

The Impact of Post-IPO Private Equity Ownership on Company Performance[☆]

An Empirical Study on the Nordic Market

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Abstract

This thesis contributes to existing research by examining the unexplored field on how private equity (PE) ownership post-IPO impacts financial performance (abnormal return and ROA). We investigate whether superior performance can be explained by a higher degree of sponsor ownership retention in the listed firm. To test the hypotheses, a 12 quarter post-IPO panel data sample was constructed consisting of 83 companies that underwent a public offering between January 2000 and March 2018 on one of the Nordic stock exchanges. We employ a quantitative methodology using different econometric methods dealing with potential endogeneity issues between ownership and performance, including fixed effects, lag identification, and instrumental variable estimation. Results suggest that higher degrees of PE ownership retention post-IPO positively impact the abnormal return. This is likely due to the positive signal that higher PE ownership sends to outside investors about the quality of the company and the information asymmetry existing between public and private markets. ROA, on the other hand, seems to be negatively impacted by higher degrees of PE-ownership post-IPO. These findings provide valuable insights for both investors and sponsors, as research on this aspect of PE is relatively limited.

Keywords: Private Equity, IPO, Ownership, Abnormal return, ROA

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1. Introduction

1.1 Background

Within finance, few topics gain more public attention than private equity (PE). The surge in initial public offering (IPO) activity in the Nordic region during the last ten years has fuelled the debate about the performance of IPOs backed by private equity sponsors. Studies on PE-backed IPOs show that they outperform non-PE-backed IPOs (Cao and Lerner, 2009; Bergström et al., 2006; Levis, 2011). Despite the media hype around private equity, the research on PE involvement post partial exit of their portfolio companies is surprisingly limited, which sparked our interest and will act as the foundation of our thesis.

The PE firm's investment structure can be divided into four stages: fundraising, investment, value-adding, and finally divestment. PE firms referred to as "general partners" (GPs) raise money from institutional investors such as pension funds or insurance companies, referred to as "limited partners" (LPs). PE funds often purchase a majority stake of a company and intend to stay invested for an average of five years. During this period, the sponsor's goal is to enhance the portfolio company's performance through strategic, financial, and operational improvements (PwC, 2018). After the holding period, the fund's divestment typically allows it to realize returns, which are distributed back to the LPs. The exit partly determines the financial success of the investment and is hence a crucial stage for the PE firm. There are various possible exit routes, of which one is an initial public offering (IPO). After an IPO, PE firms are subject to a lock-up period, usually lasting six months (Dong et al., 2020), restricting the sponsor from selling their shares to prevent a drastic decrease in the stock price. Typically, the PE firms continue to remain large blockholders in the newly publicly listed company and then stepwise reduce their ownership stake through sell-downs until their stake has been fully realized to the public market (Dong et al., 2020). Since PE firms often retain substantial holdings for a long time after the IPO, they have both incentives and opportunities to influence the portfolio companies' performance, which gradually decreases as their stakes are reduced.

As many firms choose to hold their stakes beyond the lock-up period when possessing the ability to sell on the public market, this decision may signal a promising future and that the company is of high quality. This logic would imply that more extensive post-IPO holdings of the PE firm are associated with better performance. The opposite would apply for the reverse situation with a lower degree of post-IPO holding. Our study aims to test this hypothesis and determine whether the ownership stake by the PE firm post-IPO represents an essential factor that affects the performance of the public firm.

1.2 Purpose

The extensive existing literature on PE-backed IPOs, combined with the fact that the initial seed for this thesis came as a request by a top-tier PE firm in the Nordics, proves the topic's interest and relevance. Studies suggest that continued ownership post-IPO may be a fundamental reason for the superior performance of PE-backed IPOs. While multiple studies investigate the value that PE funds bring to portfolio companies, the relationship between ownership of the sponsor and the performance of PE-backed companies post-IPO is relatively unexplored. This impact, however, can be highly relevant from a practical viewpoint in determining insights regarding investment and exit strategies for public market investors and financial sponsors, respectively. Our thesis intends to bridge the literature gap and assist in reaching more meaningful insights that illuminate how varying degrees of PE ownership retention post-IPO impacts companies' financial performances.

Most studies on PE-backed IPO performance have been conducted in the US, and there is limited literature analyzing the well-developed Nordic private equity market (Spliid, 2013). Although the business environment in the US differs from the Nordic region on certain institutional and cultural aspects, Spliid (2013) argues that the theories are not irrelevant but rather need to be empirically tested on the Nordic market.

Previous studies that examine the performance of PE-backed IPOs vs. non-backed IPOs (Cao & Lerner, 2009; Levis, 2011) have to a large extent ignored the fact that PE firms usually do not fully exit at the time of the IPO. Furthermore, research that has examined the divestment process of PE firms post-IPO (Fürth and Rauch, 2015) has not explicitly tested if higher ownership retention is associated with superior performance. In all modesty, this thesis attempts to contribute to the existing literature by providing empirical evidence on the little-studied circumstance of whether continued ownership post-IPO i) sends a positive signal by the PE firm and ii) allows the sponsor to positively impact the results that affect the aftermarket performance of the portfolio company.

1.3 Research question

This thesis seeks to answer the question:

How does post-IPO private equity ownership affect the performance of portfolio companies?

1.4 Summary of research design

We aim to answer the research question through a quantitative research method, collecting data in the form of a balanced panel. When we measure financial performance, we analyze the stock returns against the market (abnormal returns), and as our accounting metric we use return on

assets (ROA). ROA is used to be consistent with previous literature (Dong et al., 2020; Bruton et al., 2006). In section 4.5, a robustness test is performed using alternative accounting metrics. We use six different regression models to test our research question. The final sample consists of 83 PE-backed IPOs between January 2000 and March 2018. Data on all variables included in the regressions were collected from the IPO date and the 12 subsequent quarters.

1.5 Assumptions and limitations

There are different types of private equity investors, and a commonly used categorization is venture capital (VC) and private equity (PE). In general, VC is investments in earlier stages, often in high-growth sectors. Whereas PE funds are characterized by a significant difference in the level of operational involvement, they usually seek controlling stakes and invest in more mature, stable, and larger companies (Kaplan & Strömberg, 2009). Given our interest in understanding how ownership affects long-run performance, it is of greater interest to look at the investors with the highest possibility of making an impact. Hence, we solely focus on PE-backed IPOs and exclude all VC-backed IPOs from our sample. Additionally, less research has focused solely on PE-backed IPOs, which act as another reason for making the distinction.

We limit the scope of this thesis to finding the relationship between post-IPO PE ownership and company performance. We do not examine the underlying reasons why private equity firms choose IPO as their exit path.

As previously mentioned, we limit our study to the Nordic markets due to the scarce amount of research and the frequent PE activity in the region. Furthermore, our study is limited to the period of January 2000 - March 2018. This period is chosen as i) it has been the most active period for the PE industry, ii) PE firms stay invested on average 2.8 years post-IPO (Fürth and Rauch, 2015). See similar findings on our sample in Appendix 5. Therefore, by looking at three years post-IPO, we will on average capture the entire holding period post-IPO, and iii) the cut-off in March 2018 was done to get complete measurements of three years (12 quarters) historical performance (to March 2021). Short-term effects of PE ownership post-IPO (i.e., underpricing) have been excluded from our discussions since this topic deserves a thesis of its own.

1.6 Summary of results

The results suggest that higher degrees of PE ownership retention post-IPO positively impact abnormal returns. Three main reasons can explain this finding. First, the positive signal that higher PE ownership sends to outside investors about the company's quality. Second, PE firms have larger incentives to retain a higher ownership stake in a company with high quality and a

bright outlook. Third, PE firms can maintain the power to monitor the company, which subsequently affects performance positively. However, to our surprise, our results suggest that ROA is negatively impacted by higher PE ownership. The possible reasons for this result will be discussed in section 5.2. This finding creates question marks whether PE firms continue to add operational value to companies after they have gone public or if they solely act as a signaling mechanism that affects the abnormal return post-IPO.

1.7 Structure of the study

The paper is organized as follows: Section 2 provides a brief review of relevant literature divided into three subsections. In this part, we also present the theoretical frameworks that we base our hypotheses on. Section 3 describes the unique sample and methodology used in this study. Section 4 begins with descriptive statistics followed by various statistical considerations and the findings from the regression models. Section 5 discusses these findings and relates them to previous research. Section 6 finally outlines the main conclusions and limitations of the paper and offers suggestions for future research.

2. Literature review and theory

2.1 Literature overview

The relevant prior literature can be divided into three subsections; i) literature that discusses the financial performance of PE/VC-backed companies post-IPO, ii) literature that examines the relationship between ownership and performance, and iii) literature on the performance effect of ownership by the PE firm post-IPO. By combining findings within the three research areas, we will draw informed conclusions on what result to expect from our research question that is in line with previous research. An important note to add is that the definitions of VC and PE are sometimes difficult to distinguish and are at times interlinked. Hence some of our literature will include research made on VC firms.

2.1.1 PE-backed IPOs and performance

PE-backed IPOs could be categorized as a unique subgroup of IPOs due to their typical characteristics, including significant ownership post-IPO, usually divested within a few years after the IPO (Schöber, 2008; Levis, 2011). Several studies have focused on the differences in the long-run stock market performance between PE-backed, VC-backed, and non-backed IPOs. Schöber's (2008) study on the U.S. market finds that returns of PE-backed IPOs up to five years post-IPO are positive, but that the performance worsens between 8- and 32-months post-IPO. When analyzing the London and Paris Stock Exchange, Bergström et al. (2006) found

that IPOs backed by private equity firms on average outperform their non-PE-backed counterparts. However, after the first six months of trading, they underperform the market. The research is somewhat contradicting as Levis' (2011) study on the London Stock Exchange shows that for the first three years post-IPO, the sponsor-backed companies overperformed the non-sponsored backed companies and the market index.

However, other papers outline reasons why PE-backed firms would underperform non-PE-backed firms after an IPO, arguing that PE firms drive up both the costs and the IPO size (Alavi et al., 2008). Chen and Liang (2016) find that VC firms underperform non-backed firms once they enter the public market. They find that once the firms go public and VC owners exit, they indulge in excess spending. This finding is contrary to Alavi et al. (2008), as the IPO price would not increase, but post-IPO prices would decrease.

A significant non-financial advantage of an IPO can be a gain of reputation. Brav and Gompers (1997) argue that a reason for the outperformance of VC-backed companies compared to non-backed firms may be the reputational concerns of financial sponsors. Krishnan et al. (2011) built upon Brav and Gompers' conclusions, confirming that reputation positively correlates with a company's long-run performance post-IPO. Cao and Lerner (2009) further state that there are reasons to believe reputation in the stock market is vital to PE firms.

The previous literature points mainly towards positive effects on returns of PE-backed listings. However, some indications exist that there could exist a negative relationship between returns and PE-backing (Alavi et al., 2008; Chen and Liang, 2016). There seem to be country-specific effects in the varying results, which is why a study on the Nordics is a well-needed contribution. What most previous literature agrees on is that PE-backing is an important factor when measuring post-IPO performance.

2.1.2 Ownership and value creation

Even though previous research is lacking in examining relationships between post-IPO PE involvement and performance, similar studies have been conducted in a non-PE setting. Previous studies differ in their conclusions about the relationship between ownership and performance. McConnel and Servaes (1990) find a quadratic relationship between managerial ownership and Tobin's Q (ratio between an asset's market value and its replacement value). Other researchers questioned the approach of this study, and when using a fixed effect approach, Himmelberg et al. (1999) find no significant relationship with Tobin's Q. This research is interesting as it points out the econometric challenges with endogeneity when dealing with ownership and performance. Additionally, as various approaches give different answers, there is no unified answer to how ownership affects performance.

Despite the focus on maximizing returns, PE firms have been shown to add value to a company. Throughout their ownership period, they usually play an active role in financial and operational decisions (Jensen, 1986). PE funds generally manage to outperform other types of owners as they possess operational and financial expertise, which increases the efficiency of companies they invest in (Kaplan and Strömberg, 2009). Moreover, firms run by more prominent sponsors exhibit better long-term financial and stock price performance when they go public (Katz, 2009). Consensus across previous research is that PE firms create value for their portfolio companies. This indicates that the sponsors should continue to add value to companies when they retain ownership stakes post-IPO.

