Essays on Private Equity Value Creation

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Table of Contents

3. Private Equity Target Selection: Performance and Risk Measurement via Propensity Score Matching

List of Tables

List of Figures

Preface

This dissertation is a collection of three essays that analyze empirically the widely disputed value creation of alternative investments, specifically value creation of large private equity (PE) funds on an enterprise level.

The surge in the volume of large leveraged PE buyouts before the credit crisis, followed by a precipitous drop in the wake of the crisis, have led many observers to believe that PE is no more than leveraged public equity. According to this view, PE generates big returns through high leverage during times of lax credit markets, which makes formerly financially healthy companies more likely to become distressed in times of tense credit markets (Moody's, 2009).[1] Some observers even compare PE loans with subprime mortgages, due to similarities between them, including for instance, syndicated bank debt that is traded in the secondary market (Acharya et al., 2007),[2] simultaneous decreases in prices of the collateral and refinancing needs of roughly similar size in total (Boersen-Zeitung, 2009).[3]

By contrast, other research views PE activity as a market force that helps to mitigate managerial agency problems (e.g., Jensen, 1986 and 1989).[4] From this viewpoint, the higher debt disciplines managers; moreover, because PE owners assume majority stakes in companies, PE owners monitor and support the management more effectively in comparison to, for example, a diversified public equity holder.[5] In addition, some claim that PE also has an indirect positive impact on companies that are not PE-owned, because management has to

[1] Moody's. 2009. $640 Billion Dollars & 640 Days Later. Moody's Corporate Finance Special Comment, November 2009.
[2] Acharya, V. , J. Franks and H. Serveas. 2007. Private Equity: Boom and Bust? *Journal of Applied Corporate Finance*. Vol. 19, Number 9, Fall 2009.
[3] Boersen-Zeitung. 2009. Die naechste Krise. Boersen-Zeitung. S.8, November 19, 2009.
[4] Jensen, M. C. 1986. Agency Costs of Free Cash Flow, Corporate Finance and Takeovers. *American Economic Review*, 76(2), 323-29.
Jensen, M. C. 1989. The Eclipse of the Public Cooperation. *Harvard Business Review*, September-October, 61-74.
[5] Another mechanism emphasized in the literature are increased managerial incentives (e.g., Leslie and Oyer, 2009). Leslie, P. and P. Oyer. 2009. Managerial Incentives and Value Creation: Evidence from Private Equity. Working Paper, Stanford-GSB.

fear that its company will become a PE target when it is underperforming, and that the new PE owner would replace the management in an effort to increase the company value (e.g., Kaplan, 1997).[6]

This thesis represents an attempt to shed empirical light on the value creation of large PE investments on an enterprise level with the following specific contributions:

In the first chapter we un-lever the deal returns in order to purge the impact of higher leverage at PE owned companies and to derive a measure of true financial outperformance, so called abnormal performance. In the cross-section of large PE investments we find a positive abnormal performance. We further relate the abnormal performance to operating performance to show that our findings are not an artifact of our methodology, but are rather validated by operational improvements.

In the second chapter, we go one step further and analyze human capital factors at play in PE transactions. We are able to show that there is heterogeneity in skills at deal partner level that relates to and potentially explains abnormal performance. This finding further bolsters our former result that abnormal performance is not a financial artifact.

In the final chapter, we describe the clearly non-random target selection pattern of PE investments and the risk limiting role of debt providers in PE investment decisions. We subsequently use the identified target selection pattern to assemble a control group, via propensity score matching, which is more adequate to serve as a counterfactual of PE investments than the broad sector. Based on these matched sector companies, the abnormal performance is still positive, but significantly lower than shown in the first chapter. However, the operational improvements during PE ownership are more pronounced than those described in the first chapter. We also find that the operational volatility of PE-owned companies is low relative to the sector and the debt service coverage ratio, despite the additional leverage, does not drop significantly below sector levels.

[6] Kaplan, S. 1997. The Evolution of U.S. Corporate Governance: We Are All Herny Kravis Now. Mimeo.

In conclusion, the high returns of large PE funds are first of all attributable to high leverage during PE ownership. But PE does not lower the debt service coverage ratio below sector levels, due to the risk limiting influence of debt providers in the investment decision. In addition, large and mature PE funds seem to be able to generate financial outperformance, which is related to operational improvements in portfolio companies and ultimately to human capital factors at fund level. However, the financial outperformance disappears without a growing enterprise value during PE ownership – an important finding for periods of stagnant capital market value development.

1. Financial and Operating Performance of Private Equity Owned Companies

Abstract

We examine deal-level data from 110 private equity (PE) transactions in Western Europe initiated by mature PE houses during the period 1995 to 2005. We un-lever the deal-level equity return and adjust for (un-levered) return to quoted peers to extract a measure abnormal performance of the deal. The abnormal performance is significantly positive on average. In the cross-section of deals, higher abnormal performance is related to greater improvement in EBITDA to sales ratio (margin) and greater growth in EBITDA multiple during the private phase, relative to that of quoted peers. In particular, so-called "organic" deals that focus exclusively on internal value creation programs improve margins; while deals with an M&A or so called "inorganic" strategy grow multiples more substantially.[7]

1.1. Introduction

In a seminal piece on private equity (PE), Jensen (1989) argued that leveraged buyouts (LBOs) create value through high leverage and powerful incentives. He proposed that public corporations are often characterized by entrenched management that is prone to cash-flow diversion and averse to taking on efficient levels of risk. Consistent with Jensen's view, Kaplan (1989), Smith (1990), Lichtenberg and Siegel (1990), and others provide evidence that LBOs create value by significantly improving the operating performance of acquired companies and by distributing cash in the form of high debt payments.

By contrast, the recent literature has focused on the returns that PE funds – which usually initiate the LBO and own (or more precisely manage) at least a majority of the

[7] This chapter is based on joint work with Viral V. Acharya and Conor Kehoe.

resulting private entity – generate for their end investors such as pension funds. In particular, Kaplan and Schoar (2005) studied internal rates of return (IRRs) *net* of management fees for 746 funds during 1985-2001 and found that the median fund generated only 80% of S&P500 return and the mean was only slightly higher, at around 90%.[8] However, the evidence is better for the largest and most mature houses (those that have been around for at least 5 years). Kaplan and Schoar document that for funds in this sub-set of PE houses, the median performance is 150% of S&P500 return and the mean is even higher at 170%. Furthermore, this performance is persistent, a characteristic that is generally associated with potential existence of "skill" in a fund manager. It is interesting to note that such persistence has rarely been found in mutual funds, and when found has generally been in the worst performers (Carhart, 1997).

Our paper is an attempt to bridge these two strands of literature concerning PE, the first of which analyses the operating performance of acquired companies, and the second analyzes fund IRRs. We focus on the following questions: (1) Are the returns to large, mature PE houses simply due to financial leverage over and above comparable quoted sector, or do these returns represent the value created in enterprises they engage with, over and above the value created by the quoted sector peers? (2) What is the effect of PE ownership on the operating performance of portfolio companies relative to that of quoted peers? (3) How does this performance relate to the financial value created (if any) by these houses?

(1) To answer the first question, we develop a methodology to break-down the deal-level equity return earned by a PE house, measured by the IRR, into two components: the un-levered return and amplification of this un-levered return by deal leverage. Next, we extract a

[8] This evidence has been confirmed by studies in Europe (see Related Literature), although some believe these numbers are at best rosy given survivorship biases in data employed. This by itself does not necessarily refute Jensen's original claim; it could simply be that PE funds keep the value they create through fees. The puzzle that the evidence on median return of PE funds raises is thus more

benchmark return (un-levered) that the quoted peers of the deal generated over the life of the deal. The difference between these two un-levered returns is what we call "abnormal performance," a measure of *enterprise-level* outperformance of the deal relative to its quoted peers after purging the effects of financial leverage.[9] We hypothesize, and later verify, that the abnormal performance of a deal captures the return associated with operational strategies and human capital factors (skills at a deal partner level).

We apply this methodology to 110 large deals (greater than ~€50mln in enterprise value) in Western Europe from 14 mature PE houses initiated over the period 1995 to 2005.[10] We find that, on average, about 16-24% of average deal IRR comes from abnormal performance, another 56-58% is due to higher financial leverage, and the remaining portion is due to exposure to the quoted sector. Although abnormal performance has substantial variation across deals, it is on average positive and statistically significant, consistent with the view that large, mature PE houses generate higher (enterprise-level) returns compared to benchmarks. In the cross-section of deals abnormal performance has interesting properties. Abnormal performance has a highly statistically significantly positive correlation, even if imperfect, to IRR and to the "public-market equivalent" (PME) measures based on Kaplan and Schoar (2005).

(2) Regarding the second question we raised at the outset, about whether PE is related to value creation in terms of operational improvements, we show that this is indeed the case. We identify a positive impact of PE ownership on the operating performance of portfolio companies relative to that of the sector. We find that PE ownership causes the deal margin

about why their investors (the limited partners) choose to invest in this asset class as a whole, an issue investigated by Lerner and Schoar (2004) and Lerner, Schoar and Wong (2007).

[9] The leverage amplification can also be further broken down into amplification due to deal leverage on the quoted peers' return and amplification on abnormal performance. Since such abnormal performance also contains (idiosyncratic) risk at the deal level, the leverage amplification on abnormal performance can be interpreted as financial leverage amplifying the operating risk of the deal.

(EBITDA/Sales) to increase by around 2%. For deals with M&A events during the private phase we also find a multiple increase (EBITDA/Enterprise Value) of 18-24%.

We interpret the findings as causal PE impact, since we find no evidence for a violation of the strict exogeneity assumption of PE ownership. For example, could it be that what we are calling "operational improvements" is simply a reversion of acquired deals to the mean? The answer is no. Although the sample size of deals with more than 2 years of available data pre-acquisition is small, there is evidence *against* the mean-reversion argument. PE deals show no difference to their respective sector companies in performance trends pre-acquisition. Both targeted and sector companies show nearly the same robust increase in nominal sales and constant profitability. [11]

(3) Finally, we show that in the cross-section of deals, higher abnormal performance is associated with a stronger operational improvement relative to quoted peers, and hence that abnormal performance is not merely an artifact of our return attribution methodology. First, especially in the deals without M&A events in the first 2 years of the private phase, we find margin improvements as an important explanatory factor for abnormal performance. Second, for deals with M&A events during the private phase we find the increase in EBITDA multiple as one of the most prominent explanatory variables. Interestingly, exactly those measures show up as important for abnormal performance, for which we found a causal PE ownership impact earlier. The improvements in margins and multiples are robust determinants of abnormal performance. In particular, they are robust to controlling for deal duration and

[10] We believe this time period is particularly well-suited for studying value creation through operational engineering. Kaplan and Stromberg (2008) note that operational engineering became a key private equity input to portfolio companies primarily in the last decade.

[11] Yet, PE might still be able to identify companies which will be subject to a positive future shock. This is something we can not rule out. However, a systematic relationship between PE-ownership and future performance shocks does not seem reasonable. To financially exploit individual shocks on a company, a PE house must have a systematic informational advantage in forecasting the future in comparison to the seller and other bidding PE houses. This systematic informational advantage appears questionable in a competitive buyout market, such as that for the large sized firms in Western Europe.

dummies for various acquisition time sub-periods (that control for trends in stock-market valuations).

One could argue that we only studied deals from the funds we sampled, which were cherry-picked by the PE fund? This is not the case. While we have a bias for large PE funds, this is by design, given that we wish to understand drivers of their persistent outperformance. However, within the funds we sampled for our deals, we find no statistical significant difference between a fund's publicly reported IRR and the average IRRs of the deals from that fund in our sample. Remarkably, our data set has also no bias towards public-to-private deals only. In contrast to the literature, the data set covers all vendor types (e.g., carve-out deals) where only part of a company is acquired, and private-to-private deals, where a non-listed business is acquired. Using carve-out and private-to-private deals is important, because they comprise 74% of PE deals in the last decade, and they are different in size (enterprise value) and profitability (EBITDA margin) than public-to-private deals.

In Section 1.2, we review the related literature. In Section 1.3, we provide a description of the data we collected and some summary statistics. In Section 1.4, we describe the methodology for calculating abnormal performance. In Section 1.5, we discuss operating performance. In Section 1.6, we link abnormal performance and operating performance. Section 1.7 concludes.

1.2. Related literature

Jensen (1989) argued that LBOs create value in their portfolio companies through a combination of high financial leverage and powerful incentive schemes. The increased management ownership provides strong incentives for managers to improve operating performance and generate cash flows. The high debt level limits manager's ability to squander free cash on wasteful investments. In addition, PE funds' active participation in the management of the companies improves monitoring.

Kaplan (1989) analyzes the post-buyout operating performance of 48 large management buyouts (MBO) of public companies completed between 1980 and 1986. Consistent with Jensen's hypothesis, he finds that in the three years after the buyout, these companies experienced increases in operating income, decreases in capital expenditures, and increases in net cash flow. Specifically, operating income, adjusted for industry changes, remained unchanged in the first two post-buyout years while it increased by 24% in the third year. The median industry-adjusted net cash flow in the first three post-buyout years was 22%, 43%, and 81% larger than in the last pre-buyout year. These increases in net cash flow were driven both by increases in operating incomes and by decreases in capital expenditures. Consistent with the results on operating changes, Kaplan also finds that the mean (median) increase in market value adjusted for market-wide returns is 96% (77%) in the period ranging from two months before the buyout announcement to the post-buyout sale. This figure suggests increases in operating performance as important sources of the buyout premium.

In her sample of 58 MBOs between 1977 and 1986, Smith (1990) also finds that operating cash flows both per employee and per dollar of book value of assets increased on average after an MBO due to better working capital management. She finds little evidence that the post-buyout cash-flow improvements are driven by cutbacks in discretionary expenses. The increases in operating cash flows were correlated with the buyout-induced changes in debt ratios and management ownership. The above findings suggest that these organizational changes play an important role in value creation in LBOs. Similarly Lichtenberg and Siegel (1990) examine post-buyout changes using plant-level data for approximately 1000 LBOs between 1981 and 1986. They find that, for LBOs during 1983-1986, plant productivity increased from 2% above industry mean in the three pre-buyout years

to 8% above industry mean in the three post-buyout years[12]. Moreover, the authors show that this enhancement in economic performance is not attributed to reductions in R&D, wages, or capital investment.

The topic of measuring fund-level PE performance has received quite a lot of attention recently. The seminal paper in this area is Kaplan and Schoar (2005). Based on a sample of 746 funds raised between 1985 and 2001, the study finds that the return of PE is close to that of the S&P500, net of fees. [13] One of the most interesting and discussed facts that has come out of this literature is that PE performance is persistent. Kaplan and Schoar find that GPs whose funds outperform the industry in one fund are likely to outperform the industry in the next fund. In addition, Kaplan and Schoar find that larger funds and funds with higher sequence numbers generate significantly higher returns, suggesting that the fund size and the maturity of the GP is important for performance. This evidence is somewhat suggestive that mature GPs generate this value (even net of fees) through active ownership and governance. However, convincing evidence in support of this has been elusive, perhaps due to a lack of detailed deal-level data on their involvement with portfolio firms.[14]

The most recent wave of PE transactions (2001-2006) has, however, prompted researchers to re-examine whether buyouts are still creating value in this new era. Guo,

[12] However, 1981 and 1982 buyouts did not experience significant productivity changes. Note that Kaplan (1989), Smith (1990), and Lichtenberg and Siegel (1990) also investigate whether LBOs improved operating performance at the expense of workers. They find that the wealth gains from LBOs were not a result of significant employee layoffs or wage reductions (see Palepu (1993) for a detailed survey of these papers).

[13] Benchmark to S&P 500 implicitly assumes that beta of LBO funds is 1. Jones and Rhodes-Kropf (2004) find that beta of LBO funds is 0.65. Phalippou and Gottschalg (2007) contend that Kaplan and Schoar's results are perhaps still overly optimistic. After correcting for sample bias and adjusting for overstated accounting values, they find that PE funds underperform 3% per year with respect to the S&P 500. Some other studies argue that private equity as an asset class has generated unimpressive returns (net of fees) for their investors (Phalippou, 2007).

[14] An interesting question is whether the value enhancements are sustained after PE houses re-sell their investments. Cao and Lerner (2006) answer this question by studying the long-run performance of 526 reverse LBOs, which are initial public offerings of firms that had previously been bought out by PE funds. The study finds that, in the five years after they are re-sold, LBO firms outperform the market by

Hotchkiss, Song (2009) try to answer this question with a sample of 94 US public to private transactions between 1990 and 2006. They find that gains in operating performance are either comparable to or exceed (by 2% in some measures) those observed for benchmark firms. Leslie and Oyer (2009) find weak or generally no evidence of greater profitability or operating efficiency of LBOs between 1996 and 2004, relative to public companies.

Finally, Lerner, Sorensen and Stromberg (2008) provide evidence that in contrast to the often-cited claim that PE has short-term incentives, buyout deals in fact lead to significant increases in long-term innovation. They find that patents applied for by firms in PE transactions are more frequently cited (a proxy for economic importance), show no significant shifts in the fundamental nature of the research, and are more concentrated in the most important and prominent areas of companies' innovative portfolios. The last finding is consistent with our conjecture that the substantial improvement in margins and efficiency in our sample of deals comes from a shift in focus from inefficient units to productive ones.

Evidence on buyouts in Western Europe: Several studies have examined PE investment in the UK, which has also experienced a tremendous increase in buyout activity in recent years. Nikoskelainen and Wright (2007) study 321 exited buyouts in the UK in the period 1995 to 2004. On average, these deals generated a 22% return to enterprise value and 71% return to equity, after adjusting for market return. In a related paper, Renneboog, Simons, and Wright (2007) examine the magnitude and the sources of the expected shareholder gains in UK public to private transactions from 1997 to 2003. They find that pre-transaction shareholders receive a premium of 40%. They also find that the main sources of the shareholder wealth gains are undervaluation of the pre-transaction target firm, increased interest tax shields, and incentive realignment. Harris, Siegel, and Wright (2005) study the productivity of management buyouts (MBO) plants in the UK. On average, plants involved in

approximately 0.5% per month on a risk-adjusted basis, suggesting that the value enhancements were

MBOs were 2% less productive than other plants in the same industry *before* experiencing a buyout. However, MBO plants experienced a substantial increase in productivity *after* an MBO (71 - 90 %). These productivity gains are substantially higher than those reported in the US by Lichtenberg and Siegel (1990).

Overall, the literature suggests that buyouts have created value through operating improvements, in both US and UK markets, during both the recent and the 1980s buyout booms. Our contributions to this literature lie in providing abnormal performance – a deal-level measure of value creation— and showing the critical role of EBITDA margin and multiple improvements in explaining the variation in abnormal performance. Finally, a unique feature of our analyses, in contrast to the most literature, is that we do not cover the small niche of public-to-private transactions only.

1.3. Data and sample selection

The sample represents relatively large deals, all greater than roughly €50 million in enterprise value, all acquired by fourteen large and mature PE houses between 1995 and 2005. We collected the data in the following way: (1) We developed a list of 40 well-established European multi-fund PE houses. We sought out large houses, either in mid market or large cap. Next, we approached the senior partners at these houses to seek their cooperation. We assured them the information collected would remain confidential, as data would be aggregated and not attributable to any single deal or PE house. 14 PE houses (35%) agreed. (2) For those who agreed, we requested information on as many deals as possible, but made sure it was representative of overall fund performance and not skewed. After that, we followed up with a data request template and worked with the accounting department to obtain data. (3) We tested with the IRRs, of deals for which data was received to see if deals were in fact representative of each fund – and pushed back on a small selection of deals to

sustained.

meet this condition. (4) We also rigorously checked data, looking for discrepancies (e.g., in currencies, sales, cash flows, etc.) and followed up with PE houses when necessary. (5) We collected data from Datastream for c. 7,000 PLCs in Europe to construct sector indices, based on ICB level 3 classification; We ensured EBITDA(E) data was provided to remove effects of exceptional items (as EBITDA is not a GAAP defined parameter).

Our final data-set comprises 110 deals, of which 102 were exited during 2000 to 2007. Out of the 102 exited deals, there were 5 bankruptcies.[15] For each deal, we have the exact structure of cash inflows and outflows from the standpoint of the PE house involved in the deal, detailed data on financial and operating performance, and ownership and board structure. We *do not* have all enterprise level cash flows, which would include for example also taxes or interest and principal paid on debt.[16] The softer information on governance effected by the PE house was collected via interviews with one of the general partners (GP) from the PE house involved in the deal. Each interview lasted for 45-60 minutes.

Table 1.1 shows that our deals are well spread-out over time (within our sample period) although there is some concentration in 2002-2003 in terms of acquisitions. The fall in deal number and flow during 2001 is due to the global recession and tightening of credit.

Table 1.2 provides additional summary statistics for the deals. Deals in our sample have high mean IRR (38.6%) and cash multiples (2.9), with significant outliers on either side. While a high value for average IRR is to be expected from a sample of deals from mature PE houses (Kaplan and Schoar, 2005), this high value does beg the question of how representative our sample is of the overall PE universe in Western Europe, and even within

[15] The proportion of bankruptcies – 5 out of 102 – is typical of buyout data. Kaplan and Stromberg (2008) report an average of 6% of bankrupt deals in a large sample of buyouts since 1980.

[16] We also do not have all cash flows for the 8 un-exited deals because there is no exit cash flow from sale, nor can it be deemed to be zero as in the case of bankruptcies. Therefore, the end enterprise-value cash flow was simulated using the EV / EBITDA multiple at the start of the deal and applying that number to 2006 or 2007 year-end EBITDA. Our results are robust to alternative and more conservative assumptions on these un-exited deals, including one assumption that they produced no terminal cash

the funds of PE houses we focus on. We discuss this sample selection issue in greater detail below.

Next, we report the duration for all deals and also the time until first major M&A or divestment events during PE ownership. M&A and divestment events seem to be mutually exclusive, since no deal shows both during deal life. It is important to note that first acquisition events happen earlier in the private phase than first divestment events. Specifically, first M&A events take place on average after one year, while first divestment take place after two years. In the following analyses we classify deals without major M&A events in the first 2 years during PE ownership as organic deals.

In the second part of the Table we compare financial ratios at the entry and exit date. The mean entry EV/EBITDA multiple is 8.9, whereas the corresponding exit multiple is 11.1, which indicates that on average our deals seem to have improved their market valuations (consistent with the findings of Kaplan, 1989). The median debt to equity ratio at entry is 2.0, which is in line with the usual LBO capital structure, believed to be 70% debt and 30% equity (Axelson et al., 2008). At the same time, the median debt to equity ratio at exit is 0.9. The debt to EBITDA ratio does not fall as much as the debt to equity ratio (it goes from a median entry value of 5.6 to an exit value of 4.7). Therefore, it appears that the debt to equity ratio falls for PE deals during their life partly due to improvements in coverage ratio (debt/EBITDA), but mainly due to improvements in equity value over deal life.

Next, we come to the sample-selection issue. Table 1.3 – Table 1.6 provides several relevant comparisons between our sample and the PE universe. Overall, our sample seems to be representative in terms of the performance of large PE houses, covers mainly large deals, but most importantly includes all different vendor types, e.g., also the frequent private-to-private deals.

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flow whatsoever. However, we have verified that such a pessimistic scenario is unlikely to be

First, Table 1.3 presents the comparison of deal performance in terms of IRR to the PE funds in our sample and shows that PE funds did not cherry-pick the deals that they reported. The difference between the fund IRR and the average IRR of our deals per fund is in fact not statistically significant (t=0.52). This illustrates that we have in terms of performance, a good representation of deals within the funds we sampled.

At this point, we first need to convert our gross deal-level IRRs (before fees charged by PE houses to fund investors) to net IRRs (after fees, or in other words, IRRs from the viewpoint of fund investors). This is because the data we have on the overall universe is primarily in the form of net IRRs.

To perform this conversion, we also construct an artificial fund of our sample deals and calculate its IRR. The pseudo-fund starts in 1995 and lasts for 13 years, until 2007. Investments or cash inflows take place in years 1-9 (with small investments in years 10 and 11 as well). The bulk of the investments occur in years 3-9. Cash payouts start in year 5 and in the last 3 years, the fund only has cash payouts. Using this pattern of cash inflows and outflows, we calculate the gross IRR of the pseudo-fund. Next, we deduct from the gross IRR a 2% annual fee and 20% carry for IRR above (the typical) benchmark (the market return of 8%).[17] This pooled net IRR for our deals is 23.9%, which is close to the average net deal IRR of 26.2%. In contrast, if we focus only on the returns of the 32 specific funds (based on Prequin figures) from which our deals were financed, we get a simple average of net fund IRRs of 24.1% and a median of 26.4%, which is close to the performance of the deals in our sample.

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appropriate for these deals.

[17] More specifically, if a) Gross IRR<=10%, then LPs keep all return except 2% fees, so that Net IRR = Gross IRR - 2% fees; b) 10%<Gross IRR<12.5%, then LPs keep all return up to 10% except for 2% fees and GPs keep all return from 10% to 12.5%, so that Net IRR = Gross IRR - 2% fees – (Gross IRR – 10%) = 8%; and c) Gross IRR>=12.5%, then LPs and GPs share in 80:20 ratio the return exceeding 12.5%, so that Net IRR = Gross IRR - 2% fees - 2.5% - 20%*(Gross IRR - 12.5%).

Second, Table 1.4 shows that the sampled funds are a good representation of similar-sized funds, once we take into account the fact that we are focusing on funds whose sizes are above €500 million. All 229 funds in Western Europe with the same vintage year 1993-2003 as our sample have a simple average net IRR of 16.3% (based on Thomson Financial Venture Expert figures), which is lower than the net IRR of our funds (t=-2.29). Yet large funds have higher returns. Specifically, the 53 funds above €500 million, like the participating funds in our sample, show a net IRR of 22.0%, which is again not statistically significantly different from the 24.1% net IRR average of our 32 participating funds (t=-0.50). In row (0) we also report the net IRR of the previous funds, to show that the higher performance of our funds seem to be persistent.

Third, Table 1.5 shows that the number of deals in our sample is significantly smaller than that of all Western European deals over the sample period. Our sample only represents 110 out of 5,384 deals, for which data was available. However, in value terms we cover 13.7 % of large and very large deals – €100 to €500 Mio and greater than €500 Mio. Ultimately, because we are studying the performance of large, mature PE houses, we have a sample with a large-size bias. However, most of the literature has an implicit large-size bias, too. The reasons are that the literature a) mainly focuses on public-to-private deals only, which are mostly large deals or b) on deals with public debt financing, which are typically larger as well.[18]

Finally, Table 1.6 shows the biggest advantage of our data set. As previously mentioned, our sample includes all types of deals. For example, the sample includes carve-out deals, where only part of a company is acquired, or private-to-private deals, where PE acquires a non-listed business. Moreover, our data also includes deals which were previously

[18] Though it should also be noted that the large-size bias makes our sample more comparable to the benchmark group we employ, which consists of publicly quoted peers. The size of these is generally larger than a typical private equity deal in the entire universe of such deals.

owned by PE and former state-owned companies. We think covering all vendor types is an important novelty. First, public-to-private transactions represent by volume only 4% of the total buyout activity. By contrast, the majority of deals are carve-out and private-to-private. For example in Western Europe, carve-out and private-to-private comprise 74% of all PE deals between 1995 and 2005. Second we find statistically significant operational improvements during PE ownership, in contrast to Guo, Hotchkiss and Weihong (2009) for example. And the differences could be caused by a particularly strong PE impact in carve-out deals or on former private companies, since we find that carve-out and private-to-private deals are different before their acquisition. [19] Namely, they are smaller in size and different in profitability (EBITDA margin) from public-to-private deals in the Western European universe, as shown in Table 1.6.

1.4. A measure of abnormal financial performance

1.4.1. Methodology

One of the key questions we want to answer in this study is how much of the excess return generated by PE firms, relative to quoted peers, comes from pure financial leverage, and how much comes from genuine operational improvements. To disentangle the effect of leverage from that of operational improvements, we first calculate the IRR of the deal – its levered return – using the entire time pattern of cash inflows and outflows for the deal, as experienced by the PE house (before fees). Then we un-lever this IRR. Next, we benchmark this un-levered return to (similarly calculated) un-levered return for the quoted peers of the deal. The resulting residual un-levered return is what we call the "abnormal performance" of the deal.

Formally, to un-lever the levered return of deal *i,* $R_{L,i}$, we use the un-levering formula:

[19] However, due to our small sample size, we are not able to identify differences in financial performance or operational improvements by vendor type. We have only 14 public-to-private deals in

$$R_{U,i} = \frac{R_{L,i} + R_{D,i}(1-t)(D/E_i)}{(1+D/E_i)} \quad (1.1)$$

The un-levered IRR, $R_{U,i}$, corresponds to the return generated at the enterprise level. Since the PE houses in our sample did not report $R_{D,i}$, which is the average cost of debt, we use the base rate and interest margin spread reported in Dealogic for each deal.[20] The leverage ratio D/E_i of the deal is the average of the entry and exit debt to equity ratio of the deal. Since the starting *D/E* is higher than exit *D/E* for most deals, the average pattern of leverage is one of decline over the life of the deal. Hence, we employ the average of the two. Finally, we use for tax rate *t* the average corporate tax rate during the holding period from the country in which the portfolio companies' headquarter is located.

We also apply (1.1) to un-lever sector IRRs. In this case, a sector is defined as containing all quoted European "peer" companies sharing the deal's 3-digit ICB code in Datastream. In particular, we calculate the median annualized total return to shareholders (TRS) over the life of each deal of these quoted peers of the deal, denoted as $R_{S,i}$.[21] The median return of these peers represents the benchmark–levered sector return, which we un-lever using (1.1) and the median *D/E* ratio for the sector company over a three-year average from the deal's entry date onwards. We further assume the same tax rate and cost of debt for

our data.

[20] Dealogic provides information on the base rate and the interest margin spread for only 67 deals (out of 110) in our sample. For 19 deals we can find only the base rate (Libor vs. Euribor) and for the remaining 24 deals we find no information. If the margin spread is unknown, we use the median spread of all PE deals in Western Europe in the same year. If the base rate is unknown, we use LIBOR for the UK deals and Euribor for all other deals.

