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Private Equity Sponsored Leveraged Buyout Transactions in the German-speaking Region – An Analysis of Value Drivers, Determinants of Performance and the Impact on Stakeholders

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List of Abbreviations

BCG	Boston Consulting Group
BVK	German Association of Venture Capital and Private Equity Investors (Bundesverband Deutscher Kapitalanleger)
CAGR	Compound Annual Growth Rate
Capex	Capital expenditure
CMBOR	Centre for Management Buyout Research
CoD	Cost of Debt
DACH	Germany (D), Austria (A) and Switzerland (CH)
$\overline{D} / \overline{E}$	Average debt/equity ratio over the holding period
Div	Dividends
DJ Stoxx	Dow Jones Stoxx
DM	Deutsche Mark
EBITDA	Earnings Before Interest Taxes Depreciation and Amortisation
EBITDA%	EBITDA margin (EBITDA over sales)
EBITDA/Multiple Mix$_{Var}$	Variance of the combination effect between EBITDA and the EV/EBITDA Multiple
EBITDA$_{Var}$	EBITDA variance
EqInj	Equity injections
EqV$_{En}$	Equity Value at entry
EqV$_{Ex}$	Equity Value at exit
et al.	et alia
EV	Enterprise Value

EVCA	European Private Equity and Venture Capital Association, now Invest Europe
FCF	Free Cash Flow
FCF_{Var}	Free Cash Flow variance
FY	Financial Year
GBP	Great British Pound
GP	General Partner
HP	Holding Period
ICB	Industry Classification Benchmark
IPO	Initial Public Offering
IRR	Internal Rate of Return
IRR_L / IRR_{LEV}	Levered Internal Rate of Return (gross IRR)
IRR_U / IRR_{UNLEV}	Unlevered Internal Rate of Return (net/ equity IRR)
KPI	Key Performance Indicator
LBO	Leveraged Buyout
LMBI	Leveraged Management Buyin
LMBO	Leveraged Management Buyout
LP	Limited Partner
MBI	Management Buyin
MBO	Management Buyout
MM	Money Multiple
MSCI	Morgan Stanley Capital International, is a global share benchmark index
$Multiple_{Var}$	EV/EBITDA Multiple variance
n.m	not meaningful
ND_{En}	Net debt at entry

ND_{Ex}	Net debt at exit
negCF	Negative Cash Outflows of the GP
NewCo	New Company
OLS	Ordinary least squares
os%	Ownership percentage at entry
PE	Private Equity
PLC	Public Limited Company
PME	Public-Market-Equivalent
posCF	Positive Cash Flows received by the GP
PPM	Private Placement Memorandums
ppts	Percentage points
RVPI	Residual Value to Paid-in Capital
S&P	Standard & Poor's
SMEs	Small and medium-sized enterprises
t	Average tax rate, while *(1 – t)* represents the tax shield
TVE	Thomson Venture Economics
TM	Times Money Multiple
TM_{LEV}	Levered Times Money Multiple
TM_{UNLEV}	Unlevered Times Money Multiple
UK	United Kingdom
US	United States of America
WSJ	Wall Street Journal
XETRA	Exchange Electronic Trading

1 Introduction

1.1 Motivation and Research Questions

Private equity represents an asset class which invests its capital in either newly established start-up and growing companies, also referred to as venture capital, or settled and mature companies, referred to as private equity in its more narrow definition. With regard to venture capital there are broadly three financing stages (1) the seed financing stage for start-up companies in order to finance the test of the overall marketability, (2) the early stage to finance production capacities and marketing initiatives after marketability was tested successfully, and (3) the later stage to financing growth and expansion of the business. Private equity in its narrow definition relates to investments in settled and mostly healthy companies that have proven the success of their business model over years. The most common type of such investments is carried out as leveraged buyout transactions (LBOs) as the majority of the purchase price is financed through debt. In the underlying thesis private equity relates to the narrow definition and thus does not cover venture capital activity.

The LBO business model emerged in the mid 1970s to early 1980s, mainly in the US with some activity in the UK. First buyout activity on the Continental European and German-speaking markets occurred in the mid 1980s (Lowenstein, 1985; Jensen, 1989; Acharya et al., 2007). The German-speaking region covers Germany, Austria and Switzerland, which is also referred to as the DACH region.

Economically, private equity has developed into a major asset class with globally a total of $3,788bn of assets under management as of June 2014.[1] Further, in regard of buyout activity, the total global buyout volume amounted to $252bn in 2014, additionally some $180bn were raised for new buyout funds and private equity sponsors had $1,144bn of dry powder available, with more than a third ($452) being attributable to buyouts. In 2012 buyout activity accounted for ca. 8% of global M&A activity, while this ratio traded at 19% and 16% in the peak buyout years of 2006 and 2007, respectively (Bain, 2015).

With its increasing economic importance private equity has been subject to research since the late 1980s, which mainly emerged in the US. Ever since one of the main research

[1] This figure includes committed but non-called capital, referred to as “dry powder”, as well as the value of unrealised investments (Preqin, 2015).

question was private equity's ability to generate value and hence focused on the relation between general partners and portfolio companies (Phalippou, 2007). Another research stream, which evolved slightly later, is related to fund performance and performance persistence and as such mainly addresses the relation between limited and general partners (see e.g. Kaplan and Schoar, 2005). Following the regional distribution of leveraged buyouts as a business model the majority of studies carried out relate to the US and UK markets with only a few studies covering the Continental European market(s). In general private equity is chronically under-researched, primarily due to restrictions in the availability of data, which mainly result from the fact that neither general nor limited partners are legally obliged to any publication requirements (Nikoskelainen and Wright, 2007).

In the German-speaking region, also referred to as the DACH region, private equity activity increased significantly in the late 1990s to early 2000s. As of 2014 private equity sponsors in Germany have a total of ca. €39bn of assets under management and funds of ca. €40bn. Private equity gained widely spread public interest in Germany following a statement of the former leader of the social democratic party, who compared the private equity business model with a locusts plague in light of TPG's takeover of Grohe: "Certain private equity investors do not waste a thought on the employees, whose workplaces they destroy – they stay anonymous, have no face, are invading companies like a plague of locusts, grazing them and move on. We are fighting against this type of capitalism".[2] Since, and in contrast to the US and UK markets, private equity in the German-speaking region has a widespread negative reputation and investors are seen as corporate raiders that create value through financial engineering and structuring efforts, which lead to a reduction in workforce, a lower tax burden and ultimately bring overall negative social welfare effects.

Based on the above the motivation of the underlying thesis is twofold. First, to the best of the author's knowledge no study has been carried out yet exclusively focusing on value creation and performance drivers of leveraged buyout transaction in the German-speaking region. These topics are addressed by means of research questions one to five as outlined below. Second, given the controversial debate and the negative reputation of private equity investors, it is the goal to analyse how various stakeholders are affected by leveraged buyouts in this region. This is covered by means of research questions six and seven outlined below. The specific research questions get addressed in the form of three separate research essays by apply-

[2] Interview with Franz Müntefering in Bild am Sonntag dated 17th April 2005; see also Der Spiegel, 2006, issue 51, p. 71, translated from German to English.

ing a novel dataset comprising of 124 leveraged buyout transactions carried out in the German-speaking region between 1995 and 2010. The research questions are:

Research question 1: What are the most relevant deal level drivers of the value generated in private equity buyout transactions in the German-speaking region?

Research question 2: Is there an abnormal financial and/ or operational performance of private equity buyout transactions compared to public benchmark companies in the German-speaking region? Further, do value drivers change and abnormal performance levels differ when analysing buyouts pre vs. post the financial crisis of 2008 and by type of exit channel chosen?

Research question 3: What are determinants of abnormal operational deal performance and unlevered returns in leveraged buyout transactions in the German-speaking region?

Research question 4: Is the impact of private equity performance drivers in the German-speaking region different under various business models, defined as (1) organic vs. inorganic growth strategies and (2) small vs. larger cap private equity investors?

Research question 5: Does the impact of private equity performance drivers in the German-speaking region differ between deals exited pre and post the global financial crisis of 2008?

Research question 6: How do changes in operational performance of the buyout company compare to those of applicable benchmark companies and what are relative contributions in terms of levered buyout returns?

Research question 7: What is the effect of leveraged buyout transactions in the German-speaking region on the main stakeholders involved, other than the private equity sponsor?

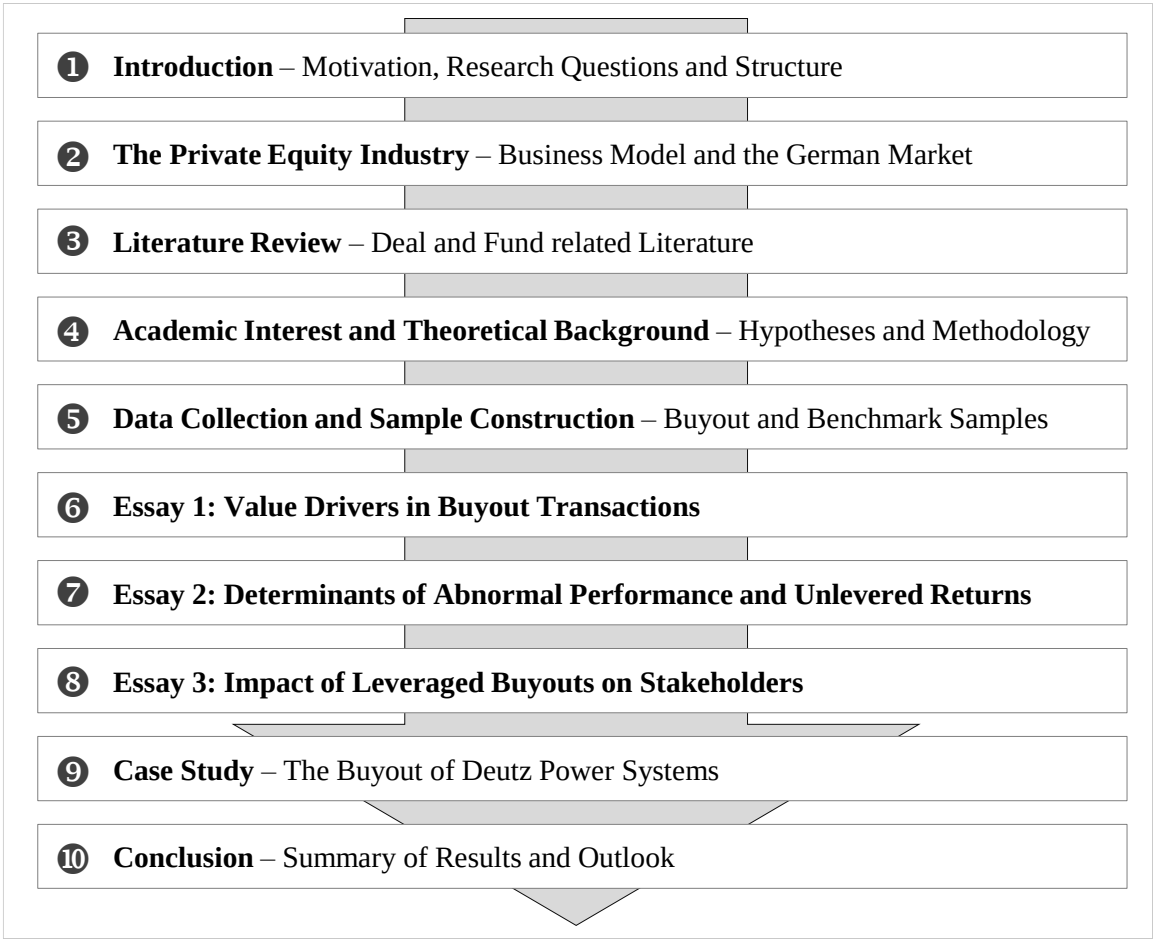
1.2 Structure of the Thesis

As highlighted in Figure 1 the thesis is divided into ten chapters, while Chapters 1 to 5 represent the introduction, Chapters 6 to 8 relate to the main part of the thesis, represented by three separate research essays. Chapters 9 and 10 reflect the findings by means of a case study and conclude accordingly.

