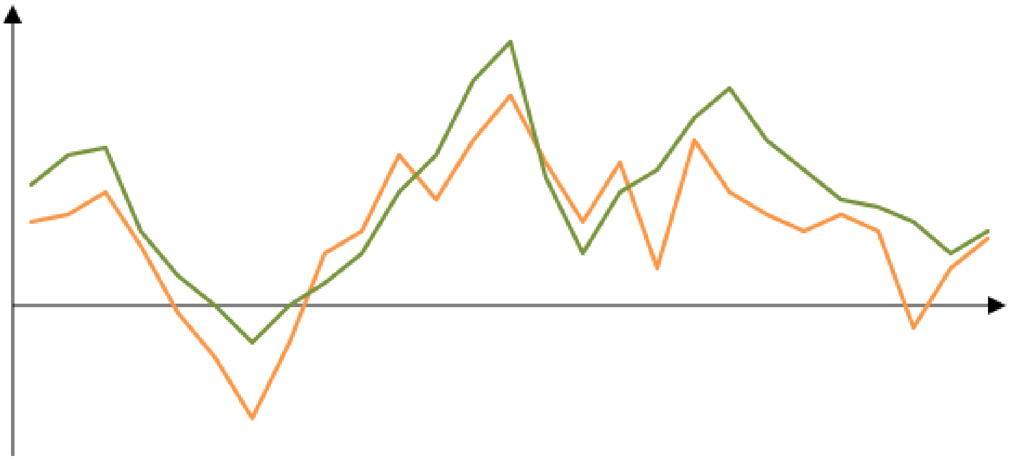
An Empirical Study on the Aftermarket Performance of Nordic IPOs

MASTER´S THESIS



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Executive Summary

This thesis investigates the aftermarket performance of private equity-backed and non-sponsored IPOs, using a sample of 239 IPOs issued in the Nordic countries between January 1st 1997 and December 31st 2012, where the aftermarket performance is measured by comparing each IPOs performance, calculated by both the CAR and BHAR approach, to a representative benchmark in the short-, medium- and long term. Further on, four main focus areas are covered in the thesis, where three investigate the effect of different IPO characteristics on aftermarket performance, and one investigate the effect of a specific IPO characteristic on the growth in value added to society in a long term perspective. Thus, the thesis investigates the long run effects of private equity ownership, market-to-book ratio and IPO activity on the aftermarket performance of the IPOs, in addition to investigate the effect of private equity ownership on the three-year growth in value added to society.

In the long run, we find no significant effects of being private-equity backed on aftermarket performance, nor do we find significant effects of being floated in a market characterized by low IPO activity. However, we find that the IPO aftermarket performance is positively related to having a low market-to-book ratio at floating date. Furthermore, in a three-year perspective, we find no significant effect of being private equity-backed on the growth in value added to society.

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1.0 Introduction

The Nordic private equity (PE) industry has seen a significant growth in assets over the past few years, and in 2014 a new record was set for the total investment values in the region (Argentum, 2014). As a consequence of the growing private equity industry, both in stature and importance to the overall economy, levels of attentions have been attracted to the industry, not all of it being positive. A number of different sources, hereunder politicians, corners of the media and union representatives, among others, have criticized the private equity industry, saying that it is rather value destroying than value creating. Private equity firms have been accused of stripping assets, as well as cutting jobs and indiscriminately closing down factories and business operations. In addition, the critics would have it that private equity is just a leveraged market play where the firms are relying solely on leverage for returns. Furthermore, the critics argue that the investment horizon of the private equity firms is far too short, suggesting that it is only beneficial for the acquirer and not the businesses it backs (EY, 2012).

Obviously, the private equity industry disagrees and argues that these critiques are myths. According the European Private Equity and Venture Capital Association (EVCA) *"(...) private equity grows employment, creates more valuable businesses and generates returns through strategic and operational transformation" (EY, 2012).* Furthermore, private equity funds have a typical holding period of three to seven years. Thus, the private equity funds focus on improving the businesses they back to increase the value over a number of years before selling it to a buyer who appreciates that lasting value has been created (EVCA, 2016). That is, private equity firms aim to create valuable high-performance portfolio companies with the intention of capitalize on long-term gains. In contrast, hedge funds usually invest in stocks, bonds or commodities with a holding period of weeks or months, with the intention of selling it off with a short-term profit (CVC Capital Partners, 2016). Additionally, the corporate governance structure we find in private equity, where companies are owned by a small number of professional investors that are specialized in the industry of the acquired company and monitor the portfolio company closely, creates clear accountability and useful knowledge in the process of strategic and operational improvements. This reduces agency problems, which again gives comfort to lenders. Therefore, the high leverage that is associated with the private equity acquisition is, in fact, the cheapest source of capital as the private equity-backed companies can attract relatively cheap debt (EVCA, 2016), which comes along with a tax-shield that provides a corporate tax benefit each year (Berk and DeMarxo, 2014). Even though the motivation for the private equity funds is to create valuable companies that can be sold at a profit, one can argue that private equity funds also create value for the society, as companies that pay employee wages, taxes to the state and profits to owners generate value added for the society. That is, when the performance of a company is high, one can expect that the additional value created for society by a company´s capital and employees also will be high (SVCA, 2015).

Despite these counterarguments, the private equity industry faces some important challenges. Firstly, the state of the economy affects the private equity-backed companies as well as the non-sponsored companies. For both types of companies, profit growth is the main driver of value creation, and will consequently be affected by the wider economic environment as neither of the two company types are immune to the challenges of a low-growth economy. Thus, the state of the economy will affect the trading performance. Secondly, the state of the economy will affect the activity level in the private equity industry. In times of economic uncertainty and low levels of market confidence, both new investments and exits are challenging for the private equity firms (EY, 2012).

1.1 Research problem and motivation

With the above reasoning in mind, the purpose of this paper is to examine whether or not private equity funds are able to create lasting value for both society and the companies they back. Bearing in mind the previous critique of the private equity industry, we want to investigate whether private equity-backed companies manage to maintain the benefits from the backing even after the exit of the private equity fund, and if these advantages benefit society as well as the company in question. Thus, we will investigate whether the aftermarket performance and value added to society by private equity-backed IPOs is significantly higher than for the non-sponsored IPOs. We find this problem area intriguing, given the high attention private equity firms receive, and the criticism these funds are facing. By investigating portfolio companies' performance after the exit of the private equity fund rather than during the holding period, we hope to gain a better understanding of the real, long-term benefits private equity ownership can provide.

In order to examine this field, we will investigate whether or not private equity companies are able to create lasting value for their portfolio companies even after the exit. We will focus on exits through initial public offerings (IPOs) as these backed companies are publicly traded, meaning that they are subject to disclosure requirements, enabling information collection. Furthermore, we will examine whether the post-IPO performance can be affected by market conditions and/or firm-specific characteristics.

Several previous papers have researched the performance of the average IPO, where strong evidence suggests that on average, IPOs tends to be underpriced (e.g. Rock, 1986; Levis, 1990) and that the long-run performance of a newly public company (three to five years form the date of issue) is poor (e.g. Ritter and Welch, 2002). That is, the IPO offer price is normally substantially lower than the closing price at the first day of trading, and a buy and hold strategy of three- to five-years appears to be a bad investment (Berk and DeMarxo, 2014).

As mentioned in the previous section, private equity-backed companies have some special characteristics, e.g. corporate governance structure, professional fund managers and higher levels of debt that distinguishes them from other companies. According to Jensen (1986, 1989), these characteristics are the key value drivers for the private equity model and generate operational efficiencies. Because both structure, terms and timing of the floats is the fund managers' responsibility, one can expect that financial and management practices that were established during the holding period will be maintained for some time after the exit. In addition, the fund managers often retain holdings for a substantial period of time after the IPO, meaning that the private equity firm´s involvement is rarely terminated at the time of issuance. This facilitates closer monitoring and reduces agency problems as well as potential stakeholder conflicts, which could result in improved operating performance and greater aftermarket performance (Levis, 2011). Hence, one could expect that private equity-backed IPOs are performing better and generates greater value added to society than non-sponsored IPOs.

Acknowledged papers on the subject, to be more thoroughly elaborated in section 2, support this claim and conclude that private equity-backed IPOs perform abnormal stock returns on the US market (e.g. Degeorge and Zeckhauser, 1993; Cao and Lerner 2009; c.f. Levis, 2011). Outside of the United States however, limited research on the subject have been published. However, Levis (2011) finds that private equity-backed IPOs outperform venture capital-backed and non-sponsored IPOs on the London Stock Exchange in the period 1992-1995. In the Nordic region, even less evidence is available, despite the fact that the Nordic private equity industry is one of the most important investor groups in the region (Spliid, 2013). In addition, to our knowledge, the value added to the Nordic society by the private equity-backed companies is poorly covered in the literature.

Furthermore, there are several theories about the general post-IPO performance that are also inadequately tested in the Nordic region, hereunder the potential influence of cyclicality and firm-specific characteristics on aftermarket performance. Evidence from London Stock Exchange and Paris Stock Exchange suggests that the underpricing of non-sponsored IPOs are more strongly affected by the market conditions than those of private-equity backed IPOs (Bergström, Nilsson and Wahlberg, 2006). Levis (2011) finds similar evidence in his study of the U.S. market. Additionally, the theory of market-to-book ratio and post-IPO abnormal returns is poorly covered in research of the Nordic region. Studies of American IPOs find that companies with a low market-to-book ratio experience higher abnormal returns, compared to those with a higher market-to-book ratio (Simutin, 2009; Brav, Geczy, and Gompers, 2000). Even more deficient is the research of whether there is a difference in the relationship between market-to-book ratio and post-IPO performance of non-sponsored companies and private equity-backed companies in the Nordic region.

Thus, to contribute to the small existing pool of research on these topics, this paper will focus on the following research problem:

"Do private equity-backed IPOs in the Nordic region perform better and generate more value added to society than the non-sponsored IPOs? Do the market conditions, as well as the market-to-book ratio, at the time of issuance, affect the post-IPO performance? And is this effect greater for PE-backed compared to that of their non-sponsored equivalents?"

To answer this research problem, we have collected a sample of 239 IPOs, comprised of 51 private equity-backed 188 non-sponsored from January 1997 to December 2012. The sample collection is further described in section 5. Using several methods described in section 4, we test different hypotheses described in section 3. We compare short-, medium- and long-term returns of private equity-backed IPOs to those of the non-sponsored IPOs and test how the post-IPO performance is affected by market conditions and market-to-book ratio at floating day. Furthermore, we compare the growth in value added to society for the two sample groups.

1.2 Key definitions

Invest Europe defines **private equity** as *"(...) a form of equity investment into private companies not listed on the stock exchange. It is a medium to long-term investment, characterized by active ownership."* (Invest Europe, 2016). A company whose majority of the equity capital is owned by a private equity firm is defined as a **portfolio company** (SVCA, 2015). We follow US tradition were it is common to distinguish between **venture capital funds** and **buy-out-funds**. This contrasts the European notion where venture capital refers to all transactions involving private equity, irrespective of investment stage. We define venture capital as *"(...) a type of private equity focused on start-up companies. Venture capital funds back entrepreneurs with innovative ideas for a product or service who need investment and expert help in growing their companies."* (Invest Europe, 2016). Buy-out funds, on the other hand, focus on the later stage of the spectrum, where the funds acquire a significant or majority equity stake in a well-established business (Finans Norge, 2016; Wright, Gilligan and Amess, 2009). However, the idea is the same for the two types of funds: they invest in a company with the intention of making it more valuable before selling it to a buyer (exit). The funds exit in two main ways: through an acquisition where the buyers can be large corporations or financial investors, or through a public offering where the buyers are stock market investors. The process of selling stock to the public for the first time is called an **initial public offering (IPO)** (Berk and DeMarxo, 2014).

When we refer to the **Nordic region** in this paper, we define it as Sweden, Denmark, Norway and Finland. All four countries have a high degree of social security, comprehensive public service, and a welfare system based on high taxation. Furthermore, both cultures and languages of Sweden, Denmark and Norway are similar. In Finland they speak a different language, but the Finnish culture is strongly related to that of Sweden due to more than 600 years of affiliation. However, even though the four countries have a lot in common, there are some differences between them. For example, in Denmark and Finland, small- and medium-sized companies dominate, while large international corporations dominate in Sweden. Furthermore, oil has a great impact of the Norwegian economy. In addition, Sweden, Denmark and Finland are all members of the European Union (EU), while Norway has rejected membership. Despite some differences, the Nordic countries have more in common than most European countries, and will be considered as one market in this paper. Geographically and culturally, Iceland also belongs to the Nordic region, but due to negligible private equity activity in the country, we choose not to include Iceland in our research (Spliid, 2013).

1.3 Reasons for going public

There exist several theories explaining why companies decide to go public, where the traditional perspective considers an IPO as a milestone in the company´s growth process. This idea has been challenged by newer research, which identifies the costs and benefits of an IPO. As Schöber (2008), we will not elaborate on these arguments further, but summarize some of the academic contributions to illustrate that there is no common agreement that explains why companies choose to go public, and thus no shared understanding of the characteristics of the company types that carries out an IPO.

Table 1.3.1 – Different explanations for why firms go public	
Rydqvist and Högholm (1995)	(Swedish) firms perform an IPO because initial owners want to sell shares and seek portfolio diversification, and not in order to raise capital to finance future growth and investment.
Pagano, Panetta and Zingales (1998)	(Italian) firms do not go public to finance future investment and growth, but to reduce leverage after a period with high investment and growth.
Stoughton, Wong and Zechner (2001)	Firms go public to obtain independent certification about product quality in order to compete more effectively.
Bohmer and Ljungqvist (2004)	The likelihood of an IPO is mostly influenced by general market conditions that capture stock market returns and investment opportunities.
Brau, Ryan and DeGraw (2005)	The funding of internal and external growth is the most important reason for going public.
Kim and Weisbach (2005)	Firms carry out an IPO mainly to raise capital.
Brau and Fawcett (2006)	The primary motivation for performing an IPO is to facilitate future acquisitions.
Burton, Helliar and Power (2006)	The decision to go public is highly influenced by the expectations of superior reputation and increased visibility as a publicly traded company.
Chemmanur, He and Nady (2006)	Firms operating in less competitive industries, firms operating in more capital intensive industries, firms characterized by riskier cash flows and firms with greater market shares are more likely to perform an IPO.

Previous academic contributions, based on Schöber (2008).

1.4 Delimitations

This paper will not elaborate on the underpricing phenomenon, as this topic is thoroughly investigated in previous literature. We will, however, investigate the short-, medium- and long-term aftermarket performance, as well as value added generated to society of private equity backed IPOs and compare it to that of non-sponsored IPOs. In addition, we will test theories about cyclicality and market-to-book ratios in relation to the post-IPO performance of private equity-backed and non-sponsored companies. There are several other general post-IPO theories that could have been tested as well, but since this paper is limited in terms of both time and a maximum amount of pages, they are excluded from the analysis. They are, however, discussed in section 8 where we pose suggestions for further research.

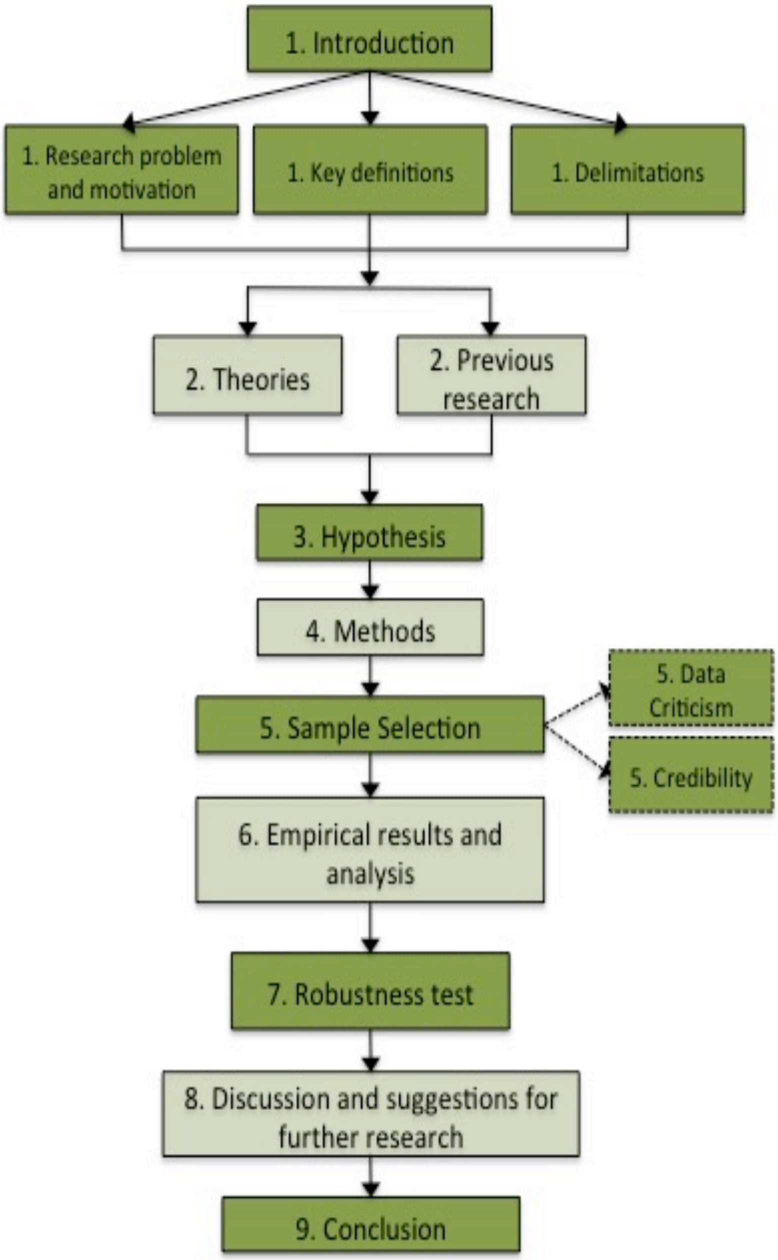
In this study, we will look at buy-out-backed IPOs and compare their performance and value added to that of non-sponsored IPOs. Thus, we are not including venture capital-backed IPOs in our sample. This is due to the characteristics of portfolio companies that are backed by a venture fund; a start-up company is not deemed as being comparable to the general IPOs nor to the general market. Hence, when we refer to private equity-backed IPOs, we refer to buy-out backed IPOs where the portfolio company is a well-established growth company. Furthermore, when looking at post-IPO performance, we only analyze those private equity-backed companies that go public. Thus, our sample might differ from the universe of all private equity-backed companies, which include exits through acquisitions of different characteristic.

Our sample consists of IPOs on the regulated main exchanges in Norway, Sweden, Finland and Denmark, i.e. Oslo Børs and Nasdaq Nordic Main Market. Thus, we have excluded listings on alternative marketplaces such as Firth North and Oslo Access. These marketplaces have less strict regulatory requirements, and to ensure that companies with insufficient company information and different risk profile do not affect our calculations on abnormal aftermarket performance, they are not included in our sample. This can explain why we have identified fewer VC-backed IPOs in our initial sample compared to other papers that have included listings on alternative marketplaces.

1.5 Disposition

The following Section 2 provides an overview of previous research and theories explaining these results, which form the basis for our hypotheses that are presented in section 3. The methods used to answer our research problem are explained in section 4, and in section 5 we describe our sample selection process followed by some data criticism. In section 6 we present the empirical results, followed by a thorough analysis where the findings are debated in light of the characteristics of the Nordic Private Equity industry. Further on, we will in section 7 employ several robustness tests on our previously debated results, to investigate their sensitivity to the methods employed. In section 8, we discuss several choices made throughout the thesis and their potential consequences for the presented results, together with suggestions for further research. Finally, in section 9 we will present our conclusions.

Figure 1.5.1 - Structure



2.0 Theory and previous research

In this section, we break down the problem into four main areas and elaborate the theories and previous research relating to each problem area. Based on the existing research and theories on each subject, we will in the next section formulate a set of hypotheses to test if these theories will hold in an empirical context.

2.1 Aftermarket performance

2.1.1 Theories

Throughout the years, several theories have been introduced to explain the aftermarket performance of initial public offerings. As we will clarify in the next section, previous literature has failed to provide a generally accepted consensus on whether IPOs underperform, outperform or show no abnormal returns in the aftermarket. However, as numerous studies have documented an underperformance of new issues (Ritter, 1991), most accepted theories strive to explain this phenomenon. Thus, we will in this section elaborate the explanations to why IPOs underperform in the aftermarket, before we move on to the previous research done in the area, to point out that such conclusions will depend on several factors.

According to Miller (1977), investors have diverse set of expectations regarding the true value of an IPO, thus different investors will have different beliefs and opinions regarding the firm's true value. Further on, in most cases, there will be a limited amount of securities, meaning that there are not enough shares for every investor to buy. This leads to the minority of highly optimistic investors buying in to the IPO, leaving the more negative investors out, and pushing the stock price upwards (Miller, 1977). However, as time goes by, some uncertainties of the company's future will be resolved and the opinions and valuations of the company will be less divergent, pushing the stock price down towards equilibrium (Miller, 1977). This concept is backed up by other studies, showing that investors constantly misevaluate the possibility of picking winners, and are thus being too optimistic regarding the future prospects of the newly floated firms. The issuing firms will take advantage of these "windows of opportunity", and go public in times where rapid growth in the industry, so called industry-spesific "fads" (Ritter, 1991), justify the marginal investor's optimistic valuation of the company (Loughran and Ritter, 1995). Over time, more information will be become available to these optimistic investors, pushing their perceived valuation, and thus the stock price, down towards equilibrium (Loughran and Ritter, 1995; Bergström, Nilsson and Wahlberg, 2006). This explanation is supported by Brav and Gompers (1997), which show that small companies going public underperform more severely than larger companies. This is likely due to the fact that small companies are often held by individuals, and thus the investors of these small firms are more likely to be influenced by fads or asymmetric information (Brav and Gompers, 1997).

Another explanation is presented by Schultz (2003), by a theory he calls the pseudo market-timing phenomenon. This explanation is based on that managers use prices to determine when to issue equity, so that when prices are rising, managers will choose to take the company public. However, most issues will follow the peak in the industry, meaning that the last group of issues will cluster when the prices are near its peak, thus will the majority of the newly issued stocks capture the subsequent fall in prices (Schultz, 2003).

Finally, other studies have focused on why private equity-backed IPOs in theory should show different aftermarket performances than their non-sponsored equivalents. According to Bergström, Nilsson and Wahlberg (2006), the performance of a private equity-backed IPO will depend on the degree of underpricing on the first day of trading, as well as to which degree the private equity company retains shares in the company when it goes public. Furthermore, it can be argued that investors in a private equity-backed issuing firm have less divergent opinions about the true value of the IPO because more information is available to potential investors prior to the floating date. Hence, the price adjustment following the issue will be less dramatic and the firms will experience less underperformance (Bergström, Nilsson and Wahlberg, 2006). In addition, Bergström, Nilsson and Wahlberg argue that over optimism among investors is more frequent when it comes to small firms, since they are more risky and harder to value. Thus, smaller firms are more likely to be invested in by irrational retail investors, whereas more sophisticated, institutional investors are prone to invest in larger companies. As PE-backed IPOs are often larger and owned by a larger fraction of institutional investors, these firms are less likely to experience drastic price appreciations at floating date with the corresponding underperformance in the aftermarket (Bergström, Nilsson and Wahlberg).

To conclude this section, we can see that there are several different theories regarding why IPOs underperform in the aftermarket. However, as we move on to the previous research and empirical studies conducted on the area, we can see that these theories might have a problem explaining several empirical findings throughout the past decades, as research show that IPOs do not always perform in the way one might expect.

2.1.2 Previous Research

In the past, the aftermarket performance of initial public offerings has received a great deal of attention, and different empirical studies have displayed evidence for both under- and outperformance of newly issued companies. In addition, some studies provide evidence for aftermarket efficiency of new issues, in terms of excess returns that are not statistically different from zero. These observations have differed based on sample size, research period and across industries. However, several empirical studies show a long-run underperformance of initial public offerings (Ritter, 1991). From an empirical study based on a large sample of IPOs between 1975-1985, evidence point towards underperformance of new issues in comparison to a sample of matching firms, from the closing price at the first day of trading until they have been listed for three years (Ritter 1991). These findings are supported by several other studies that point to statistical significant negative aftermarket performance for newly issued stock (Stern and Bornstein, 1985).

However, other studies provide more inconclusive results. From his study of both initial and aftermarket performance of newly issued common stocks during the 1960s, Ibbotson (1975) point towards results that are consistent with aftermarket efficiency in terms of the risk-adjusted returns of new issues. However, even though the excess returns throughout five years are not significantly different from zero, which indicates aftermarket efficiency, the empirical results show generally positive performance the first year, negative performance throughout year two to four, and positive performance the fifth year (Ibbotson, 1975).

Further on, Buser and Chan (1987) evaluate the 2-year aftermarket performance of 1000 NASDAQ/NMS eligible initial public offerings during the period between 1981 and 1985. Their findings show a significant positive aftermarket return of new issues, with a mean 2-year market-adjusted return of 11,2% exclusive of the initial return (Buser and Chan, 1987).

Furthermore, some studies have investigated the potential effect of different ownership structures at the floating date of the company. As previously discussed, it is common to separate between three types of initial public offerings; non-sponsored, venture capital-backed and private-equity backed. As explained earlier in this thesis, we will solely focus on the non-sponsored and private equity-backed initial public offerings, and have therefore focused on the studies regarding these two types of offerings. In the past, several studies have researched the possible influence of a majority private equity-sponsor at the floating date on the aftermarket performance. In general, empirical studies show that as opposed to evidence of underperformance of the general IPO, private equity-backed IPOs seem to avoid this norm (Levis, 2011). Several of these studies show evidence that LBOs going public tend to outperform other new issues (Degeorge and Zeckhouser, 1993; Cao and Lerner, 2009). Furthermore, Cao and Lerner (2009) provide evidence of a sample of private equity-backed IPOs between 1980 and 2002 outperforming various benchmarks through a 5-year period. This is consistent with other research finding positive and significant buy-and-hold abnormal returns for private equity-backed IPOs, whereas non-sponsored issues show consistently poorer or negative performance (Levis, 2011).

However, as most studies are conducted in the United States market, the research on performance of private equity-backed IPOs in Europe is sparse and inconclusive (Levis, 2011). In the European market, the limited research has pointed towards evidence in several directions; some find no significant differences between the long-run performances of private equity-backed MBOs and their non-PE backed equivalents (Jelic, Saadouni and Wright, 2005) and others have found that private equity-backed IPOs in London and Paris outperform their non-sponsored counterparts but that the group in total show strong, negative abnormal aftermarket returns for a 5-year period (Bergström, Nilsson and Wahlberg, 2006). As previously touched upon, Levis (2011) questions these findings with his study of IPOs on the London Exchanges from 1992 until 2005, which shows evidence of significant positive abnormal returns for private equity-backed IPOs and poorer or negative performance for non-sponsored IPOs.

To sum up, several different findings have been presented regarding the long-run aftermarket performance of IPOs, both looking at non-sponsored and private equity-backed issues. These findings have differed due to sample size, time period, measuring method and geographic focus. However, even though the subject might be a controversial area, several findings lean towards a general underperformance of IPOs, with PE-backed showing higher abnormal returns on average

(Levis, 2011). Thus, we find it interesting to see whether our sample will show equal, or completely different, results as the majority of previous literature.

2.2 Market-to-book ratio

2.2.1 Theories

The market-to-book ratio, also referred to as the price-to-book [P/B] ratio, is the ratio of a company´s market capitalization to the book value of stockholders´ equity. Variations in the ratio reflect differences in both firm characteristics and value added by management. Analysts often classify firms with high market-to-book ratios as growth stocks (Berk and DeMarxo, 2014). Conversely, firms with low ratios, are classified as value stocks, and tell investors one of two things. Firstly, it could indicate that the company is earning a very poor return on its assets, which isn't necessarily a bad thing; if management is able to improve return on assets and turn the firm around, investing in these firms could generate strong positive returns. Secondly, it could indicate that the market believes the value of the assets is overstated; suggesting that investors should steer clear of these shares as the market will most likely correct the asset value downward, leaving investors with negative returns (McClure 2016).

Moving on to the effect of market-to-book ratio on aftermarket performance for private equity-backed companies, theories suggest that private equity-backed companies trading at a low market-to-book value are either having assets that are deemed as overstated by the market or having problems with creating positive returns on their assets. Either way, one could argue that these companies have not benefited from being private equity owned, and that the private equity funds have failed to some extent. However, theory also suggests that if the low ratio can be explained by poor returns on assets, these companies may have the largest potential for abnormal returns, as they may be the most undervalued companies. Investing in these value stocks is often referred to as value strategies, and can produce superior returns. According to Lakonishok, Shleifer and Vishny (1994), a value strategy can take 3 to 5 years to pay off, and might underperform the market in the meantime. Opposite, investing in growth stocks is often referred to as glamour strategies. (Lakonishok, Shleifer and Vishny, 1994).

2.2.2 Previous research

Lakonishok, Shleifer and Vishny (1994) find that firms with high book-to-market, i.e low market-to-book, tend to have poor past earnings growth, and as a result these firms tend to have high future returns (c.f. Fama, 1998). In their study they find that value strategies, i.e. investing in companies with low market-to-book ratios, outperform glamour strategies over the April 1968 to April 1990 period. The authors conclude that the higher average returns on value stocks does not seem to be explained by the reward for bearing fundamental risk, as value strategies appear to be no riskier than glamour strategies (Lakonishok, Shleifer and Vishny, 1994). Rosenberg, Reid and Lanstein (1984) find similar results and conclude that stocks with low market relative to book values of equity outperform the market (c.f. Lakonishok, Shleifer and Vishny, 1994). Further work (e.g. Chan, Hamao and Lakonishok, 1991; Fama and French, 1992) have refined and extended these results (c.f. Lakonishok, Shleifer and Vishny, 1994).

Furthermore, in a study on all IPOs of common stocks by U.S. corporations during the 1986-2006 period, Simutin (2009) finds that IPO prices are negatively related to the market-to-book ratio of the firm going public. The author suggests that lower market-to-book stocks are being less speculative than other IPO issues, and that the underwriters indicate this by selecting higher prices for these companies. To ensure that the market-to-book ratio does not drive these findings, he include the variable in his regression, and finds that both raw and abnormal returns following the issue are greater for IPO firms with lower market-to-book ratios. Thus, according to Simutin (2009), post-issue stock performance is greater for IPOs having a low market-to-book ratio. Brav, Geczy and Gompers (2000) find similar results in their study on the U.S. market during 1975-1992, and conclude that underperformance is concentrated in small issuing firms with high market-to-book ratios.

2.3 IPO cyclicality

2.3.1 Theories

Together with the extensive research on IPO aftermarket performance, several studies have investigated the effect of market conditions on aftermarket performance. In this thesis, when referring to market conditions, we have determined to investigate how market conditions in terms of IPO cyclicality affects the aftermarket performance of newly issued firms. That is, previous research have shown that IPO activity is typically higher in booming markets, and that high IPO activity leads to more IPOs being issued (Ibbotson, 1975; Schultz, 2003). In addition to this, the general consensus has found the individual IPO's aftermarket performance to be negatively related to high IPO activity (Ritter, 1991; Bergström, Nilsson and Wahlberg, 2006).

In addition to providing evidence on that newly issued stocks' performance is negatively affected by booming market conditions, some researchers have published theories on *why* this effect arises. As previously mentioned in section 2.1.2, Schultz (2003) has introduced an accepted theory called the pseudo market timing theory. According to this explanation, the decision to implement an IPO has nothing to do with the manager's ability to predict the future, but depends solely on rising stock prices in the market. Thus, managers will issue stock when the market price is above some trigger level. Further on, this trend will lead to several managers issuing their stock when the industry peaks, following that these IPOs will experience a market decline shortly after issuance (Schultz, 2003).

In addition to capturing the decline in stock prices following an industry-peak, other theories on why IPOs in high-activity periods show poor aftermarket performance have been presented. Ritter (1991) argues that in times of booming stock markets, over-optimism amongst investors will tend to grow, leading to investors consequently evaluating the future prospects of the firms too high. The optimistic belief of being able to picking winners is higher in booming markets than in slow-growth markets, which again will lead to a sharper decline of the investors' valuation once the market slows down, time passes and more information is revealed (Ritter, 1991). In addition, Loughran and Ritter (1995) points out that managers are quick to exploit these "windows of opportunity" that booming markets and high valuations present. Thus, there is reason to believe that some firms might be issued "too early" to exploit the market conditions, even though they are not in the phase where they should optimally be floated.

Moving on, some theories have been presented to whether there is a difference between IPO cyclicality's influence on the aftermarket performance of PE-backed and non-sponsored IPOs. As previously touched upon, Bergström, Nilsson and Wahlberg (2006) argue that PE-backed IPOs often have more information published prior to floating date, which would mean that the valuations of these companies are less divergent, and that the decline towards true equilibrium price will not be as drastic as for non-sponsored companies. If we put this in the context of Ritter's (1991) theory of overoptimistic investors in booming markets, one theory would be that the over-optimism in high-growth markets would not be as pronounced for private equity-backed companies as it would be for non-sponsored ones. Thus, one could expect that being issued in a boom market will have less impact on private equity-backed companies' aftermarket performance than for non-sponsored companies.

On the other hand, others have presented theories on the fact that PE-backed IPOs are even more vulnerable to market timing than non-sponsored IPOs. Cao (2011) provides evidence for the private equity holding period to be negatively correlated with a hot IPO market, which means that private equity firms tend to shorten their holding period if they own the company in an environment of high IPO activity. Furthermore, a shorter holding period is related to greater deterioration of performance and higher possibility of bankruptcy (Cao, 2011). This suggest that market timing is even more crucial to PE-backed IPOs' aftermarket performance than for non-sponsored firms, since a booming market can encourage private equity firms to sell the company before the critical restructuring process is complete. If so, the issued PE-backed companies will miss parts of the benefits the private equity holding period is supposed to provide, and they will be more vulnerable in the aftermarket.

2.3.2 Previous research

In contrast to the inconclusive empirical evidence in regards to whether or not IPOs underperform in general, previous research on the effect of IPO cyclicality on IPO aftermarket performance seem to more or less agree on a negative relationship between high IPO activity and aftermarket performance. Throughout the years, it has been seen that IPO activity is indeed cyclical, and is dependent on market prices and the state of the economy (Ibbotson, 1975). Further on, empirical studies show that firms floated in these booming, high IPO-activity markets show poorer long-term aftermarket performance than firms floated in slow-growth markets with less IPO activity (Ritter, 1991). In his study of 1526 IPOs, Ritter (1991) provided evidence for IPOs going public in the high-volume market in the 1980s consistently delivering poor aftermarket performance. These observations are supported by Bergström, Nilsson and Wahlberg (2006), as their empirical study observes a negative relationship between IPO aftermarket performance and the high IPO activity around the dot-com bubble in 1999-2000.

Moving on to literature on private equity-backed firms going public in booming markets with high IPO activity, Bergström, Nilsson and Wahlberg (2006) discuss whether or not private equity-backed IPOs will be affected more or less than non-sponsored firms by market conditions at floating date. In one way, they argue that managers in private equity-firms are actively trying to time periods of high valuation with taking the firm public, meaning that these firms will more actively exploit investors' over-optimistic valuations than other firms, and will thus perform worse in the aftermarket. On the other hand, they argue that even if private equity-backed IPOs have a larger tendency to go public in periods of high IPO-activity, they could possibly experience a lesser effect of the market conditions on their aftermarket performance, since the investors buying in to these firms are mainly sophisticated institutional investors with a more rational valuation and the following price will be less biased upwards (Bergström, Nilsson and Wahlberg, 2006). The empirical findings are thus somewhat surprising, as they find the percentage of private equity-backed IPOs going public in years of high IPO activity to be relatively low compared to non-sponsored IPOs, contradicting their hypothesis about private equity firms taking advantage of booming markets to a higher extent than non-sponsored firms. Further on, their empirical evidence show that the private equity-backed IPOs going public in booming markets perform poorer than private equity-backed IPOs floated in slow-growth markets (Bergström, Nilsson and Wahlberg, 2006).

The literature on whether the effect on aftermarket performance of issuing in times of high IPO activity is less for private equity-backed firms than for non-sponsored firms is extremely sparse, which is why we find this worth investigating. Even though the general consensus in previous research is that both type of IPOs' aftermarket performance will be affected by market conditions, we would like to see if the performance of private equity-backed IPOs has a stronger (or weaker) positive relationship to periods of low IPO activity. Our expectations and hypotheses in this research area will be elaborated in section 3 where we present our hypotheses.

2.4 Value added

2.4.1 Theories

The term Value Added refers to the "*measure of the additional value created for society by a company´s employees and capital (…) and is defined as EBITDA + labor expenses*" (SVCA, 2015). Every company that pays employee wages, profits to owners and taxes to the state will generate value added. Thus, this term include the return of all stakeholders; both employees, owners, creditors and the state.

As mentioned previously, a central hypothesis since argued by Jensen (1989) has been that private equity funds improve the operations of the companies they back, and that the portfolio companies are able to maintain these improvements after the exit of the fund (cf. Bernstein, Lerner, Sorensen and Strömberg, 2010). Based on this, theory also suggests that private equity funds provide portfolio companies with extensive value-added post-investment support (Frontier Economics, 2013). This theory rests on the governance structure we find in private equity. A structure where the funds bring specialized industry know-how and managerial expertise to the portfolio companies, through active ownership and close monitoring, reduces agency problems and thus facilitates the process of strategic and operational improvements. That is, the governance structure enable portfolio companies to improve performance through exploiting opportunities for both cost efficiencies and growth, and thereby generate value added to society (Forbes, 2014; Wilson, Wright, Siegel and Scholes, 2012; Frontier Economics, 2013; SVCA, 2015). Furthermore, theory suggests that the involvement of a private equity fund may enable timely restructuring that could reduce the likelihood of failure if the portfolio company experience problems with servicing financial structures or trading difficulties. This may be more difficult for non-sponsored firms, suggesting that portfolio companies are generating greater value added than non-sponsored companies during a recession (Wilson, Wright, Siegel and Scholes, 2012). Hence, based on the governance structure found in private equity, theory suggests that restructuring is easier for the backed companies, and thereby facilitates enhancement.

