Performance timing

Is there a difference between PE-backed and non PE-backed IPOs?

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Abstract

The aim of this paper is to contribute to the current discussion on the effects of private equity ownership. We try to answer if both PE-backed IPOs and non-backed IPOs are timed to coincide with a period of unusually high operational performance. Our empirical sample consists of 118 PE-backed companies and 1,186 non-backed companies listed during 1997-2009. We compare the operational performance in the year prior to going public with the three years following the IPO to determine whether there is a decline and how this development differs between the groups. Our data supports that both groups face deteriorating growth variables while only the PE-backed subsample also show deterioration in profitability. For all operational measures that we investigate, PE-backed firms underperform non-backed firms in terms of change in operational performance post-IPO. Further, our results show that profitability declines are more apparent for PE-backed IPOs made in cold markets compared to hot while there is no difference among non-backed IPOs. This indicates that performance timing is more refined for PE-backed companies as it is used differently depending on market conditions. Finally, we are unable to tell whether the level of retained equity is an indicator of performance timing.

Keywords: Performance timing, Private equity, Operational performance post-IPO

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Date: 19 May 2014

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1. Introduction

Whilst private equity and the advantages of leveraged buyouts have been heavily discussed ever since its emergence in the 1980s, relatively little has been said on the timing of the divestment phase. At the time of writing, we note a substantial pick-up in initial public offerings (IPOs) compared to the same period last year. Globally there were 370 firms that went public in the first quarter of 2014, whereof a staggering 34% were backed by a private equity firm according to Zephyr. In parallel to the increased presence of private equity investments, however, the subject of actual value creation has grown to become a heavily debated issue. Largely, the debate has concerned whether private equity firms merely engage in short-term operational improvements that are timed to peak with divestment rather than creating longer-term impact seen through the lens of performance post-exit. The notion that IPOs are timed to coincide with a point in time where operational performance is unusually high (known as *performance timing*), as a way to reach higher equity valuations, has been established for both IPOs backed by private equity and IPOs backed by other kinds of owners ("non-backed"), but never have there been a comparative study amongst the two groups. The results will indicate the quality of potential operating improvements inherent for firms that have been backed by private equity in comparison to IPOs backed by other types of owners. By taking a closer look at operational performance post-IPO, the aim of this paper is therefore to contribute to the current discussion where both academia and the private sector debate the effects of private equity ownership.

In this thesis we try to answer the question: *is there a difference in performance timing between PE-backed companies and non PE-backed companies?* Previous studies have mainly focused on the development of operating performance post-IPO in general. For example, Jain and Kini (1994) found evidence of a significant decline in operating performance post-IPO when looking at data from the late 1970s and 1980s. Similar to our report, they investigate the performance of different operating metrics and compare post-IPO years to the year before the IPO. Their dataset includes IPOs regardless if they have been backed by a financial sponsor. Degeorge and Zeckhauser (1993) on the other hand, investigate the operational performance of reverse leveraged buyouts (RLBOs). Looking at a sample solely consisting of PE-backed companies rather than an unfiltered group, the authors find that both operating margin and operating ROA decline post-IPO.

Given what has been said in previous literature, we conclude that a discussion on whether PE-backed firms engage in short-term operational improvements that deteriorate post-IPO is not

complete without acknowledging the fact that non-backed firms show similar trends. The difference between our study and those of previous papers is therefore that we compare the difference in performance post-IPO and the year prior going public between a group of PE-backed companies and a group of non-backed companies. To the best of our knowledge, we are the first authors to complete such a comparative analysis. Also, unlike the samples in previous literature who use data from the 70s and 80s, we base our investigation mainly on IPOs that have occurred in recent years (1997-2009).

We find that both PE-backed and non-backed companies have deteriorating sales growth and EBITDA growth as they fail to sustain pre-IPO levels. This is seen as evidence that both groups try to time their listing to a point in time when performance is unusually good. When looking at profitability measures, we find that PE-backed companies also see deteriorations in operating return on assets ("operating ROA") post-IPO. The group of non-backed companies however, show no decline in profitability. For all operational measures that we investigate, PE-backed firms underperform non-backed firms in terms of change in operational performance post-IPO. The results should be of interest in the ongoing debate discussing the benefits and drawbacks of private equity ownership.

Moreover, we are examining whether the presence of performance timing changes in different time periods by making a distinction between hot and cold IPO markets. We hypothesize that the difference in change in operational performance post-IPO between hot and cold IPO markets is larger for PE-backed firms than for non-backed firms. The hypothesis is based on the compensation structure of PE-firms, i.e. carried interest representing the right to collect a certain level of cash returns of a given investment. We believe that this would create an incentive to list the portfolio company, before completing all restructuring measures, in order to ensure that they start divesting in a favourable IPO market. We acknowledge that non-backed firms also have been shown to time their listings to periods of favourable market conditions (Baker and Wurgler, 2007), but we argue that the incentive to rush to the market when the company is not yet at its peak in operational performance may not be deemed as strong due to non-backed firms not having limited investing periods. Our results indeed show that performance timing is more apparent for PE-backed IPOs made in cold markets compared to hot. This is not the case for non-backed IPOs whose post-IPO abnormal performance is unaffected by the market conditions during the year of listing.

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Further, we investigate if ownership retention can have a signalling effect for the occurrence of performance timing, and whether this signalling is stronger for any of the two different groups. We hypothesize that the signalling of performance timing from ownership retention at the time of going public is larger for PE-backed firms than for non-backed firms. This hypothesis is based on fundamental economic theory presented by Leland and Pyle (1977), who argue that a high fraction of equity retained by the prior owners is the main signal of high quality. Applying this theory would mean that backers of an IPO are inclined to maintain high ownership stakes if there is room for additional operating improvements (i.e. listing does not coincide with a temporary peak in operating performance). However, as our literature review concludes that the choice of retained equity level is not as flexible for non-backed firms as for PE-backed firms, we argue that low ownership retention is a stronger signal of performance timing for PE-backed firms than for non-backed firms. Our results on the other hand do not show a statistically significant difference in the signalling effect from retained equity. Also, in contrast to established theories, we find that high level of retained equity has a negative effect on performance measures, regardless of being backed by a private equity firm or not. In sum we can conclude that both groups show signs of going public in periods of unusually high growth, but only private equity companies show evidence of timing profitability as well. The performance timing of PE-backed companies also seems more refined as it differs depending on market conditions.

Data in this paper was gathered through Capital IQ, Compustat, Zephyr, SDC Platinum and Orbis. The dataset used for testing of our hypotheses consists of 118 PE-backed firms and 1,186 non-backed firms, with each firm's set of operational measures matched to industry benchmarks using two-digit SIC codes. Initially, we use a Wilcoxon signed-rank test to determine whether there is a change in location between the median of our operational measures in the year prior to the IPO (Y_{-1}, where the numbers in subscript denotes the relative years from the IPO) and each respective year of interest (Y_0, Y_{+1}, Y_{+2} and Y_{+3}). Subsequently, we use a Wilcoxon rank-sum test to establish whether there are differences in the change in location of the median for each year of interest between our sample of PE-backed IPOs and our sample of non-backed IPOs.

Thereafter, we use a robust regression model to assess the explanatory power of chosen independent variables on the change in percentage points between performance in Y_{-1} and the performance in Y_{+3}. Used operational measures include sales growth, EBITDA growth, EBITDA margin and operating ROA. We particularly try to determine the level of performance timing by

looking at private equity ownership, market conditions and the signalling effect from retained equity using proxy variables described in chapter 4. To reduce confounding effects of variations in third variables we control for pre-IPO performance characteristics, size, change in leverage, geographical region and industry.

The rest of this paper is organized as follows. In the next chapter we initially provide an overview of previous research on the development of operating performance post-IPO for both PE-backed and non-backed firms. This section also includes our hypotheses on performance timing and our underlying thoughts on why we initially expected a difference between our two subsamples. Chapter 3 provides a summary of our data collection process, followed by a description of chosen methodology in chapter 4. Subsequently, we discuss our results in chapter 5 and compare them to existing literature. Our conclusions and recognised limitations are then highlighted in chapter 6 and 7 respectively.

2. Previous literature and Hypothesis development

In this section, we start off by briefly summarizing what previous literature has concluded on the development of operational performance post-IPO. Noting some of the missteps that have been made along the way, we then proceed to clarify in what ways previous papers indicate a difference in post-IPO performance between PE-backed and non-backed companies. Thereafter, we try to set a basis for potential explanatory factors for differences in performance timing.

2.1 Rationale for going public

As a company decides to follow through on its initial public offering, they will get the opportunity to utilize a range of advantages. More specifically, going public is a way to improve access to alternative financing. For instance, the IPO can improve debt financing terms, as the transparency of the business increases post listing. For a private equity firm in particular, the IPO marks the beginning of the divestment phase. The objective of the private equity firm is to increase operating performance during the holding period in order to increase the value of the investment. This in turn will yield a higher payoff once the target company is divested. However, the divestment puts a spotlight on performance after exit as it shows whether the improvements among the portfolio companies during the holding period are sustainable or only short term.

2.2 Operating performance post-IPO

The shift of ownership, from private to public, has been shown to have an effect on the operating performance of the company as indicated by previous research. Jain and Kini (1994) find evidence of a significant decline in operating performance post-IPO when looking at data from the late 1970s and 1980s. They investigate the performance of different operating metrics and compare post-IPO years to the year before the IPO. Relative to the year before the IPO Jain et al (1994) find evidence for large declines in operating ROA and operating cash flow deflated by total assets, significantly different from zero at the 1% level. This decline is still significant after adjusting for industry, which proves that the downturns cannot be explained by industry fluctuations. While also showing consistent capital expenditure ("CAPEX") as a % of sales for firms in the post-IPO period compared to industry, they rule out cutbacks on CAPEX (as a % of sales) as explanations for the decline in operating performance.

Mikkelson, Partch and Shah (1997) are examining the operating performance post-IPO as well, by looking at offerings between 1980 and 1983. Using operating ROA, their report also supports a decline in operating performance, with the most substantial decline between Y_{-1} and Y_0 and between Y_0 and Y_{+1}. As initial public offerings typically create a substantial increase in assets due to the quick inflow of cash, Mikkelson et al also measure operating margin, as the asset base might create misleadingly low figures. However, despite not being scaled by assets, operating margin still follows a downward trend post-IPO, falling from a median of 13% in Y_{-1} to 8% in Y_{+1}. When adjusting for industry, the median of operating margin falls from 3% to -1% for the same period.

Degeorge and Zeckhauser (1993) investigate the operational performance of reverse leveraged buyouts (RLBOs). As earlier studies, they are interested in the post-IPO performance of the measures operating ROA and operating margin, but uses a sample consisting of PE-backed companies rather than an unfiltered group. Just as in the report by Mikkelson et al (1997), the operating margin is used to ensure their findings are robust against changes in total assets, as a result of the IPO. They measure the change in both of these measures by looking at the change in performance between Y_{-1} and Y_0. Degeorge et al find that both these measures decline for RLBOs as well. Measuring the change in operating ROA they observe an industry adjusted median of 6.05% one year prior to the IPO and an industry adjusted median of -0.80% one year after. This is seen as evidence that private equity backed firms going public are expected to follow the same pattern after being listed as non private equity backed firms. Similarly, Holthausen and Larcker (1996) finds that the excess performance experienced in the year prior going public fades during the following four years after the IPO.

Finally, Pagano, Panetta and Zingales (1998), looking at Italian data observe a decline in sales growth post-IPO. They divide up their sample of IPOs into two subgroups, and distinguish between carve-outs and independent companies, where the first group is companies who are owned by already publicly traded firms and where the sub-sample of independent companies has excluded these carve-outs. Pagano et al observe a small decline in median industry adjusted growth from 3.1% to -0.3% between Y_0 and Y_{+2} for the whole sample, and a decline from 1.6% to -4.0% for the subsample of independent companies, during the same period.

Given the one-sided evidence in previous literature, we reach *Hypothesis H1* and *Hypothesis H2* for our first pass analysis. It should be well noted that the purpose of these hypotheses is not to

answer our research question, but rather to conduct an initial investigation in order to confirm that the firms in our sample follow the same pattern post-IPO as noted in prior studies.

> **Hypothesis H1:** *Both PE-backed firms and non-backed firms experience a decline in growth variables post-IPO.*

> **Hypothesis H2:** *Both PE-backed firms and non-backed firms experience a decline in profitability ratios post-IPO.*

2.3 Performance timing

Previous literature is treating several possible explanations for the decline in operational performance post IPO. The most notable reason brought forward is that of *performance timing*. Jain and Kini (1994) explain how it is possible to time the listing of a company to a period where operational performance is temporarily high, in order to fully benefit from the equity issue. This means the company will have difficulty in continuing to perform on the same high levels in post-IPO periods. While Jain et al (1994) discuss IPOs in general; Degeorge et al (1993) focus on PE-backed companies in particular. As indicated in section 2.2, PE-backed IPOs see the same downward trend in operational performance as non-backed IPOs. Similarly, timing the IPO to a period of unusually high performance is mentioned as the main reason for the post-IPO decline.

2.3.1 Comparison between PE-backed and non-backed firms

The incentive for PE-backed IPOs to use performance timing is strong. With a limited contractual lifetime of the investment, the exit strategy is a crucial part of it. As Kaplan and Strömberg (2009) write in *Leveraged buyouts and private equity*, private equity firms are deemed as more sophisticated than they were previously. While these financial sponsors further improve their business strategies over time, it is reasonable to assume they gain experience in optimizing the timing of their exits. These arguments point towards a hypothesis that PE-backed firms will see a larger decline in operational performance compared to non-backed firms post-IPO, since the more sophisticated group should utilize performance timing to a larger extent. However, Cao and Lerner (2009) study the three- and five-year stock performance of IPOs made between 1980 and 2002 and find that PE-backed consistently outperform non-backed IPOs. This would point to the contrary, that the decline in operating performance post-IPO is less for PE-backed firms than non-backed firms. Such findings would in turn indicate that presence of performance timing is not more widespread for PE-backed IPOs than non-backed IPOs. If that turns out to be true, the quality of improvements done by PE-firms prior to going public cannot in any way be seen as

different from the quality of improvements made by other owners. As both these views are strong and contradictory, it is hard to assess the magnitude of each argument. This leads to the development of two conflicting hypotheses:

Hypothesis H3: *PE-backed firms underperform non-backed firms in terms of change in operational performance post-IPO.*

Hypothesis H4: *Non-backed firms underperform PE-backed firms in terms of change in operational performance post-IPO.*

2.3.2 Market conditions

Closely related to the discussion of performance timing is the discussion of taking firms public when IPO markets are hot. This means that the listings coincide with periods of active IPO markets and favourable market conditions. Cao (2011) show that the holding period of portfolio companies is negatively correlated to hot IPO market conditions, indicating that a hot IPO market indeed is an important factor for choosing exit period. In addition, the compensation to the private equity fund is tied to the carried interest, which is the right to collect a certain level of cash returns of a given investment. At the same time, the private equity fund aims to generate returns for its investors and the faster they can do so the better (Cao, 2011). This creates an incentive to list the portfolio company, albeit prematurely, in order to divest in a favourable IPO market and achieve high rates of return. The fundamental effect of market conditions on the decision for when to go public makes it interesting to study if there are differences in performance timing during years of favourable IPO conditions in comparison to other periods. We expect that a private equity fund will rather turn to the market when it is hot, than hold the portfolio company to its peak performance, and exit in that period. If this is true, it seems reasonable that the performance timing during periods with hot IPO markets will be less extensive. Thus, it can be expected that operational performance will not decline as much for IPOs made during hot periods as for IPOs made during cold periods, since the portfolio company has not yet reached its peak performance when being listed.

