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How does the time in portfolio affect private equity portfolio company performance?

A study of 139 PE backed buyouts being exited through IPO between 1997 and 2010

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Abstract

The private equity market has developed significantly since its inception both in size and industry scope. Furthermore, after the collapse of the first private equity wave, due to the over-issuance of junk bonds, there seems to be a shift to more operational focus in the industry. With the aforementioned, it has been argued in previous studies, that the portfolio company holding period has increased on average. Studying a sample of 139 PE-backed firms exited through IPO between 1997 and 2010, this paper aims to study the effect of holding period on portfolio company performance, both in regards to operational performance and short-term stock performance (underpricing). However, due to the small data sample and large number of outliers, we are unable to draw clear conclusions. However, since we find some statistical significance, our study can contribute as an inspirational framework for further research.

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Table of Contents

Introduction

Purpose and relevance

Private Equity firms (PE firms) raise capital to, and manage, Private Equity funds (PE funds), in which mainly institutional investors invest capital. The PE firm create value to the PE fund investors by buying, developing and exiting private companies (or public entities taken private). They might exit companies by selling the company to an institutional investor, a strategic buyer (e.g. a company within the same industry as the portfolio company) or by taking the company public.

The private equity market (PE market) has grown significantly since its inception in the 1980s. The number of transactions has increased, the industry scope has broadened and the market has become a more global phenomenon (Strömberg 2007). These changes have received more attention in the PE literature recently, confirming a shift in the PE industry. Furthermore, this shift in the PE environment has shown to be more pronounced since the first PE wave, which collapsed due to the over-issuance of junk bonds.

With the aforementioned shift in the industry, it has become more challenging in addressing PE firm's strategies. Hoskisson et. al. (2013) shed light on this matter and argue that today's PE market has become more complex where it is no longer possible to generalize PE firm strategy. Instead, PE firms need to adopt a specific strategy in order to gain a competitive position in the market. The different strategies mentioned are categorized accordingly to the level of leverage the PE firm takes on as well as its industry scope (either broad or narrow).

One important aspect in regards to PE firms and their strategy is related to how long firms stay in PE firm ownership. There has been disparate views within the academic literature on longevity of buyouts firms, more specifically when discussing leverage buyouts (LBOs). Earlier literature, such as Jensen (1989), argues that LBO ownership is the optimal long-term structure whereas Rappaport (1990) argues LBOs being a short term structure. Kaplan (1991) on the other hand argue that LBO ownership is neither short, nor long term. A more recent study by Strömberg (2007) argue the holding period of LBOs has increased.

Cao (2011) states that the longevity in the PE fund is a proxy for the effort put into operational improvement, thus indicating the firm's aftermarket potential. Therefore, the time in portfolio may reduce the valuation uncertainty and hence its risk composition.

The aim of this study is to further contribute with evidence of change in the PE market by studying the longevity of firms in PE fund ownership. More specifically, we will be addressing the issue in regards to mature buyout companies being exited through IPO. The reason for this is first of all due to the main critic of PE firms prioritizing market conditions over value creation, pushing overleveraged portfolio companies too quickly into the public market in order to take advantage of IPO booms. Cao and Lerner (2006) find evidence for this, thus concluding that the stock performance of so called "quick flips"

(portfolio companies held up to one year), underperform. Secondly, the market has recently been experiencing an IPO-boom were more PE firms are exiting their company through IPOs.

The drivers of PE portfolio companies' post-exit performance, as well as post IPO operational and stock performance, has been covered extensively in previous literature. To our knowledge, there are no studies *focusing* on the time in portfolio (referred to as longevity or duration) as a driver of operational performance in PE deals in general. Nor has any studies related the longevity to information asymmetry issues such as underpricing. Cao (2011) and Cao and Lerner (2006) study the longevity in relation to reversed leverage buyouts' (RLBO) performance. Their study is limited to long-term operational and stock performance. Furthermore, RLBOs are previously public companies being delisted and then re-listed. This means the market has some previous information from their earlier trading days and therefore may not be that representative of the general buyout market in relation to evaluation of longevity.

To study the implications of longevity on post-IPO operational performance and short term stock performance, we are using a sample of 139 PE backed mature buyouts, exited through IPO between 1997 and 2010. The portfolio companies are incorporated in 14 European countries, the USA and Canada and present in 12 different industries, as specified by Fama and French. We have chosen the narrow scope of mature buyouts being exited through IPO since we believe (and are able to show) that this strategy has common characteristics, independent of which type of PE firm (focusing on debt or equity), is taking on the deal. This will reduce the risk of the PE firm type and longevity being collinear in explaining improved performance.

Outline

The paper will proceed as follows: in the first section a brief description of the PE firm will be presented. Section two will discuss relevant literature followed by the research questions and underlying hypotheses. Section three and four will present the data and the methodology. Lastly, section five and six will cover our results and conclusion as well as give an insight into further studies.

The Private Equity Firm

Leverage buyout is a phenomenon which emerged in the 1980s and involves a company being acquired with a relatively large portion of debt. According to Kaplan and Strömberg (2009), the term leverage buyout (LBOs) is today also referred to as private equity (PE). In contrast to venture capital firms (VC firms), PE also invest in more mature companies and take a majority stake in the portfolio company. Hoskisson et. al. (2013) employs a somewhat wider definition of PE firms, separating PE firms that are debt oriented (LBOs) from equity related (long term improvement). Strömberg (2007) also admits there has been shift from LBOs in the PE industry.

PE firms raise capital, mainly from institutional investors, through private equity funds (PE funds), mainly from institutional investors. They manage the funds during a limited time of period with the aim of creating value for its investors. PE firms invest in private companies or take public companies private. When all companies in the PE fund have been exited, the fund is closed and if the PE firm has managed

the fund well, the proceeds are distributed among the owners and the PE firm. There are a number of ways for the PE funds to exit a portfolio company, such as selling to a strategic buyer, to another PE firm (secondary buyout, SBO) or through an initial public offering (IPO) on stock exchange.

Previous literature and hypotheses

This chapter will first cover the relevance of the topic longevity in today's PE market. The second part will then discuss the drivers of operational performance of PE backed firms and its conflict with IPO timing followed by the last section which will cover how the operational performance is translated into the stock performance.

Longevity and PE

Since Jensen (1989) introduced the discussion regarding the advantages of LBOs and his prediction regarding LBOs as a dominant organizational form, there have been much debates on PE firms' ability to create value. In contrast to Jensen, Rappaport (1990) argues that LBOs are a short term "shock therapy" for badly performing firms with poor corporate governance. He argues that PE firms apply a quick restructuring process with the aim to thereafter exit the firm at a higher value.

However, the private equity market has developed significantly since then. The market has grown tremendously both in terms of value and number of transactions. Furthermore, the industry scope as well as the international exposure, has increased where US is no longer the main LBO market. Rather, many non-US countries have grown their LBO market with Western Europe being the prominent one (Strömberg 2007). These changes have involved PE firms needing to apply different strategies. Hoskisson et al. (2013) studies the evolution of the PE market and how it has led to PE firms taking on different strategic positions in order to stay competitive. They argue that due to the highly leveraged and great portion of junk bonds used to finance the transactions during the first PE wave created an environmental change during the second wave. PE firms became more operational focused and prioritized professional guidance. The shift from "financial "to "operational engineering" implied the need for PE firms to differentiate themselves and establish competitive advantages. The authors present a conceptual framework conveying the different strategies that evolved during the second wave. They classify PE firms into two dimensions where one is their financial structure emphasizing the degree of debt versus equity used and the second emphasizing the extent of diversification scope of their portfolio firms. With this classification one can see that the portfolio firm's time in portfolio will differ depending on the extent of operational focus the PE firm has. This creates PE firms to take either a long-term perspective (if more operational focused) or short-term perspective (if more financial focused) in its portfolio companies.

Wright et. al. (1994) contribute further in explaining the nature of PE firms and with regards to holding period. They attempt to explain which factors influence longevity of portfolio companies. They argue that if the financial institutes are more focused on the internal rate of return (IRR), the quicker the portfolio company will be exited thus the lower the holding period will be. Furthermore, market factors

are also shown to affect the holding period. A rapidly changing market implies a higher degree of merger activity for companies, in order to stay competitive. Therefore, it is more likely for exit prices to bid up in times of high volumes, especially for smaller buy-out companies. Their study is however limited to the buy-out market in the U.K.

A more recent study in regards to the longevity debate and LBOs, is Strömberg's article *The new demography of private equity* (2007). He refers back to Jensen's and Rappaport's arguments regarding PE firms contribution to its portfolio companies and argues that the disparate views are caused due to the perception of LBO longevity in portfolio. Furthermore, his study shows that holding periods of private equity funds have increased and find no evidence for "quick flips" to be more common. He concludes that LBOs are more long-term then what had been thought before (Kaplan 1991). However, his study does not look into the effect of holding periods but merely states that there has occurred a shift to a more long-term focus.

Operational performance

PE firms are argued to create value through three ways: operational improvement, market timing and change in capital structure. However, Modigliani-Miller argue that the change in capital structure does not change firm value but gives the firm a benefit from an increased tax shield. Leverage here is not seen as a value creator but rather a value distributor. Furthermore, market timing depends on external factors in which the PE firm cannot effect but respond to. Therefore, as many studies argue, the operational improvement is the true value creator (Bergström et al. 2007). Especially, after the first PE wave, which collapsed due to over-issuance of junk bonds, there seems to be a shift to more operational focus amongst PE firms.