2.4.2 Previous research

Wright, Gilligan and Amess (2009) summarize approximately 100 studies of private equity from around the world, and conclude that private equity involves both economic and social benefits. Thus, empirical evidence shows that private equity funds do not only create value for the portfolio companies they back, but also generate value added for society.

According to a EY study of 230 private equity-backed portfolio companies in the U.S. between 2006 and 2012, private equity-backed companies exhibited an EBITDA growth of approximately twice the rate of their publicly traded peers (Forbes, 2014). In a paper by Bernstein, Lerner, Sorensen and Strömberg (2010), the authors examine private equity investments across 26 OECD countries and 20 industries during the period 1991-2007. They find that industries where private equity funds have been active in the past years have significantly higher growth rates than other sectors, whether measured using total wages or employment, total production or value added. Similarly, SVCA find comparable results in Sweden where they conclude that buyout companies show strong growth in terms of number of employees, revenues as well as value added after the investment during the period 2005-2014. Furthermore, they show that this growth is at a much faster pace than both listed comparables and the economy as a whole, suggesting that private equity-backed companies, by boosting their value added, create greater value growth for both their employees and owners (SVCA, 2015). Thus, previous research emphasizes the theory that private equity funds provide portfolio companies with extensive value-added support.

Wilson, Wright, Siegel and Scholes (2012) study private equity-backed buyouts in the U.K. during the global recession period 2007-2010, and find that private equity-backed buyouts experienced greater growth in value added in the recessionary period, compared to other U.K. non-buyout companies. As argued above, this can also be explained by the theory that private equity funds have supplied their portfolio companies with post-investment value-added support. Furthermore, it can be explained by the theory that private equity funds enable timely restructuring of the portfolio company. The EY study (2012) emphasize this theory, and finds evidence that during the financial crisis, private equity funds increasingly focused on organic revenue growth as the key means of value creation, in contrast to the pre-crisis years where cost reduction accounted for a greater amount of value creation. Thus, empirical evidence shows that the emphasis of the private equity funds shifted from cost-cutting and efficiency gains, which could be seen in the periods before and in the immediate aftermath of the crisis, to more of a growth agenda during the recession (EY, 2012). These findings support the theory that private equity funds enables restructuring, suggesting that private equity-backed companies generate greater value added to society.

3.0 Hypotheses

In this section, we formulate the hypotheses based on the previous outlined theory. The purpose of formulating such hypotheses is to break down the thesis into sub-purposes, and in this way answer the overall purpose of the thesis.

3.1 Aftermarket performance

In this section, we examine the IPO aftermarket performance of both non-sponsored and private equity-backed IPOs in terms of abnormal returns from a short-term, medium-term and long-term perspective. Further elaboration around time period definitions will be presented in the methodology section.

The abnormal return for a company *i* can be defined as the excess return of the stock in the period *t* compared to the expected return the same period. There are several ways to estimate the expected return of a stock, as we will touch upon in the methodology section. In this thesis, we have defined the expected return as the market portfolio, represented by the FTSE Nordic Index. In addition, we will construct several industry-specific indices, to adjust for industry-specific trends. As described in the theory section, different studies find proof of both negative and positive aftermarket performance, in addition to studies showing zero abnormal returns. As the results differ with sample size, time period and across industries (Ritter, 1991), we find it interesting to investigate whether our sample of initial public offerings will show evidence of aftermarket abnormal returns statistically different from zero. Further on, we would like to investigate whether or not there can be found a significant difference in the aftermarket performance between non-sponsored and private-equity backed IPOs in our empirical context, given that the research on this field in Europe has been thin and inconclusive (Levis, 2011). In general, we would expect our combined sample of IPOs to show signs of negative abnormal returns, since this seems to be the general consensus amongst most previous empirical studies. Further on, we expect the private equity-backed IPOs in our sample to show higher abnormal returns than the non-sponsored equivalents in the sample. However, we still expect these abnormal returns to be negative, given our belief that even though these firms will do better, they will not outperform the indices. Further on, we believe that the positive effect of being private equity-backed will be stronger in the short-term, and that the aftermarket performance of private equity-backed IPOs will converge towards the performance of non-sponsored IPOs in the medium- and long-term, as presented in Bergström, Nilsson and Wahlberg (2006). It is still worth noting that we are quite unsure of what the analysis will show, which is the reason we find the below hypotheses highly interesting to test.

H_0: Both private equity-backed and non-sponsored IPOs show no significant abnormal returns, in the short-, medium- or long-term, measured by both BHAR and CAR.

H_1: All IPOs show signs of significant negative abnormal returns in all periods, where abnormal returns are measured by both BHAR and CAR.

H_2: The effect of being private equity-backed on aftermarket performance is positive for the sample, and private equity-backed IPOs show less negative abnormal returns than non-sponsored IPOs, in all periods and measured by both BHAR and CAR.

3.2 Market-to-book ratio

In this section, we investigate whether firms with lower initial market-to-book ratios, performing an IPO, underperform less than the ones with relatively high ratios in the short-, medium- and long term, as well as whether the relationship between a low initial market-to-book ratio and firm performance post IPO is greater for private equity-backed IPOs, compared to non-sponsored IPOs.

According to theory, the market-to-book ratio is representative of a firm´s return on assets where a low market-to-book ratio suggests that the firm´s assets are overvalued or earning a too low return. In the case of the latter, there is an upside opportunity if the management is able to improve return on assets and turn the firm around, and theory suggests that these companies might be the most undervalued, and could therefore have the largest potential for abnormal returns. On the other side, firms with initially high ratios can be viewed as having less upside. Based on previous research elaborated in section 2, it is reasonable to believe that low market-to-book ratios at the floating date are, indeed, positively related to post-IPO abnormal returns. Because value strategies might take up to several years to pay off (Lakonishok, Shleifer and Vishny, 1994), we expect this relationship to also be present in the long run.

As mentioned previously, portfolio companies have some special characteristics that distinguish them from other companies, and these characteristics are the key value drivers for the private equity model and generate operational efficiencies (Jensen 1986, 1989). Based on these special characteristics and the expectations that they will be retained within the company after the exit of the fund, one can argue that private equity-backed companies might be better equipped to improve return on assets and turn the firm around, compared to the non-sponsored companies. We therefore hypothesize that the relationship between low initial market-to-book ratio and post IPO performance is greater for private equity-backed companies than for the non-sponsored IPOs. The hypotheses are formalized below:

H_0: There is no significant relationship between low initial market-to-book ratio at floating date and firm performance for all IPOs in the sample, in the short-, medium- or long term, measured by both BHAR and CAR.

H_1: IPOs with low initial market-to-book ratios show less negative abnormal performance than those with high market-to-book ratios in all periods, measured by both BHAR and CAR.

H_2: The effect of a low initial market-to-book ratio on aftermarket performance is greater for PE-backed IPOs than for non-sponsored IPOs, in all periods and measured by both BHAR and CAR.

3.3 IPO cyclicality

In this section we will investigate if firms going public in bust markets with low IPO activity underperform less than firms going public in booming markets with high IPO activity. In addition to testing market conditions' influence on the general IPOs' performance, we will investigate if the relationship between low IPO activity in the market and IPO aftermarket performance is greater for private equity-backed IPOs than for non-sponsored firms.

As seen in previous literature, IPO activity is cyclical and shows a positive correlation with rising stock prices in the market (Schultz, 2003; Benninga, Helmantel and Sarig, 2005). That is, when valuations in the market are booming, more firms take their equity public, which again leads to clusters of IPOs. Previous research has argued that firms floated at such high IPO activity tend to underperform to a higher degree than firms issued in a market with slower growth and fewer IPOs (Ritter, 1991). According to theory, this effect can stem from several different causes. Schultz (2003) uses the pseudo market timing to explain the negative relationship between booming markets and aftermarket performance, whereas Ritter (1991) and Loughran and Ritter (1995) argue that investors tend to be extraordinarily optimistic in their valuations in times of high stock prices and high IPO activity, and that issuing firms exploit these windows of opportunity, leading the true value of the IPO to be adjusted down towards equilibrium as time passes by and more information is revealed. In the light of the presented theoretical foundations and previous empirical research, we want to test if our sample shows similar findings of a negative relationship between IPO activity at floating date and aftermarket performance. Hence, we expect our sample of all IPOs to exhibit evidence of this negative relationship, in the short- medium- and long-term.

Further on, empirical studies have researched whether the negative relationship between high IPO activity and IPO aftermarket performance would still exist in a sample of only private equity-backed IPOs. This is an interesting area, since according to theory, this effect could be different when the issuing firm is private equity owned. On one hand, Bergström, Nilsson and Wahlberg (2006) argue that the negative relationship could be stronger, given that private equity firms can better time their floating date to capture the "window of opportunity" to ensure maximum valuation, leading to a severe price decline in the aftermarket. This theory is supported by Cao (2011), as he argue that PE-backed firms are especially vulnerable to such timing, since it might convince managers to float the firm before the crucial restructuring process is finished and the firm is operationally ready to go public. However, empirical evidence from Bergström, Nilsson and Wahlberg (2006) show that fewer private equity-backed IPOs go public in high IPO activity than non-sponsored firms, leading this theory to be questioned. On the other hand, Bergström, Nilsson and Wahlberg (2006) argue that since private equity-backed IPOs are larger in general, and tend to attract more sophisticated investors, investor asymmetry is a lesser issue in these types of offerings, and that the price decline post issuance will not be as dramatic as for non-sponsored IPOs. In spite of this theory, their empirical study shows a negative relationship between booming markets with high IPO activity and the aftermarket performance of PE-backed IPOs.

In addition to investigating our entire sample of IPOs as a whole, we also want to investigate whether or not the effect of IPO activity is different for private equity-backed IPOs than for the non-sponsored ones. Based on the empirical research presented above and on the previous discussed characteristics of private equity-backed firms, we expect our sample of private equity-backed IPOs to show signs of a negative relationship between performance and IPO activity, and thus show a positive effect of being issued in a bust market with low IPO activity. Further on, given the previously debated characteristics and benefits of private-equity backing, we expect that private equity-backed IPOs issued in slow market conditions with low IPO activity, will perform better than their non-sponsored equivalents, seeing as we believe the private equity-backed companies are better able to exploit such markets. Moreover, we expect this potential difference and effect to be present in the short-, medium- and long-term, even though we anticipate that this difference will decline over time. Our hypotheses are formalized below:

H_0: There is no significant relationship between IPO activity at floating date and aftermarket performance for all IPOs in the sample, in the short-, medium- and long-term, measured by both BHAR and CAR.

H_1: IPOs floated in bust markets with low IPO activity show less negative abnormal returns than IPOs floated in booming markets with high IPO activity in all periods, measured by both BHAR and CAR.

H_2: The effect of being listed in a bust market with low IPO activity at floating date on aftermarket performance is greater for PE-backed IPOs than for non-sponsored IPOs in all periods, measured by both BHAR and CAR.

3.4 Value added

In this section we investigate whether private equity-backed IPOs generate greater growth in value added than non-sponsored IPOs.

As described in section 2.4, theory suggests that the governance structure we find in private equity reduces agency problems and facilitates the identification of issues and upside opportunities, such as revenue growth and margin enhancement, in the process of strategic and operational improvements. Thus, the governance structure enables private equity-backed companies to improve performance through exploiting opportunities for both cost efficiencies and growth, and thereby generate value added to society. That is, according to theory, the reduced agency costs provide private equity-backed companies with extensive value added post-investment support. This theory is supported by empirical evidence, which shows that private equity-backed companies are generating greater value added than non-sponsored companies (for example Wright, Gilligan and Amess, 2009; Bernstein, Lerner, Sorensen and Strömberg, 2010; Wilson, Wright, Siegel and Scholes, 2012).

To our knowledge, there are no academic researches on this topic in the Nordic region. However, the Nordic venture capital associations, hereunder NVCA, SVCA, DVCA and FVCA have published some performance studies of their respective countries´ private equity investments on number of employees, revenues and value added. Thus, based on these studies and the theories tested on the U.S. and U.K. market, as well as the OECD countries, we postulate that our sample of IPOs in the Nordic market will show similar results. Hence, we expect that the Nordic private equity-backed IPOs show stronger growth in value added compared to that of non-sponsored IPOs, and we hypothesize the following for our sample:

H_0: There is no significant difference in growth in value added between private equity-backed IPOs and non-sponsored IPOs.

H_1: Private equity-backed IPOs show stronger growth in value added compared to that of non-sponsored IPOs.

4.0 Methods

4.1 Measuring abnormal returns

In this section, we will describe how we calculate the abnormal returns we use to evaluate the IPOs throughout the thesis. In addition, we will discuss advantages and limitations about the methods used.

4.1.1 Stock performance and required return theories

To be able to evaluate the aftermarket performance of the IPOs, we need to consider their return throughout the research period. The raw return of a stock measured in percent for month *t* is calculated by the formula displayed below, a method that will be conducted throughout the entire thesis when referring to an IPOs' return in a given month.

$$return_t = \left(\frac{price_t}{price_{t-1}} - 1 \right) \times 100$$

However, when investigating a stock's performance, the stock's return explained as a percentage of itself does not give us much usable information about its fit as an investment. Thus, we need some sort of comparable benchmark to measure if the stock has over- or underperformed. In this way, we will be able to evaluate whether the investor would have been better or worse off by investing in other securities. However, one needs to consider the risk profile of the stock when evaluating the stock's performance against a benchmark, since using a benchmark with a completely different risk profile would be misguiding. Thus, the stock's required rate of return is often a usable benchmark to measure if the stock has over- or underperformed, as the required return takes the risk profile into consideration by displaying the stock's risk-adjusted expected return. This risk-adjusted relationship holds for portfolios of stocks as well. If $R_{\tau,t}$ is the return of a time series of a portfolio of companies floated at time *t*, the below time series model can test for abnormal returns α of the portfolio:

$$R_{\tau,t} = \alpha + (R_{\tau,t})^E + \varepsilon_t$$

Where $(R_{\tau,t})^E$ is the risk-adjusted expected, or required, return on the portfolio, and ε_t is the zero mean error term at time *t*.

The relationship between risk and expected return can be explained by either the CAPM model or by the Fama-French Three Factor Model, which expands the CAPM model to include both size and value factors. For simplicity, we will use the CAPM model to derive the expected rate of return. The CAPM relationship is displayed below.

$$(R_{\tau,t})^E = r_{f,t} + \beta \times (R_{B,t} - r_{f,t})$$

Here, $r_{f,t}$ is the risk-free rate at time *t*, and $R_{B,t}$ is the return of the chosen benchmark. By following the procedure outlined by Gregory, Guermat and Al-Shawawreh (2010) in their study of IPOs in the UK, we can now simplify the CAPM equation by including the restriction of $\beta = 1$. Thus, we end up with the following relationship (Gregory, Guermat and Al-Shawawreh, 2010):

$$(R_{\tau,t})^E = R_{B,t}$$

This relationship states that the expected, or required, return equals the return of the benchmark. Thus, we will in this thesis calculate the abnormal performance of the IPOs as the difference between the IPOs' return and the benchmark's return.

4.1.2 Benchmarks

After deriving that the expected return equals the benchmark's return, the benchmarks used in this thesis need to be specified. Throughout the past years, several studies have employed this particular method when estimating abnormal aftermarket performance, however it has been debated which benchmarks to use to ensure the most robust results. In his study of 1,526 IPOs in the 1980s, Ritter (1991) criticizes the study of Buser and Chan (1987) by pointing out that they only used one index in their empirical study, and that this particular index was performing especially poorly in the investigated time period, leading their published results to be biased upwards. To display the consequences of a limited amount of indices, Ritter (1991) used four in his study – three market indices and one matched-pair sample of listed firms matched to each IPO based on size and industry. Based on these benchmarks, he shows that the abnormal returns calculated will very much depend on the index or benchmark chosen. Furthermore, Ritter (1991) argues that the general NASDAQ index would be a natural choice in his study given that most of his IPOs in question were traded on that particular exchange and the industry mix of the index would thus match the industry mix of the IPOs closely. However, his study was conducted in the 1980s, the period where most of the stocks on NASDAQ went public. Thus, he argues that this benchmark would possibly be biased to the results of finding no abnormal market-adjusted returns.

However, looking at more recent literature, we find examples of studies using market indices to estimate abnormal returns (Levis, 2011). In their study, Bergström, Nilsson and Wahlberg (2006) argue that the use of a market index as benchmark is a more fruitful approach than constructing a matched-pair sample, since it better evaluates the active investment strategies investors will tend to use.

Based on these considerations, we will in this thesis make use of two different benchmarks – one market index and one industry-specific benchmark. Even though one might argue that a matched-pair sample would serve well as a benchmark, we find the market indices a better option, as we see these benchmarks as more realistic investment alternatives to investors.

The industry-specific benchmark is used in order to estimate and compare aftermarket performance across sectors, so that the performance of the individual IPO is adjusted for the performance of the entire industry. Thus, all IPOs are classified into different industries based on the NASDAQ's Industry Classification Benchmark, before they are matched by a corresponding MSCI Europe industry benchmark. To illustrate, if an IPO is classified into the Utilities industry, it will be matched with the MSCI Europe Utilities Index. The reason industry benchmarks are employed on a European level is to avoid potential bias stemming from a too large influence of the IPOs on the respective benchmarks, seeing as the sample firms are not excluded from the benchmark. By using industry benchmarks consisting of firms from all European countries, the Nordic IPOs will most likely not influence the benchmarks, and potential bias will be mitigated.

The distribution of industries in the sample is illustrated in table 4.1.1. It is important to note that PE-backed IPOs are not included in each industry. However, we have decided to include these industries, as the entire point of using industry-specific benchmarks is to eliminate the industry-related performance for each firm.

Table 4.1.1 – Industry distribution

Industry	All IPOs		PE		NS	
Oil & Gas	30	13%	5	10%	25	13%
Industrials	49	21%	11	22%	38	20%
Consumer Goods	32	13%	8	16%	24	13%
Consumer Services	15	6%	6	12%	9	5%
Technology	43	18%	9	18%	34	18%
Basic Materials	9	4%	1	2%	8	4%
Health Care	20	8%	6	12%	14	7%
Financials	34	14%	4	8%	30	16%
Telecommunications	5	2%	1	2%	4	2%
Utilities	2	1%	0	0%	2	1%
Total	239	100%	51	100%	188	100%

Further on, we would like to see if the IPOs outperform or underperform the general market. To evaluate this, we need a benchmark reflecting the entire market portfolio, so that we are able to evaluate whether investors will be better or worse off by investing in the IPOs rather than in the general market. Optimally, the MSCI Nordic Countries Investable Market Index (IMI), which covers approximately 99% of the free-float adjusted market capitalization in Sweden, Norway, Denmark and Finland (MSCI.com, 2016) would be employed in this case. Further on, this would be an obvious choice, given that most IPOs in the sample would be represented in the index, which would provide a closely matched industry mix to the industry mix in the sample (Ritter, 1991). However, the daily trading history of this index was not available further back than 2007, making this approach useless. Thus, the FTSE Nordic Index is employed in this thesis, an index that shares several characteristics to the MSCI Nordic Countries IMI. The FTSE Nordic Index is designed to help European investors benchmark their international investments, and covers large and mid-cap stocks in Norway, Sweden, Denmark and Finland. Furthermore, the index is derived from the FTSE

Global Equity Index Series, an index that covers 98% of the world's investable market capitalization (FTSE.com, 2016). In other words, this index is a good choice given that this thesis aims at employing an investable benchmark, to illustrate a relevant option for investors that consider investing in IPOs.

As a final note to this section, it is important to clarify that we have not removed the companies in our IPO sample from the indices, as previously mentioned. This decision was made based on the belief that given the large amount of companies in the indices, the IPOs in the sample will not be significantly large enough to influence the development of the indices. However, it is important to be aware of the fact that this could potentially lead to the abnormal returns being biased (Bergström, Nilsson and Wahlberg, 2006).

4.1.3 Time period definitions

In this thesis, we will test our IPO sample's aftermarket performance in the short-, medium- and long-term. However, this means that we need to define the time period terms. In previous literature, several studies have investigated the long-run performance of IPOs. Further on, even though there are some variations in the definition of "long-term", previous studies commonly uses this definition to describe a three-year, or 36-month, period (Ritter, 1991; Bergström, Nilsson and Wahlberg, 2006; Levis, 2011). Thus, we will in this thesis use 36 months of data, each month consisting of the trading days within two dates, when we refer to the "long-term time period". As for the short- and medium-term, it is trickier to conclude on a general consensus among previous literature. However, we have decided to define short-term as 6 months, arguing that this is a sufficient amount of months for the IPOs' returns to somehow stabilize. Further on, the medium term was chosen to be 12 months, to capture the aftermarket performance in a significantly longer time frame than in the short-run, while avoiding to define it in a way that might collide with the study of Buser and Chan (1987) where they define long-term as 24 months.

To summarize, we will look at 6, 12 and 36 months of trading, to capture the short-, medium- and long-term aftermarket performance of the IPOs, respectively. For all time periods, the months are defined as the trading days between two given dates, where the first daily return is measured from the closing price at the 2nd day of trading (corresponding to the opening price at the third day of trading) to exclude the initial return period. To illustrate, if a firm is floated the 1st of January 2007, event month one will consist of all closing prices for the trading days between January 2nd 2007 and February 2nd 2007. If February 2nd is not a trading day, the last registered price previous to this date will be used. Further, when calculating abnormal aftermarket returns, the benchmarks' returns in the exact same time interval will be used.

The decision to exclude the two first days of trading from the analysis is based on the fact that we have explicitly stated that this thesis will not include any initial return considerations. Thus, to mitigate the potential bias stemming from the initial return period, we will start our analysis from the closing price at the second day of trading. This approach has been adopted, with some adjustments, from previous studies investigating long-run IPO aftermarket performance. To illustrate, Ritter (1991) and Bergstöm, Nilsson and Wahlberg (2006) defines the aftermarket period as "3 years *after* the initial return period", where their initial return period consists of minimum the first day of trading. As this thesis is limited both in terms of time and pages available, we will not define an initial return period for each IPO. However, we will define this period as 2 days for each IPO, aiming, as mentioned, to mitigate the potential bias from the initial return period.

4.1.4 Time regimes

There are mainly two different approaches to measuring abnormal aftermarket returns, namely the event time approach and the calendar time approach (Fama, 1998). Both methods have been found applied in previous literature, and even though they both strive to measure the same phenomenon, their applications are somewhat different. We will in the following section describe both methods and discuss their benefits and limitations.

In the event time approach, calendar dates are irrelevant. Furthermore, this method defines an event window, in this thesis of both 6, 12 and 36 months, and compares the event windows of each IPO without taking their floating date into consideration. To illustrate, we will compare the event windows of IPOs issued in 1998 to the event window of an IPO issued in 2006. The event is set to be the IPO, however we exclude the two first days of trading to avoid the initial return period. Thus, since we use monthly returns to estimate aftermarket performance, our first event month will start with the closing price at the second day of trading, and contain the trading days within one month, which is a commonly used method when estimating event time performance (Ritter, 1991; Levis, 2011). The benefit of using the event time approach is that we are able to compare every IPO, regardless of its floating date. On the other hand, this implicitly assumes that the returns of the different IPOs are independent. Based on previous research, one can find indications on that this might not always be a realistic assumption.

Even though the event time approach is widely used in studies investigating IPO long-run aftermarket performance, this method might, in some cases, fail to present evidence correctly (Gompers and Lerner, 2003). This is due to the fact that several researchers argue that there exists a cross-sectional dependence across the observations, as described in the theoretical section discussing IPO cyclicality (Ritter, 1991; Schultz, 2003; Gompers and Lerner, 2003). The reason for this cross-sectional dependence is that IPOs cluster in times of high market valuations and growing prices. Thus, if we use the event time approach, the event windows of the individual IPOs will overlap considerably in calendar time. Further on, this leads to common shocks at specific calendar times influencing the returns of several IPOs, which creates cross-sectional dependence (Schöber, 2008).

Therefore, some studies use the calendar time approach to adjust for IPO clusters and mitigate the cross-sectional dependence. This approach bundles the returns of the IPOs based on calendar time, and are thus independent of the age of the IPOs. In this way, one calculates the aftermarket abnormal return allocated to periods of times, i.e. a specific year, and not to event windows. To illustrate, monthly portfolios of IPOs floated within a particular time frame are created, each portfolio assigned to a particular calendar month. By adding or compounding the abnormal return for each calendar month, one can derive the abnormal IPO return for each calendar year.

Even though both the event time approach and the calendar time approach are widely recognized and in some studies employed as complements, it can be seen that almost every empirical study make use of the event time approach as the primary method of measuring aftermarket performance, whereas the calendar time approach is not as frequently used. Thus, seeing as this thesis is limited in terms of time and pages, and we therefore need to choose one primary method, we will in further analyses use the event time approach. Furthermore, we are aware that the calendar approach might yield different results, which is a topic to keep in mind. However, as several previous empirical studies, such as Ritter (1991), have also discarded the calendar time approach from the analysis, we argue that the event time approach will provide a more thorough insight when analyzing our problem area. Further on, this topic and the consequences of using only the event time approach will be discussed in section 8.

4.1.5 Calculating abnormal returns

Studying previous research on IPO aftermarket performance, it can be seen that there are mainly two widely used ways to measure performance: the cumulative abnormal return (CAR) approach, and the buy-and-hold abnormal return (BHAR) approach. Even though both methods are frequently used and acknowledged, they each have different limitations and benefits. Though research shows that results may differ with the use of these two calculation methods, studies struggle agreeing on one preferred method (Gompers and Lerner, 2003). Thus, we will in this thesis employ both the CAR and the BHAR approach to increase the validity of our results. In this section, we will first discuss the suggested benefits, limitations and applications of each approach, before moving on to the definitions and technical procedures of conducting CARs and BHARs.

The key advantage of BHARs compared to CARs is that they reflect the returns earned by an investor following the buy-and-hold strategy. Due to the fact that this strategy is a well-known and commonly used strategy, the BHAR method could be argued to more realistically reflect the returns received on an actual investment, which is the reason some researchers favor this approach (Schöber, 2008; Barber and Lyon, 1997). On the other hand, the compounding technique of the BHAR method means that this approach tend to produce more extreme results, since the compounding of single period returns at a monthly frequency can magnify under- or outperformance (Gompers and Lerner, 2003). Thus, the BHARs often have fat tails and are heavily skewed, which will violate the assumptions of several test statistics, hereunder the standard *t*-test (Schöber, 2008). However, Lyon, Barber and Tsai (1999) have addressed this problem by suggesting a skewness-adjusted *t*-statistic with bootstrapped *p*-values, a statistic that has been adopted in several recent studies (Schöber, 2008; Levis, 2011). We will return to this issue in subsequent sections.

As previously stated, there is no general consensus on which method is the most appropriate to calculate aftermarket abnormal returns. However, some researchers favor the usage of CARs compared to BHARs, as this method produces less extreme results and the distributional properties are better understood, which facilitates statistical tests. Hence, it can be argued that the CAR approach is better fitted to draw formal inferences (Fama, 1998). However, several studies have highlighted the concern regarding positively biased CARs as a result of the existence of a bid-ask spread. Further on, one can argue that the CAR method represents a rather unrealistic trading strategy for potential investors. In the process of computing CARs, a commonly used approach is to operate with fixed weights, and a following rebalancing of the portfolio on a monthly basis. Thus, if any of the IPOs in the sample are delisted, or the relative values of the IPOs are changed and value weighting is being used, the portfolio needs to be rebalanced. This, in reality, would incur relatively high trading costs, which the CAR approach does not account for. Thus, the CAR results would suffer from an additional upward bias (Schöber, 2008).

As previously commented on, we will in this thesis use both CARs and BHARs to estimate our sample's aftermarket performance. By including both approaches, we hope to better grasp how sensitive results can be to methodology, and to increase the validity of our final conclusions. When computing both CARs and BHARs, we will in this thesis use equal weighting instead of value weighting. Which method is most appropriate is a debated theme as the two approaches have somewhat different applications, which is why some studies employ both equal- and value-weighting of the portfolio (Brav, Geczy and Gompers, 2000). Furthermore, they argue that value weighting would be a better alternative when studying the wealth change subsequent to an event, whereas the equal weighting approach could be better if believing that underperformance is more severe for smaller companies. As mentioned, we will in this thesis use equal weighting, as employed by for example Ritter (1991). However, this choice will not affect our findings dramatically, seeing as we, to a large degree, will employ CAR and BHAR medians throughout the analysis. In addition, we will not include IPOs that are delisted during the three-year research period, a choice we will defend more thoroughly in the data selection section. Hence, our portfolio will not need rebalancing during the research period, which may help mitigate the previously mentioned additional upwards bias when calculating CARs.

4.1.5.1 Computing CARs and BHARs in event time

As previously stated, we will use the event time approach when calculating aftermarket abnormal returns. In the event time calculations, calendar dates are irrelevant, and the IPOs' individual aftermarket returns are aggregated based on their location in the event window. Hence, for CARs, we will aggregate and compute the average and the median of the IPOs' abnormal return in the specified event window, with event month 1 starting from closing price at the 2nd day of trading. For the BHARs, we will aggregate and compute the average and the median of the IPOs' compounded abnormal returns in the specified event window.

To calculate CARs, we need to calculate the aftermarket abnormal return of each IPO in each event month. The benchmark-adjusted return for stock *i* in event month *t* is defined as:

$$ar_t^i = r_t^i - r_t^b$$

The cumulative benchmark-adjusted aftermarket performance for firm *i* in event window *t* to *T* is the summation of the firm's monthly benchmark-adjusted returns:

$$car_{t,T}^i = \sum_{t=1}^{T} ar_t^i$$

The cumulative benchmark-adjusted aftermarket performance from event month *t* to event month *T* for the portfolio is the average of all firms' benchmark-adjusted returns:

$$CAR_{t,T}^p = \frac{1}{n}\sum_{i=1}^{n} ar_{t,T}^i$$

Finally, the median CAR for event month *t* to event month *T* is calculated as follows:

$$CAR_{t,T}^{p_{median}} = median\left[car_{t,T}^i\right]$$

To compute BHARs, we need to derive the return to an investor following the buy-and-hold strategy. The formula for calculating each IPO's buy-and-hold return from period *t* to *T* can be formalized as:

$$BHR_{t,T}^i = \prod_{t=1}^{T}(1 + r_t^i)$$

Thus, by subtracting the buy-and-hold return for the benchmark, we can estimate the abnormal return from the buy-and-hold strategy:

$$BHAR_{t,T}^{i} = \left(\coprod_{t=1}^{T} (1 + r_t^i) \right) - \left(\coprod_{t=1}^{T} (1 + r_t^b) \right)$$

Furthermore, we calculate the average BHAR of the portfolio by taking the equally weighted arithmetic average of each IPO's BHAR:

$$BHAR_{t,T}^{p} = \frac{1}{n} \sum_{i=1}^{n} \left(\coprod_{t=1}^{T} (1 + r_t^i) \right) - \left(\coprod_{t=1}^{T} (1 + r_t^b) \right)$$

Here, n is the number of IPOs in the sample and r_{bt} is the return of the benchmark.

Finally, we calculate the median BHAR for each event window:

$$BHAR_{t,T}^{p_{median}} = median\left[BHAR_{t,T}^{i} \right]$$

4.1.6 Test statistics

To be able to verify our test results, we need to test whether our estimates of aftermarket performance are statistically significant. As stated in previous sections, a series of hypotheses has been formed, which will be tested using different methods and statistics. The approaches used to answer each hypothesis will be elaborated in the relevant sections, while this section will outline the general test statistics used on the sample.

The analysis in the thesis will broadly consist of two different ways of testing data. First, we will use tables to present the findings, where the results are divided into groups based on the characteristics relevant for the hypothesis in question. These results will then be tested, to see whether they are significantly different from zero, and if they significantly differ between the chosen groups. Second, multiple regression analyses will be conducted to test the effect of different characteristics on IPO abnormal aftermarket performance. Consequently, relevant test statistics will be employed to investigate whether the estimated parameters are significantly different from zero, and whether they are significantly larger (or smaller) than zero.

4.1.6.1 Testing statistical significance of calculated results

A widely acknowledged approach to test the statistical significance of results is the standard Student's t-test. However, together with several other statistical tests, this method relies heavily on distributional assumptions, such as normality. When plotting the abnormal returns of our sample, as can be seen from both table 6.1.2 and table 6.1.2, it is clear that the CARs and BHARs show a skewed distribution, and are therefore not following a normal distribution. Thus, another approach than the Student's t-test is needed to avoid errors. To deal with this issue, non-parametric tests are designed to have desirable statistical properties when few assumptions can be made about the underlying distribution of the data, or if the data distribution is containing outliners.

Taking into consideration previous research, we see that the issue of non-normal abnormal returns has been addressed in different ways. One commonly used approach is to use the skewness-adjusted *t*-statistic with bootstrapped *p*-values as suggested by Lyon, Barber and Tsai (1999), as employed in Levis (2011) and Gompers and Lerner (2003) when testing the significance of BHAR results. To illustrate, Gompers and Lerner (2003) conduct this procedure by drawing 5,000 resamples of size *n*, with replacement, from each return series, and then calculate a skewness-adjusted *t*-statistic for each sample by the below formula:

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

$$\hat{\gamma} = \frac{\sum_{i=1}^{n}(AR_{it} - \overline{AR_t})^3}{n\sigma(AR_t)^3}$$

Where:

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

Then, critical values for the skewness-adjusted *t*-statistics are calculated based on the resamples by solving:

$$\Pr\left[t_{sa}^{b} \leq x_{1}^{*}\right] = \Pr\left[t_{sa}^{b} \leq x_{u}^{*}\right] = \frac{\alpha}{2}$$

Finally, the skewness-adjusted *t*-statistics are calculated for each of the actual BHR return series, and are then compared to the bootstrapped critical values.

Another approach to address the issue of skewed abnormal returns is the Wilcoxon signed-rank test, another non-parametric test that does not assume normal distribution and can be used to test the significance of results. Another benefit with this specific test is that it is superior in the case of extreme outliers (Barber and Lyon, 1997), as it tests for statistical significance of the median as opposed to the mean. Based on the fact that our sample is relatively small, and thus sensitive to outliers, we have in this thesis chosen to use the Wilcoxon signed-rank test to determine the statistical significance of our results. When running the Wilcoxon signed-rank test in SAS, the null hypothesis is that the median is not significantly different from zero, with the corresponding p-value based on the signed-rank S-statistic. Thus, if the p-value is less than the specified alpha, we reject the null. To test whether the medians are significantly larger or smaller than zero, a U-statistic is calculated manually. This statistic is an approximation to the normal distribution, and is calculated by the below formula:

$$U_{+} = \frac{T_{+} - \frac{n\,(n+1)}{4}}{\sqrt{\frac{n\,(n+1)(2n+1)}{24}}} \sim N(0,1)$$

From the calculated U-statistic, we derive whether the medians are significantly larger or smaller than zero based on the two-sided p-value generated by SAS. Thus, if the U-statistic is negative, we divide the two-sided p-value by 2, the results presenting the p-value of a median equal to zero, with the alternative of a median lower than zero. On the contrary, if the U-statistic is positive, dividing the two-sided p-value by two will give the p-value of the null of median equal to zero, against the alternative hypothesis of a median larger than zero. However, this will only be worth testing if the medians in question are significantly different from zero in the first place.

When investigating whether two different groups of abnormal returns differ, the Wilcoxon Rank Sum test will be employed. This test is numerically equivalent to the Mann-Whitney U test, and can be viewed as the non-parametric equivalent to the two-sample t-test. Furthermore, the Wilcoxon Rank Sum test will test the null hypothesis that the two sample groups are identical, versus the alternative hypothesis that the two sample groups differ only with the respect to the median. Here, the null hypothesis of equal medians will be rejected if the two-sided p-value generated by the Exact Test in SAS is lower than alpha. Further on, if the null of equal medians is rejected, we test the null hypothesis of that one group's median is significantly larger than another group's median. This null will be rejected if the one-sided p-value generated by the Exact Test in SAS is lower than alpha.

4.1.6.1 Testing statistical significance of multiple regression parameters

After presenting the abnormal returns based on IPO characteristics in tables, we will run an OLS multiple regression analysis to estimate the impact of different variables on aftermarket performance. In this multiple regression, we want to capture the effect PE-backing, market-to-book ratio and IPO cyclicality has on aftermarket performance, as well as whether the effects of market-to-book ratio and IPO cyclicality are greater for private equity-backed firms than for their non-sponsored equivalents. To test this, we will run multiple regression analyses on both CAR and BHAR, where both will include binary variables. Binary variables, or so called dummy variables, take the value 0 or 1, and are suitable when the data can be classified to either one or another category.

When the dummy variables are created, they are then used together with other variables in a multiple linear regression model, yielding Ordinary Least Squares (OLS) results. This method involves several assumptions for the estimates to be unbiased. First of all, the dependent variable, in this case the abnormal returns of the IPOs, should be a linear function of the independent variables. Furthermore, random sampling and no perfect collinearity between the independent variables are assumed, together with the assumption of zero conditional mean, meaning that the error term has an expected value of zero. Finally, for the multiple regression parameters to be BLUE (Best Linear

Unbiased Estimator), the assumption of homoscedasticity, meaning that the error terms are uncorrelated and have the same variance, needs to be fulfilled. If parameters are BLUE, meaning that the estimators are unbiased, the standard Student's t-test can be employed when testing the estimators.

To make sure the OLS parameters in this thesis are BLUE, the regression will be tested for multicollinearity and heteroscedasticity before testing the estimated parameters. To test for multicollinearity, the correlation between the independent variables will be checked, together with running a Variance Inflation Factors test on all independent variables to confirm that there are no collinearity problems. Furthermore, the regressions will be tested for heteroscedasticity by computing heteroscedasticity tests, hereunder White´s test and the Breusch-Pagan, both based on the residuals of the fitted model. For both tests, the null hypothesis is homoscedasticity against the alternative hypothesis of heteroscedasticity. If we reject the null hypothesis, the regression will be run with White Errors in SAS, leading the estimates and t-statistics to be correct.