2.1.3 Post-IPO PE ownership impact on performance

Performance incentives and liquidity considerations often result in PE firms retaining significant holdings for a considerable period after flotation and the lock-up period, which may lead to superior aftermarket performance (Levis, 2011). Leland and Pyle (1977) argue that ownership retention post-IPO acts as a signal to investors regarding the quality of the underlying business. Large amounts of "insider selling" might signal that the firm is overvalued, while on the other hand, large degrees of retained ownership might signal that the company is of good quality. Barry et al. (1990) suggest that by retaining their share ownership after the offering, the venture capitalists provide assurance of continued monitoring and can credibly signal their belief in the firm's prospects. More recently, Bergström et al. (2006) argue that the performance of PE-backed IPOs in the post-IPO period may depend upon the amount of retained shares. Dong et al. (2020) furthermore find that the decision of a private equity sponsor to sell shares post-IPO decreases firm value. Fürth and Rauch's (2015) study of the divestment process of sponsors in the U.S. concludes that the process of gradually divesting shares post-IPO is driven by sponsor and portfolio characteristics.

Schöber (2008) finds that the combined equity stake of financial sponsors falls from 72.8% before the IPO to 47.4% thereafter. These results show that the belief that financial sponsors use IPOs of portfolio companies to "cash out" to a large degree is a misperception. Fürth and Rauch (2015) conclude that PE firms stay invested for several years post-IPO (on average 2.8 years), gradually reducing their stake in the portfolio company. When PE firms retain a significant fraction of shares after the IPO, these firms are likely firms of high quality with solid operating performance to continue maximizing the value of their investment (Bergström et al., 2006). Schöber (2008) argues that investors interpret large share sales at IPO by financial sponsors, who are well-informed insiders, as negative because they may signal i) a lack of faith in the company's prospects, ii) limited upside potential in aftermarket trading, and iii) lower

monitoring efforts and strategic guidance by financial sponsors. The same logic probably applies to share sales post-IPO. However, to gain more depth, counterarguments to Schöber's (2008) considerations also need to be examined. First, one can argue that investors understand the business model of financial sponsors as limited partnerships that require them to exit their investments and realize returns. Thus, investors may not interpret share sales by financial sponsors as a negative insider signal. Secondly, financial sponsors may aim to sell shares in the IPO at a discount to strengthen their reputation. This repeat placement hypothesis by Ainina and Mohan (1991) argues that financial sponsors allow investors upside potential in aftermarket trading by taking firms public at low valuations having in mind future IPOs and selling shares at favorable prices in following equity offerings. This might be a consideration but is likely dominated by the concern over fund returns. Third, share sales by financial sponsors in the IPO reduce overhang and may alleviate investors' concerns that large share sales reduce the share price over time. Worth noting is that the incentive structures differ between investors. They could either receive carry on a fund level or per deal, which will likely impact the sponsor's focus.

Schöber (2008) draws interesting conclusions on PE-backed IPO performance but does not consider how the degree of ownership translates into performance in the longer term. Levis (2011), however, finds that the stock performance is positively affected by the higher retained ownership by the private equity firm. By maintaining ownership after the lock-up period post-IPO, sponsors show commitment in monitoring the company, thereby alleviating investors' potential concerns regarding information asymmetry and moral hazard issues. Chao (2011) finds that a continued presence post-IPO suggests that PE firms realize more operating efficiency gains. Krishnan et al. (2011) add to the research with their finding that more reputable VCs exhibit more post-IPO involvement in their portfolio firms, and this continued involvement positively influences post-IPO performance.

An interesting angle to highlight is that the public market understands the PE firms need to exit the fund and deliver returns to the LPs sooner or later. This "PE overhang" creates a reluctance in the market as the investors expect a large dump of shares from the sponsor in the short- to mid-term. The reluctance to purchase the stock as an effect of the "PE overhang" will likely create a drag on the stock price. Schöber (2008) proposes academic support for the "PE overhang" theory, suggesting that PE-backed offerings are characterized by significant subsequent secondary distribution overhang since sponsors generally divest within several years post-IPO.

Dong et al. (2020) provide deeper insights into PE firms' effects on selling shares post-IPO. Suppose negative excess returns reflect the belief that the PE firm sells stakes after IPOs because of negative private information. In that case, there should be a decline in profitability (relative to industry benchmarks) consistent with Degeorge and Zeckhauser's (1993) hypothesis. In contrast, if the PE firm sells its stake because the firm has been restructured and can maintain its future profitability, there should be no change or perhaps even an improvement in profitability as the full effects of PE's restructuring efforts become observable in subsequent public accounting data. This view indicates that the change in PE ownership post-IPO and the signaling effect this implies is more complex than what seems to be at first glance, which makes this an exciting area of research. Moreover, another aspect further contradicting the link between PE and outperformance post-IPO is that there may be little share price response on a PE firm's sale of shares if the capital market views the sponsor as having sufficient reputational capital to assure investors about the portfolio firm's future profitability (Dong et al., 2020).

Another aspect worth considering is that the current market situation and outlook may also affect retained ownership by the sponsor post-IPO. If the sponsor predicts a promising market in the coming years, they will more likely want to be exposed than if they predict a recession (Schöber, 2008). Fürth and Rauch (2015) extended this research by demonstrating that different market environments play a role in the exit strategies of PE investments after IPOs in the U.S. This is true to some extent, but the PE firm's business is to continuously operate in the market and not specifically to time the market.

Most of the research related to PE ownership of companies post-IPO is consistent with our hypothesis that the PE firm's expectation of company performance probably drives ownership decisions. Hence, PE ownership post flotation sends positive signals to investors, which should be reflected in the firm's stock price. One general conclusion that we can draw based on the previous research in the field is that much of the literature does not distinguish between VC and PE, is US-centered, and is limited with regards to the relationship between PE ownership post-IPO and performance. Hence, we want to contribute to existing literature and focus on the long-term effects of post-IPO PE ownership on the Nordic market.

2.2 Theoretical framework

2.2.1 Signaling theory

Leland and Pyle (1977) define the signaling hypothesis as the message sent to the market on the willingness of owners to retain ownership. PE firms have worked with their portfolio companies for years, making the presence of asymmetric information between PE firms and

the public market substantial. Signaling theory helps describe the behavior when two parties have different access to information. The number of shares sold by the PE firms can indicate the shape of the portfolio company. It might determine investors' value of the company, which affects the company's stock market return. Leland and Pyle (1977) show that the value of a firm (which is directly related to its stock price when the firm is public) increases as the insider ownership increases. Their findings could partly explain the positive relationship between continued PE ownership post-IPO and superior performance that we expect in our hypothesis.

Furthermore, Dou et al. (2018) find that when the blockholders (owners with >5% ownership, e.g., PE firms) sell the firm's stock, they send a credible signal to the market of lower firm value. As a result, the stock price declines. Courteau (1995) moreover finds that the length of the lock-up period also serves as a positive signaling mechanism to the market.

However, we have identified a negative signaling effect to provide further depth to the discussion, as the signaling mechanism is not as straightforward as we have now portrayed it. If the PE firm maintains ownership for "too long", this can indicate that they have not been able to divest at a multiple high enough to realize targeted returns. This may act as a negative signal to outside investors and negatively impact returns in the long run.

2.2.2 Principal-agent theory

Principal-agent theory suggests that the separation of managers and shareholders leads to a conflict of interest (Meckling, 1976). To make managers maximize shareholder value, interests need to be aligned. PE firms often have representatives in the management and their portfolio companies' boards (Cao & Lerner, 2009). Fürth and Rauch (2015) find that this also holds post-IPO. As a result of this information asymmetry, PE firms choose to maintain ownership post-IPO based on private information leading them to believe that they can expect to earn high returns in the future. Adverse selection implies that it is rational for private equity to retain substantial stakes in high-quality firms for some period (Dong et al., 2020). More extensive share sales should have more negative share price effects due to the greater severity of adverse selection. A consequence of PE firms being involved in the company post-IPO is that they can monitor other managers, which reduces asymmetric information and thus reduces the principal-agent problem. When managers know they are monitored, they are forced to act in the interest of shareholders to keep their position. As PE firms gradually dispose of their shares, the incentives and opportunities to influence their portfolio companies are reduced. Hence, according to agency theory, we would expect a higher ownership stake and more significant influence over the portfolio company to affect stock market performance post-IPO positively.

Dou et al. (2018) find that if the managers' wealth is tied to the stock price, they suffer directly from blockholder exits that send a negative signal to the market, causing the stock price to decline. To prevent the loss of personal wealth, managers will align their actions with those of shareholders, leading to greater governance. In line with the principal-agent theory, these findings further support our expectation on PE ownership positively affecting performance post-IPO.

Bruton et al. (2010) find that retained ownership by VCs does not mitigate agency problems after the IPO since they do not focus on monitoring the firm, which causes their retained ownership to impact performance negatively. However, they also note that different types of investors can lead to contrasting performance outcomes, which is why we want to investigate whether we find a contradicting conclusion for PE investors. Welch (1989) finds that the period in which insider ownership is maintained post-IPO allows private information held by insiders to become more available. This result suggests that PE ownership maintained post-IPO allows investors to become more familiar with how PE impacts the company's operations. Hence, the information asymmetry regarding how the companies and PE firms interact may partly explain the expected positive relationship between performance and the degree of PE ownership.

2.3 Hypothesis

Due to the lack of previous studies directly related to our research area, we are dependent on combining findings from the studies discussed previously with financial theories to make predictions for the relationship between post-IPO PE ownership and performance. As previous scholars have briefly discussed, it is reasonable to believe that continued ownership post-IPO will positively affect the performance due to the positive signal it sends to outside investors about the quality of the company. Correspondingly, if PE sponsors sell their stakes when they believe the firm is overvalued, there should be a negative share price effect (Dong et al., 2020; Dou et al., 2018). PE firms have more significant incentives to keep a higher ownership stake in a company with a bright outlook and maintain the power to monitor the company, which sequentially affects performance. There seem to be factors working in different directions; information asymmetry, positive signaling if continued ownership stakes are maintained after IPO, and negative signaling as the duration of PE ownership post-IPO becomes "too long". However, studies on other markets find that higher maintained ownership by the private equity firm post-IPO positively affects aftermarket performance (Levis, 2011; Dong et al., 2020). We thus hypothesize the following:

H1: A larger retained ownership post-IPO by the private equity firm positively affects abnormal return of the portfolio company.

H2: A larger retained ownership post-IPO by the private equity firm positively affects ROA of the portfolio company.

The definition of retained ownership is the portion that the PE firm owns immediately post-IPO compared to the 12 subsequent quarters. For clarification purposes, retained ownership does not reflect the percentage of the initial stake sold at IPO. The analysis is focused only on the pace of the sell-downs after the IPO. When sponsors sell a fraction of their stake in the company in the post-IPO period of interest, the retained ownership is reduced. As previously mentioned, we include both abnormal return and ROA in our definition of performance. By including an accounting performance measure, we aim to investigate if PE ownership improves the operations of the portfolio companies also post-IPO. However, due to the nature of the PE business model, we expect a stronger relationship between PE ownership and abnormal return than on ROA. PE firms have incentives to improve the portfolio companies' accounting performance if it results in a better return when they exit their investments. However, often improvements in stock performance are fuelled through improving accounting performance. Thus, there might exist a positive relationship also in the case of ROA. Another reason for expecting a less significant relationship when considering ROA instead of abnormal return is that signaling is not relevant in accounting performance.

3. Methodology

3.1 Sample

We aim to answer the research question by collecting data in the form of a balanced panel. Extensive data gathering and processing, combining data from multiple sources, and manually cross-checking the data with company press releases and IPO prospectus ensure the highest possible quality of our data.

The sample was constructed by obtaining all PE-backed IPOs listed on the Nordic Stock Exchanges between January 2000 and March 2018 using the reputable databases Dealogic and Pitchbook. As the definition of private equity is vague and differs between geographies, we only included IPOs backed by sponsors matching one of the two requirements; i) a minimum of €1bn in AUM or ii) if they follow the typical PE 'philosophy' when they invest. However, as previous literature (Schöber, 2008; Cao and Lerner, 2006) note, establishing whether a sponsor is a VC or PE-investor is demanding as the boundaries between the two may be blurred.

Furthermore, companies that were delisted, acquired, or went bankrupt within the timeframe (12 quarters after IPO) have been excluded from our sample to be consistent with previous research and obtain a balanced panel. We considered this feasible as only a small fraction of companies in the sample were delisted (~3%), thus allowing us to collect a balanced instead of an unbalanced panel. We deemed the slight survivorship bias this can create negligible as the excluded companies are placeable on both ends of the quality range (bankrupt companies of low quality and acquired companies likely of high). The initial sample size of 253 IPOs was scrubbed down to a final sample size of 83 IPOs (Table 1). Due to the tangible size of the sample, it has manually been cross-checked with IPO prospectus to confirm that the IPO date and ownership percentage every quarter are correct. Appendix 5 displays the complete dataset.

