHAR using control variables only to check if the signs of the variable coefficients are consistent across models, and whether adding the PE- and VC-sponsorship dummies to the model will improve the explanatory power of the model. This model is notated as Model 1.1, and its mathematical equation can be seen below:

Model 1.1:

$$\widehat{BHAR}_i = \beta_0 + \beta_1 \ln\left(mkt_{cap}\right)_i + \beta_2 \text{Recession\_year}_i + \beta_3 Price\_to\_book_i + \beta_4 \text{Leverage}_i + \beta_5 \text{Asset\_turnover}_i + \beta_6 EBITDA_{margin_i} + \beta_7 DK_i + \beta_8 SE_i + \beta_9 FI_i + \beta_{10} First\_day\_return_i + \epsilon_i$$

Before presenting the results of this model, we will shortly discuss the independent variables.
Our basic control model, Model 1.1, includes the following basic operational characteristics: Leverage, Market cap, EBITDA-margin, Asset turnover-rate, and the Market Cap to Total Assets-

multiple. The profitability of the firm is reflected through the EBITDA-margin while the asset turnover-rate is an indication of the firm's asset efficiency. The leverage ratio expresses the financial risk and is thereby also a proxy for some of the risk in the company. The market cap reflects the valuation of the company at the time of the IPO. Lastly, the market cap to total assets-ratio can be assessed as a proxy for the investors' expectations to growth and profits in the future. The five variables each describes a different aspect of operations and combined they are perceived to be a good proxy for the overall operational performance.

In addition, a group of IPO country dummies are included with Norway as the baseline country. In this paper, we consider the countries mainly considered as one Nordic market. However, if there are some differences in aftermarket performance across the Nordic countries, the model will catch the difference in variation through the inclusion of country dummies.

While this study measures BHAR in event-time, there might also be differences in the IPO abnormal performance across calendar time. Thus, it could be argued that there should be included a group of dummy variables taking the IPO-listing year into account to catch the potential effect. However, our dataset stretches over ten years from 2005 to 2014, why nine dummies should be included to take each year into account. Since we have a relatively small sample set, we wish to avoid including too many variables to get sufficient degrees of freedom. Consequently, we follow a similar approach to Levis (2011), who created a dummy for the bubble years of 1999-2000. In our sample of IPOs, the years 2008, 2009 and 2011 are noted as recession years, as there was a recession in at least two of the four countries in the years (OECD, 2018), further there was little or none IPO activity among PE- and VC-funds as previously seen in Figure 1.

The last variable included is the first-day returns which we presented in Chapter 4. The first-day return indicates whether the investors initially believed the IPO was under- or overpriced. Levis (2011) found a negative relationship between the first-day-result and the 36-month BHAR. He argues that this could be due to the notion that a high first-day return results in an unstainable price level that is gradually corrected in the aftermarket leading to long-run underperformance (Levis, 2011). While we will include the first-day return in the first two models to examine whether can

document a similar effect in our sample set, this variable will be excluded in models 1.3 and 1.4, as the inclusion restricts the number of observations in the model too much. The SAS code for regression models 1.1-1.4 can be seen in Appendix 2.

Results of Control Variables

The results of the first set of regression models can be seen in Table 14. The R^2 of all four models are below 0.20, indicating that the models are quite poor at predicting the BHAR using the independent variables. Still, the R^2 is in line with expectations, as capital market theory suggests that excess stock returns are unpredictable, as earlier mentioned.

Even though the model does not explain a large part of the variation in BHAR, some of the coefficients are consistently significant across the four models, indicating there might not be a coefficient bias for these variables. Further, the signs of most of the coefficients are consistent across the models. At first, the coefficients of the control variables will be discussed.

The recession dummy variable has negative coefficients in all four models, but these are not significant at the 0.10 level. The coefficient indicates that firms that were issued in 2008, 2009 or 2011 had lower 3-year BHAR holding all other variables constant. This is in line with the results of Levis (2011), who found a significantly negative association between IPOs of the bubble-period years and aftermarket performance. Even though our results are not significant, it appears that IPOs' stock prices are more affected by recessions than its traded peers of similar size and industry, which is likely due to overly optimistic initial IPO valuations.

In Chapter 5, we found a negative correlation between the abnormal stock performance and the initial market cap of the non-sponsored and PE-backed IPOs, which together represent around 90% of the dataset. Therefore, negative coefficient of *ln(market cap)* is in line with expectations.

Table 14 – Multivariate Regression of IPO Long-Run Abnormal Performance

Multivariate OLS regression with BHAR as the dependent variable. BHAR is the Buy-and-Hold-Abnormal-Return of the 36-months consecutive to the first ended month of trading. BHAR is calculated using size- and industry-adjusted benchmark groups with locked-in portfolio weights. The independent variables are: dummies of whether the IPO took place in 2008, 2009 or 2011, the natural logarithm to the market cap at the time of IPO, the Market Cap to Assets ratio, the leverage ratio (Total Debt/Total Assets), the EBITDA-margin, country dummies with Norway as baseline, the IPO first-day return, and PE-backed or VC-backed dummies with Non-sponsored as baseline.
The numbers in parentheses below the parameter coefficients are the White t-statistics

Variable	Model 1.1	Model 1.2	Model 1.3	Model 1.4
Recession ('08,'09,'11)	-0.259	-0.241	-0.271	-0.240
	(-1.11)	(-0.92)	(-1.02)	(-0.91)
ln (Mkt. Cap)	-0.027	-0.042	-0.101	-0.112
	(-0.51)	(-0.71)	(-1.57)	(-1.6)
Mkt. Cap to Total Assets	-0.057 **	-0.069 **	-0.076 **	-0.084 **
	(-2.01)	(-2.21)	(-2.21)	(-2.33)
Leverage	-0.425	-0.519	-0.663	-0.811
	(-0.99)	(-1.13)	(-1.37)	(-1.57)
Asset Turnover Ratio	-0.106	-0.118	-0.059	-0.086
	(-0.84)	(-0.88)	(-0.49)	(-0.65)
EBITDA-margin	-0.335 **	-0.381 **	-0.275 *	-0.298 *
	(-2.27)	(-2.24)	(-1.82)	(-1.85)
DK	-0.024	-0.105	0.203	0.148
	(-0.14)	(-0.54)	(1.13)	(0.74)
SE	-0.124	-0.129	-0.063	-0.080
	(-0.5)	(-0.53)	(-0.29)	(-0.36)
FI	0.606 ***	0.651 ***	0.727 ***	0.701 ***
	(3.76)	(2.88)	(3.97)	(3.04)
1'st day return	0.330 **	0.364 ***		
	(2.58)	(2.89)		
PE-sponsorship		0.206		0.168
		(1.06)		(0.91)
VC-sponsorship		0.183		-0.094
		(0.36)		(-0.22)
Intercept	0.387	0.573	1.294	1.495
	(0.56)	(0.8)	(1.48)	(1.59)
R^2	**0.168**	**0.180**	**0.175**	**0.181**
Adj. R^2	0.085	0.079	0.114	0.106
# of observations	111	111	133	133

**** Significant at the 0.01 alpha level*

*** Significant at the 0.05 alpha level*

** Significant at the 0.10 alpha level*

The coefficients of the *Market cap to Total Assets* multiple are negative and consistently significant at the 0.05 level. This indicates that the IPOs with a high initial valuation relative to its total assets were on average not able to live up to the expectations post IPO. Thus, these firms with Market cap to Assets value, in general, appear overpriced in the long-run. The finding supports the one of Levis' (2011) regression of UK IPOs, where the market cap to total assets ratio was negative and significant at the 0.01 level.