Non-backed firms have also been shown to time their listing to periods of favourable market conditions. Alti (2005) develop a model that shows how the outcome of the first IPOs in a new period gives information about investors' common valuation factors. This will make subsequent IPOs easier to price which attracts more firms to the market. Consequently, a phenomenon emerges where IPOs tend to cluster during times when the market is hot. This view is also

supported by Baker and Wurgler (2007) who claim that the demand for going public is closely related to market sentiment. They mean that there are windows of opportunity opening and closing, and firms will rush to the market when the time is right. However, in contrast to private equity firms, non-backed firms do not have limited investing periods, and the incentive to rush to the market is not as strong. Going public during periods of favourable market conditions is thus assumed to be a more frequent strategy within PE-backed IPOs than non-backed IPOs. If this assumption is true, *performance timing* will be less apparent for PE-backed IPOs in times of hot IPO markets, compared to cold IPO markets. Non-backed IPOs will on the other hand not show as large differences between hot and cold periods. This means the difference in post-IPO performance between hot and cold periods will be larger for PE-backed IPOs compared to non-backed IPOs. To further assess whether performance timing is affected by the current market conditions we develop the following hypothesis:

> **Hypothesis H5:** *Looking at changes in operational performance post-IPO, the difference between hot and cold IPO markets is larger for PE-backed firms than for non-backed firms.*

2.3.3 Signalling of performance timing

Whilst a backer of an IPO may know that the quality of their firm's operating performance is sustainable, investors cannot as easily distinguish them against companies where the operating performance levels are not sustainable. Leland and Pyle (1977) present a theory on how owners by means of equity retention may signal the quality of its profitability and growth. It is in the owners self-interest to send true signals if they believe that there is unobserved value to be realized. Leland et al mean that a high fraction of equity retained by the prior owners is the main signal of high quality. Applying this theory to the objective of this paper would mean that owners are inclined to maintain high ownership stakes as they take their companies public assuming there is room for additional operating improvements (i.e. listing does not coincide with a temporary peak in operating performance). Additionally, company insiders and those holding majority stakes that did not sell their shares in the IPO are often forbidden to sell due to lockup provisions (usually between 90 to 180 days), which increases the incentive to only hold high quality equity.

Consistent with the implications of signalling theory, Jain and Kini (1994) find results of relatively superior post-IPO operating performance of firms with high ownership retention. This indicates that the extent of performance timing could be anticipated by looking at the ownership retention at the time of going public. However, as mentioned earlier, the choice of timing the IPO to a

peak in performance may not always be possible. For instance, Pagano et al (1998) underline that there are many reasons for going public. This includes financing aspects such as equity diversification and elevated bargaining power with banks due to increased transparency which in turn leads to reduced cost of credit. In addition, the proceeds from the IPO may be needed to rebalance accounts and pay-off high levels of debt. All of these factors need to be taken into consideration, both for the timing of the IPO and for the level of equity retained by the owners. Timing and level of retained equity might therefore not always be a decision completely free from aspects to relate to, for the typical IPO.

In contrast, Kaplan and Strömberg (2009) concludes that as private equity funds have grown significantly in size over time, their span of relationships with institutional investors, wealthy individuals, banks and hedge funds have increased. This means that they are wealthier than ever before, thus have increased potential to finance additional positive NPV projects within portfolio companies when current funds of the portfolio company are insufficient. Furthermore, given a good track record by the PE-firm, lenders are more willing to let the portfolio company take on additional debt compared to owners without a proven ability to run companies that repay debt. This means that going public is to a lesser extent a financing issue for PE-backed companies. Instead, the goal of the IPO is simply to extract as much value as possible as they now enter the divestment phase. As they are freer to choose the level of retained equity, it can be argued that low ownership retention is a stronger signal of performance timing for PE-backed firms than for non-backed firms. In other words, we hypothesize that the signalling of performance timing from ownership retention by PE-firms at the time of IPO should be larger than for firms backed by other owners. Given our definition of ownership retention as one minus the float size of the IPO,[1] it leads to the development of our last hypothesis:

> **Hypothesis H6:** *The signalling of performance timing from ownership retention at the time of going public is larger for PE-backed firms than for non-backed firms.*

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[1] In accordance with Jain and Kini (1994).

3. Data

This chapter covers the sample selection process and our primary sources of data. We give an overview of the distribution of IPOs in our two groups (PE-backed and non-backed IPOs), while also distinguishing the dataset used for evaluation of our hypotheses with the dataset used to test the robustness of our conclusions.

3.1 Data collection

The selection of IPOs and operational measures used in this paper were primarily retrieved through the databases Capital IQ and Compustat. In the cases where there were partially missing data we manually screened Zephyr, SDC Platinum and Orbis.

An extensive number of IPOs is available through Capital IQ. However, as privately held companies in many jurisdictions are not forced to publish financial reports the data availability in the years prior to the IPO was a problem, particularly in terms of accounting data earlier than 1995. This low availability of data in Capital IQ in earlier periods is acknowledged by Strömberg (2008) as a consequence from Capital IQ having its data service started in 1999. Despite back-filling their data using various sources of information, their coverage is still incomplete. As we needed data within the interval Y_{-2} and Y_{+3} for our analysis, this paper solely comprises IPOs in North America and Europe between 1997 and 2009. In addition to time frame, we also filtered on "Sponsor-backed offerings" to distinguish which companies that have been owned by a financial sponsor. After removing these companies from our list of non-backed IPOs we also manually screened for and removed companies who themselves are financial sponsors, i.e. listed financial sponsors. Note that we also removed companies of which we could not categorise business description, e.g. if the company had not been given a SIC code in the used databases. Finally, we conduct extensive web searches on a firm-by-firm basis in our PE-backed group and removed companies that have been backed by a venture capitalist or an angel investor rather than a private equity firm.

3.2 Dataset used for hypothesis and robustness testing

Aforementioned gathering process gives us a first sample of 198 PE-backed firms and 2,958 non-backed firms, with each firm's set of operational measures matched to industry benchmarks collected through Compustat using two-digit SIC codes. We call this initial dataset our *Robustness panel* which we use to verify the conclusions made by a more detailed dataset that only includes

companies where growth variables and profitability ratios of interest were available between Y_{-1} and Y_{+3}. As this smaller dataset is used to test our hypotheses we have defined it as our *Hypothesis panel*. It contains 118 PE-backed firms and 1,186 non-backed firms.

3.3 Overview and comparison with previous literature

Table III and Table IV summarize the geographical and yearly distribution of our dataset. In addition, Table V shows the average and median size one year prior going public in terms of sales, EBITDA and total assets. As our data shows a large difference between averages and medians, we conclude that our dataset contains many influential outliers.

INSERT TABLE III, IV AND V HERE

We also find that our data samples are significantly different from previous papers that have looked at the development in operational performance post-IPO, both in terms of sample size, timeframe and geographical exposure. Jain and Kini (1994), Holthausen and Larcker (1996) and Degeorge and Zeckhauser (1993) all focus on IPOs from the US while Pagano et al (1998) only look at IPOs from Italy. Jain and Kini (1994) and Pagano et al (1998), who include IPOs regardless if they have been backed by a financial sponsor or not, cover the respective timeframes 1976-1988 and 1982-1992. Sample size for Jain and Kini (1994) is 682 IPOs while Pagano et al (1998) merely look at 69 companies. Given the size of PE-backed IPOs in our *Hypothesis panel*, we find a little similarity with Holthausen and Larcker (1996) who cover 90 RLBOs exited in 1983-1989. Degeorge and Zeckhauser (1993) on the other hand, merely cover 62 RLBOs exited in 1983-1987.

4. Methodology and Theory

In this section we lay out the statistical and econometric models applied in our empirical analysis. Initially, we describe the type of median comparison we use to establish whether there is a difference in operational performance between PE-backed IPOs and non-backed IPOs. Thereafter, we describe the multivariate regression model used to evaluate how different factors potentially affect performance timing.

4.1 Event specification

As our aim is to conduct a comparative study on the use of performance timing, we try to observe whether there is a decline in operating performance, after the companies go public. To perform this analysis we have defined the year of the initial public offering as Y_0 and can therefore be seen as the event window. The change in operational performance as a result from going public is measured as the difference between the year prior going public (Y_{-1}) and the respective years of interest (Y_0, Y_{+1}, Y_{+2} and Y_{+3}). Since we use full year accounting data the operational performance Y_0 cannot be allocated to before or after the event. Hence, for some firms Y_0 may be based largely on the operating results of the firm when it is private, and for others the results may be based largely on a period when the firm is public. Therefore, we have been restrictive in drawing conclusions from operational performance values from that particular year. Figure I gives an overview of the chosen timeline.

Figure I: Timeline for comparison.

Pre-IPO	Event window	Post-IPO		
Y_{-1}	IPO - Y_0	Y_{+1}	Y_{+2}	Y_{+3}

4.2 Performance measures

Our chosen set of operational performance measures constitutes a mixture of different growth variables and profitability ratios. Table I presents the different measures, the categories they belong to and how they are defined.

Table II: Performance measures definition

Category	Measure	Definition
Growth variable	Sales growth	$(Sales_t / Sales_{t-1}) - 1$
Growth variable	EBITDA growth	$(EBITDA_t / EBITDA_{t-1}) - 1$
Profitability ratio	EBITDA margin	$EBITDA_t / Sales_t$
Profitability ratio	Operating ROA	$EBITDA_t / Assets_{t-1}$

Some of these operational measures have been used in previous papers that analyses operational performance. For instance, Jain and Kini (1994) note that growth variables such as sales growth may be able to provide an explanation for changes in other operating performance measures experienced by IPO firms during the first few years after going public. Holthausen and Larcker (1996) and Pagano et al (1998) both look at the ratio of earnings before interest, taxes, depreciation and amortization deflated by total assets at the end of previous year (denoted as operating ROA). As we are only interested in operational performance, we have chosen measures in the income statement that are immune to any influence of tax jurisdictions and capital structure. Operating ROA provides a measure of the efficiency of asset utilization. However, as the total assets on a firm's balance sheet are recorded at historic cost, while operating income is recorded in current dollars, Barber and Lyon (1996) argues that the appropriate denominator is current or replacement cost of total assets. Also, they note that the usage of total assets could understate productivity as it reflects all assets of a firm, not just operating assets. According to the authors, a solution to overcome the historic cost and non-operating assets problems associated with operating ROA would be to scale EBITDA by sales (denoted as EBITDA margin). However, the disadvantage of using profitability ratios such as EBITDA margin is that it does not directly measure the productivity of assets. Given that we have not been able to find a database that provides operating assets or total assets recorded at current or replacement cost, we have chosen to both include a margin measure and operating ROA in its current form. Altogether we believe this mixture of growth variables and profitability ratios gives a well-rounded view of post-IPO performance and in turn the usage of performance timing.

Jain and Kini (1994) emphasize the necessity of determining a benchmark against which to measure actual operating performance. We therefore compare each company that have gone public in our dataset with their already listed industry peers in the geographic region North America and Europe. Thereafter, we construct an industry adjusted performance measure:

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Industry adjusted performance

$$AP_{i,s,t} = P_{i,t} - I_{s,t} \tag{1}$$

where, $P_{i,t}$ is the actual performance measure during a particular year t for one of the firms i in our sample. $I_{s,t}$ is the median ratio of performance year t for two-digit SIC code s in geographic region North America or Europe.

4.3 Tests for difference between PE-backed and non-backed

For hypothesis H1 and H2 we will use a two-tailed Wilcoxon signed-rank test to determine whether there is a difference in location between the median of our operational measures in the year prior to the IPO (Y_{-1}) and each respective year of interest (Y_0, Y_{+1}, Y_{+2} and Y_{+3}). All significance levels will be based on two-tailed tests. This implies a null hypothesis that post-IPO performance is unchanged in comparison to pre-IPO performance, against an alternative hypothesis that performance is either better or worse post-IPO. Barber and Lyon (1996) highlights that the use of non parametric Wilcoxon test statistics are uniformly more powerful than parametric t-statistics, regardless of which operating performance measure employed[2]. Also, according to Kaplan (1989), the benefits from the usage of median rather than means (and Student t-tests) is that it helps to control for outliers that often distort the means.

For hypothesis H3, H4 and H5, we subsequently use a Wilcoxon rank-sum test (also known as the Mann-Whitney two sample statistic) to determine whether there are differences in the location of median change for each year of interest between our sample of PE-backed IPOs and our sample of non-backed IPOs. This implies a null hypothesis that the change in performance post-IPO is the same for our two groups, against an alternative hypothesis that the median change is of different size.