Table 1: Sample construction procedure

Sample collection	Procedure	# of IPOs
<i>Original sample:</i>	<i>Screening and combining sample from Dealogic and Pitchbook</i>	253
<i>Dropped due to:</i>	<i>VC- or non-PE backed</i>	-121
	<i>Non-Nordic IPOs</i>	-17
	<i>Delisted within 12 quarters (three years) after IPO</i>	-7
	<i>Lack of relevant data</i>	-25
<i>Cleaned data:</i>		83

3.2 Research design

Our dataset is a balanced panel, and we use panel data methods in our analysis. In panel data, the same companies are observed over multiple periods. Using panel data has many advantages, including increased sample size, which is beneficial considering our tangible sample size. Furthermore, panel data allows for the reduction of multicollinearity problems and to control for unobserved effects which can be correlated with the regressors (Wooldridge J. M., 2016). We examine 12 quarters (T=12) post-IPO for each of the IPOs in our sample (N=83), meaning that the time span is the same for each firm, but the observed years and quarters will be different depending on when the firm was listed.

Stock performance is used as a proxy for performance as it is a well-established indicator of a company's value, even though no metric holistically analyses performance. Under the assumption that the efficient market hypothesis holds, a company's stock trades based on all public information, including its ownership structure which is why we believe this is a suitable way to examine performance. We have chosen to also look at ROA as our accounting metric to stay consistent with previous research (Dong et al., 2020; Bruton et al., 2006) and give a more holistic view of aftermarket performance.

After the sample of 83 IPOs during the relevant period was collected, a second step in the research process was finding the share price development of listed companies in our sample from the IPO date and 12 quarters going forward. All historical stock prices were found using the industry leader S&P Capital IQ database and were adjusted for stock splits, reverse stock splits, spin-offs, right offerings, and dividends. Percentage change in the adjusted price between given dates thus represents total shareholder return.

Data for MSCI Sweden, MSCI Norway, MSCI Denmark, and MSCI Finland were collected from Capital IQ to calculate the market returns. In our sample, we have one IPO from Iceland. Since there was no MSCI index for Iceland before May 2021, the Norwegian index was used as by our assessment they have the most similar public markets compared to the other Nordic exchanges. As for the stock return, the index return is representing the total index returns adjusted for stock splits, reverse stock splits, spin-offs, right offerings, and dividends.

We measure performance through the stock's relative strength to the overall market over a quarter, namely abnormal return. Calculations of stock market return and market index return followed a logarithmic approach in line with previous research (Sias et al., 2006). The logarithmic return has the advantages of being normally distributed and enabling additivity, as a two-period log return is the sum of each period's log return. Underpricing results from the IPO being priced lower than the market value rather than value creation immediately after the IPO. To neglect the abnormal returns resulting from underpricing, which otherwise possibly would distort the analysis, we begin the first observed quarter one week after IPO when the stock price is likely more stabilized.

Collecting the quarterly ownership data required us to cross-check the data points manually to ensure entirely accurate information. First, we obtained ownership stakes of the sponsor post-IPO from Dealogic and IPO prospectus. Second, we used Dealogic and Capital IQ to extract a list of all sell-downs in ownership made by the PE firms in our sample throughout the period of interest, to be able to test if the performance decreases as ownership goes down. Ownership data was then used to construct the variable PE ownership for every firm. To be consistent with the aforementioned approach, the respective stakes begin one week after the IPO date and change when the sponsor sold off a stake in the company.

We finally used Capital IQ to extract figures for all the firms in our sample from the 12 subsequent quarterly reports following the public offering. These data points include ROA¹,

¹ As well as data on the alternative accounting metrics for robustness test displayed in Table 6.

asset turnover, size², volatility, EBITDA-margin, quick ratio, debt ratio, and P/B ratio. The accounting metrics were also cross-checked with relevant company reports. All variables are discussed in section 3.5 and Appendix 2.

3.3 Endogeneity and causation

Before explaining the applied regression models, we deem it necessary to present a background of the method choices used to deal with the possible endogeneity existing between company performance and ownership structure. McConnel and Servaes (1990) point out one-way causation going from ownership to performance where the mechanisms are treated as exogenous. Other researchers (Himmelberg et al., 1999) argue that the one-way causation instead has endogenous mechanisms as ownership is considered to be an outcome as the fraction varies depending on the company's characteristics, which also explains firm performance. A third body of research observe a two-way causation between ownership and performance (Al Farooque et al., 2007). This method creates endogeneity in the form of simultaneity bias. It becomes clear that earlier research analyzing the relationship between ownership and performance has caused discrepancies in terms of method choices. As will be described in the following section, we have developed models representing these different methods in analyzing ownership and performance.

The methodologies mentioned above have been tested on ownership in general, and not particularly PE ownership. However, we believe it is reasonable to assume the existence of endogeneity when it comes to PE ownership. This would imply that PE ownership can affect performance, but performance can also affect PE ownership. Fürth and Rauch (2015) conclude that both fund-specific factors and company-specific factors determine PE ownership. It is likely that these factors also could affect the performance of the portfolio companies. PE firms have incentives to change their holdings post-IPO based on performance or expectations on the portfolio companies' performance to deliver a desirable IRR on the LPs capital.

3.4 Regression equations

To investigate the primary objective of our study, whether PE ownership post-IPO affects performance, we define two regression equations (i) and (ii) to answer the hypotheses. Table 2 displays six models used to deal with varying aspects of time effects and potential endogeneity issues. Furthermore, firm-specific time-variant control variables are included along with

² Natural logarithm of the opening book value of Total Assets (absolute metric converted to SEK as Sweden represents 61 % of the sample (Figure 3), thus avoiding potential harmful currency fluctuations).

dummies for time. Definitions of the included variables in the regression are provided in section 3.5 and Appendix 2.

Estimations of the equations are conducted using pooled OLS (Model I), Fixed Effects with different aspects of time effects (Model II-IV), as well as Fixed Effects using lags for suspected endogenous variables both as proxies (Model V) and as instruments in the instrumental variable estimation (Model VI). The rationale behind the inclusion of the models is explained in section 3.6. Robust standard errors are clustered by firm. Our regression equations (i) and (ii) take the following form:

$$\begin{aligned} Abnormal\ return_{it} = & \beta_0 + \beta_1 PE\ Ownership_{it} + \beta_2 Asset\ turnover_{it} + \beta_3 Size_{it} \\ & + \beta_4 Volatility_{it} + \beta_5 EBITDA\ margin_{it} + \beta_6 Quick\ ratio_{it} + \beta_7 Debt\ ratio_{it} \\ & + \beta_8 P/B\ ratio_{it} + \gamma_i + \varepsilon_i \end{aligned} \quad (i)$$

$$\begin{aligned} ROA_{it} = & \beta_0 + \beta_1 PE\ Ownership_{it} + \beta_2 Size_{it} + \beta_3 Quick\ ratio_{it} + \beta_4 Debt\ ratio_{it} \\ & + \gamma_i + \varepsilon_i \end{aligned} \quad (ii)$$

3.5 Variables

This section describes the applied variables for the regression equations (i) and (ii) used to test our hypothesis. All variables are measured and collected on a quarterly basis for consistency as we want to capture as immediate effects as possible from a change in PE ownership and due to the reason that there is no way to collect more frequent public accounting data. We develop methodologies that account for multiple influences on performance, rather than using models that attempt to utilize only one element, in our case the variable of interest, *PE ownership*. Control variables explained later in this section that might correlate with the variables of interest (PE ownership, Abnormal return, and ROA) are therefore used to prevent omitted variable bias. Further definitions, sources, and mathematical background of the variables are provided in Appendix 2.

3.5.1 Dependent variables

Abnormal return – For equation (i), the dependent variable Abnormal return is included to measure the stock's relative strength to the overall market. Returns follow a logarithmic approach in line with previous research (Sias et al., 2006), thus having the advantages of being normally distributed and enabling additivity, as two-period log return is the sum of each period's log return.

ROA – For equation (ii), the dependent variable ROA is included as the primary accounting performance metric as it is in line with previous literature (Dong et al., 2020; Bruton et al., 2006). However, as aforementioned, we have also conducted robustness tests in the analysis

by replacing ROA with alternative accounting metrics (ROCE, ROIC, ROE, and ROS) using the same equation.

3.5.2 Independent variable

PE ownership – The independent variable is PE ownership and is the foundation when we analyze the effect it has on the performance measurements. As pointed out in section 2.3, where the hypotheses are developed, we deemed it reasonable to believe that higher PE ownership positively affects performance. This is expected for three main reasons; i) Because PE firms have larger incentives to retain a higher ownership stake in a company with a bright outlook, ii) PE firms can maintain the power to monitor the company, which sequentially affects performance positively and iii) Continued PE backing of the portfolio company will likely send out positive signals to outside investors about the quality of the company.

3.5.3 Control variables

Asset turnover – Equation (i). Asset turnover is included as a control variable as an indicator for investors how effectively the company's assets are used to generate sales. This is in line with previous research, Levis (2011). Logically, an improvement of asset turnover is expected to affect abnormal return positively.

Size – Equation (i) and (ii). Proxy for firm size defined as the natural logarithm of the opening book value of total assets to account for the skewness of the distribution, which is in line with previous research (Ayuba et al., 2019; Dou et al. 2018), among others. As it represents absolute values, and since the sample consists of several countries with different currencies (EUR, SEK, NOK, DKK, and ISK), the metric has been converted to SEK (as Sweden represents 61% of the sample) in order to minimize currency fluctuations. This will also be negligible by following the logarithmic approach. As a robustness check, we have used other proxies for size, which gave us similar results.³ Previous research suggests the existence of a so-called “small firm effect”, implying that small firms outperform large firms in terms of performance (Roll, 1981), which is why we expect a negative coefficient.

Volatility – Equation (i). Volatility is used to control for the total risk and is given as the standard deviation of the stock, defined as the three months historical share price volatility. Financial theory suggests that investors should be compensated for increased volatility. However, research has found a negative relationship between volatility and stock market return (Jin, 2017). Therefore, we expect a negative relationship with abnormal return as well.

³ Other size measured used: Natural logarithm of revenue and market capitalization (converted to SEK).

EBITDA margin – Equation (i). The EBITDA margin is included as a proxy for profitability as it snapshots the short-term operational efficiency in line with Levis (2011). As the value of the stock represents all free cash flows in perpetuity, a higher EBITDA margin will generate higher compounding cash flows, thus valuing the business higher, ceteris paribus. We therefore expect a positive relationship between EBITDA margin and abnormal return.

Quick ratio – Equation (i) and (ii). The quick ratio is an indicator of the short-term liquidity position by measuring the company's ability to meet its short-term obligations with its most liquid assets. The ratio is defined as the sum of total cash, short-term investments, and accounts receivables divided by total current liabilities. This theoretically means the higher liquidity, the better. Hence, we expect a positive coefficient on performance.

Debt ratio – Equation (i) and (ii). In line with previous research (Dong et al., 2020; Bruton et al., 2010; Levis, 2011), we have used the Debt ratio as an indicator to show the portion of a company's assets financed through debt. We have no clear expectations for the coefficient on debt ratio as, on the one hand, a high debt ratio can increase the probability of financial distress. On the other hand, Jensen (1986) describes that the free cash flow problem might be limited by higher debt levels, indicating a positive coefficient.

P/B ratio – Equation (i). The price-to-book ratio is included in line with Levis (2011). At unity, the P/B ratio indicates the identical market value and the book value of a stock. If the ratio is >1, that would mean the firm has added value and vice versa. Hence, we expect a positive coefficient.

γ_i – Equation (i) and (ii). We have included dummies to control for time fixed effects, either Year (1), Quarter (2), or Year-Quarter (3). Model II-IV accounts for these, respectively.

- 1) Year – Each year 2000-2018 is a dummy variable with a 1 if the variable matches the observation year (0 otherwise). Year dummies are included to consider year-specific factors that influence performance, such as recession periods (e.g., 2008 and 2013)
- 2) Quarter – Each quarter (Q1-Q4) during the period 2000-2018 is a dummy variable with a 1 if the variable matches the observation quarter (0 otherwise). Quarter dummies are included to account for seasonality within the sample.
- 3) Year-Quarter – Each year-quarter during 2000Q1-2018Q1 is a dummy variable with a 1 if the variable matches the observation year-quarter (0 otherwise).

