

A study on the performance of private equity owned companies during booms and busts

Abstract:

The benefits of private equity ownership are by many deemed to be substantial. Analysing operating performance of private equity owned companies in the US during economic upturns and downturns for the periods 1997-2002 and 2005-2009, we find conflicting results with regards to their performance relative to peers. EBITDA margin is lower for private equity owned companies during the first period and comparable during the second period. The private equity owned companies are however found to outperform in terms of sales growth during both upturn periods while no significant difference is found during the downturn periods. To conclude, our results indicate that the effects of private equity ownership differs with regards to different time periods and characteristics of portfolio companies.

Keywords: Private equity, Buyouts, Financial crises, Portfolio companies

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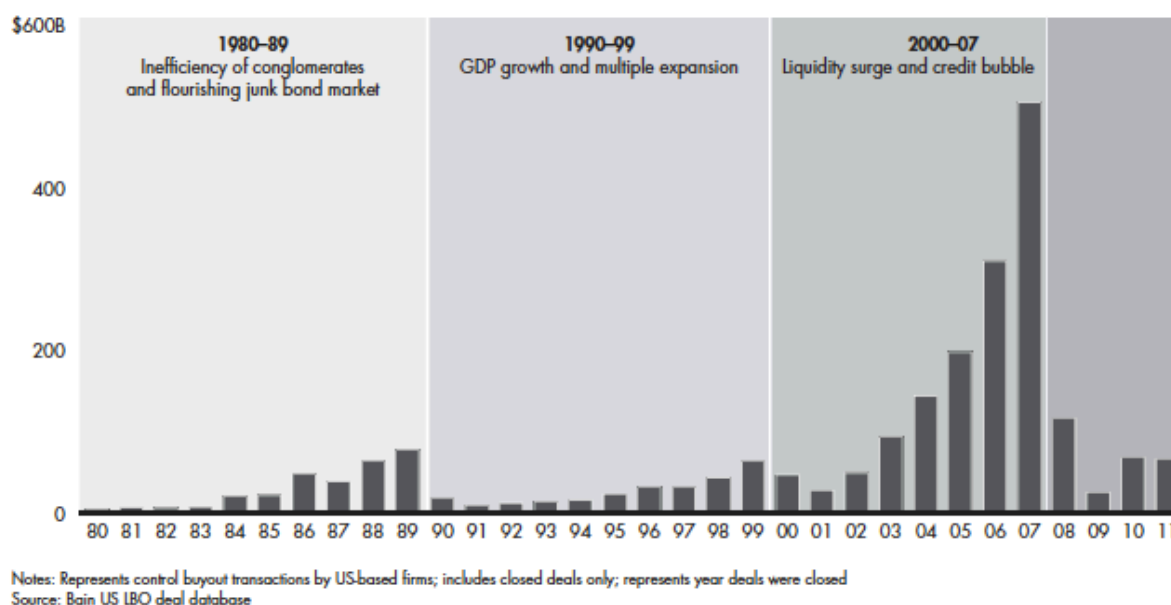
I Introduction

The recent fast growth and volatility of the private equity industry inevitably raises questions on the performance of private equity funds and the value creation of private equity as an ownership class. Most previous research focuses on the returns of private equity funds rather than the value creation in their portfolio companies. In this paper we will thus analyse the performance of private equity owned companies in relation to non-private equity owned peers. To assess how and when the potential value creation occurs, our analysis will focus on the performance during upturns and downturns of the recent financial crises, given the boom and bust nature of the industry. We also aim to analyse if there are any patterns in the relative performance depending on upturns and downturns. Although private equity is a popular area of research within finance, this particular approach has not to the best of our knowledge been previously undertaken and will add a deeper understanding to private equity performance.

The private equity industry has increased in size dramatically during the last decades and has become one of the major forces in corporate finance. Since its emergence as a major asset class in the early 1980's, the private equity industry has been notoriously volatile and experienced three major boom and bust cycles. Each cycle has illustrated the private equity industry's adaptive capabilities, capitalizing on constantly evolving financial markets. During the late 1980's, the sale of poorly run public companies and conglomerate divestitures enabled significant operational improvements. This in combination with a flourishing junk bond market led to highly leveraged deals and inflated returns. The rally however ended abruptly following the collapse of the junk bond market, the savings-and-loan crisis and the recession of the early 1990's. The following decade saw a much more moderate private equity industry, no longer driven by high leverage but rather by strong GDP growth and increasing price-to-earnings multiples. This led to a new surge in buyout volumes during the late 1990's, ending with the IT-bubble and a new recession in 2001. The "golden era" of private equity however started in the mid 2000's, as innovative structured financial products dramatically increased the amount of available leverage. This, in combination with low interest rates and favourable fund-raising conditions, fuelled the industry to reach a total buyout transaction volume exceeding \$500 billion in 2007, only in the US. (Bain & Company, 2010)

In 2007 the credit crisis vastly limited the amount of available debt financing, leading to a decrease in transaction volumes of 94% in the fourth quarter compared to the previous year (Shivdasani & Wang, 2011). As a result, private equity companies experienced mark-to-market losses of 30-40% of their holdings (Rizzi, 2009). An overview of the private equity industry's cyclical emergence in the US can be seen in figure 1 below.

Figure 1 - Buyout transaction volume in the US 1980-2011, Source: (Bain & Company, 2012)



When looking at available research regarding performance of private equity funds and portfolio companies, a somewhat dispersed pattern appears. On the one hand there are studies that claim that private equity funds outperform the market irrespective of what risk is assigned to the investment (Robinson & Sensoy, 2011). Some also claim that private equity has outperformed the S&P 500 for almost all vintage years since 1980 (Higson & Stucke, 2012). On the other hand some, albeit criticized, studies show a contradicting picture of an on par or lower performance for private equity funds (e.g. (Phalippou & Gottschalg, 2009) (Kaplan & Schoar, 2005)). These contradicting views continue when looking at the performance of private equity owned portfolio companies.

The logic behind value creation in private equity owned companies is primarily based on the private equity owners improving operations, financing structure and governance (Kaplan & Strömberg, 2009). These changes are found to have a positive effect on firm value and/or

operating performance by incentivising, putting pressure on and extending the knowledge available to the management team of the portfolio companies (Cressy, Munari, & Malipiero, 2007) (Kaplan & Strömberg, 2009)). There are however examples of studies where the operating performance for the private equity owned companies is comparable to or even inferior to their peers (e.g. Vinten (2008) and Leslie & Oyer (2008)). Thus, even if the majority of studies conclude that there is a positive relationship between private equity ownership and operating performance, some contradicting views do exist.

Building on the consensus that private equity funds on average outperform the market, we find it likely that private equity owned companies on average should have a superior operating performance compared to non-private equity owned peers. Given a higher risk due to excessive leverage, private equity owned companies should outperform during upturns and underperform during downturns, all else equal. However, building on previous research regarding operational and managerial improvements imposed on portfolio companies by private equity owners, we believe that the performance difference derives from a significant outperformance during upturns but an insignificant underperformance during downturns. Hence, we frame our hypothesis as; significantly better performance for private equity owned companies during upturns and not significantly worse performance during downturns. We believe that evaluating the performance of private equity owned companies during differing economic climates, gives a deeper understanding of the dynamics of their relative performance.

This paper thus studies the performance of private equity owned companies relative to non-private equity owned peers during the economic upturns and downturns throughout the two most recent financial crises. Firstly, we analyse if private equity owned companies have outperformed non-private equity owned peers in terms of operating performance by looking at EBITDA margin and sales growth. Secondly, we study if there is a difference in the relative performance of the private equity owned companies during economic upturns and downturns.

The study includes a total of 1,263 companies for the 1997-2002 period and 967 companies for the 2005-2009 period, of which 94 and 122 are included in our sample of private equity owned companies for each period respectively. The sample and peer groups are subdivided based on industry and size to study and control for the differences within these groups. We find that private equity owned companies in general have a lower or comparable EBITDA margin compared to non-private equity owned companies with a few exceptions. The results differ between the two periods as the first period shows a significant EBITDA margin underperformance by private equity owned companies, compared to the second period where no

significant difference was found. We do however find that companies in certain size and industry group do outperform in relation to non-private equity owned peers. Small private equity owned companies within service and manufacturing are found to have a significantly higher EBITDA margin compared to peers during the second period (2005-2009). We believe that these results can be a consequence of the large impact that governance and operational improvements have on small companies within these industries. Hence, it is plausible that small companies within e.g. the service industry can benefit more from active knowledgeable owners to improve profitability.

In terms of sales growth, we find an almost conclusively higher performance for private equity owned companies during upturns, and an insignificant performance difference during downturns in both periods. These results are in line with prevailing research, however somewhat contradicting the negative relationship found with regards to EBITDA margin during the first period.

We can thus conclude, based on our study, that the benefit of private equity ownership differs among industry and size groups. Some subgroups of the private equity owned companies display a significantly higher operating profitability in terms of EBITDA margin compared to non-private equity owned peers. However, the majority of the private equity owned companies show a comparable or lower EBITDA margin. The findings are to a certain extent in line with existing literature since we find that private equity in many cases are value and performance enhancing especially in terms of sales growth. A generally negative effect of private equity ownership on EBITDA margin during one of the periods is however not in line with our hypothesis or prevailing research.

The remainder of the paper is structured as follows. In section II of this paper we introduce the reader to an overview of the previous research that has been conducted within the field of private equity fund and portfolio company performance. We then motivate and present our hypotheses in section III and give an overview of the methodology of the study in section IV. In section V we describe the data used in the study and continue by presenting the empirical results in section VI. Lastly, in section VII we conclude our findings and discuss the implications of our results.

II **The private equity industry and previous research**

In this section, we briefly introduce the reader to previous relevant research within the field and give an overview of the historical performance of private equity funds and the private equity industry in general.

The three cycles of the private equity industry

The evolution of the private equity industry as we know it today has mainly taken place during the past 30 years, following a volatile path through three major boom and bust cycles. This section will give a brief overview of these different cycles as they lay the foundation for the history of the private equity industry and its characteristics today.

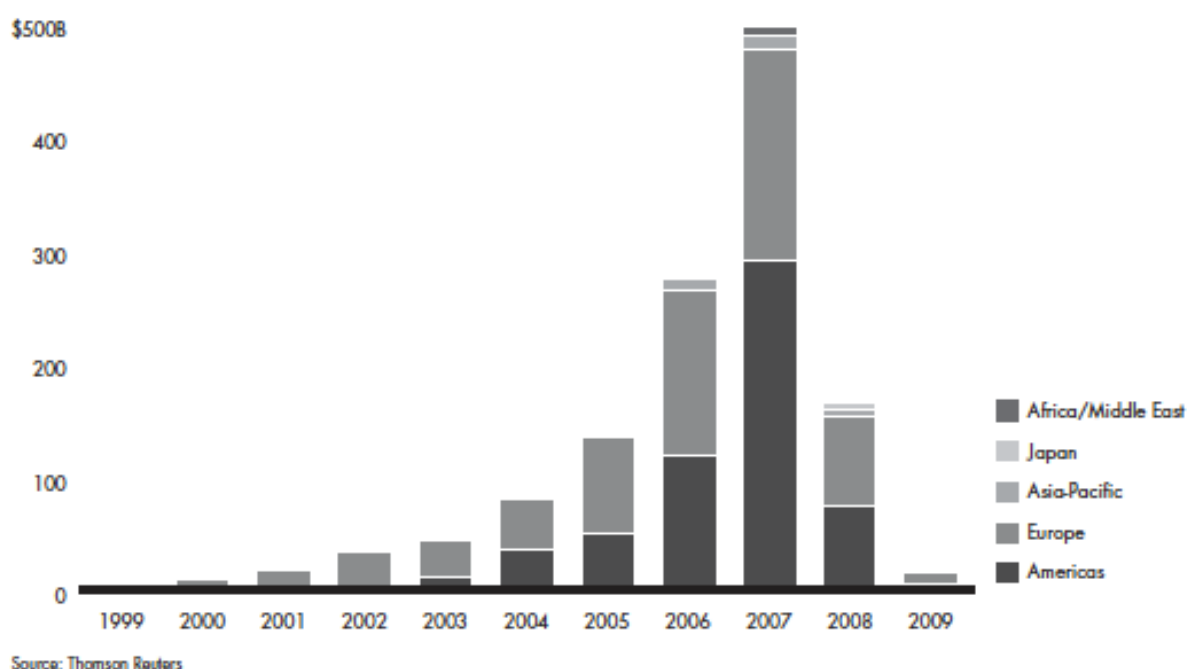
The late 1980s is by many seen as the “first wave” of private equity, where many funds made attractive returns in a relatively short period of time by exploiting corporate inefficiencies prevailing in the market (e.g. (Vinten, 2008), (Rizzi, 2009) (Guo, Hotchkiss, & Song, 2011)). These inefficiencies were a result of the previous conglomerate wave in the 1960s, where many companies sought to diversify its operations to reduce risk, gain management synergies and make use of internal capital markets (Matsusaka, 1993). A changing corporate environment in the 1980’s following more liberal antitrust regulations, the rise of the junk bond market and improved shareholder control mechanisms however led conglomerates to de-diversify and divest non-core operations (Blair, 1993). This provided private equity companies with vast investment opportunities at discounted prices, resulting in high returns and a fast growing private equity industry. The first wave culminated with KKR’s \$25 billion buyout of RJR Nabisco in 1988, portrayed in several movies, books and newspapers as a testimony of the inflated prices and greed prevailing at the time (e.g. (Time Magazine, 1988), (Burrough & Helyar, 1989)). During the early 1990’s buyout volumes came to an abrupt halt, following the crash of the junk bond market and the recession in 1990, leading to a number of private equity related multibillion bankruptcies during the following years ((Rizzi, 2009) (Guo, Hotchkiss, & Song, 2011)).