We verified that this assumption does not have a large impact on our results. First, the spread does not vary much in the cross-section. In our sample period and for all deals covered in Dealogic, the standard deviation of the weighted (by risk tranches) average spread is 1.1%, with an average (median) spread of 2.6 (2.3) % (n=984). In addition, the sensitivity of the abnormal performance of a deal (alpha) to different interest rate assumptions is less than 1. It varies according the un-levering formula by (D/E)/ (1+D/E) * Δi. For example, with a D/E ratio of 2, a 1 bp increase of the interest rate only changes the abnormal performance by 2/3 bp. Second, the base interest rate is twice as important for determining the deal interest rate as the interest spread. In our sample period, the average (median) Libor base rate is 5.6 (5.6) % with a standard deviation of 1.2 % (n=132) and Dealogic provides information on the base rate for 92 out of 110 deals in our sample.

the sector as for the deal. Note that higher values of $R_{D,i}$ result in greater un-levered return for the same levered return. Since the $R_{D,i}$ for the less levered sector companies is potentially lower than for the deals, we overestimate the un-levered sector returns and are therefore conservative in the deal performance measurement.

After obtaining the un-levered returns, $R_{U,i}$, and $R_{SU,i}$, which are purged of the effect of financial leverage, the next key step is to measure the portion of PE excess return that is brought about by genuine operational improvements. For this purpose, we employ a one factor model and express the un-levered return of each firm in terms of the contemporaneous un-levered sector return as follows:

$$R_{U,i} = \alpha + \beta_S R_{SU,i} + \varepsilon_i \tag{1.2}$$

The coefficient β_S in (1.2) is a measure of correlation between PE return and the median quoted public sector return. In our analysis, we assume that $\beta_S = 1$ rather than estimating it.[22] In particular, since we have only one IRR value for each deal, α and β_S can be estimated only in the cross-section. In other words, the regression model corresponding to (1.2) implicitly needs to assume that each deal in our sample is a random draw from the PE universe which has identical but independently distributed portfolio companies with α and β_S characteristics. The intercept, α, captures the component of PE return that is not linked to industry-wide risks, and therefore can be considered an estimate of average *excess* return on the deal. The residual, ε_i, measures the idiosyncratic under-/outperformance of each individual PE deal relative to average PE abnormal performance of α and has a mean of zero.

[21] Using an equally weighted average of the annualized TRS of these quoted peers does not qualitatively alter our results.

[22] Note that (2) employs total returns rather than returns in excess of the risk-free rate. This does not affect results when beta is assumed to be one. When beta is different from one, the assumption is not innocuous but we have verified that the impact is small for reasonable levels of the risk-free rate.

In essence, applying (1.1) and (1.2) allows us to make the following decomposition or performance attribution of each deal IRR:

(i) Deal-level abnormal performance: $\alpha_i + \varepsilon_i$

(ii) Unlevered sector performance: $\beta_S R_{SU,i}$

(ii) Total leverage effect: $R_{L,i} - R_{U,i}$

The leverage effect $(R_{L,i} - R_{U,i})$ measures the total effect of leverage on deal return. More often, however, we are interested in measuring the effect of the additional leverage that firms take on after they are purchased by PE. To get at the incremental effect of increased leverage, we re-write (1.2) in terms of $R_{L,i}$ as follows, where D/E_i and $D/E_{S,i}$ denote the deal and sector debt to equity ratios respectively:

$$R_{L,i} = R_{U,i}(1 + D/E_i) - R_{D,i}(1-t)(D/E_i)$$

whereby

$$\begin{aligned} R_{L,i} &= \alpha_i(1 + D/E_i) + \beta_S R_{SU,i}(1 + D/E_i) + \varepsilon_i(1 + D/E_i) - R_{D,i}(1-t)(D/E_i) \\ &= [\alpha_i + \varepsilon_i] + [\beta_S R_{SU,i}(1 + D/E_{S,i}) - R_{D,i}(1-t)(D/E_{S,i})] \\ &+ [(\beta_S R_{SU,i} - R_{D,i}(1-t)(D/E_i - D/E_{S,i}) + (\alpha_i + \varepsilon_i)(D/E_i)\ ] \end{aligned}$$

This equation provides an alternative decomposition of each deal IRR:

(i) *Deal-level abnormal performance*: $\alpha_i + \varepsilon_i$ measures the excess asset return generated at the enterprise level of the portfolio company for PE investors, and it is purged of the effect of leverage financing that the firm takes on.

(ii) *Levered sector return*: $\beta_S R_{SU,i}(1 + D/E_{S,i}) - R_{D,i}(1-t)(D/E_{S,i})$ measures the effect of contemporaneous sector returns, including the effect of sector-level leverages.

(iii) *Return from incremental leverage*:

$(\beta_S R_{SU,i} - R_{D,i}(1-t))(D/E_i - D/E_{S,i}) + (\alpha_i + \varepsilon_i)(D/E_i)$ captures the amplification effect

that a) the incremental deal leverage beyond the sector leverage, ($D/E_i - D/E_{S,i}$), has on the sector returns and b) the total leverage has on enterprise-level abnormal performance.

The purpose of performing such a decomposition or return attribution is three-fold. First, it is to see if the sample deals from mature PE houses generated a significantly positive abnormal performance or not. Second, if we believe that the abnormal performance is attributable to operating strategies and changes attempted by the PE houses, then what is the cross-sectional distribution of this abnormal performance? And, third and perhaps most importantly, is there evidence at the individual deal level that abnormal performance is related to actual measures of operational improvements?

Before we proceed to discussing our results, it is useful to note some of the limitations of our methodology. First, it treats leverage as purely financial gearing rather than having some incentive effect. Second, our methodology is subject to the usual problems associated with IRRs, that they are a way of discussing cash flows rather than being actual realized returns, and that they translate into returns only under extreme assumptions of constant and common discount rates and reinvestment rates. To address the second issue, another approach we adopted was to calculate a public market equivalent (PME) for each deal. As a benchmark, we used the sector return to discount all cash flows and then calculate the ratio of discounted cash flows to the largest cash inflow for the deal (in the spirit of Kaplan and Schoar 2005). We discuss the relationship between abnormal performance, IRR and PME in the next section. Finally, since we do not have the exact cash payouts on debt, we are unable to employ the methodology of Kaplan (1989), which is to simulate the enterprise-level (not equity) cash flows that would be obtained by investing these cash inflows in the quoted sector and examining the cash outflows thus generated. We chose to use IRR, given its simplicity and also because it is easily broken down into abnormal performance and related components.

1.4.2. Average abnormal performance and its characteristics

Table 1.7 summarizes the results from employing the decomposition method of Section 1.4.1. It presents (1) the overall sample of 110 deals; (2) the sample of 102 deals which excludes the 8 un-exited deals; and (3) the set of 67 deals where Dealogic provided the exact cost of debt for the deals.

(1) We find that out of the average IRR of 38.6 % for all 110 deals, sector risk and leverage amplification on its account for a total of 8.5%. In other words, less than one third of the total return is attributable to sector-picking ability of PE houses or simply to pure luck. The average abnormal performance of 8.4% is statistically significant (significant at a 1% level), confirming that large, mature PE houses do generate higher (enterprise-level) returns compared to benchmarks and not all of these returns are attributable to sector exposure and financial gearing. The medians tell a similar story. Interestingly, since quoted sectors have little leverage on average, most of the incremental leverage effect of 21.7% is due to deal leverage, above and beyond the sector.

(2) When we only include deals in the analysis that were exited by 2008, the results do not vary much – our exit simulation for the 8 un-exited deals is conservative and has nearly no impact on the average level of abnormal performance. In fact, the abnormal performance estimate is hardly affected when we include deals with simulated exits. Therefore, we keep the un-exited deals in our data set for the following analyses.

(3) We find that the abnormal performance is also statistically significantly positive when we only look at the 67 deals for which data on the cost of debt was available in Dealogic. Interestingly, the abnormal performance of 6.5% seems lower than the abnormal performance of all deals. This is partly explained by the fact that the deals with an entry year

early in our sample period perform better and it is less likely to find information on the cost of debt for those deals in Dealogic.[23]

In Table 1.8 and Table 1.9 we compare abnormal performance and the alternative financial performance measures IRR, PME of the deals relative to the sector. We find that *IRR = 25.3% + 1.6 * abnormal performance*. Thus, IRR and abnormal performance are positively related (t = 12.7) but the association is far from perfect, as revealed by the R^2 of 59.9%. Consistent with the positive abnormal performance, PE also generates (on average) returns above the sector and the market: average sector PME is 116.4%.[24] Overall the evidence points to outperformance of PE deals in our sample in a manner that is robust to alternative measures, as the large, positive correlations between all three performance measures (Table 1.9) indicate.

1.5. Operating performance

1.5.1. Operating measures

The next step in our analysis is to see if abnormal performance is related to operating abnormal performance at the enterprise level. Operating abnormal performance is reflected in two ways, first, in a larger increase in EBITDA of the portfolio company during PE ownership or, second, in a larger increase in the EBITDA after PE ownership than the sector. To disentangle the PE impact on EBITDA *during* PE ownership, we focus on (1) sales and (2) profitability (margin = EBITDA / sales). We capture the impact on the company *after* the PE ownership period by analyzing (3) the EBITDA multiple (enterprise value / EBITDA). Here, we have to rely on the assumption that market expectations are rational at exit, since we do

[23] In comparison to the deals with an entry in 2003 or 2004, the deals in 1996-2000 and 2001-02 were doing substantially better. This might correspond to availability of cheap debt financing, a phenomenon believed to be at work especially for PE deals struck during 2003 to mid-2007 and is likely responsible for the somewhat high valuation multiples paid by PE houses during 2003-07 (Acharya, Franks and Servaes, 2007; and Kaplan and Stromberg, 2008).

[24] We also obtain that IRR = 22.3% + 14.0 * PME sector (t = 5.9 ; R^2 = 24.6%).

not have operational figures after the PE phase for many of the deals (trade sales, for example).[25]

The three measures we analyze in detail are:

(1) *Sales,* equal to operating revenues earned in the course of ordinary operating activities.

(2) *Margin (EBITDA/ sales).* EBITDA *(Earnings before Interest, Taxes, Depreciation and Amortization),* equal to Operating revenues – COGS (cost of goods sold) – SG&A (selling, general and administrative expenses) – Other (e.g., R&D) = Operating income.

Academics and practitioners widely use EBITDA since it shows a company's fundamental operational earnings potential. However, EBITDA is not a defined measure according to Generally Accepted Accounting Principles (GAAP) or IFRS/IAS. In the present paper we define EBITDA *excluding* "Non-operating income".[26] Often this measure is more precisely referred to as EBITDAE (Earnings Before Interest, Taxes, Depreciation, Amortization and Exceptionals).

(3) *EBITDA multiple (enterprise value/EBITDA).* In our data, enterprise values are available only at acquisition and at exit. For these dates, the PE house also reported the total debt and total equity of the company. For the 5 bankrupt deals, the equity value is assumed to be 0 at the time of bankruptcy (exit).

Note that to identify the PE impact on operating performance between pre-acquisition and during PE ownership, it is crucial to have access to a consistent dataset for both periods. Probably the only data source without a structural inconsistency is the data PE houses collect

[25] Since we work with operational numbers in €, we convert all figures into € at the exchange rate applicable in that year.

[26] The reason for the exclusion of "Non-operating income" is that this measure contains income derived from a source other than a company's regular activities and is by definition nonrecurring. For example, a company may record as non-operating income the profit gained from the sale of an asset other than inventory (which can be large in relation to the operating income). From a practitioner's perspective, an EBITDA multiple including "Non-operating income", would not be a helpful measure to understand the price paid in relation to the current performance capability. From our perspective, the operational performance indicator EBITDA would then be subject to a measurement error.

themselves in the due diligence process and through monitoring efforts during their ownership. This is the data we use in the present paper.

1.5.2. PE impact on operating performance

Table Table 1.11 reports for three previously described operating measures x the difference $\Delta x_i = x_{iT} - x_{it}$ from the last pre-acquisition year ($t=0$) to last PE-ownership year (T).[27] First, we report the changes for all deals. Second, we separate deals with organic strategies from deals that had major M&A events during the private phase, so that we can analyze the operating performance difference by strategy.[28] We also include deals with M&A events after 2 years of PE ownership in the organic deal set, since late M&A events might be endogenously determined by the observed performance of the deal.[29]

We also report the same figures for deal corresponding sector companies $\Delta x_s = x_{sT} - x_{st}$. We use median sector changes, given that there are mostly less than 100 companies in each three digit sector. In the last column, we test if the changes are different from zero and, in a spirit of a difference-in-difference (DiD) regression setting, also for differences between deal and median sector changes.[30]

Coming to our main results, organic deals, which are deals without M&A events in the first 2 years of PE ownership, seem to improve profitability (EBITDA margin) by about

[27] The differences in sales and margin between entry and exit date are calculated without including changes in years with M&A or divestment events. This is because the numbers might get artificially inflated or deflated in the presence of acquisition or divestment activity. However, our findings stay qualitatively robust when we include years with M&A or divestment events.
[28] Also Nikoskelainen and Wright (2007) explicitly control for deals with acquisitions.
[29] For example PE funds could potentially change their strategy from an internal (organic) improvement program to an inorganic strategy whenever a deal is underperforming in the first years, in order to blur their underperformance. So, it would not be the strategy that causes the observed difference in operating performance. Instead it would be rather the operating performance that causes the strategy. However, M&A events in the first 2 years are only exogenous, if we assume that it takes at least one year to find out that a deal is underperforming and at least another year to identify and buy another company.
[30] We control for sector movements with medians as RHS variable instead of pooling the deals with sector companies, due to the distortion coming from outliers in the sector figures.

2.5% above sector during PE ownership as shown in Table 1.11, column (2).[31] These improvements are roughly in line with the 1.4 - 3.8 ppt. reported in Kaplan (1989). In contrast, inorganic deals seem to increase the EBITDA multiple (enterprise value/ EBITDA) by 2.1 or 17.8% above sector during PE ownership as shown in Table 1.11, column (3). Although PE deals grow annually in sales during PE ownership with 5.6% (we divide the difference in log sales between *t* and *T* by the number of PE ownership years (*T-t*) to get annual nominal sales growth), we find that deals underperform the median sector sales growth. However, this finding is mainly caused by the fact that the sector companies are smaller than our deals and smaller companies show a higher growth as discussed in chapter 3.[32]

In Table 1.10, we provide a snapshot of the pre-acquisition operating performance change for the deals in our sample (available for 2 years pre-acquisition) and each corresponding sector. Targeted companies show a robust increase in nominal sales but a constant profitability. Importantly, in terms of performance trends, PE owned companies do not differ statistically significantly from their sector peers in the pre-acquisition phase. Although the sample size is smaller for deals with more than 1 year of available data pre-acquisition overall, there is evidence against a simple mean-reversion argument that PE targets are recent under-performers. As described in Kaplan (1989) and also according to our data, PE does not seem to pick companies that were exposed to an idiosyncratic shock, which in better times would revert to the mean and the target potentially be sold with an upside.[33]

[31] We include deals with M&A events after 2 years of PE ownership, since late M&A events might be endogenously determined by the performance of the deal. However, our results are qualitatively robust to using deals only without M&A events.

[32] In chapter 3 we use (propensity score) matched peers as benchmark instead of the broad sector, since PE does not randomly pick targeted companies. All the results shown in this paper are qualitatively robust to using matched peers, except the finding on sales growth.

[33] These findings also provide evidence that the buyout company managers do not cook the books in the last year pre-acquisition, as discussed in Cumming et al. (2007), or at least that PE houses in our sample are able to collect the figures in the due diligence process, which are not subject to this problem (measurement error).

Therefore, the exogeneity assumption of the PE acquisition, which is fundamental for any identification of a causal PE impact in our analysis, does not seem to be violated. [34]

1.6. Abnormal performance and operating performance

Having separately identified financial and operating abnormal performance of PE deals relative to quoted peers, in Table 1.12 we investigate the relationship between the two measures. Specifically, we regress abnormal performance on the increase in EBITDA margin, growth in sales and change in EBITDA multiple. And once more we distinguish between initially organic and inorganic deals. As additional controls, we include duration and dummies for the entry time. However, note that the significance and size of the estimates on operating improvements is minimally affected by omitting time dummies for entry years (results are available upon request). We do not include as independent variable the size of the deals since size does not show up as significant and lowers the explanatory power of the regressions. This is potentially due to a lack of variation in size in our sample which consists mainly of large deals. Another potential driver of abnormal performance is that PE houses may have been lucky on some deals simply because they bought them at the right time when the margins or multiples in the sector were growing. We therefore include the sector change for all three operating measures too.

Coming to our main results, out of the three measures of operating performance, the two which we have identified as being causally altered by PE ownership, also show up as significant determinants of abnormal performance: Both EBITDA margin and multiple changes have a positive and economically meaningful impact on abnormal performance. Once

[34] Yet we cannot rule out that PE might still be able to identify companies that will be subject to a positive future shock. However, a systematic relationship between PE-ownership and future performance shocks does not seem reasonable. To financially exploit individual shocks on a company, a PE house must have a systematic informational advantage in forecasting the future in comparison to the seller and other bidding PE houses. This systematic informational advantage appears questionable in a competitive buyout market, such as that for the large sized firms in Western Europe.

again, EBITDA margin improvements seem to be more important for organic deals while EBITDA multiple improvements are more important for inorganic deals. First, according to specification (4), 1 ppt. improvement in EBITDA margin, controlling for sector EBITDA margin improvements, increases abnormal performance by roughly 1.1 ppt. for organic deals. In addition, a growth of the multiple from entry to exit by 10% increases abnormal performance by roughly 3.4 ppt. in regression (6). Second, changes in margins do not seem to relate to abnormal performance in inorganic deals, as shown in regression (6). In contrast, multiple improvements do not seem to explain abnormal performance in organic deals, as shown in regression (4).[35]

The contribution of these operating performance changes is substantial in explaining abnormal performance. In the previous section we identified an average abnormal performance of 8.4% and an average PE impact on EBITDA margin of roughly 2-3% for organic deals and on multiple of roughly 18-24% for inorganic deals. Based on the deal strategy (organic vs. inorganic) and the coefficients in specification (4) and (6), we are thus able to explain nearly one or two thirds of the abnormal performance.[36]

Our findings are also robust to alternative financial performance measures. In Panel B, we simply replace the dependent variable abnormal performance with either a) IRR or b) PME based on sector. For example, with PME based on sector, margin improvement is significant (t = 3.94), and has a positive effect on abnormal performance. A 1 ppt. margin increase above the sector increases the PME by roughly 7%, given an average PME based on sector of 116.4. Also the effect of the log EBITDA multiple stays significant and has nearly the same size.

[35] Our findings stay qualitatively unchanged when we use as organic strategy, deals without M&A events only.
[36] Other value drivers not covered in the analysis are working capital and capital expenditure reductions.

We conclude that it is the improvement in margins for organic deals and multiples for inorganic deals that distinguishes good deals from others in terms of financial value creation. This is a potentially important result: it provides insight into the operating strategies that might be at play in different PE deals.

1.7. Concluding remarks

The surge in PE funding during 2003 through the middle of 2007, and the aftermath of the sub-prime crisis since then, has caused research on PE to confront similar issues as those after the boom and bust cycles of late 80s and early 90s. From an economic standpoint, the primary interest concerns the long-run viability and value creation, if any, from the private ownership of leveraged buyouts. On the policy front, the PE industry has a significant numbers of employees working in PE-funded enterprises and, as a result, has attracted considerable media as well as regulatory scrutiny. While some of this scrutiny is centred on whether tax rates on carry earned by PE houses is "fair," significant policy interest has also been expressed in understanding and quantifying the long-run impact of PE in terms of value creation at the enterprise level, and in the attribution of this value creation to financial engineering, systematic risk and operational engineering. Indeed, in some cases such as in the UK, policymakers have undertaken independent recommendations based on interactions with the PE industry to improve disclosure on such value attribution.[37]

This paper is best viewed as an attempt to get at some of these issues with three significant contributions. First, we provided a simple methodology that relies only on returns and leverage information at the level of deal's equity, and the returns and leverage of quoted peer firms in order to extract a measure of abnormal performance of the deal at enterprise-level. The methodology also quantifies the sector and leverage contributions to deal return.

[37] See the House of Commons Treasury Committee's Tenth Report in the UK of Session 2006-07 and Sir David Walker Report on "Disclosure and Transparency in Private Equity" (2007).

Second, by using this measure we showed that for 110 deals of 14 large, mature PE houses in Western Europe initiated during the period 1995-2005, there is evidence consistent with significant value creation for portfolio companies. Third, deal-level abnormal performance correlates well with operating outperformance of deals relative to quoted peers, measured as improvement in margins and multiples relative to the quoted sector.

Our results can be interpreted as providing evidence on operational engineering employed by large, mature PE houses in improving companies they acquire. Returns to these operational improvements are likely the reason behind persistent and significant financial outperformance of funds run by these houses.

However, much remains to be done on this front. A considerable interest remains in understanding in greater depth the nature of engagement and involvement of PE houses with portfolio companies and providing more robust evidence on how these relate to value creation. Larger, deal-level datasets prepared with the help of the PE industry are clearly required for this interest to be fulfilled by researchers. Finally, designing creative ways of understanding short-run and long-run investment impacts of the PE industry relative to other firms in the economy remains an important area to explore. The patent-based innovation analysis of PE companies undertaken by Lerner, Sorensen and Stromberg (2008) seems an exciting start on this front and suggests that PE deals generate not just productive but also innovative growth.

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1.9. Tables

Table 1.1: Distribution of deals by entry and exit years

The table shows the years in which the PE houses bought (entry) or sold (exit) the portfolio companies (deals) in our sample.

Years	1995	96	97	98	99	2000	01	02	03	04	05	06	07	sum
Entry	1	5	8	12	14	11	10	17	17	13	2	n/a	n/a	110
Exit	n/a	n/a	n/a	n/a	2	2	7	6	10	22	18	19	24[1]	110

1 Including eight deals for which exit is simulated

Table 1.2: Summary statistics

The table shows various financial measures for the deals in our sample. The first part reports the financial performance and the duration. We calculate the deal IRRs (internal rate of return) using the entire time pattern of cash inflows and outflows for each deal, as experienced by the PE house (before fees). The cash in/cash out multiple measures the absolute value of all positive cash flows divided by all negative cash flows minus 1. The duration captures the length of the deals in years, using the entry and exit months and years as reported by the PE house. The time until first M&A event reports the duration in years between entry data and first M&A event of a deal; the time until first divestment reports the same for divestment events. The second part of the table compares the enterprise value (deal size) and several financial ratios between entry and exit date. The number of observations is smaller than in the first part, since we only include deals that the PE funds sold by end of 2007, and assume an equity value of zero for bankrupt deals. In addition, information on EBITDA at entry and exit is not available for all deals. In the last column we test for differences between entry and exit values.

Variable	n	mean	median	std. dev.	min	max	t-stat of diff. exit and entry
Deal IRR %	110	38.6	36.0	40.5	-87.8	123.4	
Cash in/cash out multiple		2.9	2.8	1.8	0.0	10.3	
Duration (years) [1]	102	3.9	3.6	1.5	1.4	9.0	
Time until first M&A event	37	1.2	0.9	1.3	-0.2	4.3	
Time until first divestment	15	2.5	2.2	1.8	0.4	7.3	
Deal size (Entry) [1]	102	650.2	397.6	694.6	42.7	3,154.9	6.50***
Deal size (Exit) [1]		1,062.3	592.2	1,160.5	64.1	4,970.0	
Debt/equity (Entry) [2]	97	2.0	1.9	1.1	0.1	8.7	-9.97***
Debt/equity (Exit) [2]		0.9	0.6	0.8	0.0	4.5	
Deal size/EBITDA (Entry) [3]	73	8.9	7.9	7.0	-13.7	38.7	1.92
Deal size/EBITDA (Exit) [3]		11.1	9.5	7.5	2.4	56.3	
Debt/EBITDA (Entry) [3]	73	5.6	5.1	4.5	-5.5	32.4	-1.33
Debt/EBITDA (Exit) [3]		4.7	3.6	4.4	0.0	33.6	

Note: In Mio, EUR; significance level * p<0.1, ** p<0.05, *** p<0.01
1 Only exited deals
2 Only exited deals which did not go bankrupt, since we assume zero equity for bankruptcies
3 Only exited deals and if EBITDA for exit and entry date IS available, including 5 bankruptcies

Table 1.3: Benchmarking of our deals vs. our funds by net IRR comparison

This table compares the deals with the funds in our sample by Net IRRs. Row (1) provides the Net IRR for 32 out of 36 funds that participate in our sample and for which Prequin reports the NET IRRs by end of 2007.[5] We weight the 32 fund returns by the number of participating deals per fund. In row (2) we show the simple average NET IRRs of all deals in our sample for which we have publicly available fund return data (for 93 out of 110 deals). In row (3) we pool these deals artificially in one pseudo fund. Since the data on the European universe is primarily in the form of net IRRs, we convert our gross deal-level IRRs (before fees charged by PE houses to fund investors) to net IRRs (after fees, or in other words, IRRs from the viewpoint of fund investors). In the last column we test with Welch's t-test if the PE houses cherry-picked the deals out of their funds in terms of performance.

	n	Net IRR [1]		t-stat of diff. to our funds
		mean	median	
(1) Our funds [4]	32	24.1 [4]	26.4	
(2) Our deals	93	26.2 [2]	25.0	0.52 [6]
(3) Our deals pooled in 1 pseudo fund [3]	1	23.9		

Note: All values in percent or Mio EUR **,** vintage year 1993-2003, significance level * p<0.1, ** p<0.05, *** p<0.01

1 NET IRR, estimated for our deals in the following way: If a) Gross IRR<=10%, then LPs keep all return except 2% fees, so that Net IRR = Gross IRR - 2% fees; b) 10%<Gross IRR<12.5%, then LPs keep all return up to 10% except for 2% fees and GPs keep all return from 10% to 12.5%, so that Net IRR = Gross IRR - 2% fees – (Gross IRR – 10)% = 8%; and c) Gross IRR>=12.5%, then LPs and GPs share in 80:20 ratio the return exceeding 12.5%, so that Net IRR = Gross IRR - 2% fees – 2.5% - 20%*(Gross IRR - 12.5%).

2 Simple average

3 Pooled by calendar period using quarterly cash flows

4 Weighted averages by number of participating deals per fund

5 In 5 cases, more than one fund of a PE house is involved; in these cases we take the simple average fund net IRR of the funds involved and treat the funds as one fund. For 1 deal the fund names is unknown, for 3 funds we cannot find fund returns

6 We use Welch's t-test of difference between (1) and (2) assuming unequal variance for (1) and (2).

Table 1.4: Benchmarking of our funds vs. PE universe by net IRR comparison

This table compares the returns of the funds in our sample with fund returns of the EU universe. First, row (1) provides the Net IRR for 32 out of 36 funds which participate in our sample and for which Prequin reports the NET IRRs. [3] Second, row (2) provides the Net IRRs for all funds in Western Europe and (3) for very large funds only, as reported in Thomson Financial Venture Expert.
In addition, in row (0) we report the performance of previous funds, e.g., of fund "Europe I" for fund "Europe II." However, we only find Net IRRs for 25 funds (out of the 32 funds), since 5 funds did not have a previous fund in Western Europe, and for two previous funds there is no Net IRR available. In the last column we test if the PE funds in our sample are different in terms of Net IRR from a) the previous funds, b) the Western European universe and c) the universe with the same fund size.

	n	Net IRR		fund size	t-stat of diff. to our funds
		mean	median		
(0) Previous funds of our funds [1]	25	24.2 [4]	22.1	500-5000	0.03 [5]
(1) Our funds [1]	32	24.1 [4]	26.4	500-5000	
(2) All funds in Western Europe [2]	229	16.3	9.8	0-1000+	-2.29*** [6]
(3) All large funds in Western Europe [2]	53	22.0	18.9	500-1000+	-0.50 [7]

Note: All values in percent or Mio EUR **,** vintage year 1993-2003, significance level * p<0.1, ** p<0.05, *** p<0.01

1 As reported in Prequin
2 According to Thomson Financial Venture Expert
3 In 5 cases more than one fund of a PE house is involved; in these cases we take the simple average of the funds involved and treat the funds as one fund.
4 Weighted averages by number of participating deals per fund
5 We test for the difference between (0) and (1) assuming equal variance for (0) and (1) and use for (1) only the 25 funds, for which previous fund Net IRR was available (Net IRR 24.18%).
6 We test for the difference between (2) and (1) assuming equal variance for (2) and (1)
7 We test for difference between (3) and (1) assuming equal variance for (3) and (1). Unequal variance assumption leads to t= -0.58

Table 1.5: Benchmarking of sample by distribution of deal size

The table classifies the deals by the price paid for the acquired company (deal size). The first part of the table shows the distribution by size for the deals in our sample and the second part for the European universe. The last column shows the share of our sample on all large and very large buyouts.

	Deal size (in Mio EUR)				**total**	**sample coverage of large & very large deals**
	small (0-50)	**medium** (50-100)	**large** (100-500)	**very large** (>500)		
Our deals per #	1.8%	7.3%	44.5%	46.4%	110	
Our deals per value	0.1%	0.8%	15.4%	83.7%	73,487	
EU universe per #	67.3%	11.9%	15.2%	5.5%	5,384	8.9%
EU universe per value	9.4%	7.1%	26.9%	56.5%	636,604[1]	13.7%

Note: In Mio, EUR

Source: EU universe data from Private Equity Insight, covering all deals acquired from 1995 to 2005 in Western Europe for which information on deal value or deal size category was available

1 For 22.8% of all deals in EU universe, only deal size category was available. Deal value estimated with the mean deal value per category. Mean deal value per category calculated with 77.2% of all deals for which exact deal value was available (sum deal value = mean deal value per category * number of deals)

Table 1.6: Benchmarking of sample by vendor type

The table classifies the deals by vendor types into five different categories. Category (1) shows public-to-private deals in which PE acquired a whole public company and (2) carve-out deals in which PE acquired only a part of a company. Category (3) reports PE acquisitions of former family or private companies, (4) of companies which were owned by institutional investors, e.g., other PE funds, and (5) of former state or government owned companies. The first part of the table reports the categories for the deals in our sample, the lower part for the PE universe in Western Europe. In addition, the table reports the mean (median) size (enterprise value) and profitability (EBITDA margin) of the company at the acquisition date. In the last column we test for differences in profitability by vendor type.