3.6 Model descriptions

Unobserved firm characteristics and possible simultaneity may create endogeneity issues. In order to estimate the relationship between company performance and PE ownership, we have used six different models summarized in Table 2. They have different pros and cons in dealing with endogeneity that will be presented further in this section. Model I is mainly included for comparison and will not be analyzed deeply in our conclusions. Model II-IV cover sources of error that could be attributable to endogeneity in the form of unobserved heterogeneity, yearly fluctuations, and seasonality in the data. Suppose the results of these models are similar. In that case, we can conclude that seasonality effects do not significantly impact our results. We will then use Model II as the primary model in our analysis as this is most in line with previous research in the field. In many applications a lag identification which will be discussed more thoroughly later in this section is justified on the grounds of “reverse causality” rather than unobserved heterogeneity. Intuitively, it is reasonable to argue that temporal ordering prevents the dependent variable from affecting past values of a causal variable of interest. In Model V, the suspected endogenous variable *PE ownership* is replaced by its one quarter lagged value as more of an “ad hoc” solution. Model VI is instead estimated using instrumental variable (IV) estimation and 2SLS which is probably the best way to deal with endogeneity concerns if appropriate instruments are selected. Thus, Model V and VI are included to deal with issues of endogeneity as a defense against simultaneous or reverse causation existing between performance and ownership.

Table 2: Six models to deal with varying aspects of time effects and endogeneity

I	II	III	IV	V	VI
<i>Pooled OLS</i>	<i>Fixed Effects Y (main)</i>	<i>Fixed Effects Q</i>	<i>Fixed Effects Y- Q</i>	<i>FE (w/ lags as proxies)</i>	<i>FE2SLS</i>

As the same sample is split over all periods, either Fixed or Random effects models are usually applied (Wooldridge J. M., 2010). The potential unobservable heterogeneity in the sample could be solved by applying a fixed-effects model where the time-invariant characteristics are eliminated. To confirm that fixed effects is the correct approach for estimating causal effects from our panel dataset, Appendix 1 displays various tests performed to check that our model choices are the most appropriate in our case. As the fixed effects estimator is used to adjust both for unobserved firm-specific and time-specific factors, by the inclusion of time dummies, it becomes a two-way fixed effects model (2FE). However, we acknowledge that there are potential drawbacks when using the fixed-effects models. As

variables that are held constant over the entire timespan will get eliminated in the fixed effects method, fund-specific characteristics (e.g., fund age at IPO, fund size) could not be measured using fixed effects. These fund-specific characteristics may affect PE ownership and thus also the performance.

Another way of dealing with endogeneity concerns in observational data, which was briefly discussed earlier in the section, is by applying lagged explanatory variables as a proxy or an instrument, a so-called “lag identification”. If a dependent variable is potentially endogenous, intuitively, it is more appealing to look for a proxy that is not subject to the same issue, where the most common approach is to lag the suspect variables one or multiple periods. In our case, this implies that performance depends on PE ownership which depends on performance. A third and best way to deal with endogeneity concerns is by using an instrument that is exogenous to the performance equation but related to PE ownership. Since previous PE ownership changes will be strongly correlated with current PE ownership, the new variable can serve as an instrument for PE ownership. Frequently, researchers propose that by using the lagged version of an explanatory variable X , it becomes “exogenized” when estimating the causal effect of X on Y . This is grounded in the fact that Y_t cannot possibly cause X_{t-1} , so by replacing X_t with X_{t-1} we obviate concerns that X is endogenous to Y . It is therefore reasonable to assume that performance today Y_t cannot affect the PE ownership in the past (X_{t-1}). Thus, we may alleviate threats to causal identification using lagged variables without requiring additional data than what is available in the dataset. The causal process is depicted in Figure 1, visualizing what was previously described in the setting relevant to our model.

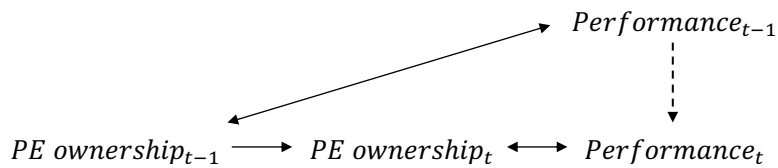


Figure 1: Lagged independent variable with reverse causality⁴

Despite being widely used, these methods have received criticism, especially using a lagged variable as a proxy. Reed (2015) argues that using lagged variables as a proxy does not avoid the inconsistency problems associated with simultaneity. Furthermore, it is difficult to empirically determine how severe the endogeneity problem is by using these techniques and whether the solution is adequate to deal with it. However, by using the lagged form of PE

⁴ Figure 1 depicts pure simultaneous causation with no unobservables. The dashed line represents the causal relation between *Performance* in time t and $t - 1$ that must be zero.

ownership as an instrumental variable, we deal with some of these issues. We do this in Model VI by replacing and instrumenting our variable PE ownership with its lagged values. A difficulty of the instrumental variable estimation is finding suitable instruments. To be a good instrument it must be correlated with the endogenous variable, but uncorrelated with the dependent variable. Having a poor instrument might even cause a worse result than pooled OLS when endogeneity is a potential issue (Wooldridge J. M., 2016). To limit this drawback, a test for weak instruments is conducted in Appendix 1, where the rule of thumb is to have a F-statistic >10 from the first stage in the 2SLS to reject the null hypothesis.

4. Analysis

In this section, we present our data analysis followed by displaying the results of our two hypotheses presented in section 2.3 along with several robustness tests. Lastly, we conclude our findings in section 4.6.

4.1 Descriptive statistics

Summary statistics of the variables included in our analysis are displayed in Table 3 below.

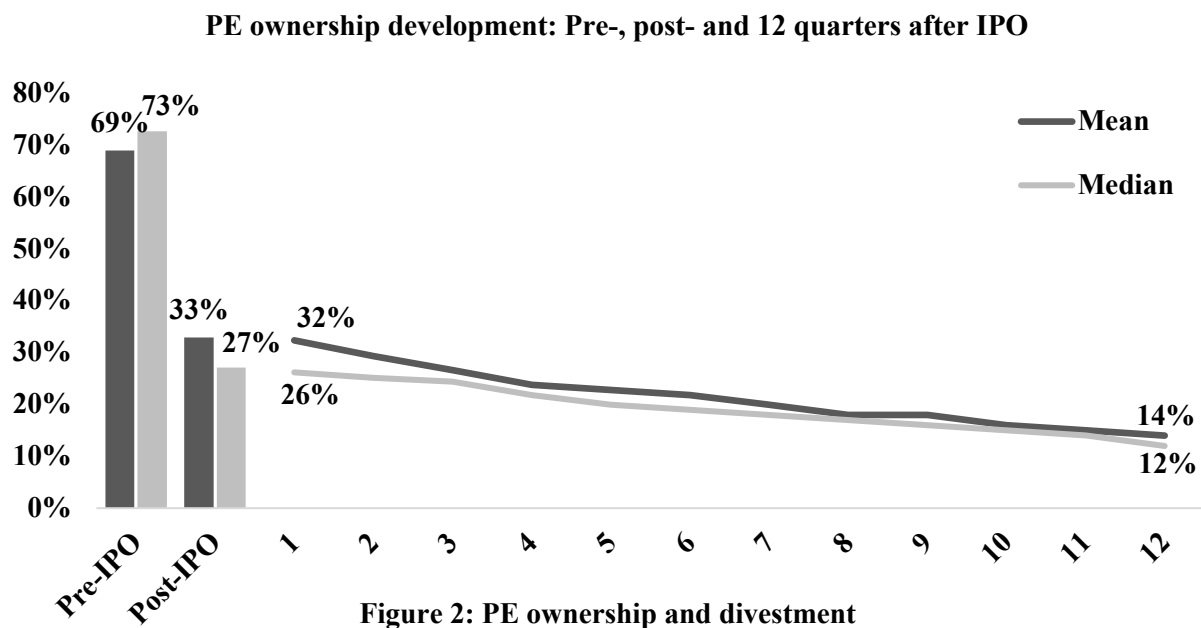
Table 3: Descriptive statistics for the panel dataset

Variable	N	Mean	SD	Min	Pctl(25)	Median	Pctl(75)	Max
<i>PE ownership</i>	996	0.227	0.179	0.000	0.104	0.207	0.312	0.733
<i>Abnormal return</i>	996	-0.006	0.168	-0.444	-0.106	0.003	0.100	0.361
<i>Asset turnover</i>	996	1.187	0.708	0.257	0.723	1.061	1.446	3.806
<i>Volatility</i>	996	0.202	0.094	0.085	0.143	0.177	0.228	0.532
<i>Size</i>	996	7.966	1.211	5.294	7.151	8.036	8.839	10.993
<i>EBITDA margin</i>	996	0.106	0.162	-0.582	0.061	0.103	0.164	0.469
<i>Quick ratio</i>	996	1.071	0.727	0.143	0.630	0.918	1.266	3.655
<i>Debt ratio</i>	996	0.287	0.142	0.000	0.211	0.283	0.364	0.610
<i>P/B ratio</i>	996	5.576	12.460	0.284	1.489	2.342	3.464	71.971
<i>ROA</i>	996	0.046	0.069	-0.225	0.025	0.051	0.080	0.184
<i>ROCE</i>	996	0.067	0.104	-0.350	0.034	0.070	0.113	0.290
<i>ROIC</i>	996	0.026	0.174	-0.668	-0.022	0.048	0.110	0.371
<i>ROE</i>	996	0.103	0.257	-0.831	0.029	0.119	0.214	0.738
<i>ROS</i>	996	0.022	0.155	-0.703	0.011	0.043	0.081	0.270

Note: This table presents descriptive statistics for all variables used in the study. The same N=83 companies are measured over T=12 periods for a total of 996 observations. ROCE, ROIC, ROE, and ROS are only included as robustness checks in section 4.5. Variables are winsorized at the 2nd to 98th percentile and are based on quarterly observations.

PE ownership varies from a maximum of 73.3% to a minimum of 0% over the 12 quarters following the IPO for all companies. The average stake is 22.7% in the sample. The average

Abnormal return is -0.6%, indicating that the average sample with equal weighting performs worse than the respective market indices. *ROA* is on average 4.6%. We have winsorized the variables between the 2nd to 98th percentile to minimize the influence of outliers in the data. Hence the tiny differences of the means, medians, and standard deviation indicate a minor fraction of outliers in the data (with a possible exception for the *P/B ratio*). However, as there are both advantages and disadvantages with the method, we provide non-winsorized regression results in section 4.5.



Further examining our variable of interest, Figure 2 illustrates how average PE ownership develops over the 12 quarters post-IPO. The average PE ownership stake right after the IPO is 33%. It gradually decreases towards 14% after three years. These findings support what previous research has concluded, that the IPO is not an immediate exit for the PE firm. PE firms stay invested in the portfolio company with significant positions that gradually decrease, for an average of 2.1 years post-IPO in the sample (Appendix 5). Another interesting observation is that there does not seem to be a significant reduction in ownership on the expiration of the lock-up agreement (usually approximately half a year after the IPO).

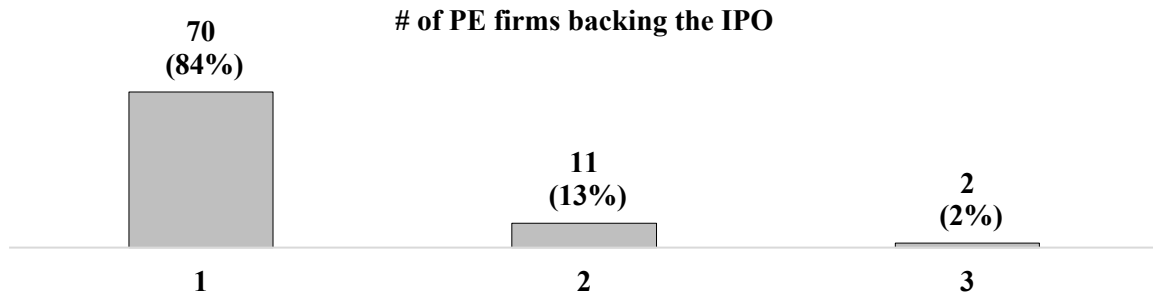


Figure 3: Number of financial sponsors (PE) in the IPO

Figure 3 illustrates that 84% of the IPOs in the sample are backed by a single PE firm. Only 15% of the IPOs are backed by more than one single PE firm, which comes with sharing both risks and gains. In our sample, this implies that PE firms have not commonly pursued joint investments in the Nordic region between 2000-2018.

