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Private Equity Involvement in Nordic IPOs

An empirical study on first-day returns and long-term performance of IPOs on the Nordic market

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ABSTRACT

Title:	**Private Equity Involvement in Nordic IPOs** - An empirical study on first-day returns and long-term performance of IPOs on the Nordic market
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Authors:	Leo Dajakaj, Tim Jacobsson, Julia Wilsby
Advisor:	Susanne Arvidsson
Key words:	IPO, Ownership Structure, First-day returns, BHAR, Long-run performance
Purpose:	The aim of this study is to determine whether there are any differences in the first-day returns and the long-run performance between IPOs with different ownership structures. Further, the authors have chosen a number of variables from previous studies in order to examine whether these can explain the long-run performance of IPOs on the Nordic market.
Methodology:	A quantitative method with a deductive approach was used in the study in order to analyze the collected secondary data.
Theoretical perspectives:	The previous research that has been used in this study has mainly focused on the first-day returns and long-run performance of IPOs on the US and European markets.
Empirical foundation:	The research is based on data from companies on Nordic stock exchanges. The data was obtained from Zephyr, Thomson Reuters Datastream, Argentum, annual reports and firm prospectuses.
Conclusions:	The authors find that the private equity-backed IPOs in the sample perform the best in the long-run and also have the lowest first-day returns in comparison to the venture capital-backed IPOs and the non-sponsored IPOs, however the differences are not significant. Further, the independent variable high IPO activity showed a significant negative impact on BHAR.

ABSTRAKT

Titel:	**Private Equity Involvement in Nordic IPOs** - An empirical study on first-day returns and long-term performance of IPOs on the Nordic market
Seminariedatum:	2017-01-12
Ämne/kurs:	FEKH89, Företagsekonomi: Examensarbete i finansiering på kandidatnivå, 15 högskolepoäng
Författare:	Leo Dajakaj, Tim Jacobsson, Julia Wilsby
Handledare:	Susanne Arvidsson
Fem nyckelord:	Börsnotering, Ägandestruktur, Första dagens avkastning, BHAR, Långsiktig prestation
Syfte:	Syftet med studien är att fastställa om det finns några skillnader mellan börsintroduktioner med olika ägandestrukturer vad gäller första dagens avkastning och långsiktig prestation. Vidare valde författarna ett antal variabler från tidigare studier för att undersöka huruvida det finns något signifikant samband mellan dessa och den långsiktiga prestationen av börsintroduktioner på den nordiska marknaden.
Metod:	I denna studie har författarna använt en kvantitativ metod med en deduktiv ansats för att analysera den insamlade sekundärdata.
Teoretiska perspektiv:	Den tidigare forskning som har använts i denna studie har huvudsakligen undersökt börsintroduktioners första dagens avkastning och långsiktiga prestation på den amerikanska och europeiska marknaden.
Empiri:	Denna studie är baserad på data från företag noterade på nordiska börser. Datan samlades in via Zephyr, Thomson Reuters Datastream, Argentum, årsredovisningar och företags prospekt.
Resultat:	Författarna finner att de börsintroduktioner som är "private equity-backed" presterar bäst på lång sikt och även har lägsta nivån av första dagens avkastning när man jämför med de börsintroduktioner som är "venture capital-backed" och "non-sponsored". Dock är skillnaden mellan grupperna ej signifikant. Vidare visar den oberoende variabeln för hög börsnoteringsaktivitet ett signifikant negativt samband med BHAR.

TABLE OF CONTENTS

1. INTRODUCTION

The first chapter will present the topic of the study and will lead to the problem statement. Further, the purpose of the study and research questions will be presented, with its scope and limitations explained. Finally, the target audience and the disposition for the study will be presented.

1.1 BACKGROUND

In the United States, firms funded by a private equity (PE) firm have long been seen as a standard in the equity capital market (van Frederikslust & van der Geest, 2001; Levis, 2011). In contrast, the European capital market has staggered, falling behind on this trend (PriceWaterhouseCoopers (PwC), 2014). Just recently, PE firms have started establishing themselves in Europe (Levis, 2011). In 2003, 43 % of the initial public offerings (IPO[1]) in the United States were private equity backed while corresponding numbers were only 9 % in Europe (PwC, 2014). Over the last ten years these numbers have drastically changed as PE-backed IPOs amounted to 50 % in the United States and 48 % in Europe (PwC, 2014). The PE industry has in the last decade also seen a large and substantial growth in the Nordic region, where PE investment has risen from 0.19 billion dollars in 1990 (European Private Equity and Venture Capital Association, 2007) to over 6.3 billion dollars in 2015 (Argentum, 2015). Consequently, it is of no surprise that PE has attracted media attention given the recent surge of PE-backed IPOs (PwC, 2014; Cotterill, 2016).

The definition of a PE firm can best be described as when an investment manager invests in and funds the private equity of operating firms. PE firms are involved in various kinds of investment strategies such as leverage buyouts (LBO), buyouts (BO), venture capital (VC) and growth equity funding (Mogilevsky & Murgulov, 2012). One important distinction to be made is between PE firms and VC firms. In a PE-backed IPO the issuer is highly leveraged i.e. has a lot of debt. In addition, PE funds have majority ownership in the firm, tend to invest in mature cash-flow-stable firms and exit their investment within a few years (Schöber, 2008). PE firms normally consist of small teams, where the professionals working there have backgrounds primarily from investment banking, however backgrounds from strategy and management consulting are also common (Levis, 2011). In contrast, Mogilevsky and Murgulov (2012) state that the professionals working in VC firms tend to have backgrounds

[1] An IPO is the first time that a security is offered to the public and introduced to the market (Ritter, 1998).

in technology or experience from working in industries. In addition, VC firms tend to invest only a minority stake in start-up companies. These firms are young and riskier but have higher growth potential. The expertise VC firms possess in their specific field allows them to distinguish great business ideas from average and bad ones (Mogilevsky & Murgulov, 2012). Comparatively, because PE firms only invest in mature companies with stable cash flows, the need to have the same in-depth industry knowledge in specific markets is not as important. Instead skillets in operational efficiency are more valued.

An important aspect in any PE or VC firm is how they will realize the return from their investment (Sinah, Gonzalez & Aase, 2005). Most commonly, PE and VC firms tend to realize their return from a market introduction i.e. IPO (Levis, 2011), thus one would expect there to be a lot of research and studies regarding PE- and VC-backed IPOs.

1.2 PROBLEM STATEMENT

Loughran and Ritter (1995) performed an extensive study on the US market where they found that IPOs significantly underperform compared to other public firms and showed average abnormal returns of -26.9 percent. Similar studies have researched the performance of IPOs and have confirmed that IPOs do in fact underperform in the aftermarket (Ritter, 1991; van Frederikslust & van der Geest, 2001; Bergström, Nilsson & Wahlberg, 2006; Levis, 2011). Miller (1977) provides an explanation for this IPO phenomenon as he finds that investors hold different expectations on the value of an IPO and that there thus exists a divergence of opinions, which can explain why these firms demonstrate long-run underperformance. Similarly, Loughran and Ritter (1995) present that an important explanation for IPO underperformance is that the shares are incorrectly valued at the IPO. This can be explained by the uncertainty that exists when a firm has not yet been previously valued by the market. Further this explanation relates to another IPO trait where the offering price of IPOs is found to be undervalued. Ritter (1984) is one of many that has examined the first-day returns of IPOs. In his study he found an average increase in the trading price of 18.8 percent compared to the offering price. This underpricing phenomenon of IPOs has been confirmed by several previous studies (Ritter, 1984; van Frederikslust & van der Geest, 2001; Bergström et al., 2006).

Conversely, PE- and VC-backed IPOs seem to experience less underperformance and less underpricing, if any at all, as seen in prior empirical studies conducted on the US market (Holthausen & Larcker, 1996; Cao & Lerner 2009; Mogilevsky & Murgulov, 2012). Factors like improvements in operating performance, stronger corporate governance and access to more capital in PE-backed firms differentiate PE-backed IPOs from Non-Sponsored (NS) IPOs and may partially explain why there are differences in the long-run performances of IPOs (Kaplan & Strömberg, 2008). Furthermore, the long-run performance of VC-backed IPOs is known to be better than that of NS IPOs, as the presence of venture capitalists in a firm signals an insurance of quality to the market (Megginson & Weiss, 1991). Other studies have been performed on the European market, while far fewer and more limited, these have supported the theories implied by the studies from the US markets (van Frederikslust & van der Geest, 2001; Bergström et al, 2006; Levis, 2011). More specifically, that PE-backed IPOs tend to experience better long-term performance and lower underpricing than that of VC backed IPOs and NS IPOs.

Most studies on the role of PE and VC in IPOs are concentrated on the American market (US) (Levis, 2011), while some studies have been conducted on the European market there has been almost no research on the Nordic markets (Spliid, 2013). Given that the corporate environment between the US, European and the Nordic markets differ in many aspects such as economic, cultural, political and fundraising, there is a need to further research on whether American- and European-biased findings apply to the Nordic market (Spliid, 2013).

1.3 PURPOSE AND RESEARCH QUESTIONS

The purpose of this study is to determine whether there are any differences in the first-day returns and the long-run performance between IPOs with different ownership structures i.e. PE-backed IPOs, VC-backed IPOs and NS IPOs. Further, the authors have chosen a number of variables from previous studies including first-day returns, leverage ratio, offering size, market capitalization, ownership structure and IPO activity period in order to examine whether these can explain the long-run performance of IPOs on the Nordic market.

Moreover, very limited studies have been conducted on the Nordic market regarding the long-run performance of IPOs (Westerholm, 2007). Similarly, no studies have distinguished between the ownership structures when examining the performance of IPOs (Spliid, 2013).

Thus, the authors aim to contribute with further knowledge in this area that is intended to provide helpful insights for individuals who are considering investing in Nordic IPOs.

This study will answer the following questions:

How do the first-day returns and the long-run performance of PE-backed IPOs, VC-backed IPOs and NS IPOs compare to each other?

Can the chosen variables explain the long-run performance of IPOs on the Nordic market?

1.4 SCOPE AND LIMITATIONS

This study will include IPOs from four Nordic countries; Sweden, Norway, Denmark and Finland between the years 2000 and 2012. The reason for this is to test whether similar results and conclusions that have been found on the US and European markets also apply to the Nordic region. The length of the time period was chosen in order to include a large enough sample of PE- and VC-backed IPOs to be able to conduct appropriate statistical tests (Körner & Wahlgren, 2006; Brooks, 2014). Consequently, the chosen time period resulted in a sample, mostly consisting of NS IPOs, that was too large to process in this study's time frame. Therefore, a random sample of NS IPOs was selected. In the aforementioned time period three financial crises are included: the 2001 dot-com bubble, the financial crisis of 2008 and the Eurozone debt crisis of 2009 (Denning, 2011). As a result, the data in this study is affected by the financial crises, hence allowing the authors to study any eventual impact on underperformance or underpricing of IPOs as the access to credit financing and fund raising becomes limited during market downturn (McCahery & Vermeulen, 2013).

1.5 TARGET AUDIENCE

This study's target audience are researchers and students who work or study in the field of finance. The authors believe that this thesis will contribute to current literature and might inspire researchers to attempt further studies. This thesis also aims to help potential investors in making better investment decisions in regard to Nordic IPOs.

1.6. DISPOSITION

The remainder of this thesis is organized in line with quantitative studies according to Bryman and Bell (2013):

Theory: This chapter will present the theories that have been developed regarding the first-day returns and long-run performance of IPOs. Furthermore, previous literature will be presented in order to explain the performance pattern of IPOs and the differences in the performance between PE-backed IPOs, VC-backed IPOs and NS IPOs.

Research Design: This chapter will present the methodology that has been used in this study. A description of the collection of data, the selection of variables and the statistical tests used will be presented. Furthermore, a critical reflection over the various decisions and the effects of these decisions on the results will be presented.

Results: This chapter will present the results from the collected data as well as the results from the tests that have been conducted.

Analysis: In this chapter the results will be analyzed based on the theories and previous research that have been presented in this study. This will be done for each of the research questions.

Conclusion: This chapter will present a conclusion and discussion of the study. The authors will critically reflect over the results. Furthermore, thoughts on further research will be discussed.

2. THEORY

In this chapter the most prominent theories that have been developed regarding the first-day returns and long-run performance of IPOs will be presented. Further, previous literature will be presented in order to explain the performance pattern of IPOs and the differences in the performance between PE-backed IPOs, VC-backed IPOs and NS IPOs.

2.1 UNDERPRICING AND FIRST-DAY RETURNS

When a firm performs an IPO, different phenomena can arise. A large first-day return is one of these, which also may be the most common one, according to Ritter (1998). First-day returns refer to when the offering price of the issuing firm is underpriced compared to the market value. The underpricing phenomenon has been studied extensively since it was noticed during the 1970s by Ibbotson (1975). According to Ritter (1998), underpricing exists on markets worldwide but the amount varies from country to country. Different levels of underpricing can also be seen depending on the ownership structure of the IPO where PE-backed and VC-backed IPOs are found to show less underpricing than NS IPOs (Levis, 2011). Although most theories point at asymmetric information situations (Ritter, 1998) every theory has its own conclusion that will be further discussed below.

2.1.1 THEORIES EXPLAINING THE UNDERPRICING OF IPOS

This section will display the main theories that have been developed in academic literature which aim to explain the occurrence of underpricing in IPOs. The theories include:

- The winner's curse
- The market feedback hypothesis
- The signaling hypothesis
- The ownership dispersion hypothesis
- The bandwagon hypothesis
- The certification hypothesis

One of the most established theories is *the winner's curse*, which refers to when asymmetric information situations occur, here the less informed investor will always have a disadvantage. IPOs often have a fixed number of shares and are sold at a fixed offering price. If the interest in the issuance is strong, the shares will have to be rationed between the interested investors,

but if the interest is low the investors will get the full amount of shares they are demanding. If some investors are more informed than others, they will have an advantage and therefore can spot if the shares are underpriced. This will cause the more informed investors to participate in the underpriced IPOs but not in the overpriced IPOs. The less informed investors will therefore suffer from the *winner's curse,* getting all the shares in overpriced IPOs but only a small amount of the underpriced IPOs. (Ritter, 1998)

Further, Ritter (1998) describes a theory called *the market feedback hypothesis* as when an underwriter wants more information from the market regarding the price of the IPO. To receive credible information from the market the underwriter will underprice the IPO as compensation to the market for presenting the true information. A pattern of underpricing can then be seen in the final prospectus of the firm, which shows that the IPO is underpriced when the price is revised upwards in relation to the preliminary prospectus (Ritter, 1998). This theory and pattern has also been justified on the US market in a study between the years 1990 and 1996 (Barry, Gilson and Ritter 1998 see Ritter, 1998).