During the coming five years, private equity activity remained low and did not recover again until the rise of the IT-bubble in the late 1990’s (Bain & Company, 2010). M&A activity in general was high during this period, driven by globalisation and new technology. Buyout volumes in the US during this cycle however did not reach the levels of the 1980’s and were far from those during the coming cycle of 2003-2007. This is mainly explained by a focus on other markets and buyouts being driven by GDP growth and multiples expansion rather than leverage, due to a lack of credit abundance as in the other cycles (Bain & Company, 2010). What is commonly called the “second wave” in private equity thus refers to the 2003-2007 period, skipping the late 1990’s period.

Not until the beginning of the “second wave”, commencing in 2003, did the industry reach and exceed the levels that had prevailed during the 1980’s (Rizzi, 2009). Following a period of reduced market volatility, known as the “great moderation”, many investors felt a false sense of security and increased their risk profile. Pension funds and endowments thus became attracted to the high yields of private equity, which also offered potential diversification benefits (Rizzi, 2009).

During this period, debt capital markets experienced drastic changes as loans were increasingly bundled into structured financial products and sold to investment vehicles (Shivdasani & Wang, 2011). This way of handling capital vastly increased the available amount of leverage and transformed loan markets from an institutional bank market to a capital market ((Rizzi, 2009) (Guo, Hotchkiss, & Song, 2011)). The massive amount of capital available to private equity funds led to increased competition and higher valuations. The focus of private equity firms hence shifted from conducting operational improvements to using financial engineering to motivate their fully-priced deals. This resulted in over-priced and excessively leveraged deals that depended on receptive capital markets for funding and exit. The pricing multiples reached levels comparable to the first wave and private-to-private investments increased dramatically. (Rizzi, 2009)

Figure 2 - Loan issuance for LBO transactions 1999-2009, Source: (Bain & Company, 2010)



During the summer of 2007, capital markets collapsed as a result of the subprime crisis and private equity firms were no longer able to obtain funding. The crash of the credit markets imposed dramatically lower valuations as leverage dried up, leading to a lower deal flow and

decreased exit opportunities. Fundraising became almost impossible and mark-to-market losses of between 30-40 % occurred at e.g. KKR, Blackstone and Carlyle. Figure 2 gives an overview of the dramatic boom and bust cycle of the LBO market during this time, depicting the loan issuance to LBO transactions during 1999-2009. In 2009 the market stabilized at a low level and during the first quarter the same year, transaction intensity was at a 6-year low despite decreasing acquisition prices. (Rizzi, 2009)

Previous research within private equity performance

To provide an overview of the previous research that has been conducted in areas of relevance to our topic, we start by summarizing the findings of research within private equity fund performance and then move on to the performance of private equity portfolio companies. Although these topics are interconnected, they are not entirely the same and are often researched separately. The main difference between fund performance and the performance of the underlying companies concern the fund fee structure and varying degrees of financial engineering. Thus even if the underlying portfolio companies outperform the market, the net-of-fee return to investors may not do so.

The performance of private equity funds is a relatively hot topic within financial research and is thus a well-documented area. The performance of private equity portfolio companies, which is of greater relevance to our study, is however not as frequently examined. The following section is thus a brief summary of previously conducted research that is of relevance to our topic and not in any way a representation of all the literature available in the area.

The performance of private equity funds

Following the dramatic increase in funds allocated to private equity investments during the past decades, the field has become an increasingly popular area of research. Generally, most papers study the gross-of-fee or net-of-fee performance of buyout funds and venture capital funds by typically comparing the returns to the S&P 500 or similar indices. The bulk of previous research indicate that private equity has outperformed the market, although some contradicting views exist. (e.g. (Phalippou & Gottschalg, 2009) (Harris, Jenkinson, & Kaplan, 2012) (Kaplan & Schoar, 2005))

The private equity industry is highly cyclical and driven by recent returns and interest rates relative to earnings and stock market values. Thus different fund vintage years have a strong effect on subsequent returns, as funds raised during “hot markets” will be faced with poorer investment opportunities and a likely economic downturn (Kaplan & Strömberg, 2009)

(Robinson & Sensoy, 2011). A strong persistence in returns has also been found between funds raised by the same private equity partnership. Thus the returns of previously raised funds by private equity firms are found to be strong predictors of future fund returns (Kaplan & Schoar, 2005). There is however strong empirical support that private equity on average create economic value (Kaplan & Strömberg, 2009). One such example is a recent study by Higson and Stucke (2012), where U.S. buyout funds are found to have on average outperformed the S&P 500 for almost all vintage years since 1980.

The performance of private equity funds is often measured as both gross-of-fee and net-of-fee returns. Depending on the methodology and time period, different studies find varying results on the funds' performance. Gross-of-fee returns are found to be higher than the S&P 500 index returns by both Kaplan & Schoar (2005) and Phalippou & Gottschalg (2009). Net-of-fee returns are however found to be comparable or lower for the private equity funds, also depending on how the risk adjustment is made (Kaplan & Schoar, 2005) (Phalippou & Gottschalg, 2009). These studies have however been heavily debated since the data used is by many regarded to be underestimating the performance of private equity funds (e.g. (Harris, Jenkinson, & Kaplan, 2012) (Higson & Stucke, 2012)).

The risk of private equity funds, measured by its beta, has been estimated at different levels through several different methods in previous research reports. Given the difficulties of making accurate estimates of beta, Robinson & Sensoy (2011) instead examines how the inferred relative performance of private equity funds change when varying the beta between zero and three. To address this question, the authors use public market equivalent (PME)¹ as a performance measure to assess the relative performance of private equity. This measure reflects the net-of-fees return obtained from a private equity investment compared to the return that LPs would have obtained from an equal investment in public markets (S&P 500), measured during the time between capital calls and distributions. By introducing a beta to the PME calculation² and levering the public

¹ Public market equivalent (PME) = $\frac{\sum_{t=0}^T \frac{D_t}{\pi_{t=0}^{1+r_t}}}{\sum_{t=0}^T \frac{C_t}{\pi_{t=0}^{1+r_t}}}$ where D_t and C_t are, respectively, capital distributions and calls occurring at time t , and r is the (time-varying) realized return on the S&P 500 index

² Levered public market equivalent (LPME) = $\frac{\sum_{t=0}^T \frac{D_t}{\pi_{t=0}^{1+\beta r_t}}}{\sum_{t=0}^T \frac{C_t}{\pi_{t=0}^{1+\beta r_t}}}$ introduces a beta parameter to obtain a risk-adjusted measure

market benchmark, the risk-adjusted performance of private equity can be analysed for different values of beta.

Robinson & Sensoy (2011) find that varying the beta between 0 and 1 has significant impact on levered PME returns, however further increases in beta renders strongly diminishing effects, implying a convex function. Interestingly, the levered PME measure is greater than 1 for all levels of beta. This implies that private equity investments during the period of study have outperformed the public market significantly, regardless of the risk one assigns to the investments.

To conclude the previous research on private equity fund performance, although the net-of-fee performance is questioned in certain studies, there is consensus that they on average outperform the market on a gross-of-fees basis.

The performance of private equity portfolio companies

The performance of private equity portfolio companies has been debated widely in the academic community and much research has been made investigating how these companies perform in relation to non-private equity owned peer companies. A vast majority of reports state that private equity ownership has a positive effect on firm value and/or operating performance e.g. Guo et al. (2011), Kaplan & Strömberg (2009), Cressy et al. (2007).

There are a number of different categories of changes that private equity companies often impose on portfolio companies e.g. operational, governance and financial (Kaplan & Strömberg, 2009). There is strong empirical support that these changes result in increased productivity and operational improvements. In addition, value increases of LBOs can apart from this also be due to a rise in industry valuation multiples (Guo, Hotchkiss, & Song, 2011). As to what extent the different changes affect the value, Gou et al. (2011) state that operational improvements and changes in valuation multiples on average account for 20% each of the returns to pre-buyout capital, whilst the effects of tax shields can be significantly larger.

In terms of financial and governance changes, private equity companies often require substantial equity investments from the management team. This is made to incentivise the managers in an aligned way by both a significant upside and downside potential (Kaplan & Strömberg, 2009). In addition, the high levels of leverage typically associated with buyouts create not only tax shields, but also a pressure on managers not to waste money in order to be able to cope with interest and principal payments (Baker & Wruck, 1989). Finally, the boards of private equity owned companies are typically smaller and meet more often than comparable peers. The private equity

owners are often heavily involved in order to take an active role in managing their investments and maximising the return. (Kaplan & Strömberg, 2009). The active ownership should be considered to be one of the success factors since it has been shown that there is a negative relationship between the quantity of simultaneous investments and performance (Lopez de Silanes, 2011). As an indication of the effect on performance Cressy et al. (2007) claim that private equity owned companies have a 4.5% higher EBIT margin compared to non-private equity owned peers. A figure that they state increases further by 6%-8.5% if the private equity company is industry specific and thus have specialist knowledge. Hence, the pressure, incentives, knowledge and governance specific factors seem to play a significant role in achieving improved performance for the portfolio companies.

There is however research that present a contradictory view of the value creation of private equity ownership e.g. Vinten (2008), Desbrières & Schatt (2002) and Leslie and Oyer (2008). Both Vinten (2008) and Desbrières & Schatt (2002) claim that private equity owned companies perform worse than their peers. They find a significantly negative effect on operating performance due to the private equity ownership and discard the superior private equity governance idea. Even though these studies are conducted in a different geographic region, Denmark and France respectively, we find them interesting as examples of LBO value deterioration. It should however be noticed that a more recent study by Boucly et al. (2011) on French LBOs show contrasting results with increased profitability and growth for portfolio companies relative to peers. Hence, the results are ambiguous in terms of the performance of French LBOs.

There is also research that finds no major difference in operating performance due to ownership structure e.g. Leslie and Oyer (2008) and Guo et al³ (2011). These studies claim that the operating performance for private equity owned companies are comparable or in certain cases only slightly higher than for non-private equity owned companies.

To summarize, there is vast support for the claim that private equity ownership is value creating in terms of improved operating performance. Private equity owners do typically impose changes to the financial structure, improve operations and align incentives for the management. There is a

³ The authors still find value creation due to private equity ownership, however this is primarily an effect of increases in valuation multiples and financial engineering.

consensus in previous research that private equity portfolio companies on average perform better than comparable non-private equity owned peers. These results are however not unanimous and are based on data from many different countries and time periods. Some studies also claim that there is no difference or even that private equity owned companies perform worse than their peers, e.g. Vinten (2008), Desbrières and Schatt (2002) and Leslie and Oyer (2008).