Chapter 2 of the underlying thesis provides an introduction to the private equity industry in general and specifically introduces private equity activity in Germany. Chapter 3 provides a literature overview relating to private equity and sheds light on the two main research pillars,

being deal related and fund related performance. Based on this Chapter 4 elaborates on the academic interest of the thesis and the main research questions with accompanying hypotheses being derived. In addition, this chapter provides background information on the methodological framework applied.

Figure 1: Structure of the Thesis



Source: Own illustration

Before the individual research questions are addressed in the main part of the dissertation, in the form of three distinct research essays in Sections 6 to 8, Chapter 5 discusses how the underlying sample, relevant to all research essays, was constructed. It is distinguished between how the relevant deal and benchmark data was collected; furthermore, descriptive statistics of the samples are provided, a potential sample bias is discussed and robustness checks are performed. The main body of the thesis is then represented by the three research essays as follows:

***Essay 1**: Corporate Raiders at the Gates of Germany? Value Drivers in Buyout Transactions*

***Essay 2**: Buyout Transactions in the German-speaking Region – Determinants of Abnormal Performance and Unlevered Returns*

***Essay 3**: Leveraged Buyout Transactions in the German-speaking Region – A Stakeholder Perspective*

In Chapter 9 a case study is provided to reflect the results obtained by means of a real life transaction, being the buyout of Deutz Power Systems by 3i. Section 10 provides a conclusion of the findings and includes an outlook with regard to future research requirements.

2 The Private Equity Industry

It is the goal of the underlying section to provide a foundation for the thesis. As such this section defines the term private equity, introduces the private equity business model, discusses different types of private equity investments and specifically provides insights on past and current private equity activity in the German-speaking region.

2.1 Definition of Private Equity and the Business Model

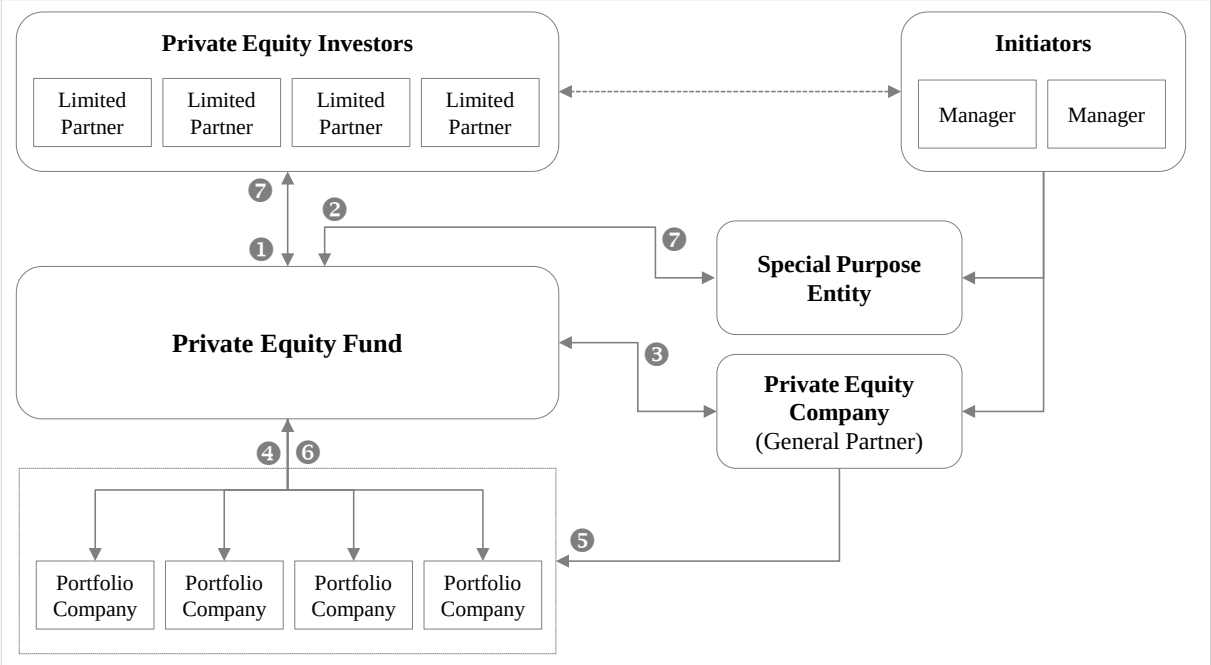
Private equity is liable, non-subordinated, capital which is mainly provided by institutional investors, such as pension funds or insurance companies, to a private equity fund, serving as an intermediary, over a mid- to long-term period, which is invested in non-public companies and gets managed by a private equity company. The latter, known as the general partner, receives fees from the investors, known as limited partners, on committed or invested capital for the management services provided to the fund and for the monitoring of the portfolio companies. Further, the general partner normally participates in returns, known as carried interest (or carry) upon realisation (exit) of the investment, while the majority of the returns and the principal are to the benefit of the limited partners. Main characteristics of private equity are its limited financing period, no interest payments on invested/ committed capital and no trading of the investments on secondary markets (Jesch, 2004, p. 22; Kaserer et al., 2007, p.13 f; Phalippou, 2007, p.1; Boué et al., 2012, p. 43).

As discussed previously, in its narrow definition, and especially in the German-speaking region, private equity is mostly associated with buyout investments, so is the definition of private equity throughout the underlying thesis. All analyses relate to leveraged buy-

outs rather than investments during the seed, early or growth stage of a given company (Kaserer et al., 2007, p. 14).

Based on the definition provided above Figure 2 illustrates the private equity business model (see Kaserer et al., 2007, p. 17 and Boué et al., 2012, p. 83). At the very beginning the initiators of the private equity business start the fundraising process, represented by the dotted line in Figure 2, by contacting potential investors, in most cases with the professional support of fundraising agencies. As highlighted previously, potential investors (limited partners) are mainly institutional investors, such as pension funds, insurance companies, banks or hedge funds, but typically also include high wealth individuals and family offices. In light of this process a so-called private placement memorandum (PPM) is issued, which generally comprises the strategy and characteristics of the fund, such as size, vintage year, maturity, hurdle rates and key terms, a track record of the preceding fund's performance and CVs of key managers involved (Brettel et al., 2008, p. 21f.). The following explanations relate to the numbers included in Figure 2:

Figure 2: Main Stages of the Investment Process and Key Parties Involved



Source: Based on Kaserer et al. (2007, p. 17); own illustration and translation

(1) Once the key terms are agreed the contracts get finalised, which are between the individual limited partner and the fund itself. The limited partners commit a certain amount to be

invested under the terms agreed which can be drawn/ called by the fund. Typically the limited partners contribute 99% of total committed capital.

(2) The remaining 1% of the fund's capital is typically contributed by the initiators/ managers of the fund, but also partly by the team of the general partner. However, depending on the jurisdiction this might be relatively complex in terms of legal- and tax-structuring purposes. Hence, the illustration shows a special purpose entity owned by the initiators/ managers which is assumed to contribute the remaining 1% of total capital. (3) The general partner, the private equity company, is also owned by the initiators/ managers and provides advisory services to the fund. For these services the company receives a management fee typically amounting to 2% of committed or invested capital (see Stoff and Braun, 2014). The general partner is the operating arm of the private equity construct; it employs all staff of the investment team, performs deal sourcing and finally the deal execution. (4) Once an appropriate target is identified, the purchase process is finalised, i.e. signing and closing of the transaction, required amounts are called from the limited partners. Typically for transaction, tax and liability purposes a so-called New Company (NewCo) is established, which acquires the portfolio company, the NewCo itself is owned by the private equity fund.

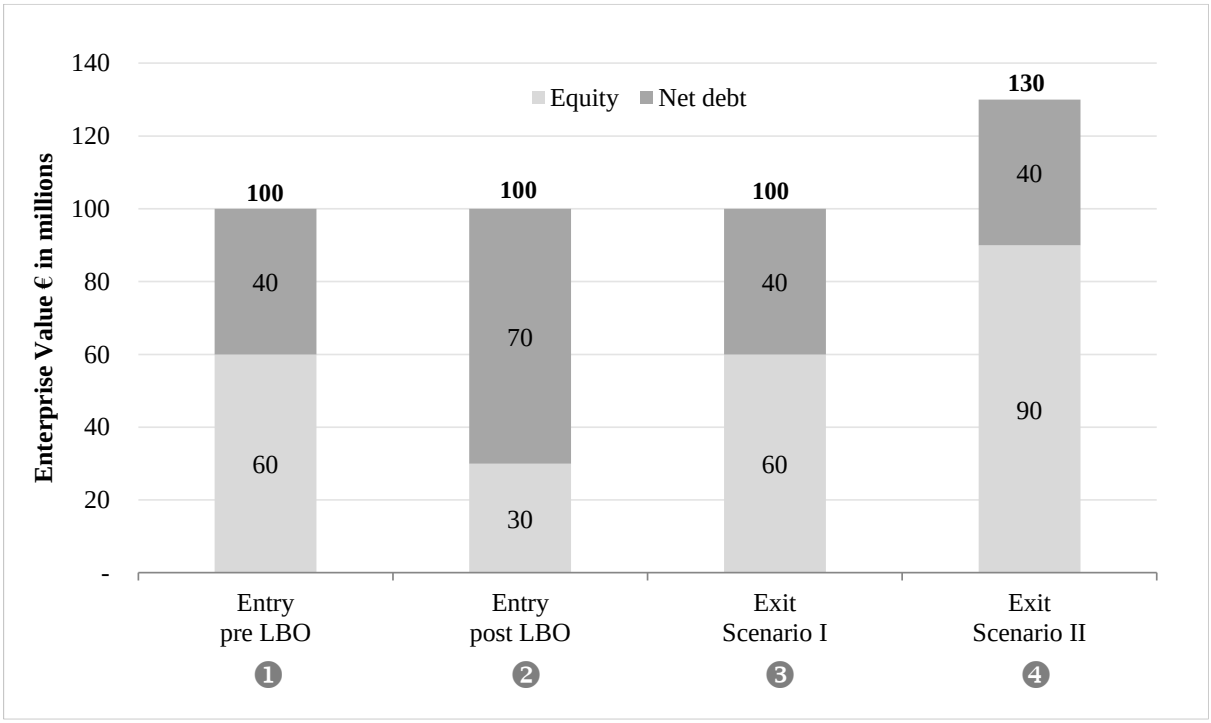
(5) During the period of ownership the general partner monitors and advices the portfolio company, but typically the general partner has no operating role. Normally, one or two employees of the private equity company receive a seat in the advisory board of the portfolio company. (6) After a holding period of typically three to five years the portfolio company gets sold to a strategic company, another private equity investor or it is taken public. (7) The proceeds realised are distributed to the limited partners and the special purpose entity. Normally the limited partners receive 80% of the profits, in addition to their principal, while the initiators receive the remaining 20% of profits, the so-called carried interest. The latter ratio depends on the agreed hurdle rate and the total return realised (Stoff and Braun, 2014).[3]

[3] In their paper, Acharya et al. (2013, p.11) provide details on how the carried interest is typically calculated, they assume the three typical hurdle returns being (1) the main hurdle rate of 8%, which reflects the assumed general market return, (2) 10% as a second hurdle rate, (3) 12.5% as a third hurdle rate. If the gross IRR is below 10% then the GP only receives the management fee. If the gross IRR is between 10% and 12.5% the GP receives all returns in this bracket, while the return up to 10% is with the LP, before the management fee, i.e. 8% net IRR. Finally, if the return is equal to or exceeds 12.5%, then the GP receives the returns allocable to the 10%-12.5% bracket plus 20% of the returns exceeding 12.5% and the management fee. These 20% reflect the typical 80:20 ratio outlined above.

In light of Figure 2 the underlying thesis primarily deals with the value generated on the portfolio company (deal) level, rather than analysing the returns being allocable to the limited and general partners, respectively.