When the models are checked, and potentially corrected, for multicollinearity and heteroscedasticity, the estimators will be tested for individually statistical significance, using both the 2-tailed t-test to test if the estimator is significantly different from zero.

4.1.7 Testing hypotheses

In this section, we will structure and explain how we will conduct the analysis and reach our conclusions. As stated in section 3.0, we have formulated a set of hypotheses to formally test our theories. Further on, to test our hypotheses and present our findings, we will be inspired by the structure found in several previous studies, hereunder in the work presented by Ritter (1991), Gompers and Lerner (2003), Bergström, Nilsson and Wahlberg (2006) and Levis (2011).

In the manners explained in the previous sections, we will start by calculating aftermarket BHARs and CARs for the entire sample and for the three different time horizons. Further on, we will present these findings by organizing the aftermarket abnormal returns in terms of several characteristics, displayed in tables. By doing this, we will in an easily interpretable way present aftermarket abnormal returns classified by PE-backed and non-sponsored firms, market-to-book ratio and IPO cyclicality. Further on, we will for each aftermarket abnormal return estimate test its significance by a employing a test statistic specified for each hypothesis.

As previously explained, several hypotheses will be tested using multiple regression analysis. When using this approach to draw conclusions about the statistical inference of the results, it is important that the regression does not suffer from omitted variable bias, which occurs when at least one of the included regressors correlates with the omitted variable *and* the omitted variable is a determinant of the dependent variable. To illustrate, we need to be aware of potential determinants of IPO aftermarket performance that are not included in the regression, and can correlate with one or more of the included, dependent variables. Thus, to avoid this problem, the regressions employed in previous literature have been thoroughly studied, and used as inspiration. Overall, several researchers use tables where they present their findings with corresponding significance testing, whereas fewer studies have employed an additional multiple regression analysis to test IPO aftermarket performance. However, both Ritter (1999) and Levis (2011) use multiple regressions to test the influence of different factors on IPO aftermarket performance. In his study of IPO aftermarket performance in the 1980s, Ritter (1991) test his sample by running the below regression:

$$Return_i = \beta_0 + \beta_1 IR_i + \beta_2 \log(1 + age_i) + \beta_3 Market_i + \beta_4 Vol_i + \beta_5 Oil_i + \beta_6 Bank_i + e_i$$

Here, he tests IPO aftermarket returns by regressing the IPO returns on initial return, age, a market index, the volume of IPOs issued in the year of the IPO, and two dummies separating the IPOs that operate wihtin the oil and the bank segments. Given that Ritter's study is based on IPOs issued in the 1980's, the sample in this thesis will have some different characteristics, leading to some of Ritter's independent variables being redundant. To illustrate, Ritter includes a dummy to separate the companies operating within the oil industry, since most of these companies were young and had some specific characteristics in this period of time. However, as our sample covers IPOs issued many years later, we deem the oil & gas industry to be sufficiently mature to be compared with other industries. In addition, all IPOs within the bank segment have been removed from the sample, as will be explained in subsequent sections, meaning that there is no reason to include a bank dummy variable. Finally, even though Ritter have included the initial return as an explanatory variable, this thesis does not consider the initial return period. Thus, aftermarket performance has deliberately been measured excluding the initial return period, and this factor will not be included in the multiple regression.

Moving on to more recent literature, Levis (2011) includes several extra explanatory variables in his study of IPO aftermarket performance in London between 1992 and 2005:

$$
\begin{aligned}
Aftermarket\ return \\
&= \beta_0 + \beta_1 IR + \beta_2 Log(MarketCap) + \beta_3 PriceBook + \ d_1 Bubble \\
&+ \beta_4 AssetTurnover + \beta_5 Leverage + \beta_6 postOwnership + \ \beta_7 preOwnership \\
&+ d_2 VC + d_3 PE + e_i
\end{aligned}
$$

Here, Levis (2011) uses the first day return, market capitalization, price-to-book, asset turnover, leverage and the length of private equity or venture capital ownership both pre and post IPO to explain the sample's aftermarket performance, together with dummy variables representing PE-backing, VC-backing and whether the IPO was floated during the dot-com bubble in the early 2000s.

When testing our sample for IPO aftermarket performance, we will employ a regression strongly inspired by both Ritter(1991) and Levis (2011). As metioned, the first day return will not be considered in the thesis, and will thus be excluded from the regression, together with any measures of the length private equity ownership, due to time limitations. However, as this measure is not included by other studies, we believe that the regression analysis used in this thesis will not suffer from omitted variable bias, even though this is an issue to keep in mind in further analysis. The multiple regression used in this thesis is formalized below:

$$
\begin{aligned}
\boldsymbol{Aftermarket\ performance} \\
&= \boldsymbol{\beta_0 + \beta_1 Ln(1 + age) + \beta_2 Ln(MarketCap) + \beta_3 AssetTurnover} \\
&\boldsymbol{+ \beta_5 Leverage + \ d_1 PE + d_2 MB + d_3 BUST + d_4 (PE * MB) + d_5 (PE} \\
&\boldsymbol{* BUST) + e_i}
\end{aligned}
\tag{1.1}
$$

When running the regression to answer the different hypothesis, the maximum scope of this thesis leads to the amount of regressions tested to be limited. Thus, given the long-run focus of this thesis, with respect to the effects of private equity-backing, firm-specific characteristics and market conditions, we will run the regression with CAR 36 months and BHAR 36 months as dependent variables. This decision is in line with previous literature, as for example Ritter (1991) has limited the regression analysis to only include one time period. Our dependent and independent variables are presented and explained in 4.1.2:

Table 4.1.2 – Abnormal Return Regression Variables

CAR_36	The abnormal 36 months performance of the IPO, measured by CAR.
BHAR_36	The abnormal 36 months performance of the IPO, measured by BHAR.
Ln(1+age)	The logarithm of the age of the company at the time of the IPO.
Ln(MarketCap)	The logarithm of the market capitalization at the time of the IPO.
AssetTurnover	Revenues/Assets at the time of the IPO.
Leverage	Debt in percent of total capital at the time of the IPO.
PE	Dummy variable = 1 if the entity is private equity-backed, 0 if it is non-sponsored.
MB	Dummy variable = 1 if the IPO has a low market-to-book ratio at listing, else 0.
BUST	Dummy variable = 1 if the listing takes place during a bust period, else 0.
PE*MB	Interaction term between the two binary variables PE and MB.
PE*BUST	Interaction term between the two binary variables PE and BUST.

With the general methods being presented, the hypotheses for testing abnormal performance are now presented below, together with the specific methods employed to test them.

H_0: Both private equity-backed and non-sponsored IPOs show no significant abnormal returns, in the short-, medium- or long-term, measured by both BHAR and CAR.

H_1: All IPOs show signs of significant negative abnormal returns in all periods, where abnormal returns are measured by both BHAR and CAR.

Ad H_0 and H_1: To test these hypotheses, the median CARs and BHARs for all time periods, 6, 12 and 36 months, are calculated and presented in a table, to visually display the results. Further on, the individual results' statistical significance will be tested, using the Wilcoxon Signed-Rank test, with the null hypothesis of medians equal to zero. If the null is rejected, a new Wilcoxon Signed-Rank test is performed to investigate whether the medians are significantly smaller than zero.

H_2: The effect of being private equity-backed on aftermarket performance is positive for the sample, and private equity-backed IPOs show less negative abnormal returns than non-sponsored IPOs, in all periods and measured by both BHAR and CAR.

Ad H_2: To test this hypothesis, both result tables and regression analysis will be used. First, tables of IPO aftermarket performance classified by either PE-backed or non-sponsored IPOs will be presented, represented by the two groups' median BHARs and CARs for 6, 12 and 36 months. Further on, these medians will be tested by the Wilcoxon Rank Sum test, to investigate whether the two groups' medians significantly differ. If the null of statistically equal medians is rejected, we will test if the PE-backed IPOs' median BHARs and CARs are significantly higher than the equivalent medians for the non-sponsored IPOs.

Secondly, the regression derived previously will be used to test the potential impact of PE-backing on IPOs' aftermarket performance. The multiple regression analysis (1.1) is run in SAS:

$$
\begin{aligned}
&Aftermarket\ performance \\
&\qquad = \beta_0 + \beta_1 Ln(1+age) + \beta_2 Ln(MarketCap) + \beta_3 AssetTurnover + \beta_5 Leverage \\
&\qquad + \ d_1 PE + d_2 MB + d_3 BUST + d_4(PE * MB) + d_5(PE * BUST) + e_i
\end{aligned} \tag{1.1}
$$

Here, we are interested in the statistical significance of the PE-coefficient. Thus, we will employ the Student's t-test to investigate whether the estimated coefficient is significantly different from zero. If we are able to reject the null of a coefficient equal to zero, an one-sided t-test will be employed to test whether the coefficient is significantly larger than zero.

4.2 Market-to-book ratio method

In this section, the methods used to test our hypotheses regarding the effect of market-to-book ratio on IPO aftermarket performance will be explained. As described in section 2.2, previous studies have found evidence that firms with low initial market-to-book ratios tend to have greater abnormal returns. Thus, we will investigate if the same holds for our Nordic IPO sample. That is, we will test if the IPOs in our sample that have a low initial market-to-book ratio show evidence of greater aftermarket performance, compared to that of the IPOs with higher market-to-book ratios.

4.2.1 Classification of the IPO sample – "Low M/B" vs. "High M/B"

As mentioned in section 2.2, the market-to-book ratio, also referred to as price-to-book [P/B] ratio, expresses the market value of a company´s equity over the book value of its equity (Berk and DeMarxo, 2014). We collect the initial ratios from Thomson Financial Datastream, and similar to previous studies (e.g. Brav and Gompers, 1997; Brav, Geczy and Gompers, 2000; Simutin, 2009), we have categorized each entity into a quintile, according to its market-to-book ratio for the first day of trading. Our test uses the classification of IPO firms into four quintiles. The entities with the lowest 25 per cent of market-to-book ratios are put into quintile 1, the second lowest 25 per cent are put into quintile 2, and so on. Table 4.2.1 illustrates the different ranges of market-to-book ratios.

Table 4.2.1 – Ranges of M/B-ratios

Quintile	Market-to-book
1st	0,15-1,31
2nd	1,32-2,27
3rd	2,28-4,06
4th	4,07-19,19

We chose to follow the same approach as Schöber (2008), where we stick with this classification throughout the time horizon. That is, the quintiles are based on market-to-book ratios immediately after the IPO and not rearranged to reflect any changes in the ratios that might have occurred during the analyzing period.

The sample-IPOs have a mean (median) initial market-to-book ratio of 3.11 (2.27). For the private equity-backed IPOs the mean (median) is 4.07 (3.54), while the non-sponsored IPOs have a mean (median) of 2.85 (1.93).

Table 4.2.2 – M/B ratios

	Market-to-book ratio		
	All IPOs	PE	NS
Mean	3,11	4,07	2,85
Median	2,27	3,54	1,93

Allocating the sample IPOs into the different quintiles in Table 4.2.1, we find that 41% of the private equity-backed IPOs belong to the quintile with the highest initial market-to-book ratio, as illustrated in Table 4.2.3. This figure is somewhat similar to that reported in previous literature on IPOs where the greatest share belongs in the highest quintile. For example, Schöber (2008) find that 56.2% of the buyout-backed companies belong to the quintile with the highest market-to-book ratio, Gompers and Lerner (2003) report a percentage of 60.5%, while Brav, Geczy and Gompers (2000) find a percentage of 77.6%.

Table 4.2.3 – Distribution of IPOs by market-to-book ratio

Sample Distribution

	Market-to-book Quintile				
IPO	Lowest	2	3	Highest	**Total**
PE	6 12%	9 18%	15 29%	21 41%	**51**
NS	54 29%	51 27%	45 24%	38 20%	**188**
Total	**60**	**60**	**60**	**59**	**239**

4.2.2 Testing hypotheses

In order to investigate whether IPOs with lower market-to-book ratios underperform less than the ones with relatively higher ratios, we create a dummy variable that takes the value of 1 if the market-to-book ratio is classified into the first quantile, else 0. This dummy variable is labeled MB and is included in regression (1.1), which is derived in section 4.1.7.

The starting point of testing the hypotheses regarding market-to-book ratio, will be different tables displaying the evidence relevant to each hypothesis for this particular area, followed by OLS multiple regression analysis. The following of this section will present the market-to-book hypotheses and the methods we will employ to test them.

H_0: There is no significant relationship between low initial market-to-book ratio at floating date and firm performance for all IPOs in the sample, in the short-, medium- or long term, measured by both BHAR and CAR.

H_1: IPOs with low initial market-to-book ratios show less negative abnormal performance than those with high market-to-book ratios in all periods, measured by both BHAR and CAR.

Ad H_0 and H_1: When testing whether there is a relationship between having a low market-to-book ratio at floating date and firm performance, we measure median BHARs and CARs for short-, medium-, and long term, categorized by initial market-to-book ratios. The goal is to reject H_0, and find evidence of a significant positive relationship between low market-to-book ratios at floating date and aftermarket performance, as hypothesized in H_1. By employing the Wilcoxon Signed-Rank test, we test the null that the medians do not differ significantly from zero. Furthermore, we test whether the median of the IPOs with low initial market-to-book ratio is statistically different from that of IPOs with higher ratios, using the Wilxocon Rank Sum test. If we reject the null that the two medians are significantly equal, we employ the Wilxocon Rank Sum test to investigate whether the median of IPOs with low initial market-to-book ratios is significantly greater than that of IPOs with higher ratios.

In addition, to test the effect of low initial market-to-book ratio of aftermarket performance, we run regression (1.1), which is described further in section 4.1.7:

$$\begin{aligned} &Aftermarket\ performance \\ &\quad = \beta_0 + \beta_1 Ln(1 + age) + \beta_2 Ln(MarketCap) + \beta_3 AssetTurnover + \beta_5 Leverage \\ &\quad + \ d_1 PE + d_2 MB + d_3 BUST + d_4 (PE * MB) + d_5 (PE * BUST) + e_i \end{aligned} \tag{1.1}$$

Here, the coefficient on the MB dummy, d_2, is of interest, and we will employ a two-sided Student´s t-test to test whether it is statistically different from zero.

H_2: The effect of a low initial market-to-book ratio on aftermarket performance is greater for PE-backed IPOs than for non-sponsored IPOs, in all periods and measured by both BHAR and CAR.

Ad H_2: To test whether there is a significant difference in the median abnormal returns for private equity-backed and non-sponsored companies, classified as having a low initial market-to-book ratio, we employ a Wilcoxon Rank Sum test. Thus, we investigate whether the medians of private equity-companies having a low initial market-to-book ratio are statistically different from that of non-sponsored companies. Furthermore, we will run regression (1.1). To capture the extra effect of being private equity-backed and having a low initial market-to-book ratio, we create a new regressor by taking the interaction between the PE dummy variable and the MB dummy variable. The product PE*MB is called an interaction tern and allows the effect on aftermarket performance of having a low market-to-book ratio to depend on whether the company is classified as private equity-backed (Stock and Watson, 2012). The coefficient on this interaction term will capture the effect of being private equity backed *and* having a low initial market-to-book ratio, above and beyond the effect captured by the two variables alone. That is, d_4 is the difference in the effect of having a low market-to-book ratio for private equity-backed and non-sponsored companies.

$$
\begin{aligned}
&Aftermarket\ performance \\
&\qquad = \beta_0 + \beta_1 Ln(1+age) + \beta_2 Ln(MarketCap) + \beta_3 AssetTurnover + \beta_5 Leverage \\
&\qquad + \ d_1 PE + d_2 MB + d_3 BUST + d_4(PE * MB) + d_5(PE * BUST) + e_i
\end{aligned}
\tag{1.1}
$$

Here, the coefficient on the (PE*MB) dummy, d_4, will be of interest. By employing a two-sided Student´s t-test, we test whether the coefficient is statistically significant.

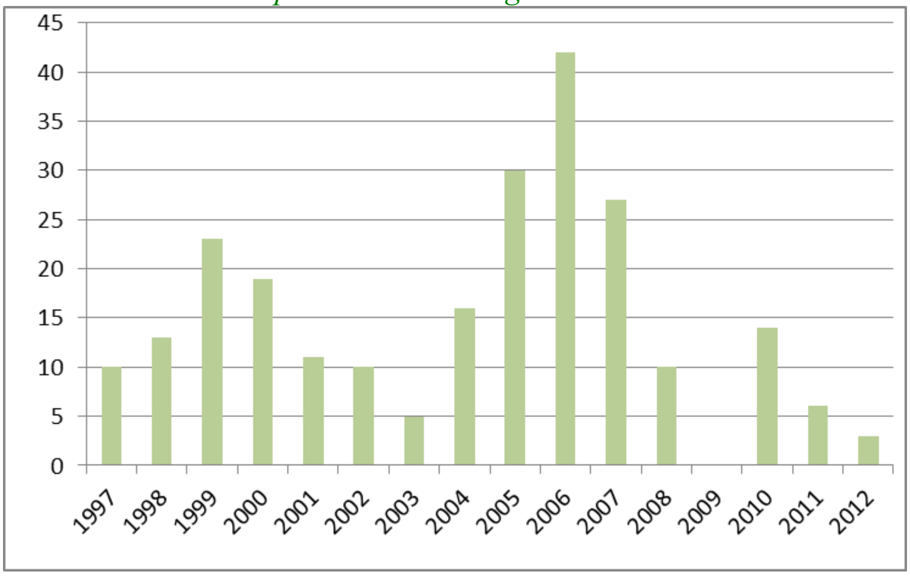
4.3 IPO Cyclicality

In this section, we will explain the methods used to test our hypotheses regarding the influence of IPO cyclicality on IPO aftermarket performance. As previously explained, theory states that IPOs issued in hot markets will perform worse than firms floated in periods of low market activity, a theory supported by several empirical findings. Thus, we will investigate whether the IPOs in our sample issued in so-called "bust markets" will show higher aftermarket performance than the IPOs issued in periods of high IPO activity.

4.3.1 Classification of the IPO sample – "Boom" vs. "Bust"

To be able to perform our analysis, we need to classify the IPOs in our sample to either a "boom" or a "bust" market. Hence, we need a definition of a booming market. Inspired by the study of Ljungqvist, Nanda and Singh (2006) investigating hot markets and IPO pricing, we employ their definition of "hot markets" as periods with high investor optimism. As discussed in the theory section, overly optimistic investors can translate to high valuations in the market, which studies have shown lead to clusters of IPOs. Thus, IPOs classified to "boom" markets will in this thesis translate to IPOs issued in periods of extraordinary high IPO activity. Further on, we will classify the remaining IPOs, issued in periods of medium or low market activity, to "bust" markets. By distributing our sample of IPOs by floating year, we can see clear signs of periods of high IPO activity in the graph below.

Graph 4.3.1 – Floating Distribution



In some previous research, comments have been made on the dramatic rise in IPOs around the new millennium. From the graph above, it is clear that this is supported by or sample, as we see a peak in the amount of IPOs in the years 1999 and 2000. Furthermore, we observe an extraordinary amount of IPOs starting from 2005 throughout 2007, before the financial crisis hit the market and the IPO activity decreased drastically, leading to zero firms in our sample going public in 2009.

Based on the above distribution, we have identified 5 years of extraordinary high IPO activity, years which we will classify as "Boom Markets". Thus, the remaining 11 years consists of years with either medium or low IPO activity, and will be classified as "Bust Markets". In the light of the theories and findings presented in Bergström, Nilsson and Wahlberg (2006) where they argue that managers of PE-backed IPOs should better be able to time the floating to periods of high activity and thus, a large percentage of all PE-backed IPOs should be issued in hot markets, but however finds the evidence of the opposite, it is interesting to observe the distribution of PE-backed and non-sponsored IPOs in the "Boom" and "Bust" markets, respectively.

Table 4.3.1 – Distribution of IPO activity

"BOOM Markets"

Year	1999	2000	2005	2006	2007
ALL	23	19	30	42	27
PE	2	1	8	10	7
NS	21	18	22	32	20

"BUST Markets"

Year	1997	1998	2001	2002	2003	2004	2008	2009	2010	2011	2012
ALL	10	13	11	10	5	16	10	0	14	6	3
PE	2	5	2	5	0	2	0	0	5	2	0
NS	8	8	9	5	5	14	10	0	9	4	3

In the table above, the IPOs have been classified by the IPO activity at their respective floating date, and then categorized by years in chronological order. As seen from this distribution, there are PE-backed IPOs in every year, except 2003, 2009 and 2012. More interesting, however, is the fact that the "Boom Market" years does not correspond perfectly with the years where most PE-backed IPOs were issued. Even though the amount of PE-backed IPOs reached a peak in the booming market years of 2005 through 2007, more PE-backed IPOs were floated in 1998, 2002 and 2010 than in the booming market years of 1999 to 2000. Further on, this makes the theory of PE-backed IPOs' managers' tendency to time floating date to "hot markets" to exploit windows of opportunity questionable. By classifying IPOs issued in either "Boom" or "Bust" markets to PE-backed or non-sponsored IPOs, we see that a smaller percent of PE-backed IPOs in the sample is, in fact, issued in "hot markets".

Table 4.3.2 – Percentage distribution of IPO activity

Classification	IPO Activity	Distribution of IPOs (%) ALL	PE	NS
Boom	High	59	55	60
Bust	Medium/Low	41	45	40
Total	Total	100	100	100

The above results from our sample support the findings presented in Bergström, Nilsson and Wahlberg (2006). Contrary to what one might expect, a smaller percentage of PE-backed IPOs were issued in "Boom Markets" compared to the percentage of non-sponsored IPOs issued in these years.

Given the theoretical foundations and previous research, the belief that IPOs issued in "Boom Markets" do indeed perform poorer than other IPOs, in combination with the relatively low percentage of PE-backed IPOs issued in these years, support the belief that PE-backed IPOs will underperform less than non-sponsored IPOs. However, to be able to draw any conclusions for our sample, a formal test of IPO cyclicality's influence on aftermarket performance needs to be conducted.

4.3.2 Testing hypotheses

To be able to formally draw any conclusions about IPO activity's influence on IPO aftermarket performance, and to investigate whether this effect is larger for PE-backed IPOs, dummy variables based on whether the IPOs in the sample are issued in high- or low-activity markets are needed. Thus, a dummy variable named "BUST" is created, where the IPOs issued in "Boom markets" take the value 0, and the remaining IPOs, issued in "Bust markets", take the value 1. Moreover, this variable is included in the general multiple regression (1.1).

In addition to running a multiple regression analysis, median CARs and BHARs for all IPOs in the sample have been calculated for all time horizons. To thoroughly present the findings, we will create tables to visually display the evidence relevant to each hypothesis regarding IPO cyclicality, before running the OLS multiple regression analysis. To structure the remains of this section, the hypotheses regarding this particular area will be presented together with the methods employed to test them.

H_0: There is no significant relationship between IPO activity at floating date and aftermarket performance for all IPOs in the sample, in the short-, medium- and long-term, measured by both BHAR and CAR.

H_1: IPOs floated in bust markets with low IPO activity show less negative abnormal returns than IPOs floated in booming markets with high IPO activity in all periods, measured by both BHAR and CAR.

Ad H_0 and H_1: When testing whether there is, in fact, a positive relationship between issuing IPOs in "Bust Markets" and aftermarket performance, the goal is to reject H_0 and find that it exist a significant, positive relationship, as described in H_1. To start, median BHARs and CARs are measured for all time horizons and presented in a table, categorized by IPO-activity at floating date. Further on, each median will be tested using the Wilcoxon Signed-Rank test to test the null that they are not significantly different from zero. Moreover, the Wilcoxon Rank Sum test will be employed to test whether the medians for the IPOs issued in Bust markets and the medians of the IPOs issued in Boom markets significantly differ. Here, the null hypothesis is that the two medians are significantly equal. Moreover, if we reject the null, the Wilcoxon Rank Sum test will be employed to test whether the medians of IPOs issued in Bust markets are significantly larger than the medians of IPOs issued in Boom markets.

Moreover, the effect of IPO cyclicality on aftermarket performance will be tested using multiple regression analysis. Here, regression (1.1) will be employed:

$$\begin{aligned} Aftermarket\ performance \\ &= \beta_0 + \beta_1 Ln(1 + age) + \beta_2 Ln(MarketCap) + \beta_3 AssetTurnover + \beta_5 Leverage \\ &+ \ d_1 PE + d_2 MB + d_3 BUST + d_4 PE * MB + d_5 PE * BUST + e_i \end{aligned} \tag{1.1}$$

First, the coefficient on the BUST dummy will be tested to see if it is significantly different from zero, using a two-sided Student's t-test. Further, if we are able to reject the null, we will employ a one-sided Student's t-test to investigate whether the coefficient on the BUST dummy is significantly higher than zero.

H_2: The effect of being listed in a bust market with low IPO activity at floating date on aftermarket performance is greater for PE-backed IPOs than for non-sponsored IPOs in all periods, measured by both BHAR and CAR.

Ad H_2: This hypothesis will be tested using a multiple regression analysis. However, the abnormal returns of all IPOs issued in Bust markets will first be presented in a table, classified by being either private equity-backed or non-sponsored, to visually display the potential differences in medians. These medians will be tested to see if they are significantly different from zero, using the Wilcoxon Signed-Rank test, in addition to testing if the medians of the two groups significantly differ, using the Wilcoxon Rank Sum. Further on, the multiple regression (1.1) will be employed to capture the potential extra effect being PE-backed brings if an IPO is issued in a Bust market. To test this extra effect, we have created a dummy variable, PE*BUST, similar to the procedure explained in the Market-to-Book section, where we create a PE*MB variable.

$$\begin{aligned} Aftermarket\ performance &= \beta_0 + \beta_1 Ln(1+age) + \beta_2 Ln(MarketCap) + \beta_3 AssetTurnover + \beta_5 Leverage \\ &+ d_1 PE + d_2 MB + d_3 BUST + d_4 PE * MB + d_4 PE * BUST + e_i \end{aligned} \tag{1.1}$$

Here, the coefficient on the PE*BUST dummy is of interest, and will be tested using a two-sided Student's t-test to see if it is significantly different from zero.

4.4 Value-added

In this section, we will elaborate on the methods used to test our hypothesis regarding growth in value added. As described in section 2.4, theory suggests that private equity-backed companies are provided with extensive value-added post-investment support, proposing that the value-added generated by these companies are greater than that of non-sponsored companies.

4.4.1 Value-added model and sample

In order to examine differences in value added among private equity-backed and non-sponsored companies, we specify a production function similar to that of Wilson, Wright, Siegel and Scholes (2012). In this model, the authors relate total output (value added) to labor and capital inputs, together with controls for competition and sector. The production function specification is Cobb-Douglas, a method commonly used in studies of the impact of private equity backed buyouts on productivity (e.g. Lichtenberg and Siegel, 1990; Harris, Siegel and Wright, 2005):

$$Q = \propto L^{\beta} . K^{\beta 1} . e$$

where

$$Ln(Q) = \propto \ + \beta Ln(L) + \beta 1 Ln(K) + Controls + e$$

Wilson, Wright Siegel and Scholes (2012) use the following multivariate model to determine productive efficiency:

$$Value\ added = f(Labor, Capital, Age, Industry\ Risk, Competition, Time\ Trend\ and\ Company\ Type).$$

As we are interested in the growth in value added of private equity-backed companies, we collect data at t_0, which is the year of the IPO, and at t_3, for each of the variables used in the model. Based on the regression of Wilson, Wright, Siegel and Scholes (2012), we present the following multiple regression (1.2):

$$\begin{aligned} Ln(Value\ Added) &= \beta_0 + \beta_1 Ln(L) + \beta_2 Ln(K) + \beta_3 Ln(Age) + \beta_4 Industry\ Risk \\ &+ \beta_5 Competition + \beta_6 Bust + \beta_7 PE + \beta_8 d3 + \beta_9 (Ln(L) * d3) + \beta_{10} (Ln(K) \\ &* d3) + \beta_{11} (Ln(Age) * d3) + \beta_{12} (Industry\ Risk * d3) + \beta_{13} (Competition \\ &* d3) + \beta_{14} (Bust * d3) + \beta_{15} (PE * d3) + \varepsilon_i \end{aligned} \tag{1.2}$$

In the following we will elaborate on some of the variables used in the regression. All variables and their corresponding labels are displayed in table 4.4.1.

Value added is measured as EBITDA plus labor expenses (SVCA, 2015), and will therefore depend on the size of each company. Similar to previous studies (e.g. Wilson, Wright, Siegel and Scholes, 2012; Bernstein, Lerner, Sorensen and Strömberg, 2010), we will investigate the *growth* in value added. That is, to test whether private equity companies are able to generate a greater *growth* in value added compared to that of non-sponsored IPOs.

According to economic theory, L and K are inputs used to obtain the output, which in this case is value added. In our model, we define L as number of employees and K as tangible and intangible assets.

Industry risk is defined as the systematic risk that cannot be diversified away in a portfolio, measured by industry beta for the respective entity at the year of the IPO, t_0, and at t_3. These values are collected from the widely used website Damodaram where Stern University estimate industry betas. In this dataset, updates from January 1998 contain beta values as of December 1997, and so on. The beta values are estimated by regressing weekly returns on stock against an index using five years of data or listed period (if less than five years). The beta is not estimated if data is available for less than two years. To ensure that the global average across all the companies is close to one, an aggregate check is applied (Stern University, 2016). The industry breakdown from Stern University classifies companies into approximately 100 different industries. To be able to measure the industry risk for each entity in the best way, we have chosen to classify every entity into one of Stern Univesity´s industries by looking at each company´s specific operations. The difficulties related to breaking down companies into sectors or industries are pointed out by Stern University, where every method is said to be imperfect due to for example changes in operations or that some firms are challenging to pigeonhole (Stern University, 2016). However, Stern University provides a spreadsheet including the listing of companies in each industry, which we have used when classifying our entities into the database´s industries. Not every company in our sample is listed in this spreadsheet, but in these cases we have found an equivalent company with similar operations, and classified our entity based on the industry that this comparable company is listed in.

In practice, measuring competition is a complex task, given that it cannot be measured directly. Thus, to incorporate the effect of competition in the regression, we use a proxy, hereunder market share, as we believe it is highly correlated with the unmeasurable competition variable. According to academic literature, market share is a key indicator of market competitiveness and says something about how well a company is doing against its competitors. A firm´s market share is calculated as its size, typically in revenue or units produced, divided by the corresponding figure of the set industry (Paul and Reibstein, 2010). As it would be very difficult, imprecise and time consuming to calculate the overall industry revenue or units sold for each entity in the sample at both t_0 and t_3, we have based our measure on each company´s sector peers provided by Nasdaq in cooperation with Morningstar. These peer groups are defined based on data from audited source materials such as annual reports and financial releases (Morningstar, 2015). To calculate the relative market share, we collect data on the revenue of each company in the peer group at t_0 and t_3, and compare it to the total revenue of the group at the same time. Using this methodology, we believe that we are able to present a picture of the competition each entity is facing, even though it is not based on the whole set industry.

The following table displays the label for each variable used in the regression:

Table 4.4.1 – Value Added Variables

Ln(VA)	The logarithm of the value added generated by the entity.
Ln(L)	The logarithm of the numbers of employees.
Ln(K)	The logarithm of intangible and tangible assets.
Ln(Age)	The logarithm of the age of the company.
Industry Risk	Industry beta for the entity.
Competition	Market share of the entity.
Bust	Dummy variable = 1 if the listing takes place during a bust period, else 0.
PE	Dummy variable = 1 if the entity is private equity-backed, 0 if it is non-sponsored.
d3	Dummy variable = 1 if t_i=t_3, 0 if t_i=t_0.
Ln(L)*d3	Interaction term between the continuous variable Ln(L) and the binary variable d3
Ln(K)*d3	Interaction term between the continuous variable Ln(K) and the binary variable d3
Ln(Age)*d3	Interaction term between the continuous variable Ln(Age) and the binary variable d3
Industry Risk*d3	Interaction term between the continuous variable Industry Risk and the binary variable d3
Competition *d3	Interaction term between the continuous variable Competition and the binary variable d3
Bust*d3	Interaction term between the two binary variables Bust and d3
PE*d3	Interaction term between the two binary variables Bust and d3

4.4.2 Testing hypotheses

In order to investigate any differences in value-added generated by private equity-backed and non-sponsored IPOs, we will run regression (1.2):

$$\begin{aligned} Ln(Value\ Added) &= \beta_0 + \beta_1 Ln(L) + \beta_2 Ln(K) + \beta_3 Ln(Age) + \beta_4 Industry\ Risk \\ &+ \beta_5 Competition + \beta_6 Bust + \beta_7 PE + \beta_8 d3 + \beta_9 (Ln(L) * d3) + \beta_{10} (Ln(K) \\ &* d3) + \beta_{11} (Ln(Age) * d3) + \beta_{12} (Industry\ Risk * d3) + \beta_{13} (Competition \\ &* d3) + \beta_{14} (Bust * d3) + \beta_{15} (PE * d3) + \varepsilon_i \end{aligned} \tag{1.2}$$

As described in section 4.1.6, this regression will also be tested for multicollinearity and heteroscedasticity. When the model is checked, and potentially corrected, for multicollinearity and heteroscedasticity, we use the following methods to test the value-added hypothesis:

H_0: There is no significant difference in growth in value added between private equity-backed IPOs and non-sponsored IPOs.

H_1: Private equity-backed IPOs show stronger growth in value added compared to that of non-sponsored IPOs.

Ad H_0 and H_1: In order to test if there is a significant difference in growth in value added between private equity-backed IPOs and non-sponsored IPOs, we will run regression (1.2) where the interaction term between PE and d3, β_{15}, is the coefficient of interest as it measures the partial effect at t_3 of being private equity-backed, above and beyond the individual effect of the time dummy and the PE dummy alone. The goal is to reject H_0, and find evidence of a significant stronger growth in value added generated by private equity-backed IPOs, compared to that of non-sponsored IPOs, as hypothesized in H_1. When testing the null, that is, whether the coefficient on the (PE*d3) variable is statistically significant, we employ a 2-tailed t-test to test if the coefficient is significantly different from zero. If we are able to reject the null, we will perform a 1-tailed left sided t-test to test if the coefficient is significantly greater than zero.

(1.2)

5.0 Data collection and sample selection

Many writers on methodological issues distinguish between quantitative and qualitative research, as the two methods constitute different approaches to investigation. In broad terms, quantitative research method is the collection of numerical data of a greater sample population that can be transformed into useable statistics, which can be used to draw general conclusion of the entire sample population. Qualitative research, on the other hand, tends to be concerned with words rather than numbers, and typically uses smaller sample sizes. The qualitative data collection methods vary using unstructured or semi-structured techniques, from which conclusions are drawn (Bryman and Bell, 2015). In consensus with previous similar studies (for example Cao and Lerner, 2009; Levis, 2008; Bergström, Nilsson and Wahlberg, 2006), this study will take on a quantitative approach. In this section, we will provide an overview of the collection of numerical data and describe our sample selection criteria. Furthermore, we portray our full sample and argue for how we have ensured credibility. Finally, we discuss the deficiencies our dataset may suffer from.

5.1 IPO data collection

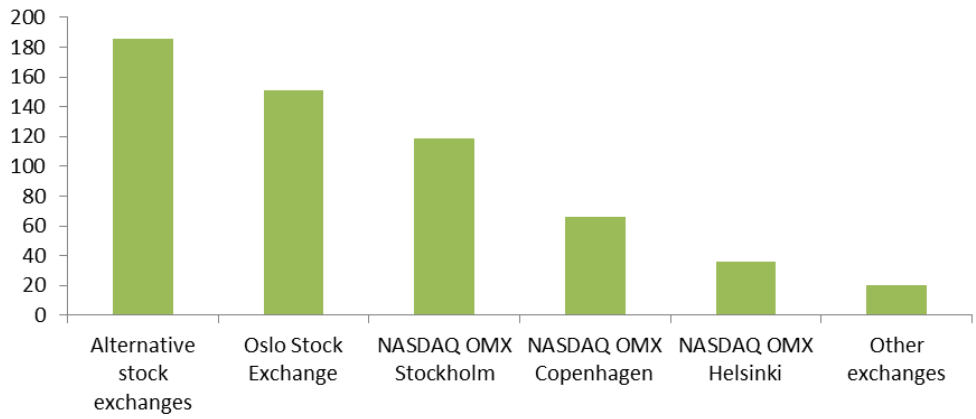
The overall objective of this paper is to elaborate on whether or not the value created by private equity funds are preserved within the Nordic portfolio companies after the exit of the funds. Thus, we will investigate post-IPO performance, and compare the performance of private equity-backed companies to that of non-sponsored companies. In order to do this, our sample objects must have completed an initial public offering on the regulated main exchanges in the Nordic region. Furthermore, we need clear criteria for identifying our IPO sample objects as either being *private equity-backed* or *non-sponsored.*

We have collected our original IPO data sample from Zephyr, a database provided by Bureau van Dijk. This database contains information about corporate mergers and acquisitions, initial public offerings, venture capital, and private equity deals. For European deals, Zephyr covers completed, pending, withdrawn, announced and rumored deals dating back to 1997. In order to build as large a database as possible, we have collected data reaching back to this date. For each observation, three years of post-IPO accounting data is needed to elaborate on the post-IPO performance. That is, our initial sample consists of every *completed* IPO deal in Norway, Sweden, Denmark and Finland from

January 1997 to December 2012, as well as post-IPO performance data from January 1997 to December 2015.

This initial sample originally contains all listings in the Nordic region, but we discovered some listings on other non-Nordic exchanges that were wrongfully included and therefore removed from the sample. Focusing on the Nordic region, the Zephyr sample includes IPOs on both main markets and alternative stock exchanges such as First North and Oslo Axess. Oslo Stock Exchange consists of two market segments, Oslo Børs (main exchange in Norway) and Oslo Axess. The former is the obvious choice for larger companies with an established track record, and represents a full stock exchange listing that follows EU directives. Oslo Axess gives companies access to an authorized and fully regulated marketplace, with less detailed requirements and obligations than Oslo Børs, suitable for younger companies. Both market segments require a minimum of 25% of shares to be in public hands (Oslo Børs, 2016). The Nasdaq OMX Nordic also consists of two market segments; Nasdaq Nordic Main Market and Nasdaq First North. The Nasdaq Nordic Main Market complies with EU requirements, and comparable to Oslo Børs, it is a suitable choice for larger companies with established track records. Furthermore, the minimum requirement of share capital offered to the public is 25%. Similar to Oslo Axess, companies listed at First North are subject to less detailed requirements and obligations, but in contrast, they only need to offer 10% of their share capital to the public (Nasdaq, 2016). As outlined in section 1.3, to avoid companies with insufficient company information and different risk profiles affect our calculations on abnormal aftermarket performance, we have excluded listings on alternative stock exchanges from our original sample.