Vendor type (previous owner)	**n**	**split in %**		**enterprise value** [1]		**EBITDA margin**	
		by n	**by value**	**mean (median)**	**test of diff.** [2]	**mean (median)**	**test of diff.** [2]
Our sample							
(1) Public-to-Private	12	10.9%	12.3%	756.2 (389.6)	0.01	15.3 (14.3)	-0.09
(2) Carve-out	43	39.1%	38.1%	651.5 (501.6)	-0.16	16.5 (16)	0.44
(3) Family/Private	35	31.8%	27.5%	577.9 (370.5)	-0.61	13.5 (12.4)	-2.06**
(4) Instit. Investor	18	16.4%	20.9%	852.3 (439.4)	0.98	22.3 (21.9)	2.06
(5) State	2	1.8%	1.1%	414.8 (414.8)	-0.60	10.9 (10.9)	-0.71
Total	110	100.0%	100.0%	668.1 (405.2)		16.2 (14.4)	
EU universe							
(1) Public-to-Private	249	4.6%	17.3%	442.7 (170.7)	16.67***	10.3 (8.1)	-2.66***
(2) Carve-out	2,066	38.4%	44.7%	137.6 (31.3)	6.09***	9.8 (8.9)	-3.52***
(3) Family/Private	1,937	36.0%	13.2%	43.4 (14.1)	-18.50***	13.5 (10.4)	2.85***
(4) Instit. Investor	749	13.9%	19.3%	163.7 (55.7)	13.01***	14.3 (11.1)	3.71***
(5) State	74	1.4%	2.6%	226.5 (36.9)	1.45	12.3 (8.4)	0.72
(6) Not Disclosed [3]	309	5.7%	2.9%	59.5 (9.5)	-9.70***	10.8 (9.8)	0.44
Total	5,384	100.0%	100.0%	118.2 (25.0)		11.8 (10.0)	

Note: In Mio EUR, significance level * p<0.1, ** p<0.05, *** p<0.01
Source: Private Equity Insight, all deals acquired from 1995 to 2005 in Western Europe with deal size or size category available
1 We estimated the mean enterprise value for 23% of the deals in the EU universe, for which only information on the deal size category was available. We estimate the mean with the mean enterprise value of each deal size category.
2 We test for differences with Wilcoxon tests and compare each vendor type with all other deals. Test on margins for the EU universe (n=1,524) and for deals in our sample (n=94) for which data on margin was available.
3 Including "In Receivership"

Table 1.7: IRR decomposition

The table provides simple averages of three gross IRR components:
(i) Deal-level abnormal performance (alpha): $\alpha_i+\varepsilon_i$ measures the excess asset return generated at the enterprise level of the portfolio company for PE investors. It is purged of the effect of leverage financing the firm takes on, since $\alpha_i + \varepsilon_i = R_{Ui} - \beta_S R_{SUi}$. Whereby R_{Ui} is the un-levered return of the deal *i* and R_{SUi} the un-levered return of the sector *i*, using the standard un-levering formula.
(ii) Return from incremental leverage: $(\beta_S R_{SUi} - R_{Di} (1-t))(D/E_i-D/E_{Si})+(\alpha_i+\varepsilon_i)(D/E_i)$ captures the amplification effect that a) the incremental deal leverage beyond the sector leverage, $(D/E_i-D/E_{Si})$ has on the sector returns and b) the total leverage has on enterprise-level outperformance.
(iii) Levered sector return: $\beta_S R_{SUi} (1+D/E_{Si}) - R_{Di} (1-t)(D/E_{Si})$ measures the effect of contemporaneous sector returns, including the effect of sector-level leverage.
For the sector, we use the median IRR in each deal corresponding sector, since we later relate the financial performance to median changes in the operational performance. [1]
We report the IRR decomposition for different scenarios: (1) We break down the returns for all deals, (2) only for the deals exited by 2008, and (3) only for deals for which the cost of debt was available.

Scenario	n	(i) deal-level abnormal performance	(ii) return from incremental leverage	(iii) levered sector return	total IRR
(1) All deals	110	8.41*** (10.49)	21.65*** (18.81)	8.53*** (7.07)	38.59***
(2) Exited deals	102	9.83*** (10.73)	22.95*** (19.40)	8.15*** (6.75)	40.93***
(3) Deals with cost of debt information	67	6.46*** (4.31)	23.22*** (18.38)	10.65*** (10.50)	40.33***

Note: All values in percent, significance level * p<0.1, ** p<0.05, *** p<0.01, medians in parentheses
1 We further use the average *D/E* ratio during deal life for the deals, a median *D/E* ratio over 3 year for the sector and $\beta=1$. We further assume the same cost of debt and tax rate for the sector as for the deal. For 67 deals we find the cost of debt (based rate and margin spread) in Dealogic; for 19 we only find the base rate (Libor vs. Euribor); and for 24 deals we find no information. If the margin spread is unknown for a deal we use the median spread of PE deals in Western Europe in the same year. If the base rate is unknown we use Libor for UK deals and Euribor for all other deals.

Table 1.8: Abnormal Performance vs. PME

The table reports summary statistics on the abnormal performance, as reported in the previous table under scenario 1, IRR and the public market equivalent (PME) for each deal in the spirit of Kaplan and Schoar 2005. In the PME calculation, we discount all cash flows with the total sector return and then calculate the ratio of discounted cash flows to the largest cash inflow for the deal.

	n	mean	median	std. dev.
Abnormal performance (scenario 1)	110	8.41	10.49	19.79
IRR gross		38.59	36.00	40.45
PME Sector		116.35	105.05	142.81

Note: All values in percent

Table 1.9: Correlation matrix: Abnormal Performance, IRR and PME

The table shows the correlation between abnormal performance, IRR and the public market equivalent (PME) for all deals in our sample.

	n	IRR gross	PME Sector
Abnormal performance (scenario 1)	110	0.77	0.58
PME Sector		0.58	1

Note: All values in percent

Table 1.10: Operating performance change PRE PE ownership

The table provides performance trends in the last year PRE PE ownership (*t=0*) for 69 deals in our sample, for which we have at least two years of PRE PE ownership data. [1]
More specifically, the table reports change in EBITDA margin (*ebitda margin* $_t$ - *ebitda margin* $_{t-1}$) in percentage points and the growth in sales (*logsales* $_t$ – *logsales* $_{t-1}$) in percent for the deals.
In addition, we provide also sector median changes and test for differences between deal and sector in the last column.

Variable (n=69)	**mean**	**median**	**std. dev.**	**min**	**max**	**t-stat of diff. with**	
						zero	**deal**
Deal sales growth	5.87	7.18	14.79	-59.03	58.11	3.29***	
Sector median sales growth	6.54	5.52	8.08	-8.81	23.02	6.71***	0.65
Deal margin change	0.08	0.60	3.66	-19.97	10.94	0.17	
Sector margin median change	0.23	0.17	1.11	-1.56	8.11	1.72*	-0.34

Note: All values in percent
1 Conversion into EUR based on annual exchange rates

Table 1.11: Operating performance change during PE ownership

The table reports for various operating measures x the difference $\Delta x_i = x_{iT} - x_{it}$ from the last pre-acquisition year ($t=0$) to last PE-ownership year (T). We divide the difference for log sales between t and T by the number of PE ownership years $(T-t)$ to get annual nominal sales growth.
(1) First, we report the changes for all deals. (2) We show changes only for deals, which had no M&A event (organic deals), or at least only an M&A event after 2 years of PE ownership. We include deals with M&A events after 2 years of PE ownership, since late M&A events might be endogenously determined by the performance of the deal. (3) Third, we report changes only for deals which had M&A events.
We also report the same for deal corresponding sector companies $\Delta x_s = x_{sT} - x_{st}$. We use median sector changes, given that there are mostly less than 100 companies in each three digit sector. In the last column we test if the changes are different from zero and also for differences between deal and median sector changes, in the spirit of a difference-in-difference (DiD) regression. We calculate the differences without including changes in years with M&A or divestment events.[4] Since the numbers might get artificially in- or deflated in the presence of acquisition or divestment activity. However, our findings stay qualitatively robust, when we include years with M&A or divestment events.

Variable	(1) all deals					(2) organic deals					(3) deals with M&A events				
	n	mean	median	t-stat of diff. with		n	mean	median	t-stat of diff. with		n	mean	median	t-stat of diff. with	
				zero	deal				zero	deal				zero	deal
Δx_i deal log sales [1]	85	5.58	4.60	4.32***		59	4.59	3.95	2.74***		30	7.36	5.41	4.65***	
Median Δx_s sector log sales	85	7.95	6.37	12.23***	1.76*	59	7.70	6.19	9.66***	1.76*	30	8.68	7.81	8.52***	0.81
Δx_i deal margin [1]	85	2.13	0.91	2.74***		59	2.51	0.41	2.34**		30	1.28	1.44	1.75*	
Median Δx_s sector margin	85	0.18	0.12	1.37	-2.51**	59	0.24	0.24	1.49	-2.13**	30	0.00	-0.04	0	1.62
Δx_i deal multiple [1 2]	73	2.23	1.37	1.92*		55	2.32	1.35	1.54		22	2.12	1.66	2.18**	
Median Δx_s sector multiple	73	0.22	0.33	3.21***	-1.71*	55	0.30	0.35	4.39***	-1.33	22	0.04	0.07	0.26	-2.28**
Δx_i deal log multiple [1 2 3]	71	14.29	16.84	2.08**		53	14.42	16.84	1.71*		22	17.76	21.48	1.79*	
Median Δx_s sector mult.	71	2.68	4.50	2.62**	-1.66	53	4.25	4.88	4.02***	-1.18	22	-0.72	-0.35	-0.33	-2.01*

Note: All values in percent, except change in multiples; significance level * p<0.1, ** p<0.05, *** p<0.01
1 Exited deals only and including bankruptcies
2 Including deals only with entry and exit EBITDA multiple available
3 Excluding observations with negative EBITDA
4 All numbers are without years with major M&A or divestment events during PE ownership as reported by the PE house or as mentioned in the press, Capital IQ database, or PE house website. We classify an event as major if it altered sales or enterprise value of the deal by more than 20%.

Table 1.12: Abnormal performance and operational performance changes

The table relates cross-sectional changes in operating measures to financial performance. Therefore, for EBITDA margin, log sales and log EBITDA multiple, we calculate the average difference $\Delta x_i = x_{iT} - x_{it}$ between the last pre-acquisition year ($t=0$) and the last PE-ownership year (T).[3] We divide the difference for log sales by the number of PE ownership years $(T-t)$ to get annual nominal sales growth. In the same way we use changes in the sector companies $\Delta x_s = x_{sT} - x_{st}$.
First, in regression (1) – (2) we use all deals. Second, in regression (3) – (4) we show regressions for only organic deals, including deals, which had M&A events after 2 years of PE ownership. We include deals with late M&A events, since these M&A events might be endogenously determined by the performance of the deal. In the regression (5) – (6) we use deals only, which had M&A events. In the lower part of the table we control for deal duration and different entry time periods.

Dependent variable	**abnormal performance in %**					
	(1) all deals		**(2) organic deals**		**(3) deals with M&A**	
Independent variables	**(1)** [1]	**(2)** [1 2]	**(3)** [1]	**(4)** [1 2]	**(5)** [1]	**(6)** [1 2]
Δx_i log sales	-0.04	0.08	-0.03	0.05	-0.22	0.34
	(-0.29)	(0.44)	(-0.22)	(0.25)	(-0.38)	(1.04)
median Δx_s log sales	-0.03	-0.60**	-0.03	-0.60*	0.04	-0.33
	(-0.11)	(-2.35)	(-0.11)	(-1.99)	(0.08)	(-0.43)
Δx_i margin	0.60**	1.07***	0.66**	1.10***	1.24*	2.09
	(2.38)	(3.06)	(2.59)	(2.95)	(1.95)	(1.56)
median Δx_s margin	1.40	1.53	1.54	1.10	1.10	0.26
	(1.15)	(0.91)	(1.13)	(0.67)	(0.49)	(0.06)
Δx_i log multiple		0.09*		0.06		0.34***
		(1.97)		(1.50)		(3.32)
median Δx_s log mult.		-0.42**		-0.26		-1.01**
		(-2.15)		(-1.03)		(-2.94)
Other controls						
PE duration (exit year – entry year)	-4.89***	-5.33***	-5.72***	-6.60***	-2.93*	2.69
	(-4.36)	(-3.31)	(-4.10)	(-3.53)	(-2.04)	(1.05)
Entry dummy 95-00	Yes	Yes	Yes	Yes	Yes	Yes
Entry dummy 01-02	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Number of deals	85	70	59	50	30	22
R^2 adjusted	0.23	0.32	0.3	0.38	0.02	0.28

Note: t-stats in parentheses with robust standard errors, significance level * p<0.1, ** p<0.05, *** p<0.01
1 Exited deals only and including bankruptcies
2 Including deals with entry and exit EBITDA multiple available only and including observations with positive EBITDA only
3 Without years with major M&A or divestment events during PE ownership as mentioned by the PE house or in the press, Capital IQ database, or PE house website. Events are major if they altered sales or enterprise value by more than 20%.

Table 1.13: IRR, PME and operational performance changes

The table relates IRR and public market equivalent (PME) to operational changes (Δx_i and Δx_s).[1] [2] We calculate the PME in the spirit of Kaplan and Schoar 2005.
For the operational changes we calculate the average difference $\Delta x_i = x_{iT} - x_{it}$ from the last pre-acquisition year ($t=0$) to last PE-ownership year (T) for EBITDA margin, log sales and log EBITDA multiple.[3] We divide the difference for log sales by the number of PE ownership years $(T-t)$ to get annual nominal sales growth. In the same way we add to the regressions changes in the deal corresponding sector companies $\Delta x_s = x_{sT} - x_{st}$.
First, in regression (1) – (2) we use all deals. Second, in regression (3) – (4) we show regressions for only organic deals, including deals, which had M&A events after 2 years of PE ownership. We include deals with late M&A events, since these M&A events might be endogenously determined by the performance of the deal. In the regression (5) – (6) we use deals only, which had M&A events. In the lower part of the table we control for deal duration and different entry time periods.

	(1) all deals		**(2) organic deals**		**(3) deals with M&A**	
Dependent variable	**IRR**	**PME**	**IRR**	**PME**	**IRR**	**PME**
Independent variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Δx_i log sales	0.41	0.01	0.49	0.01	0.71**	0.01
	(1.14)	(1.01)	(1.31)	(1.09)	(2.25)	(0.11)
median Δx_s log sales	-1.07*	-0.01	-0.85	-0.02	-1.43	0.04
	(-1.77)	(-0.48)	(-1.13)	(-0.94)	(-1.68)	(0.32)
Δx_i margin	2.30***	0.11**	2.00*	0.08***	5.46***	0.41
	(2.70)	(2.57)	(2.02)	(3.94)	(4.32)	(1.56)
median Δx_s margin	4.05	0.12	5.87*	0.24*	-2.76	-0.09
	(1.43)	(0.86)	(1.85)	(1.93)	(-0.71)	(-0.19)
Δx_i log multiple	0.21**	0.01**	0.14	0.00	0.79***	0.02*
	(2.12)	(2.04)	(1.57)	(1.63)	(5.74)	(2.15)
median Δx_s log multiple	0.13	0.00	0.16	-0.02	-1.22**	0.01
	(0.34)	(0.03)	(0.22)	(-1.06)	(-2.66)	(0.12)
Other controls						
PE duration (exit year – entry year)	10.89***	-0.18	11.15***	-0.26**	-0.87	0.46
	(-3.53)	(-1.60)	(-2.96)	(-2.59)	(-0.34)	(0.91)
Entry dummy 95-00	Yes	Yes	Yes	Yes	Yes	Yes
Entry dummy 01-02	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Number of deals	70	70	50	50	22	22
R^2 adjusted	0.42	0.16	0.38	0.38	0.84	0.04

Note: t-stats in parentheses with robust standard errors, significance level * p<0.1, ** p<0.05, *** p<0.01; IRR in %
1 Exited deals only and including bankruptcies
2 Including deals with entry and exit EBITDA multiple available only and including observations with positive EBITDA only3 Without years with major M&A or divestment events during PE ownership as mentioned by the PE house or in the press, Capital IQ database, or PE house website. Events are major if they altered sales or enterprise value by more than 20 %.

2. Private Equity Deal Partner Background, Value Creation Strategies and Outperformance

Abstract

We study whether deal partner background affects the performance of private equity (PE) deals. In our sample of 102 large and mature PE fund investments in Western Europe between 1996 and 2005, we found evidence that there are specific combinations of value creation strategies and partner backgrounds that correlate with deal-level performance. First, partners with a strong operational background (ex-consultants or ex-industry experts) generate significantly higher outperformance in the so-called "organic" deals that focus exclusively on internal value creation programs. In contrast, partners with a background in finance (ex-bankers or ex-accountants) are more frequently associated with an M&A or so called "inorganic" strategy, in which they generate higher outperformance. Second, from data based on interviews with deal partners, we identified differences in PE governance practices in organic strategies based on partner background. Overall, we interpret these findings as evidence of heterogeneity in skills at deal partner levels in PE transactions.[38]

2.1. Introduction

The picture that emerged in the previous chapter is that large and mature PE houses create persistent financial value through operational improvements.[39] Also Guo et al. (2009) find a strong and positive correlation between financial performance and margin

[38] This chapter is based on joint work with Viral V. Acharya and Conor Kehoe.

[39] In particular, Kaplan and Schoar (2005) provide evidence that large and mature PE funds generate financial outperformance, which is persistent. For a comprehensive review of the literature on PE and evidence on PE impact see Cumming et al. (2007).

(EBITDA/sales) increase for public-to-private deals in the US initiated by large and mature PE funds.[40]

However, such value creation requires skills and the return to such fixed skills may explain the persistent returns generated by these large funds for their investors (Kaplan and Schoar, 2005). We therefore focus on the following question: Are there any distinguishing characteristics of PE houses or partners involved in a deal, which are best associated with value creation and may explain the persistence in the outperformance of large and mature PE funds? In particular, we are interested in taking a step beyond Jensen's hypothesis (Jensen, 1989) by investigating how human capital factors create value in PE deals, in addition to employing high leverage and powerful incentives.[41] To our knowledge there have been no systematic analyses on the link between financial returns and human capital factors in PE funds themselves.[42] Also, Cumming et al. (2007) state "… there is a need to understand the human capital expertise that successful private equity firms require. There appears to be a need to broaden the traditional financial skills base of private equity executives to include more product and operations expertise."

In this paper, we study with interview data whether human capital factors at PE houses affect the performance of PE deals.[43] We find evidence for heterogeneity in skills at the deal partner level. There are combinations of (1) value creation strategies and (2) partner backgrounds that correlate in the cross-section with deal-level performance.

[40] Since public-to-private deals are larger on average than other PE deals, mostly large and mature PE funds initiate these deals.
[41] Jensen (1989) argued that leveraged buyouts (LBOs) create value through high leverage and powerful incentives. He proposed that public corporations are often characterized by entrenched management that is prone to cash-flow diversion and averse to taking on efficient levels of risk.
[42] Kaplan et al. (2008) for example analyze the relationship between PE portfolio company managers (CEOs) and the success of buyouts. They find that execution skills appear to be more strongly related to success than interpersonal skills.
[43] Our paper does not discuss the conflicts of interest between PE houses and their investors. Axelson et al. (2007), Ljunqvist et al. (2007) and Metrick and Yasuda (2007) provide good coverage of theoretical as well as empirical issues on this front.

(1) We start by classifying PE deals according to their value creation strategy. We separate deals with organic strategies from deals that had major M&A events during the private phase. Almost 34% of our deals show major M&A events during the private phase and even 26% as early as the first two years.[44] (2) We further cluster the deals in our sample by the professional background of the partners who initiated the deal. We group ex-bankers and ex-accountants together as "Finance Partners" (FPs) and ex-consultants and ex-industry experts as "Operations Partners" (OPs).

Coming to our main findings, deal partners with a strong operational background (OPs), for instance, ex-consultants or ex-industry experts, generate significantly higher outperformance in organic deals. In other words, partners who worked in the industry or as management consultants before joining a PE house seem to be better able to improve a company internally. In contrast, partners with a background in finance (FPs), for instance, ex-bankers or ex-accountants, more frequently and successfully follow an M&A strategy or a so-called "inorganic" strategy. We interpret this finding as an indication of skills at the fund manager level.

Finally, we are able to show that the deal partner background determines their governance activity in organic strategies in the early deal phase (the first 100 days).[45] Applying our interview-based data, we find that OPs more frequently make management changes, management plan revisions and strong time commitments in organic deals. Interestingly, all three measures positively relate to outperformance in organic strategies. In contrast, finance partners more often give 1st and 2nd management line equity shares and

[44] Also Nikoskelainen and Wright (2007) highlight the importance of inorganic strategies and the different nature of organic an inorganic strategies: "The consistent significance of acquisitions shows that buy-and-build strategies are common among LBO companies. …It is important to control for whether changes in operating performance are of an organic or transactional nature." (Nikoskelainen and Wright, 2007).

[45] We compare the activities in the early deal phase, since this ensures exogeneity in respect to the latter realized performance.

devise new KPIs more frequently, none of which relates to outperformance in organic strategies.

The data used in this paper is ideally suited for our goal of identifying persistent partner skills that generate outperformance. (1) The data set is representative in terms of performance of large and mature PE funds in Western Europe. (2) In contrast to the literature, which has a focus on only public-to-private deals, the data set covers various vendor types, e.g. carve-out deals, where only part of a company is acquired, and private-to-private deals, where a non-listed business is acquired. To use carve-out and private-to-private deals is important, because they comprise 75% of PE deals in the last decade, and they are different in size (enterprise value) and profitability (EBITDA margin) from public-to-private deals. (3) The data set also includes a unique set of deal-level interview data, which enables us to identify the leading deal partner per deal and his or her individual governance activities.[46]

Could it be that the observed correlation between partner background and performance is caused by other factors, e.g. by a reverse causality or PE house effects? Deal partners could potentially make their decision about the inorganic strategy based on the observed performance of a deal during PE ownership. In that case, it would not be OPs at inorganic strategies that cause underperformance; instead it would be underperformance that causes the inorganic strategy of OPs. However, since we have information on the exact M&A date, we are able to identify deals that had an M&A activity at an early point during PE ownership and therefore are exogenous to the realized performance. Our findings do not change when we only define deals as inorganic that had a clearly exogenous M&A activity. [47]

In Section 2.2, we provide a description of the data we collected and some summary statistics and discuss sample selection issues. In Section 2.3, we link financial returns to deal

[46] For 72 deals out of 102 deals, we have in-depth interview data on the governance approach; essentially wherever the relevant GPs had not left the PE house in question.

partner backgrounds. In Section 2.4, we pay special attention to endogeneity issues. In Section 2.5, we present differences in governance activity by deal partner background. Section 2.6 concludes.

2.2. Data and sample selection

The analysis is based on proprietary company-level data set of PE leveraged buyouts (deals) in Western Europe. It is mainly the same data as used in the previous chapter 1. However, in this chapter, we enlarge the data set with interview data and only include the 102 deals for which the deal partner background was available.

The data set therefore consists of two separate parts. The first part, which is also used in the previous chapter, covers deal characteristics, e.g., deal timing, deal entry and exit size, including data on debt and equity, and vendor type.[48] PE firms also reported basic accounting figures for the acquired companies, e.g., annual EBITDA, without exceptional items or sales. In addition, PE firms reported the year and month they acquired another company or business unit and merged it with the portfolio company during PE ownership.[49]

The second part consists of data from 72 in-depth interviews with general partners (GPs) involved in our deals, essentially whenever the relevant GPs had not left the PE house in question.[50] The interview data is an important novelty in this context, since it allows us to identify the professional background of the leading partner per deal. We use the most recent

[47] We also find no PE house effects at play.
[48] A vendor type, for example, is a private-to-private or a public-to-private deal.
[49] We further verified the M&A events reported by the PE houses and added on a few occasions M&A events if they were reported as major in the press, on the Capital IQ database, or on the PE house website. We defined an M&A event as major if it altered sales or enterprise value of the deal by more than 20%.
[50] In some case, we have more data points than interviews because we have information, e.g., on the management equity share, from the hard-coded PE fund documents we received. In other cases, the full questionnaire was not covered, due to time constraints of the interviewed deal partner.

profession of the interviewee before he/she joined the PE industry as an indicator for the background.[51]

Table 2.1 gives an overview of the years when the PE houses acquired (entry) and sold (exit) the portfolio companies in our sample. The deals are equally spread across the years between 1996 and 2005. In only the first and the last year and between 2000 and 2001 (due to the global recession and credit tightening) we have slightly fewer observations. The sample also includes 4 bankruptcies and 7 deals, which the PE houses did not sell until 2008.[52]

The first part of Table 2.2 reports summary statistics for all deals in our sample. The deals have a high IRR (39.3%) and cash multiple (2.9). We also show "abnormal performance" and a "Public Market Equivalent" (PME) return (in the spirit of Kaplan and Schoar 2005) for the whole sample as described in chapter 1. Again, the evidence points to outperformance of the deals in our samples.

In the second part of Table 2.2 we show abnormal performance and duration for deals with M&A, and divestment events separately. Interestingly, deals with M&A events seem to show a higher performance, while deals with divestment events show a lower performance than the other deals. Moreover, first acquisition events happen earlier in the private phase than first divestment events. First M&A events take place on average after one year, while first divestment take place after two years. We therefore interpret the divestment events as

[51] We further verified if the interviewee was indeed the single leading partner for the deal with information from the Capital IQ database, the PE house website, or press articles. We had to change the background for only a few deals, since another single leading deal partner with a different background from the interviewee was mentioned. Moreover, for 30 deals where no interview was available, we were able to find the leading deal partner in the Capital IQ database, the PE house website, or press articles.

[52] For those 7 deals we do not have all cash flows, because there is not any final cash flow from exit nor can it be deemed to be zero as in the case of bankruptcies. Therefore, the end enterprise-value cash flow is simulated using the EV / EBITDA multiple at the start of the deal and applying that to 2006 year-end EBITDA.

performance endogenous, given that the divestment events appear in deals with low performance and later in the private phase. PE seems to use divestment as an ad hoc reaction to underperforming deals and not as an exogenous value creation strategy.

The 14 participating PE houses in our sample did not report their deals to us at random. Rather, they only reported the deals if they wanted to give the data. Furthermore, the sample consists of deals initiated by mature and large PE funds only. This begs the question if the sample of deals is representative for PE investments. In Table 2.3 – Table 2.6 we are able to show that our deal sample seems to be representative for large and mature PE houses. In detail: (1) The participating funds in our sample did not seem to cherry-pick the deals they reported. (2) The funds in our sample do not seem to differ in terms of performance to large and mature PE funds. (3) We have a bias towards large buyouts, but (4) cover various types of deal sources, e.g., also private-to-private deals.

(1) First, in Table 2.3 we contrast the performance of the deals with the funds in our sample. Before we can compare the deal and fund performance, we first need to convert our gross deal-level IRRs (before fees charged by PE houses to fund investors) to net IRRs (after fees, or in other words, IRRs from the viewpoint of fund investors). [53] This is because the data we have on the overall universe is primarily in the form of net IRRs. Finally, we find no statistical difference on average between the net returns of the funds and deals in our sample (t=0.62). The 32 funds participating generated an average (median) net return of 24.5 (26.4)% and the 102 deals generated an average (median) net return of 27.1 (25.1)%. When we pool the cash flows of our deals into one pseudo fund we get a net return of 24.3%, which is even lower.

[53] More specifically, if a) Gross IRR<=10%, then LPs keep all return except 2% fees, so that Net IRR = Gross IRR - 2% fees; b) 10%<Gross IRR<12.5%, then LPs keep all return up to 10% except for 2% fees and GPs keep all return from 10% to 12.5%, so that Net IRR = Gross IRR - 2% fees – (Gross IRR

(2) In Table 2.4 we compare the net returns of our funds with the PE universe in Western Europe to find out if our funds are representative in terms of performance. Overall, we are able to show that our participating funds are representative PE funds, once we take into account the fact that we are focusing on funds whose sizes are above €500 million. First, the average (median) return of 16.3 (9.8) % of ALL funds in Western Europe is much lower than the average (median) 24.5 (26.4) % performance of the funds in our sample (t=-2.29). But the 22.0 (18.9) % average (median) return of funds with the SAME SIZE as our funds (above €500 Mio) is not statistically different from the return of our funds (t=-0.61). In row (0) we also report the net IRR of the previous funds, e.g., fund Europe II for fund Europe III, to show that the high performance of our funds seems to be persistent over time.

(3) Third, Table 2.5 shows that we ultimately have a sample with a large-size bias. The number of deals in our sample is significantly smaller than that of all Western European deals over the sample period. Our sample only represents 102 out of 5,384 deals. In contrast, in value terms we cover 13.1 % of large and very large deals – €100 to €500 million and greater than €500 million. However, most of the literature also has an implicit large-size bias. The reason is that it a) focuses exclusively on public-to-private deals, which are mostly large deals or b) on deals with public debt financing, which are also typically larger.[54]

(4) Finally, Table 2.6 describes another advantage of our data set. As previously mentioned, our sample includes all types of deals. For example, the sample also includes carve-out deals, where only part of a company is acquired, or private-to-private deals, where PE acquires a non-listed business. Moreover, our data also includes deals that were previously owned by PE and former state-owned companies. We think covering all vendor types is an

– 10%) = 8%; and c) Gross IRR>=12.5%, then LPs and GPs share in 80:20 ratio the return exceeding 12.5%, so that Net IRR = Gross IRR - 2% fees - 2.5% - 20%*(Gross IRR - 12.5%).

[54] However, it should also be noted that the large-size bias makes our sample more comparable to the benchmark group we employ, which consists of publicly quoted companies. Since the size of publicly

important novelty. This is in contrast to the literature, which mostly analyzes public-to-private deals. First, public-to-private transactions represent by volume (by value) only 4% (17%) of the total buyout activity. In contrast, the majority of deals are carve-out and private-to-private. For example, in Western Europe, they comprise 74% (58%) of all PE deals between 1995 and 2005. Second, we find that carve-out and private-to-private deals are already different pre-acquisition. They are smaller in size (enterprise value) and different in profitability (EBITDA to sales ratio) from public-to-private deals in the Western European universe, as shown in Table 2.6.

2.3. Financial performance and deal partner background

We now discuss the center piece of our analysis, which is based on qualitative deal-level information on governance practices of PE houses, collected through interviews with general partners.

In this section we provide an overview of the background of the leading deal partners and their performance per deal strategy. We distinguish between inorganic and organic strategies. We show with multivariate regressions that the background of a partner, depending on the deal strategy, seems important in explaining financial returns. Since the background or skills of a partner is fixed and the skill requirements vary with the strategy, we interpret the finding as evidence that human capital factors on fund manager level partly determine PE outperformance.

Given the small sample size, we cluster the partners by background into two groups, either Finance Partners (FPs) or Operation Partners (OPs). We define FPs as partners who

quoted companies is generally larger than a typical private equity deal in the entire universe of such deals.

before working for PE worked for a bank, as an accountant, or have a background in law. In contrast, we define OPs as partners who had worked as consultants or in the industry.[55]

Table 2.7 gives an overview of the partners' background and their performance by strategy. First, in our sample the majority of deals have FPs rather than OPs (75 out of 102 deals). Interestingly, FPs almost always manage deals with an inorganic strategy. FPs led 30 out of 35 inorganic deals. Second, inorganic seem to outperform organic deals. The 67 deals in our sample with an organic strategy have a median un-levered return of 8.2% above the sector and the 35 inorganic deals of 13.2 %. Third, OPs in general, with a median abnormal performance of 11.5 %, seem to outperform FPs, with an abnormal performance of 8.2 %. The same holds true for PME or IRR.