Having elaborated on the main stages of the investment process and the key parties involved, in the following it is shed some light on the key return levers and how private equity actually earns money. This is fundamental in light of the research questions of the thesis. Figure 3 shows four stacked bars; the first two bars represent the situation at acquisition of a target company pre and post the LBO, respectively, while the other two bars represent two different scenarios upon exit of the portfolio company. Prior to the leveraged buyout the company shows an enterprise value of €100m split into €60m equity and €40m net debt (see first stacked bar in Figure 3). It is assumed that the €100m enterprise value is based on an EBITDA of €20m and an EV/EBITDA multiple of 5.0x. Hence, €60m are to be transferred to the seller of the company and €40m to the current lenders of the target company for refinancing purposes, this sum of €100m is referred to as uses of funds. As sources of funds, to finance the total of €100m, the general partner negotiates with banks and €70m are raised by the portfolio company in the form of senior debt, the remaining €30m are drawn from the limited partners and represent equity provided by the fund (see second stacked bar).

Figure 3: The Private Equity Business Model



Source: Own illustration

Thus, at entry and post LBO the debt-to-equity ratio amounts to 2.33. Now two exit cases are assumed. In either case the long-term debt of initially €70m at entry is reduced by €30m to €40m at exit. The cash required for deleverage is assumed to be earned by the portfolio company in the form of excess cash flows after capital expenditure, i.e. free cash flows available for debt service.

The first exit scenario (third stacked bar) assumes an unchanged EBITDA and valuation multiple at exit of €20m and 5.0x, respectively. Even though no EBITDA growth took place €60m of equity value were realised and get distributed to the fund and ultimately to the limited partners, disregarding carried interest. This yields a money multiple[4] of 2.0 or an IRR of 41%, assuming a three year holding period, which is simply driven by deleverage as no operational growth was realised. The debt-to-equity is reduced from 2.33 to 0.66. The second exit scenario (fourth stacked bar) assumes an EBITDA increase from €20m to €26m between entry and exit at an unchanged valuation multiple of 5.0x. The enterprise value now trades at €130m, deducting the €40m of net debt yields an equity value of €90m. This translates into a money multiple of 3.0 or an IRR of 73%, assuming a three year holding period. The debt-to-equity is reduced from 2.33 to 0.44. In addition to deleverage operational growth contributed to returns.

To summarise, it is to be distinguished between financial and operational value drivers, which both ultimately translate into returns. While the analysis of value drivers is the central research focus of the first essay, the second essay exclusively focuses on determinants of operational (abnormal) performance.

Taking the two illustrations on how the private equity business model works into consideration one has to distinguish between different types of LBOs, which are mainly carried out as either management buyouts (MBO) or management buyins (MBI), also referred to as leveraged management buyouts (LMBO) or leveraged management buyins (LMBI). Further, later stage investments can either incur in the form of acquiring a majority or a minority stake in the target company. Additionally there are general partners which are focused on investing in turnaround and distressed cases. In MBOs current managers of the company receive a certain equity share in the company, typically ranging between 1% and 5%, while the majority is

[4] Please refer to Section 4.2 of the thesis for a detailed discussion on how the various performance measures are calculated and interpreted

owned by the private equity fund. In MBIs an external management team receives a certain stake in the company, typically through its network the private equity sponsor finds such teams or individual key persons (see also Wright et al., 1992, p. 48). The underlying thesis exclusively focuses on standard LBOs, which are most common in the German-speaking region.

2.2 Private Equity in the German-speaking Region

Before specifically introducing private equity activity in the German-speaking region a brief introduction of the European private equity market is provided. According to Invest Europe, formerly known as the European Private Equity and Venture Capital Association (EVCA), in 2014 a total of 945 buyouts were initiated with a total volume of €31.3bn. The majority of the latter amount relates to buyout transactions in France and Benelux (31%), followed by UK & Ireland (23%), the German-speaking region (20%), the Nordics (15%), Southern Europe (8%), and Central Eastern Europe (3%). In relative terms buyout investments amounted to 0.209% of the total European GDP in 2014, with Germany trading at 0.195%, Austria at 0.054% and Switzerland at 0.088% of their respective GDP. Not surprisingly, in 2014 only 19% of the total buyout Euro amount invested relates to small and medium sized entities, but measured in number of companies SMEs represent 55%.[5]

While the thesis relates to the entire German-speaking region the majority of buyout transactions analysed was carried out in Germany. Hence, the German market will be introduced in more detail. Especially given that the availability of data is more comprehensive for Germany compared to Austria and Switzerland. Figure 4 presents the development of buyout volume, number of buyouts and average volume per buyout from 1994 to 2014. The information is based on the annual statistics published by the German Association of Private Equity and Venture Capital investors (BVK).[6]

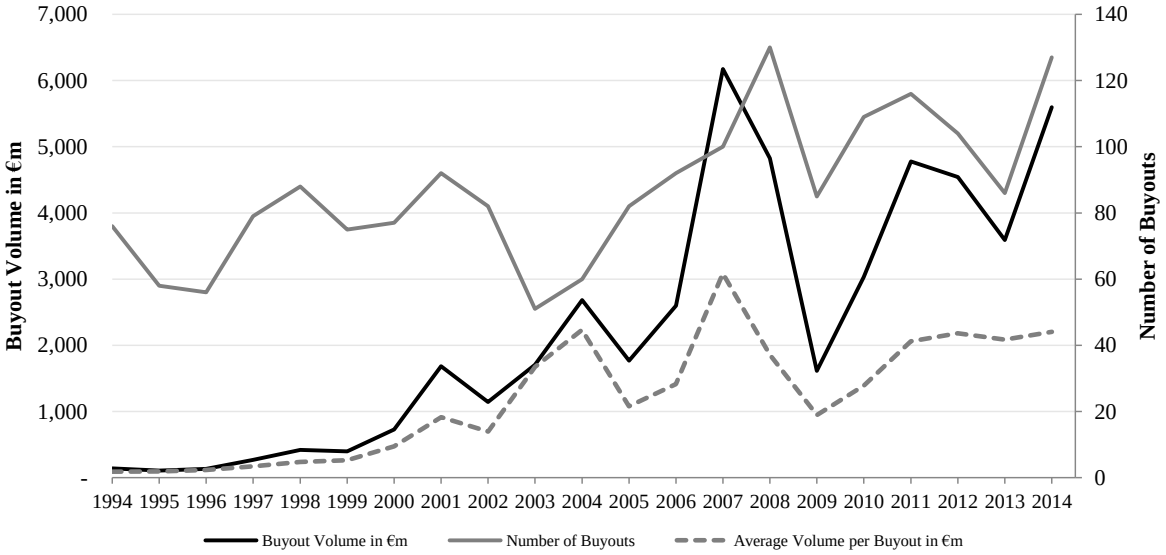
The annual buyout volume (equity investment) increased from €141m in 1994 to €5,597m in 2014, which is equal to a CAGR of 20%. Interestingly one can see the increase in 2000/2001 as well as the peak period from 2006 to 2008 followed by the drop in 2009 as a

[5] For the 2014 annual statistic please refer to http://www.investeurope.eu/media/385581/2014-european-private-equity-activity-final-v2.pdf

[6] Please refer to http://www.bvkap.de/privateequity.php/cat/42/title/Statistiken for the annual statistics. Please note that not all private equity investors doing business in Germany are registered with the BVK, but as the majority is the results represent a good indication.

result of the global financial crisis. Since the buyout market recovered and buyout volume as well as number of transaction have almost reached pre-crisis levels in 2014.

Figure 4: Buyout Activity in Germany



Source: Annual BVK statistics from 1994 to 2014

On average 87 buyouts are initiated per annum with an average volume of €24m. However, the latter figure increased significantly over the last two decades as highlighted by the dotted line in Figure 4. While prior to 2006 the average buyout value amounted to €13m this number increased to €37m in the past 2005 period, with its peak of €62m in 2007. Additionally the graph shows the drop in average buyout prices in 2009 (€19m) followed by a recovery until 2014, which are close to pre-crisis levels. Further the high average volume per buyout transaction (equity ticket) in 2007 suggests that the high prices paid by private equity sponsors were supported by attractive financing conditions obtained prior to the sub-prime crisis.

Following a significant increase with certain fluctuations driven by market shocks, private equity in Germany, as of 2014, has some €40bn in funds available and €39bn of assets under management. In 2014 there were 5,930 portfolio companies (including venture capital) that were either fully or partially owned by private equity funds. In aggregate these companies generated revenues of ca. €178bn and employed approximately 0.9 million people. As will be shown later this translates into ca. 2.4% of total jobs being provided by the private equity industry. Further, in 2014 there were 187 private equity companies (general partners), including venture capital firms, registered with the BVK employing a total of 1,200 investment profes-

sionals.[7] Overall the numbers emphasise the importance of private equity to the economy in the German-speaking region, especially taking into consideration the activity increase since the beginning of the new millennium.

Before discussing the academic interest of the thesis in more depth, deriving the relevant hypotheses for the three research essays and introducing the methodological and theoretical framework applied, a literature review on the most relevant private equity studies conducted so far is provided in the next chapter. Additionally some insights on the historical development of the LBO business model are provided.

[7] All numbers based on previously mentioned BVK statistics.

3 Relevant Literature in Private Equity

When reviewing the history of LBOs, Jensen (1989) states that the business model of LBOs emerged in the late 1980s, when partnerships and merchant banks in the US rediscovered the role active investors played prior to 1940 (p. 63). Talmor and Vasvari (2011) state that wealthy families already provided capital to companies in the 1930s and 1940s and as such the history of private equity as an asset class goes back to the beginning of the 20th century (p. 26). According to Jensen (1989) during the 1930s and early 1940s merchant banks "such as J. P. Morgan and Co. were directly involved in the strategy and governance of the public corporations they helped create"; the banks were a "powerful management force" and served on the boards of major US companies (p. 68). Following certain banking and securities acts as well as the great depression, in the late 1920s and 1930s, the active investor business model disappeared (Jensen, 1989, p. 68).

According to Lowenstein (1985) first US management buyouts can be dated back to the mid 1970s following the stock market decline in 1974, while before 1979 no buyouts with deal values significantly above $100m took place (p. 730). Further evidence of increased public-to-private deals in the US in the early 1980s is provided by DeAngelo and DeAngelo (1987, p. 38), Kaplan (1991, p. 287f) and Kaplan and Strömberg (2008, p. 2f).

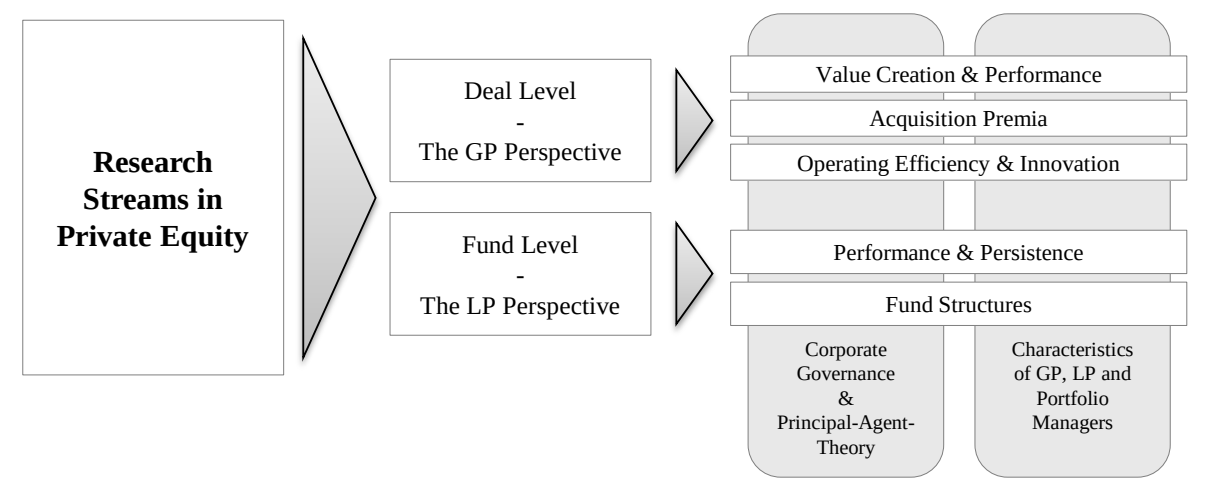
However, in the 1980s the active investor business model was reborn, mainly motivated by inefficient management of public corporations, and was dominated by LBO partnerships, entrepreneurs, merchant banks and family funds (Jensen, 1989, p. 67f). According to Jensen (1989) the inefficiencies of such corporations are explained by the absence of appropriate monitoring systems, the new investors utilised high amounts of debt and equity "to force effective self-monitoring" (p. 69), which is also referred to as the disciplining effect of debt. Through these measures the lost value was recaptured and excess cash was generated, which got distributed to the shareholders. Prior to the entry of these investors management was not incentivised to generate any excess cash to be distributed. Jensen (1989) argues that management preferred to retain high cash balances to be more competitive and attractive on the capital market, even though this destroys value and only the distribution of dividends to shareholder maximises value. Overall, Jensen (1989) summarises that the entry of investors maximises value and helps to overcome the conflict between management and shareholders (p. 69f); this view is supported by Kenneth and Poulsen (1989) who analyse going private transactions (p. 771 f.) as well as Palepu (1990, p. 261) who provides a summary of current re-

search; see also Jensen (1986, p. 320f.). In their case study paper Baker and Wruck (1989) confirm the findings of previous studies in such a way that high levels of leverage lead to an improved performance (p. 189). Cumming and Walz (2010) conclude that the more the GP monitors management, provides advice and incentivises management through convertible financial instruments the higher the return on the investment.