4.4 Regression model specification

During the second step of our analysis we will try to identify how the usage of performance timing between the two groups differs due to different factors. To make an accurate diagnosis of which variables that have an explanatory power we look at our four chosen operational measures; two growth variables and two profitability ratios using a robust regression model. Initially we will

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[2] In addition to operating ROA and EBIT-margin Barber and Lyon (1996) test return on cash-adjusted assets, return on market value of assets and cash flow return of assets.

describe the range of explanatory variables, thereafter the rationale behind using a robust regression rather than a standard OLS.

$$Y_i = \beta_0 + \beta_1 PE + \beta_2\ HOT\ IPO\ market + \beta_3\ HOT\ IPO\ market * PE + \beta_4 floatsize \qquad (2)$$
$$+ \beta_5 floatsize * PE\ +\ \delta Controls_i' + u_i$$

where

- **Y_i** is the change in percentage points between abnormal performance in Y_{-1} and the abnormal performance in Y_{+3} for the operating performance variables sales growth, EBITDA growth, EBITDA margin and operating ROA
- **PE** is a dummy variable that is equal to one if the IPO was backed by a private equity firm
- **$HOT\ IPO\ market$** is a dummy variable that acts as a proxy for favourable market conditions. The variable is equal to one if the company was listed during a year categorised as a hot IPO market. Hot IPO market is defined as a year where capital raised from global IPO activity lies above the yearly average for our IPO timeframe (1997-2009). Figure VI shows the distribution of raised capital with the above average years highlighted in black
- **$floatsize$** is a dummy variable that acts as a proxy for ownership retention. In line with Jain and Kini (1994) the variable is equal to one for the observations that have a float rate below the median of all observations in our *Hypothesis panel*
- **$Controls$** represents a range of control variables and fixed effects that are described in more detail below

In terms of controls variables, we initially control for pre-IPO performance. More specifically, industry adjusted value Y_{-1} of sales growth, EBITDA growth, EBITDA margin and operating ROA dependent on endogenous variable. This is due to the fact that we expect top-performing firms in Y_{-1} to be more likely to see drops in the following years than companies that perform below average. In addition, we control for the impact of size by taking in consideration the logarithm of total assets in Y_{-1}. The third control variable reflects the change in leverage (defined as change in total debt over assets) between Y_{+3} and Y_{-1} and acts as a proxy for the cost of agency problems. This is because Jensen (1989) have found results indicating a significant positive correlation between decreases in leverage and a decrease in operational performance. The

appertaining coefficient in this case reflects the effect from a one-unit percentage point change in leverage. Due to the fact that most of the observations in our sample occurred in North America, we added a regional dummy that is equal to one if the IPO occurred in either United States or Canada rather than in a European country. Finally, we test for industry inherency by adding a dummy variable for each two-digit SIC code to control for industry specific trends.

$$\delta Controls'_i = \beta_6 PreExit + \beta_7 Size + \beta_8 \Delta leverage + \beta_9 Region + \sum \beta_i SIC \quad (3)$$

As outlined before in section 3.3 and Table V, there is a considerable distance between the minimum and maximum of each observed operational measure, which is why there is such a large difference between the average and median. Those outliers represent companies that perform extremely poorly or well before their initial public offering. Similar large dispersion of observations is found when looking at the dependent variables of our econometric model. As we neither control for mergers nor acquisitions, our growth variables stands to be hit hard from combinations of companies and similar entities that can lead to a substantial jump between two fiscal years. Our profitability ratios on the other hand, can take on a maximum value of one while the downside is unlimited. However, for the extreme values to be classified as regression outliers the observation must have an unusual value of Y_i given its set of explanatory variables.

By computing the Cook's distance for all observations in our *Hypothesis panel* we can evaluate if our dataset contains regression outliers. Cook (1979) proposed a distance measure that explains the influence a particular observation has on the estimation of coefficients. Observations with Cook's distance larger than three times the mean Cook's distance can be considered as outliers according to Wooldridge (2013). Through looking at Figure XVIII, which plots the Cook's distance for each observation in our *Hypothesis panel* after winsorizing our data, we conclude that our sample contains many regression outliers. However, as we do not have sufficient information to conclude that these data points are data entry errors nor that they are from a different population than most of our data, we have no compelling reason to exclude them. Nevertheless, aforementioned conclusion on regression outliers means that there is rationale behind using a robust regression rather than a standard OLS (Andersen, 2008). This implies first running an OLS regression and then dropping all observations with Cook's distance greater than one. Thereafter, our chosen statistical software uses iterations to optimize the weighting of the residuals until the estimated coefficients converge. The two types of weights that are used is

Huber weigthing and *biweighting* (see further Huber, 1964). The Huber weighting is utilized first to get near the convergence point while the use of biweights is to get a discrete value cut off of zero for the outlier data.

5. Empirical Results

In this chapter we outline our empirical results and how they relate to existing literature and our hypotheses. Section 5.1 merely discusses the development for the two groups in our sample separately while it is section 5.2 that analyses the differences between the two groups. In section 5.3 we discuss the use of performance timing in relation to market conditions, followed by section 5.4 that analyses the potential signalling effect equity retention can have on performance timing. All measures in the chapter are abnormal performance figures if not stated otherwise.

5.1 Development in abnormal operating performance

In this section we examine the development in abnormal operating performance post-IPO. We stated in section 2.2 hypothesis H1 and H2, where we expected both PE-backed and non-backed companies to see deteriorations in growth variables as well as in profitability ratios post-IPO.

The change in our chosen performance measures (from Y_{-1} to each respective year) is contained in Table IX and visualized by Figure X. These figures are the medians of the changes and indicate clear deteriorations in the growth variables. There is a clear tendency for both PE-backed and non-backed firms to have lower sales growth and EBITDA growth the further away in time they are from being listed. Non-backed firms show a median in sales growth that is 1.27 percentage points lower Y_0 compared to Y_{-1}. The deterioration continues as sales growth in Y_{+3} has a median of 22.80 percentage points below the levels in Y_{-1}. These figures are almost of equal magnitude for PE-backed firms who go from 4.72 percentage points below the pre-IPO figures to 18.87 percentage points below during the observed period. These patterns are in line with Pagano, Panetta and Zingales (1998) who also find a decline in sales growth post-IPO. However, for the whole sample in their analysis, the decline is not as substantial as in our sample. The median abnormal sales growth falls some 3.40 percentage points between Y_{-1} and Y_{+2}. In our sample, the decline in sales growth for the same relative time period is 18.28 percentage points for non-backed firms and 17.34 percentage points for PE-backed firms, both significantly different from zero at the 1% level. This makes us unable to reject hypothesis H1, which states that both PE-backed and non-backed firms will see declines in growth variables post IPO.

INSERT FIGURE X & TABLE IX HERE

To analyse whether hypothesis H2 holds any merit, we return to Figure X to observe the median of changes in profitability ratios between Y_{-1} and each respective year. It is clear that there is no

decline in median for either profitability measure in the group of non-backed companies. Instead we observe increases in both EBITDA margin and operating ROA. Median change in EBITDA margin is 1.70 percentage points from Y_{-1} to Y_{+2} while median change in operating ROA is 0.17 percentage points for the same period, significant at the 1% and 5% level respectively.[3] Continuing with the subsample of PE-backed companies, we only see small changes in EBITDA margin during our time frame. The median change in EBITDA shows a slight increase in the IPO year and one year following the IPO, compared to Y_{-1}. However, in Y_{+2} and Y_{+3} median changes are both small and lacking statistical significance. In other words, PE-backed companies are so far following a pattern that is similar to non-backed companies.

Although, when looking at the development in operating ROA we see a more distinct difference between the groups. While non-backed companies have small increases in median change in operating ROA, PE-backed companies in our sample experience a decline. This decline is larger in later periods and reaches a deterioration of 4.42 percentage points in median operating ROA compared to year Y_{-1}, significant at the 1% level.

Therefore, we cannot fully reject hypothesis H2 as the subsample of PE-backed companies show deteriorations in operating ROA, while the subsample of non-backed companies show no deteriorations at all. As previous studies have seen declines in operating ROA post-IPO, irrespective of being PE-backed or non-backed, our results for non-backed companies deviate from those findings. Jain and Kini (1994) find significant declines in abnormal operating ROA for IPOs made in general. Further, Mikkelson et al (1997), both looking at operating ROA as well as operating margins, see sharp downward trends after going public. They find a drop in median operating margin of 4 percentage points between Y_{-1} and Y_{+1}.[4] Our subsample of non-backed companies instead increases 2.35 percentage points during the same relative period. However, Degeorge and Zeckhauser (1993) study RLBOs and observe the same patterns as we do in our PE-backed subsample. Following the IPO, the RLBOs see deteriorations in performance measures in line with the drops in operating ROA found among our PE-backed firms. Holthausen et al (1996) find similar patterns in performance for PE-backed firms as his results show that performance fades during the four years following the IPO.

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[3] Level of statistical significance are indicated in Table IX.
[4] Mikkelson et al (1997) find that median abnormal operating margin falls from 3% in Y_{-1} to -1% in Y_{+1}.

Despite the observed decline, Holthausen et al find that PE-backed firms continue to outperform their industries. This underlines the rationale of creating Table VII and Figure VIII where we can see the medians of abnormal performance both for PE-backed and non-backed companies. In this table it is obvious that both groups are outperforming their industries for all performance measures one year prior going public. Notable is that PE-backed firms have a median operating ROA that is 9.85 percentage points higher than industry in Y_{-1}. The ratio falls the following years but is still 4.29 percentage points higher than industry in Y_3. The same figure for non-backed companies falls from 4.64 percentage points above industry in Y_{-1} to 1.57 percentage points in Y_3. It stands clear that high growth variables and profitability ratios in Y_{-1} seems to fade post-IPO towards industry levels, irrespective of being PE-backed or non-backed.

INSERT FIGURE VIII & TABLE VII HERE

Is it so that both PE-backed and non-backed firms in our sample are going public in periods of unusually good performance, thereby utilizing rather temporary improvements in order to obtain high equity valuations? As both groups show sharp declines in growth variable compared to Y_{-1}, this is evidence that the companies went public when growth variables were at the peak. So, what does this mean for investors in the IPO? Without a doubt, our results show that they need to be wary of the fact that there are rather significant drops in growth post-IPO and that they cannot rely on a continuation of the high abnormal growth seen prior to listing.

Nonetheless, using this analysis only, it is still difficult to tell whether one group is acting more opportunistically than the other. Cao (2011) simply tests the occurrence of performance timing for RLBOs by investigating if there are deteriorations among these firms post-IPO. Yet, as we are interested in comparison between the two groups in our sample, further analysis is needed to determine if there is a significant difference between them. In order to answer whether one subsample utilizes performance timing to a larger extent than the other, we will dedicate section 5.2 to the comparison between the PE-backed and non-backed companies to see how the changes post-IPO differ. This will tell us if there are signs indicating that one group utilizes performance timing more than the other.

5.2 Comparison between PE-backed and non-backed firms

For us to evaluate hypothesis H3 and H4 we decided to conduct a comparative analysis of the change in post-IPO performance between the group of PE-backed companies and the group of

non-backed companies. Our literature review in chapter 2.3.1 ended with conflicting hypotheses due to difficulty in assessing the magnitude of two contradictory arguments. On the one hand we found a higher level of sophistication for PE firms through Kaplan and Strömberg (2009) which should indicate more performance timing as it leads to higher equity valuations. On the other hand we found through Cao and Lerner (2009) that PE-backed firms consistently outperform non-backed IPOs in terms of stock performance. As that would indicate that the presence of performance timing is not more widespread for PE-backed IPOs than non-backed IPOs, there were no particular expectations on which group would outperform the other in terms of change in operating performance post-IPO.

INSERT FIGURE X & TABLE IX HERE

Whilst we can conclude that PE-backed companies see a rather significant deterioration in performance post-IPO in terms of change in percentage points compared to Y_{-1}, we also see that they underperform non-backed companies on nearly every level by looking at Figure X. The only case where non-backed companies see a higher deterioration than PE-backed is for sales growth in the later years post going public, where the deterioration for non-backed companies is 0.94 percentage points higher in Y_{+2} and 3.94 percentage points higher in Y_{+3} in comparison to PE-backed companies. Noteworthy, those numbers are not significant which mean that we cannot assign any degree of evidence to whether the median of the populations are different. However, in terms of the remaining operating measures, we can conclude that the difference in median change is not only pointing towards an inferior development for PE-backed companies but it is also statistically significant. This means that the difference in median post-IPO changes serves as a valid indicator of the entire population. With each measure, the largest difference in the change of performance post-IPO between the groups occurs Y_{+1}. The difference in the change in performance Y_{-1} to Y_{+1} is 14.47 percentage points for EBITDA growth, 1.74 percentage points for EBITDA margin and 3.69 percentage points for operating ROA. The difference between the groups decreases the following year (Y_{+2}) since the performance for the non-backed companies falls in comparison to Y_{+1}. Thus performance declines come sooner for PE-backed companies than non-backed companies, which would suggest that there are more pre-IPO improvements among PE-backed companies that are temporary. This opportunistic behaviour is an indication of performance timing.

At first glance we have no other option than to reject hypothesis H4 while being unable to reject hypothesis H3, as our results clearly point towards PE-backed firms underperforming non-backed firms in terms of change in operational performance post-IPO. However, as we in Figure VIII see that PE-backed firms' abnormal performance in Y_{-1} are statistically superior to those of the non-backed group for all measures except sales growth, the question still remains whether the difference is inherent to PE-ownership or if it rather is due to superior abnormal performance of PE-backed firms before going public? One cannot argue against the higher likelihood of top-performing firms in Y_{-1} to see larger drops in the following years in comparison to companies that perform below average. For instance, PE-backed companies show a median abnormal EBITDA growth in Y_{-1} that is 14.74 percentage points higher than non-backed companies. In addition, abnormal operating ROA is 5.21 percentage points higher for PE-backed compared to non-backed companies. As all the values are statistically significant, we get a clear indication of the superiority in performance for PE-backed companies pre-IPO.[5]

<div align="center">INSERT TABLE VII HERE</div>

Due to the differences in pre-IPO performance we conclude that there is rationale for extending our initial analysis with an additional comparison of change in post-IPO performance compared to Y_{-1} but this time sorted on level of pre-IPO performance. This implies categorising all observations as either top performers or bottom performers dependent on whether their pre-IPO performance lies above or below the Y_{-1} median of all observations in our *Hypothesis panel* for that particular measure. If it is true that PE-backed companies utilize performance timing more than non-backed companies, this should be the case regardless of pre-IPO performance characteristics. On the other hand, if it is so that pre-IPO performance is of greater importance for post-IPO development than the type of owner you had when going public, the patterns for top performing companies in both groups should be the same. The new results, which can be found in Tables XI, are notably a lot more ambiguous than previously.[6] We now conclude that top performing PE-backed companies outperform top performing non-backed companies for all measures except EBITDA margin. For bottom performers on the other hand, non-backed companies outperform PE-backed for all growth variables and profitability ratios. These results are not in line with patterns in for top performers; instead they are indistinct and point in different directions. This makes it hard to draw any definite conclusions. Consequently, the

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[5] Levels of statistical significance are indicated in Table VII.
[6] See Figure XII and Figure XIII for visualization of Table XI.

extended analysis is inconclusive, as it cannot tell us whether it to a larger extent is the pre-IPO performance or the type of backer of the IPO that determines post-IPO development.