In the theory section of Chapter 2, we discussed how high debt levels could help mitigate agency problems since the burden of debt forces the managers to efficiently run the company to avoid bankruptcy (Jensen, 1986 & 1989). However, in our sample, high leverage is in general associated with lower abnormal performance as seen on the negative leverage coefficients of Model 1.1 - 1.4 in Table 14. However, this is not necessarily conflicting with Jensen's (1986 & 1989) theory, as we do not regress operational performance, but abnormal stock performance, where the initial valuation should reflect all available information including the leverage ratio. Even though the coefficient is not statistically significant at the 0.10 level across the models, this finding is surprising and opposed to the results of Levis (2011).

The negative coefficients of leverage could also be due to an undiscovered non-linear relationship between leverage ratio and BHAR. Perhaps, a medium level of debt is associated with superior BHARs while low debt and high debt levels are negatively correlated to the abnormal performance. A high level of debt can be an expression of either strategic value-adding leverage or financial distress. Likewise, a low leverage level could be an indication of either high profitability or lack projects in the pipeline to fund. However, as seen in appendix 1 there are no clear pattern in the leverage residuals. Furthermore, we also assessed that there is no clear non-linear patterns of the other variables. In the residual plots, we see outliers in the market cap to total assets ratio and first-day return and that the EBITDA-margin observations are clustered around 0-30%. These unbalanced variables make the model and coefficients less precise.

The measures of profitability, the EBITDA-margin and the Asset Turnover Ratio, have consistently negative coefficients, but only the EBITDA-margin is significant at the conventional significance levels. Initially, the result is surprising as one would expect better margins would have a positive impact on the stock performance. However, a likely explanation could be that the IPOs with great EBITDA-margins are overvalued by the investors, as the IPOs are unable to maintain the high levels of profitability in the years following the IPO, as we saw in Table 8 of Chapter 4.

The country dummies show that the IPOs in Finland achieved significantly better BHARs holding the other variables constant. We are unable to make any conclusions about the difference between IPOs in Sweden, Norway, and Denmark, as the DK- and SE-dummies have low t-statistics and are statistically insignificant.

A positive first-day return is associated with better BHARs. The parameter coefficients are significant at the 0.05 level in model 1.1 and the 0.01 level in model 1.2. This relationship is in sharp contrast to the findings of Levis (2011), who found the first-day return coefficients to be negative and significant. Thus, it appears that the IPOs in our dataset with high first-day returns can keep momentum in the subsequent three years. As discussed in Chapter 4, the first-day returns in this sample are on average 9.2% whereas Levis (2011) sample had substantially higher first-day returns at 18.6%, the initial relatively more precise valuation of the stocks is likely to aid to the positive association.

In conclusion, four out of six of the control variables in our study have coefficients in the opposite direction than in Levis' (2011) study. This indicates the weakness of multivariate models that regress abnormal performance, which is in line with our expectations. The fact that only two out of six control variables of our model have effects in the same direction as Levis' study shows us that the relationships between aftermarket performance and IPO characteristics are very inconsistent across countries, time and the methodology applied. Thus, this indicates at least semi-strong market efficiency as described by Fama (1970), as the IPO characteristics, in general, are unable to predict abnormal performance persistently. It is also worth noting that some of the coefficients in our model were negative and significant while in the Levis (2011) regression the coefficient was positive

and significant. This proves that researchers studying abnormal long-run performance should be very careful when making conclusions, even if the coefficients are significant, as the results might be due to sample randomness or a temporary market anomaly that is not persistent in the long-run.

Results of PE- and VC-Sponsorship Variables

In model 1.2 and 1.4 we include the PE- and VC-sponsorship dummy variables. We see that the coefficients and significance levels of the control variables are relatively unaffected by the inclusion of the sponsorship dummies, which indicates the control variables work as intended and we have effectively separated the effect of the IPO-sponsorship and the control variables. Furthermore, the models now explain slightly more of the variation of BHAR, as the R^2 of the two models increase slightly when including the variables. However, the adjusted R^2 of the two models decrease marginally, indicating that the sponsorship-dummies do not explain much of the variation of BHAR.

Effect of PE-sponsorship

From Table 14 we see that the PE-sponsorship dummy has a positive coefficient in Model 1.2 with 111 observations and Model 1.4 with 133 observations. While we should be careful when interpreting the results of the regression as discussed, the coefficients indicate that private equity-sponsorship is positively associated with aftermarket BHAR. In other words, it appears that PE-backed IPOs in the long-run outperform the baseline, the non-backed IPOs, while holding the other IPO characteristics constant. This result is in sharp contrast to the findings of Chapter 5, where we saw in Table 12 that the group of non-backed IPOs exhibited better CAR and BHAR when weighting on an equal basis. So, the PE-backed IPOs as a group performed worse than the group of non-backed IPOs, but as the robustness checks in Table 13 highlighted, this result was substantially impacted by omitted variable bias as the PE-backed IPOs performed better than the non-backed IPOs when excluding the firms with no or little leverage. The results from the regression in Table 14 indicate that, when taking all IPO characteristics into account, there is a slightly positive relation between PE-sponsorship and the long-run buy-and-hold abnormal returns. The finding of positive performance of PE-backed IPOs is in line with the reviewed literature including (Bergström et al. 2006) (Katz, 2009) (Levis, 2011).

However, we only have 36 PE-backed IPOs in our sample, and none of the PE-dummy coefficients are significant, why the null-hypothesis of no relation between PE-sponsorship and the 36-month BHAR cannot be rejected. With t-statistics around 1.0 corresponding to a p-value around 0.30, there is a relatively large probability, that the sign and magnitude of the coefficient is simply due to sample randomness and that PE-sponsorship is not associated with better abnormal performance. Furthermore, as previously discussed, we cannot use the regression to document causality between PE-sponsorship and abnormal aftermarket performance due to the endogeneity problem.