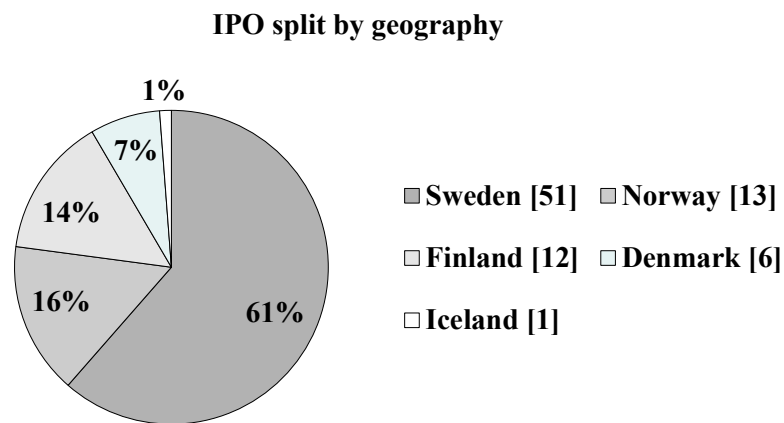


Figure 4: Geography split

Figure 4 shows another interesting observation from our data that a majority of 61% of all IPOs are made in Sweden. Since the Nordic countries are similar in terms of business environments, we do not consider this a limitation of our study. Only one IPO in our sample is from Iceland.

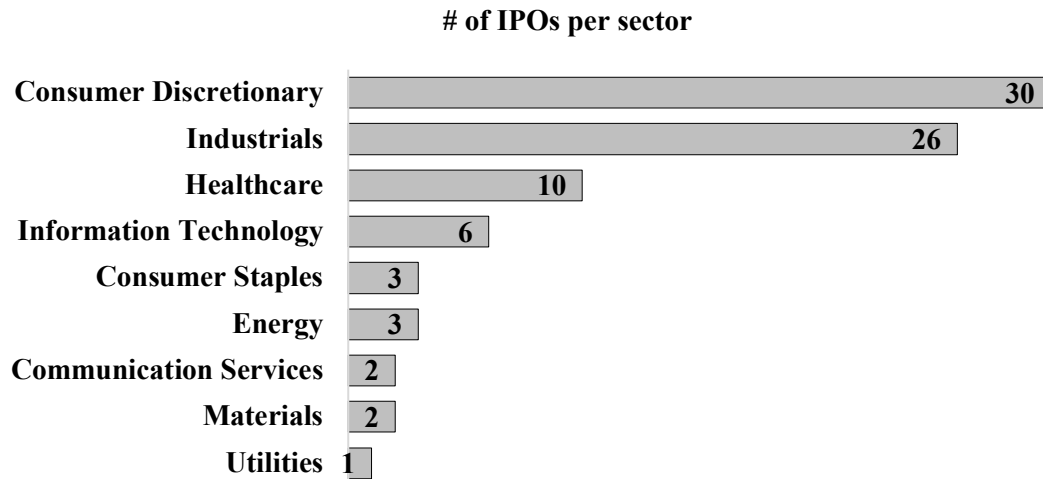


Figure 5: Sector split

Figure 5 shows the distribution of the sectors that the companies in our sample operate in. The dominating industry, representing approximately 36% of IPOs, is “Consumer Discretionary”. “Information Technology” and “Communication Services” are classified as “high-tech” sectors, which is consistent with how previous research (Schöber, 2008) have split their industry data. Firms operating in these “high-tech” sectors are usually distinguished from other firms due to their high valuations and being more “hyped” on the market. However, firms included in the “high-tech” sectors represent a small fraction of less than 10% in our sample.

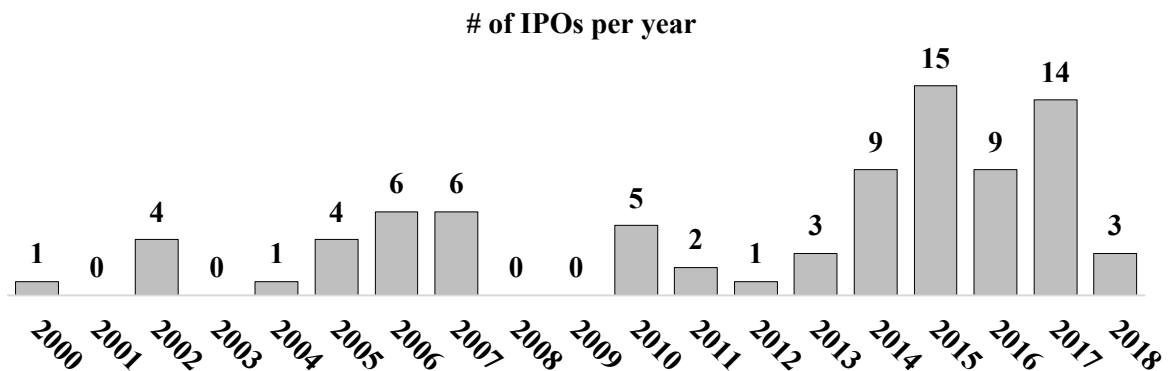


Figure 6: IPO distribution over the sample period

Figure 6 shows the distribution of IPOs per year in the time span of interest. Around the financial crisis in 2008, IPO activity was naturally significantly lower with no public offerings. Worth mentioning is that the data is collected until March 2018, hence the low number of IPOs in 2018.

4.2 Testing for multicollinearity

Multicollinearity between variables poses challenges to the interpretation of a multiple regression analysis and can thus have severe effects (Mansfeld and Helms, 1982). Hence, it is of great importance to detect its existence before drawing a conclusion on our regression results. To examine the relationship between the variables, we perform multicollinearity tests (Table 4). As a first test, a correlation matrix was constructed (see columns 1-8). A perfect positive/negative linear correlation between two variables is indicated by 1 and -1 respectively, and 0 indicates no linear correlation. As the correlation matrix exhibits, the variables are all close to 0 and thus show no alarming values. As a second test for multicollinearity, a variance inflation factors (VIF) test was conducted for the regression equations (see columns (i) and (ii)). Research commonly suggests that VIF values greater than 10 are signs of severe multicollinearity (O'Brien, 2007). Some researchers argue that one needs to be concerned with VIF values of 5-10 and higher (James et al., 2013). Either way, considering that our VIF values are never above 2 in equations (i) or (ii), we can conclude that the effects from multicollinearity are not significant enough to impact the results in our analysis.

Table 4: Correlation matrix and VIF test

Variable(s)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	VIF	
									(i)	(ii)
(1) <i>PE ownership</i>	1.00								1.07	1.01
(2) <i>Asset turnover</i>	-0.07*	1.00							1.35	-
(3) <i>Volatility</i>	0.13*	-0.1*	1.00						1.14	-
(4) <i>Size</i>	-0.01	-0.23*	-0.19*	1.00					1.41	1.23
(5) <i>EBITDA margin</i>	0.14*	-0.15*	-0.18*	0.29*	1.00				1.24	-
(6) <i>Quick ratio</i>	-0.05	-0.18*	0.13*	-0.38*	-0.19*	1.00			1.52	1.24
(7) <i>Debt ratio</i>	-0.04	-0.29*	0.05	0.32*	0.31*	-0.33*	1.00		1.45	1.81
(8) <i>P/B ratio</i>	-0.02	0.09*	-0.07*	-0.07*	-0.01	0.15*	0.01	1.00	1.06	-

*Note: The left-hand side of the table presents the correlation between the variables used in equation (i) and (ii). Variables are defined in section 3.5 and Appendix 2. Significance of the correlation coefficients are denoted as *, **, and *** (5%, 1%, and 0.1% respectively). The VIF values for the respective equation (right-hand side) are calculated by regressing a variable with regards to all other variables. Variables are winzorized at the 2nd to 98th percentile and are based on quarterly observations.*

4.3 Other statistical considerations

Appendix 1 displays various tests performed to check the quality of the variables and the accuracy of our model choices. Heteroscedasticity occurs when the conditional variance of the dependent variables is not constant (Wooldridge J.M., 2016). This increases the probability of gaining inaccurate results as the estimated coefficients' variances show too high values. We test our models for heteroscedasticity by performing a Breusch-Pagan test. The results show that heteroscedasticity exists in our dataset. Standard errors are clustered on a company level in all regressions to solve the potential issues from heteroscedasticity.

Serial correlation is the relationship between a variable and the lagged version of itself over a time interval. The presence of serial correlation can affect the standard errors and cause inaccurate results. In Appendix 1, we display a Breusch-Godfrey/Wooldridge test for serial correlation of linear panel data. The test fails to reject the null hypothesis, indicating no issue with serial correlation in our dataset.

We furthermore conduct an augmented Dickey-Fuller test to test for stochastic trends. We can conclude that no unit roots are present in our dataset and it is thus stationary. This means that the statistical properties of our dataset do not change over the examined time span.

4.4 Testing the hypothesis

The primary purpose of this study is to analyze whether retained ownership post-IPO by the private equity firm positively affects the performance of companies. The first hypothesis has been tested by applying the different regression models presented in Table 2. As aforementioned, Model I is included for comparison, and we will not draw any significant conclusions based on the results of the model. The regression results for equation (i) are displayed below in Table 4. Furthermore, the constant term is uninterpretable and omitted in Model II-VI as all time dummies are used to avoid collinearity.

Table 4: Regressions – PE ownership effect on Abnormal return

	I	II	III	IV	V	VI
Abnormal return	Pooled OLS	Fixed Effects Y (main)	Fixed Effects Q	Fixed Effects Y-Q	FE (w/ lags as proxies)	FE2SLS
<i>PE ownership</i>	0.000 (0.027)	0.136*** (0.052)	0.145*** (0.052)	0.136*** (0.052)		0.213*** (0.072)
<i>(V) lagPE ownership</i>					0.155*** (0.054)	
<i>Asset turnover</i>	0.018 (0.128)	-0.025 (0.034)	-0.014 (0.032)	-0.028 (0.035)	-0.027 (0.037)	-0.023 (0.037)
<i>Volatility</i>	-0.255*** (0.090)	-0.184* (0.120)	-0.173* (0.121)	-0.206* (0.120)	-0.180* (0.121)	-0.187* (0.122)
<i>Size</i>	0.007 (0.006)	-0.077* (0.047)	-0.087** (0.044)	-0.080* (0.045)	-0.050 (0.044)	-0.049 (0.044)
<i>EBITDA margin</i>	0.098** (0.043)	0.163* (0.094)	0.158* (0.095)	0.174* (0.090)	0.162* (0.112)	0.159* (0.104)
<i>Quick ratio</i>	0.011 (0.009)	-0.033 (0.027)	-0.031 (0.026)	-0.039 (0.033)	-0.034 (0.028)	-0.035 (0.029)
<i>Debt ratio</i>	-0.112** (0.050)	-0.101 (0.114)	-0.074 (0.108)	-0.086 (0.111)	-0.136 (0.120)	-0.132 (0.122)
<i>P/B ratio</i>	0.000 (0.000)	0.002 (0.002)	0.002 (0.002)	0.003 (0.002)	0.003 (0.002)	0.003 (0.002)
<i>Constant</i>	-0.163*** (0.061)	Omitted	Omitted	Omitted	Omitted	Omitted
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	No	Yes	Yes
Quarter FE	No	No	Yes	No	No	No
Year-Quarter FE	No	No	No	Yes	No	No
Observations	996	996	996	996	913	913
R ²	0.138	0.105	0.092	0.149	0.109	
Adjusted R ²	0.112	0.021	0.014	0.045	0.027	

*Note: This table presents the results of six models with Abnormal return as the dependent variable. The main variable of interest is PE ownership, and the rest are control variables. Models I, II, III, IV, V, and VI are explained in section 3.6. Standard errors are clustered on company level in all regressions. The heteroskedasticity robust standard errors are reported in parenthesis below the coefficients. Significance of the coefficients are denoted as *, **, and *** (10%, 5%, and 1% respectively). Variables are winsorized at the 2nd to 98th percentile and are based on quarterly observations. The constant term is uninterpretable and omitted in Model II-VI as all time dummies are used to avoid collinearity. In the Instrumental Variable estimation model (VI) no R² is reported since the explanatory variable is correlated with the error term, hence not helpful.*

Our variable of interest, *PE ownership*, shows a statistically significant positive coefficient in Model II-VI at a 1% significance level. Coefficients lie between 0.136 and 0.213, implying that a one percentage point increase in *PE ownership* likely increases the abnormal return with 0.136-0.213 percentage points. This would work oppositely as PE funds usually do not increase their stakes after the IPO. The fact that they all show similar results is a strong indication that the relationship between PE ownership and abnormal return post-IPO is positive and supports our first hypothesis.