Instead, we approach the question of what determines performance timing with a robust regression where we control for pre-IPO performance characteristics. The regression results can be found in Table XVII, where we try to determine difference in post-IPO performance from being PE-backed. Endogenous variables are the change in percentage points between performance in Y_{-1} and the performance in Y_{+3} for all our measures. The regression model specification can be found in section 4.4. Assuming we hold all other variables fixed, we conclude that being PE-backed affects sales growth by -6.96 percentage points, EBITDA growth by -15.20 percentage points, EBITDA margin by -5.03 percentage points and operating ROA by -2.72 percentage points. However, as there is no level of significance we cannot conclude that the corresponding parameters are separated from zero.

As we in the regression only have 70 observations of PE-backed companies while we have 389 observations of non-backed companies,[7] one cannot analyse the results without questioning whether the small amount of observations backed by PE affect the significance levels. More often than not, having small sample size would prohibit achieving significance.

To summarize, we did not reject hypothesis H3, predicting that the sample of PE-backed IPOs will underperform non-backed companies in terms of change in performance post-IPO. However, we also identified that the subsample of PE-backed companies have pre-IPO abnormal performance that is higher than for the companies in our non-backed subsample. By looking at Table XI we were unable to determine if post-IPO performance is attributable to pre-IPO performance rather than being backed by a PE-firm. Instead, we turned to the coefficient in our regression which indicated a negative relationship between post-IPO performance and PE-ownership, but which lacks statistical significance on any levels below 10%.

5.3 Effect of market conditions on performance timing

As hypothesized in H5 in section 2.3.2, we expect performance timing to be used less extensively in periods of favourable market conditions, as owners are more inclined to list their companies when IPO markets are hot. Furthermore, due to the different incentives between PE-backed

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[7] Note that additional observations were dropped in comparison to our *Hypothesis panel* due to missing leverage figures and float rate.

companies and non-backed companies outlined in section 2.3.2, we expect larger difference in post-IPO performance between hot and cold periods for PE-backed companies compared to non-backed companies. The market is classified as "hot" if the amount of capital raised from global IPO activity for that particular year lies above the yearly average during the timeframe 1997-2009.

To investigate whether hypothesis H5 holds any merit, we have conducted an analysis where we compare the differences in our performance measures of interest between hot and cold IPO market conditions. Table XIV shows the median in post-IPO changes for these measures for both PE-backed and non-backed, in both hot and cold periods. The right part of the table shows the differences between hot and cold periods split up for PE-backed and non-backed companies.[8]

<center>INSERT TABLE XIV HERE</center>

Starting with sales growth, we see deteriorations for both groups in both periods. To determine whether there is a significant difference between hot and cold periods, the deteriorations have been compared to each other. The differences between hot and cold periods are rather ambiguous. The group of PE-backed companies in our sample shows a lower deterioration in cold periods compared to hot, as seen in Figure XV. For instance, differences in median change Y_{+1} falls some 5.56 percentage points more for IPOs made in hot periods compared to cold. However, there is no statistical significance for these figures, and we can therefore not conclude that sales growth varies depending on the market conditions. Similarly, there is no clear pattern for non-backed IPOs either, as they seem to deteriorate more the first two years following the IPO if the market condition was cold, but deteriorate less Y_{+2} and Y_{+3}. Consequently we do not see differences in performance timing of sales growth depending on market conditions, for any of the groups.

Continuing with EBITDA growth, patterns are once again ambiguous. While both groups show deteriorations in both periods, there is only weak evidence on the differences between hot and cold market conditions.[9] Only the non-backed group shows a statistically significant difference between the periods, indicating that performance deteriorates more for IPOs made in hot markets. Still, this is only from Y_{+2} and onwards and all other figures lack significance below the

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[8] See Figure XV and Figure XVI for visualization of Table XIV.
[9] Levels of statistical significance are indicated in Table XIV.

10% level. Therefore we have not enough evidence to tell whether there is a difference in performance timing of EBITDA growth due to different market conditions, for either PE-backed or non-backed IPOs. This points towards the inference that market conditions during the IPO, have no effect on the changes in EBITDA growth in the years post-IPO. The absence of statistically significant differences in both sales growth and EBITDA growth changes leads us to the conclusion that growth variables are not timed differently depending on market conditions.

The conducted method does however yield more distinct results when looking at profitability measures. Figure XVI shows how the subsample of PE backed-IPOs made in cold IPO years experiences deterioration in EBITDA margin post IPO for Y_{+1} to Y_{+3} compared to Y_{-1}. However, when looking at the subsample of PE-backed IPOs made in hot markets, the figures are instead positive. This means that PE backed IPOs in our sample have larger deteriorations in EBITDA margin if they were listed in a year categorized with cold IPO markets. The change in median from Y_{-1} to Y_{+3} is 3.42 percentage points lower for PE-backed companies listed in hot IPO years. This is an indication of performance timing being used less extensively in years when IPO markets are hot.

Non-backed IPOs on the other hand, show no signs of performance timing when observing EBITDA margin. Both the subsample of IPOs made in hot periods as well as the subsample of IPOs made in cold periods show no deteriorations in EBITDA margin, and there is no evidence of a difference between the periods. The differences in median between the two different market conditions are less than half a percentage point for all observed years. In contrast to the established difference in hot and cold periods for PE-backed companies, we therefore do not fully reject hypothesis H5 which predicts that there will be larger difference in the median changes between hot and cold IPO markets for PE-backed companies. As discussed in section 2.3.2 there is reason to believe PE firms are more inclined to list a company earlier when IPO markets are hot, compared to non PE firms. Due to private equity firms' distinctive characteristics, such as limited investing periods, compensations structures and will to quickly generate return to its investors (as discussed by Cao 2011), it is reasonable that there will be larger difference between hot and cold markets for PE-backed IPOs compared to non-backed IPOs. This is also what our results indicate given the considerable and statistically significant difference in change in EBITDA margin between hot and cold IPO markets for PE-backed companies, while there is no clear difference for non-backed companies. Difference in hot and cold periods

for PE-backed IPOs is also found in the operating ROA. This is again in line with hypothesis H5, indicating a larger difference in performance between hot and cold market conditions for PE-backed IPOs compared to non-backed IPOs.

Finally, looking at the results from our regression (Table XVII), our hypothesis is supported further. The coefficient of our dummy for hot market conditions is negative for all observed performance measures. Holding all other variables fixed, there is a negative change of 3.41 percentage points in operating ROA between year Y_{-1} and Y_{+3} if the IPO was made in a hot market. However, looking at our interaction dummy for PE-backed IPOs made in hot markets we on the other hand see an increase of 4.44 percentage points for the same measure.[10] This indicates PE-backed firms indeed see larger deteriorations in cold IPO markets compared to hot, which underlines that performance timing is less substantial in hot IPO markets. Cao (2011) claims that sponsors can earn greater proceeds by listing the company early, rather than finalizing the restructuring process pre-IPO. This in turn means that operating improvements yet to materialize will occur post-IPO instead, as the sponsor remains present in the portfolio company and continues the restructurings. We believe this is one of the reasons for why we see a continuation in performance improvements for PE-backed IPOs made in hot markets. If that is the case, it would also indicate a relationship between the level of retained equity and post-IPO performance. Therefore we will dedicate the next section to the analysis of equity retention, and if different levels of retained equity can act as a signal of post-IPO development and performance timing.

5.4 Signalling effect from retained equity on performance timing

This section aims to analyse whether the level of retained equity can signal potential occurrence of performance timing. As outlined in section 2.3.3, we see different incentives for going public between PE-backed companies and non-backed companies. This led to hypothesis H6, which predicts that the level of retained equity will be a larger signalling effect of the use of performance timing for PE-backed IPOs compared to non-backed IPOs.

Looking at the independent variable *Floatsize* from the regression in Table XVII, we see all observed performance measures and their relation to high retention. *Floatsize* is a dummy variable

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[10] IPOs made in hot markets have a median Operating ROA which is 3.41 percentage points lower. The coefficient of the interaction dummy for PE-backed IPOs in hot markets indicate an increase in median of 7.85 percentage points, equaling a net effect of 4.44 percentage points higher median for subsample of PE-backed IPOs in hot markets.

that acts as a proxy for ownership retention. It is equal to one if the float rate is lower than the median of all observations in our *Hypothesis panel*. In stark contrast to the signalling hypothesis developed by Leland and Pyle (1977), our results show that all performance measures are affected negatively by higher retention. Consequently, the effect turned out to be opposite to what we expected. Most notably sales growth falls 5.26 percentage points from Y_{-1} to Y_{+3} compared to the subsample of companies with high float size. EBITDA margin is also affected significantly and the change from Y_{-1} and Y_{+3} is 3.11 percentage points lower than companies with low equity retention.

Even though several distinguished studies find evidence of a positive relationship between equity retention and operating performance (Jain et al. 1994, Holthausen et al 1996), there is also previous research supporting other results. Mikkelson et al (1997) find results indicating that the ownership structure is unrelated to operating performance for the ten years following the IPO. Also, a more recent study by Boubaker and Mezhoud (2011) finds results in line with ours, showing that high retention indeed has a negative influence on operating performance post-IPO. Boubaker et al explain this outcome using a theory of managerial entrenchment. This theory states that a larger stake of ownership does not have to result in profit maximization. This is due to a misalignment of interests. In other words, owners with high equity stake might carry out non value-maximizing activities since they are driven by self-interests that are not necessarily aligned with the interests of the company. This in turn leads to declining performance.

Coming back to our hypothesis H6, we still now have to determine whether equity retention has a larger signalling effect of performance timing for PE-backed firms. Therefore we turn to the coefficient named *Floatsize & PE*. This is a dummy variable equal to one for observations with a float rate below the median of all observations in our *Hypothesis panel* in addition to being PE-backed. In essence, it gives us the additional effect of high equity retention and being backed by a PE-firm. This means that the total effect of high equity retention for the subsample of PE-backed companies is the sum of the coefficients for *Floatsize* and *Floatsize & PE*. As our hypothesis states that the signalling effect for PE-backed companies will be stronger than for non-backed companies, the absolute value of the sum of the coefficients must be larger than the absolute value for the coefficient of the *Floatsize* dummy alone. Otherwise our hypothesis must be rejected.

Adding the coefficients shows that EBITDA growth is affected in different directions for PE-backed and non-backed companies. While non-backed companies where former owners remain a high equity stake are affected negatively 10.10 percentage points, PE-backed firms with high equity retention by former owners appreciates 2.40 percentage points. However, it must be noted that these figures lack statistical significance below the 10% level, indicating only weak evidence. Still, the absolute number is larger for non-backed companies, so far indicating that H6 is false. Sales growth and EBITDA margin both show a total effect that is pointing in the same direction for the subsamples. Again the absolute number is larger for the non-backed companies, in contrast to our hypothesis.

Operating ROA is the only performance measure that breaks the above mentioned pattern. Non-backed companies show a deterioration of 0.20 percentage points when prior owners retain high equity stakes. But as the p-value for this figure is very high, we find there is not much difference in this measure depending on the level of retained equity. The additional effect of being PE-backed gives an extra decrease of 1.81 percentage points indicating that the absolute number is in fact larger for the PE-backed subsample compared to the non-backed subsample. This means that we see a larger signaling of performance timing for PE-backed firms when it comes to operating ROA, but not in the direction we expected. And yet again, the evidence is rather weak, meaning we cannot draw any definite conclusions from these figures. In absence of distinct patterns, we reject our hypothesis H6.

6. Conclusion

By taking a closer look at operational performance post-IPO for PE-backed and non-backed companies the aim of this paper is to contribute to the current discussion where both academia and the private sector debate the effects of private equity ownership. In particular it focuses on whether PE-backed IPOs compared to non-backed IPOs are more timed to coincide with a point in time where operational performance is unusually high (known as performance timing). We find that both groups have deteriorating growth variables (sales growth and EBITDA growth) as they fail to sustain pre-IPO growth levels. This can be evidence of performance timing for both subsamples. When looking at profitability measures, we find that PE-backed companies also see deteriorations in operating ROA post-IPO. The group of non-backed companies however, show no decline in profitability ratios. Also, PE-backed and non-backed companies both outperform their industries pre-IPO but fall towards industry levels in the years following the IPO. This can be a potential sign of performance timing for both groups.

Yet, as we are interested in the statistical difference in changes between the two groups, we compared them to answer whether one subsample utilizes performance timing to a larger extent than the other. Our results show that there is a statistically significant difference between the groups for all operational measures, and that PE-backed companies consistently underperform non-backed companies in terms of change in operational performance post-IPO. For instance, the difference in the change in performance between the groups, from Y_{-1} to Y_{+1}, is 14.47 percentage points for EBITDA growth and 3.69 percentage points for operating ROA. We find that declines start earlier for PE-backed companies which is pointing towards more temporary improvements and performance timing for this subsample. Despite finding that PE-backed firms abnormal performance in Y_{-1} is statistically superior to those of the non-backed firms, we cannot determine if it rather is pre-IPO performance characteristics that is a stronger explaining factor than performance timing through PE-ownership.

In addition, for profitability ratios we find that performance timing is more apparent for PE-backed IPOs made in cold markets compared to hot. This is not the case for non-backed IPOs whose post-IPO abnormal performance is unaffected by the market conditions during the year of listing. We believe that the differences in change for PE-backed companies is due to the distinctive compensation characteristics for private equity firms, which incentivizes them to list the portfolio company, albeit prematurely, in order to divest in a favourable IPO market. For

investors in PE-backed IPOs, it means that performance timing is not as substantial if they were listed during a hot IPO market.

Whilst there are differences in post-IPO changes between PE-backed and non-backed companies in different market conditions, we see no statistically significant difference in post-IPO changes between the groups dependent on the level of retained equity. In contrast to what we expected, high levels of retained equity have a negative effect on performance measures regardless of being backed by PE or not. Previous papers have tried to explain the same relationship by using a theory of managerial entrenchment. This theory states that owners with high equity stakes might carry out non value-maximizing activities since they are driven by self-interests that are not necessarily aligned with the interests of the company. The anticipated differences between the groups were due to the fact that the choice of retained equity level is not as flexible for non-backed firms as for PE-backed firms. However, our results lead to the conclusion that there are no differences in signalling of performance timing by simply looking at the level of equity retained in the IPO.