Another explanation for why underpricing occurs is to signal to investors that if they participate in the issuance of a firm they will be satisfied. This is called *the signaling hypothesis,* which states that an IPO is underpriced so that the investors will see the firm as a good investment, thus providing the firm with a good reputation (Ritter, 1998). This then opens up the possibility for the firm to set a higher price in future issuances, hence profiting from the underpricing. Ritter (1998) also presents a theory called *the ownership dispersion hypothesis* which refers to when an issuing firm does not want any large shareholders in the firm. In this case the firm would intentionally underprice the IPO, get an excess demand of the shares and thus a lot of small shareholders (Ritter, 1998).

The *bandwagon hypothesis* is another explanation for why IPOs are underpriced. This theory, as described by Ritter (1998), refers to when investors mimic what other investors are doing, disregarding their own information. This occurs when investors whom have favorable information about an IPO choose to not participate in the IPO as other investors are not participating. To avoid situations like this, the IPO is underpriced in order to attract a few investors to participate. This will then lead to a bandwagon effect where all investors will participate irrespective of their own information. (Ritter, 1998)

Theories that discuss whether the financial backing of an IPO has an impact on the potential underpricing may all be derived from the *certification hypothesis*. This theory claims that if an IPO is PE-backed the market will see the IPO as more qualitative because of its financial backing, which is considered as a sort of certification. According to this hypothesis three criteria have to be met for the market to consider the certification as absolute. The certifying party has its reputation invested in the IPO and if overpriced, the loss in reputation should be greater than any potential return regarding the overpricing. Finally, it should be costly for the firm to receive a certification. IPOs involving PE or VC should therefore exhibit lower forms of underpricing than their counterparts regarding the certification effects. (van Frederikslust & van der Geest, 2001)

2.1.2 PREVIOUS RESEARCH ON UNDERPRICING AND FIRST-DAY RETURNS

Several empirical studies have been made on the subject of underpricing and first-day returns trying to explain the phenomenon. Ritter (1984) stated an average increase in trading price of 18.8 percent compared to the offering price in his study of near 5 000 IPOs between the years 1960 and 1982. Later, Beatty and Ritter (1986) argue that there exists a positive relationship between the ex-ante uncertainty of the offering's value, the level of expected initial returns for IPOs and the investment banker's reputation stake in the level of underpricing. Their study of IPOs from 1977 to 1982 provides empirical evidence that such a relationship exists and also that investment bankers have an incentive to set an accurate price on the IPO in order to not lose market shares (Beatty & Ritter, 1986).

A more recent study on the underpricing phenomenon of IPOs was conducted by Loughran and Ritter (2004) between the years 1980 and 2003. The study shows that the first-day returns differ depending on what time period the issuing firm went public, with 7 percent between the years 1980 and 1989, approximately 15 percent from the years 1990 to 1998 and a staggering 65 percent the following two years before reducing to 12 percent during the years 2001 to 2003. Loughran and Ritter (2004) explain the fluctuations in the 1980s with the previously mentioned *winner's curse*. For the following years (1990-2003) venture capitalists, analyst coverage and side payments to CEOs are found to be the reasons for the fluctuations.

Although these studies provide evidence that the average IPO is underpriced, they do not take the ownership structure of the issuing firm into account and if this has any impact on the first-day returns of the issuing firm. Megginson and Weiss (1991) made the distinction of VC-backed and non VC-backed IPOs. They examined how the certification role of venture capitalists in IPOs affects the first-day return, with 320 IPOs in each group from the years 1983 to 1987. Their study provides evidence that a certification role for venture capitalists exists, which results in reduced asymmetric information situations and thus less underpricing than in non VC-backed IPOs.

Further, Levis (2011) made an extensive study on the London Stock Exchange examining IPOs between the years 1992 and 2005 by dividing the IPOs into subgroups of PE-backed, VC-backed and NS IPOs. The same distribution was made by Mogilevsky and Murgulov (2012) in their study of the US Stock Exchange with IPOs in the years 2000 to 2009. Levis (2011) came to the conclusion that NS IPOs experienced the highest level of first-day returns (21.1%) among these three groups with VC-backed IPOs as the second highest (14.9%). Mogilevsky and Murgulov (2012) concluded almost the opposite, that VC-backed IPOs experienced the highest first-day returns (23.4%) and NS IPOs the second highest (14.3%). However, both Levis (2011) and Mogilevsky and Murgulov (2012) provide evidence that PE-backed IPOs experience the lowest first-day returns with 9.1 percent and 7.0 percent respectively. Mogilevsky and Murgulov (2012) argue that PE-backed IPOs show lower levels of first-day returns as they have large PE firms as majority owners and are larger in terms of firm size.

The findings by Levis (2011) and Mogilevsky and Murgulov (2012), that PE-backed IPOs experience less underpricing than the other two groups, is supported by two other studies on the European market. van Frederikslust and van der Geest (2001) conducted a study on the Amsterdam Stock Exchange where they examined IPOs during the years 1985 to 1998 and divided these into two groups, PE- and non PE-backed IPOs. Although this study did not provide a statistically significant result, the average first-day return of PE-backed IPOs (13%) was lower than that of the non PE-backed IPOs (17%). Bergström et al. (2006) did the same classification on the London and Paris Stock Exchange between the years 1994 and 2004. Both of their groups experienced less underpricing than the study by van Frederikslust and van der Geest (2001), however both studies reached the same conclusion that PE-backed

IPOs experience less underpricing (9.33%) than non PE-backed IPOs (12.87%). van Frederikslust and van der Geest (2001) argue that the *certification hypothesis* is a possible explanation for the results but no significant conclusion can be made. Bergström et al. (2006) on the other hand discuss the ex-ante uncertainty as a reason behind their results. In their study they set the ex-ante uncertainty in relation to the capital raised in an IPO where they find that the less ex-ante uncertainty that exists in an IPO, the larger the amount of capital raised which in turn leads to a lower level of underpricing. Further, Bergström et al. (2006) find that PE-backed IPOs have greater amounts of capital than non PE-backed IPOs on the London Stock Exchange and argue that this may be a reason for the lower degrees of underpricing in PE-backed IPOs.

2.2 LONG-RUN UNDERPERFORMANCE

The long-run underperformance of IPOs is a recurring feature that has been the topic of a wide range of previous studies. Several studies that have focused on the performance of IPOs in a variety of different countries, have confirmed the presence of underperformance in IPOs after three (Ritter, 1991; Levis, 2011) and five years (Loughran & Ritter, 1995; Bergström et al., 2006). When the long-run performance of an IPO falls below a defined benchmark it is said that the IPO is underperforming relative to this benchmark (van Frederikslust & van der Geest, 2001).

2.2.1 THEORIES EXPLAINING THE UNDERPERFORMANCE OF IPOS

This section will display the main theories that have been developed in academic literature which aim to explain the long-run underperformance of IPOs. The theories are listed below:

- The divergence of opinion hypothesis
- The impresario hypothesis
- The windows of opportunity hypothesis
- Pseudo market timing
- The delisting hypothesis

The first explanation has been developed from behavioral finance theory and holds investor sentiment accountable for the long-run underperformance of IPOs. Miller (1977) states that investors hold different expectations on the value of an IPO and that there therefore exists a divergence of opinions. Further, Ritter (1998) presents the *divergence of opinion hypothesis*

which states that the individuals that have the most optimistic view on an IPO will be the ones willing to invest in the firm. The theory argues that when there exists uncertainty regarding the market value of an IPO, optimistic investors will rate the IPO on a higher level than that of the pessimistic investors. In the long-run, as more information becomes available to the public, this uncertainty is reduced which consolidates the opinions of optimistic and pessimistic investors. Consequently, as the divergence of opinion between these two types of investors lessens the market price will decline. In line with this hypothesis, Brav and Gompers (1997) and Bergström et al. (2006) argue that the poorer performance demonstrated by smaller firms could be explained by a greater amount of irrational investors. These investors tend to be less informed and behave more optimistically than larger institutional investors due to the presence of asymmetric information. In the same way the lower underpricing and lower underperformance of PE-backed IPOs can be attributable to the greater amount of institutional investors who act in a more professional manner, requiring minimal adjustment in the after-market.

Another explanation for IPO underperformance presented by Ritter (1998) is that the *impresarios* (in this case investment bankers) try to devise an image of excess demand by underpricing the new issues in the firm to make the shares seem more attractive. This is known as *the impresario hypothesis.* According to the predictions of this hypothesis, IPOs that experience a higher degree of underpricing should have lower consecutive returns (Ritter, 1998).

Further, Ritter (1998) presents the *windows of opportunity hypothesis.* This hypothesis states that the large volume of companies going public in specific periods may be a response to the behavior of investors in times of high growth. Firms seem to attempt to time their IPOs in order to collect the advantages of the fluctuations in investor sentiment. The theory predicts that IPOs issued during high volume periods will show a greater tendency of overvaluation than IPOs issued in low volume periods. Therefore, there exists a pattern where IPOs issued in high volume periods underperform other IPOs in the long-run. (Ritter, 1998) In agreement with this hypothesis Schulz (2003) argues that firms choose to perform an IPO when they see that other firms are profiting from a high price in issuing shares. Therefore, successful IPOs are often followed by large volumes of IPOs. Schultz (2003) refers to this phenomenon as *pseudo market timing* which occurs when markets are peaking. Hence, the volume of IPOs that are issued on the basis of the successful IPOs will underperform. If the method of event

time is used to measure abnormal returns the high volume years will hold a greater weight which will result in the underperformance of the average IPO.

Finally, Benninga, Helmantel and Sarig (2005) present *the delisting hypothesis* which refers to the fact that at any given moment a firm has the option to go from public to private. The authors develop a model in which the underperformance of IPOs can be explained by the existing option to reprivatize public firms. The value of this option is greater for recently listed firms than firms who have traded for a longer period of time. This delisting option affects the value of the firm as well as the risk of the firm. Newly issued firms hold less risk than more established public firms due to their smaller cash flows. Therefore, the returns of newly issued firms should be less than the returns of more established firms which explains the underperformance of IPOs. (Benninga et al., 2005)

2.2.2 PREVIOUS RESEARCH ON LONG-RUN UNDERPERFORMANCE

Ritter (1991) examines the long-run performance of IPOs in the three years after going public from the years 1975 to 1984 in the US. In his findings he reveals evidence of the long-run underperformance of IPOs by matching 1526 IPOs with corresponding non-IPO firms that have similar market capitalization and which fall under the same industry classification. Ritter´s (1991) findings show that if one were to invest one US dollar at the end of the first trading day in all of the IPOs during the studied time frame this dollar would be worth 83 cents after three years compared to an investment in the matching firms on the New York Stock Exchange. However, there exists substantial variation in the underperformance from year-to-year where firms that choose to go public in high-volume periods tend to perform the worst. Further, Ritter (1991) discusses three possible explanations for this abnormal after-market behavior which consists of: a faulty calculation of the risks, bad luck and, the existence of over-optimism and trends among investors.

Similarly, Loughran and Ritter (1995) demonstrate the underperformance of IPOs by performing an extensive study on the US market but over a period of five years from 1970-1990. They found that the amount of this abnormal long-run performance is important from an economic perspective: Investors would have needed to invest 44 percent more in the IPO firms in order to obtain the same wealth as the investors investing in non-issuing firms of the same size five years after the offering. In line with Ritter (1991) and Loughran and Ritter

(1995), Westerholm (2007) shows that, similar to the findings on US IPOs, Nordic IPOs demonstrate negative long-run performance over a five-year period. In his study he examines a sample of 254 Nordic IPOs issued in the years 1991 to 2002.

Even though much of the evidence regarding the long-run performance of IPOs suggests heavy underperformance the results are conflicting as there also exists studies that dismiss the notion of IPO underperformance (Levis, 2011). Brav and Gompers (1997) and Gompers and Lerner (2003) for example, reject that there exists any abnormality when IPO firms are matched to a collection of corresponding non-IPO firms that acquire similar characteristics that include size and book-to-market ratios. Hence, they show that IPOs do not tend to underperform but that rather the relative performance highly depends on the benchmark and method that is chosen.

As portrayed in previous academic literature there also exists important differences in the long-run performance between IPOs with different ownership structures (Brav & Gompers, 1997; Bergström et al., 2006; Katz, 2009; Levis, 2011). Brav and Gompers (1997) study the long-run performance of IPOs by examining a sample of 934 VC-backed IPOs from 1972 to 1992 and 3407 non-VC-backed IPOs from 1975 to 1992 on the US market. By dividing IPOs into these two subgroups Brav and Gompers (1997) intend to resolve whether venture capitalists can affect the long-run performance of their firms. The findings show that over a five-year period the sample of venture-backed firms do outperform the sample of non-venture-backed firms, when the returns are equally weighted.

Another US study that distinguishes between the different types of IPOs is one performed by Katz (2009). Her research focuses on what affect the ownership structure has on long-run performance and the firm's earnings quality by differentiating between PE-backed firms and non-PE-backed firms. Her findings show that firms with PE sponsors generally exhibit higher earnings quality, display less earnings management and are more conservative in the reporting of financial results than firms that do not have a PE sponsor. Further, Katz (2009) finds that firms that are PE-backed, in which the PE sponsor owns a majority of the firm, demonstrate superior long-run performance after the IPO. This superior performance is explained by the PE ownership being more professional, tighter monitoring and control, and the positive reputation of PE sponsors (Katz, 2009).

Outside the US there have been few attempted studies that regard the long-run performance of PE-backed IPOs making the evidence rather scarce and inconclusive (Levis, 2011). In his research Levis (2011) examines the long-run performance of IPOs on the London Stock Exchange by dividing them into three separate groups: PE-backed, VC-backed and NS IPOs. Evidence from Levis (2011) shows that the IPOs within these three groups differ in areas such as market size, maturity, profitability and industry classification. Levis (2011) finds that PE-backed IPOs have a greater profitability, have greater amounts of leverage, have lower first-day-returns and are larger in terms of market capitalization at the time of the offering than the group of NS IPOs. Further, Levis (2011) examined the long-run performance of these three groups throughout a three-year period and found that the entire sample provided evidence of negative average abnormal returns. When examining the three groups performance separately however, the PE-backed IPOs superiorly outperformed the other two groups as the abnormal buy-and-hold returns for these IPOs remained positive during the entire period, regardless of the chosen benchmark. Thus the negative abnormal returns of the entire sample were mainly due to the poor performance of the NS IPOs. Further, Levis (2011) demonstrates that there is a relationship between the long-run performances of PE-backed IPOs, the amount of leverage in the firm and the amount of equity that the private equity sponsors maintain after the firm goes public.