VC-sponsorship

With only 16 VC-backed IPOs in the sample, there can hardly be made any conclusions of the aftermarket effect of a VC sponsor. The VC-sponsorship dummy variable has a positive coefficient in Model 1.2, but a negative coefficient in Model 1.4, and the t-statistics are very low, which all indicate that the effect of a VC-sponsorship is not statistically different from zero. Thus, we do not find the same result as Brav & Gompers (1997), who found superior performance of the VC-backed IPOs in the US. The result is more in line with Levis (2011), who found a slightly positive coefficient that was not statistically significant in the model including all six control variables.

Ownership Regression Models

The following set of regression models will examine the PE- and VC-backed IPOs to assess whether a series of governance variables could be associated with the abnormal long-run return. These governance-variables are related to the PE/VC-sponsors' level of ownership. As discussed in Chapter 2, the level of ownership could impact the operational performance and thereby might affect the aftermarket stock performance of the IPO. The dependent variable is still BHAR like in the previous series of regressions, but in Model 2.1-2.4 we will introduce four new variables which will be discussed in the following.

As mentioned in the theory section of Chapter 2, some of the ways that private equity firms create value in its portfolio firms are through monitoring, mentoring and parenting. Further, direct

ownership lower agency problems, as there is less separation between ownership and control, which is typically a large source of agency problems in publicly traded firms. Hence, it is expected that the ownership size-variable will be positively associated with operational performance and perhaps also with abnormal performance.

Since we only have ownership data for the PE- and VC-backed IPOs, this set of regressions will exclude all the non-backed IPOs. The four regressions Model 2.1-2.4 can be seen in Table 15. The SAS code used to conduct the regression can be seen in Appendix 3.

At first, we will assess the basic regression, Model 2.1, which only includes the control variables and a VC-dummy to distinguish between VC-backed and PE-backed IPOs. Since we do not have ownership data for all PE- and VC-backed IPOs, we exclude the first-day return to get as many observations as possible in the model. Besides, the country dummies have also been excluded, as there were too few Finnish PE-backed IPOs with available data. Furthermore, the recession dummy has been excluded, as only four PE- and VC-backed IPOs took place during these years. Thus, the model will include less control variables.

As seen in Table 15, three of the coefficients have opposite signs than the first set of regressions; *ln(market cap)*, *Asset turnover ratio* and *EBITDA-margin*. There is still a negative and significant relationship between the *Market-Cap-to-Total-Assets* ratio of PE- and VC-backed IPOs and the BHAR. In model 2.1 the VC-dummy has a very low t-statistic and a coefficient close to zero indicating no difference in performance between VC- and PE-sponsorship.

In Model 2.2, we include the Total sponsor-ownership variable, which shows the total ownership percentage of the sponsors after the IPO took place. Interestingly, the R^2 increases substantially when adding this variable indicating that the model explain more of the variation in BHAR. Since the coefficient is positive, it indicates that the IPOs with sponsors that hold on to a large ownership share after the IPO achieve better long-run performance in the aftermarket. This is supported by Model 2.3, where the coefficient increases and have a larger t-statistic. However, both coefficients are insignificant, why there cannot be made any definite conclusion. Even though the coefficients

are not significant, it is quite interesting that there appears to be a positive relation. If a study with more observations would find a strong positive relation, it could be explained by PE-funds being more engaged in firm governance, monitoring and mentoring if they have a large share after IPO. While a potential positive relation could be due to benefits of active ownership, it is not necessarily the ownership that causes the stock performance. Perhaps the sponsor keeps a large share because they expect the stock to perform well and that is the real cause of the positive relation.

Shares Sold by IPO-Sponsor

In Model 2.3 and 2.4, we include a variable of how large a share of ownership the IPO-sponsors sold at the IPO. From Table 6 in Chapter 4, we saw that the PE-sponsors on average owned 76% of the firm before the IPO but sold over half of their shares during the IPO resulting in post-IPO ownership of 36%. It is reasonable to expect that the sponsoring PE-fund would be more eager to sell its shares if they believe that the offering price of the IPO is overpriced. Likewise, if the PE-sponsors believe that the IPO will demonstrate superior aftermarket performance, they would likely hold on to as many shares as possible. Thus, this variable could be an indicator of how the insiders (the IPO-sponsors) view the market valuation and prospects. If there is asymmetric information, and the VC- or PE-sponsors have strategically timed the IPO or conducted window dressing as described in Chapter 2, then the PE- or VC-sponsor would be interested in selling as many of its shares as possible to avoid losses in the aftermarket, as the firm going public would likely disappoint the investors in the long-run resulting in negative aftermarket BHAR.

If there is strong market efficiency, as described in Chapter 2, then we would expect the coefficient of the ownership-sold-variable to be zero as neither outside investors or insiders should be able to predict excess stock performance (Fama, 1970). In other words, the IPO price should already include all public and private information making it impossible to predict whether the share price would perform better or worse than the market benchmark. However, if there is only semi-strong market efficiency, the IPO-sponsors should be able to predict the BHAR better than the market if they possess private information not available to the public.

Table 15 - Multivariate Regression of IPO BHAR with Ownership Variables

Multivariate OLS regression with BHAR as the dependent variable. BHAR is the Buy-and-Hold-Abnormal-Return of the 36-months consecutive to the first ended month of trading. BHAR is calculated using size- and industry-adjusted benchmark groups with locked-in portfolio weights. The independent variables are: the natural logarithm to the initial market capitalization of the IPO, the Market cap to total assets ratio, the leverage ratio calculated as Total Debt/Total Assets, the Asset Turnover Ratio, the EBITDA-margin, a dummy variable of whether the sponsor was a VC or PE (baseline), the total ownership percentage of all PE/VC sponsors post to the IPO, the shares sold by the PE/VC-sponsors relative to the shares held prior to the IPO, the ownership percentage of the largest PE/VC-sponsor post-IPO, the ownership percentage of the second largest PE/VC-sponsor post-IPO.
The numbers in parentheses below the parameter coefficients are the robust White t-statistics.