III Hypotheses

In this section, we present and motivate the hypotheses that we aim to study in the paper. These are based on the theoretical framework and previous research previously presented.

By evaluating previous research conducted within our field of study, we conclude that the majority of the reports find that private equity owned companies in general have outperformed their peers. In line with the bulk of previous research, our hypotheses are based on the overall outperformance of private equity owned companies relative to their peers. Our belief is however that the relative performance of private equity owned companies varies during different time periods and economic climates. More specifically, we believe that the outperformance of private equity owned companies derive from significantly better operating performance during upturns but no significant underperformance during downturns. Given the high risk of private equity investments, one would expect to observe relative outperformance during upturns and underperformance during downturns. Our belief is however that the improved managerial and shareholder control mechanisms outweighs these tendencies, resulting in improved performance during downturns. Our hypotheses are presented and summarized below.

Better performance during economic upturns

H₁: Private equity owned companies have had a significantly better operating performance compared to non-private equity owned companies during the economic upturn in 1997-1999.

H₂: Private equity owned companies have had a significantly better operating performance compared to non-private equity owned companies during the economic upturn in 2005-2007.

Not significantly worse performance during economic downturns

H₃: Private equity owned companies have not had a significantly worse operating performance compared to non-private equity owned companies during the economic downturn in 2000-2002.

H₄: Private equity owned companies have not had a significantly worse operating performance compared to non-private equity owned companies during the economic downturn in 2008-2009.

IV Method

This section gives a thorough review of how the study has been conducted with regards to data selection, data processing, selection of performance metrics and statistical methods employed.

Study methodology

To test our hypotheses we analyse data on private equity owned companies in the US, before and after the crises of 2000 and 2008. The study period for the crisis of 2000 is defined as 1997-2002, during which 1997-2000 marks the upturn years and 2001-2002 marks the downturn years. For the crisis of 2008, the period of study is defined as 2005-2009, during which 2005-2007 marks the upturn years and 2008-2009 marks the downturn years. The different lengths of the periods of study are due to differing characteristics of the economic cycles during the two crises.

All data has been obtained through the database CapitalIQ, which proved to be the database at our disposal with the largest amount of available financial data. For each of the two studied crises, we have identified both a sample group of companies that have been owned by a private equity company during the period of study as well as a peer group of companies that does not fulfil this criteria. Private equity ownership has been established by first constructing a list comprising all companies that have been subjects to a buyout during the three years prior to each observation period. All companies that have been majority owned by one or several private equity companies at the beginning of the observation period have then been identified manually.

Sample data includes financial performance data on companies in the US that were owned by private equity companies during the specified time periods. The criteria for private equity ownership is defined as one or more private equity companies jointly having a shareholder stake in excess of 50% at the beginning of each period. Companies that have been partly exited during the study period, i.e. where the private equity company is no longer a majority shareholder, have also been included since it is reasonable to assume that they still possess significant influence. This criteria modification has been made to obtain an unbiased and meaningful sample size. If the criteria would have been that all companies needed to be private equity owned during the entire period of observation, the sample would likely be negatively biased as only bad private equity investments are generally held for such a long period of time.

The peer group is structured to include companies that were not owned by private equity companies during the respective time periods but share similarities in size and industry orientation with the sample companies. Different clusters within both groups have also been constructed in order to provide better benchmarks when measuring relative performance. These

clusters are divided into three different size groups (Small, Medium and Large) and four different industry groups (Manufacturing, Services, Wholesale & Retail and Other). Industry clusters have been formed based on each company's US SIC core code, giving a total of nine industry groups. These have then been condensed to four categories to obtain meaningful group sizes. The size groups are organized so that large companies have an average turnover during the observation period above USD 1,000m, medium companies between USD 250-1,000m and small below USD 250m. This categorization has been done to create size groups of approximately equal sizes.

Performance metrics

To determine the relative performance of private equity owned companies, two different performance metrics will be analysed and benchmarked against a comparable peer group. When evaluating operating performance there are several performance metrics that can be used e.g. return on book/market value of assets, EBIT/EBITDA margin, (Barber & Lyon, 1996) and sales growth (Mauboussin, 2012).

As our hypotheses relate to the profitability of the sample companies, the selected metrics are solely earnings related performance metrics. Since private equity transactions are often highly leveraged, we focus on metrics that do not include effects of financing. This thus enables us to examine the operational profitability of our companies relative to the peer group, regardless of their different financial structures. The metrics used in this study are presented and defined below.

$$EBITDA \text{ margin} = \frac{EBITDA}{Net \text{ revenue}}$$

The operating income to sales measure overcomes issues regarding historical cost and non-operating assets. Since this measure solely includes information from the firms' income statements it enhances the matching between the numerator and the denominator. The use of EBITDA margin disregards how efficiently firm assets are utilized, which is a drawback inherent in the metric. However it does show operating performance changes in terms of cost reductions in SG&A expenses and reductions in costs of goods sold. (Barber & Lyon, 1996)

$$Sales \text{ Growth} = \frac{Net \text{ revenue}_t}{Net \text{ revenue}_{t-1}} - 1$$

The sales growth measure has been chosen to show the companies increase in operating revenues. Revenue is also a strong driver of cash flow, which is important in terms of investor returns. Since revenue is on a high level in the income statement the effects from accounting choices and decisions can be considered to be fairly small.

Statistical methods employed

When examining previous research reports with methodologies similar to this paper, a number of different statistical methods are used to derive empirical results. The two main techniques commonly applied are either various forms of matched t-tests or regression analysis (e.g. (Vinten, 2008), (Bogdanov & Teye, 2011)). Given the relatively large sizes of our samples, regression analysis is more suitable for this paper.

Our regressions are structured into three levels with increasing degrees of complexity. An explanatory list of all regression variables can be found in table A.9, located in appendix A. Level I regressions only include the private equity ownership variable (*own_pe*) to give a sense of its effect on performance. Level II regressions add size and industry dummies and level III regressions include all interaction variables as well. All of these regressions are run for both EBITDA margin and sales growth, during both upturn and downturn periods. All regressions have been conducted with both equal weighting (EW) and value weighting (VW). The value weighting is based on average total revenue for each company during the entire period of each cycle. In order to mitigate effects of outliers in the equally weighted regressions a 90% winsorization has been applied.

$$(Level\ I) \quad PM_i = \alpha + \beta_1 * own_pe_i + \varepsilon_i$$

$$(Level\ II) \quad PM_i = \alpha + \beta_1 * own_pe_i + \beta_2 * size_medium_i + \beta_3 * size_small_i + \beta_4 * ind_man_i + \beta_5 * ind_services_i + \beta_6 * ind_wr_i + \varepsilon_i$$

$$(Level\ III) \quad PM_i = \alpha + \beta_1 * own_pe_i + \beta_2 * size_medium_i + \beta_3 * size_small_i + \beta_4 * ind_man_i + \beta_5 * ind_services_i + \beta_6 * ind_wr_i + \beta_7 * small_man_i + \beta_8 * small_services_i + \beta_9 * small_wr_i + \beta_{10} * medium_man_i + \beta_{11} * medium_services_i + \beta_{12} * medium_wr_i + \beta_{13} * small_pe_i + \beta_{14} * medium_pe_i + \beta_{15} * man_pe_i + \beta_{16} * services_pe_i + \beta_{17} * wr_pe_i + \beta_{18} * small_man_pe_i + \beta_{19} * small_services_pe_i + \beta_{20} * small_wr_pe_i +$$

$$\beta_{21} * \text{medium_man_pe}_i + \beta_{22} * \text{medium_services_pe}_i + \beta_{23} * \text{medium_wr_pe}_i + \varepsilon_i$$

In the regression equations above, PM represent each companies average EBITDA margin or sales growth for the period of study. Since all explanatory variables in the above regressions are dummies, they only include $n - 1$ variables, using non-private equity owned companies within size group large and industry group other as our base case.

Potential sources of bias

Data for this study has been retrieved through the database CapitalIQ and hence there could be an issue with selection bias. It is possible and likely that not all companies in the U.S. are represented in the database. Since only a small part of all companies in the database have financial data available, there is also a likely bias in which companies that choose to provide this information. We find it plausible that available data is biased towards larger companies, public-to-private transactions and companies with public debt, since these are more likely to be obliged or accustomed to reporting their financials. Relying on information from a database is also accompanied with a potential measurement bias as it is difficult to assess the accuracy of the data.

Some of our results may also be biased due to the fact that private equity companies more frequently invest in companies with certain characteristics e.g. high growth, low-margin or companies with turnaround potential. This might cause a discrepancy between the sample and the peer group and hence affect the results of this study. Attributing these differences to the effects of private equity ownership may therefore not be true.

Another potential source of bias is our selection criteria regarding private equity ownership. As this group includes companies that were majority owned by one or several private equity companies at the beginning of each period i.e. 1997-2002 and 2005-2009, exits during these periods may bias the sample.

V Data

In this section we present our data set and how it has been structured. We also discuss the descriptive statistics of the sample group and peer group respectively to give the reader an overview of the data.

Empirical strategy

The empirical analysis of our study is based on the economic upturns and downturns of the two most recent major financial crises. The study periods of both crises have been chosen so as to include as much of the economic cycle as possible, while still being compatible with our selection criteria for private equity ownership. While a longer period gives more data points and a better understanding of the economic cycle, it also weakens the strength of our selection criteria since it only concerns private equity ownership at the beginning of the period. The periods of study have thus been chosen with this in mind, resulting in the periods 1997-2002 and 2005-2009. Since study periods concern calendar year results due to data availability reasons, it is difficult to exactly time the economic cycles. For example, the low point of the 2008 crisis occurred in March 2009 but during the second part of the year, markets recovered significantly. An overview of the study periods can be seen in figure 3 and 4 below, including a short summary of each cycle's characteristics.

Figure 3 - S&P 500 index 1996-2003



The late 1990's showed a very strong economic development in the US economy. The stock market rose significantly during the period until the crash that occurred in 2000. Technology stock prices surged to levels that could not be explained by traditional valuation models and instead relied on future growth opportunities (Clark, Zenaidi, & Baccar, 2007). The burst of the IT-bubble in 2000 resulted in a value drop in these stocks that affected the whole market. The

market was also subject to more external shocks, e.g. the 11 September events and the anthrax scare which in combination resulted in a recession for the US economy starting in 2001 (Nordhaus, 2002). During 2003 the economy started to recover, after being hit by another crash in the end of 2002 (Gangopadhyay, Yook, & Sarwar, 2009).

Figure 4 - S&P 500 index 2004-2010



The second time period 2005-2009 was different in a number of ways. The credit market experienced a tremendous increase of available capital between 2003 and the start of the sub-prime crisis in June 2007 (Acharya, Franks, & Servaes, 2007). In addition, the stock market experienced a strong growth, interest rates were low and the economy was flourishing. The burst of the U.S. housing market created a drop in prices of securities tied to U.S. real estate and was the start of a global financial crisis that affected financial institutions worldwide. This crisis is considered to be the worst since the Great Depression and economies worldwide went into recession as international trade decreased and credit supply tightened (Shahrokhi, 2011).

Data sample

For the 1997-2002 period our sample contains 94 companies and our peer group 1,169 companies. Looking at the sample characteristics in table 1, we see that it is quite evenly distributed across both size groups and industry groups. There is however a smaller portion of large companies and a larger portion of manufacturing companies.

Table 1 – Distribution of 1997-2002 sample companies

Industry group	Large	Medium	Small	Total (%)
Manufacturing	4	20	22	46 (49%)
Services	3	8	6	17 (18%)
Wholesale & Retail	3	6	3	12 (13%)
Other	1	9	9	19 (20%)
Total	11 (12%)	43 (46%)	40 (43%)	94 (100%)

The 1997-2002 peer group contains a large portion of manufacturing companies, similar to the sample group. However, the industry group other is larger than for the sample and there is a higher portion of large companies.