Another study conducted on the European market is performed by Bergström et al. (2006). In their article they research the long-run performance of PE-backed IPOs and non-PE-backed IPOs on the Paris Stock Exchange and the London Stock Exchange across time periods of six months, three years and five years. In their study VC-backed firms are included in the sample of non-PE-backed firms. Bergström et al. (2006) find that PE-backed IPOs show positive abnormal returns in the first six months but negative abnormal returns over three and five years, they also outperform non-PE-backed IPOs over all time horizons. Further, Bergström et al. (2006) observe large variations in the long-run performance of IPOs across different years. In line with *the windows-of-opportunity hypothesis,* which is more thoroughly described in the subsequent section, they find that companies which choose to go public in high volume years demonstrate a higher degree of underperformance. The findings also exhibit that on average larger IPOs perform relatively better than smaller IPOs. An explanation for this phenomenon is that large IPOs are less prone to the adjusting expectations of over-optimistic investors. As PE-backed IPOs are generally larger firms, the lower level of underperformance can be explained by the greater majority of institutional

investors that buy stock in these types of firms. Institutional investors behave less optimistically and act more professionally than individual investors that are less informed. (Bergström et al. 2006)

3. RESEARCH DESIGN

In this section the authors will present the methodology that has been used in this study. A description of the collection of data, the selection of variables and the statistical tests used will be presented. Finally, the authors will critically reflect over various decisions and the effects of these decisions on the results.

3.1 SCIENTIFIC APPROACH

This study will be quantitative and will therefore not include any qualitative data. Current research and theories regarding the performance of IPOs will be used to form hypotheses and to analyze the results. The hypotheses will be tested using the data collected and the authors will then objectively reflect over the results. (Lundahl & Skärvard, 1999)

3.2 SAMPLE SELECTION

This section aims to explain and motivate the criterion used in the sample selection. Further, the data collection and data processing will be presented.

3.2.1 TIME REGIME

Event time is a time method used to measure abnormal return (Fama, 1998). In this study a 36-month event time period will be used. The first day of the event time period is measured as the first day closing price, consequently, the last day of the event time period is measured as the last day closing price in the 36-month window (Ritter, 1991). As all of the stocks have the same event time period i.e. 36 months, all IPOs can be compared to each other, irrelevant of what date they were introduced to the market (Fama, 1998; Bergstöm et al., 2006). In order to obtain a large enough sample of PE-backed and VC-backed IPOs a 13-year time period was chosen. Further, IPOs that were issued from the years 2000 to 2012 were included in this study to obtain the most up-to-date results. As 2016 had not ended at the beginning of this study 2013 was not included due to the fact that a 36-month event time period could not be obtained for the IPOs issued in that year. To go further back in time than 2000 would have affected the relevance of this study in terms of timeliness.

3.2.2 STOCK EXCHANGE

This study consists of data from four different countries and all of the stock exchanges in these countries e.g Aktietorget, Nasdaq OMX Stockholm, Nordic Growth Market (NGM), Oslo Bors, Oslo Axess, Nasdaq OMX Copenhagen and Nasdaq OMX Helsinki. All stock exchanges were used in order obtains a valid representation of the IPOs on the Nordic region.

3.2.3 CLASSIFICATION OF OWNERSHIP STRUCTURE

All of the firms included in this study have been categorized based on their ownership structure. Three subgroups were formed that include PE-backed IPOs, VC-backed IPOs and NS IPOs. The information of each firm's ownership structure is based on the information obtained from IPO prospectuses, financial newspapers, annual reports, a Nordic private equity fund (Argentum) and the data source Zephyr.

3.2.4 SELECTION CRITERION

In this study a set of criterion was used when the data was collected and analyzed. Below follows these criterion:

- The study includes IPOs on the Nordic market.
- IPOs that have been issued between the years 2000 and 2012 were collected.
- All seasoned equities offerings (SEO) were excluded from the study.
- IPOs with cross listings on other markets prior to their listing on the Nordic market were excluded from the study.
- IPOs which were delisted prior to the 36-month period were collected.
- Only IPOs in which information on key performance indicators and ownership structure could be found and validated have been included in the sample.

3.2.5 DATA COLLECTION AND DATA PROCESSING

With previously stated selection criteria, the most adequate database to retrieve the data sample was from *Zephyr.* The initial sample resulted in 614 IPOs. In order to answer our research questions the data was divided into three subgroups; PE backed IPOs, VC backed IPOs and NS IPOs. The Zephyr database had limitations as such it could only divide the data into two subgroups i.e. the entire sample of IPOs (614) or IPOs that are PE/VC backed (63). The sample of NS IPOs was almost ten times as large as that of PE/VC backed IPOs, which was considered too large to process in the time frame of this study and therefore had to be

reduced. Both samples provided the total value of the IPO, the day of floatation and the name of the firm on that day. In the sample with PE/VC backed IPOs, the name of the backing firm was also stated. Of the entire sample 551 IPOs were NS and a random sample of 120 of these were selected. Further, all of the PE/VC backed IPOs (63) were chosen for the study. However, the authors noticed that the Zephyr database did not divide the different types of IPOs consistently or correctly as defined by Levis (2011) and Mogilevsky and Murgulov (2012). Hence, to divide PE-backed IPOs, VC backed IPOs and NS IPOs from one another other methods had to be used in order to increase the reliability of the sample.

Additional information from stock exchange publications, IPO prospectuses, financial newspapers, annual reports and data from a Nordic private equity fund (Argentum) was used to divide NS IPOs, PE-backed IPOs and VC-backed IPOs from one another. This resulted in changes in classifications as previous imposed by Zephyr, whereas a few of the PE-/VC-backed IPOs were changed to NS IPOs, conversely, a few of the NS IPOs were changed to PE-/VC-backed IPOs. Moreover, PE- and VC-backed IPOs were separated from each other. The IPOs in which data could not be found or validated through these different sources were excluded from the study.

Since the information on the IPOs from Zephyr did not include the first-day closing price or the three-year closing price and other financial performance measurements, this data had to be retrieved elsewhere. IPO prospectuses, annual reports and the financial database *DataStream* were used in order to retrieve data consisting of market capitalization, leverage, equity and adjusted and unadjusted stock prices in the 36-month period. However, in most cases *Zephyr* provided information on the IPO offering price. In the absence of this information, but also to validate the offering prices from Zephyr, IPO prospectus, annual reports and *Skatteverket* were used to collect information on offering prices.

A few of the companies in the sample had changed name since floatation. As *Datastream* provides information under the firm´s current name, the names obtained from Zephyr had to be changed in some cases. *Bolagsverket´s* and *Skatteverket´s* websites were used to validate information regarding name changes on the Swedish markets. Further, reputable financial journals were used to find the latest name for the remaining markets. The majority of the data sources used in this study had euro as a standard currency, hence all data in this study was

collected in euro. Once again, data which could not be found or validated through these different sources was excluded from the study.

After the data had been collected and compiled, the statistical program EViews was used in order to perform a multiple regression analysis as well as other appropriate model tests. Further, SPSS was used to test for differences between the groups, to create tables and to create diagrams.

3.3 LONG-RUN PERFORMANCE

Barber & Lyon (1997) note that there are different ways to calculate abnormal returns, mainly cumulative abnormal returns (CAR) and buy and hold abnormal returns (BHAR). Barber and Lyon (1997) favor BHAR because of conceptual grounds i.e. it better captures investors experience. A major advantage of BHAR over CAR is that it better measures the investor's abnormal returns who follow a buy and hold strategy (Schöber, 2008). Following this, the authors chose to use the BHAR methodology to measure long-term performance. With BHAR, a 36-month time period is used to analyze long-run performance. In the case that a firm is delisted before the 36-month time period, the firm's latest closing price is used to calculate BHAR (Ritter, 1991).

To measure BHAR, one first needs to calculate the buy and hold return (BHR). BHR measures the return of a stock or index from one time period (P_o) to another time period (P_1). The equation for BHR follows:

$$BHR = \frac{P_1 - P_0}{P_0}$$

With BHR, one can then calculate BHAR. BHAR calculates and measures the abnormal buy and hold return and shows the correlation between the required return and the expected return (Barber & Lyon, 1997). The equation for BHAR follows:

$$BHAR_{iT} = \prod_{t=1}^{T}[1 + R_{iT}] - \prod_{t=1}^{T}[\,1 + E(R_{it})]$$

where

$$\prod_{t=1}^{T}[1 + R_{it}] = BHR_{IPO} = \frac{P_T - P_0}{P_0}$$

3.4 BENCHMARK

In this study the *MSCI Nordic countries* index has been chosen as a benchmark. This index represents firms that are listed on the Nordic market providing a relevant benchmark for the Nordic IPOs in the sample. There are however different versions of this index, for example the MSCI Nordic countries price index and the MSCI Nordic countries total return index. In this study the total return index was chosen as it represents the true performance of the share as all dividends are reinvested. The dividends will therefore have no effect on the share price apart from when firms announce their future dividends. A price index on the other hand, which does not reinvest dividends, would therefore only represent the share price. (Datastream, n.d.)

3.5 INDEPENDENT VARIABLES

In the following section the independent variables that have been selected and examined for this study will be presented. As the variables have been chosen from previous academic literature the underlying theories and findings that previous studies have developed will also be displayed. Further, the hypotheses that have been derived have also been extracted from previous research articles in order to investigate whether the results and conclusions from past studies also can be applied to the Nordic region.

3.5.1 FIRST-DAY-RETURNS

Ritter (1991), Bergström et al (2006) and Levis (2011) find in their research that there exists a negative relationship between the first-day returns and IPO performance in the long-run. Further, Levis (2011) provides that PE-backed IPOs demonstrate less underpricing and also higher long-run performance compared to that of VC-backed IPOs and NS IPOS. Bergström et al (2006) provides similar results as Levis (2011) as they reveal that PE-backed IPOs generally show less underpricing and less underperformance than non-PE-backed IPOs.

To test whether these conclusions also can be applied on the Nordic market the following hypothesis has been formed:

Hypothesis 1:

There exists a negative relationship between first-day returns and long-run performance.

The first-day return according to Ritter (1991) is defined as the difference between the first day closing price (P_1) and the offer price (P_0) where this difference is divided by the offer price:

$$\text{First-day return} = \frac{P_1 - P_0}{P_0}$$

3.5.2 LEVERAGE RATIO

Levis (2011) finds that one of the reasons for the superior performance of PE-backed IPOs is due to the higher degree of leverage in these types of firms immediately after flotation. Hence, he finds a positive relationship between the leverage and long-run returns. Eckbo and Norlie (2000) also show that leverage is an explanatory variable for long-run performance. However, the overall empirical evidence that document the relationship between stock returns and leverage is quite diverse. Dimitroy and Jain (2008) and Korteweg (2010) for example, find a negative correlation while Hamada (1972) and Hou and Robinson (2006) record a positive correlation.

To test to see whether these results can be applied to this study the following hypothesis has been composed:

Hypothesis 2:

There exists a relationship between leverage ratio and long-run performance.

This explanatory variable is a measure of the debt-to-equity ratio which is calculated by dividing the firm's debt by the firm's equity (Berk & DeMarzo, 2013).

3.5.3 OFFERING SIZE

The size of the offer when a firm issues an IPO is used as an explanatory variable for the long-run performance of IPOs by Ritter (1991) as he presents that there is a positive relationship between the long-run performance and the size of the offering. Bergström et al (2006) finds, in line with Ritter (1991), that there is a positive relationship between the size of the offer and the performance of IPOs as PE-backed IPOs perform better and generally exhibit a greater offering size than non-PE-backed IPOs.

In order to see whether the same findings are applicable to this study the following hypothesis has been composed:

Hypothesis 3:

There exists a positive relationship between the offering size and the long-run performance.

According to Ritter (1991) the offering size is the amount of new capital that a firm that issues an IPO receives excluding the costs that are associated with the issue. The offering size is calculated by multiplying the offer price (P_0) with the amount of issued shares (i_0):

$$\text{Offer size} = P_0 * i_0$$

In order to operationalize this variable, the natural logarithm of the offering size is used in line with Loughran and Ritter (1995) and Westerholm (2007).

3.5.4 MARKET CAPITALIZATION

In their study Hart and Oulton (1996) aim to explain firm growth by using size as an explanatory variable. Further, they provide three alternative methods for measuring a firm's size; the number of employees in the firm, the size of the firm's total assets and the firm's revenue. Bergström et al. (2006) and Brav, Geczy and Gompers (2000) on the other hand, uses market capitalization as a measurement of size, which is the number of shares outstanding multiplied by the share price. These research papers provide contradicting results. Hart and Oulton (1996) can in their findings not show that there exists a relationship between size and growth, while Bergström et al. (2006) and Brav, Geczy and Gompers (2000) find that larger IPOs tend to perform better than smaller IPOs in the long-run. Further, Bergström et al. (2006) also provides that on average PE-backed IPOs are larger than non-PE-backed IPOs and hence perform better.

To test whether there exists a relationship between the long-run performance of IPOs and the size of a firm the authors of this study will test the following hypothesis:

Hypothesis 4:

There exists a positive relationship between market capitalization and long-run performance.

In order to examine whether there is a relationship between a firm's size and long-run performance, market capitalization has been used as a measurement of the firm´s size. The numeric values that are used in this study represent the market capitalization of the firm in the year prior to the IPO. In order to operationalize this variable, the natural logarithm of the numeric value is used in line with Loughran and Ritter (1995) and Westerholm (2007).

3.5.5 OWNERSHIP STRUCTURE

According to Brav and Gompers (1997), Bergström et al. (2006), Katz (2009) and Levis (2011) the ownership structure of the IPO firm has an effect on long-run performance. Brav and Gompers (1997) found that VC-backed IPOs outperform non-VC-backed IPOs over a five-year period on the US-market. Similarly, Katz (2009) finds that the ownership structure affects long-run performance as she shows that PE-backed firms demonstrate superior long-run performance after the IPO compared to that of non-PE-backed IPOs. Further, Bergström et al. (2006) finds that PE-backed firms outperform non-PE-backed firms on the Paris Stock Exchange and the London Stock Exchange across time periods of six months, three years and five years. In line with Bergström et al (2006), Levis (2011) shows that PE-backed IPOs outperform both VC-backed IPOs and NS IPOs over a period of three years on the London Stock Exchange.

To test whether there exists a relationship between the long-run performance of IPOs and the ownership structure the authors of this study will test the following hypothesis:

Hypothesis 5:

There is a difference in the long-run performance that can be explained by the ownership structure.

As ownership structure is not a quantitative variable it is included in the regression analysis as a dummy variable which can take the value of either 1 or 0. The NS IPOs are used as a

reference group as the main focus of this study is to see how PE-firms and venture capitalists can affect the long-run performance of the IPOs that they are involved in.

3.5.6 THE IPO ACTIVITY PERIOD

This independent variable is based on the amount of IPOs that occur during the same given year. Ritter (1991), Bergström et al (2006) and Levis (2011) examine this cyclical feature of IPOs and demonstrate in their individual studies that there is a negative relationship between long-run performance and the number of IPOs issued a year. These findings are in line with the *windows-of-opportunity hypothesis* presented in the previous section.

In the attempt to find whether the same conclusions can be applied to this study the following hypothesis is tested in line with Ritter (1991), Bergström et al (2006) and Levis (2011):

Hypothesis 6:

There exists a negative relationship between IPO activity and the long-run performance.