Returning to our initial research question "*Is there a difference in performance timing between PE-backed and non PE-backed companies?*" our findings support the notion of performance timing to a larger extent among PE backed firms than non-backed firms. While both groups seem to time their IPOs to peaks in growth, only private equity companies show evidence of timing profitability. In addition, the performance timing seems more refined for PE-backed companies as it is used differently depending on market conditions.

7. Limitations and Suggestions for future research

In this chapter we test the robustness of some of our results to determine the quality of our findings. In addition, we outline assumptions that have to be made in terms of data selection and method which could limit the ways in which results can be interpreted. Lastly, we try to pinpoint interesting fields of future research related to our research question.

7.1 Robustness testing

To analyse whether our main findings are robust, we increased the sample size by turning to our *Robustness panel* (see section 3.2). This includes observations that do not necessarily have all growth variables and profitability ratios of interest available between Y_{-1} and Y_{+3}.

INSERT TABLE XIX

In comparison to the analysis made on the *Hypothesis panel* (see Table IX), we can confirm that we find similar results. Again PE-backed companies underperform non-backed companies in terms of change in operational performance post-IPO. Both groups still see deteriorations in growth variables after going public, but only PE-backed firms see deteriorations in profitability. In sum, we have confirmed that the answers to our hypotheses H1 to H4 also are robust when using an extended dataset.

7.2 Limitation in result interpretation

Our primary concerns are associated with the data gathering process and the interpretation of post-IPO downturns. Firstly, almost our entire sample consists of North American companies, which means that we must be careful in applying our conclusions to companies outside of North America. Secondly, in terms of data gathering process, the usage of data from non-public companies pre-IPO largely limited our sample as many companies had missing data Y_{-1}. Therefore, we must make the assumption that the companies were we did find data our not biased in any direction. For instance, it might be that companies with higher profitability pre-IPO are more likely to have data from the time when still being private. Thirdly, the usage of two-digit SIC codes as industry benchmarks might not be the optimal match. Using three or four-digit SIC codes could have given a more precise industry comparison. However, we were limited by the issue of data availability.

In terms of post-IPO downturns, we acknowledge there might be other acting forces than performance timing. For instance, there is a possibility that owners and management might be less focused post-IPO as they get a sense of fulfilment from listing their company. Another possibility is that firms that go public face increased rivalry from incumbents, as they will attract more attention after going public.

7.3 Suggestions for future research

Whilst conducting this study, interesting related subjects have come to our attention. For instance, further research could involve following companies during a longer period, both pre- and post-IPO. Unfortunately, data availability prohibited such a study at this time, but with more data available in the future it would open up the door for an analysis of a longer timeframe. This would give a setup more suitable for analysing which pre-IPO improvements that are temporary and those who are sustainable.

In addition, to get a more detailed understanding of the notion of timing divestment phases one would have to delve deeper. A qualitative study would be interesting in this regard, as it may give a better understanding of the reasoning underlying the choice of divestment period. This study could focus around interviewing entrepreneurs and investment managers of private equity firms that plan to take their companies public.

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A. Tables and Figures

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Table III: Geographical distribution

Headquarter	Hypothesis panel		Robustness panel	
	PE-backed	NON-backed	PE-backed	NON-backed
United States	95	781	158	1,994
United Kingdom	4	26	7	151
Belgium	3	10	4	20
Canada	3	32	5	158
Germany	3	57	7	95
Spain	2	19	3	23
France	2	36	2	67
Netherlands	2	21	3	39
Sweden	1	14	1	29
Russia	1	13	1	21
Finland	1	4	1	10
Denmark	1	3	1	10
Italy	0	37	1	63
Poland	0	32	1	52
Switzerland	0	21	0	37
Norway	0	15	1	30
Greece	0	13	1	33
Austria	0	11	0	18
Luxembourg	0	5	1	10
Estonia	0	5	0	6
Cyprus	0	5	0	8
Ireland	0	4	0	20
Ukraine	0	3	0	5
Romania	0	3	0	3
Portugal	0	3	0	4
Channel Islands	0	2	0	19
Croatia	0	2	0	6
Slovenia	0	1	0	2
Czech Republic	0	1	0	1
Gibraltar	0	1	0	2
Iceland	0	1	0	2
Isle of Man	0	1	0	4
Hungary	0	1	0	1
Slovakia	0	1	0	1
Lithuania	0	1	0	1
Monaco	0	0	0	2
Greenland	0	0	0	1
Bulgaria	0	1	0	10
Total	118	1,186	198	2,958

Table IV: Yearly distribution

	Hypothesis panel		Robustness panel	
Year	PE-backed	NON-backed	PE-backed	NON-backed
1997	1	111	5	347
1998	4	83	5	240
1999	7	161	12	442
2000	6	168	8	371
2001	1	50	1	89
2002	4	41	4	70
2003	4	23	8	58
2004	7	91	11	193
2005	15	137	21	348
2006	21	173	35	367
2007	29	116	56	337
2008	4	22	9	68
2009	15	10	23	28
Total	118	1,186	198	2,958

Table V: Descriptive statistics Y_{-1}

(USD million)	Hypothesis panel				Robustness panel			
	PE-backed		NON-backed		PE-backed		NON-backed	
	Average	Median	Average	Median	Average	Median	Average	Median
Sales	818	194	817	80	626	159	565	51
EBITDA	104	29	133	11	82	24	89	6
Assets	1,017	172	2,012	90	1,296	173	1,593	67

Figure VI: Global IPO activity (capital raised by year)
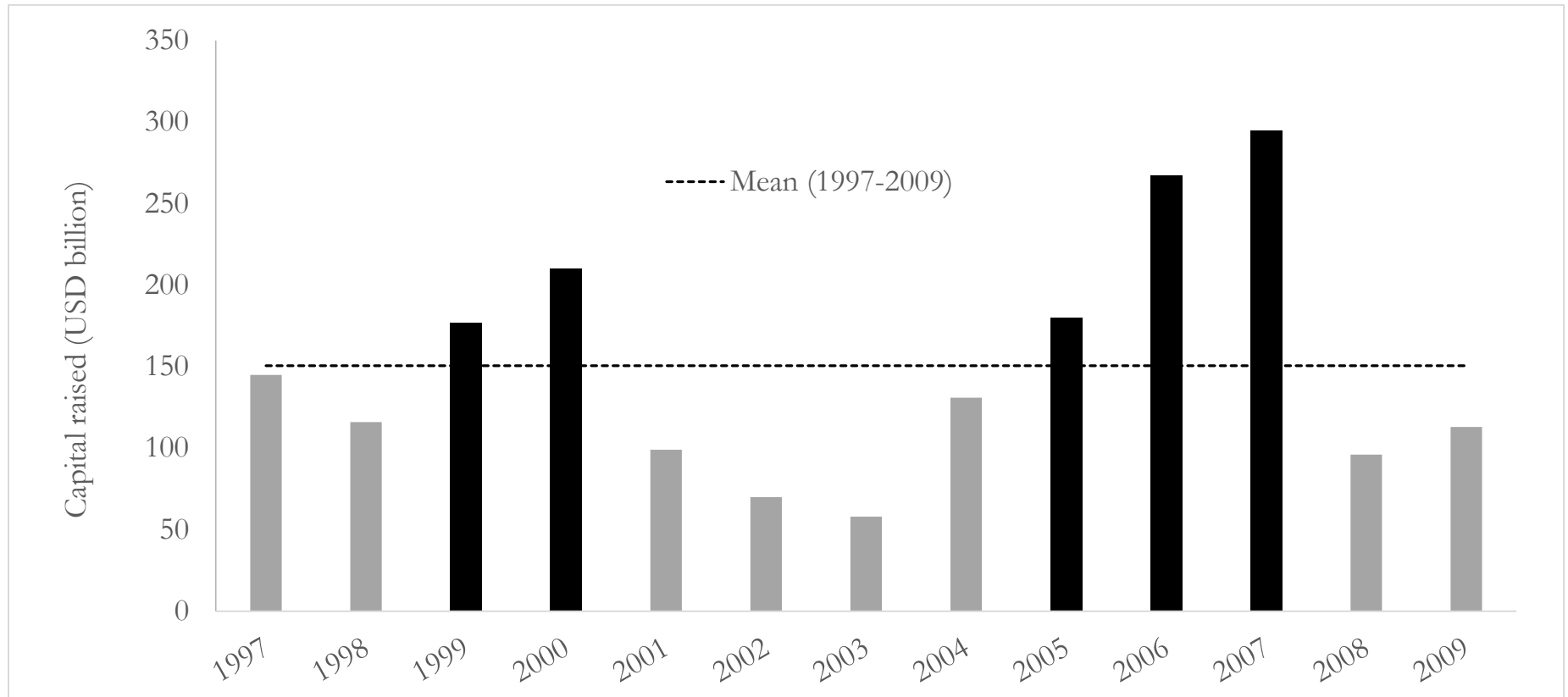
Source: Ernst & Young Global IPO update
http://www.ey.com/Publication/vwLUAssets/Global_IPO_Barometer_Q1_2013/$FILE/Global-IPO-update-Q1-2013.pdf

Table VII: NON PE and PE operational performance around IPO

This table provides summary statistics for operational performance around IPO, where the numbers in subscript denotes the rela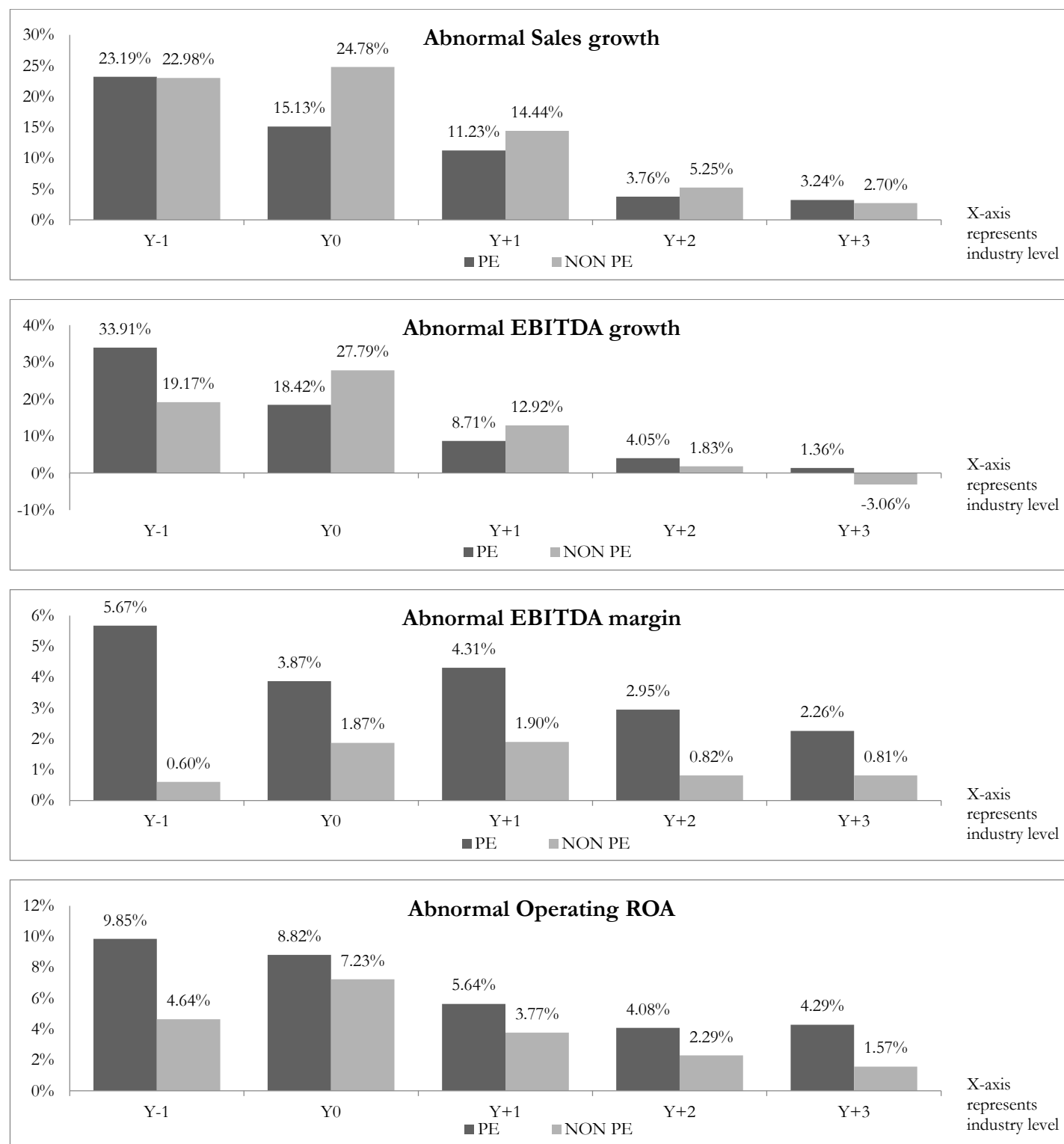tive years from the IPO. It only comprises firms in our *Hypothesis panel*, which solely includes companies where all growth variables and profitability ratios of interest were available for relative years between Y_{-1} and Y_{+3}. Growth variables include Sales growth and EBITDA growth while profitability ratios include EBITDA margin and Operating ROA. Numbers represent median in abnormal operating performance, i.e. actual performance matched to industry benchmarks using two-digit SIC codes. We use a Wilcoxon signed-rank test to determine whether there is a difference in location between the median of the operational measures and the respective industry benchmarks for that particular year. Wilcoxon rank-sum test (Mann-Whitney) is used to determine whether there are differences in the location of the median between the abnormal operating measures for non-backed and PE-backed companies. Significance at the 1%, 5% and 10% are represented by ***, ** and * respectively.