For our control variables, *Asset turnover* does not show significant results in any of the tested models, which implies that we cannot conclude its relation to abnormal return. As in most research *Volatility* shows a significant negative coefficient at the 10% level for all models, indicating that volatility has a negative effect on post-IPO abnormal returns. *Size* shows in line with expectations a negative coefficient in all models and is significant at the 5% and 10 % in three of our models. However, not enough evidence to say that firm size negatively affects abnormal return. The *EBITDA margin* is positive and significant in all models at the 10% level, in line with our expectations. This likely indicates that an increase in the *EBITDA margin* has a positive effect on abnormal return. Neither *Quick ratio*, *Debt ratio*, nor *P/B-ratio* shows significant results in our models. Hence, we are careful to draw any conclusions regarding these variables.

To test our second hypothesis, whether retained *PE ownership* post-IPO also affects a company's accounting performance, we have applied the same regression models on equation (ii) for ROA instead of abnormal return. The results are displayed below in Table 5.

Table 5: Regressions - PE ownership effect on ROA

ROA	I	II	III	IV	V	VI
	Pooled OLS	Fixed Effects Y (main)	Fixed Effects Q	Fixed Effects Y-Q	FE (w/ lags as proxies)	FE2SLS
<i>PE ownership</i>	0.008 (0.012)	-0.049*** (0.015)	-0.045*** (0.014)	-0.049*** (0.017)		-0.066*** (0.019)
<i>(V) lagPE ownership</i>					-0.048*** (0.014)	
<i>Size</i>	0.004* (0.002)	0.053*** (0.018)	0.050** (0.019)	0.050*** (0.017)	0.050*** (0.017)	0.050*** (0.017)
<i>Quick ratio</i>	-0.021*** (0.003)	0.010 (0.014)	0.011 (0.014)	0.011* (0.013)	0.009 (0.015)	0.009 (0.015)
<i>Debt ratio</i>	-0.002 (0.016)	-0.156*** (0.035)	-0.159*** (0.036)	-0.152*** (0.030)	-0.178*** (0.041)	-0.177*** (0.040)
<i>Constant</i>	0.026 (0.041)	Omitted	Omitted	Omitted	Omitted	Omitted
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	No	Yes	Yes
Quarter FE	No	No	Yes	No	No	No
Year-Quarter FE	No	No	No	Yes	No	No
Observations	996	996	996	996	913	913
R ²	0.129	0.156	0.146	0.197	0.159	
Adjusted R ²	0.107	0.043	0.051	0.019	0.036	

*Note: This table presents the results of six models with ROA as the dependent variable. The main variable of interest is PE ownership, and the rest are control variables. Models I, II, III, IV, V, and VI are explained in section 3.6. Standard errors are clustered on company level in all regressions. The heteroskedasticity robust standard errors are reported in parenthesis below the coefficients. Significance of the coefficients are denoted as *, **, and *** (10%, 5%, and 1% respectively). Variables are winsorized at the 2nd to 98th percentile and are based on quarterly observations. The constant term is uninterpretable and omitted in Model II-VI as all time dummies are used to avoid collinearity. In the Instrumental Variable estimation model (VI) no R² is reported since the explanatory variable is correlated with the error term, hence not helpful.*

To our surprise, opposing our second hypothesis, *ROA* shows a significantly negative relationship to PE ownership post-IPO at a 1% significance level. These results strongly indicate that the more the PE owners sell post-IPO – the higher is the return on assets. Refer to the subsequent discussion for possible explanations of our results. Compared to the previous results on abnormal return, *Debt ratio* shows a significantly negative coefficient, while *Size* is significantly positive, both at a 1% level. Interestingly, the coefficient for firm size likely suggests the opposite when analyzing abnormal stock returns. *Quick ratio* does not show significant results, so we cannot conclude anything on its effect.

4.5 Robustness check

This section will display various robustness checks of our results that are made on the data. Table 6 shows the outcome of the models using alternative performance metrics by replacing the dependent variable in equation (ii) to strengthen the results. As discussed in section 4.1, we

use winsorizing in our primary analysis. In Table 7, a robustness test of our results is conducted by using non-winsorized data. Appendix 3 and Appendix 4 display an analysis of our primary regression model (Model II) by adding the control variables one by one to check for omitted variable bias. The coefficients remained approximately the same as the control variables were added between a 5% and 1% significance level, signaling low omitted variable bias.

Table 6: Robustness test for different types of accounting metrics

	I	II	III	IV	V	VI
	Pooled OLS	Fixed Effects Y (main)	Fixed Effects Q	Fixed Effects Y-Q	FE (w/ lags as proxies)	FE2SLS
ROA						
<i>PE ownership</i>	0.008	-0.049***	-0.045***	-0.049***		-0.066***
<i>(V) lagPE</i>					-0.048***	
<i>ownership</i>						
Observations	996	996	996	996	913	913
R ²	0.129	0.156	0.146	0.197	0.159	
Adjusted R ²	0.107	0.043	0.051	0.019	0.036	
ROCE						
<i>PE ownership</i>	0.011	-0.071***	-0.063***	-0.069***		-0.087***
<i>(V) lagPE</i>					-0.064***	
<i>ownership</i>						
Observations	996	996	996	996	913	913
R ²	0.110	0.172	0.163	0.212	0.188	
Adjusted R ²	0.087	0.061	0.070	0.037	0.068	
ROIC						
<i>PE ownership</i>	0.002	-0.073*	-0.066**	-0.067		-0.089*
<i>(V) lagPE</i>					-0.065*	
<i>ownership</i>						
Observations	996	996	996	996	913	913
R ²	0.056	0.149	0.134	0.206	0.167	
Adjusted R ²	0.032	0.035	0.038	0.029	0.046	
ROE						
<i>PE ownership</i>	-0.048	-0.158**	-0.150**	-0.149**		-0.213***
<i>(V) lagPE</i>					-0.156***	
<i>ownership</i>						
Observations	996	996	996	996	913	913
R ²	0.096	0.162	0.043	0.236	0.176	
Adjusted R ²	0.073	0.049	0.006	0.067	0.055	
ROS						
<i>PE ownership</i>	0.018	-0.059**	-0.070**	-0.059**		-0.094**
<i>(V) lagPE</i>					-0.069**	
<i>ownership</i>						
Observations	996	996	996	996	913	913
R ²	0.176	0.072	0.062	0.150	0.076	
Adjusted R ²	0.155	0.005	0.004	0.007	0.003	

*Note: This table presents the results of six models with ROA, ROCE, ROIC, ROE, and ROS used as dependent variables respectively from equation (ii). The main variable of interest is PE ownership, and the rest are control variables (not displayed in the table). Models I, II, III, IV, V, and VI are explained in section 3.6. Standard errors are clustered on company level in all regressions. Significance of the coefficients are denoted as *, **, and *** (10%, 5%, and 1% respectively). Variables are winsorized at the 2nd to 98th percentile and are based on quarterly observations. In the Instrumental Variable estimation model (VI) no R² is reported since the explanatory variable is correlated with the error term, hence not helpful.*

The interpretation of the robustness test displayed in Table 6 is that the effect of *PE ownership* on accounting performance has a negative coefficient for all metrics with varying significance levels. We have only presented a short version of the full regressions due to i) lack of space and ii) irrelevance of the other variables considering the purpose of this table. The only metric where we are unable to find a significant relationship is for *ROIC*. However, as the coefficients are negative for all applied metrics, we can confidently conclude that it is likely that larger PE ownership retention post-IPO negatively impacts accounting performance.

Table 7: Robustness test using non-winsorized data

	I	II	III	IV	V	VI
	Pooled OLS	Fixed effects Y (main)	Fixed Effects Q	Fixed Effects Y-Q	FE (w/ lags as proxies)	FE2SLS
Abnormal return						
<i>PE ownership</i>	0.024	0.152***	0.172***	0.152***		0.208***
<i>(V) lagPE ownership</i>					0.152***	
ROA						
<i>PE ownership</i>	0.005	-0.054***	-0.053**	-0.046***		-0.076***
<i>(V) lagPE ownership</i>					-0.055***	
Observations	996	996	996	996	913	913

*Note: This table presents the results of the same six non-winsorized regression models with Abnormal return and ROA used as dependent variables respectively based on quarterly observations. The main variable of interest is PE ownership, and the rest are control variables (not displayed in the table). Models I, II, III, IV, V, and VI are explained in section 3.6. Standard errors are clustered on company level in all regressions. Significance of the coefficients are denoted as *, **, and *** (10%, 5%, and 1% respectively). No R^2 is reported as the differences are negligible in comparison with the winsorized (main) results.*

When comparing Table 7 to Table 4 and 5 that use winsorized data, we only detect minor differences. However, as coefficient signs remain the same with no apparent effect on the significance of the relationship, our conclusions remain the same. As with Table 6, only the main variables of interest are presented in the table.

4.6 Conclusion of results

The results suggest that higher retained PE ownership post-IPO positively impacts the abnormal return, confirming our first hypothesis. This is likely due to three main reasons. First, the positive signal that retention of PE ownership sends to outside investors about the quality of the company. Second, PE firms have larger incentives to retain a higher ownership stake in a company with a bright outlook. Third, PE firms can maintain the power to monitor the company, which sequentially positively affects performance. However, our results suggest that ROA is negatively impacted by PE-ownership retention, creating question marks if PE firms as experienced managers and capital raising possibilities continue to add operational value to companies after they have gone public. This finding is defying our second hypothesis.

5. Discussion

5.1 Abnormal return and post-IPO PE ownership

Typically, PE firms are in no hurry to dispose of their holdings following an IPO and continue to hold significant ownership stakes for an average of almost two years (Appendix 5). During the process of exiting a portfolio company post-IPO, the ownership is usually gradually reduced by selling smaller stakes at a time. As it appears, the exit process is a strategic and complex process that does not end at the IPO or at the end of the lockup period.

Leland and Pyle (1977) suggest that ownership retention post-IPO acts as a signal to investors regarding the quality of the business. They argue in line with the signaling hypothesis that large degrees of ownership retention by owners signal a superior quality business while large amounts of selling by the owners signal that the firm is overvalued. This idea may partially explain the positive relationship between a higher degree of PE ownership retention post-IPO and higher abnormal returns found in our regressions. By delaying the divestment of a portfolio company, the PE sponsors expose themselves to high costs and risks, including the risk of a decline in the market and negative impacts to their internal rate of return (IRR). Hence, the only reason why PE firms choose to remain invested is if they expect the stock price to perform better in the future. This expectation may be due to the private information the PE firm has access to because of the information asymmetry existing between them and the investors.

Further, Welch's (1989) findings suggest that PE ownership maintained post-IPO allows investors to become familiar with how the sponsor impacts a company's operations as opposed to when the PE firm makes a complete exit. Hence, the information asymmetry regarding how companies and PE firms interact may also explain the positive relationship between larger PE ownership retention during the first three years post-IPO and abnormal returns. More recently, Dong et al. (2020) confirm that, on average, the decision of a private equity sponsor to conduct a secondary offering (selling shares post-IPO) decreases the firm value.

Previous research has included reputational concerns as a factor when examining the aftermarket performance of IPOs (Brav and Gompers, 1997; Krishnan et al., 2011; Cao and Lerner, 2009; Dong et al., 2020). Even though this is an interesting angle, our conducted dataset consists almost solely of sponsors with a "high reputation" (as classified by Dong et al., 2020). Hence, it does not add value to our findings to consider the reputational aspect given that all IPOs in our sample are backed by sponsors of high reputation and quality.

Another aspect of ownership that might impact abnormal returns is the concept of "PE overhang", as proposed by Schöber (2008). The public market will anticipate the subsequent

secondary offerings of the PE firm post-IPO, which likely creates a drag on the stock price. It is a possibility that our coefficients on PE ownership to be even larger if this effect would have been captured in our regressions. However, opposed to this being a fundamentally correct aspect, there are underlying rationales behind how investors act that we cannot measure with the methods used in this thesis.

Moreover, if large ownership stakes are held for “too long”, it could indicate two things. First, it may indicate that they have not been able to divest at a high enough price to reach the target IRR. Second, the PE firm believes that it needs to continue maintaining high degrees of ownership to have control over decision-making and improve the company and extract returns. If this period is extended too long, outside investors may wonder whether the sponsor can enhance the company’s quality. Either indication would likely act as a negative signal to outside investors and thus negatively impact abnormal returns. The question to be asked is how long is “too long”? Given our results, suggesting a positive relationship between ownership retention and abnormal return, this effect does probably not become dominant during the first three years after IPO.