In Europe first buyouts took place at the end of the 1970s and beginning of 1980s, however, these transactions almost exclusively occurred in the UK. First German buyouts were observed in the mid 1980s. The total buyout value, on an accumulated European basis, was relatively low until the late 1980s (Acharya et al., 2007, p. 44f).

Resulting from this increased buyout activity in the late 1980s (Kaplan and Stein, 1989, p. 313; Holmstrom and Kaplan, 2001, p. 123; Strömberg, 2007, p. 31) private equity has become a major field of research over the last 25 years, which mainly arose in the US. Specific research streams have been established, which are summarised in Figure 5 and are discussed in the following. While the sub-research areas at deal and fund level can be regarded mainly quantitative in nature, there is an overlapping research area primarily addressing behavioural aspects, such as the skill sets of various people involved in the investment process. Therefore the latter can be regarded as a more qualitative area dealing with both the fund and the deal level, e.g. principal-agent conflicts between the GP and the LP.

Figure 5: Research Streams in Private Equity



Source: Own illustration

The focus of the dissertation is on value creation and performance on the deal level. Hence, the literature review in Sub-Section 3.1 will focus on this stream. Nevertheless, an

overview of relevant literature at fund level research is provided later in Sub-Section 3.2 to cover the most relevant findings of private equity research in its entirety.

3.1 Deal Level related Literature

This sub-research stream, as highlighted in Figure 5, primarily deals with value creation and changes in operational performance on transaction level, i.e. portfolio company or deal level. Value creation in this context mainly relates to additional value generated by the GP during the holding period of the respective portfolio company, which is analysed on the basis of firm level financials and relevant deal data at entry and exit. In contrast, but being closely related, changes in operating performance examine the development of specific ratios between entry and exit and compare these to benchmark information (Achleitner and Figge, 2014, p. 409). A further area addresses questions on acquisition premia paid at entry, serving as an indicator for value creation potential at company level. Driven by data constraints these studies almost exclusively deal with public-to-private transactions (DeAngelo et al., 1984). Another research stream utilises plant-level physical data, such as Lichtenberg and Siegel (1990), to address questions of changes in operating efficiency under private equity ownership.

The most significant threshold with regard to research conducted in these research streams is the availability of relevant data (Nikoskelainen and Wright, 2007, p. 511), as neither the LP nor the GP is obliged to any disclosure requirements. Due to the constraints in the availability of data there have only been a limited number of studies published so far, addressing the question of value creation and changes in operating performance at deal level. Table 1 provides an overview of key studies published.

It is worth pointing out that early publications almost exclusively relate to the US market, while only since early/ mid 2000 deals in Europe were subject to value creation research. This is in line with the general development/ movement of the LBO business model from West to East over time. With regard to the number of deals analysed in the key studies summarised in Table 1, out of the total of ca. 6,300 deals, which very likely include duplicate deals, approximately 54% and 46% relate to European and North American deals, respectively. The underlying sources of applied deal level data are manifold; while the data of US studies is mainly derived from commercial access databases, the relevant European deal data is primarily collected through proprietary access to PE houses or fund-of-funds. Especially the

lack of publicly available or commercial deal level information in Europe explains why there are only a few studies available with a sample sizes larger than 100 deals.

The first empirical study in this regard is Kaplan (1989), who analyses 76 large US buy-outs by applying post-buyout financial data. He addresses the following four topics by applying applicable sub-samples: (1) Evidence on changes in post-buyout operating cash flows (p. 224-235); (2) wealth increases to investors in management buyouts (p. 235-240); (3) evidence on changes in employment (p. 240-241) and (4) evidence on information advantages and incentive changes (p. 242-250). Following the buyout the companies experienced an increase in operating income and net cash flow, as a percentage of both assets and sales, as well as a reduction in capital expenditure. Compared to the industry median the increases at buyout company level were significantly higher (p. 227-230).

Table 1: Literature Overview – Deal Level Performance and Value Creation

Value Creation and Performance on Deal Level - Key studies

Author(s)	*Year*	*Region*	*Sample/ Deals*	*Period*	*Source(s)*
Puche and Braun	2014	Europe	1,336	1984-2013	Three fund-of-funds databases
Achleitner and Figge	2014	North America/ Europe	2,456	1990-2010	Three fund-of-funds databases
Acharya et al.	2013	Europe	395	1991-2007	McKinsey sample & PPMs
Achleitner, Braun and Engel	2011	North America/ Europe	1,980	1986-2010	Two fund-of-funds databases
Guo, Hotchkiss and Song	2011	US	192	1990-2006	SDC & Deallogic databases; SEC filings
Achleitner et al.	2010	Europe	206	1991-2005	Fund-of-funds database
Groh and Gottschalg	2009	US	133	1984-2004	Sample collected from GPs and LPs
Brigl et al.	2008	Europe	32	2000-2006	Internal BCG study
Nikoskelainen and Wright	2007	UK	321	1995-2004	CMBOR database; IPO prospectuses; Amadeus
Pindur	2007	Europe	42	1993-2004	Various secondary data providers
Loos	2006	US/ Europe	57	1981-2002	INSEAD Buyout Database
Kaplan and Stein	1993	US	124	1980-1989	Scurities Data Corporation's merger database; Morgan Stanley's merger database; W.T. Grimm's Mergerstat Review
Muscarella and Vetsuypens	1990	US	72	1983-1987	WSJ; LBO databases of investment banks
Smith	1990	US	58	1977-1986	Marais, Schipper and Smith (1989); Compustat; W.T. Grimm's Mergerstat Review
Kitching	1989	US/ UK	110	1980-1987	Selected sample based on interviews with sponsors, managers and lenders
Kaplan	1989	US	76	1980-1986	WSJ; W.T. Grimm's Mergerstat Review

According to Kaplan (1989) reduced capex could result from a sample bias, not properly accounting for divestures and acquisitions post-buyout, underspent due to a high debt burden, cash concentration following the buyout or increased efficiency and reduced agency costs.

The latter refers to the assumption that prior to the buyout the company was investing in projects with a negative net present value. He summarises that based on the data available it cannot be concluded whether reduced capex levels are creating or destroying value (p. 229).

With regard to employment changes Kaplan (1989) finds that one year post-buyout employment increased in 50% of the buyout companies, while the median change amounts to 0.9% for all companies. However, adjusting for the benchmark the buyout companies have hired 12% less people than comparable industry companies. Again, due to a lack of information available it is not possible to analyse whether this is driven by reduced wages or divestures (p. 240-241). In light of topics (2) and (4), emphasised above, Kaplan concludes that the increase in value appears to stem from improved incentives "rather than wealth transfers from employees or superior managerial information" (p.251). Leslie and Oyer (2013) also find a higher level of incentives for management at private equity owned companies, their results, however, raise the questions whether these incentives are linked to value creation.

Kitching (1989) investigated 110 US and UK buyouts being roughly split 60% and 40%, respectively. The sample only comprises one fourth of public-to-private deals, while the remainder represents divisional spinoffs (carve-outs), corporate breakups or private-to-private deals (p. 75). Therefore, this study can be regarded as the first study not only including US transactions and additionally not focusing on public-to-private deals only. He compares the operating performance of selected LBOs from entry to three years post the buyout, while key findings are high operational efficiency gains post the buyout, a stable level of employees, significantly higher tax savings for US LBOs and a more aggressive finance structure (compared to UK deals) (p. 77f). Further, Kitching (1989) states that managers contribute on average only 3% to equity while they control for 30%. In terms of personal net worth managers contribute more than 25% on average (p. 75).

Compared to Kaplan (1989) Smith (1990) utilises a slightly smaller sample comprising 58 MBOs between 1977 and 1986. Smith applies similar ratios as Kaplan to measure the changes in operating performance post the buyout, however, he applies EBIT (1990, p. 149) while Kaplan (1989, p. 224) basis his analyses on EBITDA. Additionally he analyses changes in working capital, employees and specific expenses, such as advertising, research and development and maintenance expenses (p. 149 f). In light of changes in operating performance Smith (1990) applies operating cash flows as a percentage of operating assets and employees, respectively. For both ratios, he finds that the industry-adjusted median increase from the pre-

buyout year to the first year post the buyout is significant and not explained by industry trends. Two years post-buyout the increase in the first ratio is still significant at the 10% level, while the change in the cash flow per employee ratio is not significant. The latter two observations are, however, based on smaller sub-samples of 20 and 12 observations, respectively (p. 150 f). In terms of working capital changes Smith (1990) finds that the operating cycle, days from cash-out to suppliers to cash-in by customers, is reduced by one week one year post-buyout and on an industry-adjusted basis by 11 days, both changes are significant. This trend is mainly driven by a reduction of inventory and receivables days (p. 153). As Kaplan (1989), Smith (1990) finds a significant decrease of capital expenditure one year post the buyout. However, changes in advertising, research and maintenance expenses are insignificantly different from zero (p. 154). Similar results are obtained by Opler (1992), who analyses a sample of 44 public-to-private transactions between 1985 and 1989 and finds an industry-adjusted increase in operating profits and operating profits per employee as well as a decrease in capex and income taxes post-buyout (p. 27f).

Muscarella and Vetsuypens (1990) analyse 72 US buyouts that went public between 1983 and 1987, but were previously subject to an LBO, either in the form of a public-to-private transaction of an entire company or a divisional carve-out that was taken private of a listed company. These 72 buyouts cover approximately 5% of total LBOs, in terms of numbers not buyout volume, carried out between 1981 and 1986 and show an average holding period of ca. three years (p. 1391 f). The authors examine possible changes in governance structure following the LBO, restructuring activities after taking the companies private, changes in performance based on various measures by comparing the last financial year before the LBO to the last year before the IPO as well as changes in leverage and value (p. 1393 f). For the latter research focus Muscarella and Vetsuypens (1990) apply sales, gross margin, EBIT margin, net (income) margin, asset turnover and sales per employee (p. 1399-1401). Overall the authors find that divisional LBOs, i.e. carve-outs, outperformed full LBOs in terms of gross and EBIT margin improvements, but not in light of sales growth. Compared to random benchmark companies, derived from Compustat, all LBOs significantly outperformed these companies with regard to operating and EBIT margin improvements. This is not the case for sales growth, net margin development and asset turnover. Further the authors find that for a sub-sample of 26 LBOs the number of employees decreased by 0.6% (median change) between LBO and IPO. This, however, might be subject to divesture activities and does not represent

evidence to "support the conventional wisdom that LBOs threaten workers' employment" (Muscarella and Vetsuypens, 1990, p. 1405).

Muscarella and Vetsuypens (1990) further conclude that LBOs, where no M&A activity occurred during the holding period, show a median increase in employees of 17%, which is higher compared to most (85%) of the random Compustat samples. In addition divisional LBOs show a positive median change of 7.7%, compared to a median decrease of 2.1% for full LBOs, which the authors attribute to higher divesture activities for full LBOs (p. 1405). What is more, the authors find a median market leverage ratio of ca. 93% at entry, which decreases to ca. 79% prior to the IPO. In light of changes in enterprise value a median change of 34.2% is found for all companies, between LBO and IPO, while full LBOs show a lower increase (21.3%) compared to divisional LBOs (37.2%) (p. 1410). The latter is in line with general hypotheses that carve-outs/ divisional LBOs bear the potential of creating more value compared to the acquisition of full companies.