Studies have shown that operational performance is higher during the PE firm's ownership due to the managerial incentives and avoidance of agency conflict. Findings show that operating income to sales increase relative to industry, ratio of capital expenditure to sales decline as well as the ratio of cash flow to sales increase (Kaplan and Strömberg 2009). However, there has been much debate regarding its conflict with market timing where PE firms have been criticized of prioritizing higher exit prices during hot IPO periods and other potential market conditions over value creation.

Jain and Kini (1994) studied the change in operating performance of firms transforming from private to public ownership. Their study is one of the first that looks into operational performance instead of the typical post-issue stock price performance of LBOs. They measure operational performance by comparing returns on assets, operating cash flows divided on total sales, sales, asset turnover and capital expenditure prior to the IPO and to each four subsequent years. Their results show that there is a decline in operational performance in all post-IPO years and suggest that potential reasons for this may be due to the increased agency cost. Reduction in management ownership leads to the agency problem where there is an increased conflict between initial owners and shareholders. Alternative reasons for decline in profits post-IPO are manager's window dressing the accounting numbers before the IPO and the timing of the issuance during periods of exceptionally good performance levels (so called operational timing).

Similarly, Cao (2011) studies the operational performance of firms going from private to public ownership. More specifically, he looks into the buyout sponsors' IPO timing of reversal leverage buyouts (RLBOs) and its impact on firm performance. The conclusions drawn from his study is that shorter LBO longevity leads to greater deterioration on performance. This suggests that buyout sponsors are unable to add any value during shorter holding periods. Cao concludes that these so called "quick flips" occur due to operational efficiency being succumb to favorable IPO market conditions. However, his findings of operational performance of RLBOs as a whole do not exhibit greater declines in operating performance then comparable firms.

Stock performance in relation to IPOs

The IPO market is affected by market conditions where it experiences a hot market during an economic upturn and is characterized of an increased number of firms going public. In contrast during economic recessions, there is less IPO activity and is a so called cold market.

However, firms undertaking an IPO, are limited in their ability to take advantage of hot markets due to the effects of underpricing when listed. Most studies argue that IPO underpricing is based on information asymmetry. Information asymmetry relates to the fact that managers and insiders, including the PE firms, have more information on the quality of the portfolio company business than uninformed external investors. This pose risk to the external investor. The uninformed external investor want to be compensated for such risk. However, by using reliable signals that are hard and costly for a bad manager or insider to imitate, this risk can be mitigated. In that case, the uninformed external investor will not require the same amount of risk compensation.

One explanation to the IPO underpricing under the asymmetric information theory is the winners curse presented by Rock (1986). The winner's curse model shows that the informed investors are more likely to withdraw from the market if an IPO is overpriced and the uninformed ones holding a larger allocation of the overpriced stock. Therefore, by underpricing an IPO, the uninformed investors are compensated for the information asymmetry and also induces them to purchase IPO shares.

Ljungqvist (2005) presents the following implications of the winner's curse model. If there is greater uncertainty in the stock value, the more it will be underpriced. Therefore, the underpricing can be reduced by decreasing the information asymmetry between informed and uninformed investors.

Ritter and Loughran (2004), discuss that the degree of underpricing can be assessed by looking at the risk composition of firms. They, in line with Ritter (1984), state that riskier stocks will be more underpriced, and if more risky stocks are being listed, there will be a greater average underpricing in the market. In this case, the level of riskiness is assessed through the technological and valuation uncertainty.

Furthermore, Cao (2011) states that duration in the PE fund is a proxy for the effort put into operational improvement thus indicating the firm's aftermarket potential. Therefore, the time in portfolio may reduce the valuation uncertainty and hence its risk composition. This suggests that firms that have been in the portfolio during a longer time period may be less underpriced. This can be concluded by Cao

who find RLBO stock performance 1, 2 and 3 years after IPO to outperform the market when using value-weighted CRSP returns, whereas quick flips show to underperform.

Cao and Lerner (2006) shed more light on this matter in regards to the stock performance and PE-backed firms by studying three and five year stock performance of RLBOs. The study concludes that RLBOs appear to outperform other IPOs and the stock market during the studied time period. The outperformance is not relative to any particular time period. Also, they find no evidence between more leveraged RLBOs and poorer performance than the compared peers. However, they find partial evidence for quick flips performing poorer than the average RLBOs.

The two previous mentioned studies are limited to RLBOs which means that the market has some previous information from their earlier trading days and therefore may not be that representative of the general LBO market. Furthermore, the studies look into the long-term stock performance and since more information is made available over time, the studies are not able to address the issue of information asymmetry of previously non-listed stocks.

Research question and underlying hypothesis

With the mentioned background and literature in mind, one can see that holding period of portfolio companies have become an important factor to consider when discussing PE firm's ability to create value. However, as mentioned earlier, there seems to be a lack of studies investigating if longevity has an effect on the portfolio company's performance. Therefore, the purpose of this study is to shed more light on this matter and inspire for further studies. Our first research question is the following:

Does holding time (longevity) of European and North American buyouts, being exited through IPO, have an effect on the operational performance after being listed on the stock exchange?

Another relevant question in regards to longevity and portfolio firm performance is how it is perceived by the market. More specifically, it is interesting to see if the holding period is translated into the stock movement of the PE-backed firmed, reducing the information asymmetry. Therefore, our second research question is the following:

In regards to information asymmetry, does the investors take the time in portfolio (longevity) in consideration when investing in PE backed buyouts being exited through IPO?

Our hypothesis for the first question is that PE-backed companies with longer holding periods will show better operational performance relative to public peers, than PE firms with shorter holding periods. This hypothesis is based on the fact PE firms have an ability to put more time on improving the company's operations and also due to Strömberg's mentioned trend of an increased average holding period.

The hypothesis for our second research question is that PE firms with longer holding periods will signal better operational improvements and thus be a more attractive investment. This implies a low degree of underpricing. This hypothesis is based on Cao's argument of holding period being a proxy for operational effort.

One important notion is that we by longevity refer to the time a portfolio company is held private in the PE fund. Hence, in relation to this study, the time span between first day of entry to the day of the IPO. Cao (2011) provide evidence that PE firms keep a large stake in the company for several years after an IPO, and hence, influence the operational performance of the public company through its close monitoring of the company.

Data

The original dataset has been manually obtained by retrieving information from a wide range of databases, including PE specific as well as general operational and stock performance databases. This section is split into three parts, one subsection describing how we obtained our original dataset, followed by a subsection describing how we have modified the dataset. At the end we will discuss the benchmarks being used.

Initial dataset

Information on PE-, VC- and investment firm-backed transactions, including IPOs, are available in the Zephyr database. The database covers deals being conducted in USA, Canada and some European countries, ranging from 1997 to the present. To be able to monitor post-IPO operational performance to the present we only include deals and IPOs being conducted prior to 2011. The database includes information on some deal characteristics, such as entry and exit dates, and information on the so called vendors (PE firms, institutional investors or merchant banks selling equity). By Zephyr's link to the Orbis database we are also able to retrieve PE firm characteristics.

Due to operational and stock performance data availability, we include deals involving portfolio companies registered in Austria, Belgium, Germany, Denmark, Spain Estonia, Finland, France, UK, Italy, the Netherlands, Norway, Poland, Sweden, USA and Canada and listed on exchanges in the mentioned countries. The benefit of studying several countries is a wider sample which will increase the power of the tests. In the early 1990's, the US PE industry was in a later stage in the industry cycle than the European firms. However, during the second wave, many PE firms had started to go global and large European PE firms had emerged. Hence, in relation to our data, PE industry cycle effects should oppose no threats to using a North America and Europe sample. In relation to company performance, we are relating the performance to benchmarks as discussed below.

Additional IPO related information, such as offer price and IPO vendors, were also obtained from the SDC Platinum service, including the VentureXpert and New Issues databases.

Operational performance, accounting and industry data for the portfolio companies was obtained from WRDS, using the Compustat North America and Compustat Global databases. Only a few of the

companies matched on company name so we had to manually search for the companies by browsing on name, ticker and IPO date. We used the gvkey, a unique company identifier for the WRDS databases, to interlink the IPO/PE characteristics data with the performance data. The benefit of using the gvkey identifier over ticker or cusip is that the gvkey is unique to a company, whilst the cusip and ticker may change if the company is delisted.

Due to data unavailability for a large number of European portfolio companies, we could not use the CRSP database for stock performance. Instead, we manually obtained the daily closing prices for the portfolio company stocks from Datastream. To identify the correct company and security we identified the relevant security by using company name, ticker and IPO date.

Dataset modifications

The initial dataset has been modified to better fit our research scope. Further, some modifications have been necessary due to data availability.

The original Zephyr dataset included PE-, VC- and institutional-backed IPOs (and institutional transactions later leading to IPOs). Since the aim of this study is to investigate how longevity affects portfolio companies' operational performance and the perception of the IPO, as indicated by the short-term performance (underpricing), we have focused on mature buyouts. First, VC and investment firm backed IPOs are excluded since we are focusing on pure PE firms (the ability to raise and hold capital differs between PE firms and investment firms and in relation to VC the value creation process and risks differs substantially). Further, by focusing on a particular strategy, used by equity focused as well as debt focused PE firms, we try to mitigate the bias of perfect collinearity between PE firm characteristics on the portfolio company longevity. This is in line with Strömberg's suggestion that PE industry is becoming more focused on operational engineering but that some strategies are shared between different types of PE firms.

We do not exclude firms that have been delisted during the period. The delisting might depend on e.g. take-over followed by delisting or because of bankruptcy. If we exclude these firm we increase the presence of survivorship bias. Single extreme performance outlier records have been excluded, e.g. EBITDA margins less than -4. Further, companies for which no operational or stock data has been found, have been excluded.