Abnormal performance	NON PE Y_{-1}	Y_0	Y_{+1}	Y_{+2}	Y_{+3}	PE Y_{-1}	Y_0	Y_{+1}	Y_{+2}	Y_{+3}	Diff in Median (NON PE minus PE) Y_{-1}	Y_0	Y_{+1}	Y_{+2}	Y_{+3}
Growth variables															
Sales growth (NON PE=1,186 | PE=118)	22.98%***	24.78%***	14.44%***	5.25%***	2.70%***	23.19%***	15.13%***	11.23%***	3.76%***	3.24%*	-0.21%	9.65%**	3.21%	1.49%	-0.53%
EBITDA growth (NON PE=1,186 | PE=118)	19.17%***	27.79%***	12.92%***	1.83%	-3.06%***	33.91%***	18.42%***	8.71%***	4.05%	1.36%	-14.74%**	9.37%**	4.20%	-2.22%	-4.41%
Profitability ratios															
EBITDA margin (NON PE=1,186 | PE=118)	0.60%***	1.87%	1.90%	0.82%	0.81%	5.67%***	3.87%***	4.31%***	2.95%***	2.26%***	-5.07%***	-2.00%**	-2.41%**	-2.13%**	-1.45%**
Operating ROA (NON PE=1,186 | PE=118)	4.64%**	7.23%***	3.77%***	2.29%***	1.57%***	9.85%***	8.82%***	5.64%***	4.08%***	4.29%***	-5.21%***	-1.59%**	-1.86%***	-1.78%**	-2.71%***

Figure VIII: NON PE and PE operational performance around IPO

This figure visualizes operational performance around IPO. It only comprises firms in our *Hypothesis panel*, which solely includes companies where all growth variables and profitability ratios of interest were available for relative years between Y_{-1} and Y_{+3}. Growth variables include Sales growth and EBITDA growth while profitability ratios include EBITDA margin and Operating ROA. Numbers represent median in abnormal operating performance, i.e. actual performance matched to industry benchmarks using two-digit SIC codes.
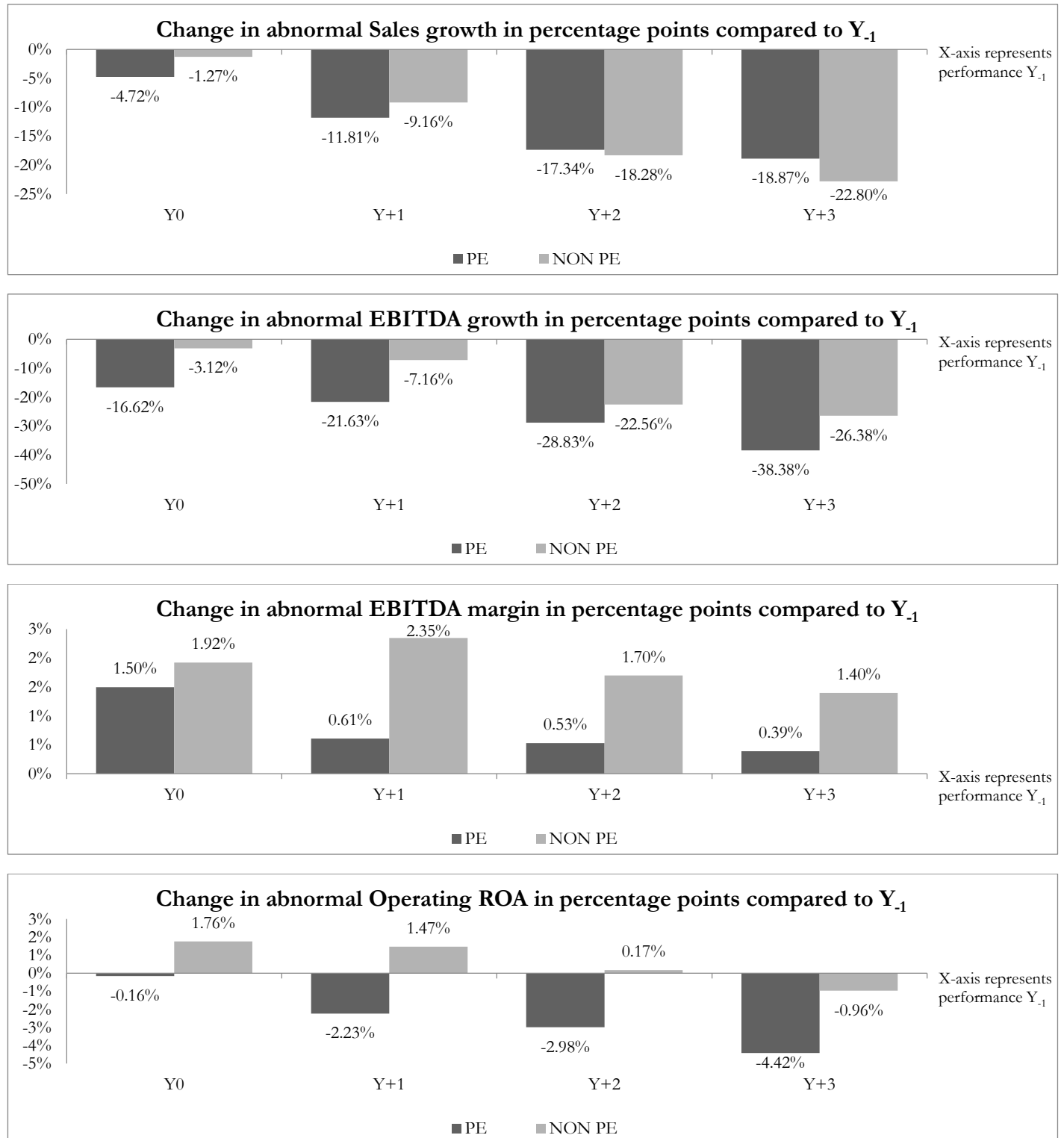
This table provides summary statistics for operational measures post-IPO compared to Y_{-1}, where the numbers in subscript denotes the relative years from the IPO. It only comprises firms in our *Hypothesis panel*, which solely include companies where all growth variables and profitability ratios of interest were available for relative years between Y_{-1} and Y_{+3}. Growth variables include Sales growth and EBITDA growth while profitability ratios include EBITDA margin and Operating ROA. Numbers represent the median change in abnormal operating performance post-IPO compared to Y_{-1} in terms of percentage points. For example, Y_{+3} is the median in abnormal performance Y_{+3} subtracted by abnormal performance Y_{-1}. We use a Wilcoxon signed-rank test to determine whether there is a difference in location between the median of the operational measures post-IPO and those of Y_{-1}. Wilcoxon rank-sum test (Mann-Whitney) is used to determine whether there are differences in the location of the median of the post-IPO change in abnormal operating performance between non-backed and PE-backed companies. Significance at the 1%, 5% and 10% are represented by ***, ** and * respectively.

Change in percentage points compared to Y_{-1}	NON PE				PE				Diff in Median (NON PE minus PE)			
	Y_0	Y_{+1}	Y_{+2}	Y_{+3}	Y_0	Y_{+1}	Y_{+2}	Y_{+3}	Y_0	Y_{+1}	Y_{+2}	Y_{+3}
Growth variables												
Sales growth												
(NON PE=1,186 | PE=118)	-1.27%**	-9.16%***	-18.28%***	-22.80%***	-4.72%**	-11.81%***	-17.34%***	-18.87%***	3.45%	2.65%	-0.94%	-3.94%
EBITDA growth												
(NON PE=1,186 | PE=118)	-3.12%	-7.16%***	-22.56%***	-26.38%***	-16.62%***	-21.63%***	-28.83%***	-38.38%***	13.50%***	14.47%**	6.27%	12.00%
Profitability ratios												
EBITDA margin												
(NON PE=1,186 | PE=118)	1.92%***	2.35%***	1.70%***	1.40%***	1.50%***	0.61%*	0.53%	0.39%	0.42%*	1.74%**	1.17%	1.01%
Operating ROA												
(NON PE=1,186 | PE=118)	1.76%***	1.47%***	0.17%**	-0.96%	-0.16%	-2.23%	-2.98%**	-4.42%*	1.91%	3.69%***	3.16%**	3.45%***

Figure X: NON PE and PE post-IPO performance compared to Y_{-1}

This figure visualizes operational measures post-IPO compared to Y_{-1}. It only comprises firms in our *Hypothesis panel*, which solely include companies where all growth variables and profitability ratios of interest were available for relative years between Y_{-1} and Y_{+3}. Growth variables include Sales growth and EBITDA growth while profitability ratios include EBITDA margin and Operating ROA. Numbers represent the median change in abnormal operating performance post-IPO compared to Y_{-1} in terms of percentage points. For example, Y_{+3} is the median in abnormal performance Y_{+3} subtracted by abnormal performance Y_{-1}.

Change in abnormal Sales growth in percentage points compared to Y_{-1}

	Y0	Y+1	Y+2	Y+3
PE	-4.72%	-11.81%	-17.34%	-18.87%
NON PE	-1.27%	-9.16%	-18.28%	-22.80%

X-axis represents performance Y_{-1}

■ PE   ■ NON PE

Change in abnormal EBITDA growth in percentage points compared to Y_{-1}

	Y0	Y+1	Y+2	Y+3
PE	-16.62%	-21.63%	-28.83%	-38.38%
NON PE	-3.12%	-7.16%	-22.56%	-26.38%

X-axis represents performance Y_{-1}

■ PE   ■ NON PE

Change in abnormal EBITDA margin in percentage points compared to Y_{-1}

	Y0	Y+1	Y+2	Y+3
PE	1.50%	0.61%	0.53%	0.39%
NON PE	1.92%	2.35%	1.70%	1.40%

X-axis represents performance Y_{-1}

■ PE   ■ NON PE

Change in abnormal Operating ROA in percentage points compared to Y_{-1}

|	Y0	Y+1	Y+2	Y+3
PE	-0.16%	-2.23%	-2.98%	-4.42%
NON PE	1.76%	1.47%	0.17%	-0.96%

X-axis represents performance Y_{-1}

■ PE   ■ NON PE

Table XI: NON PE and PE post-IPO performance compared to Y$_{-1}$ sorted by level of pre-IPO performance

This table provides summary statistics for operational measures post-IPO compared to Y$_{-1}$ sorted by level of pre-IPO performance, where the numbers in subscript denotes the relative years from the IPO. It only comprises firms in our *Hypothesis panel*, which solely include companies where all growth variables and profitability ratios of interest were available for relative years between Y$_{-1}$ and Y$_{+3}$. Growth variables include Sales growth and EBITDA growth while profitability ratios include EBITDA margin and Operating ROA. Numbers represent median change in abnormal operating performance post-IPO compared to Y$_{-1}$ in terms of percentage points. For example, Y$_{+3}$ is the median in abnormal performance Y$_{+3}$ subtracted by abnormal performance Y$_{-1}$. The analysis is sorted on level of pre-IPO performance as all observations have been classified as either top performers or bottom performers dependent on whether they lie above or below the Y$_{-1}$ median of that particular metric. We use a Wilcoxon signed-rank test to determine whether there is a difference in location between the median of the operational measures post-IPO and those of Y$_{-1}$. Wilcoxon rank-sum test (Mann-Whitney) is used to determine whether there are differences in the location of the median of the post-IPO change in abnormal operating performance between non-backed and PE-backed companies. Significance at the 1%, 5% and 10% are represented by ***, ** and * respectively.

| Change in percentage points compared to Y$_{-1}$	NON PE				PE				Diff in Median (NON PE minus PE)			
	Y$_0$	Y$_{+1}$	Y$_{+2}$	Y$_{+3}$	Y$_0$	Y$_{+1}$	Y$_{+2}$	Y$_{+3}$	Y$_0$	Y$_{+1}$	Y$_{+2}$	Y$_{+3}$
Growth variables												
Sales growth												
Top Performers (NON PE=593 | PE=59)	-34.93%***	-64.43%***	-81.24%***	-86.69%***	-26.23%***	-39.37%***	-69.83%***	-60.56%***	-8.70%	-25.06%	-11.41%**	-26.13%**
Bottom Performers (NON PE=593 | PE =59)	9.34%***	9.33%***	3.85%***	1.79%***	2.23%**	5.01%**	-3.62%	-3.80%	7.10%**	4.32%	7.47%**	5.59%
EBITDA growth												
Top Performers (NON PE=582 | PE=70)	-50.63%***	-74.78%***	-93.48%***	-105.14%***	-45.79%***	-57.15%***	-89.29%***	-77.57%***	-4.84%	-17.64%	-4.19%	-27.57%
Bottom Performers (NON PE=604 | PE =48)	31.87%***	37.58%***	24.91%***	19.53%***	-0.92%	10.32%**	11.84%	9.07%*	32.80%***	27.26%**	13.07%*	10.47%
Profitability ratios												
EBITDA margin												
Top Performers (NON PE=574 | PE=74)	0.96%**	0.47%	-0.82%***	-2.24%***	0.46%	0.17%	-1.82%**	-2.42%***	0.50%	0.30%	1.00%	0.18%
Bottom Performers (NON PE=608 | PE =44)	4.76%***	7.24%***	7.97%***	11.57%***	3.89%***	2.54%***	6.19%***	6.57%***	0.87%	4.70%	1.78%	5.01%
Operating ROA												
Top Performers (NON PE=576 | PE=76)	-0.47%*	-8.25%***	-11.24%***	-13.12%***	-0.58%	-4.51%***	-5.80%***	-9.93%***	0.11%	-3.73%	-5.43%	-3.18%
Bottom Performers (NON PE=610 | PE =42)	5.18%***	13.09%***	11.01%***	11.48%***	5.07%***	4.10%***	5.64%***	5.19%***	0.11%	8.99%**	5.37%**	6.29%

Figure XII: NON PE and PE post-IPO performance compared to Y_{-1} for Top Performers