Table 2 – Distribution of 1997-2002 peer companies

Industry group	Large	Medium	Small	Total (%)
Manufacturing	101	83	233	417 (36%)
Services	10	27	101	138 (12%)
Wholesale & Retail	34	34	41	109 (9%)
Other	166	124	215	505 (43%)
Total	311 (27%)	268 (23%)	590 (50%)	1,169 (100%)

For the 2005-2009 period our sample contains 122 companies and our peer group 845 companies. As can be seen in the table below, both size groups and industry groups are quite evenly distributed throughout the sample.

Table 3 – Distribution of 2005-2009 sample companies

Industry group	Large	Medium	Small	Total (%)
Manufacturing	14	20	8	42 (34%)
Services	6	12	16	34 (28%)
Wholesale & Retail	7	14	3	24 (20%)
Other	6	9	7	22 (18%)
Total	33 (27%)	55 (45%)	34 (28%)	122 (100%)

The 2005-2009 peer group is relatively evenly distributed with regards to size groups, although containing a slightly higher portion of large companies than the sample group. Looking at industry groups, services and wholesale & retail are relatively small while the other group is large.

Table 4 – Distribution of 2005-2009 peer companies

Industry group	Large	Medium	Small	Total (%)
Manufacturing	94	43	105	242 (29%)
Services	17	26	54	97 (11%)
Wholesale & Retail	37	15	12	64 (8%)
Other	218	111	113	442 (52%)
Total	366 (43%)	195 (23%)	284 (34%)	845 (100%)

Descriptive characteristics

The following section will display and discuss descriptive characteristics of the studied companies. As an introductory test, table 5 below displays the correlation between the two performance metrics, EBITDA margin and sales growth. A likely possibility would be that private equity companies either invest in growth cases or margin cases, deeming it valuable to separate these in the data. As can be seen in the table below, no such correlation can be found, either for all companies or only private equity owned companies. This also implies that the two metrics have an explanatory value in their own right.

Table 5 – Correlation between sales growth and EBITDA margin

	1997-2002	2005-2009
All companies	0.0217	0.0060
Only PE-owned	-0.0466	0.0939

Below follows a thorough overview of the data to give the reader a sense of its characteristics. The two different time-periods are displayed separately and the measures are presented both as value weighted (VW) and equally weighted (EW). The value weighting is based on the individual companies' average revenue during the respective full cycle period. The equally weighted measures have been winsorized at 90% in order to mitigate the effect of outliers in the data. Outliers have also been handled in general by removing companies with extreme values and those showing an EBITDA margin greater than 100% in absolute terms. A visual overview of the data can be seen in the scatter plots in appendix B.

Table 6 – Descriptive statistics of sample and peer group 1997-2002

	EBITDA margin (%)			Sales Growth (%)		
Sample	Full cycle	Upturn	Downturn	Full cycle	Upturn	Downturn
Mean (VW)	12.06	12.01	11.86	19.83	28.65	2.81
St.d. (VW)	9.02	9.18	8.38	22.02	31.98	15.88
Mean (EW)	13.44	13.57	12.94	19.59	25.77	3.53
St.d. (EW)	10.19	9.91	10.89	24.40	29.04	19.41
Max	44.95	46.60	43.30	112.48	112.48	48.18
Min	-27.21	-23.51	-44.25	-17.25	-19.01	-50.00
N	94	92	67	95	94	67
Peer	Full cycle	Upturn	Downturn	Full cycle	Upturn	Downturn
Mean (VW)	18.99	19.59	17.78	8.33	12.32	0.73
St.d. (VW)	13.30	13.16	14.95	12.62	16.91	15.25
Mean (EW)	19.10	19.95	17.39	10.30	14.95	1.50
St.d. (EW)	20.30	20.65	21.74	21.44	28.43	24.66
Max	91.63	94.53	91.50	210.49	300.69	323.16
Min	-92.62	-95.80	-88.10	-39.47	-53.78	-63.90
N	1,169	1,169	1,169	1,176	1,176	1,175
Diff. mean (VW)	-6.92***	-7.58***	-5.92***	11.50***	16.33**	2.08
Diff. mean (EW)	-5.66***	-6.38***	-4.45***	9.29***	10.82***	2.03

*, **, *** represents significance levels of 10%, 5% and 1% respectively.

During the first studied period (1997-2002) the private equity owned companies underperformed in terms of EBITDA margin compared to non-private equity owned companies. However the sales growth measure shows the opposite, a better performance for private equity owned companies. Investigating the upturn and downturn period separately show similar results regarding the EBITDA margin as the private equity owned companies underperform. On the other hand, the sales growth is only significantly positive during the upturn. We can hence conclude that the results in this test are contradictive in terms of the effect private equity ownership has on operating performance for this time period.

Table 7 – Descriptive statistics of sample and peer group 2005-2009

	EBITDA margin (%)			Sales Growth (%)		
Sample	Full cycle	Upturn	Downturn	Full cycle	Upturn	Downturn
Mean (VW)	13.10	13.28	13.28	9.96	18.88	-4.74
St.d. (VW)	12.28	11.70	14.52	21.21	31.31	14.98
Mean (EW)	16.66	16.83	17.04	13.83	22.26	-1.79
St.d. (EW)	15.77	15.30	18.93	23.59	34.03	15.65
Max	71.09	73.42	94.78	124.89	219.89	54.97
Min	-24.43	-38.13	-42.40	-20.35	-11.15	-78.42
N	122	122	96	127	121	99
Peer	Full cycle	Upturn	Downturn	Full cycle	Upturn	Downturn
Mean (VW)	17.22	18.04	15.91	6.24	11.14	-1.11
St.d. (VW)	12.19	11.92	14.91	13.38	18.69	13.30
Mean (EW)	21.03	21.90	19.68	8.58	14.24	0.13
St.d. (EW)	19.09	19.49	20.34	20.90	21.55	17.14
Max	98.40	98.50	98.25	242.15	392.82	124.11
Min	-59.26	-98.57	-56.15	-28.08	-29.33	-58.53
N	845	845	845	849	849	849
Diff. mean (VW)	-4.12***	-4.76***	-2.63	3.72*	7.74***	-3.63**
Diff. mean (EW)	-4.37***	-5.07***	2.64**	5.25***	8.02***	-1.92

*, **, *** represents significance levels of 10%, 5% and 1% respectively.

The second period (2005-2009) show quite similar results in terms of EBITDA margin. Private equity owned companies have a significantly worse performance for both the full cycle and the sub-periods. Even though the significance levels and the mean difference is lower compared to the first period. Sales growth is significantly higher for the private equity owned companies during the upturn and lower during the downturn, differing in significance. Thus, the results from this test do also show some disputing results about how operating performance is affected by private equity ownership during the period.

VI Empirical Results and Discussion

In this section we present the results of our study by structuring regression results in three different levels based on complexity. By the end of the section we summarize our results and discuss their implications.

Three levels of empirical results

The empirical results of our data analysis will be presented in three different levels to provide the reader with a good understanding of our testing procedure. The different levels comprise regressions including an increasing number of explanatory variables. Level I regressions only include the private equity ownership variable (*own_pe*) to give a sense of its effect on performance. Level II regressions also include size and industry variables to show variations within these characteristic subgroups. Level III regressions finally include all interaction variables as well, showing differences in performance among the private equity owned companies.

Level I regressions – Only private equity ownership dummy

To fully understand the data, a number of basic regressions including only the private equity ownership dummy have been made as a first step in our analysis. These models are fairly unsophisticated and render low explanatory power, but are made to give the reader a sense of how private equity ownership impacts company performance. As can be seen in the tables below, separate regressions have been conducted for different time periods and performance metrics.

Table 8 – Level I regression 1997-2002

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
Full cycle									
own_pe	-6.92	1.60	0.000***	0.0069	-5.31	1.04	0.000***	0.0068	1,263
cons.	18.99	0.96	0.000		19.21	0.51	0.000		
Upturn									
own_pe	-7.58	1.60	0.000***	0.0084	-6.28	1.06	0.000***	0.0092	1,261
cons.	19.59	0.93	0.000		20.21	0.51	0.000		
Downturn									
own_pe	-5.92	1.83	0.001***	0.0033	-4.27	1.19	0.000***	0.0029	1,236
cons.	17.78	1.10	0.000		17.74		0.000		
Sales growth									
	Coef.	Std.err	p-value	R2	Coef.	Std.err	p-value	R2	N
Full cycle									
own_pe	11.50	3.48	0.001***	0.0196	7.73	1.77	0.000***	0.0229	1,271
cons.	8.33	0.84	0.000		8.87	0.38	0.000		
Upturn									
own_pe	16.33	6.42	0.011**	0.0216	9.87	2.34	0.000***	0.0211	1,270
cons.	12.32	1.11	0.000		13.11	0.50	0.000		
Downturn									
own_pe	2.08	2.53	0.411	0.0004	3.22	2.00	0.108	0.0025	1,242
cons.	0.73	1.05	0.485		0.25	0.42	0.551		

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used.

During the 1997-2002 period, private equity ownership has a significantly negative impact on EBITDA margin during both the upturn and the downturn. During the entire period of study, private equity owned companies perform significantly worse than their peers. This, and especially the significantly negative underperformance during the upturn, thus contradicts our hypothesis. Looking at sales growth however, the results are more in line with our hypotheses. Private equity owned companies significantly outperform their peers during the upturn but do not show significantly diverse performance during the downturn. For the entire period, private equity owned companies show a significantly higher sales growth than their peers. These findings are true both for equal weighted and value weighted regressions. What can be said about these two regression types is that value weighting renders greater coefficients for own_pe in absolute terms. Thus a stronger underperformance with regards to EBITDA margin and a stronger outperformance with regards to sales growth. This implies that larger private equity owned companies have lower margins and higher growth than the smaller ones, since value weighting with regards to average revenue emphasizes large companies.

Table 9 – Level I regression 2005-2009

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
Full cycle									
own_pe	-4.12	1.50	0.006***	0.005	-4.21	1.34	0.002***	0.0078	967
cons.	17.22	0.81	0.000		20.89	0.55	0.000		
Upturn									
own_pe	-4.76	-3.38	0.001***	0.006	-4.78	1.30	0.000***	0.103	967
cons.	18.04	22.85	0.00		21.82	0.55	0.000		
Downturn									
own_pe	-2.63	1.99	0.185	0.001	-3.15	1.56	0.044**	0.0033	941
cons.	15.91	1.05	0.000		19.85	0.58	0.000		
Sales growth									
	Coef.	Std.err	p-value	R2	Coef.	Std.err	p-value	R2	N
Full cycle									
own_pe	3.72	2.78	0.181	0.0029	3.58	1.16	0.002***	0.0135	976
cons.	6.24	0.72	0.000		6.92	0.34	0.000		
Upturn									
own_pe	7.74	3.94	0.049**	0.0062	5.28	1.51	0.000***	0.0179	970
cons.	11.14	0.88	0.000		11.53	0.43	0.000		
Downturn									
own_pe	-3.63	2.92	0.214	0.0026	-0.48	1.20	0.683	0.002	948
cons.	-1.11	1.04	0.289		0.90	0.36	0.012		

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used.

The results of the 2005-2009 period are similar to those of the 1997-2002 period, as we see underperformance in terms of EBITDA margin and outperformance in terms of sales growth. The results for sales growth are in line with our hypotheses as private equity owned companies perform significantly better during the upturn but do not perform significantly worse during the downturn. Comparing the results for equal weighting and value weighting, we see that coefficients are very similar, although differing slightly in significance. All of these models have very low R-squared values and thus lack any significant explanatory power.

Table 10 – Upturn vs. downturn volatility regression

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
1997-2002									
own_pe	-1.69	0.69	0.014**	0.0010	-2.23	0.55	0.000***	0.0037	1234
cons.	1.81	0.53	0.001		2.47	0.25	0.000		
2005-2009									
own_pe	-1.61	1.10	0.142	0.0009	-0.98	0.60	0.099*	0.0017	941
cons.	2.13	0.82	0.010		1.96	0.26	0.000		
Sales growth									
	Coef.	Std.err	p-value	R2	Coef.	Std.err	p-value	R2	N
1997-2002									
own_pe	16.04	8.27	0.053*	0.0104	7.26	2.97	0.015**	0.0058	1241
cons.	11.59	1.46	0.000		12.87	0.62	0.000		
2005-2009									
own_pe	12.12	4.75	0.011**	0.0112	6.18	1.95	0.002***	0.0146	942
cons.	12.24	1.24	0.000		12.42	0.51	0.000		

*,**,*** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used. PM refers to performance measure and thus include both EBITDA margin and sales growth.