Variable	Model 2.1	Model 2.2	Model 2.3	Model 2.4
ln (Mkt. Cap)	0.055	0.150	0.126	0.180
	(0.5)	(0.98)	(0.8)	(1.58)
Mkt. Cap to Total Assets	-0.100 **	-0.146 ***	-0.142 ***	-0.186 ***
	(-2.31)	(-3.07)	(-2.86)	(-4.59)
Leverage	-0.165	-0.947	-0.850	-0.573
	(-0.16)	(-0.78)	(-0.72)	(-0.67)
Asset Turnover Ratio	0.319	0.201	0.234	0.475 **
	(1.26)	(0.88)	(1.01)	(2.49)
EBITDA-margin	0.402	-0.019	-0.031	-0.431 *
	(1.1)	(-0.07)	(-0.11)	(-1.84)
VC-sponsorship	0.085	-0.518	-0.491	-0.119
	(0.14)	(-1.63)	(-1.58)	(-0.44)
Total sponsor-ownership, post-IPO		0.459	0.710	
		(0.52)	(0.78)	
Total sponsor-ownership sold (relative)			-0.064	-0.116
			(-0.1)	(-0.21)
Main sponsor - Post-IPO ownership %				1.756 **
				(2.4)
Secondary sponsor - Post-IPO ownership %				-3.576 **
				(-2.6)
Intercept	-1.057	-1.952	-1.796	-2.894 **
	(-0.89)	(-1.15)	(-0.96)	(-2.22)
R^2	**0.167**	**0.416**	**0.412**	**0.642**
Adj. R^2	0.024	0.246	0.198	0.489
# of observations	42	32	31	31

**** Significant at the 0.01 alpha level*
*** Significant at the 0.05 alpha level*
** Significant at the 0.10 alpha level*

As seen in Table 15, the coefficient of the *total sponsor-ownership sold* variable of Model 2.3 is negative but insignificant with a low t-statistic of -0.1, and in Model 2.4 the coefficient is also negative with a slightly larger t-statistic. Since we have a small sample of only 31 observations in these models and the coefficients are insignificant, no definite conclusions can be made. However, the negative sign of the coefficients provides slight support for the supposition that the IPO-sponsors have inside information and sell a larger part of their shares if they expect undesirable aftermarket performance. On the other hand, the coefficients have so small t-statistics that we cannot reject the null hypothesis of no relation between BHAR and the proportion of sold shares by the sponsors, why the result could also be viewed as evidence of strong market efficiency on the Nordic market. It could be interesting to conduct a similar study of a larger sample set to examine further whether a large proportion of shares sold by insiders is associated with negative abnormal performance in the subsequent years.

Main Sponsor and Secondary Sponsor Ownership

Model 2.4 replaces the variable of total sponsor ownership with two variables of the ownership levels of the main and secondary sponsor respectively. With an R^2 of 0.642, this model is by far the model that explains most of the variation of the dependent variable. Thus, distinguishing between ownership of the main and the secondary IPO-sponsor appears favorable when trying to predict abnormal performance.

Interestingly, there is a positive and significant relationship between the size of the main IPO-sponsor and the abnormal performance, while there is a negative and significant effect of large secondary sponsors. This provides support for the presumption that it is the main sponsor who engages in the value-driving active ownership and that having one large blockholder with a controlling stake is preferable, while having a large secondary sponsor could cause a free-rider problem as both sponsors might expect the other party to conduct the governance and monitoring of the portfolio firms.

In conclusion, we find slight support for the notion that the size of ownership of the main IPO sponsor has a positive effect on the aftermarket performance of IPOs, and that the size of ownership

by secondary sponsors is negatively associated with aftermarket abnormal stock performance. The other findings of this chapter will be summarized in the next chapter.

Chapter 7 – Main Conclusion and Further Research

In this chapter, we will first summarize the findings of this paper. Then we will discuss implications of our results in relation to the research area and related literature, and make suggestions for further research. Finally, we will present the main conclusion of the paper.

Summary of Results

In Chapter 4, we examined the sample of 158 Nordic IPOs and differences in the characteristics of the three IPO groups. We found strong indications of market timing among PE- and VC-sponsors, since there was none of the 32 PE-backed or 16 VC-backed IPOs that took place in 2008, 2009, or 2012. The group of VC-backed IPOs consisted of smaller firms with unprofitable operations. But with 10 out of 16 firms being in the healthcare sector, our sample might not be representative for the typical performance of VC-backed listings. On the other hand, the PE-backed IPOs were, in general, larger, more leveraged, demonstrated as-good or better operational performance, and had higher market cap multiples than the non-sponsored IPOs.

We found that the PE-backed IPOs were able to maintain superior operating performance for at least three years following the IPO, while the VC-backed and non-sponsored IPOs experienced large declines in the sales growth rates and EBITDA-margins post-IPO. Thus we found support for the evidence suggesting that a PE-sponsorship adds operational value that lasts for at least three years post-IPO, and that the PE-sponsors do not engage in window dressing.

In line with Schuster (2003), we found all IPOs to exhibit a substantial average first-day price jump of 9.2% using equal weights, which indicated that Nordic IPOs during 2005-2014 were underpriced in the short-run. Interestingly, we found that the VC-backed IPOs were the least underpriced IPO group, while the non-sponsored IPOs, on average, had the highest first-day returns. Thus, the results indicate that VC- and PC-sponsors are better to extract value from the IPO than the issuers of the non-sponsored IPOs.

Aftermarket Performance of IPO Groups

In Chapter 5, we found interesting results regarding the long-run abnormal stock performance of the IPO groups and the sensitivity to methodology. We proposed a new benchmark method, which creates unique benchmark portfolios with locked-in weights to resemble the way that delisted stocks are weighted in the IPO groups. This method resulted in around 11% less underperformance than when using the conventional approach of monthly rebalancing of the benchmark portfolios. This difference in results of methodology indicates that other studies might overestimate the magnitude of underperformance among IPOs. Nevertheless, even when using our proposed benchmark method, we also found evidence of general IPO aftermarket underperformance in the Nordics. The size- and industry-adjusted 3-year buy-and-hold abnormal returns (BHAR) of the full sample of IPOs were -15.2% and -23.4% on an equal- and value-weighted basis and significant at the 0.05 and 0.01 alpha level respectively. This adds support to the findings of IPO underperformance by Ritter (1991), Schuster (2003), Bergström et al. (2006), and Levis (2011).

In contrast to the reviewed literature, the Nordic PE-backed IPOs demonstrated substantial long-run underperformance relative to the non-sponsored IPOs when applying the size- and industry-adjusted benchmarks and equal weights. However, when using value weights, there was little difference between the BHARs and CARs of the PE- and non-sponsored IPOs. Nevertheless, the group of PE-backed IPOs did not demonstrate superior aftermarket performance, as found in the studies by Schuster (2003), Bergström et al. (2006), and Levis (2011). Neither did the small sample of VC-backed IPOs outperform the non-sponsored IPOs. Instead, the VC-backed IPOs experienced the worst buy-and-hold abnormal returns as well as cumulative abnormal returns using both equal and value weighting, which is opposite to the results found by Brav & Gompers (1997).

Since Chapter 4 demonstrated large differences in IPO characteristics among the three IPO groups, we conducted a robustness check at the end of Chapter 5 to assess if the results were consistent across characteristics. This analysis showed that the outperformance of the non-backed IPOs was not robust, i.e., when restricting the sample to firms with a leverage ratio above 0.10, the PE-backed IPOs went from underperforming to outperforming the non-backed IPOs. Thus, these robustness checks indicated that the study of long-run performance across IPO groups is impacted by omitted

variable bias, as there could be undiscovered relations between IPO characteristics and the abnormal stock performance.