To examine whether there exists a relationship between the IPO activity and the long-run performance each year is labelled as high, medium or low which is determined by the amount of IPO activity that year in line with Schöber (2008). First, the entire sample of Nordic IPOs was collected from Zephyr. The years in which the number of IPOs fall below the 25th percentile value are classified by low IPO activity while the years in which the number of IPOs were above the 75th percentile value are classified as high IPO activity. The remaining sample was then labelled with medium IPO activity. This approach resulted in the years 2002, 2003 and 2012 being noted as low IPO activity periods while the years 2006 and 2007 experienced high IPO activity. The sample of IPOs collected in this study are classified as high or medium/low depending on which year they were issued and the level of IPO activity in the year of issuance. As previous studies have found a negative relationship between long-run performance and the number of IPOs issued a year and this study aims to find whether the same results can be found on the Nordic market our sample firms are defined as high or medium/low. This is so that the high IPO activity period can be used as a dummy variable with the medium/low group as a reference.

3.5.7 SUMMARY OF HYPOTHESIZES

1. *There exists a negative relationship between first-day-returns and long-run performance. (Ritter, 1991; Levis, 2011)*
2. *There exists a relationship between leverage ratio and long-run performance (Eckbo & Norli, 2000; Levis, 2011)*
3. *There exists a positive relationship between the offering size and the long-run performance in all of the three groups. (Ritter, 1991; Bergström et al. 2006)*
4. *There exists a positive relationship between market capitalization and long-run performance. (Hart & Oulton, 1996; Bergström et al, 2006)*
5. *There is a difference in the long-run performance that can be explained by the ownership structure. (*Brav & Gompers, 1997; Bergström et al., 2006; Levis, 2011; Katz, 2009)
6. *There exists a negative relationship between IPO activity and the long-run performance. (Ritter, 1991; Levis, 2011; Bergström et al, 2006)*

3.6 TEST STATISTICS

This section will present the different statistical tests that have been conducted in order to answer the two research questions.

3.6.1 TESTING BETWEEN GROUPS

When conducting tests on different groups, the most common test is the Student's t-test which is used in order to determine whether there exist any differences between two groups' average values. As this study intends to determine whether there are any differences between three groups (PE, VC and NS), the Student's t-test would be insufficient to use. If more than two groups exist, an analysis of variance, also called ANOVA, is an alternative. Both the Student's t-test and ANOVA tests the alternative hypothesis for any difference between the groups' average, while the null hypothesis is tested for the opposite i.e. no difference in the groups average values. In order to receive a statistically significant result, the level of significance has to be established, where the three most common levels are 5, 1 and 0.1 percent. Therefore, all three of these levels are used in this study. When receiving a significant result in an ANOVA test, a post hoc test was conducted in order to determine between which groups the difference exists in. (Körner & Wahlgren, 2006)

3.6.2 REGRESSION ANALYSIS

In order to see if a relationship exists between the dependent variable (BHAR) and the independent variables (first-day returns, leverage ratio, offering size, market capitalization, ownership structure and IPO activity period) a regression analysis was conducted. As the variables *market capitalization* and *offering size* are not set in comparison with anything, the natural logarithm of each variable was used instead, which is in line with Megginson and Weiss (1991), Loughran and Ritter (1995) and Westerholm (2007). The variables *ownership structure* and *IPO activity period* are purely qualitative data, why these variables were converted into dummy variables. This means that the variables are dichotomous, i.e. can either take the value one or zero (Brooks, 2014). In clarification, the ownership structure was divided into two dummy variables, PE-backed IPOs and VC-backed IPOs, where the value one in the dummy variable *PE* represents the ownership structure of PE-backed IPOs. The *VC* dummy works in the same way, which means that the NS IPOs were used as a reference group for these two dummy variables. When constructing the dummy variable for the IPO activity period, the high period was set to the value one and the medium and low periods were used as a reference, which is explained in *section 3.5.6.*

According to Brooks (2014) the method called Ordinary Least Squares (OLS) is the most commonly used method for a regression analysis. OLS adjusts the line to the data after the vertical distance between each point and the regression line is squared, and then the total sum of the areas of squares is minimized. In order to use OLS different assumptions must hold. Firstly, as for any regression analysis the model has to be linear, which was therefore tested for by *Ramsey's RESET*. Further, five OLS assumptions have to be fulfilled and are as follows:

1. $E(u_t) = 0$
2. $var(u_t) = \sigma^2 < \infty$
3. $cov(u_i, u_j) = 0$
4. $cov(u_t, x_t) = 0$
5. $u_t \sim N(0, \sigma^2)$

The first assumption states that the average value of the errors should be zero. In order for this assumption to hold, Brooks (2014) explains that the line has to have a y-intercept, or else

the slope coefficient estimates may be very biased. The second assumption is called the *assumption of homoscedasticity,* meaning that the errors have a constant variance. In order to verify that this assumption holds, different tests can be made in order to detect if any non-constant variance, also called heteroscedasticity, exists. Either the *Goldfeld-Quandt* (GQ) test or *White's* test can be conducted, where the GQ test might be the simplest. However, *White's* test is the one with fewest assumptions regarding the likely form of heteroscedasticity, why this test was conducted. The third assumption basically states that the errors are assumed to be uncorrelated with each other, meaning that no correlation can exist between the errors or else they would be considered *autocorrelated*. In order to validate that this assumption holds, a *Durbin-Watson* test is included in the regression analysis. In the fourth assumption it is claimed that the covariance between the independent variable and the corresponding error term is zero. The fifth assumption states that error terms are normally distributed which, in order to verify that the assumption holds, were tested for via the *Bera-Jarque (BJ)* test where skewness and kurtosis interpret any deviation. (Brooks, 2014)

When all of the five above assumptions hold, one more test has to be conducted in order for the OLS estimation method to generate effective results, which is a test for *multicollinearity.* This means a sixth assumption exists; that the independent variables should not be correlated to one another, as otherwise multicollinearity exists. Brooks (2014) categorizes multicollinearity into two classes, perfect multicollinearity and near multicollinearity, which occurs when two or more independent variables correlate perfectly with one another respectively a non-negligible correlation exists. In practice the latter is more probable to occur, but in case of any multicollinearity present, the statistical significance will be reduced, why a correlation test must be conducted. A correlation matrix and the Variance inflation factor test were used in order to detect if there existed any multicollinearity between the variables. (Brooks, 2014)

Brooks (2014) states that when these assumptions hold the estimators determined by OLS are the *Best Linear Unbiased Estimators*, also known as *BLUE*. A confirmation of this is the Gauss-Markov theorem which proves that the OLS estimators possesses the lowest variance of all methods (Brooks, 2014). The following table provides a summary of the tests that have been conducted in order to determine that the assumptions for OLS hold.

TABLE 1

Assumption	Test	Value to hold
Non-linearity	Ramsey's RESET	Above 5 percent significance
Heteroscedasticity	White test	Above 5 percent significance
No autocorrelation	Durbin-Watson test	Above 1.65
Normally distributed errors	Bera-Jarque test	Above 5 percent significance
No Multicollinearity	Correlation matrix & VIF tests	Below 0.8 and ≤1 respectively

Further, in order to determine to what extent the linear variation in BHAR could be explained by the linear relationship of an independent variable the coefficient of determination (R^2) should be used. If R^2 is greater than zero, the linear relationship between the independent variable and BHAR could be explained. However, as more than one independent variable is examined in this study the *adjusted* coefficient of determination (adjusted R^2) had to be used. In contrast to the unadjusted coefficient of determination (R^2) the adjusted R^2 takes the number of variables into consideration instead of, as would be the case with R^2, accumulating the degrees of explanation for each independent variable. (Körner & Wahlgren, 2006)

3.7 DISCUSSION AND CRITICISM OF RESEARCH DESIGN

In the following section, this study's approach will be critically examined. The authors will also discuss the possible alternative ways in which the study could be carried out differently and present the advantages as well as the disadvantages with these alternative methods.

3.7.1 TIME REGIME

There are two ways to measure abnormal return, event time and calendar time (Fama, 1998). In this study, event time was used over calendar time. Schultz (2003), Mitchell and Stafford, (2000) and Gompers and Lerner (2003) argue that there is a cross sectional dependence among IPOs, especially during times with high IPO activity. This cross sectional dependence leads to return overlapping with each other. Bergström et al (2006) therefore argues that calendar time is a better method used when analyzing the variations of abnormal returns across years and event time is the better method when analyzing IPOs on different dates.

However, as event time is widely used in previous studies (Mitchell & Stafford, 2000; van Frederikslust & van der Geest 2001; Gompers & Lerner, 2003; Schultz, 2003) and due to the time constraint of this study the authors chose to use event time over calendar time.

3.7.2 BHAR

The dependent variable of long-run performance can take on several alternative measurements. Academic literature mainly utilizes two methods in order to calculate long-run abnormal returns; cumulative abnormal returns (CAR) and buy and hold abnormal returns (BHAR) (Bergström et al., 2006). Ritter (1991), Brav, Geczy and Gompers (2000) and Bergström et al. (2006) include both of these two methods in order to measure underperformance while Levis (2011) utilizes BHAR and van Frederikslust and van der Geest (2004) utilizes CAR. The choice between these two methods highly depends on the underlying assumption of trading strategy (Bergström et al., 2006). Further, the choice of CAR as a method becomes less suitable with increasing volatility of the firm (Gompers and Lerner, 2003). As this study aims to focus on a trading strategy over a time horizon of three years, BHAR is seen as the most appropriate method for calculating the long-run abnormal returns (Brown and Warner, 1985). Further, as the long-run returns are to be calculated for firms issuing IPOs, our sample will consist of smaller firms which are more volatile than larger firms (Berk & Demarzo, 2013). Due to these underlying conditions BHAR has been chosen as the method to calculate long-run returns for our sample of firms.

3.7.3 BENCHMARK

In their article Bergström et al., (2006) states that "benchmarks ideally have the same exposure to fundamental risks as IPO firms and also capture their risk characteristics so that the risks determining expected returns are matched" (Bergström et al. 2006, p. 21). Previous academic literature mainly employs two types of benchmarks. The first method involves using a large equity market index, for example the MSCI countries index. The second method involves the construction of a portfolio based on matching-firms where each IPO is matched to a public firm with similar characteristics, which Ritter (1991) and Levis (2011) have used in their research. The use of the former method is widely portrayed in previous literature (e.g. Brav & Gompers, 1997; van Frederikslust & van der Geest, 1999; Bergström et al., 2006; Cao & Lerner 2009), it also has the advantage of being a simple method and is effective for evaluating trading strategies (Bergström et al., 2006; Schöber, 2008). However, a market index does not reflect the individual qualities of the IPO firms which can be seen as a

disadvantage. Despite this drawback, due to the limited time frame of this study a market index is used as a benchmark, more specifically the MSCI Nordic Index.

3.7.4 FURTHER METHODOLOGY CRITICISM

The data that is included in this study has mainly been collected from the sources Zephyr, Datastream, Argentum and IPO prospectuses. As it is difficult to assess how these different sources have collected and classified their data there is a risk that the data is not entirely comparable, which was confirmed in the search for the IPO ownership structure. It would have been preferable to collect all data from one source but this type of source has not been encountered.

The chosen time period of three years in this study can be questioned. A majority of the previous research that has been found and used in this study have chosen a three-year time horizon to measure long-run performance (Ritter, 1991; Bergström et al., 2006; Levis, 2011), therefore this time horizon has also been chosen in this study. Another reason for this choice is to be able to access and analyze the most current sample of IPOs.

In this study the independent variable of size is measured in terms of the firm's market capitalization before the IPO. Previous studies have shown that this variable can also be measured by the number of employees in the firm, the size of the firm's total assets and revenue. However, in this study market capitalization is chosen to represent firm size as it is used in a majority of the previous studies that has been presented in this study when measuring size (Brav, Geczy & Gompers, 2000; Bergström et al, 2006). The authors are however aware that an alternative measurement could alter the existing results.

In this study the independent variable ownership structure is divided into three subgroups PE-backed, VC-backed and NS IPOs. In most of the research papers presented in this study, ownership structure has however been divided into two subgroups PE-backed IPOs and non-PE-backed IPOs (Katz, 2009; Bergström et al. 2006; van Frederikslust & van der Geest, 2001) or VC-backed IPOs and non VC-backed IPOs (Brav & Gompers, 1997). In these studies, no distinction has been made between PE-backed IPOs and VC-backed IPOs as they both can be classified under PE. However, Levis (2011) does make a distinction between these groups. To gain the most accurate results when it comes to how the long-run performance and first-day returns compares to firms with different ownership structures the

authors in this study have decided to divide ownership structure into three groups in line with Levis (2011).

The fact that the entire sample of IPOs on the Nordic market is not included in this study can be criticized. Though due to the time limit of this study the sample of 614 IPOs from Zephyr, whereas 551 were NS and 63 were PE/VC backed, would be too extensive to process. Further, as this sample could not be processed and due to the inconsistency in the classifications of PE/VC-backed IPOs and NS IPOs from Zephyr the unchosen sample of NS IPOs could have resulted in a bigger sample of PE- and VC-backed IPOs.

3.7.5 RELIABILITY

A fundamental aspect for a research study is that it should be able to be replicated based on the disclosed method. Therefore, there should exist no random errors that may affect the results. During this study the authors have made certain assumptions and choices. If the research questions were to be used in an alternative study, there is a possibility that other measurements and methods are used which can in turn lead to differing results. For example, an alternative benchmark can be employed instead of using a market index. Further, an alternative method for measuring the return or the size of the firm can be used as well as different categories of ownership structure. However, the variables that are chosen in this study have been extracted from previous literature and academic theories, therefore the authors find no reason in altering these choices. When only referring to the data collection and the processing of data in this study, the same results would apply if the study were to be repeated. This is due to the fact that the data is gathered from Datastream, Zephyr and Argentum which are well acknowledged databases that are used by experts in the financial industry. Further, as these databases showed different classifications for the variable ownership structure, the ownership structure was instead identified by firm prospectuses.

All of the stock exchanges on the Nordic market were chosen to get a better representation of the entire Nordic market. The authors are aware of the fact that different rules apply to different stock exchanges. However, by not including all of the stock exchanges the results could be biased. Further, all of the IPOs that were delisted prior to the 36-month period were chosen for the study in order to avoid survivorship bias i.e. analyzing only firms which were successful enough to survive to the end.

3.7.6 NON-RESPONSE ANALYSIS

Approximately 20 percent of the entire IPO sample on the Nordic market were chosen for the study. Of these a random selection of NS IPOs was obtained from the Zephyr database while the entire sample of PE/VC-backed IPOs were selected in order to obtain a large enough sample. As the selection of the NS IPOs was random this sample should statistically reflect the entire sample of NS IPOs correctly. However, as mentioned earlier, the authors noted that a few of the NS IPOs included in the sample were actually PE-backed IPOs or VC-backed IPOs, similarly, a few of the PE-backed IPOs and VC-backed IPOs were actually NS IPOs. The true amount of NS IPOs and PE- and VC-backed IPOs is therefore unknown and could not be determined due to the limited time frame of this study.