Graph 5.1.1 – Contribution of stock exchanges



Graph 5.1.1 illustrates the different stock exchanges´ contribution to the preliminary Zephyr dataset before any exclusion. A table describing the final dataset is provided in section 5.4.

Following standard practice, we have excluded banks from the sample, as their business model to a large extent is different from that of other companies. Furthermore, the previously mentioned effects of being backed by private equity funds, does not exist in the same extraction for these companies. Therefore, it is rather the rule than the exception that these companies are omitted for analysis purposes (see for example Harris, Niu and Murray, 2006).

5.2 IPO Classification

In order to compare post-IPO performance of private equity-backed companies to that of non-sponsored companies, we must classify the entities as either non-sponsored, private equity-backed or venture capital-backed. Levis (2011), Schöber (2008) and Cao and Lerner (2006) acknowledge the challenges associated with the classification of private equity-backed entities. This is due to the overlapping nature of the funds´ involvement in both venture capital and private equity transactions, as well as the lack of publicly available information of privately owned companies (Levis, 2011). Previous studies (see for example Degeorge and Zeckhauser, 1993; Levis, 2011; Schöber, 2008; Cao and Lerner, 2006) use several different methods to classify IPO objects, hereunder financial databases, trade publications, IPO prospectuses, press articles, and company and fund webpages. Thus, in our classification process, we have applied a similar approach. Firstly, we have identified all IPOs in the Zephyr database that are priced until December 2012 and listed on a Nordic main exchange. When excluding banks and alternative stock exchanges, our preliminary sample consists of 365 entities. Secondly, we double-check that the entities from Zephyr are in fact listed for the first time, as well as classify them as either private equity-backed, venture capital-backed or non-sponsored. That is, we have crosschecked the preliminary sample with IPO prospectuses, trade publications from the Nordic countries´ respective venture capital associations (NVCA, SVCA, DVCA, FVCA), press articles, and company and fund webpages.

In the first step we found that some of the companies´ shares were not available for the general public for the first time. That is, some entities had previously been traded on a different exchange, and were now being listed on the main exchange. Other entities had previously been traded, and were now issuing new shares in a secondary offering. In either case, these entities were not sold to the general public for the first time, and were therefore excluded from our sample.

In the second step, we have based our classification methodology to that of Schöber (2008) and Levis (2011). That is, we identify venture capital-backed entities as rather small, young companies with a limited operating history. The typical venture capital-backed company is a high-risk venture in a high technology industry, such as biotechnology. In contrast, private equity-backed entities are identified as well-established, large enterprises with a long operating history. Furthermore, the private equity fund(s) must have the controlling interest of the portfolio company at the time of the exit. According to company law *"(...) a person is treated as entitled to exercise or control the exercise of voting power if he is entitled to exercise or control the exercise of one-third or more of the voting power at general meetings of that body corporate"* (Ervine, 2015). That is, we classify private equity-backed IPOs as those who satisfy the following criteria:

I) The entity completed an initial public offering during the time period of 1997-2012.
II) Prior to this initial public offering, the entity experienced private equity sponsoring.
III) The private equity fund(s) has a pre-IPO ownership of at least one-third.

The entities that satisfy the first criteria, but are not sponsored, are classified as non-sponsored IPOs, whereas those entities identified as venture capital-backed are excluded from our sample as elaborated in section 1.4.

Even though the Zephyr database contains information about private equity and venture capital deals, we find their classification as being inconsistent and inaccurate. We have therefore solely based our classification method on IPO prospectuses, trade publications, press articles as well as company and fund webpages. In this process, some entities lacked the required information needed to classify them, and were therefore excluded from our sample. This was mostly a problem regarding the early listings of companies that was later liquidated. This can be explained by the fact that these companies were listed before the standard of publishing company information online was introduced. After this classification process, we end up with a total sample of 264 IPOs; 210 non-sponsored and 54 private equity-backed.

Table 5.2.1 – Distribution by Classification and Country

	PE	NS	**Total**
Oslo Stock Exchange	20	90	**110**
Nasdaq OMX Copenhagen	5	30	**35**
Nasdaq OMX Stockholm	24	60	**84**
Nasdaq OMX Helsinki	5	30	**35**
Total	**54**	**210**	**264**

5.3 Post-IPO performance data collection

5.3.1 Abnormal return data collection

In order to measure the post-IPO performance for the IPO sample, we have collected share price information from Bloomberg. Even though we are using monthly returns in our analysis, we have collected daily data on share prices in order to incorporate that the entities are listed on different dates. Companies for which share price information is not available are excluded from the sample, accounting for approximately 9% of the IPO sample. A table detailing the total exclusion process can be found in section 5.4.

The benchmarks used to calculate abnormal returns are collected from Datastream, a global financial and macroeconomic database with available equity data from initial public offering to 2016. Datastream also provides us with market-to-book ratios for the first-day of listing.

5.3.3 Value-added data collection

As described in section 4.4, the data needed for the value added analysis are collected from databases provided by Stern University and Wharton Research Data Services.

Data on industry risk, hereunder industry beta, are collected from Stern University´s Damodaran. This data is drawn upon several different data sources, for example Bloomberg, Morningstar, Capital IQ and Compustat. Even though these are considered reliable sources, Stern University points out that the data might contains some errors. That is, if the data service makes a mistake, this will affect the data provided by Stern University as they do not check the raw data on 40,000+ individual companies. However, given the size of the sample, the effect on sector averages will be small. Furthermore, Stern University notes that they must be sensitive to the commercial interest of the data services, which is to sell data to subscribers. The industry betas used in our value added analysis is therefore created from S&P Capital IQ´s raw data, and not reported directly as S&P Capital IQ´s industry classifications or betas (Stern University, 2016).

The rest of the data used in the value added analysis are collected from Wharton Research Data Services, hereunder Compustat Global Fundamentals, a database of non-US and non-Canadian fundamental and market information on both active and delisted publicly held companies dating back to 1987. The data are based on quality data and industry-leading solutions from S&P Capital IQ and SNL, covering 98% of the world´s market capitalization. (S&P Global, 2016). Compustat has both the scope and reputation demanded by financial professionals, suggesting that this data is highly reliable.

5.4 Final sample

After the collection of post-IPO performance data, some entities were removed from our sample due to missing data. Thus, our final sample consists of 239 IPOs; 188 non-sponsored and 51 private equity-backed.

Table 5.4.1 – Final Sample

Final sample		
Preliminary Zephyr IPOs		578
- Entities listed on alternative stock exchanges		204
- Banks		9
Total		**365**
- Entities not satisfying IPO classification criteria		52
- Entities excluded due to missing classification information		23
Total		**290**
Hereunder		
Private equity-backed	54	
Non-sponsored	210	
Venture capital-backed	26	
- Entities removed due to missing post-IPO data		25
Final sample (excluding VC)		**239**
Hereunder		
Private equity-backed	**51**	
Non-sponsored	**188**	

5.5 Credibility

The accuracy of any scientific study is vital as research outcomes are of no value if the methods from which they are derived are lacking reliability, validity and replicability.

Reliability refers to the consistency of a measure of a concept, and is concerned with the question of whether the findings of the paper are repeatable. The reliability indicates the accuracy of the study and to what extent the results are affected by randomness (Bryman and Bell, 2015). The data used in our sample are collected from acknowledged databases such as Bloomberg, Datastream, Compustat and Zephyr, which are commonly used by practioners in the financial industry, indicating that these are reliable sources. With a time span ranging from 1997 to 2012 (2015) we hopefully remove any temporality or irregularity that could have affected the results, suggesting that the extent to which the results are affected by randomness is low. However, as will be further elaborated in the next section, our data might suffer from both misclassification and incompleteness. Thus, despite an extensive verification and exhaustive sample selection process, the accuracy of our results might be affected by erroneous classification and missing information.

The idea of reliability is very close to the criterion of replicability. That is, in order to assess the reliability of a study, the procedures that constitute that study must be replicable by someone else. By thoroughly describing the sample collection classification and the different methods used to test the hypothesis, we consider this study replicable. Thus, anyone should be able to follow the same procedures described in the paper (Bryman and Bell, 2015).

Validity is concerned with the integrity of the conclusions that are generated from the research. It refers to the issue of whether of not an indicator that is contrived to measure a concept really measures that concept. Writers distinguish between a number of ways of testing measurement validity, hereunder internal and external validity. Internal validity relates mainly to the issue of causality, and is concerned with the question of whether a conclusion that incorporates a causal relationship between two or more variables holds water. By applying different methods used in previous studies, we are confident that the independent variables are at least partly responsible for the identified variation in the dependent variable, and thus we have measured what was intended. External validity is concerned with the question of whether the results of a study can be generalized beyond the specific research context (Bryman and Bell, 2015). We have ensured external validity through reliable methods and sources, similar to that of previous studies, as described in section 4.

5.6 Data Criticism

Because this study relies on empirical analyses, a discussion of data quality and potential data issues is necessary. Even after extensive verification and an exhaustive sample selection process, our final dataset may have some shortcomings that will be elaborated in the following section.

Firstly, due to missing information, our final sample is incomplete, as it does not include all IPOs in the Nordic region during the time period 1997-2012. As described in section 5.2, we have crosschecked the initial sample from Zephyr with IPO prospectuses, trade publications, press articles, and company and fund webpages. Even though this process mainly involved excluding listings from the Zephyr dataset, due to either missing information or unfilled criteria, we also found a few IPOs that were not included in the initial sample. To moderate the incompleteness of our sample, we have examined the trade publications of the Nordic Venture Capital Associations (NVCA, SCVA, DVCA and FVCA) for IPO exits, and added these listings to our dataset. However, despite this exhaustive crosschecking process, our final sample might be missing some more IPOs.

Secondly, our sample might suffer from erroneous classification. That is, we might have classified some listings as IPOs even though this is not the case, meaning that they should not be included in the dataset. Furthermore, when collecting industry betas for the value added analysis, we might have classified some of our entities into the wrong industry, meaning that the industry risk used in the analysis is erroneous for the respective entities that this might apply for. In addition, we might have classified a company as being private equity-backed, when in fact it is not. This fault can arise in two situations. First, as the boundaries might be blurred, the distinction between a private equity- and a venture capital-type investment has sometimes been difficult. Therefore, we might have mistakenly included IPOs that experienced a venture capital-type investment, rather than a private equity-type investment. Previous studies that analyze venture capital-backed IPOs show that they demonstrate a different performance pattern than that of private-equity backed companies, meaning that such an accidental inclusion could mislead our analysis and potentially lead to a bias. Second, our sample might erroneously include IPOs classified as private equity-backed, where the investment was indeed of the private equity-type, but where the private equity fund(s) did not hold a pre-IPO ownership of at least one-third. Fortunately, IPO prospectuses have been available for a great portion of our sample, where information regarding stockholders´ equity stakes before and after the IPO is included. Based on this, we have determined the involvement of the private equity-fund, and included the IPOs that satisfy the one-third ownership criteria. However, for some observations, prospectuses are not available. Again, this was mostly a problem regarding the early listings, due to increased publication of IPO prospectuses online. Therefore, it seems likely that the degree of erroneous classification of our sample is decreasing over time. In these cases, we have collected information about ownership structures from other sources, hereunder press articles, trade publications, and company and fund webpages. We have searched exhaustively for information regarding the company and its respective financial sponsor(s) around the time of the IPO, and thus ruled out several of the potential erroneous inclusions in the sample.

Thirdly, our sample might suffer from selection bias. By relying on the Nordic trade publications when adding additional listings to our initial Zephyr sample, we are missing information about international funds, delisted funds, and other non-members who might have completed an IPO on the Nordic market. However, our final dataset is built upon the initial dataset from Zephyr, where each observation is crosschecked with IPO prospectuses, trade publications, press articles, and company and fund webpages. It is in these trade publications and webpages we have discovered a few listings not included in Zephyr´s dataset. Thus, we have not based our dataset on information that exclude international funds, delisted funds and non-members. In addition, because the overall proportion of international funds in the Zephyr dataset is initially small, we believe the share that might be missing to be minor, and thus consider the magnitude of this fault to be small. Furthermore, to our knowledge, the only delisted fund in this study´s time period is *Norsk Vekst ASA*, which was sold to Norvestor Equity in 2005, a fund that is present in our final sample. Furthermore, as it seems like the degree of incompleteness and misclassification decreases over time, this might also be a source of potential selection bias in the sample. That is, we observe a generally greater transparency in the later part of our sample as a result of the standard of publishing company information online. Therefore, our early sample probably encompasses a smaller share of actually completed IPOs, compared to the later part of the sample. However, this seems to be a general problem in similar studies (see for example Schöber, 2008; Bernstein, Lerner and Strömberg, 2010).

Fourthly, our self-constructed market-share ratios might suffer from survivorship bias. That is, the companies included in each entity´s peer group, are companies that are currently listed on any of the Nordic main exchanges. Even though we use data from t_0 and t_3 to calculate the market shares, the values might have been different if we had included companies that are no longer publicly traded, but was at t_0 at t_3.

Finally, our abnormal return calculations probably suffer from survivorship bias as well, as we have excluded companies that were not publicly traded for 36 months after the IPO. That is, companies that were delisted during the first three years after the initial public offering are not included in our sample. From our sample, 25 entities did not survive our post-IPO observation period. According to Bilo, Christophers, Degosciu and Zimmermann (2005), various studies in the literature have demonstrated that the exclusion of delisted entities leads to overly optimistic results, and thus an upward bias in the calculated abnormal return. The focus of most previous studies have been on mutual fund performance, see for example Grinblatt and Titman (1989), Elton, Gruber and Blake (1996) and Carhart, Carpenter, Lynch and Musto (2000). According to Bilo, Christophers, Degosciu and Zimmermann (2005), the survivorship bias in previous studies account for 0,1% to 1,5% annualized return bias, depending on the time period, instruments (stocks, bonds), and the sample of funds. However, in contrast to standard performance literature, Bilo, Christophers, Degosciu and Zimmermann (2005) finds that including the non-surviving entities lead to higher returns. For example, they report a positive survivorship bias of 1.81% for 1986-2003. A possible explanation to this positive survivorship bias is that it is not only bad company performance that explains the delistings; some companies are delisted due to merges, acquisitions and changed business operations. We believe that the same holds for our sample; some of our 25 entities that did not survive, were delisted due to bad company performance and other due to merges, acquisitions and changed business operations. However, we don't know if the bias is positive or negative, but as the bias found in previous studies is relative small, we do not expect the survivorship bias in our sample to have a great effect on our results.

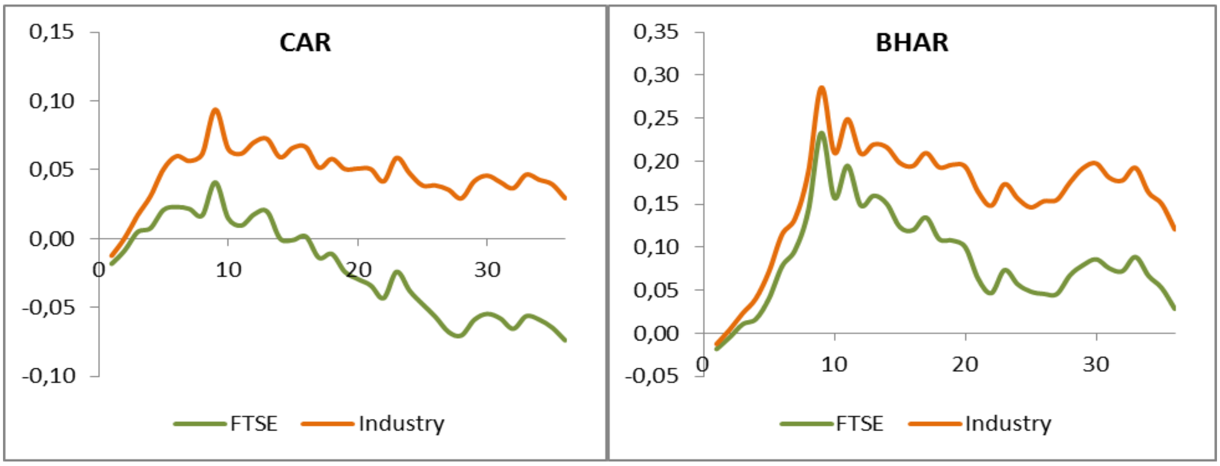
6.0 Analysis

In this section, the analysis will be performed and the results will be presented and discussed in the light of existing theories and previous literature. The section is divided into five subsections, the first covering adjustments and decisions regarding the final sample, and the last four covering the analyses relating to each problem area. For each problem area, the relevant hypotheses will be tested and the results will be presented and debated.

6.1 Final sample considerations

As discussed in the section describing data collection and sample selection, 239 IPOs have been included in the sample, where 51 IPOs are PE-backed and the remaining 188 are non-sponsored. However, before the analyses are conducted by running multiple regression analyses and testing results for significance, some considerations have to be made regarding the dependent variables used in the analyses. As mentioned in the methodology section, two benchmarks have been employed when calculating aftermarket performance through CARs and BHARs, due to the sensitivity of such calculations to the benchmark or index used (Ritter, 1991). Thus, after employing both the FTSE Nordic Index and an Industry Index for each IPO, two sets of CARs and BHARs for the sample have been derived. The average CARs and BHARs for the sample are presented below:

Graph 6.1.1 – Average CARs and BHARs for IPO sample relative to floating date



The two graphs shows CARs and BHARs for each event month relative to floating date, calculated using the two different benchmarks. From these results, it can be interpreted that the sample performs better in general when compared to its own industry, as opposed to the FTSE Nordic Index. Further on, the results emphasizes the sensitivity of the CARs and BHARs measurements to the benchmark employed, as the abnormal returns differ substantially with the indices used in the calculations. This sensitivity issue has in previous literature been offered as one of the explanations to why studies conclude differently when investigating IPO aftermarket performance, and is a topic one should be aware of when studying previous literature (Ritter, 1991). Thus, it is intriguing to continue down the path of investigating how the further test results would differ between the use of the Industry index and the FTSE Nordic Index. However, as this thesis is limited in terms of scope and time, we need to choose one index to base the remaining analysis on. This decision is in line with several other studies, as previous literature commonly base aftermarket performance investigation by regression analysis on only one benchmark (Ritter, 1991; Bergström, Nilsson and Wahlberg, 2006; Levis, 2011). Thus, this thesis will continue using the CARs and BHARs calculated using the FTSE Nordic Index as benchmark. The reason this benchmark was chosen, is that this particular index represents only the Nordic countries, and hence matches our sample geographically. Due to the fact that the Nordic countries are somewhat secluded from the rest of Europe, companies in these countries might have a different set of characteristics than companies in central Europe. Furthermore, as all the companies in the sample are listed in the Nordic countries, this benchmark is inclined to be made up by an industry mix comparable to our sample, as argued by Ritter (1991). Even though we only use the FTSE Nordic Index as the benchmark in our subsequent analysis, the robustness of the results will be tested in section 7 by employing the industry index in calculations of CAR and BHAR.

Further on, from graph 6.1.1 it is worth noticing the surprisingly high BARs for all event months. As several previous studies show significant IPO underperformance, the highly positive BHARs seem to go against most previous literature. However, it is important to keep in mind that this might not be surprising in the light of the BHAR approach's characteristics. To specify, the compounding of abnormal returns will for some observations lead to extremely positive values (Schöber, 2008). As the general BHAR methodology take the average of all observations, these values might be pushed upwards due a few, extremely positive outliers. Thus, this suggests that the analysis and testing of CARs and BHARs might benefit from using medians instead of means, or from removing certain outliers. This topic will be elaborated later in this section, after the abnormal results have been tested for normality.

As discussed, the relevant CARs and BHARs need to be tested for normality, as their distributional properties decide whether their means and medians can be tested for significance using standard, parametric test statistics. Generally, for a normal distribution, the mean and median should be equal or close to equal, and the skewness coefficient, which measures symmetry, should be approximately zero. Furthermore, the excess kurtosis coefficient that measures the spread should also be close to zero (Pappas and DePuy, 2004). By looking at the statistics in question for CAR 36 months and BHAR 36 months, presented in the table below, it is evident that the abnormal returns of the sample do not exhibit the required characteristics of a normal distribution:

Table 6.1.1 – Descriptive Statistics for CAR 36 and BHAR 36

Descriptive Sample Statistics		
	CAR 36	BHAR 36
n	239	239
Mean	-0,0739	0,0285
Median	-0,0601	-0,1926
Standard Deviation	0,9148	1,2325
Skewness	-0,0886	5,1470
Excess Kurtosis	1,0884	40,4403

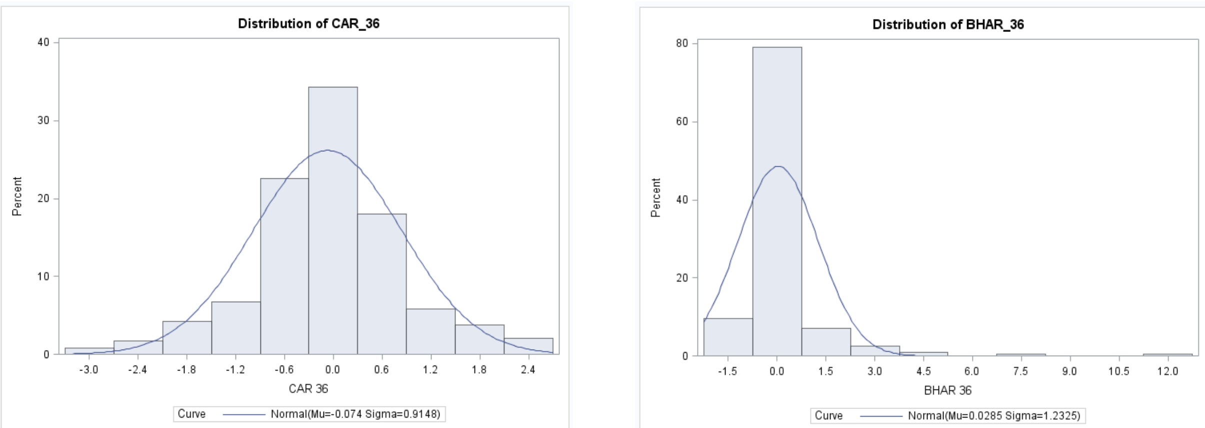
From the obtained statistics it is apparent that neither CAR 36 nor BHAR 36 can be classified as normally distributed. This is especially evident for BHAR 36, as its distribution exhibits high excess kurtosis and skewness. However, these results were expected, given the BHAR properties discussed in the methodology section. Even though the sample statistics suggest that the abnormal returns do not follow a normal distribution, a normality test is conducted in SAS to confirm the results. The corresponding test statistics are presented below:

Table 6.1.2 – Test statistics for normality

Test	**CAR 36** Statistic		**BHAR 36** Statistic	
Shapiro-Wilk	W	0.975176 (0.0003)	W	0.594388 (0.0001)
Kolmogorov-Smirnov	D	0.078843 (<0.0100)	D	0.201771 (<0.0100)
Cramer-von Mises	W-Sq	0.342764 (<0.0050)	W-Sq	3.965709 (<0.0050)
Anderson-Darling	A-Sq	2.199503 (<0.0050)	A-Sq	21.72307 (<0.0050)

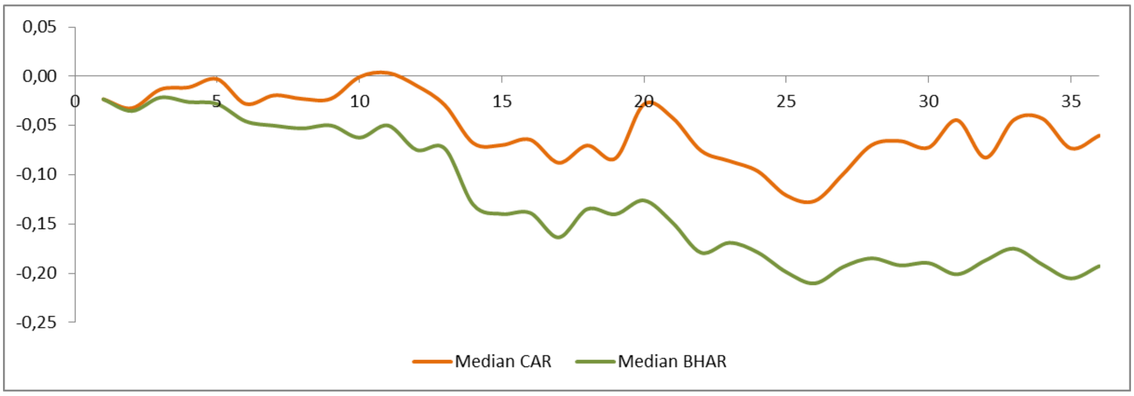
In general, if the p-values are less than 0.05, then the data should be considered non-normally distributed. However, these tests are heavily dependent on sample size, and therefore graphical representations are examined below. Distribution and probability plots for both CAR 36 and BHAR 36 can be found in appendix 11.2 where one can see that both variables experience departures from the straight diagonal line in the normal probability plot, indicating departures from normality (Pappas and DePuy, 2004).

Graph 6.1.2 – Distribution of CAR 36 and BHAR 36



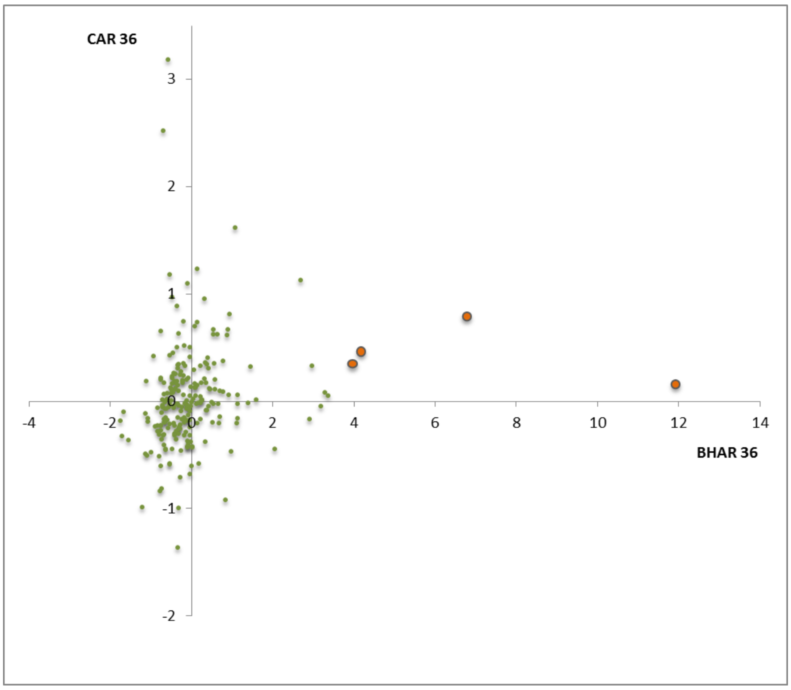
Based on the presented statistics, tests and graphs, it is evident that the sample abnormal aftermarket performance does not follow a normal distribution. Thus, we draw the conclusion of having to employ the non-parametric tests elaborated in the methodology section, the Wilcoxon Signed-Rank and the Wilcoxon Rank Sum, to test the significance of the calculated abnormal returns. As previously explained, these tests do not assume normal distribution, and test the significance of the sample median. As sample medians will be used in further analyses, the sample CARs and BHARs medians are presented below, by plotting the medians for each event month relative to the IPOs' floating date:

Graph 6.1.3 – Medians for CAR and BHAR relative to floating date



In the light of the previously discussed issues regarding extreme outliers and their influence on the mean, graph 6.1.3 presenting the medians of the CARs and BHARs suggest that this most likely is an important issue in our sample as well. When comparing graph 6.1.3 displaying sample medians to graph 6.1.1 displaying sample means, it is evident that for the BHARs especially, some extreme values are pushing the average up. As it is already concluded that the sample abnormal returns do not follow a normal distribution, and that standard, parametric tests can yield errors, this issue will not present difficulties when testing if the abnormal returns are significantly different from zero, since non-parametric tests based on medians will be employed. However, as some hypotheses will be tested using multiple regression analysis, the apparent outliers in the sample represent an issue that needs to be dealt with. To fully identify the problem of outliers, a scatterplot of CAR 36 and BHAR 36 is presented below, visually presenting the couple of extreme values produced by the BHAR methodology.

Graph 6.1.4 – Scatterplot of CAR 36 and BHAR 36



As displayed in the scatterplot, some BHARs in the sample are extremely high, pushing the average BHAR dramatically upwards. Thus, the most extreme outliers are identified and removed from the sample in the multiple regression analysis, to mitigate potential bias. The four outliers in question are Vestas Wind Systems, Clas Ohlson, Sevan Marine and Aker ASA (all non-sponsored IPOs), all four producing a BHAR of around 4 or higher, equivalent to a 400% or higher outperformance. By excluding these observations from the sample used in the multiple regression analysis, the most obvious outliers are removed, and the sample is deemed ready for further analyses.

6.2 Aftermarket performance

H_0: Both private equity-backed and non-sponsored IPOs show no significant abnormal returns, in the short-, medium- or long-term, measured by both BHAR and CAR.

H_1: All IPOs show signs of significant negative abnormal returns in all periods, where abnormal returns are measured by both BHAR and CAR.

Ad H_0 and H_1: Table 6.2.1 reports all IPOs' medians calculated by both CAR and BHAR in event time for 6, 12 and 36 months. Consistent with previous research on IPO aftermarket performance on the US market (Ritter, 1991; Cao & Lerner, 2009) and on the European market (Levis, 2011), all calculated medians are negative, suggesting an underperformance of the entire IPO sample in all time horizons. As explained in the hypotheses section, this result is expected in the light of previous studies and presented theory. However, no medians except for BHAR 36 are significantly different from zero, meaning that we fail to reject the null of medians equal to zero and no abnormal returns. In the light of theory suggesting IPOs in general will underperform in comparison to the market in the long run, due to overoptimistic investors pushing the price upwards and the aftermarket price converging down to the real value in the long run (Miller, 1977), the insignificant medians of our sample are somewhat surprising. The sample results are presented below:

Table 6.2.1 – Sample medians for all IPOs measured by CAR and BHAR

	All IPOs, n=239				
	CAR		**BHAR**		
Months	Median	p-value	Median	p-value	
6	-0,02792	0,5021	-0,04560	0,2034	
12	-0,00930	0,5773	-0,07462	0,1409	
36	-0,06006	0,1691	-0,19258	0,0002	***
**p < 0,10; **p < 0,05; ***p < 0,01*					

Based on the calculated U-statistic, derived from the Wilcoxon Signed Rank S-statistic, we find evidence of median BHAR 36 being significantly smaller than zero. The calculations can be found in appendix 11.4.

There are several possible explanations to why our sample does not show any significantly negative medians, except when measured by BHAR for 36 months. First of all, few published studies have researched IPO aftermarket performance in the Nordic market, as most previous literature investigates the European or American market. Thus, the possibility of the existence of different IPO market dynamics in the Nordic countries is a topic worth keeping in mind, given the sparse research on this particular geographical area. Second of all, the sample investigated in this thesis does only consist of companies listed on the main stock exchanges in the Nordic countries, hereunder Oslo Børs and NASDAQ OMX. As defended in the data collection and sample selection section, all companies listed on smaller, secondary stock exchanges, such as First North and Oslo Axess, have been removed from the sample. Further on, this may be of importance when measuring aftermarket performance, since the largest stock exchanges operate with certain requirements for companies applying to be listed. One of these requirements involves that the firms need to show an established track record, another requires the companies' market capitalization to be of a certain size. Given that all firms in the sample meet these requirements, there is a present possibility of these firms being better equipped to go public than smaller firms with a less established track record. In the light of the findings presented in Levis (2011), the size of a firm's market capitalization has a significant, positive influence on IPO aftermarket performance, suggesting that the firms in our sample might perform better than smaller firms issued on other stock exchanges. Moreover, as several previous studies have included IPOs listed on smaller, secondary stock exchanges with less strict requirements, one could imagine this might, and to some degree, explain our negative, but insignificant, medians.

In addition to the size and track record of our sample firms, we need to take the size of our chosen market into consideration. As previously mentioned, there is sparse previous research on IPO aftermarket performance in the Nordic countries, which presents the question if methods and approaches employed on other markets are appropriate to use in this thesis. In particular, it can be seen that the Nordic market is smaller than, for example, the American market, raising the question on whether the IPOs in our sample make up a larger share of the chosen benchmark than in other markets. To illustrate, both Ritter (1991) and Bergström, Nilsson and Wahlberg (2006) emphasize that the market index at which most IPOs in the sample are traded is commonly the best benchmark choice, as this index will contain a comparable industry mix to the sample. However, as these studies were conducted on larger markets than the Nordic market, there is an existing possibility of that the firms in our sample represent a large fraction of the FTSE Nordic Index throughout the research period. If this is the case, the results could be biased towards finding no abnormal returns (Ritter, 1991). Further on, as our only significantly negative median is the BHAR 36 months, this issue will be kept in mind throughout the analysis, and later on, a robustness check will be conducted through a regression analysis on CAR 36 and BHAR 36 calculated with the industry index as benchmark.

Finally, it is important to note that even though most of the calculated medians are statistically insignificant, they still show negative medians. In addition, the calculated BHAR for 36 event months is, in fact, statistically negative and significant on a 1% level, indicating that the sample does indeed, show signs of negative abnormal returns.

H_2: The effect of being private equity-backed on aftermarket performance is positive for the sample, and private equity-backed IPOs show less negative abnormal returns than non-sponsored IPOs, in all periods and measured by both BHAR and CAR.

Ad H_2: Table 6.2.2 show the event time median CAR and BHAR calculated for 6, 12 and 36 months, where the sample firms are classified by whether or not they were private equity-backed at floating date. Furthermore, the table shows the p-value generated by the Wilcoxon Rank Sum in SAS when testing if the two medians significantly differ. As can be interpreted from table 6.2.2, all reported medians are negative, however only significant for CAR 6 for non-sponsored firms and BHAR 36 for both private equity-backed and non-sponsored firms. This corresponds to the results presented in table 6.2.1 and indicates a negative aftermarket performance for both types of firms. From the calculated U-statistics derived from the signed-rank S-statistics, we find evidence of these medians being significantly smaller than zero. The calculations can be found in appendix 11.4. However, table 6.2.2 also reports that for both performance measures and for all time horizons, we fail to reject the null of statistically equal medians. In the light of the theories presented by Bergström, Nilsson and Wahlberg (2006), these results are somewhat surprising, as we expected a significant difference between the two medians with PE-backed IPOs showing less negative medians than their non-sponsored equivalents. The findings are presented below:

Table 6.2.2 – Sample medians classified by PE and NS measured by CAR and BHAR

CAR

	PE-backed, n=51			**Non-sponsored, n=188**			**H0: PE = NS**
Months	Median	p-value		Median	p-value		p-value
6	-0,06818	0,1562		-0,06147	0,0102	**	0,2939
12	-0,06431	0,5726		-0,00201	0,7318		0,7577
36	-0,09279	0,3393		-0,05229	0,2759		0,8600

BHAR

	PE-backed, n=51			**Non-sponsored, n=188**			**H0: PE =NS**
Months	Median	p-value		Median	p-value		p-value
6	-0,08546	0,1076		-0,03315	0,5263		0,3391
12	-0,01491	0,3585		-0,06839	0,2236		0,9283
36	-0,18235	0,0642	*	-0,20547	0,0014	***	0,9247

**p < 0,10; **p < 0,05; ***p < 0,01*

In addition to calculating the medians for the two groups of IPOs and testing for difference in medians, multiple regression analyses with both CAR 36 and BHAR 36 as dependent variables were conducted, with the results presented in table 6.2.3 and table 6.2.4, respectively. Both regressions are tested for heteroscedasticity by conducting both the White's test and the Breuch-Pagan test, both tests reported in appendix 11.3.1. Even though we fail to reject the null of homoscedasticity for the BHAR 36 regression, both regressions are performed using heteroscedasticity consistent standard errors, seeing as this will not provide erroneous results. In addition, when running the Variance Inflation Factors (VIF) test it confirms that there are no multicollinearity problems. In regards to the formulated H_2, it can be seen that the coefficient on the binary variable PE is negative, but statistically insignificant for both multiple regression analyses. With respect to the previous discussed theories presented by Bergström, Nilsson and Wahlberg (2006), these results are unexpected in terms of both negative *and* insignificant coefficient estimates. Further on, it is worth noticing that both models shows low R^2, indicating that the explanatory variables does not explain more than 8,85% and 9,46% of the variation in CAR 36 and BHAR 36, respectively. The two regression outputs are presented below:

Table 6.2.3 – Multiple regression analysis with CAR 36 as dependent variable

Dep: CAR_36	**n=235**				
R2 0,0885			**Heteroscedasticity Consistent**		
Variable	**Parameter estimate**		**Standard error**	**t Value**	**Pr > |t|**
Intercept	-1,23468	***	0,45876	-2,69	0,0077
Log(1+age)	0,11275	***	0,04235	2,66	0,0083
Log(MarketCap)	0,13298	*	0,06893	1,93	0,0550
Asset Turnover	0,14215	**	0,06817	2,09	0,0382
Leverage	-0,00389	*	0,00211	-1,84	0,0670
PE	-0,10293		0,17434	-0,59	0,5555
Market_Book	0,22279		0,14221	1,57	0,1186
BUST	-0,00695		0,12516	-0,06	0,9557
PE*Market_Book	0,44003		0,28405	1,55	0,1228
PE*BUST	-0,05982		0,25397	-0,24	0,8140
**p < 0,10; **p < 0,05; ***p < 0,01*					

Table 6.2.4 – Multiple regression analysis with BHAR 36 as dependent variable

Dep: BHAR_36	**n=235**				
R2 0,0946			**Heteroscedasticity Consistent**		
Variable	**Parameter estimate**		**Standard error**	**t Value**	**Pr > |t|**
Intercept	-1,08143	***	0,38931	-2,78	0,0059
Log(1+age)	0,10660	**	0,04379	2,43	0,0157
Log(MarketCap)	0,12078	*	0,06454	1,87	0,0626
Asset Turnover	0,09976	***	0,03764	2,65	0,0086
Leverage	-0,00208		0,00176	-1,18	0,2382
PE	-0,12013		0,14546	-0,83	0,4097
Market_Book	0,22963	*	0,12889	1,78	0,0762
BUST	-0,16250		0,11568	-1,40	0,1615
PE*Market_Book	0,74487		0,47146	1,58	0,1155
PE*BUST	-0,01774		0,23178	-0,08	0,9391
**p < 0,10; **p < 0,05; ***p < 0,01*					

The results presented in tables 6.2.2, 6.2.3 and 6.2.4 raise some important questions regarding the private equity industry in the Nordic countries. As previously discussed, the insignificant negative medians for both groups could be explained to some degree by the sample selection process and the benchmark employed for abnormal returns calculations. However, as the selection criteria and methods used in this sample are identical for both private equity-backed and non-sponsored IPOs, this would most likely not explain the insignificant *difference* between the two groups of IPOs. In addition, four outliers with extreme abnormal returns were removed from the sample before running the regression. As these four firms were all non-sponsored IPOs, the suggested negative coefficient on private equity-backing is strengthened. As previously mentioned, this questions the theories presented by Bergström, Nilsson and Wahlberg (2006), as they argue that private equity-backed IPOs should, in general, outperform their non-sponsored peers as they are larger and more transparent, and thus less subject to non-sophisticated, optimistic retail investors valuing them too high with the consequence of a long-run price decline. However, the research on private equity-backed IPOs outside the United States has been sparse and inconclusive. Even though Bergström, Nilsson and Wahlberg (2006) and Levis (2011) find that private equity-backed IPOs in London and Paris outperform other IPOs, Jelic, Saadouni and Wright (2005) find no significant difference in the long-run performance of private equity-backed MBOs and non-sponsored equivalents on the London Stock Exchange. Further on, when investigating the performance of IPO performance in the Nordics, previous research is limited.