A further relevant paper from the early 1990s, published by Kaplan and Stein (1993), analyses the financing structure of LBOs in the 1980s. The authors argue that while LBOs in the early 1980s generated high returns to all stakeholders, LBOs in the late 1980s were "unsoundly financed" and a larger fraction of these deals were not able to meet their debt service commitments (p. 313). Based on a sample of 124 large buyouts, from the early to the late 1980s, Kaplan and Stein (1993) conclude that prices increased over time while risk did not decrease, debt service payments accelerated, private and bank debt were replaced by public debt and management teams invested less of their personal money (p. 315). In light of post-buyout operational performance the authors find no significant difference between early and later buyouts, this indicates that also later buyouts had room for operational improvement, but pricing and financial structuring plays a significant role for the overall success of buyouts (p. 315). With regard to the impact of leverage on pricing in buyouts Axelson et al. (2013) analyse a sample of 1,157 international transactions between 1980 and 2008 and find that deal leverage is driven by changing debt market conditions and negatively related to fund returns (p. 2264).

Loos (2006) analyses 57 European and US deals retrieved from the INSEAD Buyout Database and breaks down the equity internal rate of return into various value drivers, being revenue growth, EBITDA margin effect, multiple expansion and leverage effect. However, due to data constraints with respect to multiple information, the latter two value drivers are ana-

lysed in aggregate. He finds that leverage and multiple expansion contribute 83%, sales growth 25% and EBITDA margin -8% to overall value. Moreover, Loos (2006) finds a mean sample IRR of 78.2% (p. 210).

On the basis of various sources, such as M&A databases or IPO prospectus, Pindur (2007) constructed an initial sample of 73 deals, which was reduced to a final sample of 42 realised transactions (p. 163). With regard to the exit channel the latter comprises 14 secondary buyouts and 28 IPOs. Worth mentioning, in light of the underlying thesis, is that his sample comprises eight Swiss and two German deals (p. 164). Main performance results are a mean and median IRR of 83.0% and 57.6%, respectively (p.240), while all deals outperformed the DJ Stoxx index on mean and median level by 80.2% and 49.7%, respectively (p. 251). When it comes to value creation and the individual value drivers Pindur (2007) finds an average times money (TM) multiple of 2.25x and 1.94x on mean and median level, respectively. EBITDA growth contributes ca. 45% to TM, while the free cash flow effect contributes ca. 22%, multiple expansion ca. 28% and the mix effect the remaining 5% (p. 236). Overall Pindur (2007) concludes that EBITDA variation, and thus the operational driver, "is by far the most important single component" (p. 257).

One of the first comprehensive studies with regard to buyout performance in the UK was conducted and published by Nikoskelainen and Wright (2007), who analyse 321 exited deals in the UK between 1995 and 2004. Their research focus is the impact of corporate governance mechanisms on value increase and return characteristics with the main finding that significant, but below majority, management ownership is positively related to value creation. The buyout sample applied shows and average enterprise and equity IRR of 22.2% and 70.5%, respectively, while IPO exits are performing better compared to trade sales and secondary buyout exits. Furthermore, at a threshold of GBP100m the authors find that larger deals show a better performance in terms of IRR (p. 536). Further the authors find that for mid-sized buyouts leverage is positively related to value increase, but not to higher equity returns. For large buyouts they find that leverage negatively impacts equity returns (p. 537).

Applying a relatively small sample of 32 buyouts, between 2000 and 2006 in Europe, Brigl et al. (2008) split the gross IRR of 48% into its individual value driver components and find that sales increases contribute ca. 46%, margin improvements ca. 10%, multiple expansion ca. 21% and de-leverage ca. 23%. Hence, less than a quarter of the overall value is attributable to financial engineering efforts undertaken by the PE at entry, while 56% are at-

tributable to operating measures. The authors conclude that there has been a shift away from leverage to operational improvements as the main value driver (p. 10).

In a more recent US study Groh and Gottschalg (2009) analyse 133 transactions conducted by 41 different PE houses over a 20 year horizon from 1984 to 2004. Their sample shows a mean and median IRR of 50% and 36%, respectively, being reported gross of all fees (p. 8). Based on the S&P 500 the authors construct mimicking portfolios, accounting for the operating and financial risk profiles, and derive opportunity costs of capital. Taking into account various financing assumptions they show that PE returns are ca. 3.3% below the average returns of the S&P 500 (p. 21).

In their study Achleitner et al. (2010) analyse the value drivers of 206 buyouts, based on the database of a leading European fund-of-funds, while the majority of deals (44%) is from the UK and only 6% are attributable to Germany (p. 19). It is explicitly differentiated between operational and financial risk, the authors argue that previous studies, as Brigl et al. (2008) and Pindur (2007), did not quantify the impact of debt on the return to equity holders and therefore erroneously considered debt repayments as the leverage effect. The study enhances the value creation methodology, which is also applied in the underlying thesis and distinguishes between leverage effect, EBITDA growth, Free-Cash-Flow (FCF) effect and multiple effect as the relevant value drivers (p. 18). In their sample Achleitner et al. (2010) find an average and median IRR of ca. 43% and 33%, respectively, while value creation for the purposes of the study is measured in the form of the times money multiple as it represents the measure of actual value created from the perspective of the private equity investor. The latter amounts to 2.5x and 1.8x for all deals on mean and median level, respectively.

The authors find that 46% of total value creation is attributable to operational improvements, EBITDA growth and FCF effect, while only 32% are driven by financial leverage. The multiple expansion effect accounts for 18% and mix effects for the remaining 4%. Further, EBITDA growth is mainly driven by sales growth (79%) and margin improvements account for 26%, being slightly offset by a negative combination effect of -5% (p. 21). What is more, separating the sample based on transaction size Achleitner et al. (2010) find that larger LBOs (>€100m in EV) show a statistically significant higher contribution of leverage to overall value creation and a statistically significant higher value creation on a levered TM basis, both measured at median level. The authors obtain similar results by dividing the sample in the

pre- and post-dot-com-period, i.e. before and after 2001. Moreover, the authors find that PE deals are performing better in times of recession compared to growth years (p. 22 f).

Guo et al. (2011) apply a sample of 192 US buyout transactions between 1990 and 2006 and conclude that these deals are more conservatively financed compared to LBOs in the 1980s. Moreover the authors find that gains in operating performance are either comparable or only trading slightly above their industry benchmarks, while the LBOs overall still show high returns (p. 516).

One of the most comprehensive studies in terms of numbers of deals published to date, was conducted by Achleitner et al. (2011) based on the databases of two European fund-of-funds. The sample comprises a total of 1,980 deals from Europe and North America, out of which 1,090 are realised. The median equity IRR of the realised sub-sample amounts to 26%, while the unrealised median equity IRR amounts to 10%. The sample itself is diversified in terms of regions, fund managers and deal size; further the types of entry and exit channel are known. In a multivariate regression setting the authors analyse the impact of various independent and control variables on the equity IRR as the relevant dependent variable (p. 155 f). Further multivariate regressions are performed on leverage (debt/EBITDA) as well as pricing (EV/EBITDA) at entry and exit (p. 159 f). Achleitner et al. (2011) find positive and significant evidence that sales growth, margin improvement, multiple expansion and leverage drive equity returns. Disregarding the independent variables and only focusing on the selected control variables the authors find that deal size and the MSCI annual returns are statistically significant in explaining equity returns to investors. With regard to pricing, as the relevant dependent variable, it is concluded that industry-specific multiples as well as leverage positively impact LBO pricing at entry, leverage in turn is positively impacted by the experience of fund managers (p. 159). Finally the authors find a positive impact of sales growth on pricing at exit, which supports the view that PE managers aim at moving the portfolio companies "into higher multiple classes by increasing their size" (p. 162).

Another recent comprehensive study in terms of number of deals analysed was published by Achleitner and Figge (2014), who had access to the databases of three fund-of-funds covering a total of 2,456 transactions in Europe and North America, being approximately split 73% and 27%, respectively. The sample shows a gross median IRR of 29% and a cash multiple of 2.72x. In the interest of the underlying thesis it has to be pointed out that the sample includes a total of 236 transactions in the DACH region (p. 413). The focus of the study is on

the value creation of secondary buyouts, which are compared to the lemons in the used car market according to Akerlof (1970). The overall sample includes 448 (18.2%) buyouts with a financial sponsor as the acquiring party. For both types of buyouts, financial and other, the authors find no significant difference in EBITDA growth, but the underlying drivers are significantly different between these two types of buyouts. Financial buyouts show a higher sales growth, while margin expansion is higher with other buyouts (p. 418).

What is more, in terms of debt/EBITDA the authors find significantly more leverage for financial buyouts, but no differences in debt-to-equity ratios. In addition financial buyouts are significantly more expensive than other buyouts measured through EV/EBITDA multiples at entry. In terms of IRR no significant difference is found, on median level other buyouts (29%) are trading slightly below financial buyouts (30%). Achleitner and Figge (2014) constitute that higher prices at entry are getting offset by gains from higher leverage, which results in similar equity returns. The latter is tested in a multivariate setting, which mainly confirms the results of the univariate analyses (p. 420 f). The authors find that secondary buyouts compared to primary deals obtain more leverage of between 28% and 30%, while at the same time financial buyouts are 6% to 9% more expensive than other buyouts. It is concluded that secondary buyouts are "by no means second-rate deals" as they still show returns and operating improvements comparable to other buyout types (p. 431).

Acharya et al. (2013) analyse a sample comprising of 395 European buyouts including detailed information on the cash flow pattern, deal data at entry and exit as well as operating and financial measures of the portfolio company. For benchmarking purposes data of 7,000 publicly listed peers is collected and ICB-based sector indices are constructed (p. 375). Even after winsorising the sample the authors find a mean (median) gross IRR of 56.1% (43.2%), a mean cash multiple of 4.4 (3.0). Further the authors find that the debt/equity ratio as well as the debt/EBITDA ratio between entry and exit decreased significantly at the 1% level, while the EV/EBITDA multiple and the deal size increased significantly at the 5% and 1% level, respectively (p. 376). Acharya et al. (2013) measure the abnormal unlevered performance of their buyout sample compared to public sector benchmark portfolios and find 19.8% (15.4%) outperformance on average (median), which is significant at the 1% level (p. 382). Over time abnormal performance declines, however, even in years where the sector did not perform well the authors still find outperformance of the PE deals (p. 384).

In a next step Acharya et al. (2013) analyse whether "abnormal financial performance is related to abnormal operational performance", whereas the latter can either be measured as EBITDA growth during or post ownership, both ratios are calculated relative to the sector. The authors start with comparing the change in deal sales and EBITDA margin, between year one and year two prior to entry, with the same changes for the sector and find no statistically significant differences. With regard to changes during ownership the authors find that sales increase significantly but do not outperform the sector. In light of EBITDA margin and multiples the improvements are statistically significant and both ratios outperform the market. The latter also applies when analysing organic and inorganic deals separately (p. 388).

In a multivariate setting the authors analyse the drivers of abnormal performance by applying above sector deals' sales growth, EBITDA margin growth and multiple growth as the relevant independent variables. They find that EBITDA margin and multiple growth are significant determinants of abnormal deal performance, i.e. "a change in either measure has a positive and economically meaningful impact on abnormal performance" (p. 390).

The authors further analyse whether characteristics of the deal partner impact the performance of buyouts and find that deals with ex-consultants or ex-industry managers in the lead outperform in terms of value creation, while those deals with ex-accountants or ex-bankers mainly focus on a buy-and-build approach (p. 392f). Similar to the latter research focus Kaplan et al. (2012) analyse CEO characteristics and their impact on corporate performance. In a different study Acharya et al. (2009b) interview 20 executive board members who have served on PE and Public Limited Company (PLC) boards (p. 46); they find that PE boards are focused on value creation while PLC boards primarily put their attention to governance and compliance issues (p. 50).