The previous mentioned criterion (see *section 3.2.4*) resulted in data that included 54 NS IPOs, which is a loss of 66 NS IPOs. Further, of the initial 39 PE-backed IPOs only 33 remained, comparatively, of the initial 37 VC-backed IPOs only 31 remained. All SEOs were excluded for the study since the purpose of this study was to only analyze firms that issue stocks for the first time to the public. IPOs which were cross-listed on another exchange prior to the IPO were excluded from the study. If these were to be included, it would tamper with the results as cross listed stocks are highly correlated with each other i.e. a stock listed on an exchange would affect the IPO since it already has a market value.

4. RESULTS

In the following chapter the authors will present the results from the collected data as well as the results from the tests that have been conducted. In order to answer the first research question the average BHAR values and first-day returns will be presented for all of the subgroups. Further, ANOVA tests will be displayed in order to show whether any statistical differences can be proven between the three subgroups. In order to answer the second research question the results from five different regression analyses will be presented. Finally, the results from the diagnostic tests will be displayed in order to determine if all the assumptions of OLS hold for the regression analysis.

4.1 PRESENTATION OF DATA

In this section the collected data, which has been processed, will be presented. The data is primarily presented according to origin. The data is then categorized into ownership structure, time of floatation and IPO activity period.

4.1.1 GEOGRAPHICAL PRESENTATION OF THE DATA

In the collected data Sweden represents 42.4 percent of the entire sample, whereas Finland represents a mere 8.5 percent. Norway and Denmark represent 34.7 percent and 14.4 percent respectively. This random sample can thus be seen as an accurate representation of the entire Nordic sample as Sweden represents the largest portion of IPOs followed by Norway and Denmark while Finland represents the smallest portion of IPOs. This is shown in *table 2*.

TABLE 2

Study Sample			**Entire Nordic Sample**		
Country	*All*	*Percent*	*Country*	*All*	*Percent*
Denmark	17	14.4	Denmark	75	12.2
Finland	10	8.5	Finland	40	6.5
Norway	41	34.7	Norway	189	30.8
Sweden	50	42.4	Sweden	310	50.45
Total	*118*	*100*	*Total*	*614*	*100*

4.1.2 DISTRIBUTION OF DATA BASED ON OWNERSHIP STRUCTURE

The sample used in this study consists of a total of 118 IPOs from the four Nordic countries, with a total of 33 PE-backed IPOs (28%), 31 VC-backed IPOs (26%) and 55 NS IPOs (46%).

As seen in *table 3*, the NS IPOs are not only the most represented type in the sample but also in every country.

TABLE 3

Distribution of IPOs				
Country	*PE*	*VC*	*NS*	*All*
Denmark	2	7	8	17
Finland	2	1	7	10
Norway	12	13	16	41
Sweden	17	10	23	50
Total	*33*	*31*	*54*	*118*

4.1.3 DISTRIBUTION OF DATA BASED ON IPO ACTIVITY

As illustrated in *figure 1* the number of IPOs in our sample have fluctuated dramatically over the years. The IPO activity peaked in the year 2006 and was at its lowest point in 2003 (0 IPOs).

FIGURE 1

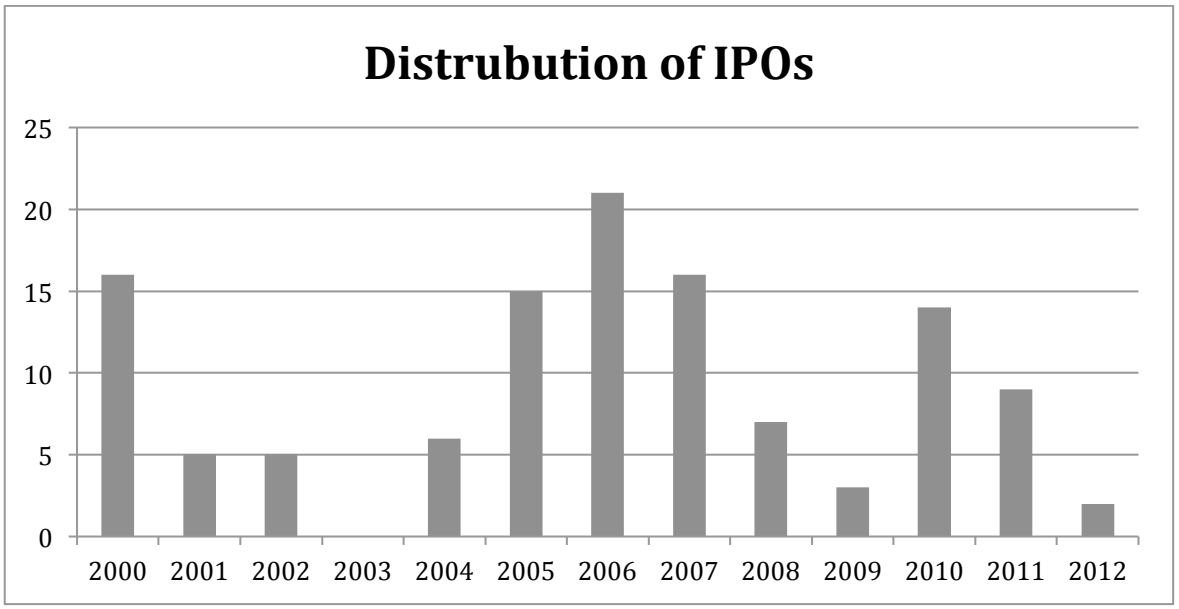

Table 4 demonstrates the distribution of IPOs according to IPO activity period and shows that PE-backed IPOs (31.4 %) and NS IPOs (31.5 %) are more common in high IPO activity, relative to that of VC-backed IPOs (22.6 %). Furthermore, our study reveals a higher degree of VC-backed IPOs (74.2 %) and NS IPOs (64.8 %) to that of PE-backed IPOs (48.5 %) in

the medium IPO activity period. Lastly, PE-backed IPOs (12.1 %) are more common in the low IPO activity periods relative to that of NS IPOs (3.7 %) and VC-backed IPOs (3.2 %).

TABLE 4

	Distribution of IPOs				**Distribution of IPOs (%)**			
IPO Activity Period	*ALL*	*PE*	*VC*	*NS*	*ALL*	*PE*	*VC*	*NS*
High	37	13	7	17	31.4	31.4	22.6	31.5
Medium	74	16	23	35	62.7	48.5	74.2	64.8
Low	7	4	1	2	5.9	12.1	3.2	3.7
Total	*118*	*33*	*31*	*54*	*100*	*100*	*100*	*100*

4.2 TEST STATISTICS

In the following section the statistical tests that have been conducted for this study will be presented. First a t-test for BHR will be presented showing whether there is a statistical difference between the average BHR of the MSCI index and the average BHR of the study´s sample of IPOs. Further, ANOVA-tests will be displayed in order to determine whether there are any statistically significant differences between the subgroups and the quantitative variables.

4.2.1 BHR

The t-test shows that the average BHR for the sample of IPO firms is negative while in contrast the average BHR for the MSCI index is positive. Further, the difference between these two groups is statistically proven where the average BHR for the index outperforms the average BHR for the IPOs by approximately 19 percent which is presented by the t-test in *table 5*.

TABLE 5

***One-Sample Test for BHR**						
	t	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Lower*	*Upper*
BHR_{IPO}	-0.18	117	0.857	-1.42%	-16.98%	14.14%
BHR_{MSCI}	3.368	118	0.001**	17.90%	7.37%	28.43%

**95% Confidence Interval of the Difference. Test Value = 0*
*** Significant at a 1%-level*

4.2.2 FIRST-DAY RETURNS

Table 6 shows that the average first-day returns of the three subgroups are quite different from one another. The PE-backed IPOs in the sample show the lowest first-day returns with an average value of 3.5 percent and the VC-backed IPOs show the highest first-day returns with an average value of 40.5 percent.

TABLE 6

Average First-Day Return (%)			
PE	*VC*	*NS*	*All*
3.46	40.53	16.94	19.37
(18.02)	(146.6)	(51.06)	(84)

Standard deviation is displayed within the parentheses (%).

However, as the standard deviations of these values are large an ANOVA-test (see *table 7*) is required in order to test the following hypotheses:

H_0 = *The average first-day returns is the same for all the subgroups.*

H_1 = *At least one of the groups' average first-day returns is different from the others in a non-random manner.*

TABLE 7

ANOVA test for First-Day Return					
	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	22554.32	2.00	11277.16	1.59	0.21
Within Groups	817682.86	115.00	7110.29		
Total	840237.19	117.00			

As the ANOVA test shows a significance of 21 percent the null hypothesis (H_0) is accepted where no difference in the average first-day returns between the three subgroups can be statistically proven.

4.2.3 BHAR

As presented in *table 8* the average BHAR values of the three subgroups are quite different from one another where the PE-backed IPOs in the sample show the least underperformance with an average BHAR of -0.82 percent and the VC-backed IPOs show the highest underperformance with an average BHAR OF -45 percent.

TABLE 8

Average BHAR (%)			
PE	*VC*	*NS*	*All*
-0.82	-45.00	-15.88	-19.32
(106.69)	(126.79)	(120.38)	(119.63)

Standard deviation is displayed within the parentheses (%).

However, as the standard deviations of these values are large (shown in *table 9*) an ANOVA-test (See *table 9*) is required in order to test the following hypotheses:

H_0 = *The average value of BHAR is the same for all of the subgroups.*

H_1 = *At least one of the groups average BHAR value is different from the others in a non-random manner.*

TABLE 9

ANOVA test for BHAR					
	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	32372.19	2.00	16186.09	1.12	0.33
Within Groups	1656467.77	115.00	14404.07		
Total	1688839.96	117.00			

The ANOVA test shows a significance of 33 percent which is higher than the significance level of 5 percent which is used in this study. Therefore, the null hypothesis (H_0) is accepted where no difference in the average BHAR values between the three subgroups can be statistically proven.

4.2.4 MARKET CAPITALIZATION

The average logarithm of market capitalization varies from 18.05 to 18.91 between the subgroups (see *table 10*).

TABLE 10

Average Market Capitalization (ln)			
PE	*VC*	*NS*	*All*
18.91	18.05	18.65	18.57

The ANOVA test shows that there are no significant differences between the average values and therefore the null hypothesis is accepted (See *table 11*).

H_0 = *There are no differences in the average market capitalization between the subgroups*

H_1 = *At least one of the subgroups average market capitalization is different from the others in a non-random manner.*

TABLE 11

LN Market Capitalization					
	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	12.437	2	6.218	1.991	0.141
Within Groups	359.243	115	3.124		
Total	371.679	117			

4.2.5 THE OFFERING SIZE

The average logarithm of offering size varies from 16.70 to 17.66 between the three subgroups (See *table 12*).

TABLE 12

Average Offering Size (ln)			
PE	*VC*	*NS*	*All*
17.49	16.7	17.66	17.36

Once again the ANOVA test shows that there are no significant differences between the average values and therefore the null hypothesis is accepted (See *table 13*).

H_0 = *There are no differences in the average offering size between the subgroups*

H_1 = *At least one of the subgroups average offering size is different from the others in a non-random manner.*

TABLE 13

ANOVA test for LN Offering Size					
	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	18.786	2	9.393	2.441	0.092
Within Groups	442.599	115	3.849		
Total	461.385	117			

4.2.6 LEVERAGE RATIO

The average leverage ratios between the subgroups varies from 22 percent to 188 percent where the PE- backed IPOs have the highest leverage ratio and the VC-backed IPOs have the lowest (See *table 14*).

TABLE 14

Average Leverage Ratio (%)			
PE	*VC*	*NS*	*All*
187.83	22.26	60.7	86.15

In order to establish whether there are any significant differences between these values an ANOVA-test (see *table 15*) is required which tests the following hypotheses:

H_0 = *The average leverage ratio is the same for all of the subgroups.*

H_1 = *At least one of the groups average leverage ratio is different from the others in a non-random manner.*

TABLE 15

ANOVA test for Leverage Ratio					
	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	502680.99	2.00	251340.50	15.46	0.00
Within Groups	1869180.14	115.00	16253.74		
Total	2371861.14	117.00			

The ANOVA test shows a significance of 0 percent which is significantly lower than the significance level of 0.1 percent. Therefore, the null hypothesis (H_0) is rejected where a difference in the average leverage ratio between the three subgroups can be statistically proven.

The ANOVA test does not on its own provide the information of which average values that differ from each other. Therefore, a post hoc-test is necessary in order to determine where the differences lie. The post hoc-test in *table 16* shows that the PE-backed IPOs have a significantly higher average leverage ratio than the other two subgroups. However, a difference in the average leverage ratios between VC-backed IPOs and NS IPOs cannot be statistically proven.

TABLE 16

Multiple Comparisons – LSD Dependent Variable: Leverage Ratio						
(I) Sponsored Type		*Mean Difference (I-J)*	*Std. Error*	*Sig.*	*95% Confidence Interval*	
					Lower Bound	*Upper Bound*
PE	*NS*	127.128*	28.17	0.00	71.33	182.93
	VC	165.568*	31.89	0.00	102.40	228.73
NS	*PE*	-127.13*	28.17	0.00	-182.93	-71.33
	VC	38.44	28.73	0.18	-18.46	95.35
VC	*PE*	-165.57*	31.89	0.00	-228.73	-102.40
	NS	-38.44	28.73	0.18	-95.35	18.46

**The mean difference is significant at the 0.01% level.*

4.3 REGRESSION ANALYSIS

In order to answer the second research question five different regression analyses have been performed which are illustrated below in *table 17*. Every independent variable is tested against the dependent variable BHAR and is added one at a time until all independent variables are included in the fifth regression. *Appendix 2* presents the complete fifth regression analysis. As the intention with the regression analysis is to answer the second research question, the fifth regression analysis will be the main focus in this section as it includes all of the independent variables. As seen in both *table 17* and *Appendix 2* the independent variable *market capitalization* is excluded, which is due to a problem with the OLS-assumptions which will be further explained in the *section 4.2.4*.

Most of the independent variables have no significant impact on the dependent variable BHAR at the five percent significance level. The only independent variable which provides a significant impact on BHAR within the five percent significance level is the dummy variable *high IPO activity period.* This shows that *high IPO activity* has a negative impact on the long-run performance not only within the 5 percent significance level but also within the 1 percent significance level. When this variable is included in the regression analysis it also provides the highest adjusted R^2.