In short, we did not find that the Nordic PE-backed IPOs outperformed the non-sponsored IPOs. Instead, we found indications of long-run stock underperformance of PE-sponsored IPOs relative to non-sponsored IPOs, but the result was very sensitive to the applied methodology and inconsistent to robustness checks.

Aftermarket Performance and IPO Characteristics

In Chapter 6, we conducted a series of multivariate regression models to isolate the effect of PE- and VC-sponsorship by including IPO characteristics as control variables. We argued that the models likely possess an endogeneity problem, as the PE/VC-sponsors invest in firms with specific operating characteristics and at the same time influence the same operating characteristics through active ownership. This issue of endogenous variables made us incapable of making conclusions of causal effects from the regression models, however, the models could still indicate associations between BHAR and the independent variables.

The first set of regressions, model 1.1-1.4, indicated a slightly positive relationship between PE-sponsorship and the aftermarket BHAR. However, the coefficients of the PE-sponsorship variable were insignificant both in model 1.2 and 1.4 with a p-value around 0.30. In addition, all of the four regression models had low explanatory power with a maximum R^2 of 0.181. Besides, the effect of a VC-sponsorship was close to zero and inconsistent, as the coefficient switched between being positive in model 1.2 to negative in model 1.4.

In model 2.1-2.4, the sample used in the regressions were restricted to the PE- and VC-backed IPOs only, and we included a set of ownership variables. We found insignificant indications of a positive relationship between the size of the sponsors' total ownership share and the IPO aftermarket performance, which indicates that a large sponsor adds more value, i.e., through undertaking more active ownership. In addition, there was a negative but insignificant association between the relative fraction of shares sold and the long-run stock performance, which could indicate that

sponsors act on inside information. On the other hand, the coefficients had small t-statistics, why it cannot be rejected that the coefficients are equal to zero, which could imply strong market efficiency.

The regressions revealed the flaws of multivariate regression models predicting abnormal stock returns, as we found that four out of six control variables had coefficients in the opposite direction than Levis' (2011) study of UK-based IPOs. This contradiction could suggest that the coefficients of a model predicting abnormal performance are not persistent across markets and over time, which is in line with the semi-strong and strong levels of market efficiency described by Fama (1970).

Discussion and Further Research

Our main purpose of this paper was to examine whether the reviewed literature's surprising finding, of PE-backed IPOs demonstrating superior abnormal stock performance, could be reproduced in a study of recent Nordics IPO.

Throughout the paper, we have seen mixed results of the relationship between PE-sponsorship and the IPO aftermarket performance. The effect of PE-sponsorship on abnormal performance has switched between indications of a positive and a negative relation and has been proved to be very sensitive to the methodology applied. Neither in Chapter 5 or 6, did we find any statistical significant outperformance of the PE-backed IPOs. Thus, we have not been able to reproduce the results of strong outperformance among PE-backed IPOs as found by Schuster (2003), Bergström et al. (2006), and Levis (2011). The fact that we have not been able to achieve the same results of these papers casts doubt on the persistence of superior PE-backed aftermarket performance across countries and time.

Since we have found that the Nordic PE-backed IPOs between 2005-2014 did not significantly outperform the non-sponsored IPOs, the results found by Schuster (2003), Bergström et al. (2006), and Levis (2011) could reflect a temporary market anomaly rather than a causal relationship that is persistent over time. Thus, it could be that the investors of the markets studied by the authors mentioned above have temporarily undervalued the long-run performance of the PE-backed IPOs

compared to the non-sponsored listings. Levis (2011) argues that the investors appear to be surprised by the PE-backed IPOs' stable level of great operating performance in the years following the IPO. In line with Levis (2011), we also found that the PE-backed IPOs could maintain better levels of operating performance in the three years post-IPO. However, it appears that the investors did not underestimate the operating performance of the Nordic IPOs during 2005-2014. Thus, the investors might have readjusted their expectations to include the superior aftermarket operating performance of PE-sponsored firms.

Another explanation for the differences in results could be that methodology used in our study and the reviewed papers do not fully capture all risk factors associated with PE-backed and non-backed IPOs. Thus, the differences in the long-run performance could reflect different unobserved risk factors. Even though we use size- and industry-adjusted benchmark groups to adjust for risk profiles, it would be favorable if the benchmark groups took more risk-factors into account, i.e., the leveraged betas and valuation multiples.

As mentioned in the literature review, there were two recent studies of Scandinavian IPOs conducted by the Swedish and Danish Venture Capital and Private Equity Associations, who found that PE-backed IPOs achieved higher abnormal returns. However, these studies did not thoroughly describe their IPO selection process and used the broad market index as the benchmark group. Therefore, we doubt their applied methodology and results. Our study examined the same markets and a similar time-period using a better benchmark and methodology approach and did not find the same evidence of superior performance among PE-backed IPOs. Therefore, this could be an example of how simplified methodology can lead to misleading conclusions. Further, we suspect that the studies might be biased as the authors have the incentive to find positive results. It could be interesting for future research to replicate their studies to confirm if they are indeed biased.

Our result of no strongly significant relationship between the type of ownership and long-run abnormal performance is in line with the conventional capital market theory, as abnormal stock returns should not be predictable by using public information in semi-strong and strong markets (Fama, 1970).

While we could not support the results of long-run abnormal stock performance of PE-backed IPOs, we did find additional evidence of positive first-day returns of all IPO groups and negative long-run abnormal stock returns across all IPO groups. Thus, it appears that IPOs are both undervalued in the short-run and overvalued in the long-run at the same time. It could be interesting for further research to closely examine why IPOs in general experience first-day returns but negative long-run abnormal stock performance, as the underlying reasons for these market anomalies remain unclear.

Main Conclusion

Using a sample of 158 Nordic IPOs listed during 2005-2014, we have not been able to find substantial evidence of superior long-run abnormal stock performance among PE-sponsored IPOs. Thus, our results conflict with the findings of Levis (2011), Bergström et al. (2006) & Katz (2009) but are in line with the capital market theory of semi-strong and strong market efficiency (Fama, 1970).

We found that the Nordic PE-backed IPOs had large deviations in abnormal performance dependent on the applied benchmark group and whether the portfolio was weighted on an equally- or value-weighted basis. Furthermore, we initially found that non-sponsored IPOs outperformed the PE-backed listings in the long-run using equal weights, but this result was not consistent to a series of robustness checks.

Through a series of multivariate regressions, we also tried to isolate the effect on aftermarket performance of the type of IPO-sponsorship. While the coefficients of the PE-dummies were positive indicating a slight positive relationship between PE-sponsorship and the buy-and-hold abnormal returns, the results of the regression were inconclusive as the coefficients were insignificant at the conventional alpha levels. Furthermore, the regression models also indicated some vague relationships between the sponsor ownership variables and aftermarket performance.