To examine the deal partner impact per deal strategy more generally, we estimate the following specification:

$$Y_i = \phi + x'_i \beta + \theta_1 FP_i + \theta_2 inorganic_i + \theta_3 FP_i * inorganic_i + \varepsilon_i \qquad (2.1)$$

in which Y_i is one of the three outperformance measures used in the present paper (abnormal performance, IRR or PME) at deal *i*. The vector *x* represents a set of control variables that include observed deal characteristics, more specifically, holding length in years and a dummy for non-exited deals and entry period dummies, since we want to control for time based variations in financial returns. We do not add the enterprise value of the deal in the regression, since it only lowers the explanatory power of the model. This is potentially due to a lack of variation in size in our sample which mainly consists of large deals.

We capture the performance differences of the deal partner, depending on the strategy, with three dummy variables. First, FP_i is a dummy equal to 1 for deals with FPs in the lead (and 0 for OPs in the lead). Second, $inorganic_i$ is a dummy that equals 1 for deals with major

[55] Only one deal partner went to the PE house immediately after graduating college and is not included

M&A events during PE ownership (and 0 otherwise). Third, FP_i *$inorganic_i$ is the interaction term of both. Thus the base group are deals with OPs in organic strategies (n=22). All effects are measured relative to the performance of this group. Lastly, $\phi, \beta, \theta_1, \theta_2$, and θ_3 are coefficients to be estimated and ε_i is the regression error. The coefficients are estimated by cross-sectional variation, since we have only one observation on *Y* per deal.

In Table 2.8, we provide evidence (based on multivariate OLS regressions) that the success of OPs or FPs depends on the deal strategy. OPs outperform in organic strategies, FPs outperform in inorganic strategies. This finding is qualitatively robust to alternative specifications, e.g., alternative outperformance measures, for example, IRR or PME returns.

We start in Table 2.8, regression (1)-(4), with abnormal performance as the dependent variable; then provide in regression (5)-(8) the same for IRR and in regression (9)-(12) for PME as the dependent variable.

First, in regression (1), (5) and (9), when we only add FP_i, it is not clear if FPs in general underperform OPs. In regression (1) and (9), with abnormal performance or PME as dependent variable, we find no statistically significant underperformance of FPs (t=-1.56 and t=-1.00). Only in regression (5), when using IRR as a dependent variable, do we find a weak relationship (t=-1.70).

Second, in regression (2), (6) and (10) we also include $inorganic_i$, to see if the weak result, that FPs underperform, interferes with potentially lower returns for inorganic deals, which FPs most frequently lead. The three regressions show mixed results.

Third, when we add an interaction term FP_i *$inorganic_i$ in regression (3), (7) and (11), in order to control for partner background effects that are strategy specific, we get similar results in sign and significance for all three dependent variables. FPs underperform the base

in the sample.

group in organic strategies (for abnormal performance as dependent variable t=-2.44, for IRR t=-2.27, for PME t=-1.92), but outperform in inorganic strategies (for abnormal performance t=2.96, for IRR t=2.69, for PME t=2.33). For example, in regression (3) OPs with organic strategies outperform relatively by 12%. In contrast, FPs with inorganic strategies, outperform by 18%.

Finally, in regression (4), (8) and (12) we also include a dummy for deals that were not exited by 2007 and find our results qualitatively unchanged.

2.4. Endogeneity issues of partner background, deal strategy and performance

In this section we discuss endogeneity concerns, which could potentially cause our unveiled partner background pattern. The first is a (1) reverse causality argument, (2) the second a concern about PE house fixed effects and finally (3) about sector picking ability of PE partners. We are not able to rule out these concerns, but we are convinced that there is sufficient evidence against all of them.

(1) Since the deal partners in some deals decide to follow an inorganic strategy late during PE ownership, as described in the previous section, the observed findings are potentially subject to a reverse causality.[56]

OPs could follow an inorganic strategy if the deal shows underperformance in the first years of PE ownership. For example, OPs are opposed to inorganic strategy but execute M&A in order to blur their underperformance, if necessary. Therefore, it is not a lack of skills of OPs at inorganic strategies that causes the relative underperformance at inorganic strategies. Instead it is rather the underperformance that causes the inorganic strategy decision for OPs.[57]

[56] Fortunately we do not face the same issue of reversed causality with the deal partner background; the deal partner background is fixed and determined before the acquisition.

[57] A second and alternative concern on reverse causality of deal strategy is that FPs are willing to apply an inorganic strategy late during PE ownership if the deal is already outperforming. Again, if this

Given the small sample size, we only have 5 inorganic deals with OPs in our sample, we cannot rule out or validate this argument. However, in order to address the reverse causality concern, we more narrowly define the inorganic strategy in Table 2.13. We only considered deals as inorganic that show the first M&A event by the end of the second PE ownership year. This early inorganic strategy is then exogenous to the performance, if we are willing to assume that it takes at least one year to find out that a deal is underperforming and another year to identify and buy another company. This reduces the number of early inorganic deals with OPs to 3 deals and with FPS to 25. The findings in Table 2.13 are qualitatively unchanged to Table 2.8. FPs still underperform in organic and outperform in inorganic deals measured with abnormal performance, IRR and PME.

In addition, we generally doubt that a reverse causality is at play. First, in the operational performance up to the first M&A event, we find no clear pattern that OPs deals already underperform or FPs deals already outperform before the first M&A event.[58] Second and most importantly, we find it hard to believe that in particular OPs use inorganic strategies to blur their underperformance and only FPs apply M&A strategies when the deal is already outperforming.

(2) PE houses are not all alike, and all have their own philosophies, which most probably differ to some extent (Moody's, 2009). Therefore another concern is that PE house fixed effects instead of the partner background is causing outperformance and we are identifying a spurious correlation if, hypothetically some successful PE houses hired mainly OPs or FPs and mainly followed a specific strategy. In Table 2.12, we provide an overview of returns, deal partner background, and deal strategy ranked by PE house returns (measured in

argument is true, outperformance would cause the inorganic strategy for FPs, rather than an inorganic strategy causing the outperformance. However, again out of the 30 inorganic/FPS deals, only 5 deals have an M&A activity after the end of the second year of PE ownership.

abnormal performance). Since we do not have many observations per PE house, we are not able to rule out that PE house effects cause our findings. However, for PE house (6), (7) and (13), which provided more than 10 deals, there seems no specific focus on a partner/strategy combination.

In Table 2.12, we also report the leverage per PE house. There also seems to be no leverage story at play: The D/E ratios in all deals are high and only two PE houses show statistically significant (at a 1% level) different leverage ratios. But those two PE houses do not show a particularly high abnormal performance.

(3) In Table 2.14, we show that the outperformance of FPs or OPs do not seem to be caused by sector picking abilities. As a dependent variable, we use the levered sector returns and the same independent variables as in Table 2.8. In contrast to Table 2.8, we do not find any statistically significant pattern.

2.5. Deal partner background and differences in the management of a PE deal

In the previous section we show that human capital factors, in the form of partner skills, partly explain outperformance. In this section we go one step further and show that a) there are differences in governance practices in how OPs or FPs manage a PE engagement per deal strategy. Moreover, since some of the governance practices relate to a higher performance, we b) discuss how these differences might explain in part the identified performance differences per partner background.

[58] Even if we could find a performance difference between FPs and OPs before the first M&A event, it would only be an indication for the reverse causality argument, since it must not inevitably have an effect on the later strategy decision.

For 72 deals, we have interview data on PE governance practices just before the PE acquisition and during PE ownership.[59] We know, for example, if the PE house changed the management or business plans, or how much time they spent with the company. We use PE actions from only the first 100 days phase, which means in the first 3 months after the PE house bought the company. This ensures that the activity of a deal partner is genuine for FPs or OPs and not an endogenous reaction to the performance of the company during PE ownership,[60] since in the first 100 days the deal partner does not yet know the deal performance.[61]

In the following, we covers two out of three mechanisms described in the literature of how PE mitigates managerial agency problems, since our interview data include questions concerning (i) enhanced governance and (ii) increased managerial incentives (Leslie and Oyer, 2009). The paper is silent on the effects how (iii) greater debt disciplines managers. We cluster the different facets of PE governance practices with the following interview topics: (1) In "management turnover & incentives" we analyze the governance actions concerning the replacement of the management team and also the ownership share of the management as described by the interviewee. (2) In "support & control" we cover the interview topics on PE time commitment and external support, e.g., through external consultants. (3) In

[59] In some cases, we have more data points on the PE practices than interviews, since we have information, e.g., on the management equity share, from the hard-coded PE fund documents we received. In other cases, the full questionnaire was not covered due to the time constraints of the interviewed deal partner.

[60] For example, an endogenous reaction would be if a PE partner spent a lot of time on a deal because it was underperforming.

[61] In this section we only define deals as inorganic if they had an M&A in the first two years, since again we can only assume that an inorganic strategy in the first two years is exogenous – given that it takes at least one year to find out that a deal is underperforming and another year to identify and buy another company. If we had also flagged late M&A activity as inorganic we could have potentially found spurious correlations. Similar to the endogeneity discussion in the previous sections, a problem could arise if OPs did not like inorganic strategies per se. However, if a deal were not going well OPs would pursue an inorganic strategy to hide their bad performance. And deals do not do well according to a low governance activity level in the first 100 days. So we would see very active OPs in organic and very passive in inorganic strategies. This would cause the difference from the FPs and not their different governance practices.

"interventions & initiatives" we look at plan adjustments and value creation initiatives applied by the PE house to a deal. We code the interview answers with a 1 if the answer was yes, and with a 0 if the answer was no. Therefore a score of 0.38, for example, means that 38% have answered the question with yes.

For each interview section, we first show non-parametrically which answer relates to outperformance before we compare the scores by partner background and strategy. Here, we rank the deals by their abnormal performance into terciles. We then compare scores of the top abnormal performance tercile with those of the mid & bottom tercile. Finally if a question is more frequently answered with a yes in the top abnormal performance tercile and there is a difference between the partners in the same answer, we interpret this as a PE governance practice, which indicates potential partner skill difference and are relevant for the performance of a deal.

However, the fact that we only have 72 interviews, of which only one-third are inorganic, limits our analyses in the following way: We are not able to identify differences in governance pattern for deals with an inorganic strategy. We therefore cannot uncover what FPs improve in those deals. In reverse, since OPs outperform FPs in organic strategies, we are only able to show what OPs do better than FPs. Further, in contrast to the financial performance analyses with 102 deals and multivariate regressions with interaction terms, we are only able to test for differences non-parametrically with bivariate tests, due to the small sample size.

Finally, we cannot rule out measurement errors in the interviews, for instance that, intentionally or unintentionally, partners in successful or unsuccessful deals overplayed or underplayed their role in the interview according to the performance of a deal. We therefore interpret our findings as descriptive rather than causal.

However, according to our data, it seems that FPs in organic deals are less active in PE governance practices, which relates to financial outperformance, but more active in governance practices, which are not important for financial outperformance:[62]

(1) **Management turnover & incentives:** Guo et al. (2009) provide evidence that operating improvements are greater at PE owned companies, when the CEO is replaced at the time of the buyout. In Table 2.9 we provide evidence that PE replaces the CEO on average in 38% of the deals, which is similar to the 37% reported by Guo et al. (2009). However, we show in Table 2.9 that FPs are less active in management changes in the first 100 days in organic deals. OPs change management in total 52% of the time in the organic deals we review. FPs do so only in 33% of the cases. This finding comes mainly from the differences in the replacement of other management, since there is no or only weak evidence that OPs replace the CEO or CFO more often.

In line with Leslie and Oyer (2009), who report that the highest manager (CEO) of a PE owned company has an on average 68% more equity ownership as a comparable public company manager, we also find that PE gives typically 1st & 2nd management line equity shares (in 57% of the cases, as shown in Table 2.9). Interestingly for our research topic, FPs seem to give higher incentives to management, as shown in Table 2.9. In particular, FPs give management high cash-multiples more frequently.

How important are these governance differences for the performance of a deal? The differences point to heterogeneity, which potentially cause higher performance, since only early management changes happen more frequently in the top tercile of organic strategies. In contrast, there is an inverse pattern between top abnormal performance deals and giving high

[62] In the following section, we discuss in detail only differences in governance practices in detail, which are statistically significant at least at a 10% level.

cash-multiples to the management, which seems to be directionally consistent with Leslie and Oyer (2009), who do not find that higher incentives relates to value creation.

(2) **Support and control:** Acharya et al. (2008) highlight the intense engagement of PE boards with the top management of a company in comparison to the more passive PLC boards. Generally, the leading deal partner is also a board member. We find again differences between FPs and OPs.

According to Table 2.10 FPs spend less time on management interactions in organic deals. While OPs reach a total management interaction score of 81% in organic deals, which is the simple average of the three sub-questions. FPs only reach a score of 59%. The usage of external support in the first 100 days, although highly positively correlated with abnormal performance, seems to be the same for FPs and OPs.

Again, time commitment, a PE governance practice in which FPs are less active, correlates positively with abnormal performance in organic strategies. Top abnormal performance deals reach a score of 79% in management interactions in comparison to 60% in the middle and bottom abnormal performance terciles.

(3) **Interventions & initiatives:** First, in Table 2.11 we find that FPs seem to engage less in revising management plans in organic strategies than OPs. 87% of OPs revise management plans in organic deals, in contrast to only 56% of FPs. On the other hand, OPs devise new KPIs less often in organic deals, since OPs devise new KPIs in 53% of their deals, but FPs in 76% of their organic deals. We find no clear pattern for differences in "value creation initiatives" for organic deals.

Overall, in our attempt to identify differences in governance practices of OPs and FPs, we interpret the findings on early management changes, incentives, and new KPIs as most

convincing in all our three interview sections. Those answers are less likely to be over or underplayed in an interview than, for example, early PE time commitment.

Finally, in Table 2.15 we also address the concern that governance practices are determined by the PE house rather than by partner background and that our findings are caused by the fact that some PE houses hire in particular FPs or OPs. However, we only have 14 PE houses and the sample size per PE house is in most cases too small to tell if PE governance practices are also determined by the PE house. Nevertheless, we find that some indeed seem to show a pattern in their governance activities. For example in all 5 organic deals of PE house (5) the "other management" was not replaced. However, we do not find a particular accumulation of FPs or OPs by PE house. Only PE house (2) seems to use exclusively OPs.

2.6. Concluding remarks

We provide evidence based on interviews with GPs involved in PE deals that implied that the abnormal positive performance in the cross-section of large PE houses is related to differences in human capital factors. There are certain combinations of PE value creation strategies and leading deal partner characteristics which correlate with deal-level performance of 102 large and mature PE fund investments in Western Europe between 1996 and 2005.

The data set we use is ideally suited for our goal of identifying persistent skills at a deal partner level. (1) It is representative in terms of performance of PE investments of large and mature PE houses. These large and mature PE funds persistently outperform the public market. (2) In contrast to the existing literature, which has a focus on public-to-private deals only, the data set covers all vendor types, e.g., carve-out deals, where only part of a company is acquired, as well as private-to-private deals, where a non-listed business is acquired. Carve-out and private-to-private transactions comprised 75% of PE deals in the last decade, are

smaller in size and different in profitability (EBITDA margin) from public-to-private deals. (3) Most importantly, the data also includes a unique set of in-depth deal-level interview data, which enables us to identify the leading deal partner background and governance patterns per deal.

Coming to our main findings, first, leading deal partners with a strong operational background (OPs) generate higher financial performance at purely internal company enhancement deals (organic strategy). In other words, the deal partner who worked in the industry or as management consultant before joining a PE house seems to be well suited to internally improve corporations, which are often characterized by entrenched management and prone to cash-flow diversion, and are averse to taking on efficient levels of risk.

Second, deal partners with a background in finance (FPs) more frequently follow an M&A (inorganic) strategy. FPs lead 30 out of 35 inorganic deals. Moreover, FPs generate higher returns when implementing an inorganic strategy. Partners with backgrounds as bankers or accountants appear to be more familiar with significant mergers and acquisitions (M&A) and in executing "buy and build" opportunities successfully.

Finally, we identify, with interview data, differences in PE governance practices between FPs and OPs, which are performance relevant. OPs more frequently make management changes, management plan revisions, and strong time commitments to management in the early deal phase. In contrast, FPs more often give equity shares to 1st and 2nd management line and devise new KPIs more frequently. However, we find that these two measures do not correlate positively with performance.

More research is needed in understanding PE fund manager skills, which drive outperformance. First, we are not able to show the success factors of FPs in inorganic deals. An active governance approach is probably less important. Instead, the identification of

potential synergy in "buy and build" strategies is probably key. Second, PE houses define themselves either as "specialist", which means a PE house focus on specific sectors, or, in contrast, as "generalist". We were not able to find performance differences between the two, possibly because of the size of our data set. Finally, we are also curious to know if investment experience plays a major role in explaining outperformance of large and mature PE funds. It could be the case that over time "surviving" PE partners in mature PE funds are able to accumulate skills that generate outperformance.

2.7. References

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2.8. Tables

Table 2.1: Distribution of deals by entry and exit years

The table shows the years in which the PE houses bought (entry) or sold (exit) the portfolio companies (deals) in our sample.

Years	96	97	98	99	2000	01	02	03	04	05	06	07	sum
Entry	4	8	11	13	10	9	15	17	13	2	n/a	n/a	102
Exit	n/a	n/a	n/a	1	2	7	6	9	18	17	19	23[1]	102

1 Including seven deals for which exit is simulated

Table 2.2: Summary statistics

The table shows various financial measures for the deals in our sample.
The first part reports the financial performance and durations for all deals in our sample. We calculate the deal IRRs (internal rate of return) using the entire time pattern of cash inflows and outflows for each deal (portfolio company), as experienced by the PE house (before fees). The cash in/cash out multiple measures the absolute value of all positive cash flows divided by all negative cash flows minus 1. The duration captures the length of the deals in years, using the entry and exit months and years as reported by the PE house.
The second part reports abnormal performance, duration for deals with M&A and divestment events separately.

Variable	n	mean	median	std. dev.	min	max
Deal IRR %	102	39.3	36.3	40.5	-87.8	123.4
Cash in/cash out multiple		2.9	2.7	1.9	0.0	10.3
Abnormal performance		8.7	10.5	20.7	-86.1	73.4
PME		1.2	1.1	1.5	-1.0	9.1
Duration (years) [1]	95	3.9	3.6	1.5	1.4	7.3
Deals with M&A events only [2]						
Abnormal performance	35	12.1	13.2	16.3	-34.7	55.5
Duration (years) [1]	32	4.2	4.3	1.7	1.8	8.1
Time until first M&A event (years)	35	1.2	0.9	1.3	-0.2	4.3
Deals with divestment events only [2]						
Abnormal performance	14	0.2	-2.0	14.2	-20.3	19.7
Duration (years) [1]	14	4.4	4.3	1.3	2.5	6.8
Time until first divestment event (years)	14	2.5	2.1	1.9	0.4	7.3

Note: In Mio, EUR; significance level * p<0.1, ** p<0.05, *** p<0.01
1 Only exited deals
2 Major M&A or divestment events during PE ownership as mentioned by the PE house or in the press, Capital IQ database, or PE house website. Events are major if they altered sales or enterprise value by more than 20%.

Table 2.3: Benchmarking of our deals vs. our funds by net IRR comparison

This table compares the deals with the funds in our sample by Net IRRs. Row (1) provides the Net IRR for 32 out of 36 funds that participated in our sample and for which Prequin reports the NET IRRs by end of 2007. [6] We weight the 32 fund returns by the number of participating deals per fund. In row (2) we show the simple average NET IRRs for all deals in our sample for which we have fund return data (for 88 out of 102 deals). In row (3) we pool these deals artificially in one pseudo fund. Since the publicly available data on the European universe is primarily in the form of net IRRs, we convert our gross deal-level IRRs (before fees charged by PE houses to fund investors) to net IRRs (after fees, or in other words, IRRs from the viewpoint of fund investors). In the last column we test if the PE houses cherry-picked the deals out of their funds in terms of performance.

	n	Net IRR [1]		t-stat of diff. to our funds
		mean	median	
(1) Our funds [4]	32	24.5 [5]	26.4	
(2) Our deals	88	27.1 [2]	25.1	0.62 [7]
(3) Our deals pooled in 1 pseudo fund [3]	1	24.3		

Note: All values in percent or Mio EUR **,** vintage year 1993-2003, significance level * p<0.1, ** p<0.05, *** p<0.01

1 NET IRR, estimated for our deals in the following way: If a) Gross IRR<=10%, then LPs keep all return except 2% fees, so that Net IRR = Gross IRR - 2% fees; b) 10%<Gross IRR<12.5%, then LPs keep all return up to 10% except for 2% fees and GPs keep all return from 10% to 12.5%, so that Net IRR = Gross IRR - 2% fees – (Gross IRR – 10)% = 8%; and c) Gross IRR>=12.5%, then LPs and GPs share in 80:20 ratio the return exceeding 12.5%, so that Net IRR = Gross IRR - 2% fees – 2.5% - 20%*(Gross IRR - 12.5%).

2 Simple averages

3 Pooled by calendar period using quarterly cash flows

4 As reported in Prequin.

5 Weighted averages by number of participating deals per fund

6 In 5 cases, more than one fund of a PE house is involved; in these cases we take the simple average of the funds involved and treat the funds as one fund. For 1 deal the Fund names is unknown, for 3 funds we could not find fund returns.

7 We use Welch's t-test of difference between (1) and (2) assuming unequal variance for (1) and (2).

Table 2.4: Benchmarking of our funds vs. PE universe by net IRR comparison

This table compares the returns of the funds in our sample with fund returns of the EU universe. First, row (1) provides the Net IRR for 32 out of 36 funds, which participate in our sample and for which Prequin reports the NET IRRs. [3] Second, row (2) provides the Net IRRs for all funds in Western Europe and (3) for very large funds only, as reported in Thomson Financial Venture Expert.
In addition, we added in row (0) the performance of previous funds, e.g., of fund "Europe I" for fund "Europe II" in our sample. However, we only find Net IRRs for 25 funds (out of the 32 funds), since 5 funds did not have a previous fund in Western Europe and for two previous funds there is no Net IRR available. In the last column we test if the PE funds in our sample are different in terms of Net IRR from a) the Western European universe, b) the universe with the same fund size and c) the previous funds.

	n	Net IRR		fund size	t-stat of diff. to our funds
		mean	median		
(0) Previous funds of our funds [1]	25	23.2 [4]	22.1	500-5000	-0.49 [5]
(1) Our funds [1]	32	24.5 [4]	26.4	500-5000	
(2) All funds in Western Europe [2]	229	16.3	9.8	0-1000+	-2.29*** [6]
(3) All large funds in Western Europe [2]	53	22.0	18.9	500-1000+	-0.61 [7]

Note: All values in percent or Mio EUR **,** vintage year 1993-2003, significance level * p<0.1, ** p<0.05, *** p<0.01

1 As reported in Prequin
2 According to Thomson Financial Venture Expert
3 In 5 cases, more than one fund of a PE house is involved; in these cases we take the simple average of the funds involved and treat the funds as one fund.
4 Weighted averages by number of participating deals per fund
5 We test for the difference between (0) and (1) assuming equal variance for (0) and (1) and use for (1) only the 25 funds, for which previous fund Net IRR was available (Net IRR 24.18%).
6 We test for the difference between (2) and (1) assuming equal variance for (2) and (1)
7 We test for difference between (3) and (1) assuming equal variance for (3) and (1). Unequal variance assumption leads to t= -0.58

Table 2.5: Benchmarking of sample by distribution of deal size

The table classifies the deals by the price paid for the acquired company (deal size). The first part of the table shows the distribution by size for the deals in our sample, and the second part for the European universe. The last column shows the share of our sample on all large and very large buyouts

	Deal size (in Mio EUR)				**total**	**sample coverage of large & very large deals**
	small (0-50)	**medium** (50-100)	**large** (100-500)	**very large** (>500)		
Our deals per #	2.0%	6.9%	43.1%	48.0%	102	
Our deals per value	0.1%	0.8%	14.4%	84.8%	70,381	
EU universe per #	67.3%	11.9%	15.2%	5.5%	5,384	8.3%
EU universe per value	9.4%	7.1%	26.9%	56.5%	636,604	13.1%

Note: In Mio, EUR **Source:** EU universe data from Private Equity Insight, covering all deals acquired from 1995 to 2005 in Western Europe for which information on deal value or deal size category was available

1 For 22.8% of all deals in EU universe only deal size category was available. Deal value estimated with the mean deal value per category. Mean deal value per category calculated with 77.2% of all deals for which exact deal value was available (sum deal value = mean deal value per category * number of deals)

Table 2.6: Benchmarking of sample by vendor type

The table classifies the deals by vendor types into five different categories. Category (1) shows public-to-private deals, in which PE acquired a whole public company and (2) carve-out deals, in which PE acquired only a part of a company. Category (3) reports PE acquisitions of former family-owned or private companies, (4) of companies that were owned by institutional investors, e.g., other PE funds, and (5) of former state or government owned companies. The first part of the table reports the categories for the deals in our sample, the lower part for the PE universe in Western Europe. In addition, the table reports the mean (median) size (enterprise value) and profitability (EBITDA margin) of the company at the acquisition date. In the last column we test for differences in profitability by vendor type.

Vendor type (previous owner)	**N**	**split in %**		**enterprise value** [1]		**EBITDA margin**	
		by n	**by value**	**mean (median)**	**test of diff.** [2]	**mean (median)**	**test of diff.** [2]
Our sample							
(1) Public-to-Private	11	10.8%	12.6%	806.4 (425.7)	0.57	15.3 (14.3)	-0.35
(2) Carve-out	40	39.2%	38.0%	668.1 (507.9)	-0.24	16.7 (16.0)	0.16
(3) Family/Private	32	31.4%	27.0%	594.7 (382.4)	1.06	14.1 (12.4)	-1.46
(4) Instit. Investor	17	16.7%	21.2%	878.3 (469.3)	1.19	22.3 (21.9)	2.04**
(5) State	2	2.0%	1.2%	414.8 (414.8)	-0.55	10.9 (10.9)	.
Total	102	100.0%	100.0%	690.1 (447.5)		16.5 (14.5)	
EU universe							
(1) Public-to-Private	249	4.6%	17.3%	442.7 (170.7)	16.67***	10.3 (8.1)	-2.66***
(2) Carve-out	2,066	38.4%	44.7%	137.6 (31.3)	6.09***	9.8 (8.9)	-3.52***
(3) Family/Private	1,937	36.0%	13.2%	43.4 (14.1)	-18.50***	13.5 (10.4)	2.85***
(4) Instit. Investor	749	13.9%	19.3%	163.7 (55.7)	13.01***	14.3 (11.1)	3.71***
(5) State	74	1.4%	2.6%	226.5 (36.9)	1.45	12.3 (8.4)	0.72
(6) Not Disclosed [3]	309	5.7%	2.9%	59.5 (9.5)	-9.70***	10.8 (9.8)	0.44
Total	5,384	100.0%	100.0%	118.2 (25.0)		11.8 (10.0)	

Note: In Mio EUR, significance level * p<0.1, ** p<0.05, *** p<0.01
Source: Private Equity Insight, all deals acquired from 1995 to 2005 in Western Europe with deal size or size category available

Table 2.7: Overview partner background and PE strategy

The table gives an overview of the background of the partners who led the deals in our sample, for all deals and by deal strategy (organic vs. inorganic strategy) [1]. We cluster the partners into 4 categories. We call partners in the first two categories Finance partners (partners with a background in banking or accounting), and in the second two categories Operations partners (partners with a background in consulting or industry). For each category, we report summary statistics on (1) abnormal performance, (2) IRR and (3) PME.

Strategy	**leading partner background** [2]	**n**	**(1) abnormal performance**		**(2) IRR**		**(3) PME**	
			mean	**median**	**mean**	**median**	**mean**	**median**
All deals	Banking	33	7.83	14.00	0.35	0.34	1.57	1.44
	Accounting [4]	42	4.87	3.13	0.31	0.31	0.76	0.7
	Subtotal (FPS)	75	6.18	8.22	0.33	0.34	1.11	1.01
	Consulting	15	16.40	11.45	0.68	0.63	1.53	1.27
	Industry Expert	12	11.59	11.92	0.44	0.41	1.23	1.29
	Subtotal (OPS)	27	14.26	11.45	0.57	0.56	1.4	1.27
	Total	102	8.32	10.49	0.39	0.36	1.19	1.05
Organic deals (without M&A events)	Banking	14	-1.96	5.03	0.23	0.24	0.77	0.99
	Accounting [4]	31	3.27	1.83	0.31	0.33	0.79	0.7
	Subtotal (FPS)	45	1.64	1.83	0.28	0.28	0.79	0.73
	Consulting	14	17.27	12.12	0.68	0.63	1.6	1.35
	Industry Expert	8	13.82	14.55	0.54	0.63	1.38	1.89
	Subtotal (OPS)	22	16.02	12.12	0.63	0.63	1.52	1.44
	Total	67	6.36	8.22	0.40	0.37	1.03	0.99
Inorganic deals (with M&A events) [3]	Banking	19	15.04	14.19	0.44	0.36	2.16	1.79
	Accounting [4]	11	9.38	4.47	0.31	0.27	0.65	0.54
	Subtotal (FPS)	30	12.97	13.46	0.39	0.36	1.61	1.16
	Consulting	1	4.13	4.13	0.71	0.71	0.61	0.61
	Industry Expert	4	7.14	3.81	0.26	0.26	0.92	0.56
	Subtotal (OPS)	5	6.54	4.13	0.35	0.40	0.86	0.61
	Total	35	12.05	13.19	0.39	0.36	1.5	1.08

Note: Abnormal performance in percent

1 Including bankruptcies and non-exited deals

2 Professional background of the partner interviewed if not mentioned otherwise in Capital IQ database, PE house website, or press articles. For deals without an interview available or if the interviewed partner is not the leading deal partner, we use the professional background of the leading deal partner if mentioned in Capital IQ database, PE house website, or press articles.

3 Deals with major M&A activity during PE ownership as reported by the PE house or as mentioned in the press, Capital IQ database, or PE house website (if M&A altered sales or enterprise value of the deal by more than 20%)

4 Including deal partners with background in law.

Table 2.8: Financial performance by partner background and PE strategy

The table reports multivariate regression results of financial performance on the background of the deal partner who initiated the deals in our sample.[1] We cluster the partner into two categories. We call partners with a background in banking or accounting as "FPs" and with a background in consulting or industry as "OPs." In regression (1) – (4) we run the regression with abnormal performance as dependent variable in (5) – (6) IRR and (9) – (12) PME.