TABLE 17

Independent Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
First-day return	0.0289 (0.132)	0.0416 (0.132)	0.030 (0.132)	0.055 (0.133)	0.034 (0.128)
Leverage Ratio		0.0834 (0.079)	0.095 (0.079)	0.058 (0.088)	0.0490 (0.0850)
Offering size (ln)			-7.56 (5.645)	-8.85 (5.737)	-9.220 (5.517)
PE (Dummy)				6.85 (28.90)	13.517 (27.862)
VC (Dummy)				-36.65 (27.897)	-43.430 (26.906)
High IPO Activity Period (Dummy)					-73.824* (23.164)
C	-19.88	-27.31	103.16	135.99	166.56
N	118	118	118	118	118
Adjusted R^2 (Squared)	-0.0082	-0.0071	-0.0002	0.0011	0.077

*Regression with BHAR as dependent variable. Unstandardized beta-coefficients and standard errors within parentheses. *Significant at a 1%-level.*

4.3.1 HYPOTHESIS OUTCOMES

TABLE 18

Independent Variable	Expected outcome	True outcome
First-day return	Negative relationship	No relationship
Leverage ratio	A relationship	No relationship
Offering size	Positive relationship	No relationship
PE-backed (Dummy)	Different from the reference groups (NS)	No relationship
VC-backed (Dummy)	Different from the reference group (NS)	No relationship
High IPO activity period (Dummy)	Different from the reference group (Medium/low)	Negative compared to reference

4.4 OLS ASSUMPTIONS

In order to use OLS as a method several assumptions have to hold for the results to be deemed valid and interpretable. These assumptions have been defined and explained in chapter three. In this section the results from the tests that have been performed on this study's regression analysis will be presented in order to show that all of the OLS assumptions hold.

4.4.1 THE ASSUMPTION THAT THERE EXIST A Y-INTERCEPT

The OLS method assumes that a y-intercept must exist in order to perform a regression analysis. As each of the regression analyses show a C-value that is greater or smaller than zero this assumption holds.

4.4.2 THE ASSUMPTION OF HOMOSCEDASTICITY

In order to test that the errors or residuals have a constant variance a *White test* has been performed. The null hypothesis that is tested states that all of the errors are homoscedastic. The results of the *White test* show that the variance of the errors is constant as the observed probability value is higher than the 5 percent level of significance (See *appendix 3*). Therefore, the null hypothesis is accepted and the assumption of homoscedasticity is confirmed.

4.4.3 THE AUTOCORRELATION ASSUMPTION

The *Durbin-Watson* test, checks for any autocorrelation between the variables in the regression analysis. A *Durbin-Watson* test is included in each regression analysis, if this value is over 1.65 the autocorrelation assumption holds and the variables are not auto

correlated. As the value from the *Durbin-Watson* test for the sixth regression is 2.2 this assumption holds. (See *appendix 2,* showing the sixth regression analysis)

4.4.4 THE MULTICOLLINARITY ASSUMPTION

This OLS assumption states that multicollinearity should not exist, otherwise correlation between the independent variables exists. In order to verify that there is no multicollinearity between the variables two methods are used. A *correlation matrix* was extracted and several *Variance Inflation Factor (VIF)* tests were conducted. In *appendix 4* the correlation matrix is presented, which shows that the logarithm of the variables *market capitalization* and *offering size* are correlated as the correlation value is 0.823 which exceeds the limit of 0.8. The values from the *VIF* tests verified this correlation, which can be seen in *appendix 5*. This meant that one of these variables had to be excluded from the regression analysis. *Market Capitalization* was excluded as it had a lower impact on BHAR. When the variable *market Capitalization* was excluded from the regression analysis all of the independent variables displayed uncorrelated values which means that the assumption of multicollinearity holds.

4.4.5 NON-LINEARITY

In order to test the regression for any non-linearity between the independent variables a *Ramsey's RESET* test was conducted. *Appendix 6* presents the complete test, which shows that the null hypothesis, which states that the data is linear, is accepted as the p-value of 16.03 percent exceeds the 5 percent significance level. This means that the assumption of non-linearity holds.

4.4.6 NORMALLY DISTRIBUTED RESIDUALS

To test if the assumption of normally distributed residuals holds, a *Bera-Jarque* test has been performed which shows if the residuals are normally distributed or not. As seen in *appendix 7* the p-value of the test (0.2012) exceeds the five percent significance level, why the null hypothesis is accepted. This means that the assumption of normally distributed residuals for the regression holds.

5. ANALYSIS

In the following chapter the results will be analyzed by the theories and previous research that have formerly been presented in this study. This will be done in order to answer each of the research questions that have been presented in the first chapter.

5.1 THE DIFFERENCES IN THE FIRST-DAY RETURNS BETWEEN OWNERSHIP STRUCTURES

As previously presented the results did not show any statistically significant results between the three ownership structures regarding the first-day returns. However, the direction of the average values between the groups can be compared and carefully analyzed (van Frederikslust & van der Geest, 2001).

When only analyzing the average values of first-day returns for the three different groups, all of the theories in *section 2.1.1* could be valid explanations, as all three groups experience underpricing. However, the PE-backed IPOs experience the lowest average first-day returns and are therefore the least underpriced while the VC-backed IPOs experience the highest average first-day returns and hence show the highest degree of underpricing among the groups.

The *market feedback hypothesis* (Ritter, 1998) explains that an IPO is underpriced in order for the underwriter to gain information from the market. This may be a valid explanation for why the NS IPOs experience an average underpricing of almost 17%, as perhaps more information is needed from the market in the absence of a PE/VC sponsor. This would also explain why the PE-backed IPOs demonstrate the lowest degree of underpricing. However, as the VC-backed IPOs in the sample show the highest degree of underpricing this hypothesis would entail that the presence of a VC-sponsor increases the asymmetric information in the market. As for the *bandwagon-, ownership dispersion-* and *signaling hypothesis,* this study does not include all relevant information to make a further conclusion then that they might be valid explanations for the results.

Although the findings in this study display similar results to the findings of Mogilevsky and Murgulov (2012), the average underpricing in the group of VC-backed IPOs is almost twice as large, with a staggering 40.53% first-day return. These findings deviate significantly from

both Megginson and Weiss (1991) and Levis (2011) where the VC-backed IPOs show first-day returns of 14.9% and 7.1% respectively. As Loughran and Ritter (2004) stated, the studied time period has a major impact on the level of first-day returns which may be a valid reason behind these findings. Another reason behind these results might be explained with the firm *International Maritime Exchange*, which shows a first-day return of over 700%. Without this firm, the average underpricing in the VC group is 17%, which is more in line with previous research (Megginson & Weiss, 1991; Levis, 2011; Mogilevsky & Murgulov, 2012).

By only analyzing the average values in the three different groups, the previous studies that state that PE-backed IPOs are less underpriced than the other two groups is confirmed (van Frederikslust & van der Geest, 2001; Bergström et al., 2006; Levis, 2011; Mogilevsky & Murgulov, 2012). According to van Frederikslust and van der Geest (2001) the presence of a PE- sponsor decreases the degree of underpricing as these sponsors are basically assumed to care about their reputation. This is known as the *certification hypothesis* (van Frederikslust & van der Geest, 2001). Further, this study's results can be explained by this theory if the PE-sponsors are considered to have a *good* reputation and the VC-sponsors are considered to have a *bad* reputation in comparison. This would confirm the results that PE-backed IPOs demonstrate less underpricing in comparison to the VC-backed IPOs. However, the ANOVA test on the first-day returns between the three groups does not provide any significant results to verify this statistically. The reason for this might be the high standard deviation within the different groups, where some of the firms within the groups show very large first-day returns, when others experience the exact opposite.

5.2 THE DIFFERENCES IN BHAR BETWEEN OWNERSHIP STRUCTURES

As the results show that there are no significant differences in the average BHAR values between the different ownership structures one must be careful when analyzing the results. However, comparisons can still be made between the subgroups based on the results of their average BHAR values.

When solely examining the average values of BHAR it is evident that the PE-backed IPOs have outperformed the other two groups in the studied sample; -0.83 percent compared to -15.88 percent and -45 percent. The direction of these results are consistent with the previous

findings on the US market (Katz, 2009; Holthausen & Larcker, 1996; Cao & Lerner 2009; Mogilevsky & Murgulov, 2012) and on the European market (Bergström et al, 2006; Levis, 2011) which find that PE-backed IPOs demonstrate superior performance compared to that of non PE-backed IPOs. However, some studies have also found that PE-backed IPOs do not show any underperformance relative to the benchmark (Levis, 2011) which is not the case in this study as all of the groups underperform the benchmark. Further the results show that the VC-backed IPOs underperform the NS IPOs by approximately 29 percent which is inconsistent with Levis (2011) as he finds the opposite; that VC-backed IPOs outperform NS IPOs.

Katz (2009) explains that the superior performance of PE-backed IPOs compared to non-PE-backed IPOs results from the PE ownership being more professional, that there is tighter monitoring and control in the firm, and the positive reputation of PE sponsors. All of these factors provide more information about the PE-backed IPO to the market. This can be paralleled to Ritter´s (1998) *divergence of opinion hypothesis* which discusses how investors hold different expectations regarding firms due to the presence of asymmetric information. As the PE-backed IPOs demonstrate less underperformance one can speculate that the presence of a PE sponsor reduces asymmetric information in the market which in turn would, according to this hypothesis, lead to a higher degree of performance. However, this would also imply (from this study´s results) that the VC-sponsor increases the amount of asymmetric information as the VC-backed IPOs demonstrate the greatest underperformance of all of the subgroups.

Another theory by Ritter (1998) that can be applied to this study's results is the *impresario hypothesis.* This hypothesis states that IPOs that show higher first-day returns will demonstrate a higher degree of underperformance. This study´s findings are consistent with this theory as the PE-backed IPOs show the lowest degree of underperformance and also the lowest average first-day returns while the VC-backed IPOs show the highest degree of underperformance and the highest average first-day returns. Further, these results are consistent with Levis (2011) who found that PE-backed IPOs have lower first-day returns and hence perform better than the other two subgroups.

Finally, Benninga et al. (2005) *delisting hypothesis* can be applied to this study´s results. This hypothesis states that the underperformance of IPOs can be explained by the prevailing

option to reprivatize, i.e. go from public to private. Further, as newly issued firms have smaller cash flows than more mature public firms, and therefore hold less risk, the returns of the newly issued firms should be less. When examining the results as a whole this theory seems to be confirmed as all of the subgroups underperform in comparison to the MSCI Nordic countries index. However, as the PE-backed IPOs in this study outperform the other subgroups one can speculate that the presence of a PE-sponsor can increase the cash-flows of the issuing firm which in turn increases the risk and the returns. This would decrease the value of the delisting option, as the option may be more complicated due to the presence of the PE-sponsor and greater cash flows. Furthermore, this theory would also imply, that for this study, the value of the delisting option is greater for VC-backed firms. However, as stated above the differences in the BHAR values between the groups are not statistically significant which means that the average values can only suggest that the PE-backed IPOs in the sample outperform the other two groups.

5.3 INDEPENDENT VARIABLES

As the results show in *table 8*, there is a significant difference (0.05>0.001) in the BHR between the average IPO and MSCI Nordic Countries index where the average BHR_{index} outperforms BHR_{IPO} by approximately 19 percent (*table 5*). These results are in line with a wide range of previous studies on both the US market and the European market which state that IPOs do underperform in the long-run (Ritter, 1991; Loughran & Ritter, 1995; van Frederikslust & van der Geest, 2001; Bergström et al., 2006; Westerholm, 2007; Levis, 2011). In contrast to these results, Brav and Gompers (1997) and Gompers and Lerner (2003) find that IPOs do not underperform in the long-run. However, in these studies a different type of benchmark is used which perhaps can explain the differing results.

To establish if any of the independent variables have an impact on BHAR, *appendix 2* displays the final regression. As seen, the only independent variable that significantly affects BHAR is the dummy variable *high IPO activity period*. This is in line with previous findings by Ritter (1991), Bergström et al. (2006) and Levis (2011) which shows that when the IPO activity is high the IPOs underperform in the long-run. The other four independent variables do however not affect BHAR with a significant value, i.e. below the 5 percent significance level. Therefore, instead, the direction of the coefficient for each of these variables will be

carefully analyzed in order to see if there exist similar patterns between this study's results and previous studies.

5.3.1 FIRST-DAY RETURNS

As seen in *table 18*, the independent variable *first-day return* has no significant impact on BHAR. The value of the coefficient varies between 0.0289 and 0.055, which shows the movement in the value of BHAR for every percentage first-day return. This means, in the first regression, that BHAR would increase with 0.0289 for every percentage of first-day return the firm experiences. This is in complete contradiction to previous research (Ritter, 1991; Bergström et al., 2006; Levis, 2011), which states that a higher first-day return results in a lower value for BHAR i.e. that there is a negative relationship. However, as the coefficient of determination or (R^2) is negative in the first model this implies that BHAR cannot be explained by first-day returns which is in contrast to the findings of Ritter (1991), Bergström et al. (2006) and Levis (2011).

5.3.2 LEVERAGE RATIO

As with the previous independent variable, the leverage ratio has no significant impact on BHAR. Further, the coefficient of determination (R^2) is negative when the variable is first added to the regression which means that BHAR cannot be explained by leverage ratio. These findings are in contrast to the findings of Hamada (1972), Hou and Robinson (2006) and Levis (2011) who find that there exists a positive relationship and the findings of Dimitroy and Jain (2008) and Korteweg (2010) who find that there exists a negative relationship between leverage ratio and BHAR.

By conducting an ANOVA test in order to see if there are any differences between the three subgroups, a significance below 0.1% can be seen (*see table 15)*. By then analyzing the post hoc test, the groups that exhibit significant differences are displayed, which shows that PE-backed IPOs have a greater leverage ratio than both of the other groups, below the 0.1% significance level. This result is in line with previous research (Bergström et al., 2006; Levis, 2011; Mogilevsky & Murgulov, 2012) that PE-backed IPOs exhibit a higher leverage ratio than the other two groups.

5.3.3 OFFERING SIZE

The regression analysis in *appendix 1* shows that offering size has no significant impact on BHAR. The coefficient of determination (R^2) is also negative, hence it cannot explain the value of BHAR. This is not in line with previous researches where offering size is found to have a positive impact on BHAR (Ritter, 1991; Bergström et al., 2006).

As seen in *table 13,* the average logarithm of offering size varies between the subgroups, where NS IPOs show the biggest average offering size followed by PE-backed IPOs and lastly VC-backed IPOs. In previous researches PE-backed IPOs have had the biggest offerings sizes, followed by VC-backed IPOs and then lastly NS IPOs (Bergström et al., 2006; Ritter, 1998). These findings are not in line with this study's results.

The ANOVA test in *table 14* shows that there are no significant differences between the subgroups. Given that the NS IPO sample consists of three very large IPOs (Telia, Telenor and Eniro) and that not all NS IPOs were chosen for the study, these results may be deceptive as the standard deviation is largely affected by this and could have had an impact on the result. However, since the NS IPO sample was randomly selected, removing these would be biased.

5.3.4 OWNERSHIP STRUCTURE

As previously stated the NS IPOs are set as a reference group when examining whether ownership structure has a significant effect on BHAR.