5.2 ROA and post-IPO PE ownership

ROA shows a significant negative association with PE ownership post-IPO. This result defies our second hypothesis, and the possible reasons for this negative relationship are up for discussion. Previous research has demonstrated the value creation that PE sponsors bring to their portfolio companies during their holding period (Jensen, 1986; Kaplan and Strömberg, 2009). As PE firms usually maintain a significant and controlling ownership stake years after the IPO, we concluded that the value creation should continue post-IPO. However, as our results suggest that as PE ownership decreases, ROA increases, this seems not to be the case.

The accounting metrics can be impacted by a time effect between i) when a company announces to do something, ii) when the company implements it, and iii) when it appears in the reported figures of the company. Pose the scenario of a restructuring, where the immediate market reactions are reflected in the stock price while it could take years to implement the changes and even longer for them to be visualized in the reported figures. Theoretically, it is not for instance the announced accounting metrics that drive the stock price. It is the delta between what the market expects the accounting metrics to be relative to the announced figures that drive the stock price. This effect is difficult to measure, but nonetheless important to have in mind.

Dong et al. (2020) present interesting findings that secondary offerings by a private equity firm post-IPO do not convey negative private information about the firm's future profitability. Instead, after these offerings, firms show superior adjusted operating performance (in their study measured as ROA), suggesting that these portfolio firms are well prepared for private equity's exit after an IPO. A possible explanation for the negative relationship between PE ownership post-IPO and ROA is the fact that a signaling effect does not occur when it comes to accounting metrics. This further supports the theory that the signaling effect is the primary driver of the positive relationship between abnormal returns and PE ownership post-IPO.

Pose the scenario that better ROA always indicates better stock performance. Assuming that the financial sponsors want to realize the return on their investment as soon as they have reached a target IRR, this would implicate that PE firms would sell shares in companies with the best accounting performance. Conversely, if the accounting figures do not look well, this would be reflected in the stock price. In that case, the fund would instead aim to turn around the performance of the company by retaining a larger stake of the company for a longer period. Eventually, they will realize a greater IRR than realizing the investments when the figures were poor. This is a potential explanation for why the accounting metrics are affected negatively by higher degrees of PE ownership. However, this supposed direct link between ROA and stock return could be viewed as partly contradicting our previous discussions.

6. Conclusion

6.1 Contribution of the study

This study examines the impact of continued PE ownership post-IPO on the performance of a firm. Existing literature addresses the performance of PE-backed companies in relation to non-PE-backed companies, but to a large extent ignores the impact that PE involvement after IPO may have on firms. Hence, we contribute to existing research by studying how the degree of PE ownership post-IPO affects the company's abnormal return and ROA performance during the three following years after IPO. Our compiled dataset of changes in ownership by PE firms 12 quarters (three years) after IPO could be viewed as a contribution to the study of the PE industry due to the difficulty in obtaining data about operations in this field. In line with our hypothesis, the findings indicate that higher levels of continued PE ownership in the first three years post-IPO positively impact abnormal return. However, when studying ROA, we find a significant negative relationship between PE ownership post-IPO and ROA, which is both a surprising and interesting contribution of our study. Even though we are satisfied with the

formation and methodology of our study, the research should, with great benefit, be conducted on other markets, other timespans or using other methodologies to further test the robustness of what our results suggest.

6.2 Limitations

Even though we have tried to the best of our capabilities to construct a study with as few sources of error as possible, the study inevitably includes limitations. We have outlined four main limitations to our study.

First of all, and most importantly, a limitation of our study is that there are many other factors than the expected future outlook of the firm that could determine the PE firms decision on the degree of ownership post-IPO. Among other things, the current market conditions may impact our results which is a limitation worth mentioning. PE-investors may choose to sell off their stakes in bad times, which would correlate with lower abnormal returns, *ceteris paribus*. Hence, this could be another variable explaining our results that have not been accounted for.

Second of all, one source of error is the existing lock-up periods prohibiting PE firms from selling company shares immediately after an IPO. These restrictions on share sales could potentially affect the results. However, as we see no significant sale of shares occurring after the usual lock-up period of approximately six months, we see this as no severe limitation that may impact our results.

A third potential limitation of our study is that we have not considered the fund characteristics (LPs, fund age, and fund size) as an instrument in our regressions. Fund age is a parameter that could impact the degree of PE ownership as we have previously discussed the PE firm's strategy of being fund managers that need to exit their investments and hopefully generate their target IRR and even more that is partly distributed back to the LPs or used in upcoming funds. Hence, if the fund is old and the sponsors need to close it, this may heavily impact their ownership decision. Another factor being the sponsors ability to exit other assets in the fund. However, as it has been a trend among PE funds to "roll over" remaining investments nearing the end of a fund's lifespan into a new fund, often referred to as "continuation vehicle", it can be hard to predict the exact definition of an "old" investment and the outcome of it. Furthermore, as the fixed effects method used in the study eliminates variables that are held constant over the entire time span (e.g., fund age at IPO or fund size), there is only a limited number of fund-specific characteristics that could potentially be examined when analyzing the degree of PE ownership.

Lastly, we do not include industry as a dummy variable in our regressions, which could possibly be a limitation to our study. Investigating whether the industry affects our results would be both relevant and interesting. However, in our sample with 83 companies, less than 10% are classified as “high-tech” companies that often generate higher returns, which means that the effect of excluding the industry component from our regressions will probably not have an impact on our overall conclusions. Furthermore, since industry is time-invariant within firms (unless the firm changes industry which is very unusual, especially within three years), using firm fixed effects is a more robust specification as the effect implicitly includes the industry fixed effects.

6.3 Suggestions for future studies

When studying a topic this interesting and relatively unexplored, we have had to stop ourselves from not branching out and testing everything there is to know about PE ownership post-IPO. These ideas that have sparked our minds need to be up to future studies to discover further.

This study can conclude that retention of higher degrees of ownership is associated with better abnormal return but worse ROA 12 quarters (three years) post-IPO. A suggestion for further research building on our findings is to examine the optimal degree and duration of PE ownership that should be maintained post-IPO to maximize performance. It would, in that case, be interesting to examine a more extended period, e.g., five years post the IPO date. This would be interesting as further research mainly due to two reasons. First, it would generate even more profound insights that could be useful for both sponsors and investors. Second, it would allow exploration of the likely existing negative signaling effect of holding a portfolio company for “too long” after the IPO. This effect could probably be better captured by examining a more extended period. Another avenue for further research could test the same method used in our study on another market to conclude whether the results are dependent on a specific geographic location.

Moreover, as our results regarding ROA performance defy our hypothesis, it would be interesting to dive into the reasons for that further. This is a challenging task, as we found no single answer to why this might be the case, which makes this area of future studies exciting.

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Appendix

Appendix 1: Test for Fixed effects, random effects, pooled OLS, time-fixed effects, serial correlation, unit roots, heteroskedasticity, and weak instruments

	Test	H ₀	Significance	Test Value	Rejection of H ₀
(1)	F-test for fixed effects vs. pooling OLS	OLS better than fixed	p-value = 0.008	F = 1.422	YES
(2)	Hausman test for fixed effects vs. random effects	Random better than fixed	p-value = 0.008	$\chi^2 = 20.747$	YES
(3)	Lagrange Multiplier Test for time fixed effects (Breusch-Pagan)	No need to use time-fixed effects	p-value = 0.025	$\chi^2 = 5.052$	YES
(4)	Breusch-Godfrey/Wooldridge test for serial correlation	No serial correlation	p-value = 0.1	$\chi^2 = 6.304$	NO
(5)	Augmented Dickey-Fuller test to check for stochastic trends	Unit roots present (i.e., non-stationary)	p-value = 0.01	Dickey-Fuller = -16.001	YES
(6)	Breusch-Pagan test for heteroskedasticity	Homoskedasticity	p-value = 0.000	BP = 286.760	YES
(7)	Model IV test for weak instrument	Weak instrument (coefficient = 0)	p-value = 0.000	F = 918.970	YES

Note: This table presents various tests/diagnostics performed to support our model choices and check the data. Tests are made on non-clustered standard error data.

Appendix 2: Variables

Variable	Definition	Sign ⁵	Source(s) ⁶
Dependent			
Abnormal return	Quarterly abnormal return calculated as $\ln(P_{i,t} / P_{i,t-1}) - \ln(\text{MSCI}_{i,t} / \text{MSCI}_{i,t-1})$, where $\ln(P_{i,t} / P_{i,t-1})$ denotes stock return and $P_{i,t}$ is the adjusted share price at the end of every quarter, $\ln(\text{MSCI}_{i,t} / \text{MSCI}_{i,t-1})$ is the total return for the relevant MSCI index (Sweden, Norway, Denmark, Finland) and $\text{MSCI}_{i,t}$ is the index level at the end of every respective quarter ⁷		CapIQ
ROA	Return on assets, calculated by $(\text{EBIT}_{i,t} \times 4) / \text{Total Assets}_{i,t-1}$, where t is the actual quarter. Opening book value of total assets is used. ROA thus has a lagging variable as one of its constituents		CapIQ, CR
Independent			
PE ownership	IPO-backing PE firm(s) total ownership stake at the beginning of every quarter	+	Dealogic, Pitchbook, Prospectus
Control			
Asset Turnover	Total asset turnover is defined as $(\text{Revenues}_{i,t} \times 4) / \text{Total Assets}_{i,t-1}$. $\text{Revenues}_{i,t}$ are measured on a quarterly basis and opening book value of total assets is used	+	CapIQ, CR
Volatility	Three months historical share price volatility, measuring risk of price movements	-	CapIQ
Size	Firm size is defined as the natural logarithm of opening book value of total assets for the quarter converted to SEKm	-	CapIQ, CR
EBITDA margin	EBITDA as a percentage of revenues of every beginning quarter	+	CapIQ, CR
Quick ratio	An indicator of short-term liquidity position by the sum of total cash and short-term investments and accounts receivable divided by total current liabilities. Lagging variable as they refer to the quarterly opening balances	+	CapIQ, CR
Debt ratio	Measures the extent of leverage defined as total debt divided by total assets. Opening balances for the quarter are used	+/-	CapIQ, CR
P/B ratio	Price-to-book ratio defined as the market value of shares divided by the opening book value of equity every quarter	+	CapIQ, CR
Year (γ)	Dummy variable to control for year fixed effects each year from 2000-2018		
Quarter (γ)	Dummy variable to control for quarter fixed effects from Q1-Q4 (2000-2018)		
Year-Quarter (γ)	Dummy variable to control for year-quarter fixed effects from 2000Q1-2018Q1		
Other			
ROCE	Quarterly return on capital employed is calculated by $(\text{EBIT}_{i,t} \times 4) / \text{Capital Employed}_{i,t-1}$, where capital employed is $\text{Equity}_{i,t-1} + \text{Debt}_{i,t-1}$		CapitalIQ, CR
ROIC	Quarterly return on invested capital is calculated by $((\text{EBIT}_{i,t} \times 4) * (1-T)) / \text{Invested Capital}_{i,t-1}$, where T is the tax rate and total capital is $\text{Equity}_{i,t-1} + \text{Net Debt}_{i,t-1}$		CapitalIQ, CR
ROE	Quarterly return on equity is calculated by $(\text{Net Income}_{i,t} \times 4) / \text{Equity}_{i,t-1}$		CapitalIQ, CR
ROS	Quarterly return on sales (Net Income margin) is calculated by $\text{Net Income}_{i,t} / \text{Revenue}_{i,t}$ of every beginning quarter		CapitalIQ, CR

Note: Variables are measured each quarter for consistency and to account for direct effects of PE ownership

⁵ Expected sign (+ or -) based on discussions in section 3.5.

⁶ Where CapIQ = Capital IQ and CR = Company reports.

⁷ Measurements are adjusted for all security level corporate actions such as (reversed) stock splits, re-invested dividends, rights offerings and spin-offs, thus showing theoretical value growth (total return index).