Deal characteristics, such as entry and exit dates, are available for the transactions. Some portfolio companies occurred multiple times in the dataset due to them being targets for institution backed M&A prior to the IPO. By using these duplicate values we can get an appropriate entry date if the PE firm has acquired the company in stages. If the PE firm has gradually increased its stake in the company the first date of entry is used, even if the acquired stake is unknown. Further, if several PE firms have syndicated to acquire the portfolio company, the syndicate leader, as stipulated in the Zephyr database, is assumed to influence the project and value creation strategy the most and hence, specified as the PE firm taking the company to the market.

To capture the effect of different PE firm value creation strategies, we classify the PE firm type in accordance with Hoskisson et. al. (2013). The PE firms are divided into four groups: "Debt and focused", "Debt and diversified", "Equity and focused" and "Equity and diversified". The classification is done manually by studying the business description of the firm in the Orbis database and the description on the respective PE firm's website. PE firm's that historically has taken on much debt when acquiring companies (typically PE firms merely conducting LBOs) are classified as debt oriented and other PE firms are classified as equity oriented. Furthermore, PE firms focused on four industries or less are classified as focused, whilst other PE firms are seen as diversified.

For some transactions, no entry dates were registered in Zephyr. Entry dates have then been manually collected by reviewing press releases and portfolio company and PE firm homepages.

Since the sample is relatively small but we still want to make industry comparisons, we use Fama and French 12 industry classification. The classification is based on the industry characteristics and previous co-movements. The classification codes can be downloaded from Kenneth French's website.

By making the modifications of the original dataset, the final dataset includes 139 PE backed buyouts between 1997 and 2010. Information on the dataset distributions is available in Appendix, Table A-1 to A-6.

Benchmarks

In our study we relate the portfolio company performance to benchmarks. Different approaches has been made to find relevant benchmarks for operational and stock performance.

In relation to the operational performance, we are studying the performance two and three years after the IPO. Since several years elapse between the different measurements, we need to reduce the risk of bias by selecting benchmarks active under similar conditions. We are matching the company to industry peers active in the same country to get an appropriate benchmark. According to Barber and Lyon (1996), industry matching is commonly used in previous literature. In line with their recommendations we are identifying the relevant industry by the 2-digit sic code. We export all available companies, present in the same company as the portfolio companies, with the same 2 digit sic code from Compustat North America and Compustat global. This results in a dataset of 7624 public companies. We calculate different performance measures for each company, including ROA, EBITDA margin and EBIT margin. From this we extract the respective median performance measure for each 2-digit sic code group in each country, every fiscal year.

Since IPO:s in general, and PE transactions in particular, sometimes give the company extreme characteristics, Barber and Lyon argues that it sometimes is important to match on more characteristics than just industry. Prior performance (e.g. RoA) might be an appropriate matching technique. Lyon and Barber however show that this approach is only providing more unbiased benchmarks (compared to industry matching) if the prior portfolio company and benchmark performance are within the same 90%-110% range. By testing this on some of the European industries, where Compustat data is not as comprehensive as in the US, we find no companies within the same 90%-110% range in the relevant

industry, leaving us to match only on industry anyways. Further, another approach is to match on prior performance and industry. According to Barber and Lyon this only gives a less biased benchmark if you are studying very small companies and very big companies. To use industry and size matching would hence be good if we studied ventures. However, we are only studying mature buyout companies. We hence, keep the yearly, country-based industry matched medians as benchmarks. The distributions of the benchmark dataset is available in Appendix, Table A-7 to A-9.

In relation to our short-term stock performance study, we use domestic market and sector value weighted market indices, namely the FTSE Global indices available in Datastream. Since we have companies listed in Europe as well as North America we want indices that are compiled in a similar way in all markets. The FTSE Global indices are the only indexes available to us with index data for all relevant industries in all relevant equity markets. The Fama French 12 industry classification, based on historic similarities in stock movement, has been used to match the companies to an applicable sector index.

Methodology

This section covers the study methodology .The aim of this study is to investigate what effect the longevity has on operational performance and short-term stock performance (related to underpricing). The first subsection covers our first event study of the abnormal operational performance post IPO. To be able to evaluate abnormal performance we have to define appropriate event and performance measures. This is followed by the model specification for analyzing the drivers of abnormal operational performance. When the influence of duration on operational performance has been covered, we move to the next subsection, covering the tests on short term stock performance. By conducting an event study of post IPO stock performance (first day returns and cumulative abnormal return up to 90 days after the IPO) we hope to detect the presence of underpricing, and if underpricing and price discovery is related to the longevity.

Operational performance

Event specification

We are interested in the post IPO operational performance. Hence, the IPO itself is the event, followed by a 2-year post event window, where we measure several operational performance ratios, as specified in the following sub section. The performance measured in the post event window will be compared to the performance in the fiscal year before the IPO. The time frame, illustrated in Figure 1 is in line with previous literature, commonly using a 2-3 year post event-window to estimate the IPO's (and other exits') implications on firm performance.

Fig.1

Measures of operational performance

In the previous literature on post IPO operational performance, a variety of measures have been used. We have chosen to focus on some of the most common performance measures, including EBITDA margin, EBIT margin and return on assets. Another appropriate measure would be sales growth. The sales growth has been extensively covered in the literature on operational timing though, saying that the post-IPO sales growth is higher. In this study, however, we are more interested of the effect of longevity on profitability i.e. how efficient the company is. Sales may easily be inflated by using discounts extensively or taking on new investments in tangible or intangible assets. By studying profitability margins and return on assets we can take account for these issues.

Furthermore, only ratios are applicable to our study. We are comparing companies of different sizes and using different currencies. It would therefore be inappropriate to compare the performance of different companies on actual reported EBITDA, rather than using a ratio.

The EBITDA margin is earnings before interest, taxes, depreciation and amortization, divided by sales. As mentioned in the section on relevant literature, PE firms may employ different strategies using different levels of leverage. Our data set includes highly and low levered companies in several tax jurisdictions. The EBITDA margin is hence a good margin to isolate the operational improvement since it does not take consideration to tax or capital structure. The EBITDA itself is also a good proxy for operating cash flow, since it does not take consideration to the non-cash depreciation and amortization items. The EBIT margin is calculated as earnings before interest and taxes, divided by sales. Unfortunately, the data availability of EBITDA in relation to the European companies in the data set is limited. Like the EBITDA margin, the EBIT margin is tax neutral and not affected by the capital structure. The EBIT is often referred to as the operating profit and takes consideration to all costs incurred in relation to the operations.

In relation to the return ratios, return on assets (RoA) is most commonly used in previous literature. How the return on assets is calculated differs between different authors. Some relate net income to the book value of assets at the beginning of the year, other relate EBIT to book value of assets at the beginning of the year. To be fair, an appropriate return ratio relating to EBIT, which is not affected by the capital structure, should use the net assets. Unfortunately, the data availability of debt items needed to calculate the net assets in relation to the European companies is limited. We hence calculate the RoA as net income, divided by book value of assets at the beginning of the year. This ratio relates the actual profit to the assets used to generate such profit. Since it takes notice to tax and capital structure implications it is not optimal to use when comparing the companies in our dataset. To be able to relate our results to previous literature it is however necessary to include the measure in our analysis. The focus will however be on the EBIT margin (because of the data availability issues in relation to the EBITDA margin).

Model specification

To analyze the effects of longevity on margin and return ratios in relation to the IPO we will conduct an ordinary event study (on the sample as a whole and divided to sub-samples of portfolio

companies with the same longevity) relating the current abnormal operational performance to previous abnormal performance. We will also use a regression model to see how different performance drivers, such as longevity, drives the change in performance. These methods have both been widely used in previous literature (see e.g. Barber and Lyon (1996) and Cao (2011) for further details).

First, our event study of abnormal performance use the calculated performance measure (EBITDA margin, EBIT margin and RoA) and deducts the performance of the benchmark (matched on country, industry and year). A full description of how the benchmark is calculated, and the motivations behind it, is provided in the data section.

(1) $AR_{IPO-1} = Company\_performance_{IPO-1} - Benchmark\_performance_{IPO-1}$

(2) $AR_{IPO+t} = Company\_performance_{IPO+t} - Benchmark\_performance_{IPO+t}$

AR_{IPO-1} is the abnormal performance one year prior to the IPO and AR_{IPO+t} is the abnormal company performance t years after the IPO (we measure the performance when t=1 and t=2).

We then compare the dependent AR_{IPO-1} to AR_{IPO+t} samples by using the non-parametric Wilcoxon signed rank sum test. This is due to the well documented problem of PE backed company performance outliers. We cannot assume the difference between the samples are normally distributed, hence we are referred to the Wilcoxon signed rank sum test to evaluate the difference between the dependent samples.

$$H_0: AR_{IPO+t;sub\text{-}sample} = AR_{IPO-1;sample\text{-}sample} \text{ against } H_1: AR_{IPO+t;sub\text{-}sample} \neq AR_{IPO-1;sample\text{-}sample}$$

where sub-sample indicates the sub-sample of observations with the same longevity (1-5 years and shared sub-sample with longevity of 6-11 years due to sample size; we also conduct tests with one sub-sample including companies with 2-5 longevity, compared to companies held for other time periods).

In addition to the previous test, we also want to evaluate if the sub-samples (split by duration) provide different abnormal performance-change between AR_{IPO+t} and AR_{IPO-1} in relation to each other. Since these sub-samples are not dependent we cannot use the Wilcoxon signed rank sum test. Instead we are referred to the Wilcoxon-Mann-Whitney test. Since we cannot assume there are matched pairs in the different sub-samples, this test is unfortunately less likely than the previous test to provide significant results on the difference between the different sub samples.

$$H_0: (AR_{IPO+t} - AR_{IPO-1})_{sub\text{-}sample1} = (AR_{IPO+t} - AR_{IPO-1})_{sub\text{-}sample2} \text{ against}$$
$$H_1: (AR_{IPO+t} - AR_{IPO-1})_{sub\text{-}sample1} \neq (AR_{IPO+t} - AR_{IPO-1})_{sub\text{-}sample2}$$

where sub-sample1 and sub-sample2 indicates the sub-samples of observations with the same longevity (1-5 years and shared sub-sample with longevity of 6-11 years due to sample size; we also conduct tests with

one sub-sample including companies with 2-5 longevity, compared to companies held for other time periods).