When adding the dummy variables of ownership structure to the regression it is the first time the coefficient of determination (R^2) becomes positive, why ownership structure seems to be able to explain the value of BHAR. However, neither of the dummy variables provide any significant impact on BHAR, why the direction of the variables coefficients is examined instead. When analyzing the direction of the variables coefficients the PE-backed IPOs have the highest positive value which suggests that this variable has a positive impact on BHAR. This is in line with previous studies on the US market (Holthausen & Larcker, 1996; Katz, 2009; Cao & Lerner 2009; Mogilevsky & Murgulov, 2012) and the European market (Bergström et al, 2006; Levis, 2011) which show that PE-sponsorship has a positive impact on BHAR. Further, the results suggest that the VC-backed IPOs have a large negative impact

on BHAR with a coefficient of -36.7 (see *appendix 2*) which then does not confirm the results found on the US and European markets (Brav & Gompers, 1997; Levis, 2011).

5.3.5 IPO ACTIVITY PERIOD

The IPO activity period is the only variable in the multiple regression that has a significant impact on BHAR. As this variable is included in the regression as a dummy variable it is important to emphasize that the h*igh IPO activity period* has an impact on BHAR only when compared to the low/medium IPO activity period (which is used as a reference group). The results from *appendix 2* show that there exists a significant negative relationship between BHAR and the high IPO activity period. These findings are in line with previous findings on the US-market (Ritter, 1991) and on the European market (Bergström et al., 2006; Levis, 2011).

Ritter (1998) explains that the large volume of companies that choose to go public in specific periods can be explained by the behavior of investors in times of high growth (booming markets). Therefore, according to the *windows of opportunity hypothesis* IPOs that are issued in high activity periods will demonstrate a greater degree of overvaluation than IPOs that are issued in low volume periods which in turn leads to a greater degree of underperformance (Ritter, 1998). This theory is confirmed by the findings in this study as the regression analysis shows a significant negative relationship between the IPO activity period and BHAR, showing that IPOs issued in high volume periods underperform IPOs issued in low/medium periods. Further, the *divergence of opinions hypothesis* can be applied to this study's results as it states that individuals are more optimistic in periods of high growth (Ritter, 1998). Ritter (1998) explains that the high expectations of optimistic investors cannot be met leading to worse performance in the long-run. Both of these theories indicate that firms as well as investors are affected by booming markets. Periods in which investors hold higher expectations lead to periods with larger volumes of IPOs that tend to be overvalued which then negatively affects the long-run performance of the firms.

Further, Schulz´s (2003) *pseudo market timing* theory may be confirmed in this study as the volume of IPOs issued each year seem to mirror the business cycle. The *high IPO activity period* includes the years 2006 and 2007 where the economy was in an upturn just before the recession in 2008. In comparison, the low IPO activity period includes the years 2002 and

2003 which are the years following the 2001 dot-com bubble. However, 2012 is also included in the low IPO activity period where the nearest crisis was the Euro-zone crisis in 2009.

6. CONCLUSION

In the following chapter the authors will reflect over the study´s results. Further, thoughts on further research areas will be presented and discussed.

The purpose of this study was to examine IPOs with different ownership structures and to find whether there existed any differences in the first-day returns and the long-run performance between the subgroups. Further, a few variables were chosen in order to examine whether they could explain the long-run performance of IPOs on the Nordic market. With this we intended to add to the existing studies that topic IPOs by examining the Nordic region that has, according to Westerholm (2007) and Spliid (2003), been relatively untouched by previous studies. We consider that the purpose of this study has been met even though significant results could not be determined for most of the variables. Even though no differences between the first-day returns and long-run performance of the subgroups could be determined this still answers the first research question. Further, the average values were analyzed in order to see if the results can be related to previous research and to see if the direction of the average values suggest that the same relationships that apply on other markets also seem to apply on the Nordic market. The only independent variable that had a significant impact on BHAR was the dummy variable *high IPO activity period*. Even though no significant impact could be determined in the rest of the variables the second research question is answered: the non-significant variables still show a coefficient of determination and therefore can answer the question of what may *not* have an impact on BHAR. Further, finding that these variables do not seem to impact BHAR is just as important as finding variables that do.

As not all of the IPOs issued on the Nordic market between the years 2000 to 2012 have been included in this study we wonder whether the results would have been different if the entire sample had been examined. However, as most of the PE-backed and VC-backed IPOs are included and a random sample of the NS IPOs are included we believe that the results show a fair representation of the Nordic market and the three subgroups, therefore we believe the sample can be deemed as a reliable representation of the market as a whole.

In this study we used a time frame of 13 years, from the year 2000 to 2012. During these periods two major market crashes occurred; the 2001 dot-com bubble and the 2008 financial

crisis. These types of events and their effects are rather irregular and may not occur within the same period of time in the future. This suggests that the results may not be comparable to studies concerning different time periods. As the dummy variable *high IPO activity period* was the only variable that had a significant impact on BHAR, and this variable seems to have been largely affected by these events, the impact of this variable for a different time period could be quite different. Further, these events negatively affected the average values of BHAR causing a higher degree of underperformance for IPOs issued in these years. This affected the average BHAR values in each of the groups negatively. Perhaps a future time period that does not contain similar events that negatively affect BHAR will show that PE-backed IPOs do not underperform as found by Levis (2011).

The first-day return and BHAR values that were obtained for the sample of VC-backed IPOs deviated the most in relation to previous studies that have found that VC-backed IPOs outperform and show lower average first-day returns than NS IPOs on average. Further, the role of PE in PE-backed IPOs and VC-backed IPOs is less established on the Nordic market in comparison to the US and European markets which may be an explanation for the poor performance of the VC-backed IPOs according to the *certification hypothesis*. However, the PE-backed IPOs in the study seem to perform in line with previous findings on both the US and European markets when only taking into account the direction of the values. This caused the authors to question whether venture capitalists on the Nordic market have worse reputations than venture capitalists on the other two markets. Perhaps, venture capitalists have not been as successful as PE sponsors when establishing themselves in the Nordic region, which in turn hinders the market from gaining credible information from these operators. Further, reputation is usually something that firms need to build which can be a time consuming process. Therefore, as private equity is a relatively unestablished form of ownership on the Nordic market in comparison to the US and European markets, it may take a few more years before similar results can be obtained and for the results to be statistically significant.

As all of the Stock exchanges on the Nordic market were included in this study this could have affected the results of the first-day returns and BHAR in different ways as different regulations exist on different stock exchanges. By only including stock exchanges that have similar regulations, for example the Nasdaq stock exchanges, the values for the first-day returns and BHAR may have been more comparable to each other. However, we believe that

this would be a misrepresentation of the Nordic market as a whole. For example, Norway does not have a Nasdaq stock exchange and therefore the country would be excluded from the study entirely.

In the study IPOs that were delisted before the three-year time frame were included in order to avoid survivorship bias. Perhaps, a more comparable sample of IPOs could be obtained by only examining "successful IPOs" or in other words IPOs that do well enough to survive a minimum of three years. However, the exclusion of these IPOs would cause a faulty representation of the entire sample of Nordic IPOs as the delisting phenomenon does exist and is common among newly listed firms.

Based on the results in this study, we would not recommend investing in IPOs on the Nordic market as all of the three subgroups underperform the benchmark on average. However, as previous studies on different markets come to the same conclusions, that PE-backed IPOs outperform non-PE-backed IPOs, this may in fact be valid reason for future investments in PE-backed IPOs as the PE-sponsorship seems to be becoming more established on the Nordic market. Hence, it seems that one is more likely to spot a winner if the IPO is PE-backed then if it were VC-backed or NS. However, when choosing between investing in IPOs or the MSCI index, the results of this study show that the index outperforms all IPOs on average irrespective of ownership structure, why this would be the current preferred choice in long-term investing.

6.1 FURTHER RESEARCH

After performing this study, the authors feel that it would be interesting to further research on the Nordic market concerning the relationship between the degree of PE ownership in an IPO and IPO performance. Katz (2009), for example, argues that firms with a higher degree of PE ownership perform better. In our study we classified PE ownership into two groups, PE- and VC-backed IPOs. If one would divide the PE and VC groups into further subgroups and classify them by the degree of ownership, one could examine if a relationship exists between the degree of ownership and the IPO performance.

Furthermore, the authors feel that it would be interesting to conduct a study on how or if the Nordic IPO performance varies according to the country origin as this was not an aspect

included in this study. Even though these countries share similarities the stock exchanges in the countries also have different rules which perhaps can affect the IPO performance in different ways. For example, a study on how the average first-day returns and average BHARs differ between the countries would be interesting to examine in order to see whether there exist any differences in these values between the countries. Further, it would be interesting to make a comparison between the different subgroups between the different countries.

Since the authors chose event time over calendar time and BHAR was used as a method over CAR to calculate abnormal returns, the results may differ if the other methods were used instead. The authors also choose a three-year period instead of a five-year period for the examination of long-run performance. It would therefore be interesting to see if using calendar time, a five-year period and/or CAR would have resulted in a different result. Given that all the methods have both upsides and downsides, the authors believe that it is important to examine whether/how the different methods impact the results.

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8. APPENDICES

APPENDIX 1 – DESCRIPTION OF SAMPLE

Company Name	Ownership structure	BHAR (%)	First-day return (%)	Leverage Ratio	LN Market Cap	LN Offering Size	IPO Activity Period
ABELCO	NS	-41.7	13.3	78.1	15.1	13.6	Medium
AFFECTOGENIMAP	PE	11.9	0.2	88.2	20.8	19.0	Medium
AHLSTROM	NS	-143.9	11.1	60.5	15.0	13.6	High
AKVA GROUP	VC	-68.7	0.0	103.1	18.4	17.5	High
ALFA LAVAL	PE	24.4	7.7	604.2	19.6	18.3	Low
ALGETA	VC	23.2	-6.4	0.0	19.3	16.3	Medium
ALPHAHELIX MOLEDIAG	VC	-87.4	2.2	0.0	17.3	14.1	High
AROCELL	NS	214.3	3.1	83.0	16.1	11.9	Medium
AUDIODEV	NS	-164.5	4.8	0.0	16.1	13.1	Medium
AXIS	VC	-211.3	1.3	13.5	17.5	14.1	Medium
BADGER EXPLORER	VC	-70.5	5.9	0.0	18.2	17.2	High
BAKKAFROST	NS	121.9	11.0	34.1	18.8	17.9	Medium
BALLINGSLOV	PE	116.5	-0.8	115.8	17.6	16.4	Low
BANKNORDIC	NS	-61.8	21.7	99.8	14.7	14.1	High
BE GROUP	PE	-58.8	4.8	30.6	18.7	17.1	High
BERGEN GROUP	NS	-64.2	-6.5	82.5	19.8	19.7	Medium
BIOINVENT	VC	-105.3	-16.1	0.0	14.1	13.8	Medium
BJÖRN BORG	NS	-57.1	-2.9	17.0	21.2	20.4	Medium
BRIDGE ENERGY	PE	-2.3	-19.6	117.9	16.1	13.6	Medium
BRIGHTER	NS	136.1	39.1	4.8	16.6	13.8	Low
BULTEN	PE	85.8	0.0	171.0	17.0	16.1	Medium
BYGGMAX	PE	2.8	5.4	247.7	19.4	17.8	Medium
CHEMOMETEC	NS	-96.4	163.5	0.0	19.1	15.7	High
CHR HANSEN	PE	140.9	5.6	1081.6	22.0	21.0	Medium
CURALOGIC*	NS	-74.7	0.0	0.0	19.8	19.0	High
DANSKE ANDELSKASSERS BANK	NS	-22.8	4.0	224.5	19.1	17.9	Medium
DELTAQ	NS	-55.8	0.0	0.0	19.9	18.9	High
DIGNITANA	NS	313.1	-30.0	0.0	15.8	13.8	Medium
DIOS FASTIGHETER	NS	-42.9	-7.7	201.1	20.5	19.0	High
DUNI	PE	11.8	0.0	365.6	18.2	16.6	High
EAST CAPITAL EXPLORER	NS	-41.6	1.5	0.0	16.8	16.5	High
ECOMB	NS	-25.7	133.3	14.2	18.9	17.0	Medium
ELECTROMAG GEOSERVICE	PE	-115.7	7.8	159.1	20.3	18.2	High
ENIRO	NS	-123.2	0.0	53.0	19.0	20.4	Medium

** Delisted within 3 years*

Company Name	Ownership structure	BHAR (%)	First-day return (%)	Leverage Ratio	LN Market Cap	LN Offering Size	IPO Activity Period
ENZYMATICA	NS	99.3	117.7	5.9	19.2	18.1	Medium
EPISURF MEDICAL	NS	258.3	2.9	0.0	18.3	18.7	Medium
ETTEPLAN	NS	-230.5	2.6	10.1	19.2	18.0	Medium
EXIQON	VC	-118.9	12.5	20.4	14.6	13.8	High
FIM GROUP	NS	-28.0	5.9	1.8	16.3	19.3	High
FLEX LNG	NS	-10.7	1.8	0.0	19.0	18.6	Medium
GANT COMPANY*	PE	-6.0	37.2	530.9	19.9	17.4	High
GENMAB	VC	-170.6	0.0	0.4	23.5	21.9	Medium
GJENSIDIGE FORSIKRING	NS	102.3	-0.4	22.4	18.7	17.7	Medium
GRENLAND GROUP ASA	PE	-104.2	56.7	43.4	19.7	19.0	Medium
HEMTEX	PE	-55.4	18.8	9.4	18.4	17.2	Medium
HMS NETWORKS	PE	5.3	-1.4	91.0	22.9	19.2	High
INDUTRADE	NS	41.6	12.7	23.3	23.6	22.8	Medium
INTERNATIONAL MARITIME EXCHANGE	VC	68.2	758.3	0.0	17.9	17.3	Medium
INTEX RESOURCES	NS	-105.2	-2.9	0.0	16.0	15.0	High
INTRUM JUSTITA	PE	33.6	6.4	345.6	17.9	16.1	Low
JAYS	VC	249.6	0.0	61.9	15.9	15.8	Medium
KAPPAHL	PE	-106.5	4.9	389.0	18.2	16.1	High
KAROLINSKA DEVELOPMENT	VC	-16.7	0.0	0.1	16.5	14.0	Medium
KONGSBERG AUTOMOTIVE	PE	-29.2	3.3	162.5	18.5	17.4	Medium
LINDAB INTERNATIONAL	PE	-53.1	2.5	69.4	21.8	19.6	High
MACONOMY	VC	-155.1	0.0	0.9	18.1	17.1	Medium
MAMUT	VC	189.3	-2.9	3.7	18.0	17.2	Medium
MICROPOS MEDICAL	VC	-51.6	16.3	18.8	15.9	14.9	Medium
MORPOL	NS	-17.5	-10.5	153.9	18.8	17.9	Medium
MQ HOLDING	PE	-32.3	-42.2	261.4	18.0	16.8	Medium
NEAS	PE	-60.1	-3.0	58.1	18.6	17.2	High
NEDERMAN	PE	-50.2	9.8	49.3	18.6	17.8	High
NEUROVIVE PHARMACEUTICAL	NS	209.6	-14.5	0.0	20.1	19.3	Medium
NEXTGENTEL	VC	16.8	20.0	40.6	17.5	15.3	High
NOBIA	PE	92.7	-9.0	131.7	15.4	13.8	Low
NORWEGIAN ENERGY	PE	-65.0	6.1	62.3	18.7	17.8	High
NORWEGIAN PROPERTY	NS	-100.3	7.9	206.0	18.8	17.3	High
NOTE	NS	102.7	-8.0	201.0	17.0	15.6	Medium
NOVOZYMES	VC	-46.9	368.8	113.4	16.2	13.8	Medium
NUNAMINERALS	NS	-53.6	-8.1	0.0	17.8	16.5	Medium