Thus, it raises the question if one should be careful to draw conclusions of private equity influence on IPO aftermarket performance in the Nordic countries based on research on the US market, as the private equity industry might differ severely between these two markets. For example, Spliid (2013) argues that American-based data and theories on the private equity industry might not be transferrable to other regions due to the differences in management cultures, the size of the economies and in the structure of industries. Furthermore, the Nordic region's investment market is much smaller, in combination with the governments being more eager to control private equity and to reduce the industry's tax advantages (Spliid, 2013). Finally, it is evident that compared to the US private-equity industry, the Nordic industry is much younger and consequently less mature. To illustrate, the private equity industry as known today boomed in the US in the 1970s, and were for many years limited to America, Canada and England, with the first PE firms in the Nordics being established in Sweden in 1989 (Spliid, 2013). As our sample covers IPOs issued between 1997 and 2012, it is evident that several of these issues are the consequences of some of the first private equity deals in the region. As this thesis tests the long-run performance of such deals, it can be discussed if the PE industry in the Nordics, in this particular research period, has been too young to establish good practices and routines to ensure the optimal aftermarket performance of the listed firms. Also, taking into consideration that Nordic PE firms are subject to stricter regulations and control by the governments than in the US, there is reason to believe that PE firms in the Nordics do not manage to fully exploit the potential benefits PE-backing could bring to firms.

To summarize, even though the effect of being PE-backed in our sample was negative, though insignificant, it is hard to tell if this is surprising, given the extremely sparse previous research on the Nordic market. Though, these results indicates that one should be careful to draw any conclusions based on research conducted on more mature private equity industries, such as the American and English private equity industries. Thus, seeing as the Nordic private equity industry is younger and subject to stricter government control than other industries, the different markets will perhaps be more comparable as more time passes and the Nordic private equity industry becomes more mature and established, thus being able to capture and exploit the potential benefits of private equity control and ensure a significant effect of private equity backing on IPO aftermarket performance.

6.3 Market-to-book Analysis

H_0: There is no significant relationship between low initial market-to-book ratio at floating date and firm performance for all IPOs in the sample, in the short-, medium- or long term, measured by both BHAR and CAR.

H_1: IPOs with low initial market-to-book ratios show less negative abnormal performance than those with high market-to-book ratios in all periods, measured by both BHAR and CAR.

Ad H_0 and H_1: Table 6.3.1 presents the median aftermarket returns measured by BHAR and CAR for all time periods, classified by the initial market-to-book ratio of the sample IPOs. Together with each sample median, one can find the p-value reported when running the Wilcoxon Singed-Rank test to investigate the individual significance of each groups´ median. Here, one can see that every median, except that of CAR 36 for IPOs having a low market-to-book ratio, are negative as expected. However, looking at the p-values, none of the reported medians are significantly different from zero, except that of BHAR 36 for IPOs having a higher market-to-book ratio. Further on, as elaborated in section 4, we will therefore test whether this median is significantly smaller than zero. The calculated U-statistic based on the signed-rank S-statistic is -15.51 with a p-value of <0.0001. Thus, the median BHAR 36 for IPOs having a higher market-to-book ratio is significantly smaller than zero.

Looking at the hypothesis that IPOs with low initial market-to-book ratios show less negative abnormal performance than those having a higher ratio, in the short-, medium- and long term, measured by both CAR and BHAR, we first test whether there is a significant difference between the medians of the two samples by employing the Wilcoxon Rank Sum test. The last column of table 6.3.1 displays the p-values reported from this test. Here, we fail to reject the null of equal medians in all time periods for both BHAR and CAR, suggesting that there is no statistical difference between the medians of the two samples. This is not as expected, as theory suggests that IPOs classified as having a low initial market-to-book ratio should outperform the IPOs having a higher ratio, because of their greater potential for abnormal returns. However, for BHAR 36, we are close to rejecting the null of equal medians at a 10% significance level.

Table 6.3.1 – Sample medians classified by MB-ratio, measured by CAR and BHAR

CAR

	All IPOs MB low, n=60		All IPOs MB high, n=179			H0: High=Low
Months	Median	p-value	Median	p-value		p-value
6	-0,02290	0,45740	-0,02792	0,74690		0,69450
12	-0,01109	0,68910	-0,00918	0,62460		0,92370
36	0,03297	0,98840	-0,09279	0,11970		0,39800

BHAR

	All IPOs MB low, n=60		All IPOs MB high, n=179			H0: High=Low
Months	Median	p-value	Median	p-value		p-value
6	-0,03255	0,37750	-0,04839	0,34030		0,79870
12	-0,03727	0,51220	-0,08700	0,20070		0,78210
36	-0,03318	0,63630	-0,25449	<0,0001	***	0,11420

**p < 0,10; **p < 0,05; ***p < 0,01*

Regression (1.1) shows somewhat similar results when looking at CAR 36, where the coefficient of the market-to-book variable is not statistically significant. However, when the regression is run for BHAR 36, we come to a different conclusion. Thus, the coefficient on the market-to-book variable is statistically significant for BHAR 36. The different findings when looking at the Wilcoxon tests and the regression output can be explained by the use of medians instead of means. The whole regression output for regression (1.1) can be found in section 6.2, while the regression outputs for the MB dummy, which is of interest in this section, are presented in table 6.3.2.

Table 6.3.2 – Regression output looking at the market-to-book variable

Dep: CAR_36		**Heteroscedasticity Consistent**		
Variable	**Parameter estimate**	**Standard error**	**t Value**	**Pr |t|**
(...)				
MB	0,22279	0,14221	1,57	0,1186

Dep: BHAR_36		**Heteroscedasticity Consistent**		
Variable	**Parameter estimate**	**Standard error**	**t Value**	**Pr |t|**
(...)				
MB	0,22963 *	0,12889	1,78	0,0762
**p < 0,10; **p < 0,05; ***p < 0,01*				

The parameter estimate for the market-to-book variable in the two regressions are both positive, hereunder 0.22279 and 0.22963, suggesting that having a low market-to-book ratio have a positive partial effect on abnormal return. This is in line with our expectations based on previous studies that find evidence of a positive relationship between abnormal returns for IPOs with lower market-to-book ratios (e.g. Lakonishok, Shleifer and Vishny, 1994; Brav, Geczy and Gompers, 2000; Simultin, 2009). Theory explains this positive relationship by the greater upside potential that can be present for companies with low market-to-book ratios. However, the t-value for the market-to-book ratio in the CAR 36 regression is 1,57 with a corresponding p-value of 0.1186, meaning that we fail to reject the null that there is no relationship between low market-to-book at floating date and firm performance for all IPOs in the sample measured by CAR 36. For the BHAR 36 regression, the t-value is 1.78 with a corresponding p-value of 0.0762, and thus, the coefficient is statistically significant. That is, when measured by BHAR 36, we reject the null that there is no significant relationship between IPOs having a low initial market-to-book ratio and aftermarket performance for all IPOs in the sample, suggesting that a positive relationship exists.

Thus, the positive relationship is statistically significant for BHAR 36, but not for CAR 36. As described in section 4.1.5, this is not a unique finding, as previous studies show that the results may differ with the use of these two calculation methods. The fact that the regression on BHAR 36 yields a significant relationship between performance and low initial market-to-book ratio, while the regression on CAR 36 does not, might be explained by the compounding technique of the BHAR method, where this approach tend to produce more extreme results (Gompers and Lerner, 2003). CAR, on the other hand, produces less extreme results. However, if we instead of employing the commonly used significance levels of 0.01, 0.05 and 0.10, increase our significance level to 0.15, i.e., decide that the hypothesis will be rejected if the p-value is less than 0.15, we find a significant relationship for both the BHAR 36- and CAR 36 regression.

H_2: The effect of a low initial market-to-book ratio on aftermarket performance is greater for PE-backed IPOs than for non-sponsored IPOs, in all periods and measured by both BHAR and CAR.

Ad H_2: The results of the Wilcoxon Rank Sum test are presented in the last column of table 6.3.3. Here, we test whether there is a significant difference in the median abnormal return for private equity-backed and non-sponsored IPOs having an initial low market-to-book ratio, measured by BHAR and CAR, in all time periods. Looking at the p-values, we fail to reject the hypothesis that these medians are significantly different.

Table 6.3.3 – Sample medians classified by MB-ratio, PE and NS, measured by CAR and BHAR

CAR

	MB low PE, n=3		MB low NS, n=57		H0: Low PE = Low NS
Months	Median	p-value	Median	p-value	p-value
6	0,01422	1,00000	-0,02807	0,48190	0,8481
12	0,17174	0,25000	-0,02054	0,49180	0,1849
36	0,48506	0,50000	0,01771	0,80490	0,2772

BHAR

	MB low PE, n=3		MB low NS, n=57		H0: Low PE = Low NS
Months	Median	p-value	Median	p-value	p-value
6	-0,01100	0,75000	-0,03455	0,41570	0,9238
12	0,08434	0,25000	-0,04787	0,36340	0,2346
36	0,43920	0,50000	-0,03409	0,44810	0,2088

**p < 0,10; **p < 0,05; ***p < 0,01*

Regression (1.1) shows similar results, where the coefficient on the PE*MB dummy for both CAR 36 and BHAR 36 is not statistically significant. Table 6.3.4 presents the outputs for the PE*MB dummy. The total regression outputs for regression (1.1) can be found in section 6.2.

*Table 6.3.4 – Regression output looking at the PE*MB variable*

Dep: CAR_36		**Heteroscedasticity Consistent**		
Variable	**Parameter estimate**	**Standard error**	**t Value**	**Pr |t|**
(...)				
MB*PE	0,44003	0,28405	1,55	0,1228

Dep: BHAR_36		**Heteroscedasticity Consistent**		
Variable	**Parameter estimate**	**Standard error**	**t Value**	**Pr |t|**
(...)				
MB*PE	0,74487	0,47146	1,58	0,1155
**p < 0,10; **p < 0,05; ***p < 0,01*				

The parameter estimate for the PE*MB variable for the CAR 36 and BHAR 36 regressions are 0.44003 and 0.74487, respectively, suggesting that the effect of having a low market-to-book ratio is greater for private equity-backed companies. Looking at the p-values one can see that the coefficients are not statistically different from zero, i.e. the difference in the effect of having a low market-to-book ratio for private equity-backed and non-sponsored companies is not significant for both CAR 36 and BHAR 36. However, as proposed above, if we expand our significance level to 0.15, the conclusion changes. Thus, at a significance level of 0.15, the coefficients are, in fact, statistically significant and in line with our expectations of private equity-backed companies being better equipped to improve return on assets.

To sum up, the only reported median abnormal return that is significantly different from zero is that of BHAR 36 for all IPOs having a higher market-to-book ratio. When looking at the difference between median abnormal returns for all IPOs, classified by market-to-book ratio, we find evidence of no significant difference between the medians of the two samples. Furthermore, when looking at median abnormal returns for private equity-backed and non-sponsored IPOs having an intial low market-to-book ratio, we also fail to reject the hypothesis that these medians significantly differ.

When looking at the regression output, we fail to prove that low market-to-book ratio has a (positive) significant explanatory power on the aftermarket performance, measured by CAR 36. The regression on BHAR 36 shows different results. Thus, when aftermarket performance is measured by BHAR 36, we find evidence of a positive significant relationship between low market-to-book ratio and aftermarket performance. Though, at a significance level of 0.15, we find the same evidence for the CAR 36 regression. Furthermore, also at a significance level of 0.15, we find that for companies having a low market-to-book ratio, the private equity-backed companies are able to take advantage of this in a better way than non-sponsored companies. This suggests that the special characteristics of private equity-backed companies that distinguish them from non-sponsored companies, make them better equipped to improve return on assets and turn the firm around, compared to the non-sponsored companies, which is in line with our expectations. However, if stick with the commonly used significance levels of 0.01, 0.05 and 0.10, the only significant relationship between aftermarket performance and low initial market-to-book ratio we are able to identify, is when running regression on BHAR 36.

6.4 IPO Cyclicality

H_0: There is no significant relationship between IPO activity at floating date and aftermarket performance for all IPOs in the sample, in the short-, medium- and long-term, measured by both BHAR and CAR.

H_1: IPOs floated in bust markets with low IPO activity show less negative abnormal returns than IPOs floated in booming markets with high IPO activity in all periods, measured by both BHAR and CAR.

Ad H_0 and H_1: Table 6.4.1 displays the calculated sample medians for all time horizons classified by whether the firm was issued in a bust or a boom market, together with the reported p-values when running a Wilcoxon Rank Sum test with the null hypotheses being that the two groups' medians are equal. Here, most calculated medians are negative as expected, with the exception of CAR 6 and 12. However, only half of the calculated medians are significantly different from zero, corresponding well to previous presented calculated sample medians. More surprising is the fact that the medians significantly differing from zero are all but one the negative medians of the IPOs issued in bust markets, when, according to theory, these firms should outperform the firms issued in boom markets. For the medians significantly differing from zero, we have calculated the corresponding U-statistics based on the Wilcoxon Signed Rank S-statistic to test whether these medians are significantly smaller than zero. The calculations can be found in appendix 11.4 where one can see that for every significant median, they are, indeed, significantly smaller than zero.

Further on, it is interesting to notice that by using both the CAR and the BHAR approach, we are able to reject the null of equal medians in the short- and the medium-term. Thus, table 6.4.2 reports sample medians together with the p-value for the Wilcoxon Rank Sum one-sided test statistic, for the null hypotheses of the medians of IPOs issued in bust markets being higher than the medians of IPOs issued in boom markets. Table 6.4.1 and table 6.4.2 are presented below:

Table 6.4.1 – Sample medians classified by BUST and BOOM, measured by CAR and BHAR

CAR									
	BUST, n=98			**BOOM, n=141**			**H0: BUST=BOOM**	
Months	Median	p-value		Median	p-value		p-value	
6	-0,06982	0,0457	**	0,00634	0,4271		0,0363	**
12	-0,12813	0,0351	**	0,04378	0,3665		0,0402	**
36	-0,07916	0,4564		-0,04789	0,2359		0,8413	

BHAR								
	BUST, n=98			**BOOM, n=141**			**H0: BUST=BOOM**	
Months	Median	p-value		Median	p-value		p-value	
6	-0,08023	0,0089	***	-0,01847	0,6486		0,0287	**
12	-0,15079	0,0122	**	-0,01597	0,9290		0,0523	*
36	-0,2668	0,0430	**	-0,18523	0,0025	***	0,2578	

**p < 0,10; **p < 0,05; ***p < 0,01*

Table 6.4.2 – Test of H_1: BUST > BOOM

	CAR							
	BUST, n=98			**BOOM, n=141**			**H0: BUST > BOOM**	
Months	Median	p-value		Median	p-value		p-value	
6	-0,06982	0,0457	**	0,00634	0,4271		0,0182	**
12	-0,12813	0,0351	**	0,04378	0,3665		0,0201	**
36	-0,07916	0,4564		-0,04789	0,2359		0,4206	

	BHAR							
	BUST, n=98			**BOOM, n=141**			**H0: BUST > BOOM**	
Months	Median	p-value		Median	p-value		p-value	
6	-0,08023	0,0089	***	-0,01847	0,6486		0,0144	**
12	-0,15079	0,0122	**	-0,01597	0,9290		0,0262	**
36	-0,2668	0,0430	**	-0,18523	0,0025	***	0,1289	

**p < 0,10; **p < 0,05; ***p < 0,01*

From table 6.4.2 it can be seen that for both CAR and BHAR 6 and 12, the null of bust medians being significantly larger than boom medians can be rejected. For CAR and BHAR 36, no significant differences between the two group's medians are detected. These findings suggest that when there is, in fact, a significant difference between IPOs issued in bust and boom markets, the IPOs floated in boom markets perform better in the aftermarket than their equivalents issued in bust markets. However, this difference is only significant for the short- and medium term, whereas both CAR 36 and BHAR 36 shows insignificant differences in the two groups' medians. These results are confirmed by regression (1.1) on CAR and BHAR 36, where the estimated coefficients are presented in table 6.4.3. The total regression outputs for regression (1.1) can be found in section 6.2.

Table 6.4.3 – Estimated coefficients on BUST variable

Dep: CAR_36		Heteroscedasticity Consistent		
Variable	Parameter estimate	Standard error	t Value	Pr |t|
(...)				
BUST	-0,00695	0,12516	-0,06	0,9557

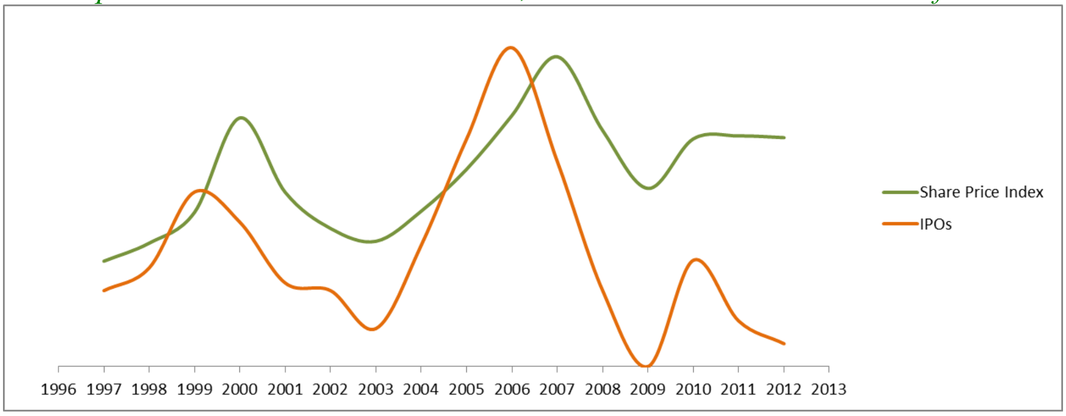
Dep: BHAR_36		Heteroscedasticity Consistent		
Variable	Parameter estimate	Standard error	t Value	Pr |t|
(...)				
BUST	-0,1625	0,11568	-1,40	0,1615
**p < 0,10; **p < 0,05; ***p < 0,01*				

From table 6.4.3 it can be seen that the estimated coefficients on BUST are negative, though insignificant. As both theory and empirical findings suggest a positive effect on aftermarket performance of issuing IPOs in bust markets, these results go against general beliefs. As previously explained, the expected positive coefficient on the BUST variable is based on the theory claiming that in bust markets, investors will be less optimistic, leading their valuations of IPOs to be more realistic than in boom markets. Thus, when time passes, the converging of the IPO valuation towards the true value will be less dramatic, translating to a less poor aftermarket performance for the bust markets IPOs. However, the findings presented in above tables contradict this theory by showing negative and insignificant estimated sample coefficients for the long term, completely opposite to what one might expect. Overall, there are two important topics to consider when interpreting the results.

First of all, the insignificant difference between IPOs issued in bust and boom markets does only hold for the long term, that is 36 months. However, for both 6 and 12 months, results suggest significant differences between the two groups of IPOs, though we have to reject the predicred result of bust medians being higher than boom medians. These findings indicate that in the short- and medium term, IPOs issued in boom markets actually perform better than their equivalents issued in bust markets. Furthermore, this raises the question of whether the converging towards a «true» IPO value, as argued by Ritter (1991) and Loughran and Ritter (1995), is a process that takes more time than the 36 months covered by this thesis. Further on, as Schultz (2003) explains the negative effect of being issued in a boom market by the pseudo market timing theoriy, he argues that IPOs issued in boom markets will be issued close to the peark in the market, and will thus be sensitive to the following recession. However, these findings might suggest that the sample IPOs issued in boom markets was not listed straight before the market peak, and that it may have taken some time after the listing before the market moved over in a recession. Seeing as both the Wilcoxon Rank Sum test and additional regression analyses on CAR and BHAR for 6 and 12 event months (to be found in appendix 11.6) show a significantly negative effect of being issued in a bust market, but no significant effect in the long term, this might indicate that it takes some time for the positive effect of being issued in a bust market to be present in findings.

Secondly, the definitions of “Bust” and “Boom” markets needs to be taken a closer look at. As explained in the methodology section, the firms are classified into categories based on the definitions presented in Ljungqvist, Nanda and Singh (2006), where “hot” IPO markets are defined as markets with high investor optimism and thus, following the argumentation of Ibbotson (1975) and Schultz (2003), clusters of IPOs. However, this classification is based on the belief that in markets with high IPO activity, the general economy is booming and the investors are, indeed, overoptimistic. Further on, the classification also assumes that in the periods not defined by IPO clusters, the general economy is slow and the investors are, indeed, not that optimistic. However, this classification presents the important question of whether the market conditions actually *were* slow in the years classified as bust markets. Given the limited amount of total IPOs in the research period, one have to consider if the amount of IPOs each year is, in fact, a fruitful approach for deciding whether the year was characterized by a bust or a boom market. To illustrate the correlation between high valuations and the amount of IPOs, graph 6.4.1 portrays the Share Price Index for the Nordic countries together with the amount of IPOs for the research period. Here, the Share Price Index is chosen to portray economic activity due to the theories stating that booming market activity is recognized by high prices and optimistic investor valuations. As the Share Price Index portrays the overall share prices in the market, this approach could paint a picture of investor optimism throughout the research period.

Graph 6.4.1 – The Share Price Index, Nordic countries and amount of IPOs



Source: OECD Statistics (Share Price Index) and own table based on sample (Amount of IPOs)

From graph 6.4.1 it can be seen that the amount of IPOs does, to some extent, follow the Share Price Index in the years of the research period. On the other hand, it can also be seen that for each classified "boom" period, that is in 1999-2000 and 2005 through 2007, the amount of IPOs peaks a year previous to the peak in the Stock Market Index. Further on, the years of 2010 through 2012, in this thesis classified as "bust" markets with low IPO activity, show relatively high market prices. Thus, based on the Stock Market Index, the "boom" market years would, in this thesis, be defined as the years 2000, 2006, 2007, 2008 and 2011, varying some from the classifications used in the analysis. Hence, one could imagine that the classification of bust and boom years could, to some degree, explain the unexpected findings in this thesis.

H_2: The effect of being listed in a bust market with low IPO activity at floating date on aftermarket performance is greater for PE-backed IPOs than for non-sponsored IPOs in all periods, measured by both BHAR and CAR.

Ad H_2: The results of the Wilcoxon Rank Sum test are presented in the last column of table 6.4.4. In this section, we test whether there is a significant difference in the median abnormal return for private equity-backed and non-sponsored IPOs issued in bust markets, measured by BHAR and CAR, for all time horizons. Looking at the p-values, we fail to reject the hypothesis that these medians are significantly different.

Table 6.4.4 – Sample medians classified by PE BUST and PE BOOM

CAR						
	BUST PE, n=23		BUST NS, n=75			H0: BUST PE= BUST NS
Months	Median	p-value	Median	p-value		p-value
6	-0,07179	0,3416	-0,06784	0,0804	*	0,7203
12	-0,12792	0,5953	-0,13883	0,0412	**	0,5431
36	-0,06006	0,9063	-0,07951	0,4259		0,7708

BHAR						
	BUST PE, n=23		BUST NS, n=75			H0: BUST PE= BUST NS
Months	Median	p-value	Median	p-value		p-value
6	-0,06806	0,1572	-0,09517	0,0212	**	0,5598
12	-0,14812	0,4777	-0,19093	0,0137	**	0,4432
36	-0,18235	0,6371	-0,30437	0,0347	**	0,5212

**p < 0,10; **p < 0,05; ***p < 0,01*

Regression (1.1) provides similar findings, with the coefficients on the PE*BUST dummy for both CAR 36 and BHAR 36 not being statistically significant. Table 6.4.5 presents the outputs for the PE*BUST dummy. The total regression outputs for regression (1.1) can be found in section 6.2.

*Table 6.4.5 – Estimated coefficients on PE*BUST variable*

Dep: CAR_36	Heteroscedasticity Consistent			
Variable	Parameter estimate	Standard error	t Value	Pr |t|
(...)				
PE*BUST	-0,05982	0,25397	-0,24	0,814

Dep: BHAR_36	Heteroscedasticity Consistent			
Variable	Parameter estimate	Standard error	t Value	Pr |t|
(...)				
PE*BUST	-0,01774	0,23178	-0,08	0,9391

**p < 0,10; **p < 0,05; ***p < 0,01*

As can be seen from table 6.4.5, the coefficient estimates on the PE*BUST variable for the CAR 36 and BHAR 36 regressions are -0,05982 and -0,01774, respectively. However, as the reported p-values are exceptionally high and we thus fail to reject that the coefficients in both regressions are significantly different from zero, these findings suggest that there are no significant extra effect of being private equity-backed when listed in a bust market.

Further on, these results indicates that private equity-backed companies do not manage to exploit the market advantages expected when issuing equity in a bust market. These results contradict our expectations, seeing as the theoretical foundations would support a significantly positive extra effect of being private equity-backed. This raises the question of why the private equity in the Nordics are unable to benefit from, and exploit favorable market conditions, especially since findings presented in previous research, though on other markets, show a positive effect of being PE-backed and of being issued in markets with low IPO-activity. This question brings the discussion back to the topics debated in section 6.2, where the potential differences in the private equity industry across regions are in focus. As concluded in section 6.2, the findings based on this sample indicates that one should be careful to draw conclusions on the effect of private equity backing based on results from other markets, seeing as the Nordic private equity industry exhibits some characteristics that differ from the private equity industry in other geographical markets (Spliid, 2013).

To summarize this section, we conclude that the sample results were highly different from what one would expect based on the proposed theories. That is, IPOs issued in bust markets performed significantly poorer than those issued in boom markets in both the short- and the medium-term, and findings showed no significant differences between the two IPO groups in the long-term. Furthermore, private equity-backed IPOs in the sample issued in bust markets did not manage to outperform non-sponsored IPOs with equal market assumptions. However, as previously discussed in section 6.2, the research on the effect of being private equity-backed in the Nordics is highly limited, and one should be careful to draw any conclusions based on the research conducted on markets with a more mature and developed private equity industry.

6.5 Value Added Analysis

6.5.1 Final sample considerations

As described in section 4.1.6, we will run an OLS multiple regression analysis to estimate the difference in growth in value added between private equity-backed and non-sponsored companies. In order to use the standard Student´s t-test when testing the estimators, we need the multiple regression parameters to be BLUE. We have therefore tested the regression for multicollinearity and heteroscedasticity, and the results can be found in appendix 11.5. When testing for heteroscedasticity we reject the null of no heteroscedasticity, and the regression will therefore be run with White Errors. We have calculated Variance Inflation Factors (VIF) for the estimated model in order to confirm that there are no collinearity problems. In addition, we have created scatterplots to identify potential outliers in the sample. As can be seen in Appendix 11.5, no extreme outliers were detected. Furthermore, as elaborated in section 4.1.7, it is important that the regression does not suffer from omitted variable bias. To mitigate this problem, we have based our regression to that of Wilson, Wright, Siegel and Scholes (2012).

6.5.2 Findings

H_0: There is no significant difference in growth in value added between private equity-backed IPOs and non-sponsored IPOs.

H_1: Private equity-backed IPOs show stronger growth in value added compared to that of non-sponsored IPOs.

The parameter estimates yielded by regression (1.2) can be found in table 6.5.1.

$$\begin{aligned} Ln(Value\ Added) &= \beta_0 + \beta_1 Ln(L) + \beta_2 Ln(K) + \beta_3 Ln(Age) + \beta_4 Industry\ Risk \\ &+ \beta_5 Competition + \beta_6 Bust + \beta_7 PE + \beta_8 d3 + \beta_9 (Ln(L) * d3) + \beta_{10} (Ln(K) \\ &* d3) + \beta_{11} (Ln(Age) * d3) + \beta_{12} (Industry\ Risk * d3) + \beta_{13} (Competition \\ &* d3) + \beta_{14} (Bust * d3) + \beta_{15} (PE * d3) + \varepsilon_i \end{aligned} \tag{1.2}$$

Table 6.5.1 – Value Added Parameter Estimates

Dep: ln(Value added)	**n=420**				
R2 0,7718			**Heteroscedasticity Consistent**		
Variable	**Parameter estimate**		**Standard Error**	**t Value**	**Pr > |t|**
Intercept	0,321900		0,45439	0,71000	0,47910
ln(L)	0,179170	***	0,03876	4,62000	<0,0001
ln(K)	0,680850	***	0,04124	16,51000	<0,0001
ln(age)	0,140960	***	0,04899	2,88000	0,00420
Industry risk	-0,205240		0,21923	-0,94000	0,34970
Mkt share	1,482100	***	0,34734	4,27000	<0,0001
Bust	0,117980		0,12030	0,98000	0,32730
PE	0,182520		0,13794	1,32000	0,18650
d3	0,303030		0,63235	0,48000	0,63200
ln(L*d3)	0,033670		0,05842	0,58000	0,56470
ln(K*d3)	-0,009690		0,06216	-0,16000	0,87620
ln(age*d3)	-0,019970		0,08678	-0,23000	0,81810
industry risk*d3	-0,111590		0,26447	-0,42000	0,67330
Mkt share*d3	-0,135390		0,46634	-0,29000	0,77170
Bust*d3	0,014450		0,17049	0,08000	0,93250
PE*d3	0,119460		0,18171	0,66000	0,51130

**p < 0,10; **p < 0,05; ***p < 0,01*

In line with prior research, we find strongly significant and positive signs on capital, ln(K), and labor, ln(L).

However, the coefficient of interest in testing our hypotheses, is that of the interaction term PE*d3, β_{15}. As can be seen in table 6.5.1, the estimated coefficient is 0.119460, suggesting that private equity-backed companies generate a stronger growth in value added compared to that of non-sponsored companies. Looking at the p-value of 0.51130, we fail to reject H_0, meaning that there is no significant difference in growth in value added between private equity-backed IPOs and non-sponsored IPOs. Thus, we cannot find evidence of a significant stronger growth in value added generated by private equity-backed IPOs, compared to that of non-sponsored IPOs, as hypothesized in H_1. Hence, for our sample, the estimated coefficient has the sign as expected, but is not statistically significant. These findings are in contrast to previous research, raising the question of which differences between our Nordic sample and the sample used in previous studies that can explain these conflicting results.

As described in section 3.4 there are, to our knowledge, no academic researches on this topic in the Nordic region. Based on the performance studies by the Nordic venture capital associations, which show that private equity-backed companies generate higher growth in value added, we hypothesized that our sample of IPOs would show similar results as comparable academic research on other markets, hereunder UK and OECD markets (e.g. Bernstein, Lerner, Sorensen and Strömberg, 2010; Wilson, Wright, Siegel and Scholes, 2012). However, this is not the case. This illustrates that even though private equity-backed firms are successful in the Nordic countries, as shown in previous performance studies, they are working in a quite different environment than that of other academic research. This problem is pointed out in the research of Bernstein, Lerner, Sorensen and Strömberg (2010), where they address the concern that the impact of private equity is different in continental Europe than in the United States and United Kingdom. The level of private equity activity is higher in the US and UK than in most other nations, and the industry is also more established as it has its roots in these two nations (Bernstein, Lerner, Sorensen and Strömberg, 2010). Despite these differences, they conclude that their findings of significantly higher growth rates in industries where private equity funds have been active, are not driven solely by common law nations such as the United Kingdom and United States, but also hold in Continental Europe (Bernstein, Lerner, Sorensen and Strömberg, 2010). Even though the Nordic region is included in their study of Continental Europe, we fail to find similar results for our sample.

In the previously discussed paper by Spliid (2013), the author focuses on differences between the private equity market in the Nordic region and the US, and argues that because of differences in management culture, industry structures, size of economies as well as differences in the way credit and capital markets work, theories based on the US market are not necessarily transferrable to the Nordic region. Even though we do not base our hypotheses in this section on previous American studies, we believe that there are some differences between the Nordic region and the UK and OECD markets that can explain why we fail to conclude that the theories hold for our sample.

For example, Spliid (2013) argues that governance structure is one of the key concepts of private equity, and as described in section 2.4.1, the governance structure we find in private equity is believed to reduce agency costs and thereby enable portfolio companies to improve performance and provide them with extensive value added post-investment support. According to Spliid (2013), the focus of the governance theory and the reduced agency costs, is financial incentives, which might not be applicable to the Nordic region because of value differences. Thus, the theories suggesting that the governance structure we find in private equity, and the extensive value added post-investment support it should provide to the portfolio companies, might not be valid for the Nordic countries. An interesting question is therefore whether the principal-agent theory works in the Nordic region, and how it works in other countries in Continental Europe as well as in the UK. According to Hofstede (1980), (cf. Spliid, 2013), the corporate culture in the Nordic countries is characterized by more feminine than masculine values, which is interesting as masculinity indicates an attitude towards financial incentives (Spliid, 2013). As can be seen in table 6.5.2, feminine values emphasize caring for the weak, quality of life, cooperation and modesty, while masculine values emphasize heroism, material rewards for success, achievement and assertiveness (Spliid, 2013; Hofstede, 2016). According to Spliid (2013), these values work as proxy values for *sensitivity to financial incentives,* and the masculine values are exactly the factors necessary for financial incentives within private equity.

Table 6.5.2 – Feminity and Masculinity

Femininity	**Masculinity**
Jealousy of those trying to excel	Competition; trying to excel
Rewards are based on equality	Rewards for winning
People work in order to live	Hard work
Leisure time is preferred over more money	Money as an important incentive
Welfare society ideal	Performance society ideal

Source: Own table based on Spliid (2013) and Hofstede (2016)

The MAS Score (masculinity) for selected European countries as well as the US can be found in table 6.5.3. In contrast to Norway, Sweden, Denmark and Finland, other European countries such as the UK, France, Germany and Italy show significantly greater masculinity scores, suggesting that financial incentives have less impact in the Nordic region.

Table 6.5.3 – MAS Score

Country	MAS Score
	Masculinity
	Femininity
Sweden	**5**
Norway	**8**
Denmark	**16**
Finland	**26**
Portugal	31
Spain	42
France	43
Belgium	54
Czech Republic	57
U.S	62
Poland	64
Germany	66
U.K	66
Irelad	68
Italy	70
Switzerland	70
Austria	79
Hungary	88
	Masculinity

Source: Own table based on Spliid (2013) and Hofstede (2016)

Based on the findings in Table 6.5.3 one could argue that even though performance studies show that private equity-backed firms are successful in the Nordic region, the environment differs from that of other academic research, suggesting that private equity firms operating in the Nordic countries should acknowledge that financial incentives alone do not necessarily lead to the same results as in the UK and other continental European countries. That is, the governance structure that we hypothesized would provide portfolio companies with extensive value added post-investment support, does not generate a significant greater growth in value added for private equity-backed companies in our sample.

7.0 Robustness Tests

In this section, robustness tests will be performed to investigate the sensitivity of our results to changes in some specific properties of the previously performed analysis. The section is divided into three subsections, each focusing on different robustness tests. Further on, it is important to note that in this thesis, several decisions regarding the methodology, approaches and employed variables have been made, meaning that due to the limited amount of time and pages, we have to limit the robustness tests to the topics regarded the most essential. However, other considerations and choices made, and their consequences for the findings, will be thoroughly discussed in section 8; Discussion and suggestions for further research.

7.1 Time horizons

Three aftermarket performance time horizons have been analyzed in this thesis, which is 6 months, 12 months and 36 months. However, the regression analyses on CAR and BHAR have only been conducted for a time horizon of 36 months, seeing as the overall topic of the thesis is to investigate the *long-run* aftermarket performance of the IPOs in the sample. Even though the other two time horizons are included in the analysis by calculating and reporting their medians corresponding to each hypothesis, one could imagine that a regression analysis performed on CAR and BHAR in the short- and medium-term could provide some interesting changes in findings. Moreover, in the light of findings presented by Ibbotson (1975), where his empirical results show that aftermarket performance varies across years relative to the time of the listing, it is interesting to see whether the results of the regression analyses performed on CAR and BHAR are sensitive to the time horizon used, and if there can be found some significant effects not captured by the calculated medians. Thus, we will investigate whether our findings presented in the analysis are robust by comparing them to results yielded by a regression analysis on CAR and BHAR in the short- and medium-term. Further on, as the gap between event month 12 and event month 36 is relatively large, we will extend the robustness test to including CAR and BHAR for 24 months, testing whether our explanatory variables will have any different effects on the 2-years IPO aftermarket performance. The estimated coefficients and their corresponding p-values can be found in tables 7.1.1 and 7.1.2, whereas the complete outputs can be seen from appendix 11.6.