We proposed a new benchmark method that better resembles the way that delisted stocks are weighted in the IPO groups. This method resulted in around 11% less underperformance than the

conventional method of creating benchmark portfolios. Even when using this method, we also found evidence of general IPO aftermarket underperformance in the Nordics, as the 3-year BHAR of the full sample of IPOs were ‑15.2% and ‑23.4% on an equally- and value-weighted basis and significant at the 0.05 and 0.01 alpha level respectively. In addition, we found that the Nordic IPOs on average achieved a 9.2% first-day return. These findings add support to the pattern found in the reviewed literature of short-run underpricing but long-run negative abnormal stock performance.

Our paper has documented how sensitive measures of abnormal performance are to methodology, and how careful researchers should be when making conclusions about relations between abnormal performance and stock characteristics.

We have not been able to recreate the results of strong market outperformance among PE-backed IPOs as found by the reviewed literature. Our results indicate that the results found by Schuster (2003), Bergström et al. (2006), and Levis (2011) could reflect a market anomaly that is not persistent across countries and over time. Levis (2011) found that the PE-backed IPOs had superior operational performance in the years following the IPO and argued that the investors could be surprised by the stable level of the superior operating performance. We also found that the Nordic PE-backed IPOs achieved superior post-IPO operating performance, which indicates that a PE-sponsorship adds value for at least three years after the IPO. However, this did not translate into superior stock performance, which indicates that the investors might have readjusted their expectations of the PE-backed IPOs to include the superior post-IPO operating performance. This possible explanation is in line with the theory of efficient markets, but further research is needed to validate this suggestion.

References

Akerlof, G. A. (1970). The Market for "Lemons": Quality Uncertainty and the Market Mechanism. *Oxford University Press*, 488-500.

Aktietorget. (2018, January). Denmark Gets a New Stock Market; Aktietorget is Coming to Denmark.

Baker, G. P., & Montgomery, C. A. (1994). Conglomerates and LBO Associations: A Comparison of Organizational Forms . *Harvard Business School*.

Berg, A., Gottschlag, & Oliver. (2007). Understanding Value Generation In Buyouts. *Journal of Private Equity, 11*(1), 22-39.

Bergström, C., Nilsson, D., & Wahlberg, M. (2006, Fall). Underpricing and Long-Run Performance Patterns of European Private-Equity-Backed and Non-Private-Equity-Backed IPOs. *The Journal of Private Equity, 9*(4), 16-47.

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

Brav, A., Geczy, C., & Gompers, P. A. (2000). Is the abnormal return following equity. *Journal of Financial Economics, 56*, 209-249.

Brealey, R. A., Meyers, S. C., & Franklin, A. (2016). *Principles of Corporate Finance.* McGraw-Hill Education - Europe.

Brown, S. J., & Warner, J. B. (1980). Measuring Security Price Performance. *Journal of Financial Economics, 8*, 205-258.

Cao, J. X. (2011). IPO Timing, Buyout Sponsors' Exit Strategies and. *Journal of Financial and Quantitative Analysis*, 1001-1024.

Cao, J. X., & Lerner, J. (2009). The performance of reverse leveraged buyouts. *Journal of Financial Economics*, 139-157.

Coakley, J., Hadass, L., & Wood, A. (2007). Post-IPO Operating Performance, Venture. *Journal of Business Finance & Accounting*, 1423–1446.

DVCA. (2017). *Kapitalfonde i 2016/17 - Årsskrift om god selskabsledelse.* Danish Venture Capital and Private Equity Association. Danish Venture Capital and Private Equity Association.

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, 383-417.

Fama, E. F. (1998). Determining the number of priced state variables in the ICAPM. *The Journal of Financial and Quantitative Analysis*, 217-321.

Fenn, G. D., Liang, N., & Prows, S. (1995). The Economics of the Private Equity Market. *Federal Reserve Bulletin*, 168-235.

Fisher, D. (2016, August 7). *Study Demolishes Private Equity's Claim Of Beating The Market*. Retrieved from Forbes: https://www.forbes.com/sites/danielfisher/2016/08/07/private-equity-returns-evaporate-when-you-account-for-leverage-small-cap-exposure/#6380dd5734e1

Goergen, M., Khurshed, A., & Mudambi, R. (2007). The long-run performance of UK IPOs: can it be. *Managerial Finance*, 401-419.

Grant, R. M. (2013). *Contemporary Strategy Analysis.* John Wiley Sons.

Guba, E. A., & Lincon, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin, & Y. S. Lincon, *Handbook of qualitative research* (pp. 105-117). Thousand Oaks: Sage.

Hamao, Y., Packer, F., & Ritter, J. (2000). Institutional Affiliation and the Role of Venture Capital: Evidence from Initial Public Offerings in Japan. *Pacific-Basin Finance Journal, 8*, 529-558.

Investopedia. (2018, 05 02). *Investopedia*. Retrieved April 22, 2018, from Capitalization-Weighted Index: https://www.investopedia.com/terms/c/capitalizationweightedindex.asp

Investopedia. (2018, 05 14). *Lock-Up Agreement*. Retrieved from www.investopedia.com: https://www.investopedia.com/terms/l/lockup.asp

Jenkinson, T., & Ljungqvist, A. (2001). *Going public: the theory and evidence on how companies raise equity finance.* Oxford : Oxford University Press.

Jensen, M. C. (1986). Agency Cost of Free Cash Flow, Corporate Finance and Takeovers. *The American Economic Review*, 323-329.

Jensen, M. C. (1989). Eclipse of the Public Corporation. *harward Business Review*.

Kaplan, S. N., & Strömberg, P. (2008). Leveraged Buyouts and Private Equity. *Journal of Economic Perspectives, 23*, 121-146.

Katz, S. P. (2009). Earnings Quality and Ownership Structure: The Role of Private Equity Sponsors. *The Accounting Review, 84*(3), 623-658.

Kester, W. C., & Luehrman, T. A. (1995). Rehabilitating the leveraged buyout. *Harvard Business Review* , 119-130.

Klier, D. O., Welge, M. K., & Harrigan, K. R. (2009). The Changing Face of Private Equity: How Modern Private Equity Firms Manage Investment Portfolios. *The Journal of Private Equity*, 7-13.

Kothari, S., & Warner, J. (1997). Measuring long-horizon security price performance. *Journal of Finance, 43*, 301-339.

Kothari, S., & Warner, J. B. (2004). Econometrics of Event Studies. In E. B. Eckbo, *Handbook of Corporate Finance: Empirical Corporate Finance* (pp. 3-36). Amsterdam: North Holland.

KPMG. (2016). *Study of Swedish IPO performance (2001-2016) - Does the prior investor matter?* KPMG Corporate Finance, Sweden. KPMG Corporate Finance, Sweden.