Puche and Braun (2014) analyse a European sub-sample of 1,336 buyout transaction obtained from limited partners. They find a median IRR of 35% and a median money multiple of 2.5 (p. 27). In terms of mean value creation drivers the authors find that 30% and 70% are attributable to leverage and operational drivers, respectively (p. 29). The latter decomposes into 37% EBITDA growth, 13% free cash flow effect, 15% multiple expansion and 6% mix effect (p. 29). Puche and Braun (2014) apply the comprehensive approach suggested by Achleitner et al. (2010), which will also get introduced and will be applied later in the underlying thesis.

Please refer to Table 2 for a summary presenting the main results of recent studies relating to deal level value creation and performance. The table comprises the same studies as already presented above in Table 1.

Table 2: Recent Studies – Deal Level Performance and Value Creation

Value Creation and Performance on Deal Level - Main results		
Author(s)	*Year*	*Result*
Puche and Braun	2014	Median IRR of 35% and money multiple of 2.5x. Value creation drivers: 30% leverage effect and 70% operational with 37% EBITDA growth, 13% FCF effect, 15% multiple expansion and 6% combination effect (mix)
Achleitner and Figge	2014	Median IRR of 29% and cash multiple of 2.7x for realised transactions; EBITDA growth between financial and other buyouts not significantly different, but financial buyouts show higher sales growth and lower margin improvements
Acharya et al.	2013	Median IRR of 43%; cash multiple of 3.0x; 15.4% median outperformance; EBITDA and multiple growth of deals outperform sector and are significant drivers of abnormal deal performance
Achleitner, Braun and Engel	2011	Median IRR of 26% and cash multiple of 2.5x for realised transactions; sales growth, margin improvement, multiple expansion, deal size and leverage drive equity returns; positive relation between sales growth and pricing at exit
Guo, Hotchkiss and Song	2011	Comparable performance or slighlty outperformance of PE deals compared to benchmarks firms
Achleitner et al.	2010	Median IRR of 33%; money multiple of 2.8x; value drivers are 32% Leverage, 31% EBITDA growth: 79% sales growth and 21% margin improvement, 15% FCF effect, 18% multiple expansion; 4% mix
Groh and Gottschalg	2009	Median IRR of 36%; Opportunity cost of capital of buyouts are on average 3.3% below S&P 500 returns
Brigl et al.	2008	Average IRR of 48% is driven by 46% sales growth, 10% margin improvements, 21% multiple expansion and 23% de-leverage
Nikoskelainen and Wright	2007	Average equity IRR of 71%; Larger deals show higher returns; For large buyouts leverage negatively impacts equity returns; IPO exits perform better compared to trade sales and secondaries
Pindur	2007	Median IRR of 58%; outperformance of 50% (median) compared to DJ Stoxx; Value drivers: EBITDA growth 45%, FCF 22%, multiple expansion 28% and mix 5%
Loos	2006	Average IRR of 78%; Value drivers: 83% leverage effect and multiple expansion, 25% sales growth and -8% negative margin effect

The literature review conducted above reveals that the various samples analysed in recent studies vary significantly. In terms of median IRR the results range between 26% and 58%. In light of abnormal performance of PE deals, compared to relevant benchmarks, Acharya et al. (2013) find a 15.4% PE outperformance, while Pindur (2007) even finds an outperformance of 50%. In contrast Guo et al. (2011) conclude that PE deals are either performing on benchmark level or only slightly exceeded benchmark performance. With regard to value creation drivers Achleitner et al. (2010) and Brigl et al. (2008) find that financial engineering efforts i.e. leverage, only contribute 32% and 23%, respectively, to overall value creation. Main drivers are operational improvements.

This section introduced the major contributions when it comes to value creation and performance on the deal level. As pointed out there are various additional research studies in

light of effects of private ownership on certain ratios or other performance measures. Jensen et al. (1989) or Kaplan (1989) focused their work on tax effects following a buyout. Jensen et al. (1989) analysed the effect on tax revenues collected by the US Treasury following a buyout and find that revenues have increased as additional taxable capital gains overcompensated the tax benefit from higher debt levels or forgone dividend payments (p. 16). Kaplan (1989) in contrast summarises that tax benefits are an important source of wealth gains (value creation) in buyout transactions (p. 630).

Additionally there are several studies addressing selective research topics (only partially relevant to this thesis), introducing all these additional research fields in detail would be out of scope. However, for completeness and to give a brief overview some of these niche areas are introduced in the following.

Cotter and Peck (2001) analyse the role of buyout specialists in light of debt structuring and find that if the majority of equity is owned by the GP the buyout's default risk gets reduced (p. 147). Harris et al. (2005) apply a sample of UK management buyouts and corresponding plant-level data to analyse productivity developments following the buyout. They find that the company's resources get utilised more efficiently post the buyout (p. 148f). Krohmer (2007) applies 712 private equity and venture capital investments to analyse whether the experience of investment managers has an impact on the follow-on investment decision for loss making portfolio companies. He finds that more experienced managers invest a lower share of the fund, hold the loss-making company for a shorter period and tend to invest lower amounts in light of follow-on investments (p. 23).

Further, Lopez-de-Silanes et al. (2015) set their research focus on structural questions as the size of a GP or the timing of investments. Even though they do not specifically analyse operating performance drivers on the deal level it is worth mentioning their study as they had access to some 11,700 deals (7,453 in the working sample) carried out globally between 1973 and 2005, which were collected from PPMs provided by several LPs. Overall the authors find a median IRR of 21% and the sample includes 259 German deals with a median IRR of 25% (p. 386).

Another niche area deals with shareholder premiums in the case of public-to-private buyouts. Renneboog et al. (2007) find that pre-transaction shareholders in the UK receive an average premium of 40%, which mainly stems from an undervaluation of the company, tax-

shield effects as well as incentive realignment (p. 593). Another study conducted by Officer et al. (2010) is dedicated to the characteristics of club deals, they find investors to receive approximately 40% lower premiums compared to sole-sponsored LBOs.

Lerner et al. (2011) analyse the patent activity of 472 leveraged buyouts to measure innovation under private equity ownership. They find no significant changes in the level of patenting, but that firms tend to focus on specific areas after ownership.

3.2 Fund Level related Literature

In contrast to the previous section the fund level research stream mainly ignores the performance on the portfolio company level, but rather focuses on the overall performance and return characteristics of entire private equity funds. The main sub-research area is the performance persistence of private equity funds as highlighted below. Another sub-area addresses research questions with regard to fund terms negotiated between LP and GP. Please refer to Table 3, which summarises some of the main fund related research contributions that have been published over the last decade.

Ljungvist and Richardson (2003) obtained data for 73 private equity and venture capital funds with vintage years between 1981 and 2003 from one limited partner including the complete cash flow patterns of all private equity investments. Venture capital funds account for approximately one-quarter in terms of number of funds, but only for ca. 15% in terms of fund capital (p. 7). The majority of their funds (91%) are based in the US, while 7% are based in Europe and 2% in Latin America. In addition to cash outflows upon entry and cash inflows upon exit, the cash flow pattern shows management fees paid by the LP to the GP, which traded between 1% and 2% of committed capital. Carried interest cannot be seen from the cash flow numbers as realised proceeds of an investment are generally transferred on a net basis. Additionally, the obtained cash flow numbers include dividends paid and interest payments if cash is held by the GP prior to making the investment. Overall the authors find a mean (median) IRR of 19.8% (18.7%) for all 73 funds and an average outperformance of 3% to 8% depending on the benchmark index (S&P 500 or Nasdaq) and the applied investment assumption (p. 37). Furthermore the authors find that it takes over three and six years to invest ca. 57% and 91% of committed capital (venture and buyout funds together), respectively, and, most important, over ten years for the IRRs to turn positive and outperform the selected benchmark index.

Table 3: Literature Overview – Fund Level Performance

Private Equity Research on the Fund Level - Key studies				
Author(s)	*Year*	*No. of funds*	*Period*	*Result*
Stoff and Braun	2014	210	1989-2012	Mean (median) management fees of 1.85% (2.00%) of committed capital. Carried interest and hurdle rates remain stable over time at 20% and 8%, respectively
Harris et al. (2014b)	2014	1,459	1984-2008	For the 607 buyout funds they find an average IRR of 11.9% and a PME of 1.26. For 852 VC funds IRR trades at 12.5% on average and PME at 1.28
Stucke	2011	96/ 64	1980-1995	For the sub-sample of 96 (64) liquidated US buyout funds as of December 2009 (December 2001) he finds a PME of 1.10 (1.09) with the S&P 500
Phalippou and Gottschalg	2009	852	1980-1993	Aggregated IRR of 15.5% and an underperformance of ca. 2.3% (net of fees) compared to the S&P 500, whiule the underperformance for VC funds (2.5%) is higher compared to buyout funds (1.8%)
Kaserer and Diller	2005	200/ 262	1980-2003	Mean (median) IRR of 12.7% (9.1%) with an outerperfromance in terms of excess IRR over the MSCI-Euope of 4.5% (0.6%), but an underperformance if benchmarked via the public market equivalent
Kaplan and Schoar	2005	746	1980-2001	Mean (median) IRR of 17% (12%) and a slight underperformance of fund returns (net of fees) compared to the S&P 500. Gross of fees and carried interest there is an outperformance of funds compared to the market
Ljungqvist and Richardson	2003	73	1981-2001	Mean (median) IRR of 19.8% (18.7%) with an average outperformance of between 6% to 8% compared to the S&P 500 and 3% to 6% compared to the Nasdaq Composite

One of the main contributions when it comes to fund level performance was published by Kaplan and Schoar (2005), who analyse a dataset comprising of 746 venture capital and private equity funds obtained from Venture Economics. For each fund the sequence number as well as quarterly performance figures and cash flows, net of management fees and carried interest, are available, either for the life of the entire fund or through the end of 2001 (p. 1794). Out of the 746 funds, which are regarded to be mainly liquidated, 577 are venture capital and 169 are buyout funds. 41% of all funds are first-time funds, 23% second-time and 14% third-time funds, the remaining 22% show higher sequence numbers. The authors benchmark the net fund performance to the S&P 500 by calculating a public-market equivalent (PME) and find a slight average underperformance of fund performance compared to an investment in the S&P 500, which applies to both, venture capital and buyout funds (p. 1798). However, gross of fees they find an outperformance compared to the S&P 500. Further Kaplan and Schoar (2005) find variations in terms of IRR and public market equivalent (PME) with regard to the 25^{th} and 75^{th} percentile and show IRRs for the entire sample of realised funds ranging between 3% and 22%, respectively. What is more, the authors find a strong return persistence for their sample funds and that returns increase with the GP's experience as well as with fund size (p. 1821).

Kaserer and Diller (2005) start with a sample comprising of 777 European funds between 1980 and 2003, which they obtained from the European Venture Capital and Private

Equity Association (EVCA) as well as through Thomson Venture Economics. As only 95 of these funds are fully realised, applying the net asset value of the remaining funds could create a positive sample selection bias, hence a modified approach is applied, which only considers those funds with NAVs that are not higher than 10% (20%) "of the undiscounted absolute sum of all previously accrued cash flows" (p. 110). This approach adds 105 (167) additional funds to the 95 fully realised funds and leaves the authors with a sub-sample of 200 (262) funds. The extended sample of 200 funds comprises 101 venture capital and 99 buyout funds. The authors find a mean (median) IRR of 12.7% (9.1%) and an average outperformance of 4.5% (0.6%) compared to the MSCI -Europe. In terms of PME they find a mean (median) underperformance of 0.96 (0.82).[8] The results of the excess IRR and PME analysis contradict for their sub-sample of 200 funds. This is why the authors conclude that any IRR figure does not represent a suitable measure of fund performance as it only relates to the opportunity costs of a given project expressed in terms of an interest rate, but is no return figure per definition. Therefore Kaserer and Diller (2005) argue that the public market equivalent represents the appropriate measure to compare results among funds (p. 113). Further the authors benchmark fund performance by calculating a bond market equivalent (BME); not surprisingly an outperformance of 1.2 (1.0) results as one would expect returns on the bond market to be lower compared to the public equity market. Finally the authors analyse performance persistence by building winner and loser portfolios based on the median IRR. The better half joins the winner portfolio while the lower performing half joins the loser portfolio. This is repeated for all subsequent funds available. They find significant evidence for the so-called persistence phenomenon, being that winners tend to stay winners and losers remain losers (p. 116).