To evaluate some of the particular drivers of change in performance we also do a regression analysis on typical performance drivers by previous literature (c.f. Cao 2011 and Kaplan and Strömberg 2009).

$$(3)\ \Delta\frac{EBIT}{sales}_{IPO+1;IPO-1} = \beta_0 + \beta_1 log(longevity) + \beta_2 quick_{flipdummy} + \beta_3\frac{debt}{assets} + \beta_4 log(assets) + \sum_1^4 \beta_{type} PE\_firm_{type} + \sum_1^{12} \beta_{ind} industry_{ind} + \sum_{1996}^{2013} \beta_{year} year\_dummy_{year} + \varepsilon$$

Due to the well documented problem of extreme outliers in relation to PE company performance, one of the underlying assumptions of the standard Ordinary Least Squares (OLS) regression is at risk, the assumption of homoscedasticity. To mitigate this problem we have to use the natural logarithm of some measures to reduce their non-linear implications. We further need to do a robust regression with robust standard errors.

The $\Delta EBIT/sales_{IPO+1;IPO-1}$ is the EBIT margin one year after the IPO, compared to the EBIT margin one year prior to the. Longevity is one of the performance drivers of main interest to us. Unfortunately we need to use the log value of longevity due to its non-linear implications. The quickflip dummy is one if the company was divested in one year and is to compensate for our previously mentioned assumption that no real operational effort can be conducted in just one year. Debt to assets (in one year prior to the IPO) is to take the capital structure into consideration. As mentioned before, the EBIT margin itself is not taking the debt structure into consideration. However, it is effected by the risk of the leverage. The debt to asset control is hence a proxy for the credit risk. Since companies of different sizes also are able to counter problems in different ways and re-shift strategies we control for firm size using the book value of assets. The PE firm main strategy type (split between focused debt, diversified debt, focused equity and diversified equity), and covered in the previous literature section is also controlled for. Furthermore we control for industry and year effects.

Stock performance event study

Unlike the operational performance event study, we do not have any pre-event estimation period since the company is being listed through the event (the IPO). In relation to the first day performance we are interested of how the investors being assigned shares in the IPO benefit from this. We hence compare the closing price of the first day with the offer price, as has been done by Ritter (among others). In accordance with previous literature, we calculate the Cumulative Abnormal Return (CAR), the incremental abnormal performance relative to peers, from the closing price of the first trading day up to 90 days post IPO. The CAR indicate the speed of price discovery. When the median CAR stabilizes, we have an

indicator that the initial market valuation has been done. The reason for choosing 90 days as estimation window is that the true price discovery often is quite quick and that the median CAR stabilizes rather quickly. It is also highly unlikely the companies start to pay dividends, affecting share price, during this time.

As described above and in line with traditional event study methodology, we calculate first day returns, abnormal first day returns and CARs as:

(4) $First\ day\_return = Closing\_price_{IPO} \ / \ Offer\_price$

(5) $AR_{first\ day;market} = First\ day\_return - \Delta National\_benchmark$

(6) $AR_{first\ day;industry} = First\ day\_return - \Delta Industry\_benchmark$

(7) $AR_{t;market} = (Closing\_price_t \ / \ Closing\_price_{t-1} - 1) - \Delta National\_benchmark$

(8) $AR_{t;industry} = (Closing\_price_t \ / \ Closing\_price_{t-1} - 1) - \Delta Industry\_benchmark$

(9) $CAR_{30;market} = \sum_1^{30} AR_{t;market}$

(10) $CAR_{30;industry} = \sum_1^{30} AR_{t;industry}$

(11) $CAR_{90;market} = \sum_1^{90} AR_{t;market}$

(12) $CAR_{90;industry} = \sum_1^{90} AR_{t;industry}$

The national and industry benchmarks are explained in detail in the data section. As can be seen we use the growth between the closing prices each day rather than price change. This is due to our global sample. To be able to compare the price change rather than price change and exchange differences we therefore use the relative change.

In addition to the descriptive statics, we also want to evaluate if the sub-samples (split by longevity) provide different abnormal first day return, and CARs in relation to each other. Since these sub-samples are not dependent we cannot use the Wilcoxon signed rank sum test. Instead we are referred to the Wilcoxon-Mann-Whitney test. These tests on first day returns and CARs are done in accordance with Wilcoxon-Mann-Whitney tests on abnormal operational performance described in the previous section.

Endogeneity and Biases

One potential bias in our data sample selection is the classification of PE-backed and VC firms. First of all the distinction between the two can be vague especially when there are several investment firms involved in the transaction. Secondly, the databases do not distinguish PE transactions from venture transaction that toughly. Therefore, we manually check the acquirers leaving our data prone to our own assessment of PE or venture. Furthermore, some firms provide both PE and venture-type services, making the classification even more challenging. The risk of including venture capital firms in our study, is that they are younger firms, demanding more operational efforts than mature firms, thus skewing our results towards longer holding periods.

In regards to transactions where more than one PE firm is involved, we have made the assumption that the firm with the majority stake is the leading one. It is difficult for us to evaluate if this is case and thus are aware that the strategies of other firms in the syndicate, may also have an impact.

Furthermore, the documented underreporting bias of PE firms may affect our sample resulting to it being incomplete. The underreporting bias is a consequence of the limited disclosure obligations that PE firms have. Also, the survivorship bias where less successful PE funds might be excluded due to data availability, leads to an upward bias in our sample data.

Another problem in our sample selection is outliers. By excluding the top 2 and bottom 2 percentile in EBITDA margin, we do not take the extreme outliers into consideration. The reason for excluding them in our data sample is due to its potential of not being representative of the main results. However, the risk of excluding them is that our data losses potential explanatory variables.

Omitted variable bias (OVB) is another factor that can affect our dataset. OVB is caused when some explanatory variable is excluded. Qualitative measures are particularly difficult to quantify and thus most likely to be omitted. For instance, in this study, the strategies of the PE firm is related to the executives abilities and background and thus has an impact on the decision of holding period. Excluding this factor, as in our case, has a risk of causing an OVB and biases due to correlation with the error term.

However, there is a challenge to find the balance between omitting variables and including too many variables, causing collinearity. For instance, correlation between duration and PE firm strategy has the risk of being collinear. As Hoskisson et. al. (2013) argues, longevity is a factor in the PE firm's strategy thus indicating that these two independent variables may be highly correlated, i.e. causing collinearity.

Results and empirical analysis

In this section we analyze the findings on longevity, operational performance and short-term stock performance. We start by covering some general descriptive statistics in relation to longevity. The following subsection covers the operational performance. It includes descriptive statistics, findings through analysis of the dependent and independent sub-samples (split by longevity) and the outcome of the regression of performance drivers on post IPO EBIT margin change. Then we continue to investigate the CAR in relation to post IPO stock.

General descriptive statistics

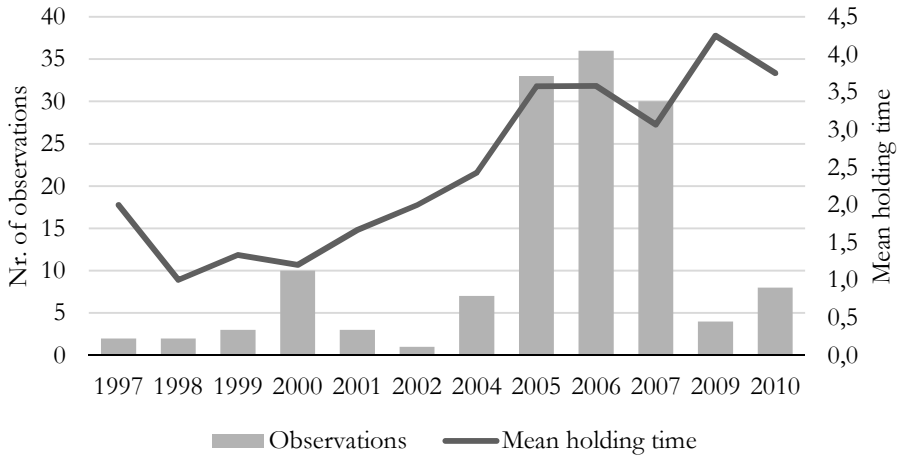
As Table 1 and figure 2 shows, the average holding period between 1997 and 2010 has increased. This result is in line with Strömberg's (2007) finding. However, there seems to be a slight decrease in holding time between the two last years studied (2009 and 2010) where holding time decreased by 0,5 years average.

TABLE 1
Holding time between 1997 and 2010

The table presents descriptive statics and number of observations for the holding time of portfolio companies in the data set as a whole and broken down by year.