Table 7.1.1 – Regression analyses on CAR 6, 12, 24 and 36

Dep: CAR	n=235 Heteroscedasticity Consistent											
	6 months			12 months			24 months			36 months		
Variable	Parameter estimate		Pr > |t|	Parameter estimate		Pr > |t|	Parameter estimate		Pr > |t|	Parameter estimate		Pr > |t|
Intercept	-0,51182	**	0,0448	-0,59404		0,1119	-0,43494		0,3039	-1,23468	***	0,0077
Log(1+age)	-0,00729		0,7509	0,01918		0,5602	0,08200	**	0,0273	0,11275	***	0,0083
Log(MarketCap)	0,10548	**	0,0245	0,10568		0,1008	0,02941		0,6662	0,13298	*	0,0550
Asset Turnover	0,06610	**	0,0219	0,13148	**	0,0115	0,12937	**	0,0179	0,14215	**	0,0382
Leverage	-0,00232	**	0,0308	-0,00362	**	0,0245	-0,00376	*	0,0692	-0,00389	*	0,0670
PE	-0,14677	*	0,0655	-0,17056		0,2243	-0,13208		0,4099	-0,10293		0,5555
Market_Book	0,09411		0,3092	0,22381	*	0,0804	0,25999	**	0,0490	0,22279		0,1186
BUST	-0,18386	**	0,0117	-0,31342	***	0,0027	-0,17007		0,1658	-0,00695		0,9557
PE*Market_Book	0,00711		0,9592	0,26241		0,2460	-0,16334		0,6512	0,44003		0,1228
PE*BUST	0,13730		0,2817	0,13184		0,4972	0,12810		0,6418	-0,05982		0,8140

**p < 0,10; **p < 0,05; ***p < 0,01*

Table 7.1.2 – Regression analyses on BHAR 6, 12, 24 and 36

Dep: BHAR	n=235 Heteroscedasticity Consistent											
	6 months			12 months			24 months			36 months		
Variable	Parameter estimate		Pr > |t|	Parameter estimate		Pr > |t|	Parameter estimate		Pr > |t|	Parameter estimate		Pr > |t|
Intercept	-0,65953	*	0,0934	-0,31794		0,5431	-0,40294		0,4881	-1,08143	***	0,0059
Log(1+age)	-0,02896		0,4860	-0,00449		0,9199	0,07398		0,1118	0,10660	**	0,0157
Log(MarketCap)	0,15643	*	0,0792	0,10544		0,2264	0,04082		0,6433	0,12078	*	0,0626
Asset Turnover	0,09583	**	0,0459	0,23354	**	0,0253	0,11193		0,1104	0,09976	***	0,0086
Leverage	-0,00392	**	0,0330	-0,00747	**	0,0140	-0,00433	**	0,0487	-0,00208		0,2382
PE	-0,19788	*	0,0871	-0,27282		0,1964	0,05976		0,8505	-0,12013		0,4097
Market_Book	0,22394		0,2713	0,37400		0,1704	0,20152		0,1256	0,22963	*	0,0762
BUST	-0,30431	**	0,0107	-0,52675	***	0,0032	-0,20940	*	0,0803	-0,16250		0,1615
PE*Market_Book	-0,09623		0,6566	0,16126		0,6731	-0,20474		0,6858	0,74487		0,1155
PE*BUST	0,20071		0,1987	0,18514		0,4569	0,12724		0,7989	-0,01774		0,9391

**p < 0,10; **p < 0,05; ***p < 0,01*

When looking at the outputs presented in tables 7.1.1 and 7.1.2, several interesting developments can be observed. First of all, the estimated coefficients on the PE variables are for both CAR 6 and BHAR 6 negative and statistically significant on a 10% level, suggesting that for the sample, being private equity-backed has a negative effect on aftermarket performance 6 months subsequent to the listing. Further on, this significance was not captured by table 6.2.2 in the analysis section, which, to some degree, is explained by the use of medians instead of means. However, for the remaining time horizons, the effect of being private equity backed is not, as previously observed, statistically significant.

Secondly, the findings suggest that when measured by CAR, having a low market-to-book value at listing has a positive and significant influence on aftermarket performance at event month 12 and event month 24. Similar to the effect of the PE variable in event month 6, the significant effect of having a low market-to-book value is not captured when testing for differences in medians in event month 12. Thus, we see that the results are sensitive to the choice between medians and means in the case of market-to-book value as well.

Finally, we observe from tables 7.1.1 and 7.1.2 that the effect of being issued in a bust market, the extra effect of being private equity-backed when issued with a low market-to-book value, and the extra effect of being private equity-backed when issued in a bust market are all as expected when looking at the reported medians in table 6.4.2 and the regression outputs presented in the analysis, suggesting that these results are relatively robust to the change between medians and means.

To summarize, we see that the effect of being private equity-backed and the effect of having a low market-to-book value are both sensitive to the estimation methods employed. Thus, some effects could only be captured using a regression analysis, indicating that one should be careful drawing conclusions only based on one method. However, given the previously discussed properties of the sample, with several IPOs having truly high abnormal returns due to the measurement methods, one should be careful to conclude that only one method provides the true results.

7.2 Benchmark

As discussed in section 6.1, we have in the analysis employed CARs and BHARs calculated using the FTSE Nordic Index as benchmark. However, seeing as previous research emphasize the sensitivity of results to the benchmark employed (Ritter, 1991; Bergström, Nilsson and Wahlberg, 2006; Levis, 2011), we will perform the multiple regression analyses on CAR 36 and BHAR 36 over, this time using the industry index as benchmark. Furthermore, the sample medians are calculated. Hence, we check whether our previously derived findings are robust to changes in the benchmark employed. The sample medians based on the industry index can be found in table 7.2.1, and the regression outputs in table 7.2.2. and 7.2.3, all presented below:

Table 7.2.1 – Sample medians calculated using the industry index as benchmark

n=239	All IPOs			
	CAR		**BHAR**	
Months	Median	p-value	Median	p-value
6	0,00596	0,2598	-0,00266	0,6313
12	0,04636	0,2401	-0,00513	0,6757
36	0,06724	0,3967	-0,12400	0,1589

**p < 0,10; **p < 0,05; ***p < 0,01*

Table 7.2.2 – Regression on CAR 36 using the industry index as benchmark

Dep: CAR_36	**n= 235**				
R2 0,0831			**Heteroscedasticity Consistent**		
Variable	**Parameter estimate**		**Standard error**	**t Value**	**Pr > |t|**
Intercept	-0,97835	**	0,46152	-2,12	0,0351
Log(1+age)	0,08784	**	0,04268	2,06	0,0407
Log(MarketCap)	0,11065		0,06927	1,60	0,1116
Asset Turnover	0,16145	***	0,05761	2,80	0,0055
Leverage	-0,00456	**	0,00224	-2,04	0,0430
PE	-0,07486		0,17851	-0,42	0,6754
Market_Book	0,27317	*	0,14450	1,89	0,0600
BUST	0,05838		0,12655	0,46	0,6450
PE*Market_Book	0,02520		0,30885	0,08	0,9350
PE*BUST	-0,00136		0,26449	-0,01	0,9959

**p < 0,10; **p < 0,05; ***p < 0,01*

Table 7.2.3 – Regression on BHAR 36 using the industry index as benchmark

Dep: BHAR_36	**n= 235**				
R2 0,0795			**Heteroscedasticity Consistent**		
Variable	**Parameter estimate**		**Standard error**	**t Value**	**Pr > |t|**
Intercept	-0,80517	**	0,40963	-1,97	0,0506
Log(1+age)	0,07937	*	0,04394	1,81	0,0722
Log(MarketCap)	0,08875		0,06591	1,35	0,1795
Asset Turnover	0,14630	***	0,03961	3,69	0,0003
Leverage	-0,00306	*	0,00183	-1,67	0,0971
PE	-0,09074		0,14641	-0,62	0,5361
Market_Book	0,28569	**	0,13449	2,12	0,0347
BUST	-0,06831		0,11693	-0,58	0,5597
PE*Market_Book	0,14558		0,51889	0,28	0,7793
PE*BUST	0,08112		0,24394	0,33	0,7398

**p < 0,10; **p < 0,05; ***p < 0,01*

Studying table 7.2.1, we detect two differences when compared to the sample medians calculated using the FTSE Nordic Index as benchmark; in this case, all sample medians calculated using the CAR approach are positive, and BHAR 36 is no longer significant. When looking at graph 6.1.1 displaying the sample average CAR and BHAR based on both the FTSE Nordic Index and the industry index, it is not surprising that performing abnormal return calculations based on the industry index yields higher medians. However, no medians are significantly different from zero, as was also the case for the initial analysis performed using the FTSE Nordic Index. Thus, these findings suggest that our previously discussed sample medians are relatively robust to changes in the benchmark.

However, when looking at the regression results for CAR 36 and BHAR 36 when using the industry index, we see that there are some notable differences. First, when analyzing the output of the CAR 36 regression, we see that the coefficient estimate on the PE variable is still negative and insignificant, suggesting that the effect of being private equity-backed on aftermarket performance is still insignificant for the sample firms. However, we see that the estimated coefficient on the BUST variable is now positive, though still insignificant. Thus, even though the effect of being issued in a bust market is positive for the sample firms, this effect is not significantly different from zero. Moreover, the most remarkable difference between the CAR 36 regressions is that for the CAR 36 calculated using the industry index as benchmark, the estimated coefficient on the MB variable is still positive, but now significant at a 10% level, suggesting that for the sample, having a low market-to-book ratio will provide a significant, positive effect on the 36 months' aftermarket performance.

Secondly, looking at table 7.2.3 presenting the output for the BHAR 36 regression, we see that even though we now have a slightly lower R^2, there are no striking differences when calculating BHARs with the industry index as benchmark. Still, it is worth noting that in this regression, the estimated coefficient on the MB variable is statistically significant at a 5% level, whereas the initial regression in the analysis section reported the estimated coefficient only significant at the 10% level. Besides the MB variable, no remarkable differences are found, seeing as the coefficients on PE, BUST and on the interaction dummies are all still statistically insignificant.

To summarize the findings of this robustness test, it can be seen that the findings of our sample is not remarkably sensitive to changes in the benchmark employed. Even though the CAR medians for all time horizons are now positive when calculating abnormal returns using the industry benchmark, the sample medians for both CAR and BHAR for all time horizons are statistically insignificant. Further on, the regression analyses results show that the effects of private-equity backing, issuing the IPO in a bust market and the extra effects of being private equity-backed when having a low market-to-book value or issuing the IPO in a bust market are all insignificant. However, for both CAR and BHAR when using the industry index as benchmark when calculating abnormal returns, the positive effect of having a low market-to-book value at listing is statistically significant. Thus, for some of the variables investigated in this thesis, the robustness test suggests that the findings are sensitive to changes in the benchmark employed, as expected based on similar findings in previous research.

7.3 Early sample versus late sample

As discussed in the analysis section, the Nordic private equity industry is relative young and immature compared to the private equity industries in other regions. Thus, the IPOs studied in this thesis are the consequences of some of the first private deals in the Nordic region, which, as discussed in section 6, might be a part of the reason to why our sample show insignificant effects of being private equity-backed when studies on other countries and regions report positive effects of being backed by private equity firms. With this topic in mind, it is interesting to investigate whether our sample shows different results if we split the sample into two separate analyses, one covering the IPOs issued in the first 8 years of our research period (1997-2004), and the other covering the IPOs issued in the remaining 8 years (2005-2012). Seeing as we believe that the young age of the Nordic private equity industry might contribute to the insignificant effect of being private equity-backed on IPO aftermarket performance, a multiple regression analysis has been conducted on both BHAR and CAR for the early and the late sample, to see if the results will indicate a development in the effect of being private equity-backed as the Nordic private equity industry has grown older. The results are presented in tables 7.3.1 and 7.3.2 (detailed results can be found in appendix 11.7).

Table 7.3.1 – Regression of CAR 36 for the early and the late sample

Dep: CAR 36

	Heteroscedasticity Consistent					
	1997-2004, n= 103			2005-2012, n= 132		
Variable	**Parameter estimate**		**Pr > |t|**	**Parameter estimate**		**Pr > |t|**
Intercept	-0,02622		0,6142	-2,21545	***	0,0030
Log(1+age)	0,03711		0,5628	0,13192	**	0,0282
Log(MarketCap)	0,07126		0,3767	0,22564	*	0,0533
Asset Turnover	0,09286		0,1582	0,21812	**	0,0188
Leverage	-0,00604	**	0,0424	-0,00029		0,9240
PE	-0,50060		0,4148	0,09626		0,6111
Market_Book	0,25846		0,2166	0,28744		0,1244
BUST	-0,27790		0,1702	0,11371		0,4378
PE*Market_Book	0,86676	***	0,0018	0,33186		0,2330
PE*BUST	0,34817		0,5914	-0,27253		0,3493

**p < 0,10; **p < 0,05; ***p < 0,01*

Table 7.3.2 – Regression of BHAR 36 for the early and the late sample

Dep: BHAR 36

	Heteroscedasticity Consistent					
	1997-2004, n= 103			2005-2012, n= 132		
Variable	**Parameter estimate**		**Pr > |t|**	**Parameter estimate**		**Pr > |t|**
Intercept	-1,35688	*	0,0712	-0,06959	*	0,0935
Log(1+age)	0,06275		0,5164	0,15430	***	0,0004
Log(MarketCap)	0,21199	*	0,0744	0,02490		0,7244
Asset Turnover	0,09848	**	0,0327	0,06119		0,3174
Leverage	-0,00195		0,5219	-0,00225		0,1852
PE	-0,43456	*	0,0817	-0,03817		0,7958
Market_Book	0,31055		0,2411	0,18714		0,1326
BUST	-0,40056	*	0,0575	0,05428		0,6836
PE*Market_Book	1,66918	***	<.0001	0,19796		0,5424
PE*BUST	0,41451		0,2251	-0,19305		0,4732

**p < 0,10; **p < 0,05; ***p < 0,01*

From table 7.3.1 presented above, we see that for CAR 36 in both the early and the late sample, the estimated coefficients on private equity-backing are both insignificantly different from zero, suggesting that the effect of private equity-backing has not developed remarkably when looking at the late sample. However, we see that for CAR 36, the estimated coefficient on private equity-backing is negative for the early sample, and positive for the late sample. Even though this would indicate a positive development for the "private equity effect", the estimates are, as mentioned, not significant.

However, looking at table 7.3.2, we see that for BHAR 36, the estimated coefficient on private equity-backing for the early sample is highly negative and significantly different from zero on a 10% level. Furthermore, the late sample suggests an insignificant effect of being private equity-backed. These results could indicate that for the IPOs issued when the private equity industry was very young and immature, the effect of being private equity backed was negative in regards to the aftermarket performance, but over the years, as the industry has grown older, this negative effect is no longer significant. Furthermore, this might suggest that the private equity industry needs to grow older and establish procedures to enable the potential positive effects of being private equity-backed to translate into a significantly positive IPO aftermarket performance, a development that might take several years.

8.0 Discussion and suggestions for further research

In the following section, we will discuss some of the decisions made throughout our study and the following consequences of these choices. Furthermore, we will give suggestions for further research.

To start, it is important to be aware of that the results of this thesis, similar to the results of most previous studies on this topic, are sensitive to several choices regarding sample selection, methodology and scope. Therefore, as we have throughout the thesis made several decisions, we have aimed to mitigate bias and present as valid results as possible by taking the methodology of previous studies into consideration. However, as discussed throughout the thesis, we have, due to limitations in terms of time and pages, discarded some areas of research that might have provided an interesting perspective to our findings. Even though we have tested our results' sensitivity to some of these choices in the previous robustness tests, there are still several important topics to be aware of. We will in this section debate these decisions and their consequences, though slightly more briefly than in the robustness test.

As discussed thoroughly in the methodology section, we have decided to exclude the initial return period from our calculations. Further on, this was done by starting the aftermarket calculations from the closing price at the second day of trading, inspired by the procedure outlined in previous studies (e.g. Ritter, 1991; Loughran and Ritter, 2004; Bergström, Nilsson and Wahlberg, 2006), where the authors exclude each IPO's individual initial return period from the abnormal aftermarket performance calculations. By following the same procedure in our calculations, we have aimed to mitigate the bias that might stem from including the initial return period in calculations. However, two factors might still influence our results and create bias in the presented findings. First, several authors have, as mentioned, defined the initial return period based on each IPO's *individual* initial return period, which could be between one day and one month (Ritter, 1991). Moreover, we have in this thesis set a general definition of the initial return period to two days, thereby not taking the individual IPOs' specific period into consideration. As previously argued, this decision was partly made because the IPO sample in this thesis is made manually due to a limited access to databases, and the collection of each IPO's initial return period would be extremely time consuming, if even possible. In addition, seeing as acknowledged previous research, hereunder f.x. Levis (2011), employs the technique of assigning only one day to the initial return period for all IPOs in his sample, we have concluded that this approach would provide the thesis with as correct results as possible. However, as one could imagine that some of the IPOs in sample might have longer initial return period than two days, the calculated abnormal returns could be somewhat erroneous.

Secondly, we have not included the initial returns as an explanatory variable in our regression analyses. As discussed in section 4.1, this choice was based on both the limited access to databases and information, and the fact that the initial return period was excluded from aftermarket abnormal calculations. However, seeing as the procedure of removing the initial return period from the aftermarket calculations were adopted by authors choosing to include initial return as an explanatory variable as well, our regression results might be somewhat biased. To illustrate, both Ritter (1991) and Levis (2011) exclude the initial return period from their calculations, though both include the initial return as an explanatory variable in their regression analyses. In their findings, they show a significant, negative effect of the initial return on aftermarket performance, of -0,206 and -0,190, respectively (Ritter, 1991; Levis, 2011). Thus, their findings indicate that the effect of having a high initial return is negative for the IPOs in the long-run. Moreover, as we have previously explained that our aftermarket calculations might include some IPO's initial return periods, it is possible that our results are somewhat negatively biased.

Furthermore, the decision made to only include the event time approach, and not the calendar time approach, is a topic worth discussing. As argued in section 4.1, these two approaches have different properties, and are in previous research used frequently, either alone or together. Thus, our findings in this thesis will not be biased or misleading by only employing one approach, such as several other empirical studies (i.e. Ritter, 1991) do, though would the calendar time approach provide the thesis with an interesting perspective to the presented findings. As can be seen from previous research, the event time approach is by far the most common way to measure abnormal returns. However, several studies use the calendar time approach to ensure the robustness of the results, and to see whether this approach provide other findings (Gompers and Lerner, 2003). In short, this approach is mainly performed due to the assumptions of independent IPO returns under the event time approach, an assumption that has been shown to not always hold in samples. Thus, to adjust for IPO clusters and avoid the bias from cross-sectional dependence across the observations, the calendar time approach can be used to correct this dependence by comparing aftermarket returns in terms of calendar dates, and not event dates (Schöber, 2008). Taking previous empirical research into consideration, we have studied the results achieved by Levis (2011) and Bergström, Nilsson and Wahlberg (2006) by the use of the calendar time approach, to gain an understanding on how this approach could have changed our results. Both these studies have used the event time approach as the primary method to test the long-run performance of private-equity backed IPOs and non-sponsored IPOs listed in Europe, and use the calendar time approach as an alternative method, to test the robustness of the findings. Interestingly, both studies report that the use of the calendar time approach does not provide any changes to the major findings derived by the event time approach (Levis, 2011; Bergström, Nilsson and Wahlberg, 2006). Thus, both the calendar time and the event time approach suggest that private equity backed IPOs outperform their non-sponsored equivalents in all time periods, and that all other IPOs underperform. In the light of these findings, we are even more confident on our choice to only employ the event time approach, even though it is important to keep in mind that our presented results differ from that of Levis (2011) and Bergström, Nilsson and Wahlberg (2006) in general, suggesting that the markets are not necessarily comparable. However, seeing as this is only a different *method* to measure performance on the Nordic market, we believe that the calendar approach would not have provided any remarkable new insights to our results.

Moreover, we have in the methodology section made two other important choices that might have had an effect on our results, as presented in the analysis section. First, we have decided to only use a time horizon of three years, corresponding to 36 months. Even though regression analyses were performed on the other time horizons, that is, 6, 12 and 24 months in the robustness test, we have limited the time horizon to our definition of long-term, i.e. 36 months. Seeing as this is a widely acknowledged definition of the long-term time horizon (Ritter, 1991; Bergström, Nilsson and Wahlberg, 2006; Levis, 2011), we feel confident that this time period is long enough to yield results representative for the long-term performance of the IPOs in the sample. However, it can be seen that in some previous research, the authors have included aftermarket results until 5 years after the listing date, with mixed results. For example, in his study of general IPO aftermarket performance, Ibbotson (1975) present results indicating a positive aftermarket performance the first year, negative performance year two through four, and positive performance the fifth year. However, even though he suggests a change in results from year three to five, none of his results are statistically significant, suggesting market efficiency and zero abnormal returns in all years. Furthermore, in their study of IPO aftermarket performance over three years, Cao and Lerner (2009) test the robustness of their results by calculating aftermarket performance for a time horizon of five years. Even though one could expect a change in results, the authors find no substantial changes in findings when extending the time horizon to five years (Cao and Lerner, 2009). In the light of these results, we believe that our results are somewhat robust to an extension of the time horizon, seeing as the general perception in previous literature is that a three year time horizon is sufficient to capture the long-run performance of IPOs.

As described in section 6.4, seen in retrospective, our classification of “Bust” and “Boom” might advantageously have been different. Even though the classification method employed in our research is based on that of Ljungqvist, Nanda and Singh (2006), Ibbotson (1975) and Schultz (2003), it can be argued that instead of classifying the high IPO-activity years as “Boom” and the remaining years as “Bust” years, the analysis could have benefited from a different classification method. Seeing as this methodology assumes the years not classified as “Boom” to be periods recognized by a slow economy with low valuations, the results might be erroneous if some of the “Bust” years actually possess characteristics, market prices and valuations similar to the years classified as “Boom” years. Moreover, this might explain why the estimated coefficient on the BUST variable in our analysis is negative, though significant. Thus, as part of the research process, we have discovered that the analysis may have been improved if instead of creating one binary variable that takes the value 1 if issued in “Bust”, else 0, we had created three binary variables; one classifying the top high-IPO activity years as “Boom”, another classifying the lowest IPO-activity years as “Bust”, and a third variable classifying the years with medium IPO-activity as “Medium”, to be able to separate the years with extraordinarily slow economy and low prices from the remaining years.

Finally, it is of interest to note that the issues discussed above do only represent some of the choices we have made throughout the thesis. Thus, in this discussion section, we have chosen to focus on the decisions we find the most important and notable, and their corresponding, potential consequences. Further on, we have aimed to describe and argue the remaining choices throughout the study. These choices involves the choice of benchmark, where we have employed the CAPM model and a corresponding market index, instead of the Fama French Three Factor model and a corresponding matched-pair sample, as discussed in sections 4.1.1 and 4.1.2. However, in light of the findings presented in Cao and Lerner (2009), where their robustness test show that the CAPM model and the Fama French Three Factor model deliver equal major findings, we believe that this choice does not affect our results significantly. In addition to the benchmark considerations, we have in section 5.6 argued that the choice to not include delisted companies in the analysis will not affect our results notably, seeing as previous research argue that survivorship-bias could be both positive or negative, and would either way be of little importance to final results (Bilo, Chistophers, Degosciu and Zimmermann, 2005).

For the value added analysis, little academic research exists on the topic, leaving us with very few different methods and models to choose among. As described in section 2.4.2, Wright, Gilligan and Amess (2009) summarize approximately 100 studies of private equity and conclude that private equity involves both economic and social benefits. However, a limited amount of these studies are investigating the *value added* phenomenon of private equity. The studies looking at social benefits are rather looking at the impact of private equity on employment and wages, and not directly the value added generated to society. Thus, in contrast to the aftermarket analysis, where the pool of existing research on abnormal return is much greater, it is more challenging to discuss the choices we have made regarding the value added analysis and the model we have chosen to apply. However, as we have followed the methods of Wilson, Wright, Siegel and Scholes (2012), we believe that the model employed in our research is adequate when examine differences in value added among private equity-backed and non-sponsored companies.

In addition to investigate the effect of changing the decisions we have made, there are several other theories regarding post-IPO performance and private equity that could have been tested as well. For the remainder of this section, we will pose some suggestions for further research on the Nordic region based on different theories tested on other markets. For example, according to Wright, Gillian and Amess (2009), fund characteristics are especially important for returns, and theory suggests that the more established and experienced private equity funds generally achieve higher return. Previous researches on both US and Europe markets show that buyout managers build on prior experience by raising greater funds, which results in significantly higher revenue per partner (e.g. Diller and Kaserer, 2009; Kapland and Schoar, 2005, c.f. Wright, Gillian and Amess, 2009). Thus, investigating how fund characteristics affect aftermarket performance in the Nordic countries would be interesting. Another theory, which could be tested on the Nordic market, is that suggesting that larger deals are more successful than smaller deals, and that the likelihood of positive returns is related to the size of the buyout (Wright, Gillian and Amess, 2009). Furthermore, the effect of private equity on employment is a debated issue in the literature, and thus relevant for testing in the Nordic countries as well. For example, Lichtenberg and Siegel (1990) argue that compared to industry averages, private equity companies does not expand employment. In contrast, Kaplan (1989) finds evidence of small increases in total firm employment. Somewhere in between the two findings, Cressy, Malipiero and Munary (2007) conclude that employment in portfolio companies falls relative to the controls for the first four years but rises in the fifth (cf. Wright, Gillian and Amess, 2009).

9.0 Conclusion

Using a sample of Nordic IPOs consisting of 188 non-sponsored and 51 private equity backed IPOs listed between 1997 and 2012, this thesis show that in general, all IPOs underperform in the aftermarket measured by median CAR and BHAR in the short- medium and long-term. However, only medians measured by BHAR in the long-term show significantly negative aftermarket performance, indicating market efficiency for the entire sample.

Further on, results suggest no significant difference in the aftermarket performance of private equity backed and non-sponsored IPOs, a finding that is backed through a multiple regression analysis indicating no significant effect of being private equity-backed at listing. Moreover, no significant extra effect of being private equity-backed when listed in a bust market, or with a low, initial market-to-book ratio is found. However, results suggest that there exists a positive and significant correlation between aftermarket performance and having a low, initial market-to-book ratio at floating date for the sample IPOs. Unexpectedly, findings indicate that IPOs issued in bust markets underperform compared to those issued in booming markets in the short- and medium term. Further on, multiple regression analysis shows a negative, though insignificant, effect of being issued in a bust market in the long-term.

Finally, a value added analysis was performed on the sample to test whether there can be found a significantly positive correlation between the growth in value added to society and being private equity-backed. Here, findings suggest that the effect of being private equity-backed is, indeed, positive, however insignificantly different from zero.

In the light of our expectations based on theories and previous research, the findings of our thesis are somewhat surprising. Thus, the question of why this particular sample shows results different from that of other studies is important to consider. Here, two main topics need to be discussed. First, our results may differ from findings presented in previous research due to choices in regards to measurement method, benchmark, time horizon and sample selection criteria. As discussed more thoroughly in the analysis and discussions sections, previous research show that measurements of IPO aftermarket performance are sensitive to the methods employed throughout the analysis (Gompers and Lerner, 2003). Thus, our sample might show different results if aftermarket performance calculations were based on another benchmark than the FTSE Nordic Index, if we had used the calendar time approach instead of the event time approach, and if we had included the IPOs listed on smaller, secondary exchanges throughout the research period.
Secondly, the characteristics of the Nordic market present another possible explanation to why our results differ from the findings presented in previous research. Seeing as the existing research on IPO aftermarket performance is sparse when it comes to studies on the European market in general, research on the Nordic market is, to our knowledge, severely limited. Thus, it is difficult to compare our findings to some generally accepted knowledge about the topic in question. Further on, research

shows that the Nordic market might be characterized by different characteristics than other markets, in terms of management cultures, the size of the economies and in the structure of industries (Spliid, 2013). As the Nordic countries are somewhat secluded from the rest of Europe, these economies are tightly knitted to each other, and to a certain degree not as dependent on the European economy as a whole. Therefore, one could imagine that these economies possess characteristics that make our results differ from findings based on other markets. Furthermore, as argued by Spliid (2013), the characteristics of the private equity industry in the Nordic market is to a large extent different from the more developed and mature private equity industries found in England and the U.S, the two markets that are the focus of most previous research. As the Nordic private equity industry is young and less developed, in addition to being under stricter regulations, our insignificant findings related to private equity-backed IPOs might be explained by a private equity industry too immature to have developed procedures to fully exploit and capture the potential positive effects a company might get from being owned, developed and listed by a private equity firm.

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11.0 Appendix

11.1 Final Sample

Company	IPO Date	Industry	Exchange	Age	Non-sponsored	PE-backed
PKC GROUP	03-04-1997	Industrials	Nasdaq OMX Helsinki	28	0	1
TICKET TRAVEL GROUP	25-04-1997	Consumer Services	Nasdaq OMX Stockholm	8	0	1
SVEDBERGS I DALSTORP	03-10-1997	Industrials	Nasdaq OMX Stockholm	77	1	0
FRED OLSEN ENERGY ASA	08-10-1997	Industrials	Oslo Stock Exchange	0	1	0
MUNTERS	21-10-1997	Industrials	Nasdaq OMX Stockholm	42	1	0
SOLSTAD OFFSHORE	27-10-1997	Industrials	Oslo Stock Exchange	33	1	0
OLICOM	04-11-1997	Financials	Nasdaq OMX Copenhagen	12	1	0
ELCOTEQ NETWORK OYJ	26-11-1997	Technology	Nasdaq OMX Helsinki	13	1	0
JAAKKO PÖYRY GROUP	02-12-1997	Consumer goods	Nasdaq OMX Helsinki	39	1	0
NEW WAVE GROUP	12-12-1997	Consumer Goods	Nasdaq OMX Stockholm	6	1	0
SCANDINAVIAN RETAIL GROUP	02-04-1998	Consumer Services	Oslo Stock Exchange	11	0	1
A-RAKENNUSMIES	30-04-1998	Industrials	Nasdaq OMX Helsinki	15	0	1
VESTAS WIND SYSTEMS	30-04-1998	Oil & Gas	Nasdaq OMX Copenhagen	53	0	1
MSC KONSULT AB	12-05-1998	Technology	Nasdaq OMX Copenhagen	11	1	0
Industrifinans Næringseiendom ASA	20-05-1998	Financials	Oslo Stock Exchange	1	1	0
SPONDA OYJ	28-05-1998	Financials	Nasdaq OMX Helsinki	7	1	0
Polar Holding ASA	29-05-1998	Oil & Gas	Oslo Stock Exchange	50	1	0
PREVAS AB	29-05-1998	Technology	Nasdaq OMX Stockholm	13	1	0
SYNNØVE FINDEN MEIERIER	06-07-1998	Consumer Goods	Oslo Stock Exchange	70	0	1
AAB AALBORG BOLDSPIKLUB A/S (AAB)	11-09-1998	Consumer Services	Nasdaq OMX Copenhagen	113	1	0
BAVARIAN NORDIC RESEARCH INSTITUTE	04-11-1998	Health Care	Nasdaq OMX Copenhagen	4	0	1
RAPALA NORMARK OYJ	08-12-1998	Consumer Goods	Nasdaq OMX Helsinki	64	1	0
FORTUM	11-12-1998	Utilities	Nasdaq OMX Helsinki	0	1	0
ITERA	27-01-1999	Technology	Oslo Stock Exchange	4	1	0
SECTRA	03-03-1999	Health Care	Nasdaq OMX Stockholm	21	1	0
MARIMEKKO	12-03-1999	Consumer Goods	Nasdaq OMX Helsinki	48	1	0
MALMBERGS ELEKTRISKA AB	12-03-1999	Industrials	Nasdaq OMX Stockholm	18	1	0
TELESTE	30-03-1999	Technology	Nasdaq OMX Helsinki	45	0	1
TELIGENT	12-04-1999	Technology	Nasdaq OMX Stockholm	9	1	0
HIQ INTERNATIONAL AB	12-04-1999	Technology	Nasdaq OMX Stockholm	4	1	0
KUNGSLEDEN AB	14-04-1999	Financials	Nasdaq OMX Stockholm	5	1	0
CLAS OHLSON	10-05-1999	Consumer Services	Nasdaq OMX Stockholm	81	1	0
EFFNET GROUP AB	04-06-1999	Technology	Nasdaq OMX Stockholm	2	1	0
TECHNOPOLIS	08-06-1999	Financials	Nasdaq OMX Helsinki	2	1	0
H LUNDBECK	18-06-1999	Health Care	Nasdaq OMX Copenhagen	84	1	0
FRAMFAB	23-06-1999	Technology	Nasdaq OMX Stockholm	4	1	0
POOLIA AB	23-06-1999	Industrials	Nasdaq OMX Stockholm	10	1	0
NOVOTEK	29-06-1999	Technology	Nasdaq OMX Stockholm	13	1	0
ASPOCOMP GROUP	01-10-1999	Industrials	Nasdaq OMX Helsinki	0	1	0
ADERA	06-10-1999	Technology	Nasdaq OMX Stockholm	6	1	0
Perbio Science AB	18-10-1999	Health Care	Nasdaq OMX Stockholm	10	1	0
DATA FELLOWS OYJ (F-SECURE OYJ)	05-11-1999	Technology	Nasdaq OMX Helsinki	11	1	0
PROFFICE	10-11-1999	Consumer Goods	Nasdaq OMX Stockholm	39	0	1
STONESOFT OYJ	04-12-1999	Technology	Nasdaq OMX Helsinki	9	1	0
COMPTEL OYJ	09-12-1999	Technology	Nasdaq OMX Helsinki	13	1	0
VIBORG HÅNDBOLD KLUB	20-12-1999	Consumer Goods	Nasdaq OMX Copenhagen	63	1	0
SIMCORP A/S	14-04-2000	Technology	Nasdaq OMX Copenhagen	29	1	0
EQ ONLINE OYJ	14-04-2000	Financials	Nasdaq OMX Helsinki	2	1	0
NUTRI PHARMA ASA (BIONOR PHARMA)	05-05-2000	Health Care	Oslo Stock Exchange	7	1	0
TEKLA OYJ	22-05-2000	Technology	Nasdaq OMX Helsinki	34	1	0
MEKONOMEN AB	29-05-2000	Consumer Goods	Nasdaq OMX Stockholm	27	1	0
Glocalnet AB	05-06-2000	Telecommunications	Nasdaq OMX Stockholm	3	1	0
RTX TELECOM A/S	08-06-2000	Technology	Nasdaq OMX Copenhagen	7	1	0
TELIA	13-06-2000	Telecommunications	Nasdaq OMX Stockholm	7	1	0
AXIS	27-06-2000	Technology	Nasdaq OMX Stockholm	16	1	0
OKMETIC OYJ	03-07-2000	Technology	Nasdaq OMX Helsinki	15	1	0
THALAMUS NETWORKS	06-07-2000	Consumer Goods	Nasdaq OMX Stockholm	3	1	0
METRO INTERNATIONAL	18-08-2000	Consumer Services	Nasdaq OMX Stockholm	5	1	0
FJORD SEAFOOD ASA	19-09-2000	Consumer Goods	Oslo Stock Exchange	4	1	0
AUDIODEV	21-09-2000	Industrials	Nasdaq OMX Stockholm	13	1	0
ORC SOFTWARE	19-10-2000	Technology	Nasdaq OMX Stockholm	13	1	0
TELENOR	04-12-2000	Telecommunications	Oslo Stock Exchange	145	1	0
UTFORS	11-12-2000	Telecommunications	Nasdaq OMX Stockholm	6	0	1
VACON	19-12-2000	Industrials	Nasdaq OMX Helsinki	7	1	0
SSH COMMUNICATIONS SECURITY	20-12-2000	Technology	Nasdaq OMX Helsinki	5	1	0