In their paper on the performance of private equity funds Phalippou and Gottschalg (2009) utilise a similar sample as applied by Kaplan and Schoar (2005). For their base sample of 852 funds they find an average underperformance (alpha) of ca. 2.3% p.a. compared to the S&P 500 (p. 1756). However, 616 funds out of the entire sample are venture capital funds which show an underperformance of 2.5% p.a., while for the 236 buyout funds the underperformance trades at ca. 1.8% p.a. (all mean values). All findings are net of fees.

In a more recent study Stucke (2011) sheds light on previous research conducted which was based on the Thomson Venture Economics database, mainly Kaplan and Schoar (2005)

[8] The PME model will get introduced later in detail. However a PME below one is equal to an underperformance of the stock market which is chosen for calculation purposes.

and Phalippou and Gottschalg (2009), and points out certain anomalies with regard to this data source: (1) he finds that even 15 to 16 years after the funds' inception with vintage years in 1994 net asset values are still "unusually high", they amount to ca. 36% of aggregated drawdowns, and (2) this is underpinned by a high Residual Value to Paid-in Capital (RVPI) ratio compared to other databases. Stucke (2011) finds that 211 (43%) out of 488 buyout funds show constant net asset values and do not show any cash flow activity for at least two years prior to the 2009 year-end and he therefore concludes that the majority of fund data has not been updated over time (p. 10). In a next step he analyses the impact of these incomplete 211 funds on the overall fund performance and finds no special characteristics of these funds and therefore concludes that they "represent a random drawing from the full sample" (p. 14).

In order to further investigate on this issue Stucke (2011) collected fund performance data from LPs and was able to identify 140 out of the 211 incomplete funds by means of fund size, vintage year and finally interim performance data as a unique identifier (p. 15). He finds that the IRRs reported by Thomson Venture Economics and those calculated from the LP's data differ significantly at the 1% level, i.e. stem from different populations, while the TVE data shows a downward bias. He further proves that the 140 identified funds represent a random drawing from the 211 incomplete funds. In a final step Stucke (2011) replaces these 140 funds and eliminates the remaining 71 funds with no data points available. In contrast to Kaplan Schoar (2005) and Phalippou and Gottschalg (2009), Stucke (2011) finds a clear outperformance of private equity fund performance over the S&P 500 measured in terms of the public market equivalent.

In general Harris et al. (2014b) find an outperformance of buyout funds over the S&P 500 (p. 1852), which trades at approximately 3% according to Harris et al. (2014a). More explicitly, they raise the question whether performance persistence of buyout and venture capital funds has persisted (for post-2000 funds) by analysing data of 1,459 funds obtained from 200 institutional investors via Burgiss.[9] The authors point out that prior research mainly focused on the persistence of pre-2000 funds, they confirm the results of strong persistence for buyout and venture funds, but shed more light on persistence for post-2000 funds. The sample comprises of 607 buyout and 852 venture capital funds, for 285 buyout and 436 VC funds the authors have sufficient data points to analyse performance persistence. In order to analyse per-

[9] Burgiss provides record-keeping and performance monitoring services to various clients, including institutional investors (Harris et al., 2014b, p. 1).

sistence current fund returns are sorted by the quartile of performance of the previous fund. In a multivariate setting Harris et al. (2014b) find that post-2000 "top quartiles funds do not significantly outperform any of the other quartiles", while the top quartile pre-2001 vintage year funds statistically significantly outperformed the 4th quartile and first time funds (p. 19). Hence, the authors find for buyout funds that persistence has mainly disappeared post 2000, while they still find a statistically significant persistence in performance for venture capital funds post 2000. They still find that post-2000 fund performance of a current fund is significantly related to its predecessor, however, this relation is weaker compared to the pre-2000 period. The authors conclude that one explanation for the question why such funds are still in the position to raise sufficient capital for the follow-on fund is the fact that LPs do not know the final performance of the current fund at the time they commit the capital for the successor fund.

In contrast to the previous studies mainly focusing on performance Stoff and Braun (2014) analysed the compensation schemes between GPs and LPs by means of fund terms obtained for 210 funds (p. 68). They find a mean (median) management fee as a percentage of committed capital of 1.85% (2.00%), while over time this percentage decreased from 2.00% pre 2001 to 1.57% between 2001 and 2003 and increased to 1.75% between 2004 and 2007 and finally back to 2.00% post 2007 (all median values). Interestingly carried interest and hurdle rates traded at 20% and 8% (median), respectively, regardless of the time period under review. The authors find that management fees decrease with an increasing fund size, i.e. an increase in fund size by 100% reduces management fees by 0.16 percentage points (p. 71). Overall Stoff and Braun (2014) conclude that fund terms have not significantly changed over time, however, they observe slightly lower management fees the greater the fund and believe that increasing the carry and reducing the management fee, as done by Bain in their recently raised fund, could represent the new fund term market practice between LP and GP. This is because on a net level GPs would have similar compensation levels, while the emphasis is put on the variable component. Hence, those GPs being confident in signalling and able to generate above market returns do not have to fear lower management fees (p. 74). In line with the previous study Robinson and Sensoy (2013) analyse how management fees and carried interest are linked to fund performance and find both being unrelated to net cash flow performance (p. 2796).

The literature review at deal and fund level revealed that the various results obtained differ significantly in terms of overall returns or abnormal performance. However, with regard to certain drivers of deal performance or in light of performance persistence on the fund level similar results were obtained. A reason for discrepant results could be constraints in the availability of data and sample selection biases. Further the review revealed that the regional focus of the individual studies was either on European, US, North American or UK buyouts, as well as a combination of these regions. Hence, there is clearly a lack of research conducted when it comes to historical buyout performance in specific countries or regions. To the best of the author's knowledge there has been no study performed yet which addresses buyout performance and value creation related research questions explicitly focusing on the German-speaking region, i.e. the DACH region. Therefore, in the next section the academic interest of such studies is defined and relevant hypotheses are derived as well as the methodological approach applied is introduced.

4 Academic Interest and Theoretical Background

Over the last two decades the private equity industry has become an important element of the economy in the German-speaking region. Focusing on Germany the latter statement finds evidence when reviewing the annual statistics published by the German Association of Private Equity and Venture Capital investors (BVK), especially when comparing key metrics between 1995 and 2014 as presented in Table 4.[10]

Table 4: BVK Statistics – Key Metrics 1995 vs. 2014

The table shows key metrics derived from the annual BVK statistics relating to both, venture and buyout funds. Pure buyout metrics cannot be retrived from these statistics, except for Euros invested as shown in the last row.

Annual German BVK statistic - 1995 vs. 2014*

Metric	*1995*	*2014*	*Change*	*CAGR*
Private Equity professionals	365	1,200	229%	6%
Requests for investment	10,200	44,500	336%	8%
Available funds (€ in bn)	4.44	40.01	801%	12%
Investments in year (€ in bn)	0.54	7.06	1218%	15%
Number of portfolio companies/ investments	2,990	5,930	98%	4%
Assets under management (€ in bn)	2.86	39.42	1280%	15%
Annual revenues of portfolio companies (€ in bn)	40.21	178.20	343%	8%
Employees of portfolio companies	282,471	900,400	219%	6%
Buyouts as a % of total Euros invested	20%	79%		

* Financials for 1995 were stated in Deutsche Mark (DM) and were transferred to Euro amounts by multiplying with 0.51 based on the official exchange rate of 1EUR = 1.95583DM according to the German federal Ministry of Finance

In 1995 private equity invested some €540m in Germany, this number increased to some €7.1bn in 2014. So did assets under management, which increased from €2.9bn in 1995 to €39.4bn in 2014. In light of the importance of buyouts, Table 4 highlights that only 20% of the total Euro amount invested related to such in 1995, while this number increased to 79% in 2014. The latter is in line with Acharya et al. (2007) who state that the European buyout volume was relatively low until the late 1980s (p. 44f). In aggregate approximately 900k people were employed by German portfolio companies owned by private equity funds in 2014. According to the German Federal Statistical Office there have been a total of 38,306k employed

[10] Please refer to http://www.bvkap.de/privateequity.php/cat/42/title/Statistiken for the annual statistics. Statistics are available from 1994 onwards. However, as the buyout sample starts in 1995 this is reflected in the table accordingly.

persons in Germany in 2014.[11] As shown in Table 4, 900,400 people were employed by portfolio companies; this translates into ca. 2.4% of all jobs in Germany being provided by the private equity industry, under the assumption that all people are being employed in Germany.

The importance of buyouts in Germany has increased significantly over the last two decades, so did the contribution of private equity portfolio companies to the German economy. A major characteristic of the German-speaking economy, including Germany, Austria and Switzerland, is the importance of small and medium-sized enterprises (SMEs), which represent the backbone of the economy and are very attractive targets for PE investors. In addition, another key characteristic of this distinct region, especially in contrast to Anglo-Saxon countries, is the two tier governance system, which, in comparison to the one-tier system, aims at avoiding conflicts of interest and power concentration by having an executive and a supervisory board at the same time. These two different structural and regulatory characteristics in this region, together with the increasing importance of private equity activity, require a stand-alone analysis of LBO activity in this distinct economic region.

Given these facts and the lack of research conducted the underlying thesis presents empirical evidence with regard to buyout returns, value creation drivers of buyouts as well as operating performance drivers of buyouts during private equity ownership in the German-speaking region.

The following sub-sections address the relevant research questions and derive the corresponding hypotheses. Moreover, the applied methodological framework is introduced.

4.1 Research Questions and Derivation of Hypotheses

The research interest of the underlying thesis is to shed more light on leveraged buyout transactions in German-speaking countries with a distinct focus on deal related rather than fund related questions. The literature review conducted in the preceding section revealed that there is a lack of research conducted when it comes to performance and value creation drivers of buyout transactions in German-speaking countries as a distinct economic and cultural region. To achieve the goal of contributing to this research gap the main body of the thesis is divided into three parts, which is reflected by three separate research essays. However, the

[11] Please refer to the German Federal Statistical Office: https://www.destatis.de/DE/ZahlenFakten/GesamtwirtschaftUmwelt/Arbeitsmarkt/Erwerbstaetigkeit/TabellenErwerbstaetigenrechnung/ArbeitnehmerWirtschaftsbereiche.html

underlying data base applied is identical. Differences in the underlying data are explained where necessary. To provide an overview, in the following these three parts are introduced separately and the relevant research questions and hypotheses are derived accordingly.

Part I: Value Drivers in Buyout Transactions:

Firstly, the essay aims to analyse value creation at the deal level and decompose the overall value generated over the holding period into its individual drivers by differentiating between financial and operational drivers. Secondly, this first part aims at benchmarking the overall performance of buyout transactions with public companies in order to analyse a potential abnormal financial and operational performance of buyout deals over public peers in the German-speaking region. The latter requires the calculation of certain return measures and the calculation of equivalent value drivers (compared to the buyouts) for the public peers to assess a potential abnormal performance and find the corresponding drivers. Furthermore, this first part aims at analysing differences in value creation and potential abnormal performance for exited buyouts pre and post the global financial crisis of 2008. Finally, it is the goal to analyse whether value creation and private equity returns, on the deal level, differ by type of exit channel chosen by the GP. From the above two key research questions result:

Research question 1.1: What are the most relevant deal level drivers of the value generated in private equity buyout transactions in the German-speaking region?

Research question 1.2: Is there an abnormal financial and/ or operational performance of private equity buyout transactions compared to public benchmark companies in the German-speaking region? Further, do value drivers change and abnormal performance levels differ when analysing buyouts pre vs. post the financial crisis of 2008 and by type of exit channel chosen?

To address these two research questions more specific hypotheses are derived in the following. In line with prior findings, as discussed in the deal level literature overview on value creation, it is expected that leverage represents a significant portion of value creation. However, operational drivers are expected to contribute more to overall value generation. In light of operational improvements it is expected that GPs cannot realise EBITDA growth by margin improvements only, hence, sales growth is expected to additionally contribute to value generation. Based on this the following three hypotheses result:

Hypothesis 1.1: Operational improvements contribute significantly more to the overall buyout value generated than financial engineering efforts.

Hypothesis 1.2: EBITDA growth over the holding period does not solely stem from margin improvements.