	Mean	Sd.	Median	Max	Min	n
1997	2,00	0,00	2,00	2	2	2
1998	1,00	0,00	1,00	1	1	2
1999	1,33	0,58	1,00	2	1	3
2000	1,20	0,42	1,00	2	1	10
2001	1,67	0,58	2,00	2	1	3
2002	2,00	0,00	2,00	2	2	1
2004	2,43	1,27	2,00	4	1	7
2005	3,58	1,97	4,00	7	1	33
2006	3,58	2,27	3,00	10	1	36
2007	3,07	2,12	3,00	11	1	30
2009	4,25	1,50	4,00	6	3	4
2010	3,75	0,89	4,00	5	2	8
Total	3,11	2,00	3,00	11	1	139

Figure 2: Mean holding time and number of observations between 1997 and 2010



When looking at holding period in relation to industry, one can see that the average holding period is the longest in manufacturing and utility industries. The manufacturing industry is one of the industries with most number of observations (22) whereas the utility is less representative since it only includes one observation. However, standard deviation of the manufacturing industry is the highest in the sample indicating that it also includes a higher variety of holding periods. An explanation of this wide dispersion is that one of the companies in our sample from the manufacturing industry has been held for 11 years. This also explains the wide dispersion between the median and average holding period of 0,5 years.

Furthermore, a common denominator in these two industries is that they are both capital intensive. The energy and telecom industries are also capital intensive and also show a relative high average and

median holding period. A potential explanation for this is that capital intensive industries are more time consuming due to there being less capital available after these expenditures, increasing the financial risk.

The business equipment industry has the most number of observations indicating that many PE firms have become more active in high growth industries. This can be supported by Strömberg's (2007) argument of PE firms broadening their industry scopes.

TABLE 2
Holding time in different industries

The table presents descriptive statics and number of observations for the holding time of portfolio companies, listed between 1997 and 2010, in the data set as a whole and broken down by industries. The industry classification follow the Fama and French 12 industry standard.

	Mean	Sd.	Median	Max	Min	n
Consumer (non dur.)	2,67	0,58	3,00	3	2	3
Consumer (dur.)	3,25	1,67	3,00	6	1	8
Manufacturing	4,09	2,91	3,50	11	1	22
Energy	2,50	1,31	2,50	5	1	8
Chemicals	2,33	1,15	3,00	3	1	3
Business Equipment	3,00	1,88	3,00	7	1	35
Telecom	2,40	1,67	2,00	5	1	5
Utilities	4,00	0,00	4,00	4	4	1
Retail & Wholesale	3,00	1,69	2,50	8	1	22
Health	3,00	1,73	2,00	5	1	9
Finance	1,00	0,00	1,00	1	1	2
Other	3,10	2,05	3,00	7	1	21
Total	3,11	2,00	3	11	1	139

Holding periods across countries differ where countries with more mature markets; USA, UK and Germany have an average holding period of 3 years. These countries also hold the most number of transactions. This can be explained due to them having many active PE firms both nationally and globally. Sweden has also a relatively high transaction rate. However, the standard deviation in Germany and Sweden is slightly higher relative to other countries, thus confirming that the average holding period in these countries vary more.

The longest average holding period is found in Netherlands, 8 years, and Poland, 6,7 years. However, only one observation in Netherlands. Average holding period is lowest in Belgium, 1 year, but as with Netherlands, is not particular representative since it only refers to one observation. France has also a shorter holding period, 1,8 years, and somewhat more observations.

TABLE 3
Holding time in different countries of incorporation

The table presents descriptive statics and number of observations for the holding time of portfolio companies, listed between 1997 and 2010, in the data set as a whole and broken down by the country of incorporation for the portfolio company.

	Mean	Sd.	Median	Max	Min	n
Austria	4,00	2,00	4,00	6	2	5
Belgium	1,00	0,00	1,00	1	1	1
Canada	2,50	0,71	2,50	3	2	2
Denmark	3,00	0,00	3,00	3	3	1
Estonia	5,00	0,00	5,00	5	5	1
Finland	4,00	2,83	4,00	6	2	2
France	1,75	1,16	1,00	4	1	8
Germany	3,18	2,30	3,00	10	1	17
Italy	1,33	0,58	1,00	2	1	3
Netherlands	8,00	0,00	8,00	8	8	1
Norway	3,75	1,71	3,50	6	2	4
Poland	6,67	1,53	7,00	8	5	3
Spain	3,25	1,26	3,00	5	2	4
Sweden	3,89	2,93	3,00	11	1	9
U.K.	3,17	1,97	3,00	7	1	29
USA	2,76	1,60	2,00	7	1	49
Total	3,11	2,00	3	11	1	139

Holding period of PE firms with more equity focus is slightly higher compared to PE firms with more debt focus (see Table 4). However, the differences are not found to vary that much, confirming that the PE firm's general strategy does not seem to have much effect on the holding period in relation to our studied strategy of mature buyouts being exited through IPO. This is in line with our previous assumption that we can mitigate the bias of the PE firms' general strategies' effect on longevity by focusing on a particular strategy used by all PE firms. Our finding, which is necessary for unbiasedness of our analysis, is also supported by a correlation study. If we correlate the PE firm type[1] (representing the general PE firm strategy as explained in the Data section) with longevity we find that the correlation is close to zero (-0,005). We obtain the same result if we correlate the debt versus equity focus with longevity.

[1] Where "Debt and focus" is considered the most short-term strategy and assigned "1" and "Equity and diversified" considered the most long-term strategy, being assigned "4".

TABLE 4
Holding time in PE firms with different general investment focus

The table presents descriptive statics and number of observations for the holding time of portfolio companies, listed between 1997 and 2010, in the data set as a whole and broken down by the general type of PE firm, in two alternative ways. Alt. 1 is specified in accordance with Hoskisson et. al. (2013). The firms are split in relation to their general approach to investments and their portfolio scope. A debt oriented PE firm typically use high leverage. A diversified PE firm is typically a generalist, investing in a wide range of industries, whilst a focused PE firm has up to four focus areas. In Alt 2. the diversification/focus orientation has been relaxed and the four groups have been merged to a mere equity versus debt orientation.

Alt. 1	**Mean**	**Sd.**	**Median**	**Max**	**Min**	**n**
Debt and diversified	2,90	2,07	2,00	11	1	30
Debt and focus	3,18	1,93	3,00	8	1	40
Equity and diversified	3,05	1,99	3,00	8	1	44
Equity and focus	3,36	2,12	3,00	10	1	25

Alt. 2	**Mean**	**Sd.**	**Median**	**Max**	**Min**	**n**
Debt oriented	3,06	1,98	3,00	11	1	70
Equity oriented	3,16	2,03	3,00	10	1	69

Total	3,11	2,00	3	11	1	139

Operational performance:

Table 5 displays the total average EBITDA and EBIT margin of both the portfolio companies and its peers. The average of the two metrics is higher in total for the portfolio companies during the studied period (between one year before IPO to two years after IPO).This suggests that in general, the portfolio companies have better operational performance especially one year after IPO. EBITDA margin is relatively stable for the portfolio companies with a slight decrease in year 2. Furthermore, the median is close to the average when it comes to the portfolio companies but more disperse among the benchmark peers. This suggests that the higher operational margin among portfolio companies is consistent whereas the benchmark have more skewed results. RoA is lower for portfolio companies two years after IPO suggesting that the increased equity stake through IPO decreases the leverage. This can also be confirmed by the decrease in debt to assets (D/A) during the studied period.

TABLE 5
Mean and median performance and capital structure measures prior and post IPO

The table presents key characteristics (relating to performance and financial leverage) for the portfolio companies and benchmark datasets respectively ranging from one (fiscal) year prior to the IPO to two (fiscal) years after the IPO. Distribution of the different portfolio and benchmark companies are presented in Appendix, Table A-10 to A-11. EBITDA and EBIT margins are calculated by dividing the EBIT and EBITDA on sales. RoA is calculated as the net income at the end of the year, divided by the total assets (book value) in the beginning of the year. The capital structure measure, D/A, is calculated as the book value of debt over the book value of total assets (in the beginning of the year).

Year rel. to IPO	**IPO-1**		**IPO**		**IPO+1**		**IPO+2**	
	Mean	*Median*	*Mean*	*Median*	*Mean*	*Median*	*Mean*	*Median*
Portfolio comp.								
EBITDA marg. (%)	15,09	15,17	15,62	15,33	16,11	15,26	15,36	14,37
EBIT marg. (%)	8,22	8,58	9,25	10,19	9,75	10,91	8,31	9,67
RoA (%)	-1,30	2,18	4,91	3,59	5,51	5,30	1,48	3,72
D/A	0,31	0,29	0,34	0,35	0,24	0,22	0,23	0,19
Benchmark								
EBITDA marg. (%)	11,63	9,91	9,45	9,77	11,12	9,77	9,27	9,89
EBIT marg. (%)	6,72	6,05	4,46	6,44	6,19	6,46	4,16	5,70
RoA (%)	4,47	3,90	4,56	4,42	3,89	3,94	4,17	2,99

In our sample, there consisted many outliers in relation to country, industry and year. As mentioned earlier we excluded the top and bottom 2 percentiles. However, there is still a high deviation between mean and median in table 6 which displays the abnormal return of PE portfolio companies post IPO. During year 2, the average and median even have different signs with a negative median and positive mean. The standard deviation also confirms the wide dispersion in the results.

TABLE 6
Abnormal return for the sample PE portfolio companies post IPO

The table presents the mean, standard deviation and median abnormal growth in EBITDA margins, EBIT margins and RoA (net income over total book value of assets at the beginning of the year) for the 139 portfolio companies still active one and two fiscal years after the IPO.

Years post IPO	**IPO+1**			**IPO+2**		
	Mean	*Sd.*	*Median*	*Mean*	*Sd.*	*Median*
AR **EBITDA** marg. growth (perc. points)	0,88	16,19	0,27	0,58	29,46	-0,68
AR **EBIT** marg. growth (perc. points)	1,54	20,51	0,78	1,03	33,30	-0,40
AR **RoA** growth (perc. points)	7,43	53,18	3,04	4,61	56,97	1,21

We use EBIT as an explanatory measure for the operational performance. The reason for using EBIT and not RoA is due to the capital structure taken into consideration in RoA and as mentioned earlier debt is a value distributor and not creator. EBITDA is a common operational performance metric as well as a proxy for operational cash flow. However, due to lack of data of EBITDA, we found EBIT to be a more valid proxy for operational performance. Therefore, we will continue our discussion of operational performance by referring to the EBIT margin and include the RoA and EBITDA abnormal returns in the appendix, Table A-10 to A-11.