Independent variables	**(1) Dependent variable abnormal perf. in %**				**(2) Dependent variable IRR in %**				**(3) Dependent variable PME**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FPs [2]	-6.29	-7.81*	-11.77**	-11.54**	-13.45*	-14.99*	-22.10**	-21.27**	-0.33	-0.42	-0.71*	-0.69*
	(-1.56)	(-1.88)	(-2.44)	(-2.39)	(-1.70)	(-1.83)	(-2.27)	(-2.19)	(-1.00)	(-1.29)	(-1.92)	(-1.84)
inorganic [3]		8.93**	-5.62	-6.37		9.09	-16.97*	-19.66**		0.55*	-0.53	-0.60
		(2.60)	(-1.19)	(-1.27)		(1.40)	(-1.82)	(-2.10)		(1.70)	(-1.26)	(-1.35)
FPs x inorganic			17.87***	19.02***			32.01***	36.11***			1.32**	1.42**
			(2.96)	(2.85)			(2.69)	(2.96)			(2.33)	(2.40)
no exit [4]				-9.07				-32.38				-0.81**
				(-0.68)				(-1.45)				(-2.01)
holding length (in yrs)	-6.02***	-6.22***	-5.91***	-5.39***	-12.8***	-13.1***	-12.5***	-10.7***	-0.21**	-0.22**	-0.20**	-0.15
	(-4.93)	(-5.32)	(-5.19)	(-4.24)	(-5.40)	(-5.59)	(-5.44)	(-4.33)	(-2.21)	(-2.32)	(-2.05)	(-1.42)
Entry period [5]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	102	102	102	102	102	102	102	102	102	102	102	102
R2 adjusted	0.21	0.24	0.25	0.25	0.29	0.30	0.31	0.34	0.02	0.04	0.06	0.07

Note: OLS regression, t-stat in parenthesis with robust standard errors, significance level * p<0.1, ** p<0.01, *** p<0.001

1 Including bankruptcies and not exited deals

2 Dummy equals 1 (and 0 otherwise) for deals with leading deal partners who have a background in banking, accounting or law (in contrast to consulting or industry). Professional background of the partner interviewed if not mentioned otherwise in Capital IQ database, PE house website, or press articles. For deals without an interview available or if the interviewed partner is not the leading deal partner, we use the professional background of the leading deal partner if mentioned in Capital IQ database, PE house website, or press articles.

3 Dummy equals 1 (and 0 otherwise) for deals with major M&A activity during PE ownership as reported by the PE house or as mentioned in the press, Capital IQ database, or PE house website (if M&A altered sales or enterprise value of the deal by more than 20%)

4 Dummy equals 1 (and 0 otherwise) for deals, which were not yet exited

5 Dummies for entry period 1998 – 2000, 2001 – 2002 and 2003 - 2007

Table 2.9: Management turnover and incentives

The Table reports the mean score of deal involvement questions by (1) performance and (2) partner background of the deal.[1] We further show the mean scores for all deals and deals without early M&A events separately. First, in column (1) we rank the deals by abnormal performance and show the mean score of the deal involvement for different performance terciles. Second, in column (2) we show the mean scores for partners with backgrounds in finance and in operations separately.
The upper part of the table covers management changes in 1st 100 days or before, the lower part the change in incentives.
The sample size varies per answer. In some cases, we have more answers than interviews, since we have also information from PE fund documents, e.g., on the mgmt. equity share. In other cases, the full questionnaire was not covered, due to time constraints of the interviewee. [6]

		(1) abnormal perf. tercile			(2) partner background		
	Total	**top tercile**	**other**	**t-test [5]**	**FIN [2]**	**OPS [3]**	**t-test [5]**
1st 100 days management change							
All deals (N)	72	20	52		56	16	
CEO replacement	0.38	0.45	0.35	0.81	0.34	0.50	-1.17
CFO replacement	0.36	0.45	0.33	0.97	0.36	0.38	-0.13
Other replacement	0.39	0.50	0.35	1.19	0.32	0.63	-2.24**
Total mgmt. change [6]	0.38	0.47	0.34	1.28	0.34	0.50	-1.51
Organic deals (N) [4]	54	12	42		40	14	
CEO replacement	0.41	0.67	0.33	2.15**	0.35	0.57	-1.42
CFO replacement	0.37	0.50	0.33	1.09	0.35	0.43	-0.4
Other replacement	0.37	0.58	0.31	1.42	0.30	0.57	-2.15**
Total mgmt. change [6]	0.38	0.58	0.33	1.96*	0.33	0.52	-1.65*
1st 100 days change in incentives							
All deals (N)	75	26	49		54	21	
Mgmt. with high equity share	0.41	0.42	0.41	0.12	0.43	0.38	0.35
Mgmt. with high cash-multiple	0.29	0.09	0.40	-1.86*	0.36	0.00	1.78*
1st & 2nd mgmt. line with equity	0.57	0.65	0.54	0.83	0.62	0.41	1.53
Total incentives [6]	0.48	0.47	0.48	-0.17	0.51	0.39	1.32
Organic deals (N) [4]	53	17	36		34	19	
Mgmt. with high equity share	0.43	0.47	0.42	0.51	0.47	0.37	0.33
Mgmt. with high cash-multiple	0.26	0.00	0.38	-1.98*	0.35	0.00	1.28
1st & 2nd mgmt. line with equity	0.52	0.62	0.49	0.7	0.57	0.40	0.59
Total plan adjustments [6]	0.45	0.48	0.44	0.48	0.49	0.38	0.45

Note: significance level * p<0.1, ** p<0.05, *** p<0.01
1 Professional background of partner interviewed if not mentioned otherwise in Capital IQ database, PE house website, or press articles. For deals without an interview available or if the interviewed partner is not the leading deal partner, we use the professional background of the leading deal partner from Capital IQ database, PE house website, or press articles.
2 Partner with a background in banking, accounting, or law
3 Partner with a background in consulting or industry
4 Deals without major M&A events during the first two years of PE ownership as reported by the PE house or as mentioned as a major strategy in the press. We classify M&A events as major if they alter sales or enterprise value by more than 20%
5 t-test of difference to mean of all other deals
6 We fill data holes for deriving subtotals with the average score of the three questions answered per deal.

Table 2.10: Support and control

The Table reports the mean score of deal involvement questions by (1) performance and (2) partner background of the deal.[1] We further show the mean scores for all deals and deals without early M&A events separately. First, in column (1) we rank the deals by abnormal performance and show the mean score of the deal involvement for different performance terciles. Second, in column (2) we show the mean scores for partners with backgrounds in finance and in operations separately.
The upper part of the table covers management support in the 1st 100 days or before. The lower part covers external support.
The sample size varies per answer. In some cases, we have more answers than interviews, since we have also information from PE fund documents, e.g., on the mgmt. equity share. In other cases, the full questionnaire was not covered, due to time constraints of the interviewee. [6]

		(1) abnormal perf. tercile			(2) partner background		
	Total	**top tercile**	**other**	**t-test [5]**	**FIN [2]**	**OPS [3]**	**t-test [5]**
1st 100 PE support							
All deals (N)	73	21	52		56	17	
Multiple CEO interactions per week	0.53	0.76	0.44	2.55**	0.52	0.59	-0.5
Frequent CFO interactions	0.97	0.95	0.98	-0.66	0.96	1.00	-0.84
High PE partner time commitment	0.52	0.50	0.53	-0.18	0.45	0.67	-1.36
Total PE support [6]	0.67	0.78	0.63	1.83*	0.65	0.75	-1.22
Organic deals (N) [4]	54	13	41		39	15	
Multiple CEO interactions per week	0.48	0.77	0.39	2.65**	0.41	0.67	-2.65**
Frequent CFO interactions	0.98	1.00	0.97	0.63	0.97	1.00	-0.63
High PE partner time commitment	0.57	0.56	0.57	-0.23	0.46	0.77	-1.93*
Total PE support [6]	0.65	0.79	0.60	2.08**	0.59	0.81	-3.08***
1st 100 days external support							
All deals (N)	68	21	47		53	15	
Used in acquisition phase	0.78	0.81	0.77	0.39	0.74	0.93	-1.64
Used in 1st 100 days	0.34	0.57	0.23	2.83***	0.32	0.40	-0.57
Total external support [6]	0.56	0.69	0.50	2.12**	0.53	0.67	-1.36
Organic deals (N) [4]	50	13	37		37	13	
Used in acquisition phase	0.80	0.85	0.78	0.44	0.76	0.92	-1.13
Used in 1st 100 days	0.34	0.69	0.22	3.73***	0.30	0.46	-0.77
Total external support [6]	0.57	0.77	0.50	2.56**	0.53	0.69	-1.14

Note: significance level * p<0.1, ** p<0.05, *** p<0.01
1 Professional background of partner interviewed if not mentioned otherwise in Capital IQ database, PE house website, or press articles. For deals without an interview available or if the interviewed partner is not the leading deal partner, we use the professional background of the leading deal partner from Capital IQ database, PE house website, or press articles.
2 Partner with a background in banking, accounting, or law
3 Partner with a background in consulting or industry
4 Deals without major M&A events during the first two years of PE ownership as reported by the PE house or as mentioned as a major strategy in the press. We classify M&A events as major if they alter sales or enterprise value by more than 20%
5 t-test of difference to mean of all other deals
6 We fill data holes for deriving subtotals with the average score of the three questions answered per deal.

Table 2.11: Interventions and initiatives

The Table reports the mean score of deal involvement questions by (1) performance and (2) partner background of the deal.[1] We further show the mean scores for all deals and deals without early M&A events separately. First, in column (1) we rank the deals by abnormal performance and show the mean score of the deal involvement for different performance terciles. Second, in column (2) we show the mean scores for partners with backgrounds in finance and in operations separately.
The upper part of the table covers plan adjustments in 1st 100 days or before. The lower part covers value creation initiatives.[7] The sample size varies per answer. [6]

		(1) abnormal perf. tercile			(2) partner background		
	Total	**top tercile**	**other**	**t-test [5]**	**FIN [2]**	**OPS [3]**	**t-test [5]**
1st 100 days plan adjustments							
All deals (N)	68	21	47		51	17	
Revised management plan	0.68	0.76	0.64	1	0.63	0.82	-1.5
New Key Performance Indicators	0.73	0.77	0.70	0.58	0.80	0.53	2.17**
Acted on deviations	0.56	0.50	0.59	-1.34	0.56	0.57	-0.2
Total plan adjustments [6]	0.64	0.67	0.63	0.47	0.65	0.63	0.23
Organic deals (N) [4]	49	13	36		34	15	
Revised management plan	0.65	0.77	0.61	0.99	0.56	0.87	-1.71*
New Key Performance Indicators	0.69	0.71	0.68	0.45	0.76	0.53	1.89*
Acted on deviations	0.59	0.50	0.62	-1.55	0.60	0.58	0.73
Total plan adjustments [6]	0.62	0.66	0.61	0.44	0.61	0.66	0.19
1st 100 days value creation initiatives							
All deals (N)	74	23	51		57	17	
At least one productivity initiative	0.62	0.48	0.69	-1.36	0.58	0.76	-1.39
At least one organic growth initiative	0.70	0.87	0.63	2.38**	0.72	0.65	0.57
At least one strategic repo. initiative	0.12	0.13	0.12	0.57	0.16	0.00	1.76*
Total incentives [6]	0.48	0.49	0.48	0.74	0.49	0.47	0.2
Organic deals (N) [4]	57	16	41		39	15	
At least one productivity initiative	0.67	0.63	0.68	-0.35	0.64	0.73	-0.28
At least one organic growth initiative	0.70	0.88	0.63	1.87*	0.72	0.67	0.07
At least one strategic repo. initiative	0.12	0.19	0.10	0.77	0.15	0.00	1.55
Total plan adjustments [6]	0.50	0.56	0.47	1.22	0.50	0.47	0.54

Note: significance level * p<0.1, ** p<0.05, *** p<0.01

1 Professional background of partner interviewed if not mentioned otherwise in Capital IQ database, PE house website, or press articles. For deals without an interview available or if the interviewed partner is not the leading deal partner, we use the professional background of the leading deal partner from Capital IQ database, PE house website, or press articles.

2 Partner with a background in banking, accounting, or law

3 Partner with a background in consulting or industry

4 Deals without major M&A events during the first two years of PE ownership as reported by the PE house or as mentioned as a major strategy in the press. We classify M&A events as major if they alter sales or enterprise value by more than 20%

5 t-test of difference to mean of all other deals

6 We fill data holes for deriving subtotals with the average score of the three questions answered per deal.

7 Productivity initiatives are 1) purchasing (e.g., supplier consolidation), 2) process efficiency, 3) overhead reduction (e.g., in Selling, General and Admin costs), 4) other cost reduction (detailed by interview), 5) working capital reduction, 6) CAPEX reduction. Organic growth initiatives are 1) review of pricing, 2) new channels, 3) new products or new geographies.

Table 2.12: Performance and PE house characteristics

The table reports various measures by the 14 PE houses participating in our sample. We rank the PE houses by simple average abnormal performance and report for each PE house the share of Finance/inorganic and Operations/organic deals. We also test for difference in the D/E ratio by PE house.

PE house	# of deals	financial performance in %			share of deals with partner background in Finance and inorganic strategy	share of deals with partner background in Operations and organic strategy	leverage
		mean (median) abnormal performance	mean IRR	mean PME			mean (median)
(1)	3	19.59 (14.63)	37.79	4.59	0.67	0.00	1.93
(2)	4	17.53 (15.75)	42.97	2.27	0.75	0.25	2.46
(3)	8	14.43 (19.76)	79.58	1.40	0.00	0.75	2.13
(4)	1	14.19 (14.19)	44.19	4.82	1.00	0.00	2.21
(5)	1	14 (14)	84.96	1.01	0.00	0.00	2.26
(6)	11	13.8 (18.45)	35.13	1.50	0.18	0.27	1.13***
(7)	21	10.32 (10.79)	31.78	0.94	0.24	0.10	1.96
(8)	7	10.26 (4.75)	28.53	0.68	0.57	0.14	3.28***
(9)	9	7.14 (4.47)	42.62	1.21	0.33	0.11	1.70
(10)	8	7.12 (7.54)	36.68	1.26	0.38	0.25	1.93
(11)	2	6.18 (6.18)	83.37	1.49	1.00	0.00	2.38
(12)	8	3.01 (3.51)	55.30	0.68	0.00	0.63	2.34
(13)	15	0.49 (-4.44)	25.96	0.55	0.27	0.07	1.46*
(14)	4	-7.42 (-5.03)	6.56	0.63	0.25	0.00	2.06
Total	102	8.32 (10.49)	39.28	1.19	0.29	0.22	1.94

Note: significance level * p<0.1, ** p<0.05, *** p<0.01

Table 2.13: Financial performance by partner background and early PE strategy

The table reports multivariate regression results of financial performance on the background of the deal partner who led the deals in our sample.[1] We cluster the partner into two categories. We call partners with a background in banking or accounting as "FPs" and with a background in consulting or industry as "OPs." In regression (1) – (4) we run the regression with abnormal performance as dependent variable in (5) – (6) IRR and (9) – (12) PME.

The regressions are the same as in Table 2.8; however we use as M&A dummy variable early M&A events (early inorganic) only. We therefore assign a 1 for deals only with M&A in the first 2 years of PE ownership, since late M&A events might be endogenously determined by the performance of the deal.

Independent variables	**(1) Dependent variable abnormal perf. in %**				**(2) Dependent variable IRR in %**				**(3) Dependent variable PME**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FPs [2]	-6.29	-8.35**	-10.04**	-9.70**	-13.45*	-15.08*	-19.91**	-18.61**	-0.33	-0.45	-0.60*	-0.57
	(-1.56)	(-2.04)	(-2.20)	(-2.14)	(-1.70)	(-1.79)	(-2.18)	(-2.04)	(-1.00)	(-1.41)	(-1.74)	(-1.63)
early inorganic [3]		8.90**	-1.67	-1.90		7.05	-23.14**	-24.01***		0.54	-0.39	-0.41
		(2.48)	(-0.33)	(-0.35)		(1.00)	(-2.50)	(-2.66)		(1.44)	(-0.77)	(-0.77)
FPs x early inorganic			12.36*	12.87*			35.30***	37.24***			1.09*	1.14*
			(1.89)	(1.86)			(3.00)	(3.17)			(1.70)	(1.70)
no exit [4]				-8.03				-30.49				-0.73*
				(-0.60)				(-1.36)				(-1.91)
holding length (in yrs)	-6.02***	-5.54***	-5.41***	-4.95***	-12.8***	-12.5***	-12.1***	-10.34***	-0.21**	-0.18*	-0.17	-0.13
	(-4.93)	(-4.80)	(-4.71)	(-3.68)	(-5.40)	(-5.18)	(-5.16)	(-3.99)	(-2.21)	(-1.76)	(-1.62)	(-1.09)
Entry period [5]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	102	102	102	102	102	102	102	102	102	102	102	102
R2 adjusted	0.21	0.23	0.23	0.23	0.29	0.29	0.29	0.32	0.02	0.03	0.04	0.05

Note: OLS regression, t-stat in parenthesis with robust standard errors, significance level * p<0.1, ** p<0.01, *** p<0.001

1 Including bankruptcies and not exited deals

2 Dummy equals 1 (and 0 otherwise) for deals with leading deal partners, which have a background in banking, accounting or law (in contrast to Consulting or Industry). Professional background of the partner interviewed if not mentioned otherwise in Capital IQ database, PE house website, or press articles. For deals without an interview available or if the interviewed partner is not the leading deal partner, we use the professional background of the leading deal partner if mentioned in Capital IQ database, PE house website, or press articles.

3 Dummy equals 1 (and 0 otherwise) for deals with major M&A activity during PE ownership in the first 2 years of PE ownership as reported by the PE house or as mentioned in the press, Capital IQ database or PE house website (if M&A altered sales or enterprise value of the deal by more than 20%)

4 Dummy equals 1 (and 0 otherwise) for deals, which were not yet exited yet 5 Dummies for entry period 1998 – 2000, 2001 – 2002 and 2003 - 2007

Table 2.14: Sector returns by partner background and PE strategy

The table reports multivariate regression results of levered sector performance on the background of the deal partner who led the deals in our sample.[1] We cluster the partner into two categories. We call partners with a background in banking or accounting as "FPs" and with a background in consulting or industry as "OPs."

	Dependent variable levered sector return			
Independent variables	(1)	(2)	(3)	(4)
FPs [2]	1.77	2.39	2.57	2.65
	(0.80)	(1.04)	(1.11)	(1.13)
inorganic [3]		-3.62*	-2.96	-3.21
		(-1.78)	(-0.49)	(-0.53)
FPs x inorganic			-0.82	-0.44
			(-0.13)	(-0.07)
no exit [4]				-2.97
				(-0.85)
holding_ length (in years)	0.23	0.31	0.29	0.46
	(0.34)	(0.45)	(0.43)	(0.63)
d_98_00	-4.80**	-4.64**	-4.65**	-4.48*
	(-2.11)	(-2.07)	(-2.07)	(-1.95)
d_01_02	0.05	-0.24	-0.31	0.04
	(0.02)	(-0.08)	(-0.10)	(0.01)
d_03_07	14.84***	14.69***	*14.64***	15.59***
	(4.83)	(4.94)	(4.88)	(4.48)
constant	4.05	4.59	4.56	3.58
	(1.01)	(1.16)	(1.15)	(0.82)
No. of obs.	102	102	102	102
R2 adjusted	0.43	0.44	0.44	0.43

Note: t-stat in parenthesis with robust standard errors, significance level * p<0.1, ** p<0.01, *** p<0.001

1 Including bankruptcies and not exited deals

2 Dummy equals 1 (and 0 otherwise) for deals with leading deal partners who have a background in banking, accounting or law (in contrast to Consulting or Industry). Professional background of the partner interviewed if not mentioned otherwise in Capital IQ database, PE house website, or press articles. For deals without an interview available or if the interviewed partner is not the leading deal partner, we use the professional background of the leading deal partner if mentioned in Capital IQ database, PE house website, or press articles.

3 Dummy equals 1 (and 0 otherwise) for deals with major M&A activity during PE ownership as reported by the PE house or as mentioned in the press, Capital IQ database, or PE house website (if M&A altered sales or enterprise value of the deal by more than 20%)

4 Dummy equals 1 (and 0 otherwise) for deals which were not yet exited

Table 2.15: PE governance activities and PE house characteristics

The table reports for the 14 PE houses participating in our sample those governance activities, which we have identified as different by partner background in organic deals.

		PE governance activities in organic deals [2 3]							deals with Operation Partners in organic deals[1 3]
PE house	**# of deals**	**Other replacement**	**Total mgmt. change[4]**	**Multiple CEO interactions per week**	**High PE partner time commitment**	**Total PE support**	**Mgmt. with high cash-multiple**	**New Key Performance Indicators**	
(1)	5	0.40	0.40	0.40	1.00*	0.67	0.33	0.60	0.20
(2)	5	0.60	0.60	0.83*	0.83	0.89**	0.00	0.83	1.00***
(3)	1	0.00	0.00	-	-	-	-	-	0.00
(4)	1	0.00	0.00	0.00	-	0.00	-	1.00	0.00
(5)	10	0.30	0.43	0.36	0.20*	0.55	0.50	0.67	0.10
(6)	5	0.00*	0.07*	0.50	1.00	0.69	-	0.00***	0.40
(7)	13	0.31	0.28	0.50	0.55	0.65	0.33	0.75	0.15
(8)	3	0.33	0.33	0.00	-	0.50	0.00	1.00	0.00
(9)	0	-	-	-	-	-	-	-	-
(10)	5	0.80**	0.47	0.20	0.00**	0.40*	0.20	0.60	0.20
(11)	2	0.50	0.67	1.00	-	1.00	-	1.00	0.50
(12)	3	0.33	0.56	0.67	0.67	0.78	0.00	0.67	0.33
(13)	1	1.00	1.00	1.00	1.00	1.00	-	1.00	0.00
(14)	0	-	-	-	-	-	-	-	-
Total	54	0.37	0.38	0.48	0.57	0.65	0.26	0.69	0.26

Note: significance level * p<0.1, ** p<0.05, *** p<0.01; t-test of difference to other deals

1 Professional background of partner interviewed if not mentioned otherwise in Capital IQ database, PE house website, or press articles. For deals without an interview available or if the interviewed partner is not the leading deal partner, we use the professional background of the leading deal partner from Capital IQ database, PE house website, or press articles.
2 Deals without major M&A events during the first two years of PE ownership as reported by the PE house or as mentioned as a major strategy in the press. We classify M&A events as major if they alter sales or enterprise value by more than 20.
3 All deals without early M&A events, excluding deals without interview data
4 We fill data holes for deriving subtotals with the average score of the three questions answered per deal.

3. Private Equity Target Selection: Performance and Risk Measurement via Propensity Score Matching

Abstract

We use a dataset of 94 private equity (PE) buyouts initiated in Western Europe from 1996 to 2005 to identify PE target selection patterns. We find that PE funds buy stable companies within a profitability corridor above zero. Moreover, we use the identified selection pattern to measure the performance and operational risk of PE investments in comparison to propensity score matched peers. Compared to overall sector benchmarking, peer matching roughly halves the financial outperformance of large PE fund investments and increases their operational outperformance by roughly a third. In addition, we also find that PE owned companies show significantly lower operational volatility than the sector median. Also, the debt coverage ratio of PE investments does not drop below sector levels, despite the high debt-to-equity ratios during PE ownership. Our findings indicate that debt providers play a risk limiting role in the PE target selection.[63]

3.1. Introduction

During periods of economic distress there is concern that private equity (PE) owned companies face more difficult times due to the additional debt taken on during the acquisition (Moody's, 2009). Moreover, it is unclear if PE caused any operational improvements in the acquired companies (deals) in the wave of buyouts in the last decade.[64] We are able to show, with a proprietary deal-level data set for 94 European deals initiated by large and mature PE

[63] This chapter is based on joint work with Viral V. Acharya and Conor Kehoe.
[64] For example Guo, Hotchkiss and Song (2009) show that operating performance gains for US buyouts between 1990 and 2006 do not exceed (or only slightly exceed) those observed for benchmark firms. For a comprehensive review of the literature on buyouts and evidence on private equity impact see Cumming et al. (2007).

houses, that both concerns are overstated when comparing PE owned companies with propensity score matched peers.

Using matched peers instead of all sector companies as a benchmark is crucial for the valuation of PE activity, given the clearly non-random PE target selection. One can see the non-random selection in most summary tables in the literature and also in the data set used here. The acquired companies are, on average, not equal to the industry. The non-random company selection becomes manifest in the lengthy deal generation and due diligence phase. PE firms and financing banks, for example, only acquire companies that promise an upside potential but still show a sufficient profitability to service the debt. So analyzing the changes in the sector is not appropriate to control for "what would have happened if PE had not acquired the company." Fortunately, there is a solid knowledge in microeconometrics of how to identify an adequate benchmark (or in other words counterfactual) via propensity score matching. We will build on this technique heavily in the following sections.

The first half of the paper quantifies how PE funds select deals and makes the following contributions to the literature:

(1) In contrast to the existing literature, the present analyses also cover carve-out deals, where only part of a company is acquired, as well as private-to-private deals, where a non-listed business is acquired. Carve-out and private-to-private deals are mostly smaller in size and different in profitability (EBITDA margin) from public-to-private deals. Moreover, carve-out and private-to-private transactions comprised by volume 38% and 36% of PE deals in the last decade and 44% and 32% of the deals in our sample. Additionally, this paper is based on a consistent data set for the pre-acquisition phase as well as during the PE ownership phase, which is critical to match the deals on pre-acquisition characteristics.[65] (2) We provide

[65] Probably the only data source (in Western Europe) with no structural inconsistency is the data PE houses collect themselves in the due diligence process and through monitoring efforts during their

evidence that PE firms target companies with stable operating performances pre-acquisition. Companies acquired by PE firms do not systematically display an upward or downward trend pre-acquisition, which PE firms can build upon (momentum trading) or help to recover (reversal trading). These findings also provide evidence that the buyout company managers do not seem to cook the books (Cumming et al., 2007), or at least that the PE houses in our sample were able to collect consistent data in the last year pre-acquisition. (3) We show that the selection pattern is non-linear in profitability (EBITDA margin); target companies are neither too profitable nor unprofitable at acquisition. In addition, we show that the selection on profitability seems to be a general pattern, since we find qualitatively the same results when we use data of all PE buyouts in Western Europe.

The second half of this paper builds on the findings on the target selection pattern to match for each deal a comparable set of sector peers via propensity score matching. We then use the peer benchmark to re-calibrate the findings on various PE outperformance and risk measurements and get the following outcome:

(1) Previous results in literature concerning PE financial outperformance seem prone to an upward bias of roughly 50% when using sector returns as a performance benchmark. This is because PE focuses on a segment of companies which already generate higher levered returns than the sector. Also, on an un-levered basis, the bias stays statistically significant. Despite the higher debt-equity ratio of the peers in comparison to the sector, the un-levered returns for peers are still above the sector un-levered returns. We also get an upward bias when we use the "Public Market Equivalent" (PME), in the spirit of Kaplan and Schoar (2005). The PME is statistically significantly lower when we use matched peers instead of all sector companies. Nevertheless, even after taking the upward bias into account, the large PE

ownership, which is the data we use in the present paper. We tried to replicate the data set we collected from PE houses via a public source (Amadeus) and got very different and not comparable figures for

funds in our sample still generate abnormal performance (un-levered return above the un-levered return of peers) of 4.3%. However, this outperformance disappears, when we – in contrast to our data – assume that PE was not able to increase the enterprise value of the company, which is an important finding in periods of stagnating capital markets. (2) While deals and sector show profitability (EBITDA margin without exceptional items) gains, we find that comparable peers do not improve their profitability during PE holding period. Assuming that the performance of the peers represents the counterfactual of the portfolio companies during holding, we interpreted the statistically significant improvement difference of 2.6% between deals and peers as an impact attributable to PE ownership. The lower financial outperformance together with the higher profitability improvement, when using propensity score matched peers, reduces the "puzzling" divergence sometimes found in the literature. Guo, Hotchkiss and Song (2009) for example, report "large positive returns on average with only modest cash flow gains".[66] However, we are not able to discover any clear patterns in sales growth or EBITDA multiple improvements, when comparing deals and matched peers. (3) We find that the deals show or maintain a high operational stability during PE ownership, since they have a statistically significant lower volatility than their sectors and similar peers. (4) Finally, we provide evidence that the debt service coverage ratio (EBITDA/debt service requirements) of the deals in our sample does not exceed the sector average, even though the deals have a statistically significant lower ratio than their peers. Our interpretation is that PE firms select companies in a segment with relatively high EBITDA levels and the high EBITDA compensates for the increase in leverage during PE ownership. Overall, the matching exercise unveils positive findings from a risk perspective: At

the pre-acquisition and during the PE ownership period.

[66] Guo, Hotchkiss and Song (2009) also carefully select peers as benchmark. However, they use peer instead of sector benchmarking only when measuring operational performance of PE. Moreover, they do not select peers via propensity score matching. In contrast, they identify 5 companies as peers for

acquisition and potentially caused by the influence of the debt providers in the acquisition decision, PE portfolio companies show a high profitability and have a debt service coverage ratio that is in line with the sector. In addition, deals show a lower volatility in the operational performance before and during ownership than their comparable peer companies and also improve their operational performance during PE ownership.

In Section 3.2, we review the related literature on PE target selection. In Section 3.3, we provide a description of the data we collected and some summary statistics. In Section 3.4, we describe the non-random PE target selection. In Section 3.5, we identify peers via Propensity Score Matching. In Section 3.6 and 3.7, we use these peers to measure abnormal performance and operating out-performance of PE deals. In Section 3.8, we also use these peers to measure the underlying risk of PE deals in comparison to peers and sector. Section 3.9 concludes.

3.2. Related literature

There are two strands of PE literature related to the present paper:

The first strand of literature focuses on financial and operational outperformance of PE owned companies, but devotes less attention to the way in which PE funds select their target companies. Accordingly, these papers benchmark financial or operating performance of PE owned companies against the sector performance and find mixed results.[67] The second strand looks in more detail at the target selection pattern of PE and describes the selection as clearly non-random.