STRATEGIC INVS	26-01-2001	Financials	Nasdaq OMX Copenhagen	19	0	1
Capman OYJ	02-04-2001	Financials	Nasdaq OMX Helsinki	12	1	0
STUDSVIK	04-05-2001	Industrials	Nasdaq OMX Stockholm	54	0	1
D CARNEGIE&CO AB	01-06-2001	Financials	Nasdaq OMX Stockholm	198	1	0
STATOIL	18-06-2001	Oil & Gas	Oslo Stock Exchange	29	1	0
FAST SEARCH & TRANSFER ASA	21-06-2001	Technology	Oslo Stock Exchange	4	1	0
RNB RETAIL AND BRANDS	26-06-2001	Consumer Services	Nasdaq OMX Stockholm	1	1	0
ACTA HOLDING ASA (AGASTI HOLDING)	16-07-2001	Financials	Oslo Stock Exchange	11	1	0
ADDTECH	03-09-2001	Industrials	Nasdaq OMX Stockholm	95	1	0
SUOMINEN YHTYMA OYJ	01-10-2001	Consumer Goods	Nasdaq OMX Helsinki	10	1	0
BILLERUD	20-11-2001	Basic Materials	Nasdaq OMX Stockholm	68	1	0
Q-FREE ASA	03-04-2002	Technology	Oslo Stock Exchange	18	1	0
APPTIX ASA	08-04-2002	Technology	Oslo Stock Exchange	5	0	1
ALFA LAVAL AB	17-05-2002	Industrials	Nasdaq OMX Stockholm	9	0	1
LEROY SEAFOOD GROUP	03-06-2002	Consumer Goods	Oslo Stock Exchange	50	1	0
INTRUM JUSTITIA AS	07-06-2002	Financials	Nasdaq OMX Stockholm	79	0	1
BIRDSTEP TECHNOLOGY ASA	12-06-2002	Technology	Oslo Stock Exchange	6	1	0
NOBIA AB	19-06-2002	Consumer Goods	Nasdaq OMX Stockholm	6	0	1
BALLINGSLOV INTERNATIONAL AB	19-06-2002	Consumer Goods	Nasdaq OMX Stockholm	50	0	1
RICA HOTELS ASA	16-07-2002	Consumer Services	Oslo Stock Exchange	10	1	0
BIOTIE THERAPIES OYJ	31-10-2002	Health Care	Nasdaq OMX Helsinki	4	1	0
TROMS FYLKES DAMPSKIBSSELSKAP ASA	07-05-2003	Industrials	Oslo Stock Exchange	137	1	0
GUDME RAASCHOU VISION A/S (BLUE VISION)	01-06-2003	Financials	Nasdaq OMX Copenhagen	1	1	0
TANDBERG TECHNOLOGY ASA	01-10-2003	Technology	Oslo Stock Exchange	24	1	0
BRINOVA FASTIGHETER AB	20-11-2003	Industrials	Nasdaq OMX Stockholm	13	1	0
NORWEGIAN AIR SHUTTLE ASA	18-12-2003	Industrials	Oslo Stock Exchange	10	1	0
OPERA SOFTWARE ASA	11-03-2004	Technology	Oslo Stock Exchange	13	1	0
YARA INTERNATIONAL ASA	25-03-2004	Basic Materials	Oslo Stock Exchange	54	1	0
AKER KVÆRNER ASA	05-04-2004	Oil & Gas	Oslo Stock Exchange	50	1	0
TETHYS OIL AB	06-04-2004	Oil & Gas	Nasdaq OMX Stockholm	3	1	0
MAMUT ASA	10-05-2004	Technology	Oslo Stock Exchange	6	0	1
MEDISTIM ASA	28-05-2004	Health Care	Oslo Stock Exchange	20	1	0
ITAB INREDNING AB	31-05-2004	Industrials	Nasdaq OMX Stockholm	17	0	1
AKER YARDS ASA	01-06-2004	Industrials	Oslo Stock Exchange	0	1	0
TECO COATING SERVICES ASA	22-06-2004	Industrials	Oslo Stock Exchange	10	1	0
NOTE AB	23-06-2004	Industrials	Nasdaq OMX Stockholm	5	1	0
CAMILLO EITZEN&CO ASA	28-06-2004	Industrials	Oslo Stock Exchange	121	1	0
GROUP 4 A/S (G4S)	20-07-2004	Industrials	Nasdaq OMX Copenhagen	103	1	0
NEW NORMAN ASA	20-08-2004	Technology	Oslo Stock Exchange	20	1	0
AKER ASA	08-09-2004	Financials	Oslo Stock Exchange	163	1	0
KEMIRA GROWHOW	18-10-2004	Basic Materials	Nasdaq OMX Helsinki	84	1	0
SEVAN MARINE ASA	13-12-2004	Oil & Gas	Oslo Stock Exchange	3	1	0
PETROJACK ASA	23-02-2005	Oil & Gas	Oslo Stock Exchange	1	1	0
WILSON ASA	17-03-2005	Industrials	Oslo Stock Exchange	12	1	0
NESTE OIL CORPORATION	18-04-2005	Oil & Gas	Nasdaq OMX Helsinki	57	1	0
AKER SEAFOODS ASA (HAVFISK)	13-05-2005	Consumer Goods	Oslo Stock Exchange	11	1	0
WIHLBORGS FASTIGHETER AB	23-05-2005	Financials	Nasdaq OMX Stockholm	81	1	0
HAVILA SHIPPING ASA	24-05-2005	Oil & Gas	Oslo Stock Exchange	2	1	0
AFFECTOGENIMAP	27-05-2005	Technology	Nasdaq OMX Helsinki	15	0	1
KONE CARGOTEC OYJ	01-06-2005	Industrials	Nasdaq OMX Helsinki	8	1	0
KONE OYJ	01-06-2005	Industrials	Nasdaq OMX Helsinki	95	1	0
GUNNEBO INDUSTRIER AB	14-06-2005	Industrials	Nasdaq OMX Stockholm	241	1	0
KONGSBERG AUTOMOTIVE HOLDING ASA	24-06-2005	Consumer Goods	Oslo Stock Exchange	18	0	1
REVUS ENERGY ASA	27-06-2005	Oil & Gas	Oslo Stock Exchange	3	0	1
EIDESVIK OFFSHORE ASA	27-06-2005	Oil & Gas	Oslo Stock Exchange	50	1	0
SIMRAD OPTRONICS ASA	07-07-2005	Industrials	Oslo Stock Exchange	25	1	0
AKER AMERICAN SHIPPING CORPORATION	11-07-2005	Industrials	Oslo Stock Exchange	1	1	0
DEEP SEA SUPPLY ASA	15-09-2005	Oil & Gas	Oslo Stock Exchange	0	1	0
INDUTRADE AB	05-10-2005	Industrials	Nasdaq OMX Stockholm	27	1	0
TRYGVESTA	14-10-2005	Financials	Nasdaq OMX Copenhagen	15	1	0
TRETTI AB	17-10-2005	Consumer Goods	Nasdaq OMX Stockholm	1	1	0
POWEL ASA	24-10-2005	Technology	Oslo Stock Exchange	9	0	1
CERMAQ ASA	24-10-2005	Consumer Goods	Oslo Stock Exchange	10	1	0
BIOTEC PHARMACON ASA	04-11-2005	Health Care	Oslo Stock Exchange	15	0	1
GEO ASA (DOFSUB)	07-11-2005	Oil & Gas	Oslo Stock Exchange	0	1	0
TRADEDOUBLER AB	08-11-2005	Consumer Services	Nasdaq OMX Stockholm	6	0	1
ODIM ASA	18-11-2005	Industrials	Oslo Stock Exchange	31	0	1
FUTURE INFORMATION RESEARCH MANAGEMENT ASA	06-12-2005	Technology	Oslo Stock Exchange	9	1	0
DEEPOCEAN AS	07-12-2005	Oil & Gas	Oslo Stock Exchange	6	1	0
HAKON INVEST AB	08-12-2005	Consumer Services	Nasdaq OMX Stockholm	50	1	0
GRENLAND GROUP AS	12-12-2005	Oil & Gas	Oslo Stock Exchange	13	0	1
FARA ASA	16-12-2005	Technology	Oslo Stock Exchange	7	1	0

SONGA OFFSHORE ASA	26-01-2006	Oil & Gas	Oslo Stock Exchange	1	1	0
KAPPAHL AB	23-02-2006	Consumer Services	Nasdaq OMX Stockholm	53	0	1
CAPTURA ASA	27-02-2006	Technology	Oslo Stock Exchange	9	1	0
AHLSTROM OYJ	17-03-2006	Basic Materials	Nasdaq OMX Helsinki	155	1	0
SALCOMP OYJ	17-03-2006	Technology	Nasdaq OMX Helsinki	31	0	1
NAVAMEDIC ASA	31-03-2006	Health Care	Oslo Stock Exchange	4	1	0
DOLPHIN INTERCONNECT SOLUTIONS ASA	20-04-2006	Technology	Oslo Stock Exchange	14	1	0
CATENA AB	26-04-2006	Financials	Nasdaq OMX Stockholm	39	1	0
INVESTERINGSFORENINGEN SMALLCAP DANMARK	05-05-2006	Financials	Nasdaq OMX Copenhagen	0	1	0
RENEWABLE ENERGY CORPORATION ASA	09-05-2006	Technology	Oslo Stock Exchange	10	0	1
DIOS FASTIGHETER AB	22-05-2006	Financials	NASDAQ OMX Stockholm	1	1	0
BERGESEN WORLDWIDE OFFSHORE LTD	31-05-2006	Oil & Gas	Oslo Stock Exchange	9	1	0
TELIO HOLDING ASA	02-06-2006	Telecommunications	Oslo Stock Exchange	3	1	0
CURALOGIC A/S	09-06-2006	Health Care	Nasdaq OMX Copenhagen	2	1	0
HUSQVARNA AB	13-06-2006	Consumer Goods	Nasdaq OMX Stockholm	317	1	0
AKER FLOATING PRODUCTION ASA	26-06-2006	Oil & Gas	Oslo Stock Exchange	0	1	0
ABILITY GROUP ASA	03-07-2006	Oil & Gas	Oslo Stock Exchange	19	0	1
ORIOLA-KD OYJ	03-07-2006	Health Care	Nasdaq OMX Helsinki	58	1	0
TROLLTECH ASA	05-07-2006	Technology	Oslo Stock Exchange	12	0	1
INTEROIL EXPLORATION AND PRODUCTION ASA	19-07-2006	Oil & Gas	Oslo Stock Exchange	1	1	0
AARHUSKARLSHAMN AB (AAK AB)	11-09-2006	Consumer Goods	Nasdaq OMX Stockholm	127	1	0
BIOVITRUM AB	15-09-2006	Health Care	Nasdaq OMX Stockholm	5,1	0	1
MONDO A/S	06-10-2006	Technology	Nasdaq OMX Copenhagen	3	1	0
OUTOKUMPU TECHNOLOGY OYJ	10-10-2006	Industrials	Nasdaq OMX Helsinki	61	1	0
AUSTEVOLL SEAFOOD ASA	11-10-2006	Consumer Goods	Oslo Stock Exchange	25	1	0
UNIFLEX AB	01-11-2006	Industrials	Nasdaq OMX Stockholm	4	1	0
EITZEN CHEMICAL ASA	02-11-2006	Industrials	Oslo Stock Exchange	121	1	0
AKVA GROUP ASA	10-11-2006	Industrials	Oslo Stock Exchange	32	0	1
LIFECYCLE PHARMA A/S (VELOXIS)	13-11-2006	Health Care	Nasdaq OMX Copenhagen	4	1	0
NORWEGIAN PROPERTY ASA	15-11-2006	Financials	Oslo Stock Exchange	1	1	0
BE GROUP AB	24-11-2006	Basic Materials	Nasdaq OMX Stockholm	7	0	1
REZIDOR HOTEL GROUP AB	28-11-2006	Consumer Services	Nasdaq OMX Stockholm	46	1	0
LINDAB INTERNATIONAL AB	01-12-2006	Industrials	Nasdaq OMX Stockholm	47	0	1
ROVSING A/S	05-12-2006	Industrials	Nasdaq OMX Copenhagen	14	1	0
FAKTOR EIENDOM ASA	08-12-2006	Financials	Oslo Stock Exchange	5	1	0
LINKMED AB (ALLENEX)	12-12-2006	Financials	Nasdaq OMX Stockholm	8	0	1
FIRSTFARMS A/S	12-12-2006	Consumer Goods	Nasdaq OMX Copenhagen	4	1	0
TILGIN AB	15-12-2006	Technology	Nasdaq OMX Stockholm	9	1	0
CHEMOMETEC A/S	18-12-2006	Health Care	Nasdaq OMX Copenhagen	10	1	0
COMENDO A/S (COPENHAGEN NETWORK)	20-12-2006	Technology	Nasdaq OMX Copenhagen	4	1	0
RESERVOIR EXPLORATION TECHNOLOGY ASA	21-12-2006	Oil & Gas	Oslo Stock Exchange	4	1	0
CREW MINERALS ASA	21-12-2006	Basic Materials	Oslo Stock Exchange	10	1	0
REPANT ASA	03-01-2007	Industrials	Oslo Stock Exchange	13	1	0
SIMTRONICS ASA	05-01-2007	Industrials	Oslo Stock Exchange	59	1	0
COMROD COMMUNICATION ASA	22-01-2007	Industrials	Oslo Stock Exchange	59	0	1
COPEINCA ASA	29-01-2007	Consumer Goods	Oslo Stock Exchange	13	1	0
OCEANTEAM	08-02-2007	Oil & Gas	Oslo Stock Exchange	2	1	0
SCANDINAVIAN PRIVATE EQUITY A/S	12-02-2007	Financials	Nasdaq OMX Copenhagen	1	1	0
NEAS ASA	23-03-2007	Financials	Oslo Stock Exchange	19	0	1
REM OFFSHORE ASA	30-03-2007	Oil & Gas	Oslo Stock Exchange	29	1	0
ELECTROMAGNETIC GEOSERVICES ASA	30-03-2007	Oil & Gas	Oslo Stock Exchange	6	0	1
SALMAR ASA	08-05-2007	Consumer Goods	Oslo Stock Exchange	16	1	0
FRED OLSEN PRODUCTION ASA	11-05-2007	Oil & Gas	Oslo Stock Exchange	13	1	0
NEDERMAN HOLDING AB	16-05-2007	Industrials	Nasdaq OMX Stockholm	50	0	1
NORDIC TANKERS A/S	12-06-2007	Oil & Gas	Nasdaq OMX Copenhagen	44	1	0
SRV YHTIOT OYJ	12-06-2007	Industrials	Nasdaq OMX Helsinki	20	1	0
GRIEG SEAFOOD ASA	21-06-2007	Consumer Goods	Oslo Stock Exchange	19	1	0
GRRIFFIN IV BERLIN A/S	06-07-2007	Financials	Nasdaq OMX Copenhagen	5	1	0
DELTAQ A/S	28-09-2007	Financials	Nasdaq OMX Copenhagen	0	1	0
PRONOVA BIOPHARMA ASA	11-10-2007	Health Care	Oslo Stock Exchange	15	0	1
SYSTEMAIR AB	12-10-2007	Industrials	Nasdaq OMX Stockholm	10	1	0
HMS NETWORKS AB	19-10-2007	Technology	Nasdaq OMX Stockholm	19	0	1
KLIMAINVEST A/S (COPENHAGEN CAPITAL)	30-10-2007	Financials	Nasdaq OMX Copenhagen	0	1	0
SCANDINAVIAN PROPERTY DEVELOPMENT ASA	01-11-2007	Financials	Oslo Stock Exchange	3	1	0
EAST CAPITAL EXPLORER AB	09-11-2007	Financials	Nasdaq OMX Stockholm	10	1	0
NORWEGIAN ENERGY COMPANY ASA	09-11-2007	Oil & Gas	Oslo Stock Exchange	2	1	0
DUNI AB	14-11-2007	Consumer Goods	Nasdaq OMX Stockholm	58	0	1
HAFSLUND INFRATEK ASA	05-12-2007	Industrials	Oslo Stock Exchange	109	1	0
TRIFORK A/S	20-12-2007	Technology	Nasdaq OMX Copenhagen	11	1	0

NORDIC SERVICE PARTNERS HOLDING AB	15-01-2008	Consumer Services	Nasdaq OMX Stockholm	4	1	0
FORMUEEVOLUTION II A/S	25-04-2008	Financials	Nasdaq OMX Copenhagen	0	1	0
FORMUEEVOLUTION I A/S	25-04-2008	Financials	Nasdaq OMX Copenhagen	0	1	0
NUNAMINERALS A/S	04-06-2008	Basic Materials	Nasdaq OMX Copenhagen	9	1	0
HEXPOL AB	09-06-2008	Basic Materials	Nasdaq OMX Stockholm	125	1	0
NORWAY PELAGIC ASA	24-06-2008	Consumer Goods	Oslo Stock Exchange	2	1	0
BERGEN GROUP ASA	30-06-2008	Oil & Gas	Oslo Stock Exchange	6	1	0
PRIME OFFICE A/S	10-07-2008	Financials	Nasdaq OMX Copenhagen	3	1	0
POLARIS MEDIA ASA	20-10-2008	Consumer Goods	Oslo Stock Exchange	1	1	0
LOOMIS AB	09-12-2008	Industrials	Nasdaq OMX Stockholm	156	1	0
EWORK SCANDINAVIA AB	18-02-2010	Industrials	Nasdaq OMX Stockholm	10	0	1
ARISE WINDPOWER AB	24-03-2010	Utilities	Nasdaq OMX Stockholm	4	1	0
BAKKAFROST	26-03-2010	Consumer Goods	Oslo Stock Exchange	42	1	0
TIKKURILA OYJ	26-03-2010	Industrials	Nasdaq OMX Helsinki	148	1	0
BYGGMAX GROUP AB	02-06-2010	Consumer Services	Nasdaq OMX Stockholm	17	0	1
CHR HANSEN HOLDING A/S	03-06-2010	Health Care	Nasdaq OMX Copenhagen	136	0	1
PANORO ENERGY ASA	08-06-2010	Oil & Gas	Oslo Stock Exchange	1	1	0
MQ HOLDING AB	18-06-2010	Consumer Services	Nasdaq OMX Stockholm	10	0	1
WILH WILHELMSEN ASA	24-06-2010	Industrials	Oslo Stock Exchange	149	1	0
MORPOL ASA	30-06-2010	Consumer Goods	Oslo Stock Exchange	14	1	0
STORM REAL ESTATE ASA	06-07-2010	Financials	Oslo Stock Exchange	4	1	0
PANDORA A/S	05-10-2010	Consumer Goods	Nasdaq OMX Copenhagen	28	0	1
GJENSIDIGE FORSIKRING ASA	10-12-2010	Financials	Oslo Stock Exchange	36	1	0
CDON GROUP AB (QLIRO GROUP AB)	15-12-2010	Consumer Services	Nasdaq OMX Stockholm	11	1	0
KAROLINSKA DEVELOPMENT AB	15-04-2011	Health Care	Nasdaq OMX Stockholm	8	1	0
DEDICARE AB	05-05-2011	Health Care	Nasdaq OMX Stockholm	15	1	0
FINNVEDENBULTEN AB	20-05-2011	Consumer Goods	Nasdaq OMX Stockholm	10	0	1
MOBERG DERMA AB	26-05-2011	Health Care	Nasdaq OMX Stockholm	5	1	0
BOULE DIAGNOSTICS AB	23-06-2011	Health Care	Nasdaq OMX Stockholm	15	0	1
KVAERNER ASA	08-07-2011	Oil & Gas	Oslo Stock Exchange	0	1	0
SCANFIL OYJ	02-01-2012	Industrials	Nasdaq OMX Helsinki	36	1	0
SELVAAG BOLIG ASA	14-06-2012	Financials	Oslo Stock Exchange	10	1	0
BORREGAARD ASA	18-10-2012	Basic Materials	Oslo Stock Exchange	94	1	0

11.2 Testing for Normality

11.2.1 Normality Test CAR 36

Moments			
N	239	Sum Weights	239
Mean	-0.0738664	Sum Observations	-17.654062
Std Deviation	0.91475317	Variance	0.83677337
Skewness	-0.0885549	Kurtosis	1.08837935
Uncorrected SS	200.456104	Corrected SS	199.152062
Coeff Variation	-1238.3893	Std Error Mean	0.05917046

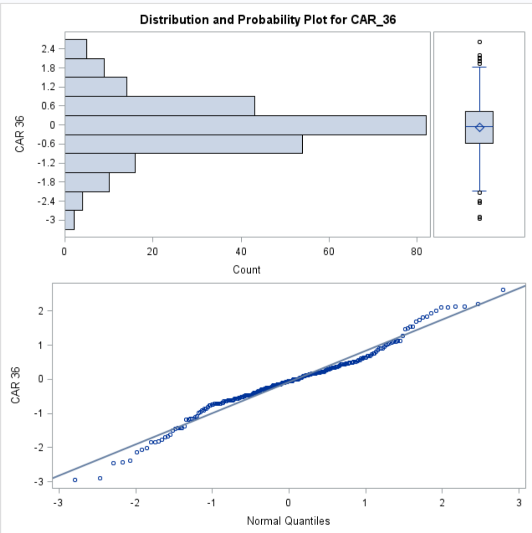
Basic Statistical Measures			
Location		Variability	
Mean	-0.07387	Std Deviation	0.91475
Median	-0.06006	Variance	0.83677
Mode	.	Range	5.56056
		Interquartile Range	0.99815

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	-1.24837	Pr > |t|	0.2131
Sign	M	-10.5	Pr >= |M|	0.1957
Signed Rank	S	-1473	Pr >= |S|	0.1691

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.975176	Pr < W	0.0003
Kolmogorov-Smirnov	D	0.078843	Pr > D	<0.0100
Cramer-von Mises	W-Sq	0.342764	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq	2.109503	Pr > A-Sq	<0.0050

Quantiles (Definition 5)	
Level	Quantile
100% Max	2.6195392
99%	2.1313620
95%	1.6938151
90%	1.0325706
75% Q3	0.4267531
50% Median	-0.0600635
25% Q1	-0.5714012
10%	-1.1543099
5%	-1.7594251
1%	-2.4562743
0% Min	-2.9410173

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
-2.94102	144	2.10157	33
-2.89483	201	2.13036	25
-2.45627	160	2.13136	32
-2.44038	184	2.20407	41
-2.38961	40	2.61954	13



11.2.2 Normality Test BHAR 36

Moments			
N	239	Sum Weights	239
Mean	0.02847203	Sum Observations	6.80481472
Std Deviation	1.23252452	Variance	1.51911669
Skewness	5.14696863	Kurtosis	40.440348
Uncorrected SS	361.743518	Corrected SS	361.549771
Coeff Variation	4328.89611	Std Error Mean	0.07972538

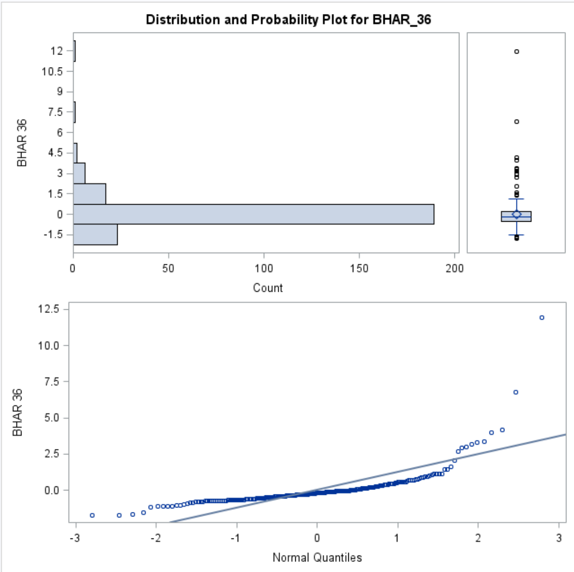
Basic Statistical Measures			
Location		Variability	
Mean	0.02847	Std Deviation	1.23252
Median	-0.19258	Variance	1.51912
Mode	.	Range	13.67214
		Interquartile Range	0.75288

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	0.357126	Pr > |t|	0.7213
Sign	M	-41.5	Pr >= |M|	<.0001
Signed Rank	S	-3889	Pr >= |S|	0.0002

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.594388	Pr < W	<0.0001
Kolmogorov-Smirnov	D	0.201771	Pr > D	<0.0100
Cramer-von Mises	W-Sq	3.965709	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq	21.72307	Pr > A-Sq	<0.0050

Quantiles (Definition 5)	
Level	Quantile
100% Max	11.925624
99%	4.178654
95%	1.598542
90%	0.885420
75% Q3	0.219511
50% Median	-0.192578
25% Q1	-0.533372
10%	-0.749703
5%	-0.998589
1%	-1.672793
0% Min	-1.746515

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
-1.74652	7	3.36884	94
-1.70621	87	3.97400	105
-1.67279	84	4.17865	32
-1.54015	86	6.77792	107
-1.20256	82	11.92562	13



11.3 Aftermarket Performance

11.3.1 Testing for heteroscedasticity

11.3.1.1 CAR 36:

Heteroscedasticity Test					
Equation	Test	Statistic	DF	Pr > ChiSq	Variables
CAR_36	White's Test	34.53	38	0.6306	Cross of all vars
	Breusch-Pagan	16.10	9	0.0648	1, PE, Market_BOOK, BUST, VAR12, assets_turnover, leverage, Log_market_cap, PE_MB, PE_BUST

11.3.1.2 BHAR 36:

Heteroscedasticity Test					
Equation	Test	Statistic	DF	Pr > ChiSq	Variables
BHAR_36	White's Test	26.49	38	0.9201	Cross of all vars
	Breusch-Pagan	5.15	9	0.8212	1, PE, Market_BOOK, BUST, VAR12, assets_turnover, leverage, Log_market_cap, PE_MB, PE_BUST

11.3.2 VIF test: testing for multicollinearity

11.3.2.1 CAR 36:

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CAR_36 CAR 36

Number of Observations Read	235
Number of Observations Used	235

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	15.97592	1.77510	2.43	0.0119
Error	225	164.59024	0.73151		
Corrected Total	234	180.56616			

Root MSE	0.85528	R-Square	0.0885
Dependent Mean	-0.10934	Adj R-Sq	0.0520
Coeff Var	-782.21939		

Parameter Estimates							
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	Intercept	1	-1.23468	0.48606	-2.54	0.0118	0
PE	PE	1	-0.10293	0.18561	-0.55	0.5798	1.85386
Market_BOOK	Market/BOOK	1	0.22279	0.14383	1.55	0.1228	1.24956
BUST	BUST	1	-0.00695	0.13330	-0.05	0.9584	1.37470
VAR12	LN(1+AGE)	1	0.11275	0.04545	2.48	0.0138	1.10520
assets_turnover	assets turnover	1	0.14215	0.06281	2.26	0.0246	1.18262
leverage	leverage	1	-0.00389	0.00235	-1.66	0.0990	1.06141
Log_market_cap	Log market cap	1	0.13298	0.08098	1.64	0.1020	1.07768
PE_MB		1	0.44003	0.54970	0.80	0.4243	1.22343
PE_BUST		1	-0.05982	0.28735	-0.21	0.8353	2.25087

11.3.2.2 BHAR 36:

The REG Procedure
Model: MODEL1
Dependent Variable: BHAR_36 BHAR 36

Number of Observations Read	235
Number of Observations Used	235

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	13.10739	1.45638	2.61	0.0069
Error	225	125.51062	0.55782		
Corrected Total	234	138.61801			

Root MSE	0.74688	R-Square	0.0946
Dependent Mean	-0.08533	Adj R-Sq	0.0583
Coeff Var	-875.33102		

Parameter Estimates							
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	Intercept	1	-1.08143	0.42445	-2.55	0.0115	0
PE	PE	1	-0.12013	0.16209	-0.74	0.4594	1.85386
Market_BOOK	Market/BOOK	1	0.22963	0.12560	1.83	0.0688	1.24956
BUST	BUST	1	-0.16250	0.11640	-1.40	0.1641	1.37470
VAR12	LN(1+AGE)	1	0.10660	0.03969	2.69	0.0078	1.10520
assets_turnover	assets turnover	1	0.09976	0.05485	1.82	0.0703	1.18262
leverage	leverage	1	-0.00208	0.00205	-1.02	0.3109	1.06141
Log_market_cap	Log market cap	1	0.12078	0.07072	1.71	0.0890	1.07768
PE_MB		1	0.74487	0.48003	1.55	0.1221	1.22343
PE_BUST		1	-0.01774	0.25093	-0.07	0.9437	2.25087

11.3.3 Regression output CAR 36

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CAR_36 CAR 36

Number of Observations Read	235
Number of Observations Used	235

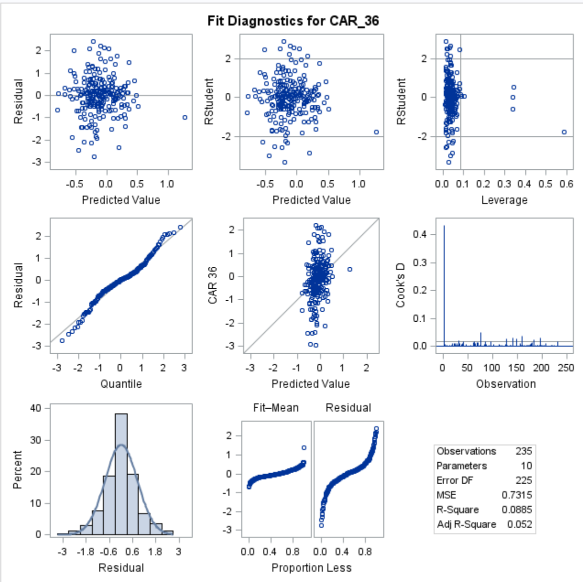
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	15.97592	1.77510	2.43	0.0119
Error	225	164.59024	0.73151		
Corrected Total	234	180.56616			

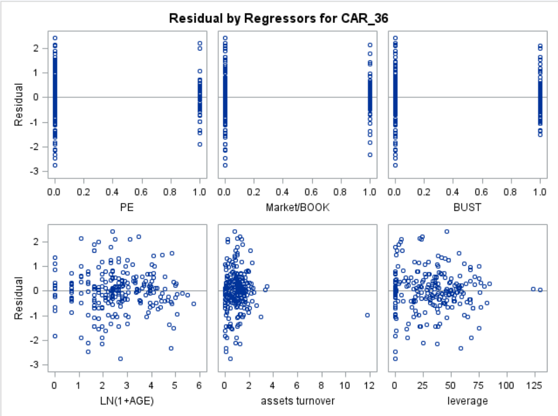
Root MSE	0.85528	R-Square	0.0885
Dependent Mean	-0.10934	Adj R-Sq	0.0520
Coeff Var	-782.21939		

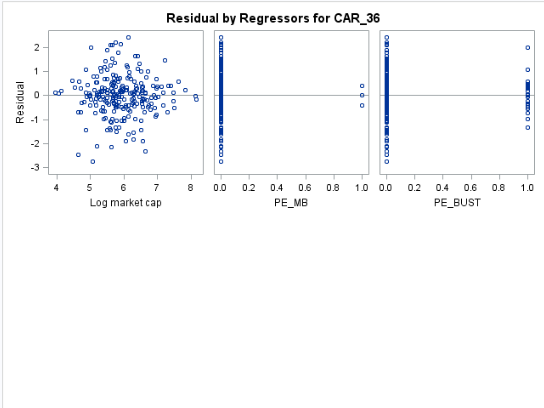
Parameter Estimates									
							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-1.23468	0.48606	-2.54	0.0118	0.45876	-2.69	0.0077
PE	PE	1	-0.10293	0.18561	-0.55	0.5798	0.17434	-0.59	0.5555
Market_BOOK	Market/BOOK	1	0.22279	0.14383	1.55	0.1228	0.14221	1.57	0.1186
BUST	BUST	1	-0.00695	0.13330	-0.05	0.9584	0.12516	-0.06	0.9557
VAR12	LN(1+AGE)	1	0.11275	0.04545	2.48	0.0138	0.04235	2.66	0.0083
assets_turnover	assets turnover	1	0.14215	0.06281	2.26	0.0246	0.06817	2.09	0.0382
leverage	leverage	1	-0.00389	0.00235	-1.66	0.0990	0.00211	-1.84	0.0670
Log_market_cap	Log market cap	1	0.13298	0.08098	1.64	0.1020	0.06893	1.93	0.0550
PE_MB		1	0.44003	0.54970	0.80	0.4243	0.28405	1.55	0.1228
PE_BUST		1	-0.05982	0.28735	-0.21	0.8353	0.25397	-0.24	0.8140

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CAR_36 CAR 36







11.3.4 Regression output BHAR 36

The SAS System

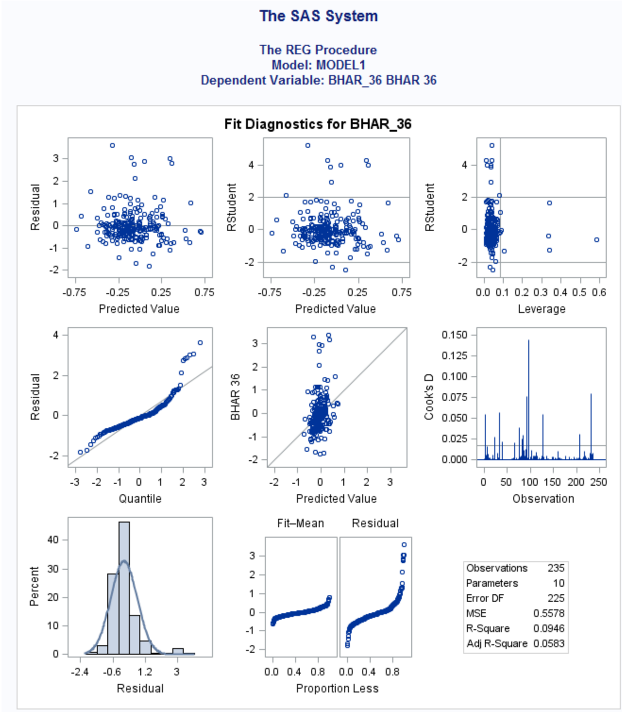
The REG Procedure
Model: MODEL1
Dependent Variable: BHAR_36 BHAR 36

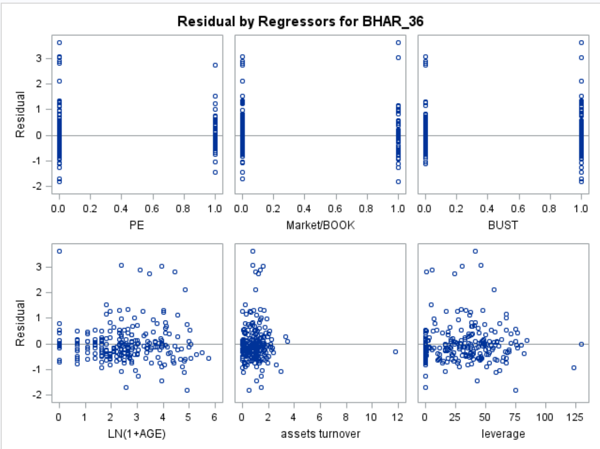
Number of Observations Read	235
Number of Observations Used	235

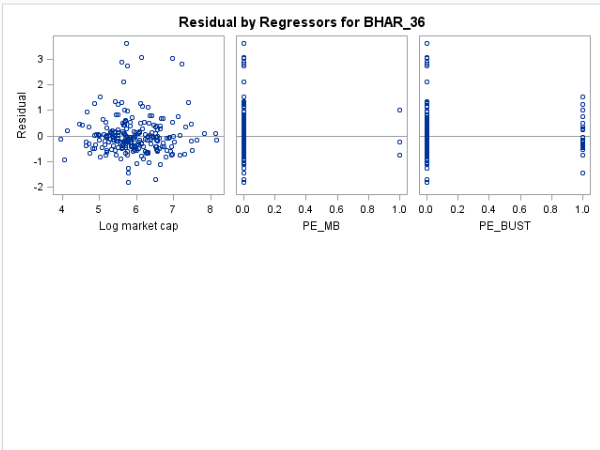
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	13.10739	1.45638	2.61	0.0069
Error	225	125.51062	0.55782		
Corrected Total	234	138.61801			

Root MSE	0.74688	R-Square	0.0946
Dependent Mean	-0.08533	Adj R-Sq	0.0583
Coeff Var	-875.33102		

Parameter Estimates									
							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-1.08143	0.42445	-2.55	0.0115	0.38931	-2.78	0.0059
PE	PE	1	-0.12013	0.16209	-0.74	0.4594	0.14546	-0.83	0.4097
Market_BOOK	Market/BOOK	1	0.22963	0.12560	1.83	0.0688	0.12889	1.78	0.0762
BUST	BUST	1	-0.16250	0.11640	-1.40	0.1641	0.11568	-1.40	0.1615
VAR12	LN(1+AGE)	1	0.10660	0.03969	2.69	0.0078	0.04379	2.43	0.0157
assets_turnover	assets turnover	1	0.09976	0.05485	1.82	0.0703	0.03764	2.65	0.0086
leverage	leverage	1	-0.00208	0.00205	-1.02	0.3109	0.00176	-1.18	0.2382
Log_market_cap	Log market cap	1	0.12078	0.07072	1.71	0.0890	0.06454	1.87	0.0626
PE_MB		1	0.74487	0.48003	1.55	0.1221	0.47146	1.58	0.1155
PE_BUST		1	-0.01774	0.25093	-0.07	0.9437	0.23178	-0.08	0.9391


The SAS System
The REG Procedure
Model: MODEL1
Dependent Variable: BHAR_36 BHAR 36
Fit Diagnostics for BHAR_36
Residual
RStudent
Predicted Value
Leverage
Quantile
BHAR 36
Cook's D
Observation
Percent
Fit–Mean
Residual
Proportion Less
Observations 235
Parameters 10
Error DF 225
MSE 0.5578
R-Square 0.0946
Adj R-Square 0.0583


Residual by Regressors for BHAR_36
Residual
PE
Market/BOOK
BUST
LN(1+AGE)
assets turnover
leverage


Residual by Regressors for BHAR_36
Residual
Log market cap
PE_MB
PE_BUST

11.4 Calculating U-statistics

U-statistic calculations

Median

BHAR 36

T	-3889
n	239
U-statistic	-17,0371
2-sided p-Value	0,0002
1-sided p-Value	0,0001

BHAR 36 NS

T	-2360
n	188
U-statistic	-15,049
2-sided p-Value	0,0014
1-sided p-Value	0,0007

CAR 6 BUST

T	-562,5
n	98
U-statistic	-10,5882
2-sided p-Value	0,0457
1-sided p-Value	0,02285

BHAR 6 BUST

T	-739,5
n	98
U-statistic	-11,2154
2-sided p-Value	0,0089
1-sided p-Value	0,00445

BHAR 36 BUST

T	-569,5
n	98
U-statistic	-11,2154
2-sided p-Value	0,043
1-sided p-Value	0,0215

Median

CAR 6 NS

T	-1911
n	188
U-statistic	-14,448
2-sided p-Value	0,0102
1-sided p-Value	0,0051

BHAR 36 PE

T	-197
n	51
U-statistic	-8,06118
2-sided p-Value	0,0642
1-sided p-Value	0,0321

CAR 12 BUST

T	-592,5
n	98
U-statistic	-10,6945
2-sided p-Value	0,0351
1-sided p-Value	0,01755

BHAR 12 BUST

T	-701,5
n	98
U-statistic	-11,0808
2-sided p-Value	0,0122
1-sided p-Value	0,0061

BHAR 36 BOOM

T	-1451,5
n	141
U-statistic	-13,2889
2-sided p-Value	0,0025
1-sided p-Value	0,00125

CAR 6 BUST NS

T	-331
n	75
U-statistic	-9,27266
2-sided p-Value	0,0804
1-sided p-Value	0,0402

CAR 12 BUST NS

T	-385
n	75
U-statistic	-9,55781
2-sided p-Value	0,0412
1-sided p-Value	0,0206

BHAR 6 BUST NS

T	-433
n	75
U-statistic	-9,81127
2-sided p-Value	0,0212
1-sided p-Value	0,0106

BHAR 12 BUST NS

T	-462
n	75
U-statistic	-9,96441
2-sided p-Value	0,0137
1-sided p-Value	0,00685

BHAR 36 BUST NS

T	-398
n	75
U-statistic	-9,62646
2-sided p-Value	0,0347
1-sided p-Value	0,01735

BHAR 36 HIGH_MB

T	-2715
n	179
U-statistic	-15,5136
2-sided p-Value	<0.0001
1-sided p-Value	<0.0001

11.5 Value Added

11.6.1 Testing for heteroscedasticity

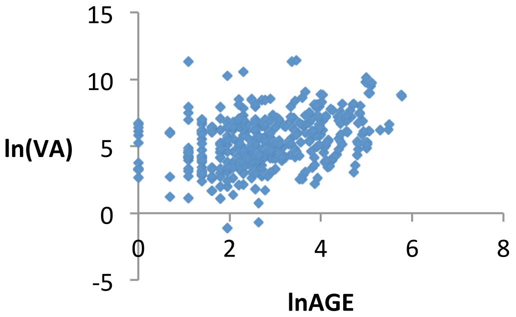
Heteroscedasticity Test					
Equation	Test	Statistic	DF	Pr > ChiSq	Variables
ln_VA	White's Test	65.50	35	0.0013	Cross of all vars
	Breusch-Pagan	32.77	7	<.0001	1, ln_L, ln_K, ln_age, Industry_risk, Mkt_share, BUST, PE_backed, lnL_d3, lnK_d3, lnAge_d3, industryrisk_d3, mktshare_d3, bust_d3, PE_d3

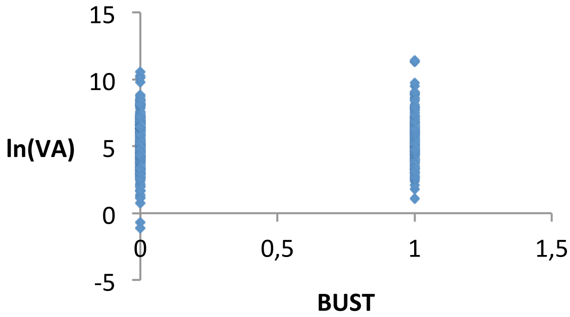
11.5.2 VIF test: testing for multicollinearity

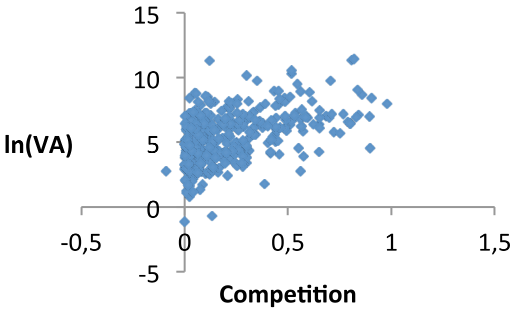
Parameter Estimates							
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	Intercept	1	0.32190	0.42922	0.75	0.4537	0
ln_L		1	0.17917	0.04131	4.34	<.0001	3.44680
ln_K		1	0.68085	0.04585	14.85	<.0001	3.30443
ln_age		1	0.14096	0.05684	2.48	0.0135	2.28677
Industry_risk	Industry_risk	1	-0.20524	0.16510	-1.24	0.2145	2.56184
Mkt_share	Mkt share	1	1.48210	0.35726	4.15	<.0001	2.88438
BUST	BUST	1	0.11798	0.13364	0.88	0.3779	2.15186
PE_backed	PE-backed	1	0.18252	0.15311	1.19	0.2340	2.10060
d3	d3	1	0.30303	0.61232	0.49	0.6209	46.46634
lnL_d3		1	0.03367	0.05479	0.61	0.5393	3.55252
lnK_d3		1	-0.00969	0.06195	-0.16	0.8758	25.74699
lnAge_d3		1	-0.01997	0.08507	-0.23	0.8145	9.77907
industryrisk_d3		1	-0.11159	0.22347	-0.50	0.6178	12.06123
mktshare_d3		1	-0.13539	0.47190	-0.29	0.7743	4.05120
bust_d3		1	0.01445	0.18874	0.08	0.9390	2.98292
PE_d3		1	0.11946	0.21345	0.56	0.5760	2.41753

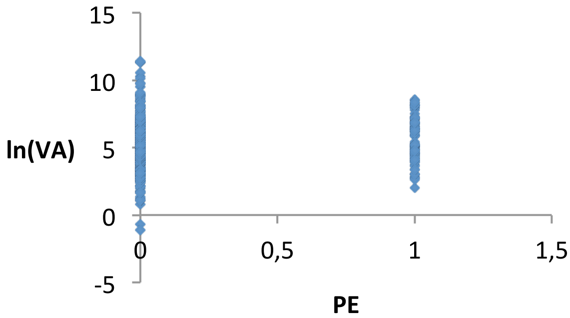
We see high VIF values for d3 and lnK_d3. However, neither of these variables are of interest. That is, they are control variables, suggesting that we can safely ignore this multicollinearity. Furthermore, the high VIFs are probably caused by the inclusion of the interaction term, which is not something to be concerned about (Paul Allison, 2012).