Kruskal, W. H., & Wallis, W. A. (1952). Use of Ranks in One-Criterion Variance Analysis. *Journal of the American Statistical Association*, 583-621.

Laurent, B., Scaillet, O., & Wermers, R. (2010). False Discoveries in Mutual Fund Performance: Measuring Luck in Estimated Alphas. *The Journal of Finance*, 179-216.

Leland, H. E., & Pyle, D. H. (1977, September 16-18). Informational Asymmetries, Financial Structure, and Financial Intermediation. *The Journal of Finance*, pp. 371-387.

Levis, M. (2011). The Performance of Private Equity-Backed IPOs. *Financial Management, 40*(1 (Spring 2011)), 253-277.

Loughran, T., & Ritter, J. R. (2000). Uniformly least powerful tests of market efficiency. *Journal of Financial Economics, 55*(3), 361-389.

Lyon, J. D., Barber, B. M., & Tsai, C.-l. (1999). Improved Methods for Tests of Long-Run Abnormal. *The Journal of Finance*, 165-201.

Megginson, W. L., & Weiss, K. A. (1991, July). Venture Capitalist Certification in Initial Public Offerings. *The Journal of Finance, Vol. 46* (No. 3), 879-903.

Mitchell, M. L., & Stafford, E. (1998). Managerial decisions and long-term stock price performance. *Working paper*.

Nasdaq. (2017, December 20). *Nasdaq Media Center*. Retrieved from http://business.nasdaq.com/mediacenter/pressreleases/1660396/market-cap-segment-review-at-nasdaq-nordic-exchanges

Nasdaq. (2018, 04 08). *Nasdaq*. Retrieved from NORDIC MAIN MARKET: http://business.nasdaq.com/list/listing-options/European-Markets/nordic-main-market

OECD. (2018). *Quarterly National Accounts: Quarterly Growth Rates of real GDP, change over previous quarter*. (OECD, Producer) Retrieved 04 29, 2018, from OECD.stat: http://stats.oecd.org/Index.aspx?QueryName=350&QueryType=View&Lang=en#

Rasmussen, P. N., & Burg, I. v. (2008). *Hedge Funds and Private Equity - A critical analysis.* Socialist Group in the European Parliament.

Ritter, J. R. (1991, March). The Long-Run Performance of Initial Public Offerings. *The Journal of Finance, XLVI*(1), 1-27.

Saunders, M., & Lewis, P. T. (2007). *Research Methods for Business Students.* Essex: Pearson Education.

Schultz, P. (2003). Pseudo Market Timing and the Long-Run Underperformance of IPOs. *Journal of Finance*, 483-518.

Schuster, J. A. (2003). *IPOs: Insights from Seven European Countries.* London School of Economics and Political Science, Financial Markets Group. London: LSE.

Sharpe, W. F. (1991). The Arithmetic of Active Management. *The Financial Analysts' Journal*, 7-9.

Shleifer, A., & Vishny, R. W. (1997). A Survey of Corporate Governance. *American Finance Association, 52*(2), 737-783.

Smith, A. J. (1990). Corporate ownership structure and performance: The case of management buyouts. *Journal of Financial Economics*, 143-164.

Stock, J. H., & Watson, M. W. (2011). *Introduction to Econometrics* (Vol. 3rd ed.). Boston, USA: Addison-Wesley, Pearson.

SVCA. (2015). *Analysis of Swedish IPOs 2001-2014, 2015-02-19.* Analysis, SWEDISH PRIVATE EQUITY & VENTURE CAPITAL ASSOCIATION.

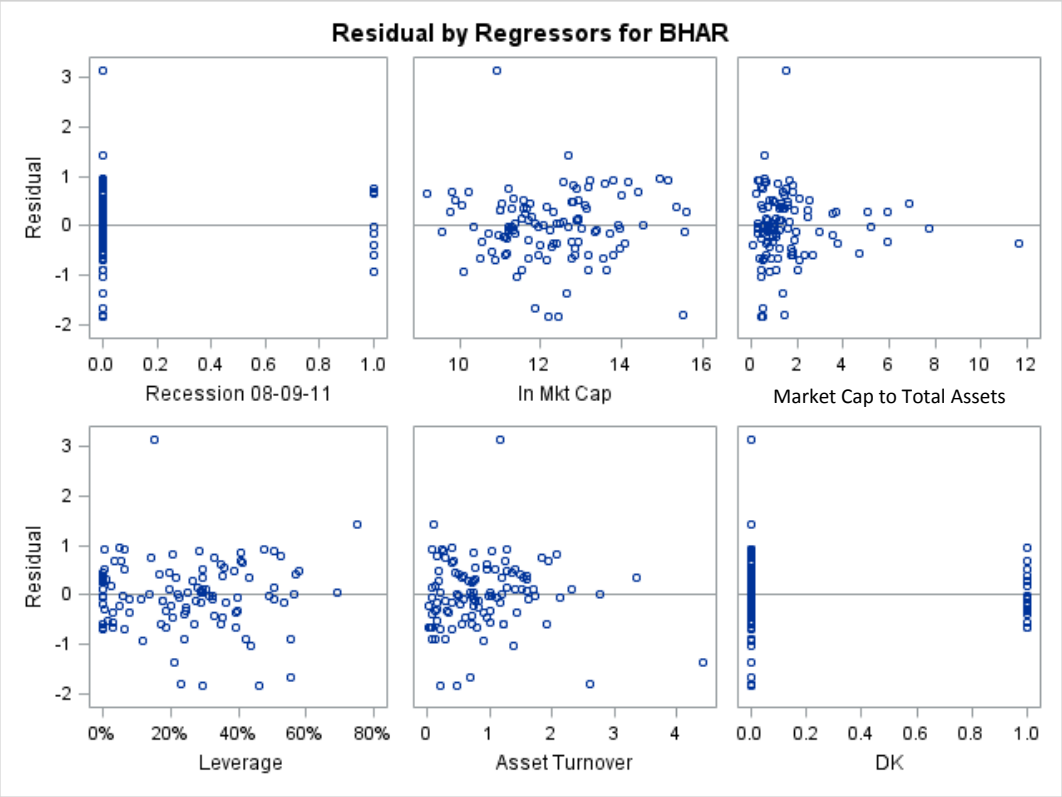
Thomsen, S., & Conyon, M. (2012). *Corporate governance: Mechanisms and systems.* Copenhagen: DJØF Publishing.