This figure visualizes operational measures post-IPO compared to Y_{-1} for pre-IPO top performers. It only comprises firms from our *Hypothesis panel*, which solely include companies where all growth variables and profitability ratios of interest were available for relative years between Y_{-1} and Y_{+3}. Growth variables include Sales growth and EBITDA growth while profitability ratios include EBITDA margin and Operating ROA. Numbers represent median change in abnormal operating performance post-IPO compared to Y_{-1} in terms of percentage points. For example, Y_{+3} is the median in abnormal performance Y_{+3} subtracted by abnormal performance Y_{-1}. The analysis in this figure is done for pre-IPO top performers as all observations have been classified as either top performers or bottom performers dependent on whether they lie above or below the Y_{-1} median of that particular metric.
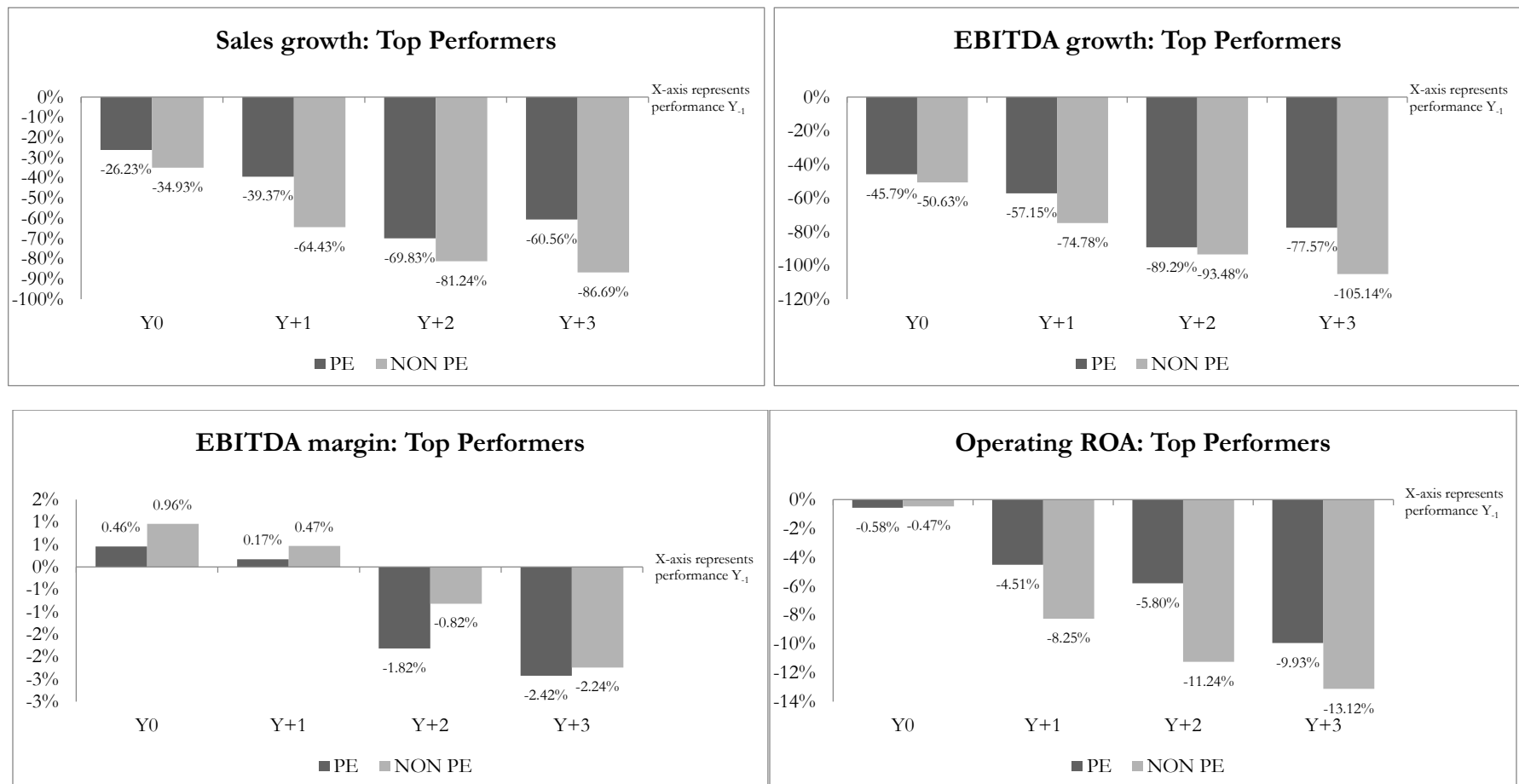
Figure XIII: NON PE and PE post-IPO performance compared to Y_{-1} for Bottom Performers

This figure visualizes operational measures post-IPO compared to Y_{-1} for pre-IPO bottom performers. It only comprises firms from our *Hypothesis panel*, which solely include companies where all growth variables and profitability ratios of interest were available for relative years between Y_{-1} and Y_{+3}. Growth variables include Sales growth and EBITDA growth while profitability ratios include EBITDA margin and Operating ROA. Numbers represent median change in abnormal operating performance post-IPO compared to Y_{-1} in terms of percentage points. For example, Y_{+3} is the median in abnormal performance Y_{+3} subtracted by abnormal performance Y_{-1}. The analysis in this figure is done for pre-IPO bottom performers as all observations have been classified as either top performers or bottom performers dependent on whether they lie above or below the Y_{-1} median of that particular metric.
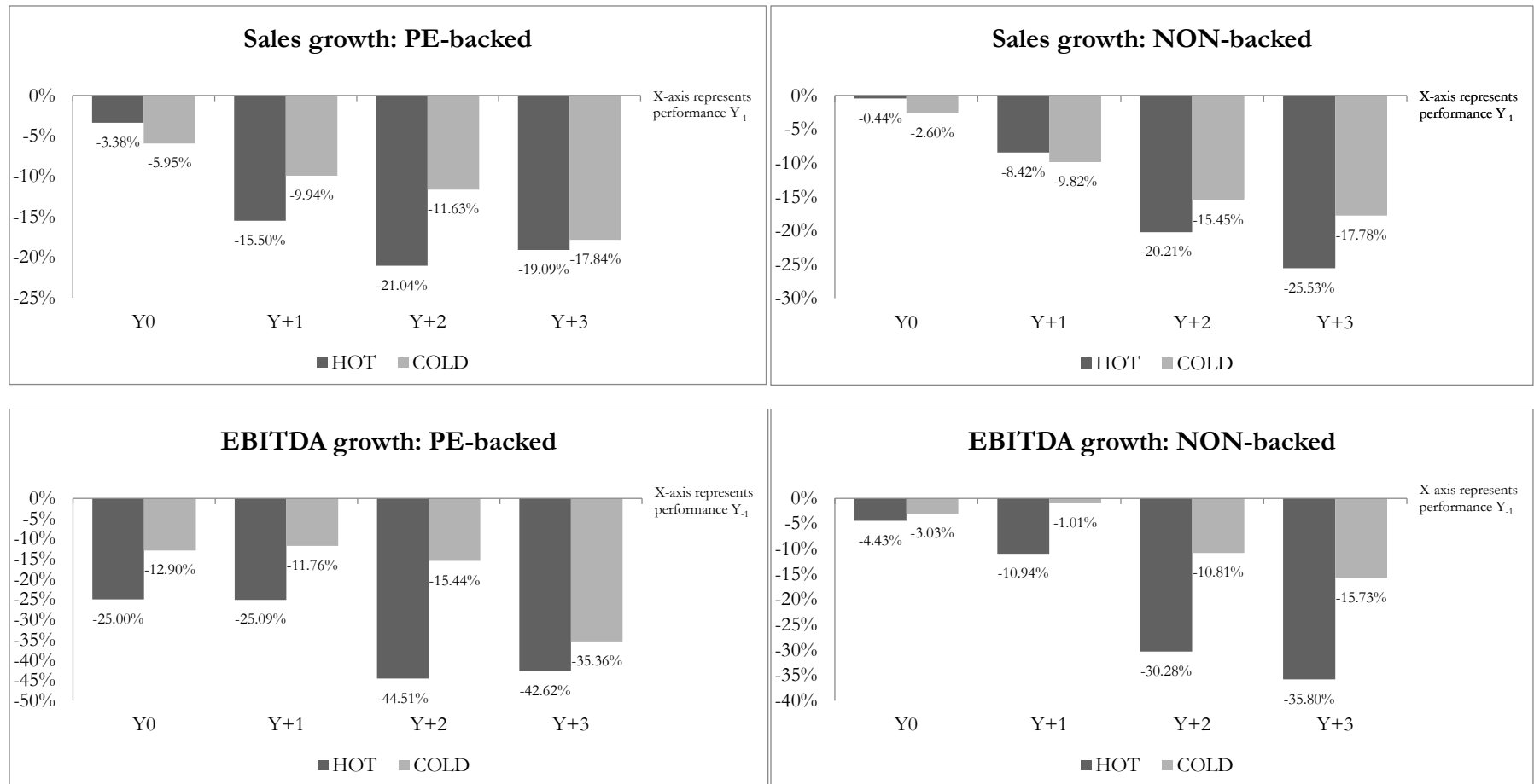

X
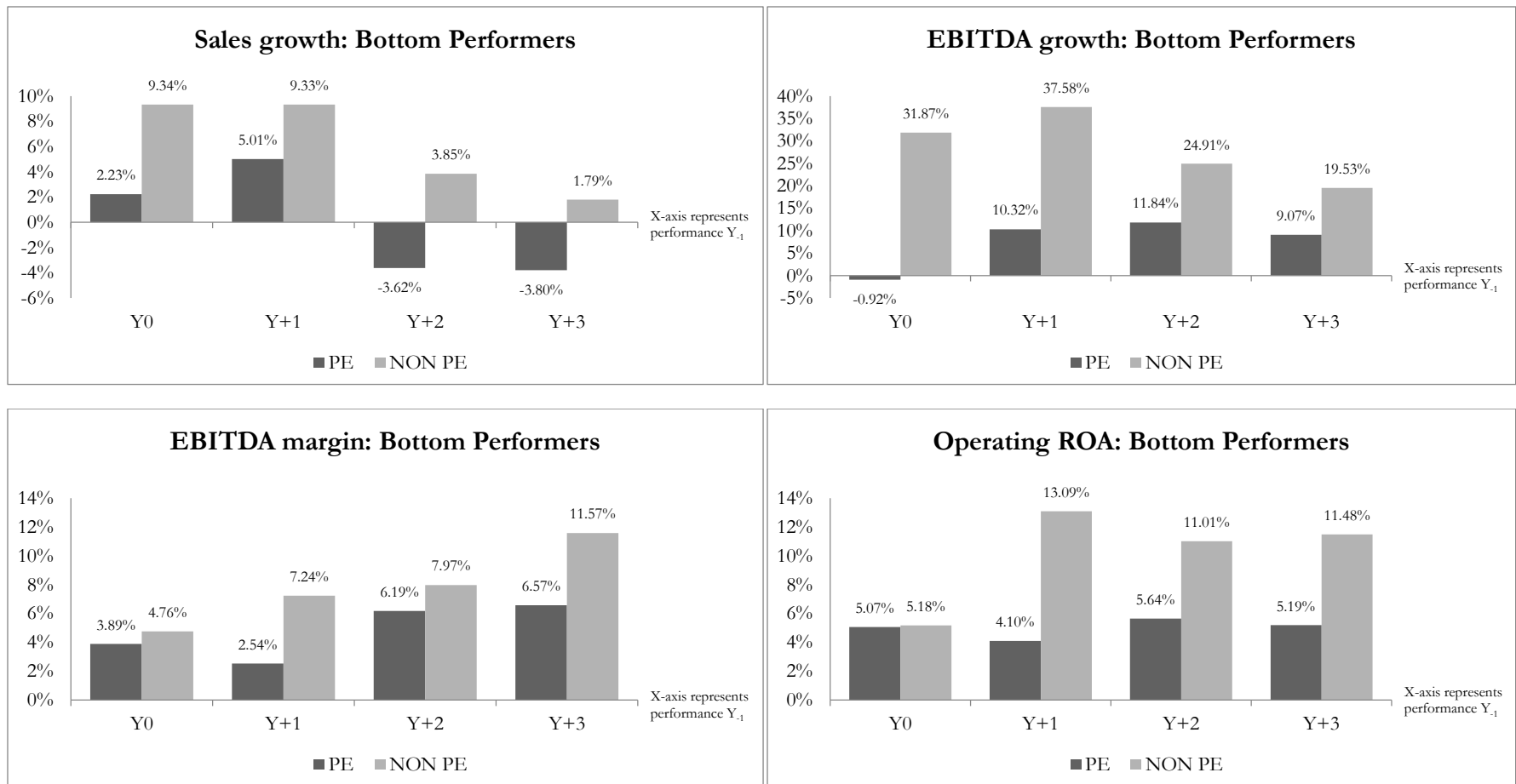
Table XIV: NON PE and PE post-IPO performance compared to Y_{-1} sorted by market conditions

This table provides summary statistics for operational measures post-IPO compared to Y_{-1} sorted by market conditions, where the numbers in subscript denotes the relative years from the IPO. It only comprises firms in our *Hypothesis panel*, which solely include companies where all growth variables and profitability ratios of interest were available for relative years between Y_{-1} and Y_{+3}. Numbers represent median change in abnormal operating performance post-IPO compared to Y_{-1} in terms of percentage points. For example, Y_{+3} is the median in abnormal performance Y_{+3} subtracted by abnormal performance Y_{-1}. The IPOs have been sorted on hot and cold market conditions, where an IPO occurs during a "hot" year if the amount of capital raised from global IPO activity lies above the yearly average during the timeframe 1997-2009. Wilcoxon signed-rank test is used to determine whether there is a difference in location between the median of the operational measures post-IPO and those of Y_{-1}. Wilcoxon rank-sum test (Mann-Whitney) is used to determine whether there are differences in the location of the median of the post-IPO change in abnormal operating performance between hot and cold IPO markets for our two groups. Significance at the 1%, 5% and 10% are represented by ***, ** and * respectively.