To study the volatility in performance measures between upturns and downturns, table 10 reports the results of regressions with the difference in performance between the periods as the dependent variable. The regression specification is thus as follows:

$$\Delta(PM_{Upturn} - PM_{Downturn})_i = \alpha + \beta_1 * own_pe_i + \varepsilon_i$$

In the above equation, PM refers to performance measure and thus include both EBITDA margin and sales growth. Looking at the results we see that there is a smaller performance difference between upturns and downturns for private equity owned companies with regards to EBITDA margin. However, the result are inversed when looking at sales growth, with a larger upturn versus downturn volatility for the private equity owned companies.

Level II regressions – All characteristics dummies

Level II regressions include industry and size variables to see how variations within these groups affect performance. Comparing these with our level I regressions, we see that the R-squared values have improved substantially in most cases.

Table 11 – Level II regression 1997-2002

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
Upturn									
ind_man	-10.41	1.63	0.000***	0.2762	-18.27	0.95	0.000***	0.2966	1,261
ind_services	-8.87	1.48	0.000***		-13.92	1.45	0.000***		
ind_wr	-17.74	1.53	0.000***		-22.36	1.09	0.000***		
size_medium	3.12	1.16	0.007***		2.77	1.02	0.007***		
size_small	0.91	1.17	0.434		0.48	0.95	0.610		
own_pe	-4.75	1.19	0.000***		-2.93	1.24	0.018**		
cons.	25.51	1.31	0.000		29.57	0.84	0.000		
Downturn									
ind_man	-10.45	2.04	0.000***	0.1830	-19.11	1.04	0.000***	0.2683	1,236
ind_services	-8.05	1.84	0.000***		-13.76	1.56	0.000***		
ind_wr	-15.79	2.01	0.000***		-20.77	1.16	0.000***		
size_medium	2.97	1.36	0.030**		2.48	1.12	0.027**		
size_small	0.14	1.34	0.917		-0.74	1.05	0.483		
own_pe	-2.83	1.19	0.017**		-0.26	1.21	0.830		
cons.	23.40	1.85	0.000		27.92	0.94	0.000		
Sales growth									
	Coef.	Std.err	p-value	R2	Coef.	Std.err	p-value	R2	N
Upturn									
ind_man	-2.86	1.86	0.125	0.0598	-3.43	1.09	0.002***	0.0419	1,270
ind_services	7.08	5.32	0.183		2.81	1.78	0.115		
ind_wr	6.57	3.86	0.089*		2.19	1.84	0.236		
size_medium	2.94	2.09	0.160		3.00	1.30	0.021**		
size_small	2.12	1.88	0.259		2.11	1.12	0.060*		
own_pe	13.42	6.60	0.042**		9.55	2.32	0.000***		
cons.	11.62	1.70	0.000		12.06	0.93	0.000		
Downturn									
ind_man	2.74	2.51	0.275	0.0078	-0.97	0.93	0.300	0.0113	1,242
ind_services	1.80	2.41	0.456		-0.52	1.48	0.728		
ind_wr	0.95	2.87	0.739		1.59	1.51	0.295		
size_medium	1.62	1.49	0.277		1.04	1.02	0.309		
size_small	-1.75	1.67	0.293		-1.50	0.98	0.127		
own_pe	1.04	2.48	0.674		2.90	2.04	0.155		
cons.	-0.41	1.44	0.778		1.04	0.83	0.210		

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used.

In table 11 above, reporting results for the 1997-2002 period, we see that when controlling for size and industry groups the results from our level I regressions persist. For the EBITDA margin case, private equity ownership has a significantly negative impact in all periods except the equal weighted downturn. This contradicts our hypotheses, as we would expect to see significant

positive performance during the upturn period. In the sales growth case, private equity owned companies however significantly outperform their peers during upturns and show no significant divergence during downturns. One should however take into account that the sales growth regressions only have an R-squared value of <6% while the EBITDA margin regressions have an R-squared value close to 30%.

Table 12 – Level II regression 2005-2009

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
Upturn									
ind_man	-7.47	1.55	0.000***	0.1972	-15.96	0.98	0.000***	0.2719	967
ind_services	-9.09	2.43	0.000***		-13.33	1.47	0.000***		
ind_wr	-13.45	1.66	0.000***		-20.05	1.04	0.000***		
size_medium	6.56	1.24	0.000***		3.77	1.05	0.000***		
size_small	6.84	1.49	0.000***		3.59	1.09	0.001***		
own_pe	-2.33	1.16	0.044**		0.13	1.26	0.916		
cons.	21.73	1.11	0.000		27.36	0.75	0.000		
Downturn									
ind_man	-6.03	2.00	0.003***	0.0964	-15.81	1.08	0.000***	0.2379	941
ind_services	-8.04	2.23	0.000***		-13.36	1.60	0.000***		
ind_wr	-11.73	1.92	0.000***		-19.90	1.16	0.000***		
size_medium	7.36	1.50	0.000***		4.25	1.16	0.000***		
size_small	6.51	1.73	0.000***		2.51	1.20	0.036**		
own_pe	-0.85	1.49	0.569		1.58	1.48	0.286		
cons.	18.92	1.64	0.000		25.60	0.84	0.000		
Sales growth									
	Coef.	Std.err	p-value	R2	Coef.	Std.err	p-value	R2	N
Upturn									
ind_man	-0.56	1.68	0.741	0.0198	0.85	0.99	0.394	0.0510	970
ind_services	9.64	3.74	0.010***		4.45	1.51	0.003***		
ind_wr	-0.73	2.01	0.717		-3.54	1.27	0.005***		
size_medium	2.80	2.35	0.233		1.46	0.95	0.124		
size_small	5.03	3.44	0.144		2.42	1.03	0.019**		
own_pe	5.61	3.89	0.150		4.80	1.56	0.002***		
cons.	10.84	1.46	0.000		9.89	0.62	0.000		
Downturn									
ind_man	-0.78	2.30	0.735	0.0192	-3.02	0.81	0.000***	0.0238	948
ind_services	7.95	2.76	0.004***		1.24	1.24	0.317		
ind_wr	-0.04	2.41	0.988		-1.68	1.21	0.164		
size_medium	1.14	1.46	0.435		1.06	0.80	0.184		
size_small	1.45	1.51	0.337		0.48	0.84	0.566		
own_pe	-4.83	2.83	0.088*		-0.37	1.24	0.765		
cons.	-1.26	1.62	0.437		-0.46	0.52	0.383		

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used.

The 2005-2009 period renders similar results as for the previous one but with slightly different implications. When controlling for size and industry variables, own_pe is negative for the value

weighted upturn but insignificant for all other periods with regards to EBITDA margin. Results for sales growth are a bit more inconclusive as the significance levels differ between equal weighted and value weighted regressions. Although all sales growth regressions have low R-squared values, the equal weighted ones have the highest explanatory power while also supporting our hypotheses. In this case, private equity owned companies show a significantly higher sales growth by 4.8% during the upturn and an insignificant minor underperformance during the downturn.

Level III regressions – Full regressions with interaction variables

We now introduce interaction variables to determine if we find support for our hypotheses within specific segments of our sample. Each interaction regression includes a total of 23 explanatory variables and an example of how these are constructed can be seen in table A.6. Each of these full regressions have then been condensed by removing insignificant variables while reducing R-squared as little as possible. This has been done to improve the reader's understanding of the data and reduce unnecessary output reporting.

In table 13 below we see the results for the 1997-2002 period and as can be seen, no three-way interaction variables are reported due to insignificance. This output confirms our previous results of EBITDA margin underperformance for private equity owned companies. What can be seen is also that some private equity owned industry groups perform relatively better, even though the net effect is still negative for most of them. The net effects of some industry and private equity ownership interaction variables are positive, although only slightly. This is true for both weighting methods during upturns and downturns.

Looking at the sales growth regressions we see that private equity owned companies as a whole tend to outperform their peers, although only significantly during the upturn. The interaction variables tell us that during the upturn, private equity owned manufacturing companies show significantly lower growth than other groups. During the downturn, private equity owned service companies experienced higher growth, although only significant in the equal weighted case.

Table 13 – Level III cleaned regression 1997-2002

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
Upturn									
ind_man	-10.57	1.66	0.000***	0.2788	-19.21	0.98	0.000***	0.3081	1,261
ind_services	-9.00	1.54	0.000***		-14.57	1.55	0.000***		
ind_wr	-17.89	1.55	0.000***		-23.19	1.13	0.000***		
size_medium	3.22	1.16	0.006***		2.90	1.02	0.005***		
size_small	1.06	1.16	0.364		0.67	0.95	0.481		
own_pe	-14.64	4.40	0.001***		-16.10	2.79	0.000***		
services_pe	10.04	5.04	0.047**		14.29	3.89	0.000***		
wr_pe	11.84	4.57	0.010***		17.02	3.39	0.000***		
man_pe	12.25	1.32	0.010***		17.72	3.04	0.000***		
cons.	12.25	4.74	0.010		29.94	0.85	0.000		
Downturn									
ind_man	-10.54	2.06	0.000***	0.1835	-19.54	1.06	0.000***	0.2715	1,236
ind_services	-7.85	1.81	0.000***		-13.44	1.56	0.000***		
ind_wr	-15.72	2.01	0.000***		-20.93	1.21	0.000***		
size_medium	2.92	1.37	0.033**		2.50	1.12	0.026**		
size_small	0.05	1.34	0.971		-0.78	1.05	0.455		
own_pe	-4.86	1.46	0.001***		-6.19	2.26	0.006***		
wr_pe	-	-	-		6.13	2.65	0.021**		
man_pe	4.94	2.30	0.032**		9.97	2.62	0.000***		
cons.	23.42	1.85	0.000		28.07	0.94	0.000		
Sales growth									
	Coef.	Std.err	p-value	R2	Coef.	Std.err	p-value	R2	N
Upturn									
ind_man	-2.31	1.87	0.217	0.0707	-2.75	1.09	0.012**	0.0474	1,270
ind_services	5.71	5.21	0.273		2.44	1.79	0.173		
ind_wr	6.25	3.88	0.107		1.87	1.84	0.310		
size_medium	3.27	2.02	0.106		3.02	1.29	0.019**		
size_small	2.63	1.81	0.147		2.18	1.12	0.051*		
own_pe	23.08	9.65	0.017**		14.45	3.24	0.000***		
man_pe	-24.03	9.85	0.015**		-10.12	4.47	0.024**		
cons.	11.51	1.70	0.000		11.85	0.93	0.000		
Downturn									
ind_man	2.74	2.51	0.275	0.0078	-0.90	0.94	0.337	0.0148	1,242
ind_services	1.80	2.41	0.456		-1.23	1.51	0.415		
ind_wr	0.95	2.87	0.739		1.71	1.52	0.260		
size_medium	1.62	1.49	0.277		1.09	1.02	0.285		
size_small	-1.75	1.67	0.293		-1.38	0.98	0.158		
own_pe	1.04	2.48	0.674		1.20	2.19	0.585		
services_pe	-	-	-		10.49	5.20	0.044**		
cons.	-0.41	1.44	0.778		1.02	0.83	0.220		

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used.

Table 14 reports the results for the 2005-2009 period, during which some of the three-way interaction variables are significant. Looking at EBITDA margin we see that private equity owned small service and manufacturing companies show significant outperformance. During the downturn, no interaction variables rendered significant and this output is thus excluded since it is the same as the level II regression. Although we have previously found an underperformance of private equity owned companies in general with regards to EBITDA margin, we now find support for our hypothesis within these two specific segments.

When analysing the coefficients of the interaction variables one should keep in mind that to obtain the actual performance within each group, the net effect must be calculated. In the case of small_man_pe this is for example done by adding the coefficients of the intercept, own_pe, size_small, ind_man, man_pe, small_pe and small_man_pe obtaining an EBITDA margin of 14.7% for the value weighted case. The specific coefficients only show the relative performance within each group.