TABLE 7
Abnormal EBIT margin growth in relation to years in portfolio

The table presents the mean, standard deviation and median abnormal growth in EBIT margins, for the 139 portfolio companies still active one and two fiscal years after the IPO. The Abnormal margin growth compared to the market is split up by the longevity for 1-5 holding years and a cumulated group of companies held for more than five years. The groups are also divided as 2-5 years holding time versus quick flips and longer holding times.

Years post IPO	**IPO+1**			**IPO+2**		
	Mean	*Sd.*	*Median*	*Mean*	*Sd.*	*Median*
Years in portfolio		*(perc. points)*			*(perc. points)*	
1	-0,18	13,13	0,78	-5,78	20,88	-1,28
2	1,57	17,46	0,96	10,16	49,17	0,00
3	-1,03	15,45	0,92	-6,28	25,74	0,89
4	9,91	38,63	1,54	10,03	39,97	2,00
5	-0,79	10,01	1,28	-5,19	18,23	-3,69
>5	-1,73	7,99	0,01	-2,33	9,15	-1,86
Typical horizon						
2-5 yrs.	2,75	23,89	0,92	-4,49	17,35	-1,57
Other	-0,78	11,34	0,24	3,75	38,65	0,24

Table 7 displays the abnormal EBIT margin growth in relations to years in portfolio. It is important to mention that since our study looks into LBOs and exit through IPO, the definition of long-term holding is relatively shorter than when studying other buyouts and exit strategies. Our classification of short-term is 1 year, referring back to Cao's quick flips. These are argued to provide quick solutions with more focus on changing the capital structure. The results confirm that these quick flips to do not add much value where the abnormal EBIT margin is negative. The typical holding period is classified as 2-5 years where 4 years and more is perceived as longer holding periods. The highest abnormal EBIT margin is found in portfolio companies with holding periods of 4 years. This is confirmed in both year 1 and 2 after IPO. However, it is important to mention that the standard deviation is also quite high for these companies in year 1 and 2. Holding the companies more than four years shows a negative abnormal return.

In general, the results in Table 7 have a high dispersion between median and average. This can also be confirmed by the high standard deviation. Therefore, the results do not give a strong support on

holding period's influence of operational performance. Therefore, in order to draw any conclusions of the descriptive statistics, we will be applying hypothesis test. These will be testing if longer holding periods will result to better outperformance in relation to short holding periods as well as to the market in general.

The test is conducted by studying if the abnormal EBIT one year after the IPO, calculated by model (1), equals the abnormal return one year prior to the IPO, calculated by model (2). For the sample as a whole we can reject the hypothesis on the 1% level. The tests shows that the abnormal EBIT is less one year prior to the IPO, as indicated by the descriptive statistics. In relation to all sub-samples of longevity, except for a holding period of four years, we can reject the hypothesis and the ranks indicate the abnormal EBIT margin has decreased. When compared to the other sub-samples it is of equal size. There is however no economic explanation to why four years of holding time is not possible to reject. For the second year post IPO we are not able to reject the hypotheses that the sample as a whole, neither split by longevity, is equal.

In the previous test we showed that the difference between models (1) and (2) for different subsamples of performance. If we instead employ a Wilcoxon-Mann-Whitney test of independent samples, we can deduct model (2) from model (1) and test the hypothesis that the median of different sub-samples, split based on the longevity, is equal. By doing so we can see if one particular holding time outperforms another. However, the hypothesis could not be rejected for the different durations, nor for the subsample containing companies held for 2-5 year compared to all other holding times. This was expected since the Wilcoxon-Mann-Whitney test is not as powerful as the Wilcoxon signed rank test. Our sub-samples are hence too small to make any predictions on these longevity implications.

In order to clarify what drives are to the EBIT growth, we conduct a regression on change in EBIT margin in line with previous literature (see method). We use model (3) to regress the performance drivers on change in EBIT margin between one year post IPO to one year prior to the IPO.

TABLE 8
Drivers of change in EBIT margin between IPO-1 and IPO+1

The table present the coefficients in regression model (3) of performance drivers on EBIT growth. It also disclose the robust standard errors. Regression (1) includes the PE firm type (described in the Data section) and Regression (2) excludes the PE firm type control.

	(1)		(2)	
	Coef.	*R. Sd*	*Coef.*	*R. Sd*
Log(duration)	-0,018	0,022	-0,018	0,023
Quick_flip	-0,104	0,091	-0,107	0,088
D/A	0,006	0,052	0,005	0,049
Log(assets)	-0,004	0,011	-0,003	0,011
Benchmark change	0,408	0,482	0,406	0,462
Constant	0,006	0,149	0,011	0,147
PE firm control	Yes		No	
Industry control	Yes		Yes	
Year control	Yes		Yes	
R-sq	0,21		0,19	

Cao (2011) and Kaplan and Strömberg (2009) argue that it is important to control for year and industry as well as PE firm type. Cao further states that log duration and other market factors drive overperformance. Studies also confirm that capital structure and portfolio company size before IPO are also important proxies for risk and thus important to control for (as stated in the method section above). We are however unsuccessful in receiving significant results. It can be noted that the driver of main interest to us, log(duration), has a negative sign, contrary to what Cao (2011) found for RLBOs. This might be due to us not only studying RLBOs (which have already been listed and where investors have some prior information on the company). This, and the lack of significance might also be due to OVB. We are assuming that some of the operational timing controls used by Cao (2011) can be captured by our year effects control. If this assumption is wrong, our result will be biased. However, the small size of the coefficients and the standard errors indicate our sample size cannot support the variance in our sample. The reason is hence most likely that we cannot make the conclusion due to our limited sample size.

We are making two regressions, one including and one excluding PE firm effects. As can be noted, and in accordance with our previous findings, PE fund effects have no particular implications on the coefficient related to the logarithm of duration. A correlation study on the independent variables is available in the appendix, Table A-12.

IPO stock performance

We employ models (4) to (6) to calculate first day return and abnormal first day returns (compared to national indices and national industry indices). Table 9 shows the first day return on average of the portfolio companies of 0,94%, the first day abnormal return of portfolio companies in relation to national market index 0,84% and first day abnormal return in relation to national industry index 2,77%. Results show that the portfolio company's average abnormal first day return is highest on an industry index bases. However, in general the first day return on average is low and has a median of 0.

TABLE 9
First day returns of the portfolio companies listed between 1997 and 2010

Descriptive statistics on first day returns and abnormal first day returns (compared to national market and national industry indices) for the sample of 122 stocks.

	Mean	Sd.	Median	Max	Min	n
First day return (%)	0,94	14,00	0,00	47,87	-50,04	122
First day AR in relation to **national market** index (pct.p.)	0,84	13,93	0,29	46,76	-49,79	122
First day AR in relation to **national industry** index (pct.p)	2,77	13,80	1,22	46,24	-49,69	79

When looking into first day return in regards to holding period, the highest stock performance is found during 3 years of holding period on average. However, because of the high number of outliers, it is better to look at the median. The median during the first and second year is around 0 and increases sharply thereafter in years 4 and 5 but back to 0 when more than 5 years (the table has due to its size been put in Appendix as Table A-13 to A-14). A high first day return indicates that the stock needs to be underpriced or external institutional and private investors value it high. This increase is contrary to our hypothesis, indicate (in relation to our sample) that underpricing increases up to the fifth year. This might indicate that rather than investors requiring a discount, the PE firms themselves signals through underpricing (if we accept the assumption that longevity is a proxy for operational effort). To test whether this is a significant finding, we employ a Wilcoxon-Mann-Whitney test of independent samples, we can use the calculation of model (4) and test the hypothesis that the median of different sub-samples, split based on the longevity, is equal. By doing so we can see if one particular holding time outperforms another. However, the hypothesis could only be rejected when comparing the sample of 2-year-longevity to 4-year longevity on the 10% level, where the underpricing is higher for 4-year longevity. This gives an indication that the underpricing might be significantly bigger for firms being kept in portfolio for longer times. Due to our small sample we cannot do any further conclusion to this though.

TABLE 10
First day returns split by positive and negative performance

Descriptive statistics on first day returns and abnormal first day returns (compared to national market and national industry indices) for the entire sample of 134 stocks, split up by them having positive or negative first day returns.

Years post IPO	**Positive first day return**			**Negative first day return**		
	Mean	*Sd.*	*Median*	*Mean*	*Sd.*	*Median*
First day return (%)	10,33	10,80	6,89	-6,04	11,89	0,00
First day AR in relation to **national market** index (pct.p.)	10,14	10,78	5,96	-6,08	11,86	-0,96
First day AR in relation to **national industry** index (pct.p)	12,08	10,69	11,17	-5,43	10,71	-0,93

When splitting the data between typical holding period of 2-5 years and other holding times as shown in table 14, we can see that the focus years have a higher average first day return of 1,5% and the standard deviation being lower in comparison to the other holding times. Other holding times have a first day return of 0,12%. This average underpricing is very low relative to other IPOs, typically being issued at 14% discount on average, as indicated by Ritter and Loughran (2004).

TABLE 11
First day returns grouped by typical holding time

Descriptive statistics on first day returns and abnormal first day returns (compared to national market and national industry indices) for the entire sample of 134 stocks, split up by the time the portfolio company has been held in PE fund portfolio.