Opler and Titman (1993) analyze 180 US companies, which undertook an IPO between 1980 -1984 and 1985-1990. They argue that PE systematically avoids companies

each deal, which are in the same corridor in performance levels, change in performance and market-to-book ratio of assets pre-acquisition.

with high costs of financial distress – because PE acquisitions are synonymous with higher leverage – and instead favors companies with entrenched management. Consistent with this view, they find for both periods that the probability of an LBO (Leveraged Buy Out) increases for a company with 1) a low cost of financial distress and 2) high cash flows and 3) low market-to-book-value-ratios.

Aslan and Kumar (2007) compare 157 PE deals with private and public companies in the UK and Ireland from 1996 to 2006, based on pre-acquisition financial and accounting data from FAME (a source providing accounting measures for all registered companies in the UK). The authors find that PE firms select companies that are large and have growing assets, higher return on assets, higher profit margin and higher liquidity, but lower market-to-book and leverage ratios. However, the finding that PE selects large companies might be biased. First, data for individual divisions of companies, necessary to estimate the selection patterns of the frequent and smaller "carve-out" deals (see Table 3.6), is not available from FAME. We suspect that the only viable data for carve-out deals is collected by the PE firms themselves during due diligence. Second, the findings cover only public-to-private transactions and do not show the PE selection pattern for potentially smaller companies that were not previously listed.

Mehran and Peristiani (2008) investigate a subset of 150 companies out of the 852 US public companies that went private through LBOs between 1990 and 2007. They find that a major reason for abandoning the public listing is inadequate analyst coverage/financial visibility due to a lack of investor interest, vis-à-vis other public companies. According to their view, without financial visibility, access to debt and equity markets becomes more costly (less liquid) and companies therefore opt out of the public market. Accordingly their results show that a decline in analyst coverage, number of institutional investors, and stock turnover

[67] For a comprehensive review see Cumming et al. (2007).

leads to a higher probability of becoming an LBO target. Interestingly, public companies with a lower market-to-book-ratio, a higher debt-to-equity ratio, a higher free-cash-flow and lower stock volatility are more likely to become private. However, the sample again only includes public-to-private transactions. Furthermore, Mehran and Peristianis' correlation might be spurious. As we argue in this paper, LBO financing banks require that target companies have stable and sufficient profitable operational figures, which may be negatively correlated with the change of analyst coverage. In other words, analysts lose interest in public companies without "hot" (volatile) stories. Hence, the results shown might be spurious, since the authors are not able to control for the stability of companies operating performance, and instead control only for the return on assets. Also Bharath and Dittmar (2007) examine public-to-private transactions in the US between 1980 and 2004. In line with Mehran and Peristiani (2008), they find the probability of a company being taken private is high if it has: low analyst coverage, low stock turnover, but high liquidity and FCFs (only in the early sample period).

Axelson et al. (2007) and Ljunqvist et al. (2007) find that the following general economic factors drive LBO volumes: Low interest rates, loose credit conditions and syndication of loans.

In conclusion, the literature suggests that, in selecting targets, PE firms systematically look for companies with higher profitability, higher cash flows, and lower valuations than their sector peers. The current literature does not cover 1) carve-outs and private companies, which make up the largest proportion of deals, 2) operational performance trends pre-acquisition and 3) non-linear selection patterns (in particular, u-shaped patterns). In addition, we go another novel step further. We use the identified selection pattern to re-calibrate the

findings in the literature on various performance and risk measurements based on propensity score matched peers instead of the broad sector .[68]

3.3. Data and sample selection

3.3.1 Data on PE deals

The analysis is based on a proprietary data set from 14 large and mature PE houses collected by McKinsey & Company, Inc. The data set covers 110 Western European PE leveraged buyouts (deals) with an enterprise value above EUR ~50 million. We have reduced the sample in this paper to 94 (69 respectively) deals, since the analysis requires 1 (2) years of pre-acquisition operational data.[69] We also excluded deals from the financial sector.

Table 3.1 shows that most of the deals in the sample were initiated between 1998 and 2004, with a dip in 2000 and 2001, due to the global recession and credit tightening. Table 3.2, provides additional summary statistics, e.g., the deals in our sample have on average a holding length of 4 years. The sample also includes 4 bankruptcies and 7 deals, which PE funds did not sell until 2008.[70]

Coming to the sample-selection issue, Table 3.3 – Table 3.6 provides several relevant comparisons between our sample and the PE universe. Overall, our sample seems to be representative in terms of performance of large PE houses, covers mostly large deals and most importantly includes all different vendor types, e.g., also the very frequent private-to-private deals.

[68] One exception is Amess, Girma and Wright (2008), who also use propensity score matching for assessing the employment effects of PE.
[69] UK (55 deals); the remaining deals are from Germany (15), France (10), Scandinavia (8), Benelux (5) and Spain (1).
[70] For those 7 deals we do not have all cash flows, because there is no final cash flow from exit nor can it be deemed to be zero as in the case of bankruptcies. Therefore, the end enterprise-value cash flow was simulated using the EV / EBITDA multiple at the start of the deal and applying that to the 2006 year-end EBITDA.

First, Table 3.3 presents the comparison of deal performance in terms of IRR to the PE funds in our sample and shows that PE funds did not seem to cherry-pick the deals. In fact, the difference between the publicly reported fund IRR and the average IRR of our deals per fund is not statistically significant (t=0.86). This illustrates that in terms of performance, we have a good representation of deals within the funds we sampled.

For the comparison we first need to convert our gross deal-level IRRs (before fees are charged by PE houses to fund investors) to net IRRs (after fees, or in other words, IRRs from the point of view of fund investors). This is because the data we have on the overall universe is primarily in the form of net IRRs. To this end, we have constructed an artificial fund of our sample deals and calculate its IRR. The pseudo-fund starts in year 1996 and lasts for 12 years until the year 2007; investments or cash inflows take place in years 1-9 (with small investments in years 10 and 11 as well); the bulk of the investments occur in years 3-9; cash payouts start in year 5, and in the last 3 years, the fund only has cash payouts. Using this pattern of cash inflows and outflows, we calculated the gross IRR of the pseudo-fund. Next, we deduct a 2% annual fee from the gross IRR and 20% carry for IRR above (the typical) benchmark (the market return of 8%).[71] This pooled net IRR for our deals is 25.0%, which is close to the median net deal IRR of 25.2%. If we focus on the publicly reported returns of the 31 specific funds (based on Prequin figures), we get a simple average of net fund IRRs of 24.8% and a median of 27.4%, which is close to the performance of the deals in our sample.

Second, Table 3.4 shows that the sampled funds are, in terms of performance, a good representation of similar-sized funds, once we take into account the fact that we are focusing on funds whose sizes are above €500 million. All 229 funds in Western Europe with the same

[71] More specifically, if a) Gross IRR<=10%, then LPs keep all return except 2% fees, so that Net IRR = Gross IRR - 2% fees; b) 10%<Gross IRR<12.5%, then LPs keep all return up to 10% except for 2% fees and GPs keep all return from 10% to 12.5%, so that Net IRR = Gross IRR - 2% fees – (Gross IRR – 10%) = 8%; and c) Gross IRR>=12.5%, then LPs and GPs share in 80:20 ratio the return exceeding 12.5%, so that Net IRR = Gross IRR - 2% fees - 2.5% - 20%*(Gross IRR - 12.5%).

vintage year (1993-2003) as our sample have a simple average net IRR of 16.3% (based on Thomson Financial Venture Expert figures), which is lower than the net IRR of our funds (t=-2.38). Yet large funds have higher returns. Specifically, the 53 funds with a size above €500 million as the participating funds in our sample show a net IRR of 22.0%, which again does not differ statistically significantly from the 24.8% net IRR average of our 31 participating funds (t=-0.67).

Table 3.5 shows that on the one hand, the number of deals in our sample is significantly smaller than that of all Western European deals over the sample period. Our sample only represents 94 out of 5,384 deals (for which data was available). However, in value terms we cover 11.7 % of large and very large deals – €100 to €500 million and greater than €500 million. Ultimately, because we are studying the performance of large, mature PE houses, we have a sample with a large bias. However, most of the literature also has an implicit large bias. The reasons are that the literature mainly focuses a) only on public-to-private deals, which are mostly large deals or b) on deals with public debt financing, which are also typically larger.[72]

Finally, Table 3.6 shows a big advantage of our data set. As previously mentioned, our sample includes all types of deals. For instance, the sample also consists of carve-out deals where only part of a company is acquired, or private-to-private deals where PE acquires a non-listed business. Moreover, our data also includes deals, which were previously owned already by PE and former state-owned companies. We think that covering all vendor types is an important novelty, in contrast to the literature, which mostly analyzes public-to-private deals only. First, public-to-private transactions represent by volume (by value) only 5% (17%) of the total buyout activity. In contrast, the majority of deals are carve-out and private-to-

[72] It should be also noted though that the large-size bias makes our sample more comparable to the benchmark group we employ, which consists of publicly quoted companies. The size of public quoted companies is generally larger than a typical private equity deal in the entire universe of such deals.

private. For example in Western Europe, they comprise 74% (58%) of all PE deals between 1995 and 2005. Second we find strong operational improvements during PE ownership, in contrast to Guo, Hotchkiss and Weihong (2007), for example. And, the differences could be caused by a particular strong PE impact in carve-out deals or on former private companies, since we find that carve-out and private-to-private deals are already different pre-acquisition. They are smaller in size and different in profitability (EBITDA margin) from public-to-private deals in the Western European universe, as shown in Table 3.6 in the last 4 columns.[73]

In addition to describing the characteristics of a deal (e.g., deal timing, size and vendor type), the PE firms also reported figures for enterprise value, equity, and debt at the point of acquisition and basic accounting figures for the acquired companies, which include:

EBITDA (Earnings before Interest, Taxes, Depreciation and Amortization), equal to Operating revenues – COGS (cost of goods sold) – SG&A (selling, general and administrative expenses) – Other (e.g., R&D) = Operating income.

Academics and practitioners widely use EBITDA since it shows a company's fundamental operational earnings potential. EBITDA is, in contrast to "Net Income", not distorted by (1) expenses outside a company's business (interest and taxes), and (2) non-cash charges due to allocation of historical cost of an asset (depreciation and amortization). Also EBITDA, in contrast to "Operating Cash Flow", does not include changes in working capital and capital expenditure, which are altered by changes in liquidity or capital investment decisions. However, EBITDA is not a defined measure according to Generally Accepted Accounting Principles (GAAP) or IFRS/IAS. In this paper we define EBITDA as EBITDA

[73] However, due to our small sample size, we are not able to identify differences in financial performance or operational improvements by vendor type. We have only 14 public-to-private deals in our data.

excluding "Non operating income".[74] Often this measure is more precisely referred to as EBITDAE (Earnings Before Interest, Taxes, Depreciation, Amortization and Exceptionals).

Sales, in this context, are operating revenues earned by a company when it sells its products, in the course of ordinary operating activities.

3.3.2 Sector data

For the sector data, we use data from Datastream for all listed companies in Western Europe in the same sectors and time periods as covered by our sample and with data on margins available, which sums up to n=7,602 in the acquisition year.[75] To identify the sector companies, we use the sector code the PE firms reported at a level 3 ICB (Industry Classification Benchmark) for each portfolio company, which segments companies into one of approximately 40 sectors; the ICB system is a global industry classification standard, based on FTSE and DOW JONES systems. Our sample covers only 23 industry codes.

To calculate EBITDA without exceptional items, we use the data field operating income (WC01250) and add depreciation plus depletion & amortization (WC01151). Sector enterprise value [76] is defined as Datastream's equity plus net debt.[77] The sector returns are calculated using annual data on the total return to shareholders, which represents the change in capital plus dividends, expressed as a percentage of the opening value.

[74] The reason for the exclusion of "Non-operating income" is that this measure contains income derived from a source other than a company's regular activities and is by definition nonrecurring. For example, a company may record as non-operating income the profit gained from the sale of an asset other than inventory (which can be large in relation to the operating income). From a practitioner's perspective, for example, a EBITDA multiple including "Non-operating income", would not be a helpful measure to understand the price paid in relation to the current performance capability. From our perspective, the operational performance indicator EBITDA would then be subject to a measurement error.
[75] Countries included are Germany, UK, Italy, France, Spain, Benelux, Scandinavia, Switzerland, Portugal and Austria.
[76] Market Capitalization at fiscal year end date + Preferred Stock + Minority Interest + Net Debt.
[77] Net debt is total debt minus cash. Cash represents Cash & Due from Banks for Banks, Cash for Insurance Companies and Cash & Short Term Investments for all other industries.

3.4. Non-random PE target selection

The intensive deal selection process undertaken by PE funds and the financing banks indicates that the target selection is non-random. Before a deal is closed, PE firms go through a lengthy and costly target generation ("origination") and due diligence phase. During this phase, PE funds collect and process quantitative and qualitative information to determine whether the investment offers a positive NPV (Net Present Value): a so called "investment upside". The information on a potential investment upside covers complex topics, such as quality of the current management, potential synergies with other companies, or benchmarking efforts to other companies.

Since the PE business model requires a significantly higher leverage than the typical public company,[78] acquisitions are almost always financed with additional bank debt, which gives the financing banks an important role in the acquisition. However, banks have their own target selection criteria. In contrast to the PE funds, which aim to maximize NPV, banks are interested in minimizing the downside risk of an investment, due to the nature of the payoff structure of the debt.

Overall, we should observe a selection of companies, which a) have room for improvement in their performance, in order to generate an upside for the PE funds, and b) are still profitable and therefore have a low downside, so that banks are willing to finance the acquisition. These criteria significantly reduce the number of potential target companies and as we later show, they explain a large proportion of the acquisition decision.

Although we must acknowledge that, due to the complexity of the information used in the acquisition and the limits of our data set at hand, we are only able to identify necessary and not sufficient criteria to become a PE target. Large parts of information gathered in the

[78] Axelson, Stromberg and Weisbach (2007) provide a theoretical explanation of why this is the case.

acquisition phase are unobservable and the decision pattern is too complex to be fully captured. However, in our later performance benchmarking effort, a selection on unobservables does not inevitably create a bias. Even though the unobservable factors have an influence on the target selection decision, we still can assume that these factors are constant, or, if they are time-varying, do not matter for the later counterfactual performance of the matched peers.

3.4.1 Target selection based on profitability and company size

PE acquires companies inside profitability (EBITDA margin) and size corridor (log sales), due to the upside-but-low-downside criteria.

Before we identify the target selection pattern in a multi-variate regression in the next section, we compare bi-variate each deal with its corresponding sector. We start with summary statistics for EBITDA margin and log sales for deals and sector and subsequently illustrate the comparison with two different types of plots. The first type of plot is a kernel density for the sector and deal distribution. The second type is a polynomial smooth, which displays the values from a polynomial regression of the acquisition status (1 for deals, 0 for sector companies) on each variable. The vertical dimension captures the probability of acquisition by PE. The grey shaded area illustrates the 95% confidence bands of the local coefficient estimates.

Profitability (EBITDA/sales margin): First, in Table 3.7, the deal average margin for the deals in our sample is 16.17%, which is statistically significantly higher than the sector with an average margin of 11.64 %. We test for the difference between deal and sector margins with a t-test (t=3.57) and a non-parametrical test (z=7.04), given the outliers in the

sector data and the non-normal distributions.[79] As a non-parametrical test we use the standard Wilcoxon-test (also known as the Mann-Whitney two-sample statistic or rank sum test).[80] Second, PE firms do not only select companies with a high margin on average, they also avoid companies with a negative margin. Since on the lower end, no deal has a margin of zero, and only 2 out of 94 deals have a negative margin. And the proportion of public companies with either nominal or negative margins is far higher by comparison; 20% of the sector companies have a negative or zero margin. Interestingly, in this bi-variate setting PE does not seem clearly to avoid companies with a particularly high margin. For example 2 out of 94 deals have a margin above 40%, which is roughly in line with 3% of sector companies with a margin above 40%. However, in the latter multi-variate regression, we find that PE avoids companies with very high margins too.

Figure 3.1 (left column, first row) illustrates the findings revealed by the t-test and non-parametric test. Both distributions of EBITDA margin show a similar shape, but the distribution for the deals is shifted to the right, i.e. PE in our sample targets companies with higher margins than the sector. In addition, PE avoids companies with low margins as indicated in the local polynomial regression in Figure 3.1 (right column, first row). The probability of being acquired becomes lower with a low margin. These findings bolster the upside-with-low-downside-hypothesis. A non negative margin allows better access to debt finance and therefore increases the probability of acquisition and a not too high margin leaves potential for operational improvement.

[79] The sector distribution has a negative skew, the deal distribution a slight positive skew, and both are clearly leptokurtic.
[80] In contrast to the t-test, the Wilcoxon-test uses solely the order in which the observations from the two distributions fall and therefore is less sensitive to outliers.

Figure 3.6 shows the same plots for the EU universe based on data from Private Equity Insight for the same time period. We get qualitatively similar findings on the selection on profitability; PE in general avoids companies with very high or very low profitability.

Size (log sales): First, a t-test (t=5.44) and a Wilcoxon-test (z=5.71) in Table 3.7 show that PE deals in our sample are on average larger than the sector. The median (average) sales size for deals is EUR 366.19 (564.23) million. In comparison, the median (average) sales for the sector is EUR 109.33 (1,562.25) million.

Second, PE targets companies inside a size corridor as indicated by the inverted U-shaped curve in the local polynomial smooth plot in Figure 3.1 (right column, second row). 23% of the sector companies have lower annual sales than the deal with the smallest sales in our sample (EUR 19.50 Mio). At the higher end, we see another cut-off: 9% of the sector companies have higher annual sales than the largest deal by sales (EUR 3,072.12 Mio). At the lower end, this might be a result of the bias toward large buyouts in our PE sample. Only large and mature PE funds participated in the data collection. At the higher end, this is not caused by the large fund bias in our sample: there is no upper limit on the deal size included in our sample, and the moderate deal sizes observed, relative to the large public sector companies, are a general feature of LBOs. The largest European buyout to-date is KKR's 2007 acquisition of Alliance Boots in the UK, with a deal enterprise value of EUR 16.3 bn, but this is less than 5% of the enterprise value of the largest company in our sector data (EUR 369.2 bn). We interpret this finding in line with our argument that banks play a risk limiting role in the acquisition decision. PE houses seem to be not able to acquire very large companies potentially due to the reluctance/ability of banks to finance larger deals.

3.4.2 Target selection based on company performance trends

As already described in Kaplan (1989), PE neither seems to acquire companies with declining performance i.e. those with falling sales or a drop in profitability pre-acquisition (reversal trading), nor does PE instead aim for companies that are already growing above the sector, in order to participate in future gains (momentum trading).[81]

Change in Profitability (EBITDA margin$_t$ - EBITDA margin$_{t-1}$): First, deals do not seem to follow a specific performance trend pre-acquisition. The average change in the deal profitability in Table 3.8 is rather low (0.08%) and not statistically different from zero (t=0.17). The change of the deal profitability also does not differ significantly from the sector (t=0.34, z=0.87). Figure 3.2 (left column, first row), shows that PE does not systematically follow a turnaround business model, nor does PE particularly select companies which are growing in profitability. Second, we find evidence in Figure 3.2 (left column, first row) that PE focuses on companies without extreme profitability fluctuations. Also in Figure 3.2 (right column, first row), the probability of getting acquired diminishes with a lower or higher change in the EBITDA margin, i.e. PE targets stable companies. However, the evidence is weak, given the wide confidence interval band and the local increase on the left side of the graph.

Sales growth (log sales$_t$ – log sales$_{t-1}$): First, deals and sectors in Table 3.8 show a robust sales growth in the year pre-acquisition. The average annual change in deal sales is 5.87% and the median sector sales growth is 6.54%. Both growth rates are statistically significantly different from zero (t=3.29, t=6.71). The deal sales growth does not differ from the sector (t=0.65 and Wilcoxon-test shows z=0.34). Second, in Figure 3.2 (right column, second row) we find weak evidence that PE does not select companies, which either drop or

jump massively in sales pre-acquisition However, the evidence is again weak, as illustrated by the local increase on the left and right side of the graph and the broad confidence interval bands.

3.4.3. Logit on pre-acquisition performance and performance changes

In this section, we show that the observed upside-but-low-downside pattern also holds in a multivariate setting. For example, the unveiled PE target selection based on profitability is not a result of the fact that PE selects smaller companies, for which profitability is often higher than for larger companies. To examine the PE target selection ("PE treatment") more generally, we estimate the following specification:

$$\pi_{i,t} = \phi + x'_{i,t}\beta + \varepsilon_{i,t} \tag{3.1}$$

in which $\pi_{i,t}$ is binary: in the last year pre-acquisition t it takes on 1 for all deals and 0 for all sector companies in each deal corresponding sector and year. The independent variables in vector x are the same as discussed before (EBITDA margin and log sales in levels and changes), ϕ is a constant term and $\varepsilon_{i,t}$ the regression error. We do not add dummies for sector and deal entry time periods in (3.1).[82] We also do not include out-of-sample variables, e.g., market interest rate movements, because we are interested in finding comparable peers rather than explaining the level of PE activity. We use in x also quadratic terms, since the upside-but-low-downside selection hypothesis implies a non-linear selection pattern. We assume a u-shaped relationship between the operational variable and the later acquisition.

[81] These findings also provide evidence that the buyout company managers do not cook the books in the last year pre-acquisition as discussed in Cumming et al. (2007), or that PE houses in our sample are able to collect the right figures in the due diligence process.

[82] Since: a) to get time specific selection patterns one has to interact the operational variables with time and sector, but we only have 94 (69) treated observations and b) we match latter the deals with companies in the same sector and year.

In Table 3.9, we analyze the PE acquisition pattern with Logit (Probit) regressions. Throughout regression (1) to (6) in Table 3.9, the non-squared and squared terms for log sales and EBITDA margin are statistically significant. The non-squared terms are positive and the squared terms have negative signs, which indicate an *inverted* u-shaped selection pattern: If a variable is either large or small, the probability of PE acquisition becomes low.

In regression (4) to (6) in Table 3.9, we include the pre-acquisition performance trends in the Logit regressions. Overall, adding performance trends has a trade-off. On one hand, it lowers the deal sample by roughly a third, since we have only 69 deals with 2 years of operational data pre-acquisition. [83] On the other hand, including the pre-acquisition operational performance changes increases the prediction power. The Pseudo R-squared and log likelihood rise slightly by adding the performance trends. In regression (6), we use the same specification, only with a Probit regression, but get a lower pseudo R-squared and log likelihood. We use the Logit regression model for the Propensity Score Matching in the following sections.

The pseudo R-squared in regression (3) - (6) indicate that we are able to describe roughly 15-16% of the acquisition, or PE-treatment decision. We interpret this as high, given that we are only able to control for necessary but not sufficient acquisition criteria with the data at hand.

In Table 3.15, we do the same type of regressions for the EU universe and get similar results as with our sample of 94 buyouts. The fact that PE avoids companies with very low or very high profitability seems to be a general pattern of PE and not a specific feature of our sample. The finding also holds for different vendor types, as shown in Table 3.15, in

[83] Moreover, other variables already incorporate part of the information on the pre-acquisition performance trends. For example, the distribution pattern of the margin itself already reflects the fact that the margin does not fall or jump in an extreme way pre-acquisition.

regression (5)-(6). However, in two time periods (regression (3) and (4)) the debt providers did not demand a particular high operating performance pre-acquisition.

3.5. Matching peers

In the previous sections we show in part how PE selects companies. In this section we will use the unveiled pattern in order to get a more adequate benchmark group. Based on the regression results of the previous section, we pick companies for each deal out of the sector via "propensity score matching" and call them "peers".[84] The goal is to find a set of companies that were similar to the deals and therefore also potential targets, but were not acquired by PE. Technically, we select a set of companies that do not differ on average to the deals in our sample in the target selection relevant criteria.

First, we use the estimated coefficients from Table 3.9, regression (5) and predict for each sector company (in the same sector and year as the deal) and each deal an acquisition probability (propensity score). For the 25 deals for which we only have one year of pre-acquisition data, we use from Table 3.15, regression (3). Second, we calculate the absolute distance in propensity score between each deal and sector company.[85] Third, we mark the 10 companies that are closest to the deals in the propensity score as peers.

Figure 3.3 and Figure 3.4 provides the propensity score for the deals and the sector companies, which we flag as peers. Figure 3.3 shows the 10 nearest sector companies by propensity score (10 nearest neighbor), Figure 3.4 shows the 5 nearest neighbors. In the following sections, we use the 10 instead of the 5 nearest neighbors. Since this does not lower the average propensity score of the nearest neighbors by much, and using 10 neighbors

[84] For more background on the methodology of propensity score matching see Rosenbaum and Rubin (1983) or Heckmann et al. (1998).
[85] We only use sector companies as peers, if their propensity score is at least a larger as the lowest propensity score of all deals (common support criteria).

increases the amount of peer data we can use. The propensity scores in Figure 3 are rather small. However, this is not necessarily problematic, as discussed in the section before.[86]

Table 3.10 provides evidence that the propensity score matching based on the 10 nearest neighbors is able to eliminate, on average, all pre-acquisition differences in the operational measures. We find no significant differences between deals and peers pre-acquisition, neither in profitability (EBITDA margin) or sales levels (t=0.79 and t=0.61), nor in profitability or annual sales growth.

3.6. Financial Performance measurement using matched peers

In the previous sections, we systematically identify peers, which on average do not differ from the deals in our sample pre-acquisition. In this section, we provide evidence that these peers have statistically significant higher returns than other sector companies. Hence, using sector returns as a benchmark instead of matched peer returns when measuring PE outperformance is prone to an upward bias. The upward bias stays statistically significant on an un-levered basis. The un-levered bias is only slightly less pronounced, given that the debt-to-equity ratios are higher for peers than for the sector, which reduces their return advantage on an un-levered basis. However, in despite of the higher peer returns, the deals in our sample still produce significant un-levered returns (abnormal performance) above peers.

We measure the financial outperformance using the same methodology as in chapter 1. Our findings are also robust to alternative performance measurements. When we use the "Public Market Equivalent" or PME, in the spirit of Kaplan and Schoar (2005), we also find that peer instead of sector benchmarking lowers the outperformance of PE. This finding does

[86] Basically, we have to assume that we have captured all factors that matter for the counterfactual performance.

not surprise us, given the high correlation between abnormal performance and PME reported in the literature.

3.6.1. Levered returns of peers vs. sector companies

Peers seem to outperform the sector during the time period of PE ownership. For the sector companies and peers we use the same time periods of the 94 different deals and calculate 94 median IRRs, either for the 10 peers or all the sector companies. We calculate un-levered returns using the standard un-levering formula.[87] As Table 3.11 shows, the levered return for the peers is 13.32% and statistically significantly higher than the 9.41% sector return (t=4.16). The table also provides the 38.22 % levered return (gross IRR) of the deals in our sample.[88]

3.6.2. Un-levered returns of peers vs. sector companies

The debt-equity-ratios (D/E ratios) for the deals in our sample are on average almost 9 times higher than for the sector.[89] [90] Also matched peers show on average (median) 1.3 (1.5) higher D/E ratios than the sector. This is in line with the upside-but-low-downside selection criterion. Peers, which are in the middle of the distribution by operational measures, have better access to debt finance and therefore are also more likely to have higher debt-equity-ratio. The leverage differences make it essential to un-lever the IRRs before comparing

[87] $R_{U,i} = R_{L,i} + R_{D,i}(1-t)(D/E_i) / (1+D/E_i)$. We further use the average D/E ratio during deal life for the deals, a median D/E ratio over 3 year for the sector and β=1. We further assume the same cost of debt and tax rate for the sector as for the deal. For 61 deals we find the cost of debt (based rate and margin spread) in Dealogic; for 19 we only find the base rate (Libor vs. Euribor); and for 14 deals we find no information. If the margin spread is unknown for a deal we use the median sector spread in the same year.

[88] Nikoskelainen and Wright (2007), who cover nearly the complete PE universe in the UK since 1994, report an average (median) deal-level IRR of 70.5 (-17.8) %.

[89] This is not a special feature of our sample of large PE funds; the D/E ratios are similar to those reported in Nikoskelainen and Wright (2007).

the financial performance between deals, sector and peers. Higher debt-equity-ratios in the standard un-levering formula lower the returns. But the higher debt-equity-ratios does not outbalance the levered performance advantage of peers above sectors.

First, Table 3.11 shows that the difference in the debt-equity ratios is statistically and economically significant. Peers have a median debt-equity ratio of 0.21 and the sector of 0.16. The difference of the ratios is statistically (t=3.54) and economically significant, since it implies a relative debt-equity ratio increase of more than 30% between peer and sector companies.

Second, we compute an un-levered return of 16.66% on average for the deals in our sample, as shown in Table 3.11.[91] We use the same methodology for the peer and sector companies as we do for each of the 94 deals. The peers also show a higher un-levered return than the sector companies. Peers generate an un-levered return above the sector of 3.45% (t=4.19), given that peers show a median un-levered returns of 12.34 %, sector companies of 8.89%.

3.6.3. Adjusted abnormal performance

Matching peers to the deals, instead of using a broad sector benchmark, roughly halves the identified outperformance and highlights the importance of getting the alternative benchmark as precise as possible for PE outperformance measurement. In Table 3.11 the adjusted abnormal performance (un-levered deal return minus median un-levered peer return) is significant lower than using the broad sector as benchmark (t=-4.19).

[90] In line with Axelson, Jenkinson, Stromberg and Weisbach (2008) we find no relationship between the leverage of the sector and the deal. For example Demoriglu and James (2007) show evidence that the reputation of the private equity house affects the deal's leverage.
[91] Nikoskelainen and Wright (2007) report an average (median) un-levered IRR of 22.2 (-5.3) %.

In the previous section we un-levered the returns for the deals with the average D/E ratio during deal life. A more conservative assumption, since the D/E ratio decrease over the deal life mainly due to a growing enterprise value, is to un-lever the returns with the D/E ratio at entry date. In un-tabulated results, we find that the abnormal outperformance, using the entry deal D/E ratio, decreases and even vanishes when we use matched peer returns. Accordingly, PE seems not to be able to generate abnormal outperformance without growing the enterprise value of the deal – an interesting finding for periods with stagnating capital markets.

3.6.3. PME based on peers vs. sector companies

In Table 3.11 we report also the "Public Market Equivalent" (PME). In addition, we provide a PME based on matched peers. Not surprisingly, given the high correlation between abnormal performance, IRR and PME, as reported in Kaplan and Schoar (2005), we get qualitatively the same findings as in the previous section. Again, peer instead of sector benchmarking lowers the financial performance of PE.

The PME compares the cash flows of each deal to an alternative investment in the sector, by using sector returns as discount rates. Therefore a deal with a PME greater than 1 outperforms and with less than 1 underperforms the sector. In the present paper, we discount all deal-level cash flows with median discount rates either based on all sector companies or the 10 matched peers only.