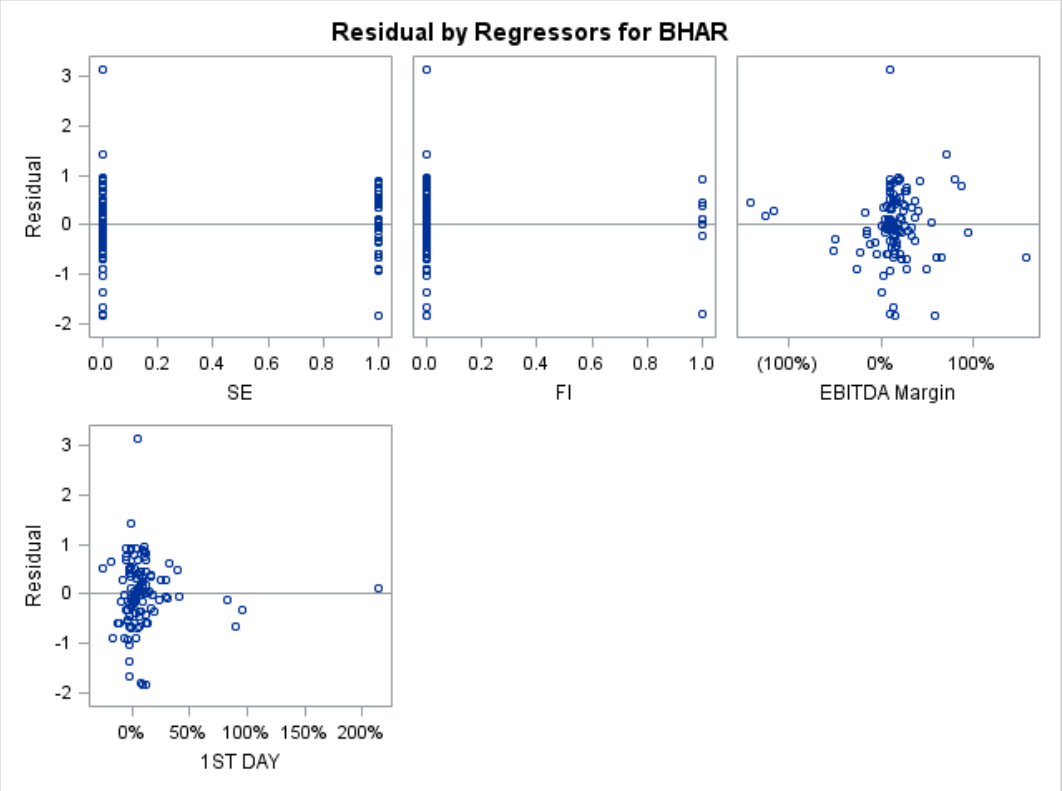
White, H. (1980). A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity. *The Econometric Society*, 817-838.

Winter, J. d. (2013, August). Using the Student's t-test with extremely small sample sizes. *Practical Assessment, Research & Evaluation, 18*(10).

Appendices

Appendix 1 – Residual plots of Model 1.1





Appendix 2 – SAS code used to conduct regression model 1.1-1.4

```
*Importing the data;
PROC IMPORT OUT = WORK.IPOs DATAFILE =
"C:\Users\joth12ab\Dropbox\Kandidatafhandling - The A Team\Statistik\IPOs.xlsx"
      DBMS = xlsx REPLACE;
      SHEET = "import";
      GETNAMES = YES;
RUN;

*Printing the first 10 observations;
PROC PRINT DATA = IPOs(obs=10);
RUN;


*Model 1.1 - Control variables only;
PROC REG DATA = IPOs;
      MODEL  BHAR  =  Recession_08_09_11  ln_Mkt_Cap  Price_to_book  Leverage
      Asset_Turnover DK SE FI EBITDA_Margin _1ST_DAY / WHITE;
      OUTPUT OUT=IPOs
      RESIDUAL=resid;
RUN;


*Model 1.2 - Including sponsorship dummies;
PROC REG DATA = IPOs;
      MODEL  BHAR  =  Recession_08_09_11  ln_Mkt_Cap  Price_to_book  Leverage
      Asset_Turnover DK SE FI EBITDA_Margin _1ST_DAY PE_dummy VC_dummy / WHITE;
      OUTPUT OUT=IPOs
      RESIDUAL=resid;
RUN;

*Model 1.3 - Control model without 1st day return;
PROC REG DATA = IPOs;
      MODEL  BHAR  =  Recession_08_09_11  ln_Mkt_Cap  Price_to_book  Leverage
      Asset_Turnover DK SE FI EBITDA_Margin / WHITE;
      OUTPUT OUT=IPOs
      RESIDUAL=resid;
RUN;


*Model 1.4 - Including sponsorship dummies, excluding 1st day return;
PROC REG DATA = IPOs;
      MODEL  BHAR  =  Recession_08_09_11  ln_Mkt_Cap  Price_to_book  Leverage
      Asset_Turnover DK SE FI EBITDA_Margin PE_dummy VC_dummy / WHITE;
      OUTPUT OUT=IPOs
      RESIDUAL=resid;
RUN;
```

Appendix 3 – SAS code used to conduct regression model 2.1-2.4

```
*Importing the data;
PROC IMPORT OUT = WORK.PE_VC DATAFILE =
"C:\Users\joth12ab\Dropbox\Kandidatafhandling - The A Team\Statistik\PE_VC.xlsx"
      DBMS = xlsx REPLACE;
      SHEET = "import";
      GETNAMES = YES;
RUN;

*Printing the first 10 observations;
PROC PRINT DATA = PE_VC(obs=10);
RUN;

*PE VC Control - model 2.1;
PROC REG DATA = PE_VC;
      MODEL BHAR = ln_Mkt_Cap Price_to_book Leverage Asset_Turnover EBITDA_Margin
VC_dummy/ WHITE;
      OUTPUT OUT=IPOs
      RESIDUAL=resid;
RUN;


*PE VC Control - model 2.2;
PROC REG DATA = PE_VC;
      MODEL BHAR = ln_Mkt_Cap Price_to_book Leverage Asset_Turnover EBITDA_Margin
VC_dummy Post_total_sponsor_own / WHITE;
      OUTPUT OUT=IPOs
      RESIDUAL=resid;
RUN;


*PE VC Control - model 2.3;
PROC REG DATA = PE_VC;
      MODEL BHAR = ln_Mkt_Cap Price_to_book Leverage Asset_Turnover EBITDA_Margin
VC_dummy Post_total_sponsor_own Sponsor_sold_relative / WHITE;
      OUTPUT OUT=IPOs
      RESIDUAL=resid;
RUN;


*PE VC Control - model 2.4;
PROC REG DATA = PE_VC;
      MODEL BHAR = ln_Mkt_Cap Price_to_book Leverage Asset_Turnover EBITDA_Margin
VC_dummy Sponsor_sold_relative post_Ownership_of_Main_BH
post_Ownership_of_secondary_BH / WHITE;
      OUTPUT OUT=IPOs
      RESIDUAL=resid;
RUN;
```