** Delisted within 3 years*

Company Name	Ownership structure	BHAR (%)	First-day return (%)	Leverage Ratio	LN Market Cap	LN Offering Size	IPO Activity Period
ODIM	PE	146.5	5.0	96.1	21.2	18.4	Medium
OHI	PE	213.5	-21.3	75.0	18.2	17.7	Medium
OKMETIC	VC	-285.2	0.0	176.9	18.5	16.5	Medium
OPERA SOFTWARE	VC	58.2	14.0	0.0	19.0	17.5	Medium
OREXO	VC	-77.2	0.0	0.0	15.8	15.8	Medium
PANDORA	PE	12.6	25.2	205.0	18.9	17.5	Medium
PANORO ENERGY	NS	-39.8	-26.2	50.9	17.9	15.6	Medium
PCI BIOTECH	VC	211.5	-10.0	0.0	17.1	17.1	Medium
PETROJARL	NS	28.8	-4.7	72.1	17.2	15.9	High
PHOTOCURE	VC	-243.4	-1.9	39.9	19.9	19.2	Medium
POLARIS MEDIA	NS	-5.1	230.0	14.2	18.7	17.4	Medium
POLIMOON*	PE	100.1	-1.4	214.5	19.9	18.6	Medium
POWEL	VC	-20.2	0.0	18.5	19.1	17.8	Medium
Q-FREE	VC	23.2	4.5	68.8	18.5	16.7	Low
REVUS ENERGY	PE	121.7	4.8	26.6	18.0	16.7	Medium
ROVSING	VC	-95.3	17.4	0.0	19.2	17.7	High
SALCOMP	PE	-132.3	-37.5	215.0	17.8	17.6	High
SAUNALAHTI	NS	-277.0	-27.7	237.8	20.6	20.1	Medium
SCAN GEOPHYSICAL*	PE	-134.4	-1.8	68.3	18.0	17.9	High
SCANDINAVIAN PRIVATE EQ.	NS	-92.8	0.0	0.0	19.7	19.0	High
SELVAAG BOLIG	NS	91.5	-5.0	275.6	18.4	17.5	Low
SENZIME	NS	-31.1	14.7	40.7	18.2	18.0	Medium
SEVAN DRILLING	NS	-35.7	-2.9	0.0	19.7	18.8	Medium
SRV YHTIÖT	NS	-60.0	10.0	137.3	21.3	20.4	High
SSH COMMUNICATIONS	NS	-171.2	-7.2	0.5	18.6	18.8	Medium
STATOIL	NS	7.1	0.0	75.8	20.0	19.6	Medium
STEPSTONE	VC	-297.3	60.9	1.3	19.7	18.8	Medium
STREAM INVEST AS	PE	217.3	0.0	14.7	18.2	17.1	Medium
SUOMEN TERVEYSTALO	NS	-31.8	-0.8	160.5	19.7	18.0	High
SWEDISH ORPHAN BIOVITRUM	PE	-61.7	11.5	0.0	18.3	17.8	High
SYSTEMAIR	NS	-19.2	0.0	121.1	19.7	19.2	High
TELE 1 EUROPE HOLDING	PE	-297.3	28.6	97.5	19.4	18.4	Medium
TELENOR	NS	-67.3	-32.2	75.2	20.8	19.9	Medium
TELIA COMPANY	NS	-216.0	4.1	48.8	18.3	17.8	Medium
THRANE & THRANE	NS	42.8	0.0	17.4	17.1	16.3	Medium

** Delisted within 3 years*

Company Name	Ownership structure	BHAR (%)	First-day return (%)	Leverage Ratio	LN Market Cap	LN Offering Size	IPO Activity Period
TIGRAN TECHNOLOGIES	NS	-56.1	150.0	0.0	18.5	18.1	Medium
TILGIN	NS	-118.8	-12.0	81.0	19.8	19.0	High
TOPOTARGET	VC	-23.0	16.9	0.4	19.8	18.1	Medium
TRADEDOUBLER	VC	-85.7	0.0	0.0	19.3	16.7	Medium
TRANSMODE	VC	84.1	2.8	0.0	17.7	16.7	Medium
TRETTI	NS	-68.8	-33.3	0.0	22.5	21.1	Medium
TRIGON AGRI	NS	-26.3	73.9	4.2	18.2	18.3	Medium
TROLLTECH*	VC	-40.4	9.4	0.0	19.1	18.8	High
VITROLIFE	VC	-48.4	-9.8	7.5	17.5	16.1	Medium
WIKING MINERAL	NS	-100.6	90.0	0.0	18.4	17.8	High
WILSON	NS	81.8	3.1	197.4	19.1	17.9	Medium
YARA INTERNATIONAL	NS	270.9	24.4	90.3	20.1	18.1	Medium
ZEALAND PHARMA	VC	-0.4	-7.6	0.0	20.5	20.3	Medium

** Delisted within 3 years*

APPENDIX 2 – MULTIPLE REGRESSION ANALYSIS

Dependent Variable: BHAR
Method: Least Squares
Date: 12/20/16 Time: 12:15
Sample: 1 118
Included observations: 118

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	166.5630	98.96590	1.683034	0.0952
FIRST_DAY_RETURN	0.034020	0.128044	0.265692	0.7910
LEVERAGE_RATIO	0.048956	0.084853	0.576951	0.5651
LN_OFFERING_SIZE	-9.215317	5.517386	-1.670233	0.0977
PE	13.51728	27.86211	0.485149	0.6285
VC	-43.42986	26.90636	-1.614112	0.1093
HIGH_IPO_ACTIVITY_PERIOD	-73.82432	23.16388	-3.187044	0.0019

R-squared	0.123937	Mean dependent var	-19.32059
Adjusted R-squared	0.076582	S.D. dependent var	120.1437
S.E. of regression	115.4517	Akaike info criterion	12.39307
Sum squared resid	1479529.	Schwarz criterion	12.55743
Log likelihood	-724.1912	Hannan-Quinn criter.	12.45981
F-statistic	2.617198	Durbin-Watson stat	2.203314
Prob(F-statistic)	0.020670		

APPENDIX 3 – WHITE TEST

Heteroskedasticity Test: White

F-statistic	1.562962	Prob. F(23,94)	0.0699
Obs*R-squared	32.64286	Prob. Chi-Square(23)	0.0875
Scaled explained SS	40.89077	Prob. Chi-Square(23)	0.0122

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/19/16 Time: 10:47
Sample: 1 118
Included observations: 118
Collinear test regressors dropped from specification

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	42649.54	32785.67	1.300859	0.1965
FIRST_DAY_RETURN^2	-0.403646	0.302387	-1.334864	0.1851
FIRST_DAY_RETURN*LEVERAGE_RATIO	-0.537575	1.228681	-0.437522	0.6627
FIRST_DAY_RETURN*LN_OFFERING_SIZE	110.6190	86.21377	1.283078	0.2026
FIRST_DAY_RETURN*PE	199.9761	302.3487	0.661409	0.5100
FIRST_DAY_RETURN*VC	357.7077	188.4398	1.898260	0.0607
FIRST_DAY_RETURN*HIGH_IPO_ACTIVIT	141.5883	132.3155	1.070080	0.2873
FIRST_DAY_RETURN	-561.1601	396.9233	-1.413775	0.1607
LEVERAGE_RATIO^2	-0.106517	0.109984	-0.968476	0.3353
LEVERAGE_RATIO*LN_OFFERING_SIZE	72.69835	44.43667	1.635999	0.1052
LEVERAGE_RATIO*PE	35.21599	65.49078	0.537724	0.5920
LEVERAGE_RATIO*VC	320.7939	104.9780	3.055821	0.0029
LEVERAGE_RATIO*HIGH_IPO_ACTIVITY_	58.49740	45.79940	1.277253	0.2047
LEVERAGE_RATIO	-362.9064	196.5365	-1.846509	0.0680
LN_OFFERING_SIZE^2	-500.0478	1301.786	-0.384124	0.7018
LN_OFFERING_SIZE*PE	3957.115	8857.948	0.446730	0.6561
LN_OFFERING_SIZE*VC	6352.169	5580.275	1.138325	0.2579
LN_OFFERING_SIZE*HIGH_IPO_ACTIVITY	-3028.683	5598.941	-0.540939	0.5898
LN_OFFERING_SIZE	-1925.792	12957.42	-0.148625	0.8822
PE^2	-24510.26	39254.97	-0.624386	0.5339
PE*HIGH_IPO_ACTIVITY_PERIOD	3600.491	10879.36	0.330947	0.7414
VC^2	-36475.17	25795.45	-1.414015	0.1607
VC*HIGH_IPO_ACTIVITY_PERIOD	-3145.045	11182.57	-0.281245	0.7791
HIGH_IPO_ACTIVITY_PERIOD^2	-7561.867	27165.08	-0.278367	0.7813

R-squared	0.276634	Mean dependent var	12472.90
Adjusted R-squared	0.099641	S.D. dependent var	21076.96
S.E. of regression	19999.35	Akaike info criterion	22.82418
Sum squared resid	3.76E+10	Schwarz criterion	23.38771
Log likelihood	-1322.626	Hannan-Quinn criter.	23.05299
F-statistic	1.562962	Durbin-Watson stat	2.370925
Prob(F-statistic)	0.069903		

APPENDIX 4 – CORRELATION MATRIX

	BHAR	PE	FIRST-DAY RETURN	LEVERAGE RATIO	HIGH IPO ACTIVITY PERIOD	LN MARKET CAPITALIZATION	LN OFFERING SIZE	VC
BHAR	1,000							
PE	0,096	1,000						
FIRST_DAY_RETURN	0,020	-0,117	1,000					
HIGH_IPO_ACTIVITY_PERIOD	-0,263	0,108	-0,070	1,000				
LEVERAGE_RATIO	0,096	0,447	-0,091	0,027	1,000			
LN_MARKET_CAPITALIZATION	-0,095	0,120	-0,066	-0,002	0,183	1,000		
LN_OFFERING_SIZE	-0,125	0,024	-0,076	-0,015	0,105	0,823	1,000	
VC	-0,128	-0,372	0,150	-0,113	-0,269	-0,173	-0,200	1,000

APPENDIX 5 – VARIANCE INFLATION FACTOR (VIF)

Independant Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
First-day return	1	1,08316	1,01284	1,004373	1,010279	1,013399	1,017554
Leverage Ratio		1,08316	1,018195	1,042034	1,277601	1,29389	1,295253
Offering size (ln)			1,015618	3,134954	3,171875	3,263348	3,265301
Market Capitalization (ln)				3,203868	3,245619	3,26072	3,260898
PE (Dummy)					1,272147	1,40434	1,412104
VC (Dummy)						1,233417	1,242886
High IPO Activity Period (Dummy)							1,024936

APPENDIX 6 – RAMSEY'S RESET

Ramsey RESET Test
Equation: UNTITLED
Specification: BHAR C FIRST_DAY_RETURN LEVERAGE_RATIO
LN_OFFERING_SIZE PE VC HIGH_IPO_ACTIVITY_PERIOD
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.413592	110	0.1603
F-statistic	1.998243	(1, 110)	0.1603
Likelihood ratio	2.124332	1	0.1450

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	26259.50	1	26259.50
Restricted SSR	1471802.	111	13259.48
Unrestricted SSR	1445542.	110	13141.29

LR test summary:

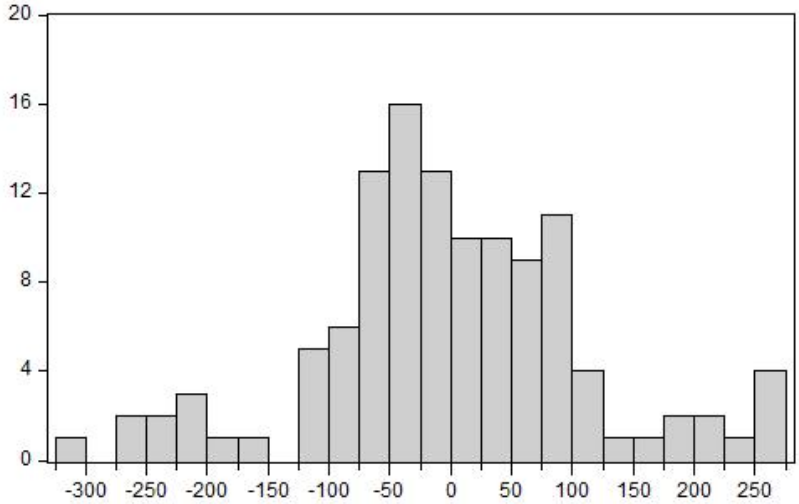
	Value	df
Restricted LogL	-723.8822	111
Unrestricted LogL	-722.8201	110

Unrestricted Test Equation:
Dependent Variable: BHAR
Method: Least Squares
Date: 12/19/16 Time: 10:52
Sample: 1 118
Included observations: 118

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	124.1286	59.96895	2.069881	0.0408
FIRST_DAY_RETURN	0.059705	0.128619	0.464201	0.6434
LEVERAGE_RATIO	0.054633	0.084296	0.648112	0.5183
LN_OFFERING_SIZE	-26.53093	12.30699	-2.155761	0.0333
PE	15.18437	27.75527	0.547081	0.5854
VC	-60.98000	29.13167	-2.093255	0.0386
HIGH_IPO_ACTIVITY_PERIOD	-106.6902	32.36975	-3.295985	0.0013
FITTED^2	0.007629	0.005397	1.413592	0.1603

R-squared	0.144061	Mean dependent var	-19.32059
Adjusted R-squared	0.089592	S.D. dependent var	120.1437
S.E. of regression	114.6355	Akaike info criterion	12.38678
Sum squared resid	1445542.	Schwarz criterion	12.57462
Log likelihood	-722.8201	Hannan-Quinn criter.	12.46305
F-statistic	2.644829	Durbin-Watson stat	2.204646
Prob(F-statistic)	0.014483		

APPENDIX 7 – BERA-JARQUE TEST



Series: Residuals
Sample 1 118
Observations 118

Mean	-6.86e-15
Median	-9.685188
Maximum	274.7390
Minimum	-313.7059
Std. Dev.	112.4524
Skewness	-0.002025
Kurtosis	3.807548
Jarque-Bera	3.206407
Probability	0.201251