Table 3.11 reports the two different PMEs. When we use median sector returns we get on average (median) a PME of 1.32 (1.14). In line with Kaplan and Schoar (2005), large and mature PE houses outperform the market. However, when we use median peer returns we get a lower PME with an average (median) of 1.16 (0.88). The difference between the two returns is statistically significantly (t=1.81).

3.7. Operational performance measurement using matched peers

Propensity score matched peers increase their profitability (EBITDA margin) and sales less, but improve the multiple more than the sector. These differences make the peer benchmarking instead of sector benchmarking important in the operational performance measurement of PE fund investments.

While deals show profitability (EBITDA margin) gains, we find that comparable peers and sector do not improve their profitability during the PE holding period. Assuming that the performance of the peers represents the counterfactual of the portfolio companies during holding, we interpreted the statistically significant improvement difference between deals and peers as an impact attributable to PE ownership (t=2.74). On the other hand, we find no clear pattern in sales growth or EBITDA multiple improvements when we compare deals to peers and sectors. The lower financial outperformance together with the higher profitability improvement, when using propensity score matched peers, reduces the "puzzling" divergence sometimes found in the literature. Guo, Hotchkiss and Song (2009) for example, report "large positive returns on average with only modest cash flow gains". [92]

First, in Table 3.12, deals in our sample improve their profitability (EBITDA margin) from entry (t) to exit year (T) by 2.13 ppt., with t=2.74.[93] These improvements are roughly similar to the 1.4 - 3.8 ppt. reported in Kaplan (1989). In contrast, the median profitability changes for the matched peers does not indicate an improvement in the same time period (t=-2.04), since the median sector changes are only marginal positive with a 0.18 ppt. increase. Second, we find a significant difference between peers and sector (t=-3.18). This bolsters

[92] Guo, Hotchkiss and Song (2009) also carefully select peers as benchmark. However, they use peer instead of sector benchmarking only when measuring operational performance of PE and not for financial performance measuring. Moreover, they do not select peers via propensity score matching. In contrast, they identify 5 companies as peers for each deal, which are in the same corridor in performance levels, change in performance and market-to-book ratio of assets pre-acquisition.

again the importance of defining the benchmark in the right way. Overall, assuming that the performance of the peers represents the counterfactual of the portfolio companies during holding, we interpret this operational outperformance as a causal PE impact on the company.

However, PE does not seem to grow companies as already pointed out by Kaplan (1989). We find no clear pattern in sales growth when comparing deals to matched peers and sector companies. According to the second part of Table 3.8, deals, peers, and sector companies increase their nominal sales during PE ownership; but we find no performance differences in growth. Again find that peers and sector show a different performance. The sales growth of peer companies is significantly lower (t=-3.38).

Moving on to the PE impact on EBITDA multiple changes, we do not see any outperformance in the absolute or relative changes in the EBITDA multiple above peers. Again we identify differences in the change of peers and sector companies.

3.8. Risk measurement using matched peers

In this section, we draw on the set of peers to further understand the operational risk of PE deals. In the first part, we find that the volatility of PE owned companies is lower than the peers and sector. In the second part, we are able to show that the debt service coverage ratio of the highly levered PE deals is higher than for peers but still in line with the sector.

3.8.1 Operational volatility

PE-backed companies seem to show or maintain a high operational stability during PE ownership. Deals have a lower volatility, measured in standard deviation, than their sector and even than similar peers.[94] In contrast to previous chapters, we combine pre-acquisition

[93] For the operational outperformance measurement we use only deals that the PE houses exited by 2008.
[94] Our findings are robust to other volatility measures like min-max comparisons.

and during PE ownership data – we simply do not have enough data points to analyze volatility for the pre-acquisition or during acquisition phase separately. Instead, we assume that the volatility of a company does not change fundamentally during PE ownership.[95]

First, the volatility is on average lower for deals than for sector companies. Deals show in Table 3.13 on average a standard deviation in the EBITDA margin of 1.98% and in log sales of 16.65%. In order to be most conservative, we do include for the deals also years with M&A or divestment events. The low volatility provides evidence for the upside-with-low-downside-hypothesis. PE selects not only companies that are reasonably profitable, but also more than the sector. Second, the fact that in Table 3.13 peers still show a slight difference in volatility from the deals allows two alternative interpretations. 1) Either our matching is not precise enough and we included companies in the peer group which are slightly different in the volatility than the deals pre-acquisition or 2) PE is more active in M&A or divestments events. The difference vanishes when we do not include years with M&A and divestment events. The fact that the difference in the volatility between peers and deals are not very pronounced shows that we are able to identify companies very close to the deals in stability criteria.

3.8.2 Debt service coverage ratio

Nikoskelainen and Wright (2007) for example use the debt coverage ratio (here defined as EBITDA/ (net debt * interest rate)) as explanatory variable of PE performance, due to the widely discussed disciplinary effect of high debt service to current cash flows in corporate governance mechanisms. However, we find that, the debt service coverage ratio is

[95] Sector data is only included for the same time period as the deals, to rule out time-based variations in volatility between the two data sets.

not different for PE deals than for the sector.[96] Our interpretation is that PE firms select companies with relatively high EBITDA levels and the high EBITDA compensates for the large increase in leverage during PE ownership.[97] The finding that PE deals have a coverage ratio in line with the sector bolsters our argument that debt providers play a risk limiting role in the target selection.

First, matched peers have a higher debt-equity ratio than the sector, but a higher debt service coverage than the sector.[98] The reason for this is peers are profitable companies, which have relatively high EBITDA levels in comparison to the sector.[99] Second, PE deals have a much higher debt-equity ratio than the sector, yet its debt-coverage ratio is no different from the sector. Our interpretation is a leverage arbitrage: 1) PE focuses on stable, profitable companies; 2) stable, profitable companies already have a higher debt-equity ratio, but their debt service is still low in relation to their high profits; 3) at acquisition, PE firms increase the leverage so that debt service coverage reaches the average sector level.

First, in Table 3.14, the deals in our sample have an average (median) coverage ratio of 4.5 (3.9), which means roughly 4-5 times more annual profit than debt service payments. This findings is in line with the debt service coverage of 4.2 reported in Nikoskelainen and Wright (2007). In contrast, peers are more conservatively leveraged (peers show a median coverage ratio of 6.9). Since the data on the coverage ratio is prone to outliers, for example, and the maximum coverage ratio for peers is 5,448.7, we prefer to use medians and in

[96] Wilson et al. (2009) even find (without controlling for other factors) that the debt service coverage ratio of PE companies is even higher than at non PE owned companies.
[97] PE funds seem to maximize the leverage per company EBITDA down to sector debt service coverage ratio levels. Axelson et al. (2008) state "a partner of a buyout firm will often say that they borrow as much as the banks will lend them."
[98] We compare EBITDA with annual debt service, assuming a 5.0% annual interest payment on the net debt. Our findings are robust to using alternative assumptions of 7.5 or 10.0%. For the deals we are applying the debt level used in the buyout.
[99] Unfortunately, we do not have data on debt pre-acquisition for the deals in our sample. However, assuming that the peers are not different also in the capital market structure pre-acquisition, we conclude that the deals also had a coverage ratio above the sector pre-acquisition.

addition Wilcoxon-tests for analyzing the differences between the two distributions. The coverage is higher for the peers than for the sector at a 1% level (t=2.77, z=5.04). Figure 3.5 (first row) provides a visual comparison for the two distribution. The distribution of the peers is clearly shifted to the right.

Second, in Table 3.14, we also add the coverage ratio for the sector companies. The median coverage ratio is 4.80 and not much different from the 4.50 for the deals. Neither the t-test nor the Wilcoxon test rejects the null hypothesis that PE deal and sector coverage ratio are equal (t=0.54 and z=0.49). According to our interpretation, PE selects companies with a high coverage ratio and reduces the coverage to the sector level by adjusting the debt levels to the relatively high EBITDA level. Figure 3.5 (second row) visualizes our findings. The distribution of the deal debt coverage ratio is centered more in the middle, but it is not shifted to the left or right in comparison to the sector distribution. Interestingly, the coverage ratio of the PE deals also does not seem to drop below a certain level, since PE avoids companies with negative EBITDA.

3.9. Concluding remarks

We use a data set of 94 PE buyouts initiated in Western Europe from 1996 until 2005, which is representative in terms of performance of large and mature PE funds, to identify PE target selection patterns. In the second part of the paper, we employ the identified selection pattern to measure PE outperformance and the underlying risk of PE investments based on propensity score matched peers.

The wider coverage of deal types (e.g. private-to-private deals) in our sample outbalances the drawback that only large and mature PE funds participated in the data collection. The literature, in contrast, uses data sets with public-to-private deals only, which

are less frequent (4% by volume), very large and therefore potentially initiated by large and mature PE houses as well.

Coming to our main findings, PE funds systematically buy companies. In our sample of 94 large buyouts, we find non-parametrically, and also with Logit regressions, that PE favors companies with a profitability corridor far above zero. We get the same findings when using the PE universe in Western Europe. We also discover that PE avoids companies with a large change in the operational figures pre-acquisition. Our interpretation is that PE acquires companies which promise an upside potential but still show a sufficient profitability to service the debt.

Second, PE investments financially outperform propensity score matched peers by 4.3%. The portfolio companies also improve the profitability by 2.5% above propensity score matched peers. Overall, propensity-score-based peer benchmarking is important in the PE performance measurement. It roughly halves the financial outperformance and increases the operational outperformance by roughly a third. Therefore, peer benchmarking explains the puzzling finding of huge financial, with only moderate operational, outperformance sometimes described in the literature (e.g. Guo et al., 2009). Interestingly, PE seems not to be able to generate abnormal outperformance without growing the enterprise value of a deal – an important finding, for periods without growing equity markets.

We are also able to reveal that PE owned companies show a lower operational volatility than the sector. In addition, the debt coverage ratio of PE investments does not drop below sector levels, despite the high debt-to-equity ratios during PE ownership. PE seems to pick systematically stable companies with a high profitability, which enables PE to increase significantly the leverage ratios of those companies without exceeding sector debt coverage levels. Our findings indicate that debt providers seem to be able to restrict the large leverage

risk appetite of PE.[100] Overall, this explains the results presented in Wilson et al. (2009) and Moody's (2009) that PE owned companies show similar default rates as sector companies, despite the high leverage during PE ownership.

Why don't companies with a stable profitability increase the leverage on their own? We have two interpretations, which are not mutually exclusive. First, PE helps to overcome supply frictions for corporate capital structure decisions. Leary (2009) finds that, in addition to demand side effects, credit supply and debt market segmentation has an influence on the capital structure choice. We find that large and mature PE funds acquire companies that are larger than average but not exceptionally large. One explanation could be that the companies acquired by PE are not large enough to have sufficient access to public debt markets, as well as not small enough to further increase their leverage via their house bank lending channel. PE engages in capital structure arbitrage by increasing debt levels for mid-size companies via organizing bank consortia and debt syndication. Our second alternative interpretation is that PE selects companies with entrenched management, since those companies promise the highest improvement potential and entrenched managers prefer a low leverage.

Future research is needed in several areas. First, we show that large and mature PE funds generate financial returns and operational improvement above matched peers. However, it is not clear if this applies to PE activity in general. We doubt that, given that large and mature PE funds show a higher performance than all PE funds. Second, the fact that using matched peers instead of the broad sector has such a large impact on PE outperformance highlights the importance of using the correct benchmark or counterfactual. Therefore more data, in particular longer time series pre-acquisition, and more research are necessary to select an adequate control group and to ultimately identify causal PE outperformance. Finally, we

[100] As Axelson et al. (2008) state "a partner of a buyout firm will often say that they borrow as much as the banks will lend them."

are curious to see if the identified selection patterns we observe for the period from 1996 to 2005 will change in a world with tight credit and/or low sector returns.

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3.11. Tables and Figures

Table 3.1: Distribution of deals by entry and exit years

The table shows the years in which the PE houses bought (entry) or sold (exit) the portfolio companies (deals) in our sample.

Years	1996	97	98	99	2000	01	02	03	04	05	06	07	sum
Entry	2	7	11	12	9	9	15	16	11	2	n/a	n/a	94
Exit	n/a	n/a	n/a	2	5	5	9	19	16	16	16	22[1]	94

1 Including seven deals for which exit is simulated

Table 3.2: Summary statistics

The table shows various financial measures for the deals in our sample.
The first part reports the financial performance and the duration. We calculate the deal IRRs (internal rate of return) using the entire time pattern of cash inflows and outflows for each deal (portfolio company), as experienced by the PE house (before fees). The cash in/cash out multiple measures the absolute value of all positive cash flows divided by all negative cash flows minus 1. The duration captures the length of the deals in years, using the entry and exit months and years as reported by the PE house.
The second part of the table compares the enterprise value (deal size) and several financial ratios at entry date.

Variable	n	mean	median	std. dev.	Min	max
Deal IRR %	94	38.2	36.3	41.0	-87.8	122.8
Cash in/cash out multiple		2.9	2.7	1.9	0.0	10.3
Duration (years) [1]	87	3.8	3.6	1.4	1.4	7.3
Entry deal size	94	665.0	447.5	695.3	42.7	3,154.9
Entry debt/equity		2.0	1.8	1.1	0.1	8.7
Entry deal size/EBITDA		8.6	7.8	6.3	-13.7	38.7
Entry debt/EBITDA		5.4	4.9	4.1	-5.5	32.4

Note: In Mio, EUR; significance level * p<0.1, ** p<0.05, *** p<0.01
1 Only exited deals

Table 3.3: Benchmarking of our deals vs. our funds by net IRR comparison

This table compares the deals with the funds in our sample by Net IRRs. Row (1) provides the Net IRR for 31 out of 35 funds that participated in our sample and for which Prequin reports the NET IRRs by end of 2007. [6] We weight the 31 fund returns by the number of participating deals per fund. In row (2) we show the simple average NET IRRs for all deals in our sample for which we have fund return data (for 82 out of 94 deals). In row (3) we pool these deals artificially in one pseudo fund. Since the publicly available data on the European universe is primarily in the form of net IRRs, we convert our gross deal-level IRRs (before fees charged by PE houses to fund investors) to net IRRs (after fees, or in other words, IRRs from the viewpoint of fund investors). In the last column we test if the PE houses cherry-picked the deals out of their funds in terms of performance.

	n	Net IRR [1]		t-stat of diff. to our funds
		mean	Median	
(1) Our funds [4]	31	24.8 [5]	27.4	
(2) Our deals	82	28.4 [2]	25.2	0.86 [7]
(3) Our deals pooled in 1 pseudo fund [3]	1	25.0		

Note: All values in percent or Mio EUR **,** vintage year 1993-2003, significance level * p<0.1, ** p<0.05, *** p<0.01

1 NET IRR, estimated for our deals in the following way: If a) Gross IRR<=10%, then LPs keep all return except 2% fees, so that Net IRR = Gross IRR - 2% fees; b) 10%<Gross IRR<12.5%, then LPs keep all return up to 10% except for 2% fees and GPs keep all return from 10% to 12.5%, so that Net IRR = Gross IRR - 2% fees – (Gross IRR – 10)% = 8%; and c) Gross IRR>=12.5%, then LPs and GPs share in 80:20 ratio the return exceeding 12.5%, so that Net IRR = Gross IRR - 2% fees – 2.5% - 20%*(Gross IRR - 12.5%).

2 Simple averages

3 Pooled by calendar period using quarterly cash flows

4 As reported in Prequin.

5 Weighted averages by number of participating deals per fund

6 In 5 cases, more than one fund of a PE house is involved; in these cases, we take the simple average of the funds involved and treat the funds as one fund.

7 We use Welch's t-test of difference between (1) and (2) assuming unequal variance for (1) and (2).

Table 3.4: Benchmarking of our funds vs. PE universe by net IRR comparison

This table compares the returns of the funds in our sample with fund returns of the EU universe. First, row (1) provides the Net IRR for 31 out of 35 funds that participated in our sample and for which Prequin reports the NET IRRs.[3] Second, row (2) provides the Net IRRs for all funds in Western Europe and (3) for very large funds only, as reported in Thomson Financial Venture Expert.
In the last column we test if the PE funds in our sample are different in terms of Net IRR from a) the Western European universe and b) the universe with the same fund size.

	n	Net IRR		fund size	t-stat of diff. to our funds
		mean	median		
(1) Our funds [1]	31	24.8 [4]	27.4	500-5000	
(2) All funds in Western Europe [2]	229	16.3	9.8	0-1000+	-2.38*** [5]
(3) All large funds in Western Europe [2]	53	22.0	18.9	500-1000+	-0.67 [6]

Note: All values in percent or Mio EUR **,** vintage year 1993-2003, significance level * p<0.1, ** p<0.05, *** p<0.01
1 As reported in Prequin
2 According to Thomson Financial Venture Expert
3 In several cases, more than one fund of a PE house is involved; in these cases we take the simple average of the funds involved and treat the funds as one fund.
4 Weighted averages by number of participating deals per fund
5 We test for the difference between (2) and (1) assuming equal variance for (2) and (1)
6 We test for the difference between (3) and (1) assuming equal variance for (3) and (1). Unequal variance assumption leads to t= -0.78

Table 3.5: Benchmarking of sample by distribution of deal size

The table classifies the deals by the price paid for the acquired company (deal size). The first part of the table shows the distribution by size for the deals in our sample and the second part for the European universe. The last column shows the share of our sample on all large and very large buyouts

	Deal size (in Mio EUR)				**total**	**sample coverage of large & very large deals**
	small (0-50)	**medium** (50-100)	**large** (100-500)	**very large** (>500)		
Our deals per #	2.1%	6.4%	43.6%	47.9%	94	
Our deals per value	0.1%	0.7%	14.9%	84.3%	62507	
EU universe per #	67.3%	11.9%	15.2%	5.5%	5,384	7.7%
EU universe per value	9.4%	7.1%	26.9%	56.5%	636,604[1]	11.7%

Note: In Mio, EUR

Source: EU universe data from Private Equity Insight, covering all deals acquired from 1995 to 2005 in Western Europe for which information on deal value or deal size category was available

1 For 22.8% of all deals in EU universe only deal size category was available. Deal value estimated with the mean deal value per category. Mean deal value per category calculated with 77.2% of all deals for which exact deal value was available (sum deal value = mean deal value per category * number of deals)

Table 3.6: Benchmarking of sample by vendor type

The table classifies the deals by vendor types into five different categories. Category (1) shows public-to-private deals, in which PE acquired a whole public company and (2) carve-out deals, in which PE acquired only a part of a company. Category (3) reports PE acquisitions of former family or private companies, (4) of companies, which were owned by institutional investors, e.g., other PE funds, and (5) of former state or government owned companies. The first part of the table reports the categories for the deals in our sample, the lower part for the PE universe in Western Europe. In addition, the table reports the mean (median) size (enterprise value) and profitability (EBITDA margin) of the company at the acquisition date. In the last column we test for differences in profitability by vendor type.

Vendor type (previous owner)	**n**	**split in %**		**enterprise value** [1]		**EBITDA margin**	
		by n	**by value**	**mean (median)**	**test of diff.** [2]	**mean (median)**	**test of diff.** [2]
Our sample							
(1) Public-to-Private	9	9.6%	10.1%	703.8 (425.7)	0.17	15.3 (14.3)	-0.25
(2) Carve-out	41	43.6%	43.9%	668.8 (501.6)	0.04	16.5 (16)	0.28
(3) Family/Private	30	31.9%	26.4%	550.6 (382.4)	-1.06	13.5 (12.4)	-1.71*
(4) Instit. Investor	13	13.8%	18.4%	884.3 (469.3)	1.22	22.3 (21.9)	2.15**
(5) State	1	1.1%	1.2%	738.9 (738.9)	-	10.9 (10.9)	-
Total	94	100.0%	100.0%	665 (447.5)		16.2 (14.4)	
EU universe							
(1) Public-to-Private	249	4.6%	17.3%	442.7 (170.7)	16.67***	10.3 (8.1)	-2.66***
(2) Carve-out	2,066	38.4%	44.7%	137.6 (31.3)	6.09***	9.8 (8.9)	-3.52***
(3) Family/Private	1,937	36.0%	13.2%	43.4 (14.1)	-18.50***	13.5 (10.4)	2.85***
(4) Instit. Investor	749	13.9%	19.3%	163.7 (55.7)	13.01***	14.3 (11.1)	3.71***
(5) State	74	1.4%	2.6%	226.5 (36.9)	1.45	12.3 (8.4)	0.72
(6) Not Disclosed [3]	309	5.7%	2.9%	59.5 (9.5)	-9.70***	10.8 (9.8)	0.44
Total	5,384	100.0%	100.0%	118.2 (25.0)		11.8 (10.0)	

Note: In Mio EUR, significance level * p<0.1, ** p<0.05, *** p<0.01
Source: Private Equity Insight, all deals acquired from 1995 to 2005 in Western Europe with deal size or size category available
1 We estimated the mean for 22.8% of the deals in the EU universe, for which only information on the deal size category was available. We estimate the mean with the mean of the deal size category.
2 We test for differences with a Wilcoxon tests and compare each vendor type with all other deals. Test on margins for the EU universe (n=1,524) and for deals in our sample (n=94) for which data on margin was available.
3 Including "In Receivership"

Table 3.7: Operational measures pre-acquisition deal vs. sector

The table reports EBITDA margin and sales in the last year PRE PE (*t=0*) for 94 deals for which we have operational data. To determine precisely if PE ownership was not already in place and therefore had an influence on a company's performance, we only count the last PRE PE-ownership year if the PE acquisition month is less than 6 months before the end of the fiscal year. We also report the variables for all sector companies in the deal's corresponding years and sector. In addition, for each deal, we calculate *i* median sector figure. In the last column we test for differences between deal and sector. In the last column we also show a Wilcoxon tests, given the outliers in the sector data and non-normal distributions.

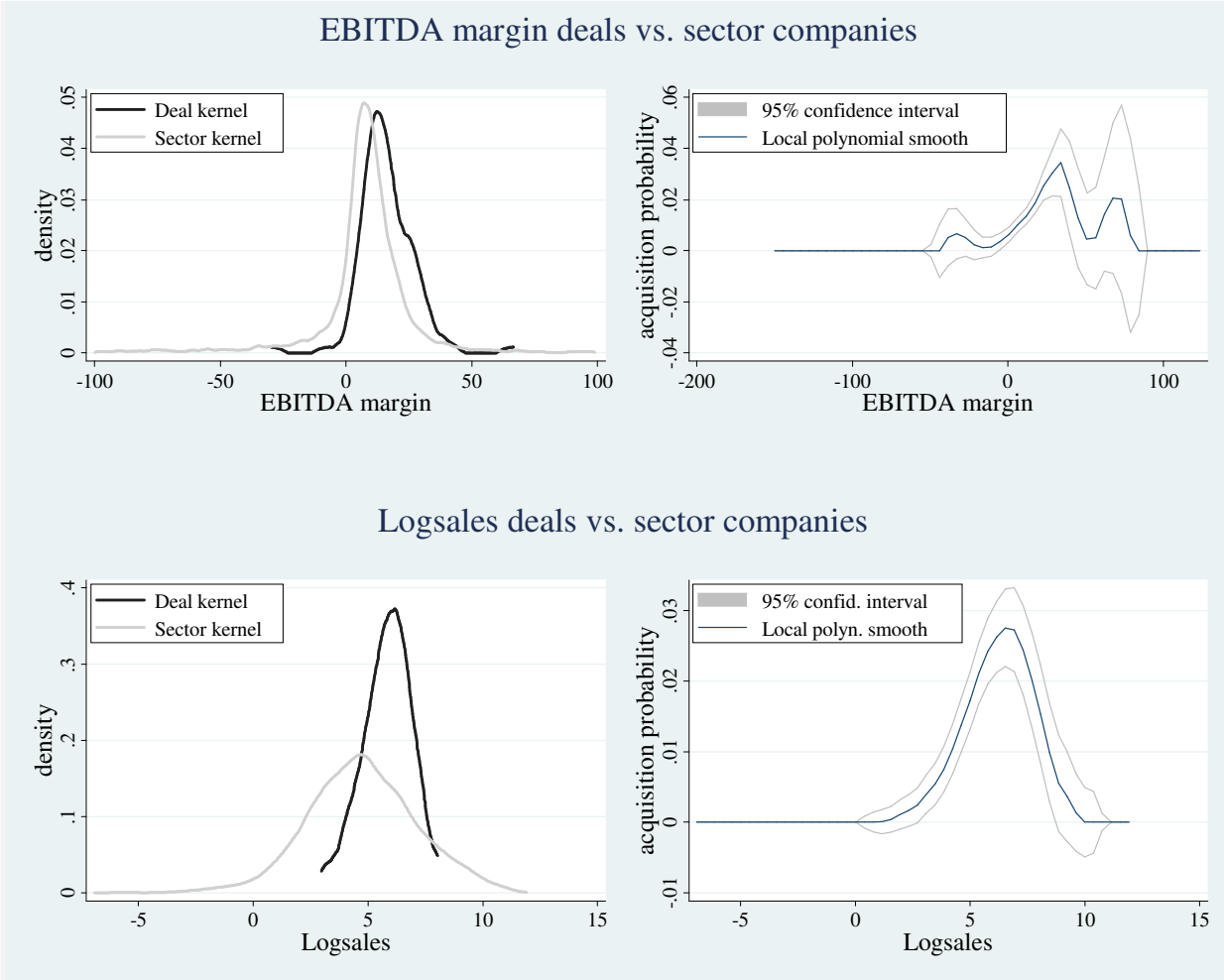
Variable $_{t=0}$	**n**	**mean**	**median**	**std. dev.**	**min**	**max**	**difference to deal**	
							t-test	**rank test**
EBITDA margin deal	94	16.17	14.43	11.15	-30.19	66.72		
EBITDA margin sector	7,602	-36.45	8.21	864.37	-51,300	3,545		-7.04***
EBITDA margin sector avg. [1]	94	11.64	10.46	5.74	4.81	45.96	-3.57***	
EBITDA margin sector median	94	9.01	9.26	2.51	2.24	15.23	-6.02***	
Log sales deal	94	5.84	5.90	1.06	2.97	8.03		
Log sales sector	7,602	4.75	4.71	2.39	-6.91	11.92		-5.71***
Log sales average	94	5.05	5.06	0.91	3.55	10.38	-5.44***	
Log sales sector median	94	4.70	4.68	0.83	2.92	6.90	-8.53***	

Note: in percent or EUR millions, significance level * p<0.1, ** p<0.05, *** p<0.01

1 Weighted average (total sector EBITDA divided by total sector sales) for each deal in corresponding years and sectors

Figure 3.1: Operational measures pre-acquisition deal vs. sector

The plots on the left are kernel densities for the sector and deal distribution. On the right we show polynomial smooth, which displays the values from a local polynomial regression of the acquisition status (1 for deals, 0 for sector companies) on the dependent variable (EBITDA margin in percent and log sales in Mio EUR). The vertical captures the probability of PE acquisition; the grey shaded area the 95% confidence bands of the local coefficient estimates.



Note: In percent or EUR Mio

Table 3.8: Change in operational measures pre-acquisition deal vs. sector

The table provides performance trends in the last year of PRE PE ownership (*t=0*) for 69 deals in our sample, for which we have at least two years of PRE PE ownership data: change in EBITDA margin (*ebitda margin* $_t$ *- ebitda margin* $_{t-1}$) in percentage points and the sales growth (*logsales* $_t$ *– logsales* $_{t-1}$) in percent for the deals. We also report the variables for all sector companies in the deal's corresponding years and sector. In addition, for each deal we calculate *i* median sector figure. In the last column we also show Wilcoxon tests, given the outliers in the sector data and non-normal distributions.

Change in… [2]	**n**	**mean**	**median**	**std. dev.**	**min**	**max**	**diff. to 0**	**diff. to deal**	
							t-test	**t-test**	**rank test**
EBITDA margin deal	69	0.08	0.60	3.66	-19.97	10.94	0.17		
EBITDA margin sector	7,380	73.44	0.07	4,517	-20,375	367,487	0.17		-0.87
EBITDA margin sector med. [1]	69	0.23	0.17	1.11	-1.56	8.11	1.72*	-0.34	
Log sales deal	69	5.87	7.18	14.79	-59.03	58.11	3.29***		
Log sales sector	7,411	9.04	6.36	47.15	-816.01	722.05	3.79***		0.34
Log sales sector median [1]	69	6.54	5.52	8.08	-8.81	23.02	6.71***	0.65	

Note: in percent, significance level * p<0.1, ** p<0.05, *** p<0.01

1 Median changes per sector (and not changes of the median)

2 For EBITDA margin change in percentage points (change in ebitda margin$_t$ = (ebitda margin$_t$ - ebitda margin$_{t-1}$)*100) for sales change in percent (sales growth$_t$ = (logsales$_t$ - logsales$_{t-1}$)*100)

Figure 3.2: Change in operational measures pre-acquisition deal vs. sector

The plots on the left are kernel densities for the sector and deal distribution. On the right we show polynomial smooth, which displays the values from a local polynomial regression of the acquisition status (1 for deals, 0 for sector companies) on the variable. The vertical captures the probability of PE acquisition; the grey shaded area the 95% confidence bands of the local coefficient estimates.
We calculate the EBITDA margin change in percentage points *(change ebitda margin$_t$ = (ebitda margin$_t$ - ebitda margin$_{t-1}$)*100)* and the sales change in percent *(sales growth$_t$ = (logsalest - logsales$_{t-1}$)*100)*

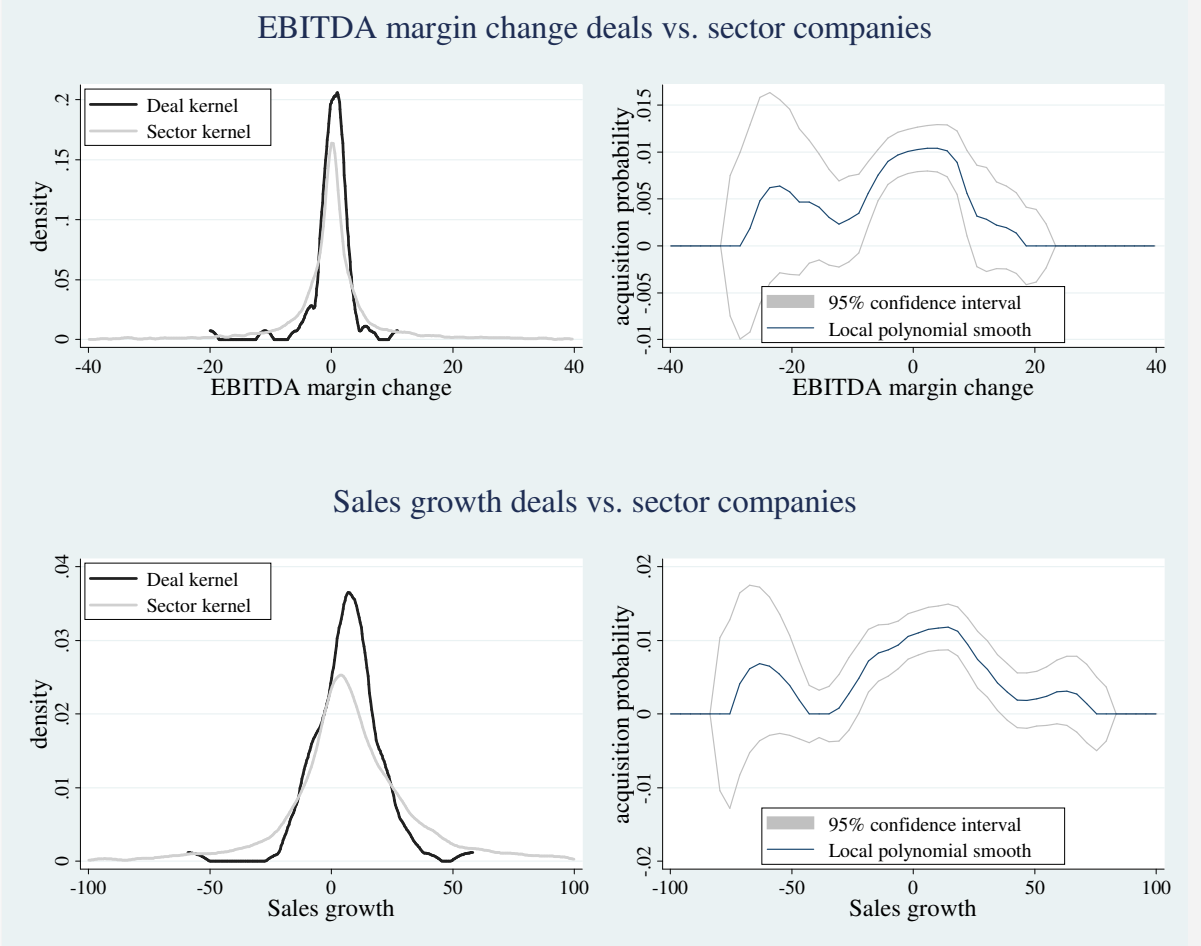


Table 3.9: PE treatment on company criteria pre acquisition

The table shows multivariate Logit or Probit regressions of the treatment status (PE acquisition) on operational measures pre-acquisition. We therefore pool our deal sample with all publicly listed companies in Western Europe as provided by Datastream.
The binary dependent variable takes on 1 for all deals and 0 for all sector companies in deal corresponding sector and years. The independent variables are levels in operational measures in the last year pre-acquisition. We do not add dummies for sector and deal entry time periods since we do not have enough observations to identify time-specific selection patterns. We also do not include out-of-sample variables, e.g., market interest rates, because we are interested in finding comparable peers and not explaining the level of PE activity.
We use a non-linear specification with the quadratic terms, assuming a u-shaped relationship between the later acquisition and the operational variable. In regression (4) to (6), we include in addition to levels also pre-acquisition operational performance changes as independent variables.