	Mean	Sd.	Median	Max	Min	n
2-5 years in portfolio						
First day return (%)	1,45	13,06	0,00	42,93	-50,04	75
First day AR, national index (pct.p)	1,37	13,00	0,36	42,69	-49,79	75
First day AR, national industry index (pct.p)	3,40	11,76	1,22	42,75	-31,02	48
Other holding time						
First day return (%)	0,12	15,49	0,00	47,87	-50,00	47
First day AR, national index (pct.p)	-0,02	15,40	0,15	46,76	-49,38	47
First day AR, national industry index (pct.p)	1,80	16,63	0,40	46,24	-49,69	31

Figure 3: CAR in relation to national market index (IPO to IPO+90 days)

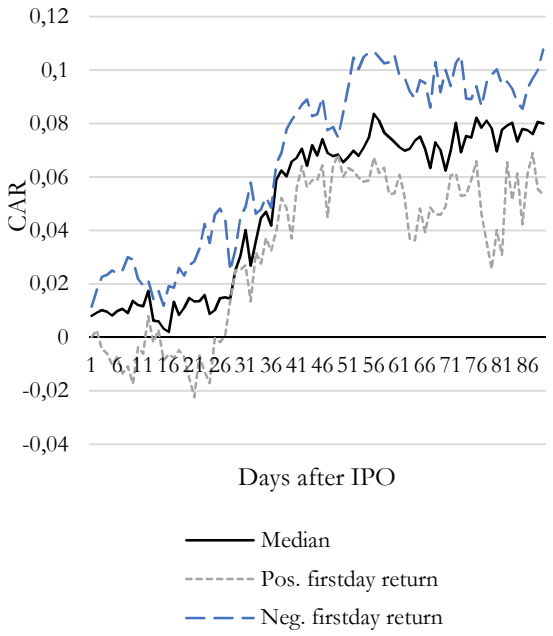
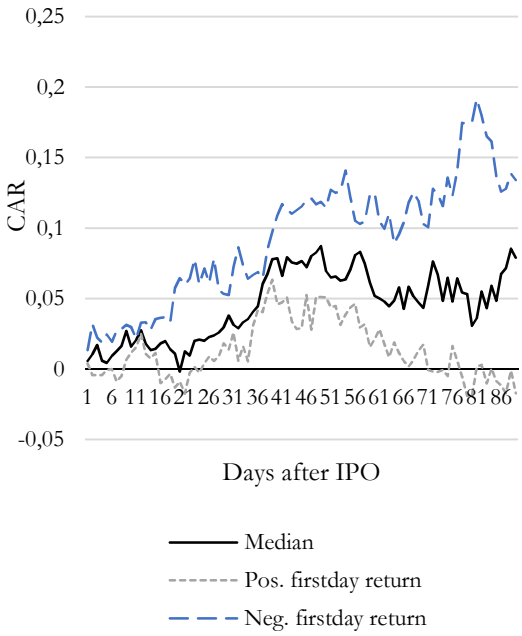


Figure 4: CAR in relation to national industry index (IPO to IPO+90 days)



Finally, we employ models (7) to (12) to calculate the CAR. Figure 3-4 and Table 12 shows the 30 and 90 days cumulative abnormal returns (CAR) in relation to national index. As can be seen in Figure 3, the median for the 30 and 60 days CAR is stabilizing in relation to the market index, indicating that the stocks usually are correctly priced after 40 days. In Figure 4 we compare the performance in relation to a national industry index instead of the market index. Adjacent to the 40-day incorporation of the price we see that the IPO-stocks seem to stabilize. However, the CAR stabilization seem to deteriorate post 40 days. This might be due to the sample size being too small (only 79 companies' stock performance could be compared to national industry indices).

Another interesting finding is that companies with a negative first day performance actually performs better (in relation to the market) than the firms with positive first day returns. This indicates a price recovery being present during the studied 90-day period. Table 13 shows the 30 day CAR in relation to holding period where median is zero up to 4 years of holding period and increases 5 years and beyond.

TABLE 12
30- and 90-day CAR of the portfolio companies listed between 1997 and 2010

Descriptive statistics on 30- and 90-day CARs (in relation to national market and national industry indices).

	Mean	**Sd.**	**Median**	**Max**	**Min**	**n**
30-day CAR in relation to **national market** index	3,30	13,67	0,00	62,09	-34,72	122
30-day CAR in relation to **national industry** index	8,01	29,45	3,05	242,80	-41,61	122
90-day CAR in relation to **national market** index	6,32	22,20	0,00	109,86	-49,72	122
90-day CAR in relation to **national industry** index	10,01	31,74	7,99	159,54	-106,42	122

TABLE 13
30-day CAR grouped by typical holding time

Descriptive statistics on 30- and 90-day CARs (in relation to national market and national industry indices), split up in subsamples by holding time, where longevities between 2 and 5 years are compared to firms being held in other time periods.

	Mean	Sd.	Median	Max	Min	n
2-5 years in portfolio						
30-day CAR in relation to **national market** index	4,22	12,01	0,00	47,95	-24,26	75
30-day CAR in relation to **national industry** index	5,44	12,78	4,30	38,47	-21,29	75
Other holding time						
30-day CAR in relation to **national market** index	1,83	16,00	0,00	62,09	-34,72	47
30-day CAR in relation to **national industry** index	12,12	44,61	2,72	242,80	-41,61	47

Conclusions and implications

The purpose of this study was to investigate how longevity effects performance of portfolio companies exited through IPO. We studied these companies during the period 1997-2010. The study aims to see if the companies with longer holding periods, have better operational performance after exit compared to firms that are held shorter and the market. The study also investigates how the market reacts to holding period (in terms of underpricing and price recovery/short-term stock performance) and if longer holding periods are as Cao states, a proxy for operational effort.

We construct an event study followed by a non-parametric Wilcoxon sign test when studying the operational performance. We find statistically significance for the EBIT margin decreasing and RoA increasing between one year prior the IPO compared to one year after the IPO for the sample as a whole. This is also found to be significant for the focus period of 2-5 years but not for quick flips or longer holding periods then 5 years. Furthermore, our results show that there is a statistical significance for higher EBIT margins of companies held for 4 years compared with 2 years. However, since no previous literature has found any explanation or supported this, we cannot draw any economical significant conclusions from this.

For our second question, relating to short-term performance and underpricing, we looked at the CAR and conducted the Wilcoxon-Mann-Whitney test to see if any particular longevity provides superior first day returns. We continued by investigating the CAR up to 90 days post the IPO. Our results indicate that the underpricing for our sample portfolio companies stabilizes in relation to the market before the 90 day limit. The underpricing for companies held for four years is higher than for two years.

Our results shed some light on longevity and portfolio company performance. However, the limited availability of data on PE investments as well as the large number of outliers has challenged our ability to find any good patterns and draw any clear conclusions. Furthermore, even though, we had some significance in our results, it is not applicable for the buyout market as a whole because of the small sample size. However, our results support similar findings from previous studies. These include PE firms having a higher operational performance than peers, underpricing adjusting to normal prices over time and an increased average holding period of portfolio companies.

Our sample shows some relationships between longevity and performance, it can contribute as an inspirational framework for further studies. Especially interesting is the descriptive statistics on first day returns, which, contrary to our hypothesis, indicate (in relation to our sample) that underpricing increases up to the fifth year. This might indicate that rather than investors requiring a discount, the PE firms themselves signals through underpricing (if we accept the assumption that longevity is a proxy for operational effort). By employing a larger dataset this hypothesis could be evaluated.

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Appendix

TABLE A-1
Country distribution

Sample incorporation distr.

Country	Total
Austria	29
Belgium	5
Canada	11
Denmark	6
Estonia	6
Finland	11
France	39
Germany	95
Italy	15
Netherlands	6
Norway	22
Poland	17
Spain	24
Sweden	51
UK	152
USA	277
Total	766
Companies	139

TABLE A-2
Industry distribution

Sample industry distr.

Industry	Total
Consumer (non dur.)	18
Consumer (dur.)	45
Manufacturing	120
Energy	47
Chemicals	18
Business Equipment	197
Telecom	27
Utilities	6
Retail	124
Health	46
Finance	12
Other	106
Total	766
Companies	139

TABLE A-3
Year distribution

Sample fiscal year distr.

Fiscal year	Total
1995	1
1996	2
1997	7
1998	9
1999	19
2000	18
2001	18
2002	19
2003	38
2004	74
2005	101
2006	106
2007	108
2008	103
2009	75
2010	39
2011	11
2012	10
2013	8
Total	766
Companies	139

Table A-4
IPO year

Sample share IPO year

IPO year	Freq.
1997	2
1998	2
1999	4
2000	12
2001	3
2002	1
2004	7
2005	31
2006	32
2007	28
2009	4
2010	8
Total	134

Table A-5
IPO listing country

Sample share IPO country

Country	Freq.
Austria	4
Belgium	1
Canada	3
Germany	16
Denmark	1
Spain	4
Finland	2
France	8
UK	27
Italy	5
Netherlands	4
Norway	4
Poland	3
Sweden	9
USA	43
Total	134

Table A-6
Longevity distribution

Sample share IPO longevity

Longevity (yrs.)	Freq.
1	36
2	29
3	25
4	20
5	8
6	8
7	5
8	1
10	1
11	1
Total	134

Table A-7
Benchmark fisc. year

Benchmark distribution

IPO year	Freq.
1996	6029
1997	6029
1998	592
1999	5773
2000	5444
2001	5108
2002	4751
2003	4471
2004	4248
2005	3986
2006	3754
2007	3542
2008	3349
2009	3215
2010	3118
2011	313
2012	3022
2013	2126
Total	77015
Companies	7624

Table A-8
Benchmark country

Benchmark incorporation distribution

Country	Freq.
Austria	667
Belgium	649
Canada	2987
Denmark	1002
Estonia	46
Finland	1206
France	5167
Germany	5109
Italy	1357
Netherlands	1988
Norway	1176
Poland	610
Spain	956
Sweden	225
UK	13566
USA	38292
Total	77015
Companies	7624

Table A-9
Benchm. Industry distribution

Benchmark industry distribution

Industry	Freq.
Consumer (non dur.)	3672
Consumer (dur.)	2069
Manufacturing	1058
Energy	4348
Chemicals	2688
Business Equipment	16391
Telecom	2891
Utilities	4097
Retail	8725
Health	6608
Finance	1259
Other	13700
Total	77015
Companies	7624

TABLE A-10
Abnormal EBITDA margin growth in relation to years in portfolio

This table provide descriptive statistics on EBITDA margins change (Earnings before interest, taxes depreciation and amortization, divided by sales, measured one and two years post the IPO and compared to the EBITDA margin one year prior to the IPO) for sub-samples of portfolio companies being held in portfolio different time periods (longevity). It also covers the 2-5 year horizon statistics in relation to other holding times.