Appendix 3: Robustness test for Model II by adding variables - Abnormal return

Variable(s)	1	2	3	4	5	6	7	8
<i>PE ownership</i>	0.113** (0.053)	0.118** (0.052)	0.133*** (0.051)	0.135*** (0.050)	0.138*** (0.051)	0.132** (0.052)	0.133*** (0.052)	0.136*** (0.052)
<i>Asset turnover</i>		0.017 (0.036)	0.014 (0.036)	0.011 (0.034)	-0.013 (0.034)	-0.017 (0.034)	-0.023 (0.034)	-0.025 (0.034)
<i>Volatility</i>			-0.214* (0.119)	-0.208* (0.120)	-0.190 (0.123)	-0.199* (0.123)	-0.194* (0.121)	-0.184* (0.120)
<i>Size</i>				-0.083** (0.042)	-0.092* (0.046)	-0.092** (0.043)	-0.079* (0.047)	-0.077* (0.047)
<i>EBITDA margin</i>					0.158* (0.099)	0.168* (0.093)	0.167* (0.093)	0.163* (0.094)
<i>Quick ratio</i>						-0.030 (0.026)	-0.032 (0.026)	-0.033 (0.027)
<i>Debt ratio</i>							-0.087 (0.111)	-0.101 (0.114)
<i>P/B ratio</i>								0.002 (0.002)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	996	996	996	996	996	996	996	996

*Note: This table presents a robustness test for Model II (Fixed effects Y (main)) with Abnormal return as the dependent variable. Variables are defined in section 3.5 and Appendix 2. The test is performed by adding the control variables one by one. All regressions control for firm and year fixed effects and standard errors are clustered on company level. The heteroskedasticity robust standard errors are reported in parenthesis below the coefficients. Significance of the coefficients are denoted as *, **, and *** (10%, 5%, and 1% respectively). Variables are winsorized at the 2nd to 98th percentile and are based on quarterly observations. The constant term is uninterpretable and omitted as all time dummies are used to avoid collinearity.*

Appendix 4: Robustness test for Model II by adding variables - ROA

Variable(s)	1	2	3	4
<i>PE ownership</i>	-0.057*** (0.016)	-0.058*** (0.015)	-0.055*** (0.015)	-0.049*** (0.015)
<i>Size</i>		0.031* (0.017)	0.031** (0.015)	0.053*** (0.018)
<i>Quick ratio</i>			0.013 (0.014)	0.010 (0.014)
<i>Debt ratio</i>				-0.156*** (0.035)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	996	996	996	996

*Note: This table presents a robustness test for Model II (Fixed effects Y (main)) with ROA as the dependent variable. Variables are defined in section 3.5 and Appendix 2. The test is performed by adding the control variables one by one. All regressions control for firm and year fixed effects and standard errors are clustered on company level. The heteroskedasticity robust standard errors are reported in parenthesis below the coefficients. Significance of the coefficients are denoted as *, **, and *** (10%, 5%, and 1% respectively). Variables are winsorized at the 2nd to 98th percentile and are based on quarterly observations. The constant term is uninterpretable and omitted as all time dummies are used to avoid collinearity.*

Appendix 5: Data sample

Company	PE Sponsor(s) at IPO	Stake pre IPO (%)	Stake sold at IPO (%)	Stake post IPO (%)	IPO date	Full exit or <5%	Holding period
Bygghemma Group First AB	FSN Capital Partners AS	73%	26%	54%	27-03-18	19-08-20	2.4y
Green Landscaping Holding AB	FSN Capital Partners AS	60%	57%	26%	23-03-18	12-06-18	0.2y
Harvia Oyj	CapMan Capital Management	69%	58%	29%	22-03-18	19-11-19	1.7y
Lyko Group AB	Fidelio Capital AB	24%	36%	15%	12-12-17	Not exited	n.a.
TCM Group A/S	IK Investment Partners Ltd	92%	87%	12%	24-11-17	24-05-18	0.5y
Crayon Group Holding ASA	Norvestor Equity AS	60%	63%	22%	08-11-17	04-09-18	0.8y
Terveystalo Oyj	EQT AB	77%	85%	11%	11-10-17	21-05-18	0.6y
Handicare Group AB	Nordic Capital Svenska AB	95%	29%	67%	10-10-17	27-01-21	3.3y
Balco Group AB	Segulah Advisor AB	88%	68%	28%	06-10-17	24-02-20	2.3y
Bone Support AB	Industrifonden AB	15%	33%	10%	21-06-17	Not exited	n.a.
Silmaasema Oyj	Intera Equity Partners Oy	68%	75%	17%	09-06-17	04-10-19	2.3y
Boozt AB	Verdane Capital, Ford Holding AS	29%	51%	14%	31-05-17	15-05-20	3.0y
Munters Group AB	Nordic Capital Svenska AB	87%	37%	54%	19-05-17	13-02-20	2.7y
Kamux Oyj	Intera Equity Partners Oy	58%	62%	22%	12-05-17	09-09-20	3.3y
Instalco Intressenter AB	FSN Capital Partners AS	59%	57%	25%	11-05-17	06-03-18	0.8y
Actic Group AB	IK Investment Partners Ltd	82%	34%	54%	07-04-17	15-11-17	0.6y
Ambea AB	KKR, Triton Advisers Ltd	100%	45%	55%	31-03-17	04-06-20	3.2y
ByggPartner	Priveq Investment	40%	43%	23%	05-12-16	14-03-19	2.3y
Arcus ASA	Ratos AB	83%	64%	30%	01-12-16	20-03-17	0.3y
Internationella Engelska Skolan AB	TA Associates Management LP	100%	29%	71%	29-09-16	25-11-20	4.2y
Lauritz.com A/S	Bure Equity AB	11%	0%	11%	22-06-16	01-12-17	1.4y
AcadeMedia AB	EQT AB, Providence Equity Partners LLC	91%	29%	65%	15-06-16	27-10-17	1.4y
Nordic Waterproofing Holding A/S	Axcel A/S	78%	50%	39%	10-06-16	16-02-17	0.7y
Dong Energy A/S	Goldman Sachs Capital Partners	18%	25%	13%	09-06-16	12-10-17	1.3y
Tokmanni Group Oyj	Nordic Capital Svenska AB	83%	45%	46%	29-04-16	13-09-17	1.4y
Humana AB	Argan Capital Advisors LLP	74%	26%	55%	22-03-16	08-12-20	4.7y
Consti Yhtiöt Oy	Intera Equity Partners Oy	65%	82%	12%	11-12-15	14-06-16	0.5y
Scandic Hotels Group AB	EQT AB, Accent Equity Partners AB	98%	44%	55%	02-12-15	30-11-16	1.0y
Attendo AB	IK Investment Partners Ltd	67%	72%	19%	30-11-15	03-06-16	0.5y
Dometic Group AB	EQT AB	92%	38%	57%	25-11-15	21-11-16	1.0y
Bravida Holding AB	Bain Capital	62%	9%	56%	16-10-15	11-05-17	1.6y
Kotipizza Group Oyj	Sentica Capital Partners Oy	73%	13%	63%	07-07-15	09-02-17	1.6y
Capio AB	Apax Partners, Nordic Capital Svenska AB	98%	25%	73%	30-06-15	11-05-17	1.9y
Europris AS	Nordic Capital Svenska AB	84%	47%	45%	19-06-15	03-03-17	1.7y
Alimak Group AB	Triton Advisers Ltd	90%	58%	38%	18-06-15	14-09-17	2.2y
Coor Service Management Holding AB	Cimven Ltd	95%	61%	37%	16-06-15	27-05-16	0.9y
Pihlajalinna Oy	Sentica Capital Partners Oy	50%	50%	25%	04-06-15	11-05-17	1.9y
Troax Group AB	FSN Capital Partners AS	74%	76%	18%	27-03-15	10-11-15	0.6y
Asiakastieto Group Oyj	Investcorp Private Equity	83%	77%	19%	27-03-15	29-06-18	3.3y
Dustin Group AB	Altor Equity Partners AB	74%	54%	34%	13-02-15	26-10-16	1.7y
Eltel AB	3i Group plc	54%	57%	23%	06-02-15	01-06-16	1.3y
RenoNorden AS	CapVest Ltd, Accent Equity Partners AB	74%	73%	20%	16-12-14	17-02-17	2.2y
Thule Group AB	Nordic Capital Svenska AB	85%	24%	64%	26-11-14	28-04-16	1.4y
XXL ASA	EQT AB	46%	51%	23%	03-10-14	09-09-15	0.9y
Inwido AB	Ratos AB	97%	78%	22%	26-09-14	22-10-15	1.1y
Scandi Standard AB	CapVest Ltd	49%	68%	16%	27-06-14	Not exited	n.a.
Zalaris ASA	Nordic Capital Svenska AB	51%	50%	25%	20-06-14	19-06-14	0.0y
Com Hem Holding AB	BC Partners LLP	99%	52%	48%	17-06-14	28-04-17	2.9y
ISS A/S	EQT AB, Goldman Sachs Capital Partners, OTPP Private Capital	86%	29%	62%	13-03-14	15-03-16	2.0y
Bufab Holding AB	Nordic Capital Svenska AB	93%	78%	20%	21-02-14	04-12-14	0.8y
Matas A/S	CVC Advisers Ltd	43%	37%	27%	28-06-13	10-01-14	0.5y
Munksjö	EQT AB	100%	76%	24%	07-06-13	03-12-14	1.5y
Asetek A/S	DE Shaw	25%	39%	15%	20-03-13	25-02-15	1.9y
Eimskipafelag Islands HF - EIMSKIP	Yucaipa Companies LLC	25%	0%	25%	16-11-12	21-12-17	5.1y
Transmode Holding AB	POD Holding AB, HarbourVest Partners LLC, European Equity Partners	55%	15%	47%	27-05-11	24-02-12	0.7y
FinnvedenBulten AB	Nordic Capital Svenska AB	100%	70%	30%	20-05-11	06-03-14	2.8y
Pandora A/S	Axcel A/S	59%	3%	57%	05-10-10	08-12-14	4.2y
MQ Holding AB	CapMan Capital Management	52%	54%	24%	18-06-10	15-02-13	2.7y
Chr Hansen Holding A/S	PAI Partners SAS	100%	45%	55%	03-06-10	11-01-12	1.6y
Byggmax AB	Altor Equity Partners AB	70%	49%	36%	02-06-10	30-04-14	3.9y
ScandBook	Accent Equity Partners	100%	60%	40%	31-03-10	12-01-14	3.8y
Duni AB	EQT AB	100%	70%	30%	14-11-07	26-08-08	0.8y
HMS Industrial Networks AB	Segulah Advisor AB	59%	90%	6%	19-10-07	02-06-08	0.6y
Pronova BioPharma ASA	Herkules Capital AS	100%	38%	62%	11-10-07	15-01-13	5.3y
Nederman Holding AB	EQT AB	93%	75%	23%	16-05-07	31-10-07	0.5y
Dockwise	3i group plc	30%	11%	26%	12-10-07	19-10-09	2.0y
Electromagnetic GeoServices ASA	Warburg Pincus LLC	89%	55%	40%	30-03-07	16-03-12	5.0y
Lindab AB	Ratos AB	48%	51%	24%	01-12-06	03-05-12	5.4y
BE Group AB	Nordic Capital Svenska AB	90%	59%	37%	24-11-06	19-11-09	3.0y
Biovitrum AB	Nordic Capital Svenska AB, MPM Capital	44%	6%	42%	15-09-06	27-03-09	2.5y
Ability Group ASA - AGR	Altor Equity Partners AB	57%	45%	31%	03-07-06	21-07-14	8.1y
Salcomp Oy	EQT AB	92%	48%	48%	13-03-06	17-08-07	1.4y
KappAhl AB	Nordic Capital Svenska AB, Accent Equity Partners AB	70%	62%	27%	23-02-06	15-01-07	0.9y
Hemtex AB	Priveq Investment	35%	45%	19%	06-10-05	13-03-07	1.4y
Revus Energy AS	3i Group plc, HitacVision Private Equity	75%	100%	0%	27-06-05	27-06-05	0.0y
Kongsberg Automotive Holding ASA	FSN Capital Partners AS, North Cove Partners	73%	45%	40%	24-06-05	16-04-08	2.8y
AffectoGenimap Oyj	CapMan Capital Management, Equitec Partners Oy	67%	64%	24%	27-05-05	02-10-07	2.4y
Orijlame Cosmetics SA	IK Investment Partners Ltd	45%	64%	16%	24-03-04	14-08-06	2.4y
Ballingslov International AB	EQT AB	100%	82%	19%	20-06-02	12-03-03	0.7y
Nobia AB	IK Investment Partners Ltd	46%	62%	17%	19-06-02	18-02-04	1.7y
Intrum Justitia AB	IK Investment Partners Ltd	43%	35%	28%	07-06-02	31-08-05	3.2y
Alfa Laval AB	IK Investment Partners Ltd	59%	49%	30%	20-05-02	07-03-05	2.8y
Micronic Laser Systems AB	Industrifonden AB	33%	39%	20%	09-03-00	06-09-05	5.5y
Mean		69%	50%	33%			2.1y
Median		73%	50%	27%			1.7y