The sales growth regressions for 2005-2009 show some differences in the relative performance of certain segments and varying results between the value weighted and equal weighted cases. Due to the inconclusiveness of the results, the only consistent variable effect seems to be the significant underperformance of private equity owned wholesale & retail companies. A deeper analysis of the results is questionable considering the low R-squared value and mixed results.

Table 14 – Level III cleaned regression 2005-2009

EBITDA margin									
	Value weighted				Equal weighted				N
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	
Upturn									
ind_man	-7.25	1.61	0.000***	0.2011	-12.16	1.05	0.000***	0.3008	967
ind_services	-9.14	2.88	0.002***		-12.27	1.85	0.000***		
ind_wr	-13.48	1.70	0.000***		-19.10	1.20	0.000***		
size_medium	6.56	1.25	0.000***		3.93	1.07	0.000***		
size_small	15.20	2.73	0.000***		8.46	1.79	0.000***		
own_pe	-1.41	2.30	0.541		-1.36	2.49	0.585		
small_man	-15.81	3.35	0.000***		-11.59	2.17	0.000***		
small_services	-12.57	4.52	0.006***		-6.90	3.20	0.032**		
small_pe	-15.46	5.34	0.004***		-10.45	5.22	0.046**		
services_pe	-0.35	3.96	0.931		0.93	4.03	0.817		
man_pe	-2.17	2.70	0.423		-0.36	2.88	0.899		
small_services_pe	27.24	7.52	0.000***		20.25	7.53	0.007***		
small_man_pe	19.92	6.77	0.003***		17.32	6.31	0.006***		
cons.	21.68	1.12	0.000		26.29	0.77	0.000		
Downturn									
No significant interaction variables for either case									
Sales growth									
	Coef.	Std.err	p-value	R2	Coef.	Std.err	p-value	R2	N
Upturn									
ind_man	-0.82	1.68	0.625	0.0277	1.03	1.13	0.360	0.0747	
ind_services	8.77	3.66	0.017**		5.28	1.60	0.001***		
ind_wr	0.52	2.01	0.797		-1.14	1.38	0.408		
size_medium	2.93	2.31	0.206		1.00	1.09	0.363		
size_small	4.60	3.46	0.184		2.37	1.03	0.022**		
own_pe	10.99	4.65	0.018**		10.93	4.02	0.007***		
medium_man	-	-	-		1.82	2.47	0.463		
medium_pe	-	-	-		6.10	3.74	0.103		
services_pe	-	-	-		-9.85	5.08	0.053*		
wr_pe	-20.18	5.20	0.000***		-17.20	4.26	0.000***		
man_pe	-	-	-		-3.35	5.20	0.519		
medium_man_pe	-	-	-		-14.57	5.97	0.015**		
cons.	10.78	1.46	0.000		9.59	0.65	0.000		
Downturn									
ind_man	-0.74	2.38	0.755	0.0252	-3.02	0.81	0.000***	0.0238	948
ind_services	7.15	2.90	0.014**		1.24	1.24	0.317		
ind_wr	0.63	2.47	0.799		-1.68	1.21	0.164		
size_medium	1.28	1.47	0.383		1.06	0.80	0.184		
size_small	2.73	2.19	0.213		0.48	0.84	0.566		
own_pe	1.18	2.08	0.571		-0.37	1.24	0.765		
small_man	-3.43	3.13	0.274		-	-	-		
small_wr	-6.94	6.09	0.255		-	-	-		
small_pe	-5.49	4.82	0.255		-	-	-		
wr_pe	-14.87	7.52	0.048**		-	-	-		
man_pe	-5.23	4.19	0.213		-	-	-		
small_wr_pe	21.06	11.64	0.071*		-	-	-		
small_man_pe	23.77	8.40	0.005***		-	-	-		
cons.	-1.33	1.63	0.416		-0.46	0.52	0.383		

Summary of results and discussion

As we can see in table 15 below, our results differ between crises and performance measures. In broad terms, our results imply that private equity owned companies underperform relative to their peers with respect to EBITDA margin. This is not in line with our hypotheses and most previous research, as private equity owned companies are commonly found to outperform their peers. These results differ slightly between the crises and when comparing the different weighting techniques. For the 1997-2002 period, *own_pe* is significantly negative in all level II cases except the equal weighted downturn. During the 2005-2009 period, *own_pe* is only significantly negative during the value weighted upturn and insignificant in all other cases. This points at an interesting finding regarding the seemingly greater underperformance of private equity owned companies during economic upturns compared to downturns. Examining industry group variations, most underperformance seem to be attributable to the industry group other, as the rest have a net effect close to zero. We also see that the segments *small_services_pe* and *small_man_pe* show a significantly positive performance during the entire 2005-2009 period. Concluding our findings on EBITDA margin, one can say that the performance difference between private equity owned companies and their peers seem to be mostly negative during the 1997-2002 period and mostly insignificant during the 2005-2009 period.

Regressions on sales growth tell a different story as private equity owned companies generally show significantly higher growth than their peers during upturns in both crises and no significant abnormal performance during downturns. This generalization is true in all cases except for the value weighted regressions of the 2005-2009 period. These findings are more in line with our hypotheses as well as previous research. Examining size and industry group variations render mixed results and reveal no clear patterns. This in combination with the low explanatory power of these regressions mitigates the depth of our analysis in this case.

Table 15 – Summary of results

EBITDA margin				
	Value weighted		Equal weighted	
1997-2002	Upturn	Downturn	Upturn	Downturn
Level I				
own_pe	-7.58***	-5.92***	-6.28***	-4.27***
Level II				
own_pe	-4.75***	-2.83**	-2.93**	-0.26
Level III				
own_pe	-14.64***	-4.86***	-16.10***	-6.19***
services_pe	10.04**	-	14.29***	-
wr_pe	11.84***	-	17.02***	6.13**
man_pe	12.25***	4.94**	17.72***	9.97***
2005-2009				
Level I				
own_pe	-4.76***	-2.63	-4.78***	-3.15**
Level II				
own_pe	-2.33**	-0.85	0.13	1.58
Level III				
own_pe	-1.41	-	-1.36	-
small_pe	-15.46***	-	-10.45**	-
services_pe	-0.35	-	0.93	-
man_pe	-2.17	-	-0.36	-
small_services_pe	27.24***	-	20.25***	-
small_man_pe	19.92***	-	17.32***	-
Sales growth				
1997-2002				
Level I				
own_pe	16.23**	2.08	9.87***	3.22
Level II				
own_pe	13.42**	1.04	9.55***	2.90
Level III				
own_pe	23.08**	-	14.45***	1.20
man_pe	-24.03**	-	-10.12**	-
services_pe	-	-	-	10.49**
2005-2009				
Level I				
own_pe	7.74**	-3.63	5.28***	-0.48
Level II				
own_pe	5.61	-4.83*	4.80***	-0.37
Level III				
own_pe	10.99**	1.18	10.93***	-
medium_pe	-	-	6.10	-
services_pe	-	-	-9.85*	-
wr_pe	-20.18***	-14.87**	-17.20***	-
man_pe	-	-5.23	-3.35	-
medium_man_pe	-	-	-14.57**	-
small_pe	-	-5.49	-	-
small_wr_pe	-	21.06*	-	-
small_man_pe	-	23.77***	-	-

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Level III regressions with no data have no significant interaction variables and are thus the same as the corresponding level II regression.

VII Conclusions and contribution

In this section we conclude our empirical findings and discuss their implications. We also give our thoughts on relevant areas for further research.

This study analyses the relative performance of private equity owned companies during the economic upturns and downturns of the two most recent major financial crises. In line with most previous research, our hypotheses are based on the belief that private equity owned companies show a significantly stronger operating performance than their non-private equity owned peers. To contribute to existing research, this paper has been structured to examine different periods of economic conditions to analyse the dynamics of the performance differences commonly found in empirical studies. Our main hypothesis is that the outperformance of private equity owned companies derive from a significant outperformance during upturns and an insignificant underperformance during downturns.

The empirical results of this study are only partly in line with our hypotheses and contradicts some of the existing research. In terms of EBITDA margin, most of our results imply a significant underperformance during the entire 1997-2002 period and no significant difference during the entire 2005-2009 period. Looking at sales growth however, most of our results indicate a significant outperformance during upturns and no significant difference during downturns, in both periods. As we examine differences within certain industry and size groups, many of our hypotheses can only be partly confirmed as results differ within these segments. Among subgroups, our main findings are that industry group other shows significantly lower EBITDA margin during the upturn of 1997-2002 whereas small_services_pe and small_man_pe show significantly higher EBITDA margin during the entire 2005-2009 period. The outperformance of small_services_pe and small_man_pe is likely due to the large impact that operational performance improvements have on these types of companies. Private equity companies have great experience in operational improvements and also contribute with managerial expertise, which has a major impact on small companies within these industries. The fact that the sales growth results are more in line with our hypotheses imply that private equity funds focused more on growth as a source of value creation rather than margin improvement during the studied periods. A summary of our hypotheses and if any support has been found for them can be seen in table 16 below.

Table 16 – Summary of hypotheses and results

Hypotheses		Support	
Differences in operating performance		EBITDA margin	Sales growth
H₁:	Private equity owned companies have had a significantly better operating performance compared to non-private equity owned companies during the economic upturn in 1997-2000.	No	Partly
H₂:	Private equity owned companies have had a significantly better operating performance compared to non-private equity owned companies during the economic upturn in 2005-2007.	Partly	Partly
H₃:	Private equity owned companies have not had a significantly worse operating performance compared to non-private equity owned companies during the economic downturn in 2001-2002.	Partly	Yes
H₄:	Private equity owned companies have not had a significantly worse operating performance compared to non-private equity owned companies during the economic downturn in 2008-2009.	Yes	Partly

Hypothesis support refers to the coefficient and significance of the *own_pe* variable in level II regressions in combination with the findings of the level III regressions

These results are in some aspects controversial as they partly contradict most previous research. Our results undoubtedly contribute to the understanding of the relative performance of private equity owned companies, although we choose not to make too large generalizations from our findings due to the potential biases within the study. Instead, we hope that our conclusions will contribute to this field of study and serve as a starting ground for further research. Interesting aspects to complement our analysis would be to gather first-hand data and thus reduce the selection bias inherent in databases or adding more explanatory variables such as years since buyout, leverage and company age. This would further strengthen the robustness of our models and provide a greater understanding of the research topic. Another interesting aspect would be to complement our analysis with financial data before and after the buyout event. As our study focuses on differences in existing performance, such data would unveil the actual impact that a buyout has.

Given the rapidly growing size of the private equity industry, understanding the underlying dynamics of portfolio company performance is essential for investors to make educated investment decisions. The aim of this paper has been to provide a valuable contribution to this field of research and enhance the knowledge regarding the performance of different types of portfolio companies during economic upturns and downturns.

VIII References

This section reports all cited references that have been used in the paper. These are presented in alphabetical order using the Harvard System of Referencing.

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IX Appendix

In this section complementary material of relevance to the thesis is presented.

Appendix A – Regression outputs

Table A.1 – Level I regression 1997-2002

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
Full cycle									
own_pe	-6.92	1.60	0.000***	0.0069	-5.31	1.04	0.000***	0.0068	1,263
cons.	18.99	0.96	0.000		19.21	0.51	0.000		
Upturn									
own_pe	-7.58	1.60	0.000***	0.0084	-6.28	1.06	0.000***	0.0092	1,261
cons.	19.59	0.93	0.000		20.21	0.51	0.000		
Downturn									
own_pe	-5.92	1.83	0.001**	0.0033	-4.27	1.19	0.000***	0.0029	1,236
cons.	17.78	1.10	0.000		17.74		0.000		
Sales growth									
Full cycle									
own_pe	11.50	3.48	0.001***	0.0196	7.73	1.77	0.000***	0.0229	1,271
cons.	8.33	0.84	0.000		8.87	0.38	0.000		
Upturn									
own_pe	16.33	6.42	0.011**	0.0216	9.87	2.34	0.000***	0.0211	1,270
cons.	12.32	1.11	0.000		13.11	0.50	0.000		
Downturn									
own_pe	2.08	2.53	0.411	0.0004	3.22	2.00	0.108	0.0025	1,242
cons.	0.73	1.05	0.485		0.25	0.42	0.551		

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used.