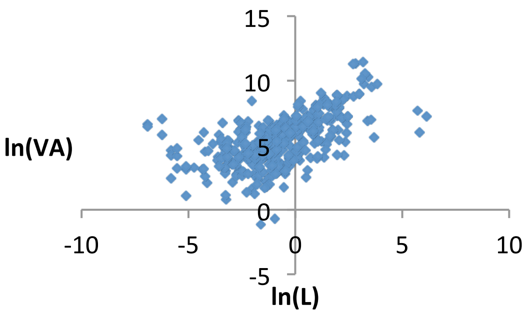
11.5.3 Scatterplots

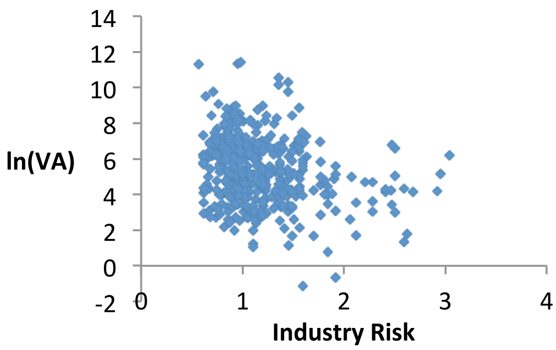


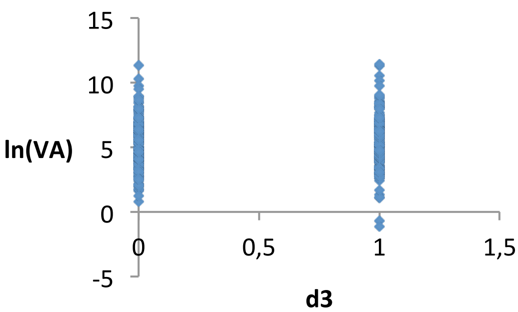


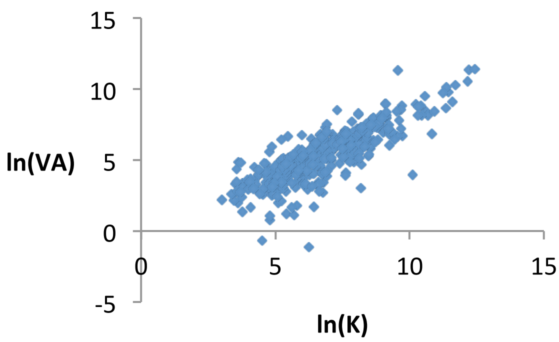












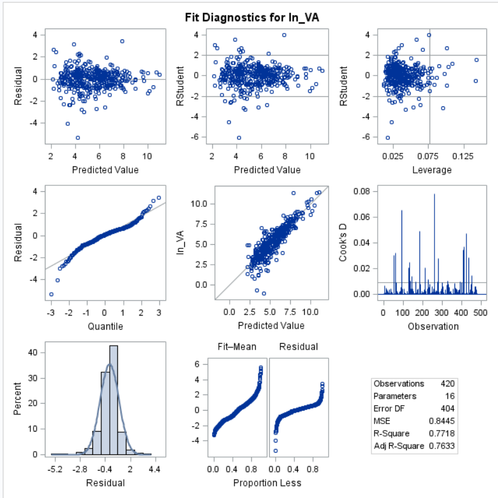
11.5.4 Regression Output

Number of Observations Read	478
Number of Observations Used	420
Number of Observations with Missing Values	58

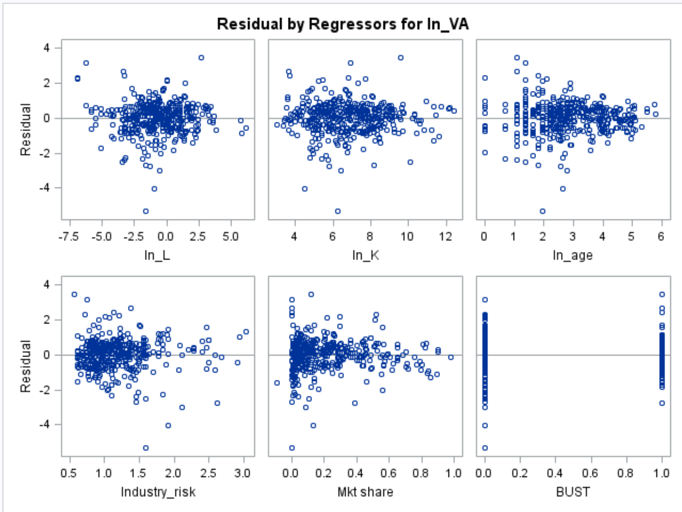
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	15	1153.68436	76.91229	91.08	<.0001
Error	404	341.16489	0.84447		
Corrected Total	419	1494.84925			

Root MSE	0.91895	R-Square	0.7718
Dependent Mean	5.39093	Adj R-Sq	0.7633
Coeff Var	17.04622		

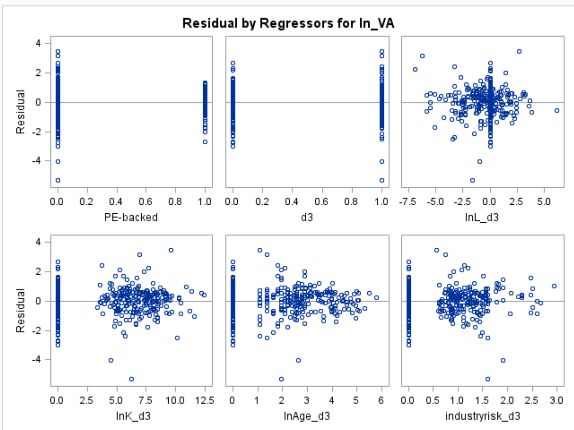
Parameter Estimates									
							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.32190	0.42922	0.75	0.4537	0.45439	0.71	0.4791
ln_L		1	0.17917	0.04131	4.34	<.0001	0.03876	4.62	<.0001
ln_K		1	0.68085	0.04585	14.85	<.0001	0.04124	16.51	<.0001
ln_age		1	0.14096	0.05684	2.48	0.0135	0.04899	2.88	0.0042
Industry_risk	Industry_risk	1	-0.20524	0.16510	-1.24	0.2145	0.21923	-0.94	0.3497
Mkt_share	Mkt share	1	1.48210	0.35726	4.15	<.0001	0.34734	4.27	<.0001
BUST	BUST	1	0.11798	0.13364	0.88	0.3779	0.12030	0.98	0.3273
PE_backed	PE-backed	1	0.18252	0.15311	1.19	0.2340	0.13794	1.32	0.1865
d3	d3	1	0.30303	0.61232	0.49	0.6209	0.63235	0.48	0.6320
lnL_d3		1	0.03367	0.05479	0.61	0.5393	0.05842	0.58	0.5647
lnK_d3		1	-0.00969	0.06195	-0.16	0.8758	0.06216	-0.16	0.8762
lnAge_d3		1	-0.01997	0.08507	-0.23	0.8145	0.08678	-0.23	0.8181
industryrisk_d3		1	-0.11159	0.22347	-0.50	0.6178	0.26447	-0.42	0.6733
mktshare_d3		1	-0.13539	0.47190	-0.29	0.7743	0.46634	-0.29	0.7717
bust_d3		1	0.01445	0.18874	0.08	0.9390	0.17049	0.08	0.9325
PE_d3		1	0.11946	0.21345	0.56	0.5760	0.18171	0.66	0.5113



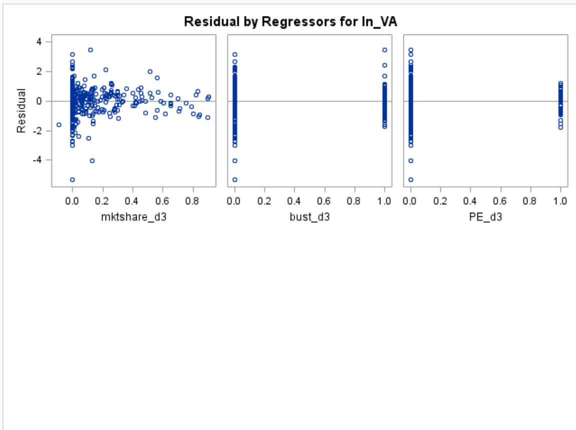
Fit Diagnostics for ln_VA
Observations 420
Parameters 16
Error DF 404
MSE 0.8445
R-Square 0.7718
Adj R-Square 0.7633



Residual by Regressors for ln_VA



Residual by Regressors for ln_VA



Residual by Regressors for ln_VA

11.6 Additional Regression Analyses

11.6.1 CAR 6

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CAR_6 CAR 6

Number of Observations Read	235
Number of Observations Used	235

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	4.52978	0.50331	2.34	0.0152
Error	225	48.30829	0.21470		
Corrected Total	234	52.83807			

Root MSE	0.46336	R-Square	0.0857
Dependent Mean	0.01597	Adj R-Sq	0.0492
Coeff Var	2902.30292		

Parameter Estimates							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-0.51182	0.26333	-1.94	0.0532	0.25369	-2.02	0.0448
PE	PE	1	-0.14677	0.10056	-1.46	0.1458	0.07931	-1.85	0.0655
Market_BOOK	Market/BOOK	1	0.09411	0.07792	1.21	0.2284	0.09235	1.02	0.3092
BUST	BUST	1	-0.18386	0.07222	-2.55	0.0116	0.07236	-2.54	0.0117
VAR12	LN(1+AGE)	1	-0.00729	0.02462	-0.30	0.7675	0.02293	-0.32	0.7509
assets_turnover	assets turnover	1	0.06610	0.03403	1.94	0.0533	0.02865	2.31	0.0219
leverage	leverage	1	-0.00232	0.00127	-1.83	0.0692	0.00107	-2.17	0.0308
Log_market_cap	Log market cap	1	0.10548	0.04387	2.40	0.0170	0.04657	2.26	0.0245
PE_MB		1	0.00711	0.29781	0.02	0.9810	0.13893	0.05	0.9592
PE_BUST		1	0.13730	0.15568	0.88	0.3788	0.12723	1.08	0.2817

11.6.2 CAR 12

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CAR_12 CAR 12

Number of Observations Read	235
Number of Observations Used	235

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	11.46841	1.27427	2.89	0.0030
Error	225	99.35202	0.44156		
Corrected Total	234	110.82042			

Root MSE	0.66450	R-Square	0.1035
Dependent Mean	0.00340	Adj R-Sq	0.0676
Coeff Var	19517		

Parameter Estimates							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-0.59404	0.37764	-1.57	0.1171	0.37222	-1.60	0.1119
PE	PE	1	-0.17056	0.14421	-1.18	0.2382	0.13998	-1.22	0.2243
Market_BOOK	Market/BOOK	1	0.22381	0.11174	2.00	0.0464	0.12745	1.76	0.0804
BUST	BUST	1	-0.31342	0.10356	-3.03	0.0028	0.10319	-3.04	0.0027
VAR12	LN(1+AGE)	1	0.01918	0.03531	0.54	0.5876	0.03287	0.58	0.5602
assets_turnover	assets turnover	1	0.13148	0.04880	2.69	0.0076	0.05161	2.55	0.0115
leverage	leverage	1	-0.00362	0.00182	-1.99	0.0478	0.00160	-2.26	0.0245
Log_market_cap	Log market cap	1	0.10568	0.06292	1.68	0.0944	0.06414	1.65	0.1008
PE_MB		1	0.26241	0.42709	0.61	0.5396	0.22559	1.16	0.2460
PE_BUST		1	0.13184	0.22326	0.59	0.5554	0.19389	0.68	0.4972

11.6.3 CAR 24

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CAR_24 CAR 24

Number of Observations Read	235
Number of Observations Used	235

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	10.01413	1.11268	1.75	0.0784
Error	225	142.76298	0.63450		
Corrected Total	234	152.77711			

Root MSE	0.79656	R-Square	0.0655
Dependent Mean	-0.06390	Adj R-Sq	0.0282
Coeff Var	-1246.54105		

Parameter Estimates

							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-0.43494	0.45269	-0.96	0.3377	0.42205	-1.03	0.3039
PE	PE	1	-0.13208	0.17287	-0.76	0.4457	0.15997	-0.83	0.4099
Market_BOOK	Market/BOOK	1	0.25999	0.13395	1.94	0.0535	0.13134	1.98	0.0490
BUST	BUST	1	-0.17007	0.12414	-1.37	0.1721	0.12231	-1.39	0.1658
VAR12	LN(1+AGE)	1	0.08200	0.04233	1.94	0.0540	0.03690	2.22	0.0273
assets_turnover	assets turnover	1	0.12937	0.05849	2.21	0.0280	0.05424	2.38	0.0179
leverage	leverage	1	-0.00376	0.00218	-1.72	0.0862	0.00206	-1.83	0.0692
Log_market_cap	Log market cap	1	0.02941	0.07542	0.39	0.6970	0.06807	0.43	0.6662
PE_MB		1	-0.16334	0.51196	-0.32	0.7500	0.36087	-0.45	0.6512
PE_BUST		1	0.12810	0.26762	0.48	0.6327	0.27499	0.47	0.6418

11.6.4 BHAR 6

The REG Procedure
Model: MODEL1
Dependent Variable: BHAR_6 BHAR 6

Number of Observations Read	235
Number of Observations Used	235

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	11.78928	1.30992	2.01	0.0395
Error	225	146.80529	0.65247		
Corrected Total	234	158.59457			

Root MSE	0.80775	R-Square	0.0743
Dependent Mean	0.06989	Adj R-Sq	0.0373
Coeff Var	1155.75274		

Parameter Estimates

							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-0.65953	0.45905	-1.44	0.1522	0.39144	-1.68	0.0934
PE	PE	1	-0.19788	0.17530	-1.13	0.2602	0.11514	-1.72	0.0871
Market_BOOK	Market/BOOK	1	0.22394	0.13583	1.65	0.1006	0.20306	1.10	0.2713
BUST	BUST	1	-0.30431	0.12589	-2.42	0.0164	0.11828	-2.57	0.0107
VAR12	LN(1+AGE)	1	-0.02896	0.04292	-0.67	0.5005	0.04150	-0.70	0.4860
assets_turnover	assets turnover	1	0.09583	0.05932	1.62	0.1076	0.04773	2.01	0.0459
leverage	leverage	1	-0.00392	0.00221	-1.77	0.0781	0.00183	-2.15	0.0330
Log_market_cap	Log market cap	1	0.15643	0.07648	2.05	0.0420	0.08870	1.76	0.0792
PE_MB		1	-0.09623	0.51916	-0.19	0.8531	0.21615	-0.45	0.6566
PE_BUST		1	0.20071	0.27139	0.74	0.4603	0.15572	1.29	0.1987

11.6.5 BHAR 12

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: BHAR_12 BHAR 12

Number of Observations Read	235
Number of Observations Used	235

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	33.10140	3.67793	2.81	0.0038
Error	225	294.04586	1.30687		
Corrected Total	234	327.14726			

Root MSE	1.14318	R-Square	0.1012
Dependent Mean	0.12812	Adj R-Sq	0.0652
Coeff Var	892.25822		

Parameter Estimates									
							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-0.31794	0.64968	-0.49	0.6250	0.52198	-0.61	0.5431
PE	PE	1	-0.27282	0.24809	-1.10	0.2727	0.21056	-1.30	0.1964
Market_BOOK	Market/BOOK	1	0.37400	0.19224	1.95	0.0530	0.27192	1.38	0.1704
BUST	BUST	1	-0.52675	0.17817	-2.96	0.0034	0.17678	-2.98	0.0032
VAR12	LN(1+AGE)	1	-0.00449	0.06075	-0.07	0.9411	0.04463	-0.10	0.9199
assets_turnover	assets turnover	1	0.23354	0.08395	2.78	0.0059	0.10370	2.25	0.0253
leverage	leverage	1	-0.00747	0.00313	-2.38	0.0181	0.00301	-2.48	0.0140
Log_market_cap	Log market cap	1	0.10544	0.10824	0.97	0.3311	0.08691	1.21	0.2264
PE_MB		1	0.16126	0.73474	0.22	0.8265	0.38166	0.42	0.6731
PE_BUST		1	0.18514	0.38408	0.48	0.6302	0.24844	0.75	0.4569

11.6.6 BHAR 24

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: BHAR_24 BHAR 24

Number of Observations Read	235
Number of Observations Used	235

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	10.49015	1.16557	1.12	0.3518
Error	225	234.86770	1.04386		
Corrected Total	234	245.35786			

Root MSE	1.02169	R-Square	0.0428
Dependent Mean	-0.01002	Adj R-Sq	0.0045
Coeff Var	-10193		

Parameter Estimates									
							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-0.40294	0.58063	-0.69	0.4884	0.58020	-0.69	0.4881
PE	PE	1	0.05976	0.22173	0.27	0.7878	0.31670	0.19	0.8505
Market_BOOK	Market/BOOK	1	0.20152	0.17181	1.17	0.2421	0.13108	1.54	0.1256
BUST	BUST	1	-0.20940	0.15923	-1.32	0.1898	0.11920	-1.76	0.0803
VAR12	LN(1+AGE)	1	0.07398	0.05429	1.36	0.1743	0.04635	1.60	0.1118
assets_turnover	assets turnover	1	0.11193	0.07503	1.49	0.1372	0.06983	1.60	0.1104
leverage	leverage	1	-0.00433	0.00280	-1.54	0.1240	0.00218	-1.98	0.0487
Log_market_cap	Log market cap	1	0.04082	0.09674	0.42	0.6735	0.08803	0.46	0.6433
PE_MB		1	-0.20474	0.65666	-0.31	0.7555	0.50540	-0.41	0.6858
PE_BUST		1	0.12724	0.34326	0.37	0.7112	0.49894	0.26	0.7989

11.7 Split Sample

11.7.1 CAR 36 for 1997-2004

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CAR_36 CAR 36

Number of Observations Read	103
Number of Observations Used	103

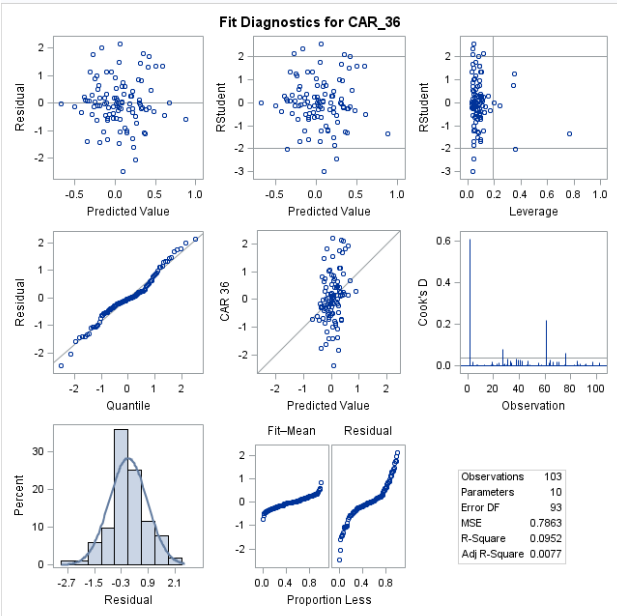
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	7.69710	0.85523	1.09	0.3794
Error	93	73.12463	0.78629		
Corrected Total	102	80.82174			

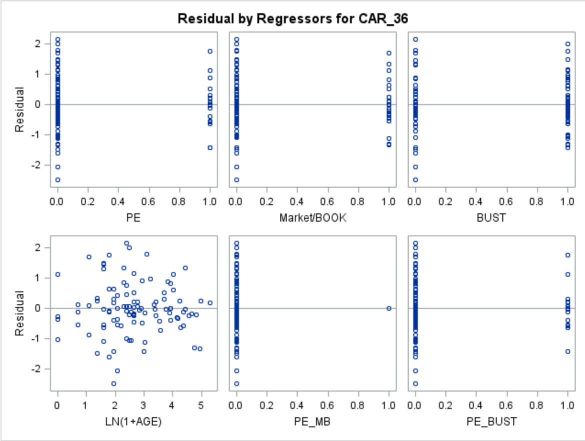
Root MSE	0.88673	R-Square	0.0952
Dependent Mean	0.05463	Adj R-Sq	0.0077
Coeff Var	1623.04617		

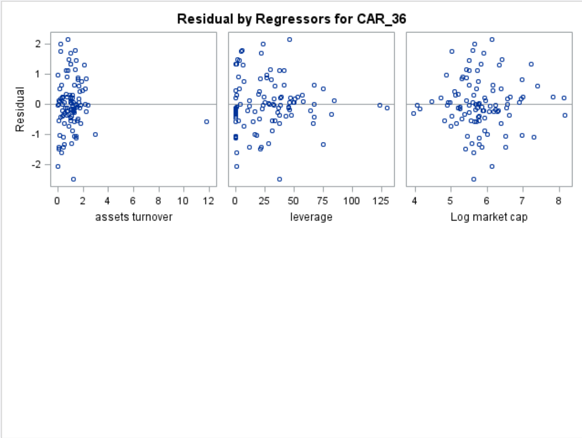
Parameter Estimates							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-0.26215	0.72402	-0.36	0.7181	0.51831	-0.51	0.6142
PE	PE	1	-0.50060	0.53716	-0.93	0.3538	0.61109	-0.82	0.4148
Market_BOOK	Market/BOOK	1	0.25846	0.22999	1.12	0.2640	0.20777	1.24	0.2166
BUST	BUST	1	-0.27790	0.20413	-1.36	0.1767	0.20106	-1.38	0.1702
VAR12	LN(1+AGE)	1	0.03711	0.07528	0.49	0.6232	0.06388	0.58	0.5628
PE_MB		1	0.86676	0.94770	0.91	0.3628	0.27007	3.21	0.0018
PE_BUST		1	0.34817	0.60369	0.58	0.5655	0.64638	0.54	0.5914
assets_turnover	assets turnover	1	0.09286	0.07608	1.22	0.2254	0.06527	1.42	0.1582
leverage	leverage	1	-0.00604	0.00368	-1.64	0.1036	0.00294	-2.06	0.0424
Log_market_cap	Log market cap	1	0.07126	0.11765	0.61	0.5462	0.08022	0.89	0.3767

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CAR_36 CAR 36







11.7.2 BHAR 36 for 1997-2004

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: BHAR_36 BHAR 36

Number of Observations Read	103
Number of Observations Used	103

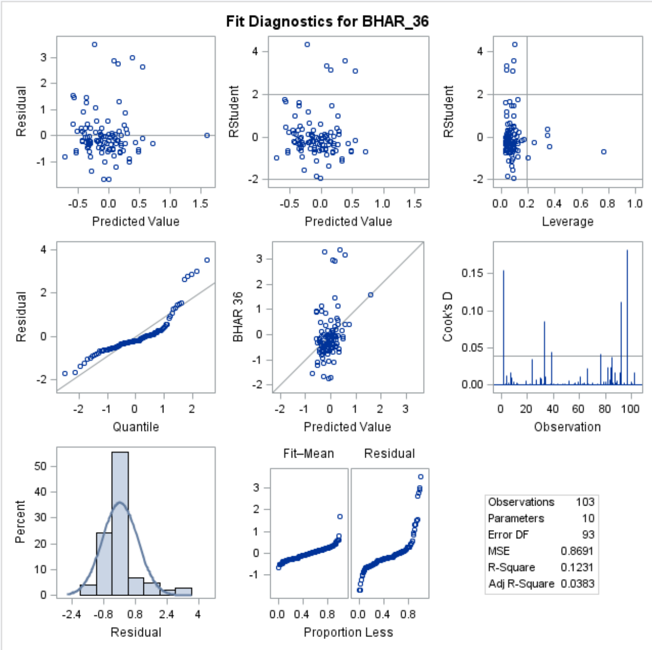
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	11.34790	1.26088	1.45	0.1782
Error	93	80.82473	0.86908		
Corrected Total	102	92.17263			

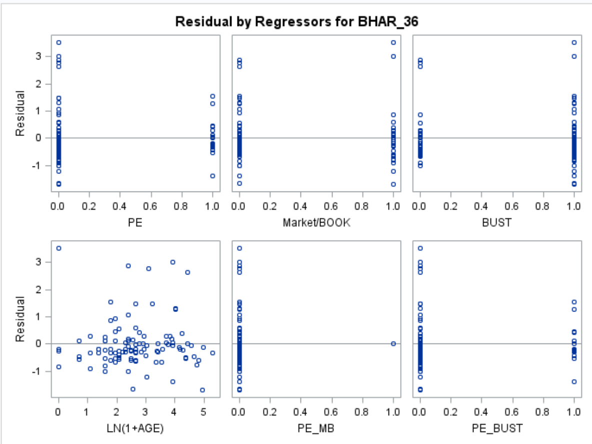
Root MSE	0.93225	R-Square	0.1231
Dependent Mean	-0.06347	Adj R-Sq	0.0383
Coeff Var	-1468.87044		

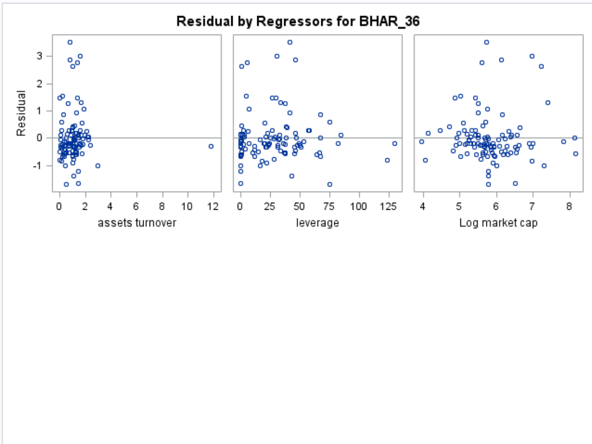
Parameter Estimates							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-1.35688	0.76119	-1.78	0.0779	0.74338	-1.83	0.0712
PE	PE	1	-0.43456	0.56473	-0.77	0.4435	0.24695	-1.76	0.0817
Market_BOOK	Market/BOOK	1	0.31055	0.24179	1.28	0.2022	0.26323	1.18	0.2411
BUST	BUST	1	-0.40056	0.21460	-1.87	0.0651	0.20829	-1.92	0.0575
VAR12	LN(1+AGE)	1	0.06275	0.07914	0.79	0.4299	0.09633	0.65	0.5164
PE_MB		1	1.66918	0.99635	1.68	0.0972	0.31748	5.26	<.0001
PE_BUST		1	0.41451	0.63468	0.65	0.5153	0.33941	1.22	0.2251
assets_turnover	assets turnover	1	0.09848	0.07999	1.23	0.2213	0.04541	2.17	0.0327
leverage	leverage	1	-0.00195	0.00386	-0.50	0.6148	0.00304	-0.64	0.5219
Log_market_cap	Log market cap	1	0.21199	0.12368	1.71	0.0899	0.11746	1.80	0.0744

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: BHAR_36 BHAR 36







11.7.3 CAR 36 for 2005-2012

The REG Procedure
Model: MODEL1
Dependent Variable: CAR_36 CAR 36

Number of Observations Read	132
Number of Observations Used	132

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	14.38318	1.59813	2.42	0.0144
Error	122	80.43083	0.65927		
Corrected Total	131	94.81402			

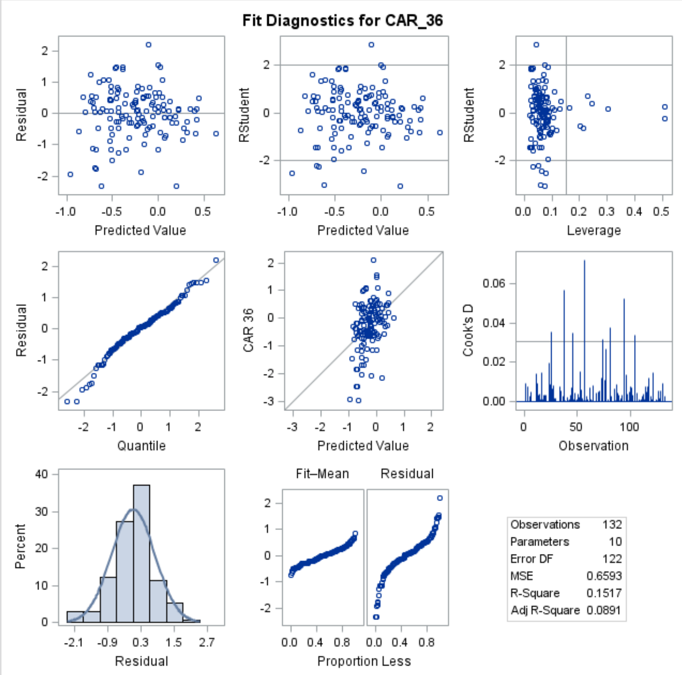
Root MSE	0.81195	R-Square	0.1517
Dependent Mean	-0.23729	Adj R-Sq	0.0891
Coeff Var	-342.17721		

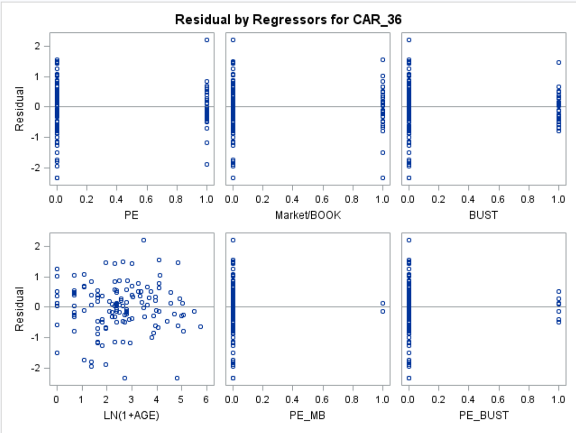
Parameter Estimates

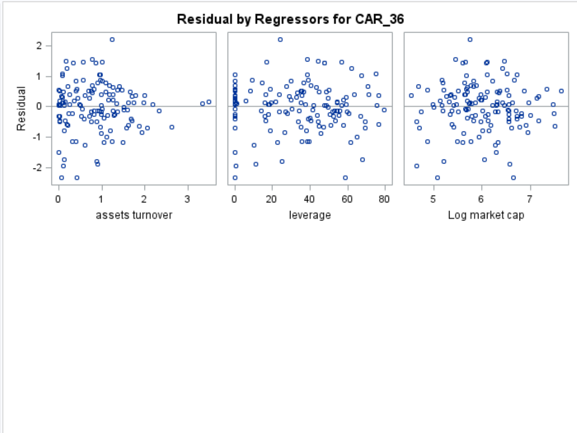
							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-2.21545	0.68715	-3.22	0.0016	0.73027	-3.03	0.0030
PE	PE	1	0.09626	0.19828	0.49	0.6282	0.18883	0.51	0.6111
Market_BOOK	Market/BOOK	1	0.28744	0.19198	1.50	0.1369	0.18579	1.55	0.1244
BUST	BUST	1	0.11371	0.19425	0.59	0.5594	0.14606	0.78	0.4378
VAR12	LN(1+AGE)	1	0.13192	0.05784	2.28	0.0243	0.05942	2.22	0.0282
PE_MB		1	0.33186	0.71706	0.46	0.6443	0.27689	1.20	0.2330
PE_BUST		1	-0.27253	0.45036	-0.61	0.5462	0.29007	-0.94	0.3493
assets_turnover	assets turnover	1	0.21812	0.12076	1.81	0.0734	0.09157	2.38	0.0188
leverage	leverage	1	-0.00028985	0.00319	-0.09	0.9277	0.00303	-0.10	0.9240
Log_market_cap	Log market cap	1	0.22564	0.11684	1.93	0.0558	0.11563	1.95	0.0533

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CAR_36 CAR 36







11.7.4 CAR 36 for 2005-2012

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: BHAR_36 BHAR 36

Number of Observations Read	132
Number of Observations Used	132

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	7.12385	0.79154	2.46	0.0130
Error	122	39.23393	0.32159		
Corrected Total	131	46.35777			

Root MSE	0.56709	R-Square	0.1537
Dependent Mean	-0.10238	Adj R-Sq	0.0912
Coeff Var	-553.89986		

Parameter Estimates									
							Heteroscedasticity Consistent		
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-0.65959	0.47992	-1.37	0.1718	0.39021	-1.69	0.0935
PE	PE	1	-0.03817	0.13848	-0.28	0.7833	0.14716	-0.26	0.7958
Market_BOOK	Market/BOOK	1	0.18714	0.13408	1.40	0.1653	0.12362	1.51	0.1326
BUST	BUST	1	0.05428	0.13567	0.40	0.6898	0.13284	0.41	0.6836
VAR12	LN(1+AGE)	1	0.15430	0.04039	3.82	0.0002	0.04264	3.62	0.0004
PE_MB		1	0.19796	0.50081	0.40	0.6933	0.32406	0.61	0.5424
PE_BUST		1	-0.19305	0.31454	-0.61	0.5405	0.26832	-0.72	0.4732
assets_turnover	assets turnover	1	0.06119	0.08434	0.73	0.4696	0.06094	1.00	0.3174
leverage	leverage	1	-0.00225	0.00223	-1.01	0.3149	0.00169	-1.33	0.1852
Log_market_cap	Log market cap	1	0.02490	0.08160	0.31	0.7608	0.07044	0.35	0.7244

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: BHAR_36 BHAR 36