Years post IPO	**1**			**2**		
	Mean	*Sd.*	*Median*	*Mean*	*Sd.*	*Median*
Years in portfolio		*(perc. points)*			*(perc. points)*	
1	-0,08	13,44	0,62	-4,84	16,99	-1,46
2	0,82	13,91	1,24	9,09	46,41	-0,04
3	-1,17	10,52	-0,45	-6,56	19,72	-2,60
4	7,42	29,32	1,29	8,04	33,24	-0,02
5	-0,84	8,99	-1,08	-4,62	16,60	-0,63
>6	-2,13	6,93	-0,27	-2,65	7,19	-2,47
Typical horizon						
2-5 yrs.	1,79	18,20	0,68	2,85	34,50	-0,62
Other	-0,87	11,32	-0,06	-4,02	14,05	-1,67

TABLE A-11
Abnormal RoA growth in relation to years in portfolio

This table provide descriptive statistics on RoA growth (Net income divided by the book value of total assets, as measured one and two years post the IPO, compared to the RoA one year prior to the IPO) for sub-samples of portfolio companies being held in portfolio different time periods (longevity). It also covers the 2-5 year horizon statistics in relation to other holding times.

Years post IPO	**1**			**2**		
	Mean	*Sd.*	*Median*	*Mean*	*Sd.*	*Median*
Years in portfolio		*(perc. points)*			*(perc. points)*	
1	9,64	120,43	2,30	6,13	138,09	1,64
2	12,41	40,19	3,95	10,16	38,64	0,86
3	5,55	13,14	1,24	3,24	11,27	1,16
4	1,91	13,12	2,31	-0,73	8,54	2,00
5	9,18	18,46	3,14	-0,84	14,12	-2,33
>5	4,48	12,88	2,44	4,68	14,82	0,78
Typical horizon						
2-5 yrs.	7,38	26,33	3,09	5,49	102,09	1,37
Other	7,54	91,86	2,44	4,27	24,59	1,16

TABLE A-12
Correlation study of independent variables

This table provide correlation comparison of the different independent variables in regression (3). Quick flip is correlated with the duration since it is applicable to all firms held for one year. Assets and D/A both include assets and are hence correlated. All correlation is below 0,5 though.

	Log(duration)	Quick_flip	D/A	Log(assets)	Benchmark change
Log(duration)	1,00				
Quick_flip	-0,47	1,00			
D/A	0,17	-0,15	1,00		
Log(assets)	-0,07	-0,07	0,36	1,00	
Benchmark change	0,13	-0,11	-0,12	-0,11	1,00

TABLE A-13
First day returns grouped by portfolio company time in portfolio

This table provide descriptive statistics for the first day return and first day abnormal returns (compared national market indices and national industry indices), split up by the time the company has been held in portfolio. The first day return is the closing price of the day of the IPO compared to the offer price.

	Mean	Sd.	Median	Max	Min	n
1 year in portfolio						
First day return (%)	0,22	18,40	0,00	47,87	-50,00	31
First day AR, national index (pct.p)	-0,07	18,28	0,36	46,76	-49,38	31
First day AR, national industry index (pct.p)	2,13	19,47	2,80	46,24	-49,69	21
2 years in portfolio						
First day return (%)	-1,63	9,48	0,00	13,18	-28,80	26
First day AR, national index (pct.p)	-1,80	9,32	-0,01	12,50	-29,46	26
First day AR, national industry index (pct.p)	0,25	7,68	-0,08	11,93	-20,04	16
3 year in portfolio						
First day return (%)	4,63	16,16	0,00	42,93	-30,92	22
First day AR, national index (pct.p)	4,75	16,11	0,15	42,69	-30,84	22

First day AR, national industry index (pct.p)	4,55	15,98	0,65	42,75	-31,02	16
4 year in portfolio						
First day return (%)	2,67	4,11	2,20	13,93	-2,67	19
First day AR, national index (pct.p)	2,44	4,27	2,12	13,75	-4,12	19
First day AR, national industry index (pct.p)	3,55	5,43	3,23	13,20	-4,56	10
5 year in portfolio						
First day return (%)	-0,21	24,07	3,75	33,84	-50,04	8
First day AR, national index (pct.p)	-0,14	23,95	3,39	33,33	-49,79	8
First day AR, national industry index (pct.p)	8,49	15,39	8,59	33,93	-12,19	6
More than 5 years						
First day return (%)	-0,07	7,70	0,00	16,08	-19,87	16
First day AR, national index (pct.p)	0,08	7,72	0,14	16,41	-20,12	16
First day AR, national industry index (pct.p)	1,10	8,87	0,26	16,11	-19,22	10

TABLE A-14
First day returns split by positive and negative performance and time in portfolio

This table provide descriptive statistics for the first day return and first day abnormal returns (compared national market indices and national industry indices), split up by the time the company has been held in portfolio. The first day return is the closing price of the day of the IPO compared to the offer price. The table split the return based on whether the first day return was positive or not.

Years post IPO	**Positive first day return**			**Negative first day return**		
	Mean	*Sd.*	*Median*	*Mean*	*Sd.*	*Median*
1 year in portfolio						
First day return (%)	12,48	12,48	10,44	-9,88	16,38	0,00
First day AR, national index (pct.p)	12,31	12,16	10,98	-10,26	16,18	-1,17
First day AR, national industry index (pct.p)	16,13	12,09	12,51	-10,60	15,89	-3,02

2 years in portfolio						
First day return (%)	4,74	4,05	3,59	-5,61	9,80	0,00
First day AR, national index (pct.p)	4,66	4,13	3,61	-5,84	9,46	-1,00
First day AR, national industry index (pct.p)	5,37	4,04	5,04	-4,86	7,09	-1,38
3 year in portfolio						
First day return (%)	21,05	13,06	16,09	-4,75	8,34	-0,83
First day AR, national index (pct.p)	21,04	12,97	16,27	-4,57	8,46	-1,19
First day AR, national industry index (pct.p)	19,63	12,65	16,21	-4,49	9,72	-0,61
4 year in portfolio						
First day return (%)	4,92	4,08	3,48	-0,41	0,94	0,00
First day AR, national index (pct.p)	4,51	4,27	3,51	-0,41	2,20	-0,81
First day AR, national industry index (pct.p)	6,20	5,11	4,11	-0,43	3,11	0,01
5 year in portfolio						
First day return (%)	15,21	12,53	9,75	-15,64	23,68	-6,25
First day AR, national index (pct.p)	14,96	12,78	10,55	-15,24	23,81	-6,26
First day AR, national industry index (pct.p)	16,02	12,12	10,90	-6,57	7,95	-6,57
More than 5 years						
First day return (%)	6,34	6,26	5,71	-2,99	6,58	0,00
First day AR, national index (pct.p)	6,10	6,39	4,49	-2,66	6,83	0,06
First day AR, national industry index (pct.p)	7,92	7,97	7,46	-1,82	7,98	0,12

TABLE A-15
30-day CAR grouped by time in portfolio

This table provide descriptive statistics for the cumulated abnormal returns (CAR) 30 days post IPO. The CAR is the sum of daily abnormal returns from the closing price of the first day of the IPO, up to 30 days post the IPO. The CAR statistics are split up by the time the company has been held in portfolio.

	Mean	Sd.	Median	Max	Min	n
1 year in portfolio						
30-day CAR in relation to **national market** index	3,93	17,01	0,00	62,09	-26,41	31
30-day CAR in relation to **national industry** index	18,81	53,18	6,62	242,80	-41,61	31
2 years in portfolio						
30-day CAR in relation to **national market** index	5,54	13,69	0,00	47,95	-18,55	26
30-day CAR in relation to **national industry** index	9,19	13,56	6,57	38,47	-16,98	26
3 years in portfolio						
30-day CAR in relation to **national market** index	0,94	11,40	0,00	24,86	-24,26	22
30-day CAR in relation to **national industry** index	0,47	10,91	1,72	22,04	-21,29	22
4 year in portfolio						
30-day CAR in relation to **national market** index	5,95	11,97	0,00	35,12	-6,68	19
30-day CAR in relation to **national industry** index	6,90	12,64	7,20	25,50	-12,54	19
5 years in portfolio						

30-day CAR in relation to **national market** index	4,82	7,01	2,25	17,22	-2,57	8
30-day CAR in relation to **national industry** index	3,39	12,76	1,64	18,88	-17,54	8
Other holding time						
30-day CAR in relation to **national market** index	-2,24	13,42	0,00	21,15	-34,72	16
30-day CAR in relation to **national industry** index	-0,83	13,22	-1,60	21,77	-25,35	16