Table A.2 – Level I regression 2005-2009

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
Full cycle									
own_pe	-4.12	1.50	0.006***	0.005	-4.21	1.34	0.002***	0.0078	967
cons.	17.22	0.81	0.000		20.89	0.55	0.000		
Upturn									
own_pe	-4.76	-3.38	0.001***	0.006	-4.78	1.30	0.000***	0.103	967
cons.	18.04	22.85	0.00		21.82	0.55	0.000		
Downturn									
own_pe	-2.63	1.99	0.185	0.001	-3.15	1.56	0.044**	0.0033	941
cons.	15.91	1.05	0.000		19.85	0.58	0.000		
Sales growth									
	Coef.	Std.err	p-value	R2	Coef.	Std.err	p-value	R2	N
Full cycle									
own_pe	3.72	2.78	0.181	0.0029	3.58	1.16	0.002***	0.0135	976
cons.	6.24	0.72	0.000		6.92	0.34	0.000		
Upturn									
own_pe	7.74	3.94	0.049**	0.0062	5.28	1.51	0.000***	0.0179	970
cons.	11.14	0.88	0.000		11.53	0.43	0.000		
Downturn									
own_pe	-3.63	2.92	0.214	0.0026	-0.48	1.20	0.683	0.002	948
cons.	-1.11	1.04	0.289		0.90	0.36	0.012		

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used.

Table A.3 – Upturn vs. downturn volatility regression

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
1997-2002									
own_pe	-1.69	0.69	0.014**	0.0010	-2.23	0.55	0.000***	0.0037	1234
cons.	1.81	0.53	0.001		2.47	0.25	0.000		
2005-2009									
own_pe	-1.61	1.10	0.142	0.0009	-0.98	0.60	0.099*	0.0017	941
cons.	2.13	0.82	0.010		1.96	0.26	0.000		
Sales growth	Coef.	Std.err	p-value	R2	Coef.	Std.err	p-value	R2	N
1997-2002									
own_pe	16.04	8.27	0.053*	0.0104	7.26	2.97	0.015**	0.0058	1241
cons.	11.59	1.46	0.000		12.87	0.62	0.000		
2005-2009									
own_pe	12.12	4.75	0.011**	0.0112	6.18	1.95	0.002***	0.0146	942
cons.	12.24	1.24	0.000		12.42	0.51	0.000		

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used. PM refers to performance measure and thus include both EBITDA margin and sales growth.

Table A.4 – Level II regression 1997-2002

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
Upturn									
ind_man	-10.41	1.63	0.000***	0.2762	-18.27	0.95	0.000***	0.2966	1,261
ind_services	-8.87	1.48	0.000***		-13.92	1.45	0.000***		
ind_wr	-17.74	1.53	0.000***		-22.36	1.09	0.000***		
size_medium	3.12	1.16	0.007***		2.77	1.02	0.007***		
size_small	0.91	1.17	0.434		0.48	0.95	0.610		
own_pe	-4.75	1.19	0.000***		-2.93	1.24	0.018**		
cons.	25.51	1.31	0.000		29.57	0.84	0.000		
Downturn									
ind_man	-10.45	2.04	0.000***	0.1830	-19.11	1.04	0.000***	0.2683	1,236
ind_services	-8.05	1.84	0.000***		-13.76	1.56	0.000***		
ind_wr	-15.79	2.01	0.000***		-20.77	1.16	0.000***		
size_medium	2.97	1.36	0.030**		2.48	1.12	0.027**		
size_small	0.14	1.34	0.917		-0.74	1.05	0.483		
own_pe	-2.83	1.19	0.017**		-0.26	1.21	0.830		
cons.	23.40	1.85	0.000		27.92	0.94	0.000		
Sales growth									
Upturn									
ind_man	-2.86	1.86	0.125	0.0598	-3.43	1.09	0.002***	0.0419	1,270
ind_services	7.08	5.32	0.183		2.81	1.78	0.115		
ind_wr	6.57	3.86	0.089*		2.19	1.84	0.236		
size_medium	2.94	2.09	0.160		3.00	1.30	0.021**		
size_small	2.12	1.88	0.259		2.11	1.12	0.060*		
own_pe	13.42	6.60	0.042**		9.55	2.32	0.000***		
cons.	11.62	1.70	0.000		12.06	0.93	0.000		
Downturn									
ind_man	2.74	2.51	0.275	0.0078	-0.97	0.93	0.300	0.0113	1,242
ind_services	1.80	2.41	0.456		-0.52	1.48	0.728		
ind_wr	0.95	2.87	0.739		1.59	1.51	0.295		
size_medium	1.62	1.49	0.277		1.04	1.02	0.309		
size_small	-1.75	1.67	0.293		-1.50	0.98	0.127		
own_pe	1.04	2.48	0.674		2.90	2.04	0.155		
cons.	-0.41	1.44	0.778		1.04	0.83	0.210		

Table A.5 – Level II regression 2005-2009

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
Upturn									
ind_man	-7.47	1.55	0.000***	0.1972	-15.96	0.98	0.000***	0.2719	967
ind_services	-9.09	2.43	0.000***		-13.33	1.47	0.000***		
ind_wr	-13.45	1.66	0.000***		-20.05	1.04	0.000***		
size_medium	6.56	1.24	0.000***		3.77	1.05	0.000***		
size_small	6.84	1.49	0.000***		3.59	1.09	0.001***		
own_pe	-2.33	1.16	0.044**		0.13	1.26	0.916		
cons.	21.73	1.11	0.000		27.36	0.75	0.000		
Downturn									
ind_man	-6.03	2.00	0.003***	0.0964	-15.81	1.08	0.000***	0.2379	941
ind_services	-8.04	2.23	0.000***		-13.36	1.60	0.000***		
ind_wr	-11.73	1.92	0.000***		-19.90	1.16	0.000***		
size_medium	7.36	1.50	0.000***		4.25	1.16	0.000***		
size_small	6.51	1.73	0.000***		2.51	1.20	0.036**		
own_pe	-0.85	1.49	0.569		1.58	1.48	0.286		
cons.	18.92	1.64	0.000		25.60	0.84	0.000		
Sales growth									
Upturn									
ind_man	-0.56	1.68	0.741	0.0198	0.85	0.99	0.394	0.0510	970
ind_services	9.64	3.74	0.010***		4.45	1.51	0.003***		
ind_wr	-0.73	2.01	0.717		-3.54	1.27	0.005***		
size_medium	2.80	2.35	0.233		1.46	0.95	0.124		
size_small	5.03	3.44	0.144		2.42	1.03	0.019**		
own_pe	5.61	3.89	0.150		4.80	1.56	0.002***		
cons.	10.84	1.46	0.000		9.89	0.62	0.000		
Downturn									
ind_man	-0.78	2.30	0.735	0.0192	-3.02	0.81	0.000***	0.0238	948
ind_services	7.95	2.76	0.004***		1.24	1.24	0.317		
ind_wr	-0.04	2.41	0.988		-1.68	1.21	0.164		
size_medium	1.14	1.46	0.435		1.06	0.80	0.184		
size_small	1.45	1.51	0.337		0.48	0.84	0.566		
own_pe	-4.83	2.83	0.088*		-0.37	1.24	0.765		
cons.	-1.26	1.62	0.437		-0.46	0.52	0.383		

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used.

Table A.6 – Example of full level III equal weighted regression of EBITDA margin 1997-2002

	Coef.	Robust St.err.	p-value	
Upturn				
ind_man	-11.76	1.33	0.000***	R-squared 0.3317 N 1261
ind_services	-10.91	2.31	0.000***	
ind_wr	-18.68	1.49	0.000***	
size_medium	4.22	1.88	0.025**	
size_small	6.91	1.83	0.000***	
own_pe	-20.26	1.06	0.000***	
small_man	-13.34	2.08	0.000***	
small_services	-7.46	3.17	0.019**	
small_wr	-9.32	2.50	0.000***	
medium_man	-3.84	2.31	0.097*	
medium_services	-0.20	3.68	0.957	
medium_wr	-2.51	2.68	0.349	
small_pe	2.16	3.84	0.574	
medium_pe	5.35	4.78	0.263	
services_pe	16.56	4.67	0.000***	
wr_pe	16.55	1.71	0.000***	
man_pe	18.56	2.33	0.000***	
small_services_pe	0.52	7.83	0.947	
medium_services_pe	-4.99	7.69	0.516	
medium_wr_pe	-1.88	5.46	0.730	
small_wr_pe	11.13	7.16	0.120	
medium_man_pe	-4.58	5.58	0.412	
small_man_pe	4.10	4.74	0.387	
cons.	26.96	1.06	0.000	

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used.

Table A.7 – Level III cleaned regression 1997-2002

EBITDA margin	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
Upturn									
ind_man	-10.57	1.66	0.000***	0.2788	-19.21	0.98	0.000***	0.3081	1,261
ind_services	-9.00	1.54	0.000***		-14.57	1.55	0.000***		
ind_wr	-17.89	1.55	0.000***		-23.19	1.13	0.000***		
size_medium	3.22	1.16	0.006***		2.90	1.02	0.005***		
size_small	1.06	1.16	0.364		0.67	0.95	0.481		
own_pe	-14.64	4.40	0.001***		-16.10	2.79	0.000***		
services_pe	10.04	5.04	0.047**		14.29	3.89	0.000***		
wr_pe	11.84	4.57	0.010***		17.02	3.39	0.000***		
man_pe	12.25	1.32	0.010***		17.72	3.04	0.000***		
cons.	12.25	4.74	0.010		29.94	0.85	0.000		
Downturn									
ind_man	-10.54	2.06	0.000***	0.1835	-19.54	1.06	0.000***	0.2715	1,236
ind_services	-7.85	1.81	0.000***		-13.44	1.56	0.000***		
ind_wr	-15.72	2.01	0.000***		-20.93	1.21	0.000***		
size_medium	2.92	1.37	0.033**		2.50	1.12	0.026**		
size_small	0.05	1.34	0.971		-0.78	1.05	0.455		
own_pe	-4.86	1.46	0.001***		-6.19	2.26	0.006***		
wr_pe	-	-	-		6.13	2.65	0.021**		
man_pe	4.94	2.30	0.032**		9.97	2.62	0.000***		
cons.	23.42	1.85	0.000		28.07	0.94	0.000		
Sales growth									
	Coef.	Std.err	p-value	R2	Coef.	Std.err	p-value	R2	N
Upturn									
ind_man	-2.31	1.87	0.217	0.0707	-2.75	1.09	0.012**	0.0474	1,270
ind_services	5.71	5.21	0.273		2.44	1.79	0.173		
ind_wr	6.25	3.88	0.107		1.87	1.84	0.310		
size_medium	3.27	2.02	0.106		3.02	1.29	0.019**		
size_small	2.63	1.81	0.147		2.18	1.12	0.051*		
own_pe	23.08	9.65	0.017**		14.45	3.24	0.000***		
man_pe	-24.03	9.85	0.015**		-10.12	4.47	0.024**		
cons.	11.51	1.70	0.000		11.85	0.93	0.000		
Downturn									
ind_man	2.74	2.51	0.275	0.0078	-0.90	0.94	0.337	0.0148	1,242
ind_services	1.80	2.41	0.456		-1.23	1.51	0.415		
ind_wr	0.95	2.87	0.739		1.71	1.52	0.260		
size_medium	1.62	1.49	0.277		1.09	1.02	0.285		
size_small	-1.75	1.67	0.293		-1.38	0.98	0.158		
own_pe	1.04	2.48	0.674		1.20	2.19	0.585		
services_pe	-	-	-		10.49	5.20	0.044**		
cons.	-0.41	1.44	0.778		1.02	0.83	0.220		

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used.