Independent variables	**Dependent variable treatment** (1 for deals, 0 for sector companies)					
	logit (1)	**logit (2)**	**logit (3)**	**logit (4)**	**logit (5)**	**probit (6)**
$Margin_t$	14.51***		14.70***	15.54***	14.63***	6.20***
	(3.53)		(3.31)	(3.47)	(3.32)	(4.04)
$Margin_t$^2	-22.25*		-21.77*	-22.92*	-20.80*	-8.61*
	(-2.20)		(-2.08)	(-2.14)	(-2.01)	(-2.46)
Log $sales_t$		4.77***	4.62***	4.66***	4.52***	1.73***
		(4.33)	(4.27)	(4.25)	(4.07)	(4.58)
Log $sales_t$^2		-0.39***	-0.38***	-0.38***	-0.37***	-0.14***
		(-4.35)	(-4.32)	(-4.29)	(-4.12)	(-4.56)
$Margin_t$ - $Margin_{t-1}$				-2.65	-2.31	-1.58
				(-1.49)	(-0.57)	(-1.18)
($Margin_t$ - $Margin_{t-1}$)^2					-7.70	-1.71
					(-0.25)	(-0.23)
Log $sales_t$ - log $sales_{t-1}$				-0.86*	-0.54	-0.23
				(-2.24)	(-0.49)	(-0.57)
(Log $sales_t$ - log $sales_{t-1}$)^2					-3.80	-1.26
					(-0.98)	(-1.07)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	5,241	5,240	5,240	5,110	5,107	5,110
No. of deals	94	94	94	69	69	69
Pseudo R^2	0.06	0.10	0.15	0.15	0.16	0.16
Log likelihood	-343.48	-329.12	-312.33	-309.94	-297.76	-308.03

Note: t-stat in parenthesis with robust standard errors, significance level * p<0.1, ** p<0.01, *** p<0.001

Figure 3.3: Propensity score deals vs. peers (10 nearest neighbors)

The figure provides on the left the propensity score for the sector companies, which we use as peers, and on the right for the deals in our sample. We calculate the score using the model we have estimated in the previous table in regression (5) for the 69 deals with two years of data pre-acquisition. For 25 deals with only one year of data pre-acquisition we use regression (3) from the previous table instead. Panel A, shows the propensity scores for the 10 companies that have the lowest absolute distance to each deal by propensity score (10 nearest neighbors). Panel B, reports the same for the 5 nearest neighbors.

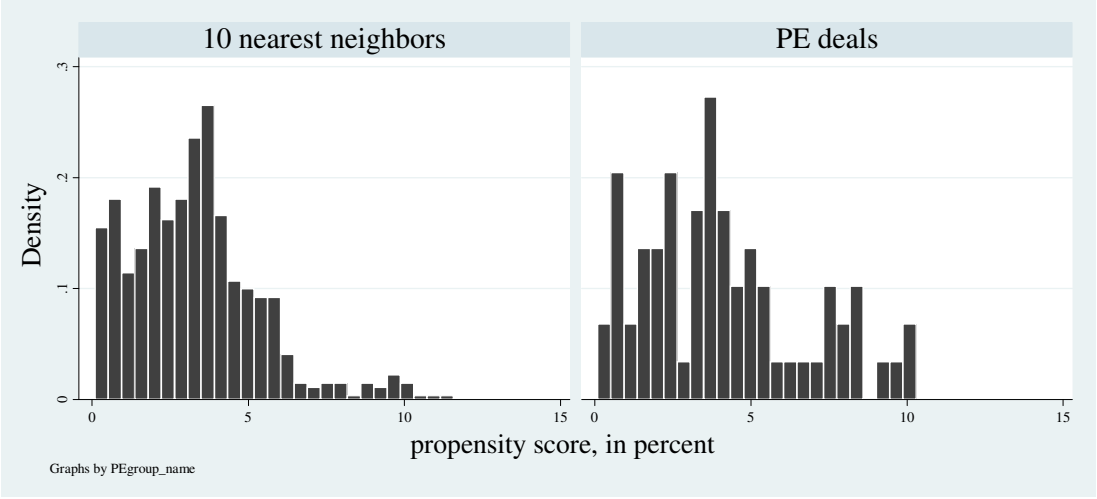


Figure 3.4: Propensity score deals vs. peers (5 nearest neighbors)

The figure, in contrast to the previous figure, reports only the 5 companies that have the lowest absolute distance to each deal by propensity score (5 nearest neighbors).

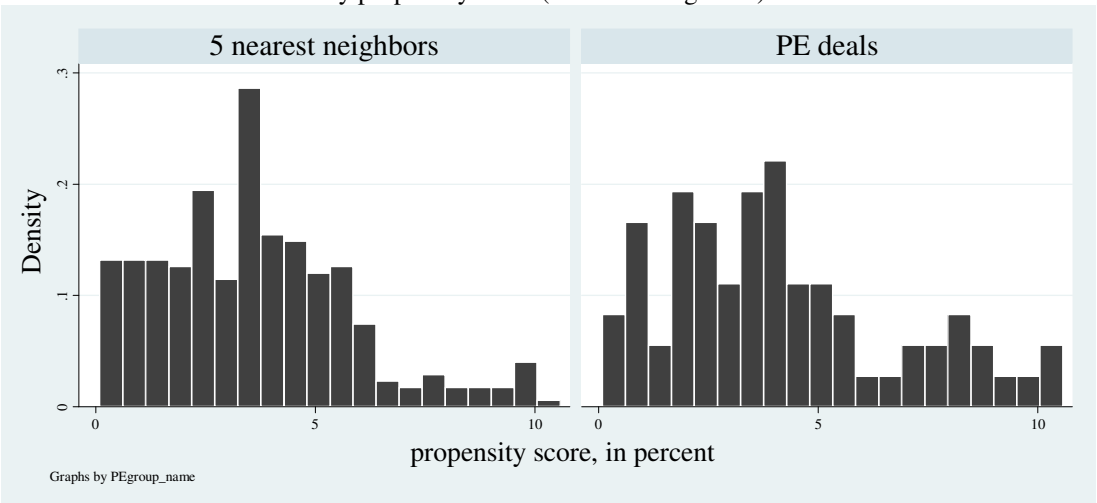


Table 3.10: Difference between deal and peers pre-acquisition

The table compares deals and matched peers, in order to show that there is no difference in the levels of operational measures between deals and matched peers pre-acquisition. In the last column we test for differences in the levels.[1]

	n	mean	median	std. dev.	min	max	t-test diff. with deal
EBITDA margin deal	94	16.17	14.43	11.15	-30.19	66.72	
EBITDA margin peer average	94	15.29	14.26	7.00	-2.70	30.89	-0.79
Log sales deal	94	5.84	5.90	1.06	2.97	8.03	
Log sales peer average	94	5.77	5.84	0.48	3.75	6.69	-0.61

Note: In percent, significance level * p<0.1, ** p<0.05, *** p<0.01

Table 3.11: Financial performance deals vs. different benchmarks

The table reports several financial performance measures for deals, matched peers and sector companies [1]. We use median sector and peer changes, given that there are mostly less than 100 companies in each three digit sector and only 10 matched peers.
(1) We provide internal rates of return (IRRs), gross of management fees, based on quarterly cash-flows for PE deals and quarterly TRS (total return to shareholders) for sector companies. (2) We also report debt-equity (D/E) ratios. For the deals in our sample we use the average D/E ratios between entry and exit date. For peers and sector we use the average D/E ratios during the first three years of PE ownership based on net debt and market equity. (3) We calculate un-levered returns using the standard un-levering formula [2]. (4) We further show deal-level abnormal performance, which measures the excess asset return generated either above the broad sector or matched peers. (5) The last part of the table shows the PME either based on the broad sector or matched peers. In the last columns we test if the measures we provide are different from the deal or sector value.

	n	mean	median	std. dev.	min	max	t-test of diff. with	
							deal	sector
(1) Levered returns (equity IRR)								
Deals	94	38.22	36.30	40.99	-87.78	122.76		
Median peers	94	13.32	11.43	14.50	-12.90	51.23	-6.31***	4.16***
Median sector	94	9.41	8.37	12.03	-16.67	52.02	-7.05***	
(2) D/E ratio								
Deals	94	1.43	1.27	0.92	0.09	6.63		
Median peers	94	0.21	0.16	0.22	-0.19	0.90	-12.71***	3.54***
Median sector	94	0.16	0.11	0.14	-0.12	0.47	-13.48***	
(3) Un-levered returns (asset IRR)								
Deals	94	16.66	15.98	19.44	-60.29	67.23		
Median peers	94	12.34	10.59	12.49	-9.28	46.93	2.08**	4.19***
Median sector	94	8.89	7.89	10.50	-15.27	48.21	3.76***	
(4) Abnormal performance								
Deals - peers	94	4.32	3.85	20.11	-93.16	72.20		-4.19***
Deals - sector	94	7.77	10.49	20.02	-86.14	65.69		
(5) Public Market Equivalent (PME), Kaplan and Schoar 2005								
Deals - peers	94	1.16	0.88	2.01	-1.00	16.68		-1.81*
Deals - sector	94	1.32	1.14	1.72	-1.00	11.84		

Note: In percent, significance level * p<0.1, ** p<0.05, *** p<0.01
1 Peers (10 nearest neighbors) and sector companies in the deal corresponding years and sectors
2 $R_{U,i} = R_{L,i} + R_{D,i}(1-t)(D/E_i) / (1+D/E_i)$. We further use the average *D/E* ratio during deal life for the deals, a median *D/E* ratio over 3 year for the sector and $\beta=1$. We further assume the same cost of debt and tax rate for the sector as for the deal. For 61 deals we find the cost of debt (based rate and margin spread) in Dealogic; for 19 we only find the base rate (Libor vs. Euribor); and for 14 deals we find no information. If the margin spread is unknown for a deal we use the median sector spread in the same year.

Table 3.12: Operational improvements deals vs. different benchmarks

The table reports for various operating measures x the cross-sectional difference $\Delta x_i = x_{iT} - x_{it}$ from the last pre-acquisition year ($t=0$) to last PE-ownership year (T) for all deals. We also report the changes in the deal corresponding sector companies $\Delta x_s = x_{sT} - x_{st}$ and for propensity score matched peers $\Delta x_p = x_{pT} - x_{pt}$ [1]. We divide the difference for log sales between t and T by the number of PE ownership years $(T-t)$ to get annual changes. We use median sector and peer changes, given that there are mostly less than 100 companies in each three digit sector and only 10 matched peers. Note that the median captures the median change and not the change of the median.
In the last three columns we test if the changes are different from zero and different to the deal and median sector changes. For the deals we do not include changes in years with M&A or divestment events. Since the numbers might get artificially inflated or deflated in the presence of acquisition or divestment activity. However, our results do not qualitatively change when we include years with M/A or divestment events.

	n	mean	median	std. dev.	min	max	t-test of differences		
							with 0	with deal	with sector
EBITDA margin $_T$ – EBITDA margin $_t$									
Deals	85	2.13	0.91	7.18	-10.01	38.61	2.74***		
Median peers	85	-0.43	-0.10	1.96	-5.26	3.90	-2.04**	3.29***	-3.18***
Median sector	85	0.18	0.12	1.21	-2.26	4.56	1.37	2.51**	
(Logsales $_T$ – logsales $_t$)/ (T-t)									
Deals	85	5.58	4.60	11.88	-44.08	41.95	4.32***		
Median peers	85	6.25	6.18	6.03	-12.60	31.05	9.56***	0.48	-3.38***
Median sector	85	7.95	6.37	5.99	-4.77	30.06	12.23***	1.76*	
EBITDA multiple $_T$ – EBITDA multiple $_t$									
Deals	73	2.23	1.37	9.91	-29.89	50.25	1.92*		
Median peers	73	0.44	0.53	1.01	-1.97	2.61	3.71***	-1.56	2.41***
Median sector	73	0.22	0.33	0.59	-1.17	1.30	3.21***	-1.71*	
Log EBITDA multiple $_T$ – log EBITDA multiple $_t$ [2]									
Deals	71	14.29	16.84	57.85	-153.55	223.24	2.08**		
Median peers	71	6.06	9.07	12.84	-25.95	38.80	3.97***	1.22	2.68***
Median sector	71	2.68	4.50	8.62	-18.82	22.00	2.62***	1.66	

Note: In percent, significance level * p<0.1, ** p<0.05, *** p<0.01
1 Peers are 10 nearest neighbors
2 Observations with positive EBITDA only

Table 3.13: Operational volatility deals vs. benchmarks

The table reports the cross-sectional standard deviation of annual EBITDA margin and log sales between the last pre-acquisition year (*t=0*) and last PE-ownership year (*T*) for all deals [1]. We also report the standard deviations in the deal corresponding sector companies and for propensity score matched peers. In addition, we also show median sector and peer standard deviations, given that there are mostly less than 100 companies in each three digit sector and only 10 matched peers. Note that the median captures the median standard deviation and not the standard deviation of the median.
In the last two columns we test with t-tests and Wilcoxon tests for differences to the deal and sector. In order to be most conservative, we do include for the deals also years with M&A or divestment events. Years with M&A or divestment events artificially inflate the operational volatility of a deal.

	n	mean	median	std. dev.	min	max	t-test of differences	
							with deal	with sector
Std. dev. EBITDA margin								
Deals	90	1.98	1.38	2.19	0.08	14.06		
Median peers	90	1.91	1.85	0.87	0.44	4.82	0.32	-5.97***
All peers	841	6.60	2.02	72.31	0.00	1906.99	4.02*** [2]	-11.67*** [2]
Median sector	90	2.77	2.63	1.38	0.51	10.17	3.02***	
All sector	5,993	57.88	3.18	763.01	0.00	36,292	7.43*** [2]	
Std. dev. Log sales								
Deals	90	16.65	10.80	17.19	0.00	105.62		
Median peers	90	13.27	11.27	6.96	2.93	40.40	-1.87*	-5.33***
All peers	841	24.85	17.71	30.31	0.04	407.45	3.78*** [2]	-6.15*** [2]
Median sector	90	16.42	15.24	6.91	5.24	41.27	0.13	
All sector	5,995	33.75	20.81	41.47	0.01	412.28	5.76*** [2]	

Note: In percent, significance level * p<0.1, ** p<0.05, *** p<0.01
1 Includes deals only with data for at least 1 year pre-acquisition and 2 years after acquisition
2 Wilcoxon Test

Table 3.14: Debt service coverage at acquisition peers vs. sector vs. deals

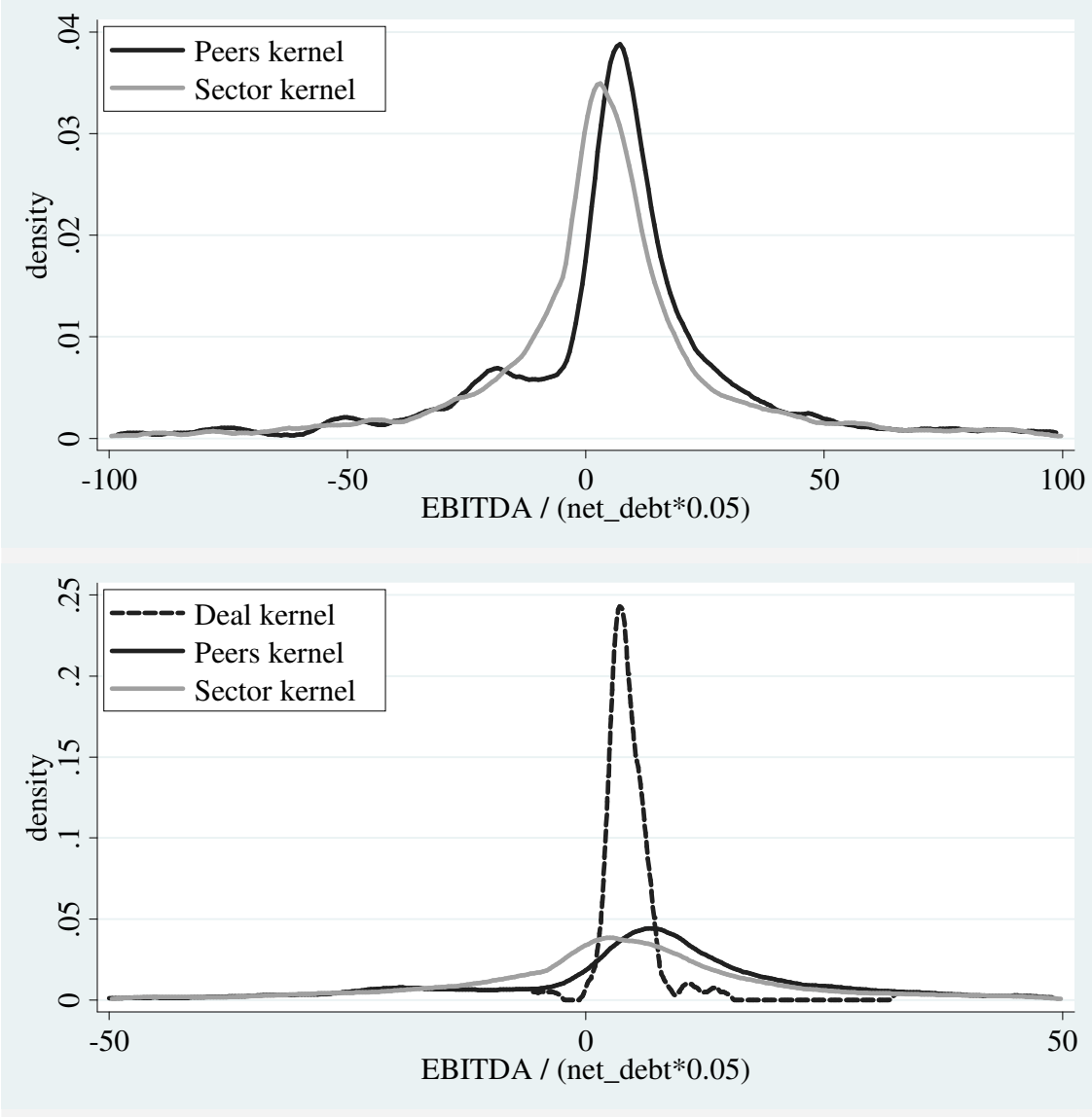
The table reports the debt service coverage ratio, here defined as EBITDA/ (net debt * interest rate) at acquisition. We assume for deals, sector and peers an interest rate of 5% [1]. In last two columns we if the debt service coverage ratio is different to the deal and sector.

	n	mean	median	std. dev.	min	max	t-test of differences	
							with deal	with sector
Deals	94	4.50	3.91	3.80	-5.54	33.23		
Median peers	94	6.87	7.08	8.17	-14.63	31.47	2.37**	2.77***
All peers	851	-41.29	7.19	708.77	-17,063.91	3,705.70	3.50*** [2]	5.04*** [2]
Median sector	94	4.80	4.89	3.09	-5.50	11.06	0.54	
All sector	6,129	-71.71	3.87	26,523	-831,272	550,116	0.49 [2]	

Note: significance level * p<0.1, ** p<0.05, *** p<0.01
1 Peers are the 10 nearest neighbors
2 Wilcoxon Test

Figure 3.5: Debt service coverage at acquisition peers vs. sector vs. deals

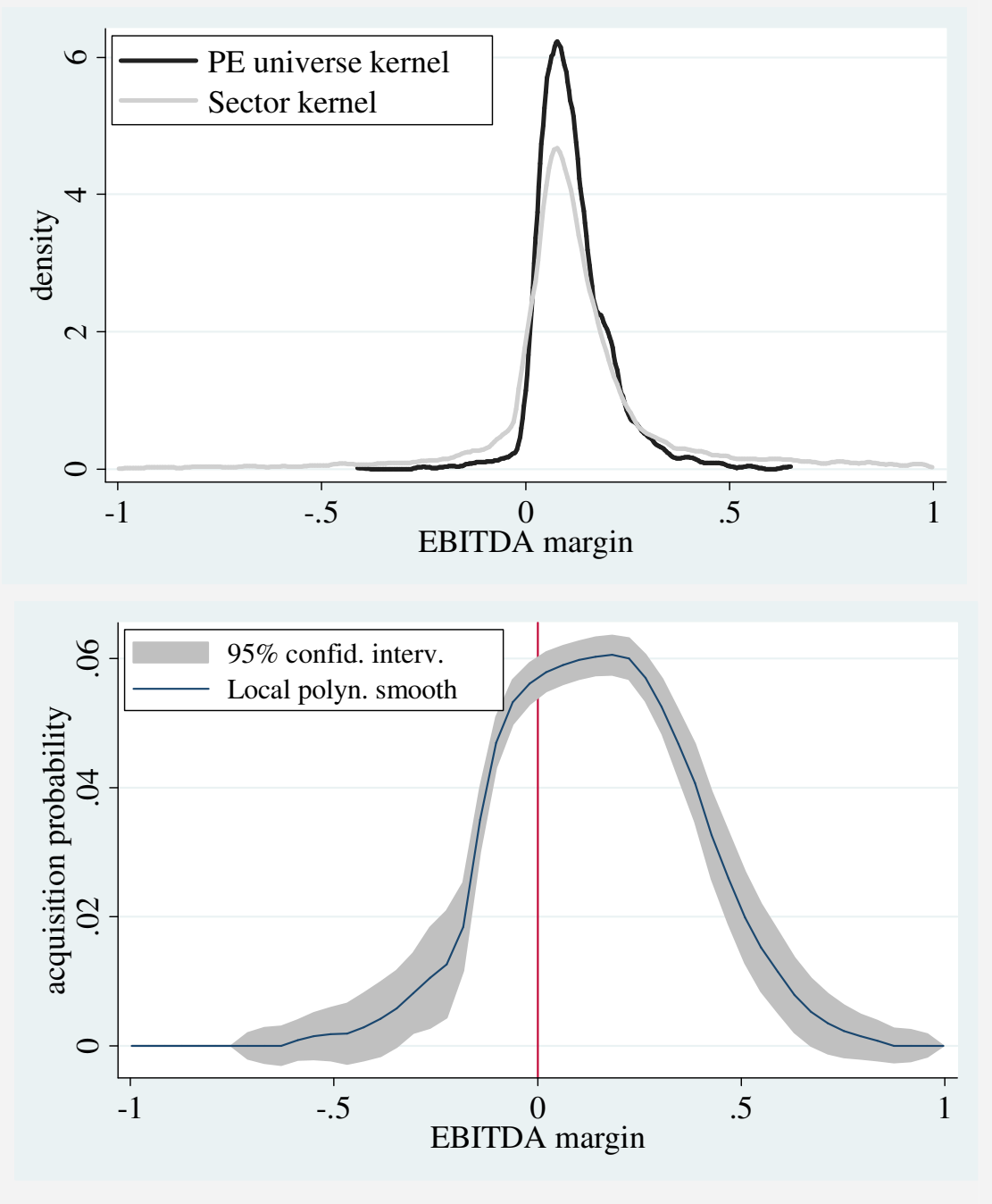
The first plot is a kernel densities of the debt service coverage ratio for the sector and peer distribution. The debt service coverage ratio is defined as EBITDA/ (net debt * interest rate) at acquisition. We assume an interest rate of 5% and use propensity score matched companies (10 nearest neighbors) as peers .The second plot is kernel densities of the debt service coverage ratio including also the deal distribution.



Note: Sector companies n=6,430; peers= 674, deals n=100

Figure 3.6: European PE universe vs. public listed companies – EBITDA margin

The first plot is a kernel density for the sector and PE universe EBITDA margin distribution. The PE universe consists of all PE deals acquired from 1994 to 2005 in Western Europe according to Private Equity Insight where operational data was available.
With the second plot we show a polynomial smooth, which displays the values from a local polynomial regression of the acquisition status (1 for PE deals, 0 for sector companies) on the EBITDA margin. The vertical captures the probability of PE acquisition; the grey shaded area the 95% confidence bands of the local coefficient estimates.



Note: In EUR Mio or percent; for EBITDA margin PE deals n=1,528 and sector companies n= 31,086

Table 3.15: PE treatment and company criteria pre acquisition (PE universe)

The table shows multivariate Logit or Probit regressions of the treatment status (PE acquisition) on operational measures pre-acquisition for the PE universe[1] [2]. The PE universe consists of all PE deals acquired from 1994 to 2005 in Western Europe according to Private Equity Insight where operational data was available. We therefore pool our deal sample with all publicly listed companies in Western Europe as provided by Datastream.
The binary dependent variable takes on 1 for all deals and 0 for all sector companies. The independent variables are levels in operational measures in the last year pre-acquisition. In regression (2) – (5) we split the sample by entry period, in regression (6) – (7) by deal source.

	Dependent variable treatment (1 for all European PE deals, 0 for all public sector companies)						
	all entry years and deals	**all deals by entry period**				**all entry periods by deals source**	
		1994-1997	**1998-2000**	**2001-2002**	**2003-2005**	**Private-to-Private**	**Public-to Private[3]**
Independent variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Margin$_t$	0.40**	3.11**	0.23	-0.34	3.85**	0.32***	5.97***
	(2.33)	(2.52)	(1.13)	(-0.58)	(2.45)	(3.93)	(4.72)
Margin$_t$^2	-0.20***	-9.68***	-0.13***	-2.59***	-10.84***	-0.26***	-20.50***
	(-3.55)	(-4.40)	(-2.90)	(-3.53)	(-3.49)	(-2.88)	(-5.14)
Log sales$_t$	-0.19	-0.79	0.02	0.00	-0.19	-0.00	-0.56
	(-0.72)	(-1.50)	(0.07)	(0.00)	(-0.40)	(-0.01)	(-1.01)
Log sales$_t$^2	-0.05**	-0.03	-0.07**	-0.08*	-0.05	-0.09***	-0.01
	(-2.08)	(-0.63)	(-2.24)	(-1.88)	(-1.22)	(-2.83)	(-0.29)
EBITDA$_t$	1.04*	-0.00***	0.00*	0.00	-0.00**	-0.00***	-0.00
	(1.68)	(-2.58)	(1.93)	(1.09)	(-2.15)	(-5.67)	(-1.47)
EBITDA$_t$^2	-0.00***	0.00**	-0.00***	-0.00	-0.00	-0.00***	-0.00
	(-4.20)	(2.51)	(-3.12)	(-1.34)	(-0.91)	(-5.48)	(-0.85)
Constant	2.87***	5.57***	2.65***	3.16**	3.03**	2.76***	3.17**
	(4.00)	(3.51)	(2.92)	(2.37)	(2.35)	(3.02)	(2.01)
No. of obs.	32,573	5,524	9,257	6,227	11,565	32,432	31,186
No. of PE deals	1,528	378	603	217	330	1,387	141
Pseudo R^2	0.88	0.94	0.91	0.89	0.84	0.87	0.73
Log likelihood	-761.85	-82.74	-205.43	-100.87	-235.80	-741.41	-241.65

Note: t-stat in parenthesis with cluster robust standard errors, significance level * p<0.1, ** p<0.05, *** p<0.01
1 All deals acquired from 1994 to 2005 in Western Europe according to Private Equity Insight with operational data; PE deals in the last year pre-acquisition;
2 Only in the Appendix does EBITDA include also exceptional items
3 Vendor type classification "Going Private" according to Private Equity Insight

Curriculum Vitae

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01/2007 – 12/2009	Ph.D. Program in Economics Ludwig-Maximilians-Universität Munich Seminar for Macroeconomics
04/2009 – 10/2009	Visiting Scholar New York University Stern School of Business
01/2005 – 01/2007	Consultant McKinsey & Company, Inc. Financial Institutions Group
09/1999 – 10/2004	Diplom-Ökonom (MSc. equivalent) University of Stuttgart-Hohenheim Studies in Economics and Business Administration
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