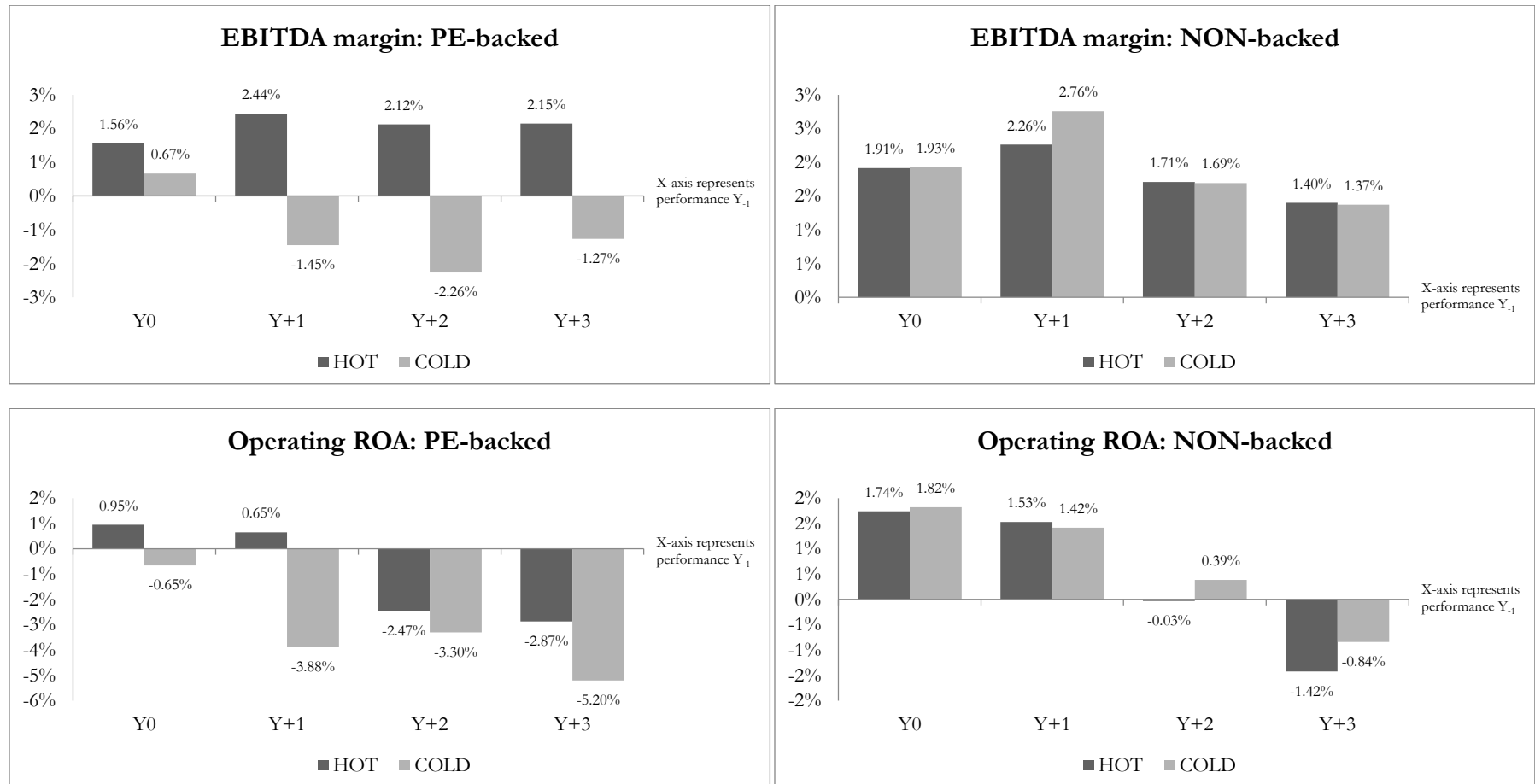| Change in percentage points compared to Y_{-1}	COLD				HOT				Diff in Median (COLD minus HOT)			
	Y_0	Y_{+1}	Y_{+2}	Y_{+3}	Y_0	Y_{+1}	Y_{+2}	Y_{+3}	Y_0	Y_{+1}	Y_{+2}	Y_{+3}
Growth variables												
Sales growth												
PE (COLD=40 | HOT=78)	-5.95%*	-9.94%**	-11.63%***	-17.84%***	-3.38%	-15.50%***	-21.04%***	-19.09%***	-2.57%	5.56%	9.41%	1.25%
NON PE (COLD=431 | HOT=755)	-2.60%***	-9.82%***	-15.45%***	-17.78%***	-0.44%	-8.42%***	-20.21%***	-25.53%***	-2.16%*	-1.40%	4.75%	7.76%*
EBITDA growth												
PE (COLD=40 | HOT=78)	-12.90%*	-11.76%***	-15.44%***	-35.36%***	-25.00%***	-25.09%***	-44.51%***	-42.62%***	12.10%	13.33%	29.07%	7.26%
NON PE (COLD=431 | HOT=755)	-3.03%	-1.01%	-10.81%***	-15.73%***	-4.43%	-10.94%***	-30.28%***	-35.80%***	1.40%	9.94%	19.47%**	20.07%**
Profitability ratios												
EBITDA margin												
PE (COLD=40 | HOT=78)	0.67%	-1.45%*	-2.26%**	-1.27%	1.56%***	2.44%***	2.12%**	2.15%	-0.90%	-3.89%***	-4.38%***	-3.42%*
NON PE (COLD=431 | HOT=755)	1.93%***	2.76%***	1.69%***	1.37%***	1.91%***	2.26%***	1.71%***	1.40%***	0.02%	0.49%	-0.01%	-0.03%
Operating ROA												
PE (COLD=40 | HOT=78)	-0.65%	-3.88%***	-3.30%***	-5.20%***	0.95%	0.65%	-2.47%	-2.87%	-1.60%	-4.53%***	-0.83%	-2.33%
NON PE (COLD=431 | HOT=755)	1.82%***	1.42%***	0.39%	-0.84%	1.74%***	1.53%***	-0.03%**	-1.42%	0.08%	-0.12%	0.41%	0.58%

Figure XV: NON PE and PE growth variables post-IPO compared to Y_{-1} sorted by market conditions

This figure visualizes growth variables post-IPO compared to Y_{-1} sorted by market conditions. It only comprises firms in our *Hypothesis panel*, which solely include companies where all growth variables and profitability ratios of interest were available for relative years between Y_{-1} and Y_{+3}. Numbers represent median change in abnormal operating performance post-IPO compared to Y_{-1} in terms of percentage points. For example, Y_{+3} is the median in abnormal performance Y_{+3} subtracted by abnormal performance Y_{-1}. The IPOs have been sorted on hot and cold market conditions, where an IPO occurs during a "hot" year if the amount of capital raised from global IPO activity lies above the yearly average during the timeframe 1997-2009.

Figure XVI: NON PE and PE profitability ratios post-IPO compared to Y$_{-1}$ sorted by market conditions

This figure visualizes profitability ratios post-IPO compared to Y$_{-1}$ sorted by market conditions. It only comprises firms in our *Hypothesis panel*, which solely include companies where all growth variables and profitability ratios of interest were available for relative years between Y$_{-1}$ and Y$_{+3}$. Numbers represent median change in abnormal operating performance post-IPO compared to Y$_{-1}$ in terms of percentage points. For example, Y$_{+3}$ is the median in abnormal performance Y$_{+3}$ subtracted by abnormal performance Y$_{-1}$. The IPOs have been sorted on hot and cold market conditions, where an IPO occurs during a "hot" year if the amount of capital raised from global IPO activity lies above the yearly average during the timeframe 1997-2009.

Table XVII: Robust regression results

This table reports the results of a robust regression, where the dependent variables represent the change in percentage points between abnormal performance in Y_{+3} and the abnormal performance in Y_{-1} for the operating performance variables Sales growth, EBITDA growth, EBITDA margin and Operating ROA. PE is a dummy variable that is equal to one if the IPO was backed by a private equity firm. HOT IPO market is a dummy variable that acts as a proxy for favourable market conditions. An IPO occurs during a "hot" year when the amount of capital raised from global IPO activity lies above the yearly average during the timeframe 1997-2009. Floatsize is a dummy variable that acts as a proxy for ownership retention. The variable is equal to one for the observations that have a float rate lower than the median of all observations in our *Hypothesis panel*. Significance at the 1%, 5% and 10% are represented by ***, ** and * respectively.

Change in percentage points Y_{-1} to Y_{+3}	Sales growth	EBITDA growth	EBITDA margin	Operating ROA
PE	-6.96%	-15.20%	-5.03%	-2.72%
HOT IPO market	-3.26%	-14.50%**	-3.28%*	-3.41%**
HOT IPO market & PE	13.00%*	13.70%	5.49%	7.85%**
Floatsize	-5.26%*	-10.10%	-3.11%*	-0.18%
Floatsize & PE	3.71%	12.50%	0.46%	-1.81%
Log (Tot assets Y_{-1})	-0.24%	4.08%**	1.74%***	2.09%***
Δ Leverage	-0.33%	-11.20%	0.08%	-6.03%***
Additional control variables				
Pre-performance characteristics	Included	Included	Included	Included
Region	Included	Included	Included	Included
Industry fixed effects	Included	Included	Included	Included
Constant	-41.90%**	5.90%	8.73%	1.91%
Number of observations	459	459	459	459
PE	70	70	70	70
NON PE	389	389	389	389

Figure XVIII: Cook's distance

This table contains computed Cook's distance for each dependent variable, i.e. change in percentage points between abnormal performance in Y_{-1} and the abnormal performance in Y_{+3} for our operating performance measures. Observations with Cook's distance larger than three times the mean Cook's distance can be considered as outliers.
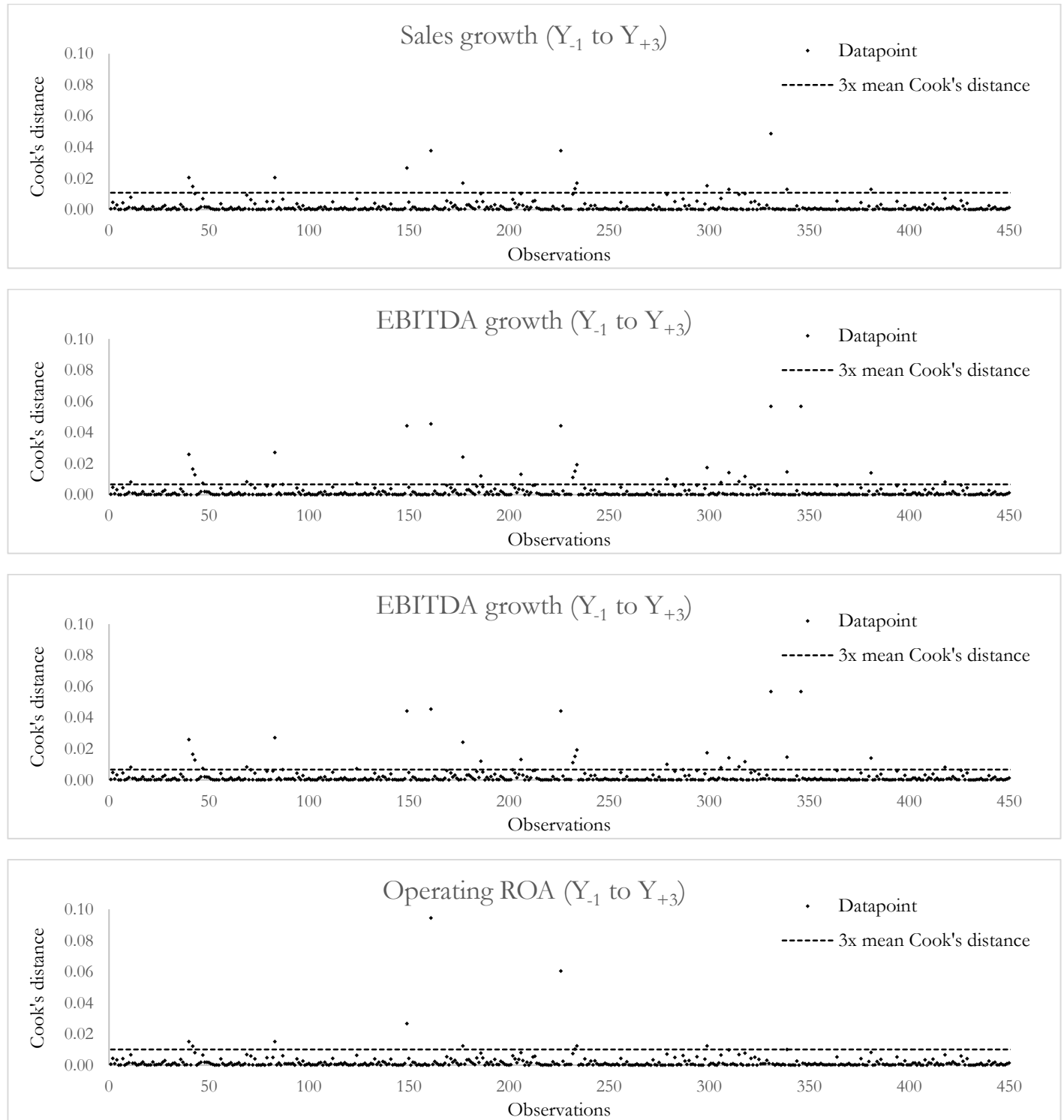
Table XIX: NON PE and PE post-IPO performance compared to Y_{-1}, (Robustness panel)

This table provides summary statistics for operational measures post-IPO compared to Y_{-1}, where the numbers in subscript denotes the relative years from the IPO. It comprises firms in our *Robustness panel*, which includes observations that do not necessarily have all growth variables and profitability ratios of interest available between Y_{-1} and Y_{+3}. In total, it contains 198 PE-backed companies and 2,958 non-backed companies. Growth variables include Sales growth and EBITDA growth while profitability ratios include EBITDA margin and Operating ROA. Numbers represent the median change in abnormal operating performance post-IPO compared to Y_{-1} in terms of percentage points. For example, Y_{+3} is the median in abnormal performance Y_{+3} subtracted by abnormal performance Y_{-1}. We use a Wilcoxon signed-rank test to determine whether there is a difference in location between the median of the operational measures post-IPO and those of Y_{-1}. Wilcoxon rank-sum test (Mann-Whitney) is used to determine whether there are differences in the location of the median of the post-IPO change in abnormal operating performance between non-backed and PE-backed companies. Significance at the 1%, 5% and 10% are represented by ***, ** and * respectively.

Change in percentage points compared to Y_{-1}	NON PE				PE				Diff in Median (NON PE minus PE)			
	Y_0	Y_{+1}	Y_{+2}	Y_{+3}	Y_0	Y_{+1}	Y_{+2}	Y_{+3}	Y_0	Y_{+1}	Y_{+2}	Y_{+3}
Growth variables												
Sales growth	-0.87%**	-9.06%***	-18.58%***	-21.67%***	-4.98%***	-12.16%***	-17.31%***	-18.87%***	4.12%*	3.10%	-1.28%	-2.81%
EBITDA growth	-3.41%	-12.67%***	-29.21%***	-30.52%***	-16.62%***	-24.01%***	-31.50%***	-35.97%***	13.21%***	11.34%	2.30%	5.44%
Profitability ratios												
EBITDA margin	2.24%***	2.95%***	1.95%***	1.87%***	0.79%	0.27%	-0.91%	0.38%	1.45%***	2.68%***	2.86%***	1.49%**
Operating ROA	2.22%***	3.07%***	1.29%***	0.42%***	-0.84%	-2.26%*	-3.21%***	-3.45%***	3.05%***	5.33%***	4.50%***	3.87%***