Table A.8 – Level III cleaned regression 2005-2009

EBITDA margin									
	Value weighted				Equal weighted				
	Coef.	Std.err	p-value	R2	Coef.	Std.err.	p-value	R2	N
Upturn									
ind_man	-7.25	1.61	0.000***	0.2011	-12.16	1.05	0.000***	0.3008	967
ind_services	-9.14	2.88	0.002***		-12.27	1.85	0.000***		
ind_wr	-13.48	1.70	0.000***		-19.10	1.20	0.000***		
size_medium	6.56	1.25	0.000***		3.93	1.07	0.000***		
size_small	15.20	2.73	0.000***		8.46	1.79	0.000***		
own_pe	-1.41	2.30	0.541		-1.36	2.49	0.585		
small_man	-15.81	3.35	0.000***		-11.59	2.17	0.000***		
small_services	-12.57	4.52	0.006***		-6.90	3.20	0.032**		
small_pe	-15.46	5.34	0.004***		-10.45	5.22	0.046**		
services_pe	-0.35	3.96	0.931		0.93	4.03	0.817		
man_pe	-2.17	2.70	0.423		-0.36	2.88	0.899		
small_services_pe	27.24	7.52	0.000***		20.25	7.53	0.007***		
small_man_pe	19.92	6.77	0.003***		17.32	6.31	0.006***		
cons.	21.68	1.12	0.000	26.29	0.77	0.000			
Downturn									
No significant interaction variables for either case									
Sales growth									
	Coef.	Std.err	p-value	R2	Coef.	Std.err	p-value	R2	N
Upturn									
ind_man	-0.82	1.68	0.625	0.0277	1.03	1.13	0.360	0.0747	
ind_services	8.77	3.66	0.017**		5.28	1.60	0.001***		
ind_wr	0.52	2.01	0.797		-1.14	1.38	0.408		
size_medium	2.93	2.31	0.206		1.00	1.09	0.363		
size_small	4.60	3.46	0.184		2.37	1.03	0.022**		
own_pe	10.99	4.65	0.018**		10.93	4.02	0.007***		
medium_man	-	-	-		1.82	2.47	0.463		
medium_pe	-	-	-		6.10	3.74	0.103		
services_pe	-	-	-		-9.85	5.08	0.053*		
wr_pe	-20.18	5.20	0.000***		-17.20	4.26	0.000***		
man_pe	-	-	-		-3.35	5.20	0.519		
medium_man_pe	-	-	-		-14.57	5.97	0.015**		
cons.	10.78	1.46	0.000		9.59	0.65	0.000		
Downturn									
ind_man	-0.74	2.38	0.755	0.0252	-3.02	0.81	0.000***	0.0238	948
ind_services	7.15	2.90	0.014**		1.24	1.24	0.317		
ind_wr	0.63	2.47	0.799		-1.68	1.21	0.164		
size_medium	1.28	1.47	0.383		1.06	0.80	0.184		
size_small	2.73	2.19	0.213		0.48	0.84	0.566		
own_pe	1.18	2.08	0.571		-0.37	1.24	0.765		
small_man	-3.43	3.13	0.274		-	-	-		
small_wr	-6.94	6.09	0.255		-	-	-		
small_pe	-5.49	4.82	0.255		-	-	-		
wr_pe	-14.87	7.52	0.048**		-	-	-		
man_pe	-5.23	4.19	0.213		-	-	-		
small_wr_pe	21.06	11.64	0.071*		-	-	-		
small_man_pe	23.77	8.40	0.005***		-	-	-		
cons.	-1.33	1.63	0.416	-0.46	0.52	0.383			

*, **, *** represents significance levels of 10%, 5% and 1% respectively. Robust standard errors have been used.

Table A.9 – List of regression variables

Variable name	Definition
ind_man	Manufacturing companies
ind_services	Services companies
ind_wr	Wholesale & Retail companies
size_medium	Medium size companies
size_small	Small size companies
own_pe	Private equity owned companies
small_man	Small manufacturing companies
small_services	Small services companies
small_wr	Small wholesale & retail companies
medium_man	Medium manufacturing companies
medium_services	Medium services companies
medium_wr	Medium wholesale & retail companies
small_pe	Small private equity owned companies
medium_pe	Medium private equity owned companies
services_pe	Private equity owned services companies
wr_pe	Private equity owned wholesale & retail companies
man_pe	Private equity owned manufacturing companies
small_services_pe	Small private equity owned services companies
medium_services_pe	Medium private equity owned services companies
medium_wr_pe	Medium private equity owned wholesale & retail companies
small_wr_pe	Small private equity owned wholesale & retail companies
medium_man_pe	Medium private equity owned manufacturing companies
small_man_pe	Small private equity owned manufacturing companies
cons.	Base case: Large non-private owned other companies

Appendix B – Data scatter plots

Figure B.1 - Scatter plots of EBITDA margin 1997-2002

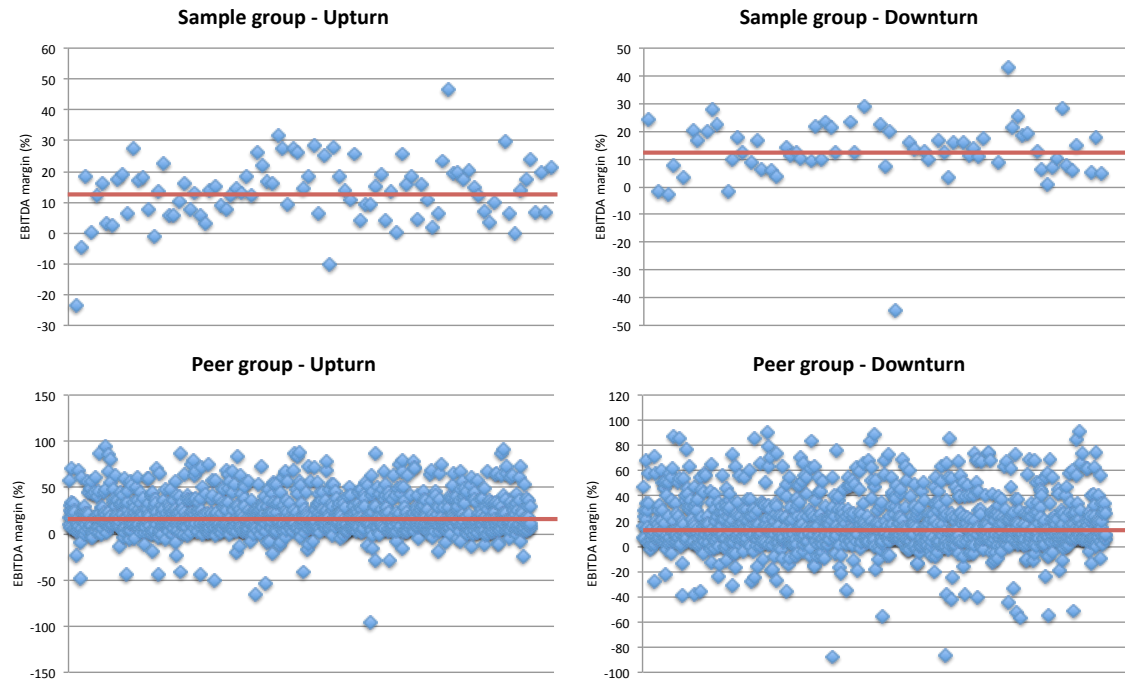


Figure B.2 - Scatter plots of sales growth 1997-2002

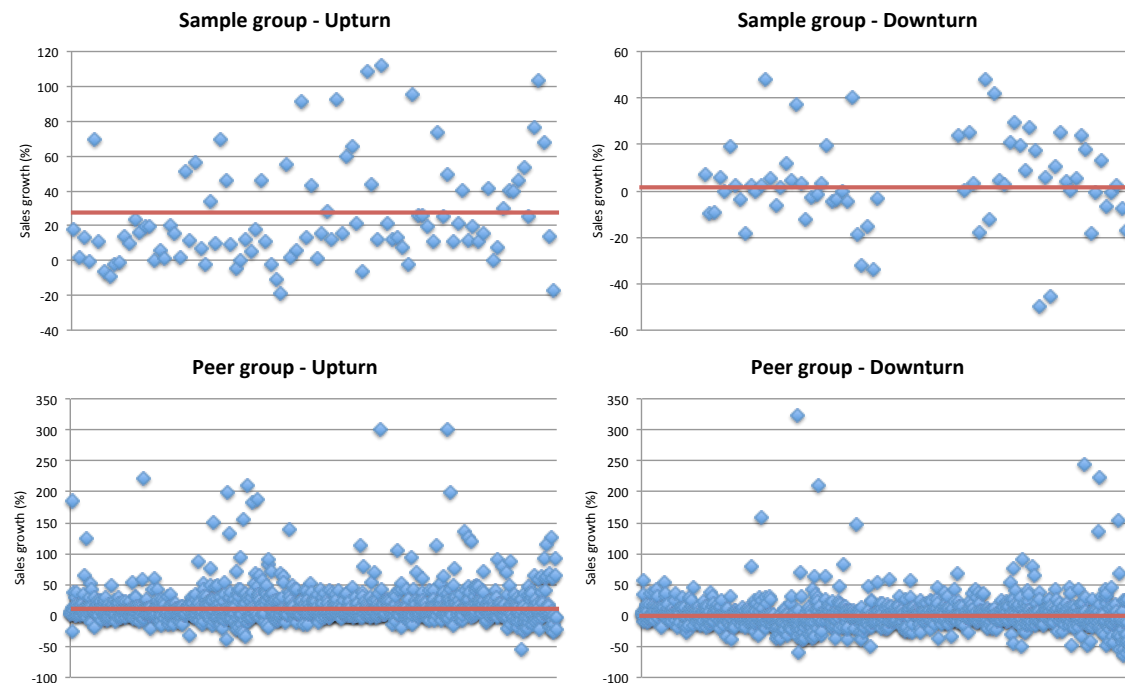


Figure B.3 - Scatter plots of EBITDA margin 2005-2009

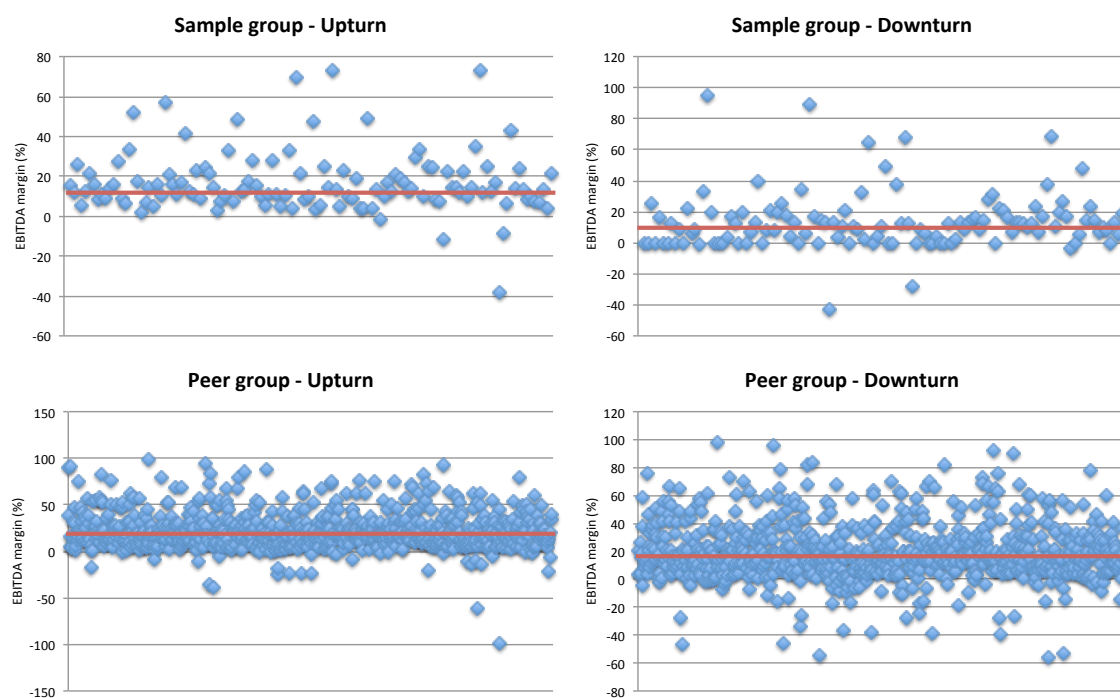


Figure B.4 - Scatter plots of sales growth 2005-2009