Hypothesis 1.3: Given the private equity business model de-leverage is a main driver of value creation.

Related to research question 1.2 it is expected that the public peer companies show a lower degree of leverage at entry than buyout transactions. Hence, financial leverage and de-leveraging efforts are expected to contribute less to value creation than other drivers, which translates into the following hypothesis:

Hypothesis 1.4: On a relative basis, operational improvements contribute significantly less to the overall value generated in buyout transactions compared to benchmark companies.

When analysing the buyout sample by differentiating into exits performed pre and post (during) the financial crisis one would expect lower returns after the crisis, but a higher value contribution of the leverage effect prior to the crisis. This leads to the following hypotheses:

Hypothesis 1.5: Buyout returns are significantly lower post (during) than prior to the financial crisis, but abnormal operational performance is expected to be higher.

Hypothesis 1.6: The relative contribution of leverage and de-leveraging efforts to overall value is smaller post (during) than prior to the financial crisis.

Finally, when analysing the different types of exit channels chosen by the GP one would expect higher returns for IPOs compared to trade sales or secondary exits. This is assumed to be the case as going publics are relatively rare and realised returns are high. Further, one could expect the contribution of leverage to be higher in secondary exits given the sequence of PE owners only and leverage being a recognised value driver among PE practitioners. Last but not least one could expect the multiple expansion effect to contribute the most in trade sales as the strategic investor is in the position to pay a premium as a result of assumed synergies. Based on this the following three hypotheses result:

Hypothesis 1.7: Buyout returns vary significantly depending on the exit channel, with the assumption that IPOs perform better than trade sales or secondary buyouts.

Hypothesis 1.8: If, upon exit, a portfolio company is sold to another financial investor (secondary buyout), leverage is expected to contribute significantly more to overall value compared to other exit channels.

Hypothesis 1.9: If a portfolio company is sold to a strategic investor (trade sale) multiple expansion is expected to contribute significantly more to overall value compared to other exit channels.

Part II: Determinants of Abnormal Performance and Unlevered Returns:

On the basis of the results obtained in the first part of the underlying thesis it is the goal of the second part to analyse the determinants of abnormal operational performance and unlevered IRR in a multivariate setting. To prepare the various regression analyses to be conducted it is firstly the goal to identify an applicable benchmark sample and calculate changes of operating performance measures between entry and exit for the identified benchmark sample. Secondly, it is the goal to identify relevant operational and other determinants and assess their impact on operational alpha and unlevered IRR. In doing so the analyses conducted will additionally examine the impact under various business models and by taking a time-differentiated perspective. The following three key research questions result:

Research question 2.1: What are determinants of abnormal operational deal performance and unlevered returns in leveraged buyout transactions in the German-speaking region?

Research question 2.2: Is the impact of private equity performance drivers in the German-speaking region different under various business models, defined as (1) organic vs. inorganic growth strategies and (2) small vs. larger cap private equity investors?

Research question 2.3: Does the impact of private equity performance drivers in the German-speaking region differ between deals exited pre and post the global financial crisis of 2008?

As indicated by the research questions the second part of the thesis can be divided into three sections, which are, however, somehow overlapping. In the following relevant hypotheses are stated to more specifically address the research questions:

Hypothesis 2.1: The differences between deal and benchmark annualised growth rates for sales, EBITDA/sales and EV/EBITDA multiple are significant determinants of operational abnormal performance (operational alpha).

Hypothesis 2.2: The differences between deal and benchmark annualised growth rates for sales, EBITDA/sales and EV/EBITDA multiple are significant determinants of the unlevered buyout IRR.

Hypothesis 2.3: For buyouts conducting a buy-and-build growth strategy annualised benchmark-adjusted sales growth is not a significant determinant of abnormal performance and unlevered returns as additional sales do not necessarily result in higher returns and a higher operational alpha.

Hypothesis 2.4: For buyouts pursuing an organic growth strategy the differences between deal and benchmark annualised growth rates for sales, EBITDA/sales and EV/EBITDA multiple are significant determinants of operational alpha and unlevered buyout IRR.

Hypothesis 2.5: Buyout transactions pursuing a buy-and-build strategy show lower operational alphas and unlevered returns compared to buyout transactions growing organically when the benchmark company is clearly outperformed in regard of annualised sales, EBITDA/sales, and EV/EBITDA multiple growth.

Hypothesis 2.6: Regardless of transaction size, the differences between deal and benchmark annualised growth rates for sales, EBITDA/sales and EV/EBITDA multiple are significant determinants of operational alpha and unlevered buyout IRR.

Hypothesis 2.7: Larger buyout transactions show higher (lower) levels of abnormal performance and unlevered returns compared to smaller buyouts when the benchmark company is clearly outperformed (underperformed) in regard of annualised sales, EBITDA/sales, and EV/EBITDA multiple growth.

Hypothesis 2.8: For buyout transactions exited during or post the financial crisis of 2008 EBITDA/sales growth is a significantly higher pronounced driver of operational alpha and unlevered returns compared to buyouts exited prior to the crisis.

Hypothesis 2.9: EV/EBITDA multiple growth as a determinant for operational alpha and unlevered IRR is less significantly pronounced for deals exited during or post the financial crisis compared to buyout transactions exited before the crisis.

Part III: Impact of Leveraged Buyouts on Stakeholders:

The third part of the main body applies the findings of the prior two parts and has the goal to analyse changes in operational performance as well as the impact of leveraged buyout transactions on various stakeholders, other than the private equity sponsor. Relevant stakeholders identified are employees, debt providers (mainly banks) and the government. Impacts on these parties will be measured by analysing the changes of personnel, interest and tax expenses of the portfolio companies between entry and exit. The analysis of changes in operational performance relates to the development of sales, EBITDA margin and EV/EBITDA multiple growth over the holding period. There are two key research questions guiding this research project:

Research question 3.1: How do changes in operational performance of the buyout company compare to those of applicable benchmark companies and what are relative contributions in terms of levered buyout returns?

Research question 3.2: What is the effect of leveraged buyout transactions in the German-speaking region on the main stakeholders involved, other than the private equity sponsor?

These two research questions translate into the following hypotheses:

Hypothesis 3.1: In decomposing the levered buyout IRR the underlying benchmark leverage contributes less than the buyout leverage to the overall levered buyout return.

Hypothesis 3.2: In decomposing the levered buyout IRR operational effects contribute more to the overall levered buyout return than leverage effects in aggregate.

Hypothesis 3.3: The annualised buyout sales growth is significantly higher than the applicable benchmark growth.

Hypothesis 3.4: The annualised buyout EBITDA/sales growth is significantly higher than the applicable benchmark growth.

Hypothesis 3.5: The annualised buyout EV/EBITDA multiple growth is significantly higher than the applicable benchmark growth.

Hypothesis 3.6: The personnel expense development of private equity portfolio companies between entry and exit is not a significant driver of EBITDA/sales improvements. Consequently there is no indication for significant headcount reductions following private equity ownership.

Hypothesis 3.7: Inherent to the leverage buyout business model interest expenses show a significant increase between entry and exit.

Hypothesis 3.8: Tax expenses will decrease significantly between entry and exit as a result of tax-optimisation and tax-structuring efforts undertaken by the GP.

All 26 hypotheses derived on the basis of the seven research questions will get reflected in the conclusion of the underlying thesis in Section 10 by means of the individual results obtained in the main body of the dissertation.

4.2 Methodological Framework of Value Creation

The following section discusses and introduces the key methodologies applied throughout the thesis, being the value creation framework and how the internal rate of return is derived. By means of an exemplary buyout transaction the methodologies will get applied at the end of this section.

The underlying value creation framework was adapted from Achleitner et al. (2010) and is in the position to distinguish between financial and operational value drivers. Most value creation models applied in relevant studies, and as discussed above in the literature review, mainly show three basic value drivers, being EBITDA growth, multiple expansion and debt repayments/ FCF effect (e.g. Pindur, 2007 and Loss, 2006). As outlined by Achleitner et al. (2010) the debt repayment driver or FCF effect is often wrongly referred to as being the leverage effect, which, as shown below, is the financial risk component and not linked to the ability of the company to de-lever its debt burden (Achleitner et al., 2010, p. 18).

In the underlying context, overall value creation, of each individual buyout, is measured in terms of the levered times money multiple TM_{LEV}, which per definition is equal to the money multiple MM of the deal minus one.

$$(1)\quad MM - 1 = TM_{LEV} = \frac{EqV_{Ex} - EqV_{En} - \frac{EqInj}{os\%} + \frac{Div}{os\%}}{\left(EqV_{En} + \frac{EqInj}{os\%}\right)}$$

The numerator includes the difference between equity value at exit (EqV_{Ex}) and entry (EqV_{En}), less equity injections contributed ($EqInj$) plus dividends received (Div) by the shareholders, GP and management, during ownership. Equity injections contributed and dividends received by the GP are retrieved from the monthly cash flow data and are reported at the re-

spective ownership percentages of the GP. As only a handful of the deals included in the sample are owned at 100% one has to divide by the respective ownership percentages (*os%*) in order to calculate the full amounts of additional equity injections and dividends. This is necessary as from a research point of view the deal level rather than the GP level is of interest. To be more precise, the deal level data at entry and exit relates to 100%, while the monthly gross cash flow data only relates to the relevant ownership percentages of the GP. Assuming for a given deal the ownership is 60% and accumulated dividends over the holding period are €120k, total dividends of the target company distributed to its shareholders are €200k, i.e. €120k divided by 60%. The same logic is applied when it comes to equity injections. As the equity values at entry and exit relate to a 100% stake all variables included in the formula above are now included at equal percentages, i.e. assuming 100% ownership. The denominator includes the initial investment of the GP, implicitly at 100% ownership as the equity value at entry is applied, plus all equity injections made over the holding period. Hence, the levered times money multiple calculates the total proceeds at 100% over the total outflows at 100%, e.g. a multiple of 2.0x means that the accumulated investment was doubled over the holding period.

In light of the monthly cash flow data, the following calculations are made in order to be able to differentiate between initial investment, dividends received (*Div*), equity injections contributed (*EqInj*) and cash received from the sale of the portfolio company. The maximum negative cash flow (*Max(negCF)*) in the pattern is assumed to be the initial investment of the GP, while the maximum positive cash flow (*Max(posCF)*) is assumed to represent the proceeds from the exit of the investment. Consequently, and as presented below, the difference between the sum of all negative (positive) cash flows and the maximum negative (positive) cash flow yield the amount of additional equity injected (dividends received) by the GP over the holding period:

$$(2)\quad EqInj = \sum negCF - Max\left(negCF\right)$$

$$(3)\quad Div = \sum posCF - Max\left(posCF\right)$$

The times money multiple, or the money multiple minus one, represents the value created during ownership, which relates to financial and operational factors. Now, in order to be able to differentiate what portion of this multiple is due to financial and what portion is due to operational factors one has to unlever the TM_{LEV} in order to retrieve the unlevered times money multiple (TM_{UNLEV}). This is achieved by means of the following formula:

$$(4)\ TM_{UNLEV} = \frac{TM_{LEV} + \left(\left((1+CoD)^{HP}\right)-1\right)\left(\frac{\overline{D}}{\overline{E}}\right)}{1+\left(\frac{\overline{D}}{\overline{E}}\right)}$$

When it comes to the applicable cost of debt (*CoD*) the formula to unlever the returns assumes risky tax shields, i.e. the factor (*1 – t*) is neglected. This is a realistic assumption given high debt to equity ratios at entry. However, if "the company does always generate sufficient income to fully utilise the tax shield" returns to equity holders would be higher as the tax shield savings can be regarded as a definite income stream (Achleitner et al., 2010, p. 21). Not assuming risky tax shields, but rather a secured income from the tax shield formula (4) above would change to:

$$(5)\ TM_{UNLEV} = \frac{TM_{LEV} + \left(\left((1+CoD(1-t))\right)^{HP}\right)-1\left(\frac{\overline{D}}{\overline{E}}\right)}{1+\left(\frac{\overline{D}}{\overline{E}}\right)(1-t)}$$

Now, *t* represents the average tax rate of the target company (Acharya et al., 2013, p.30). Not assuming the latter appears to be a more conservative assumption and follows the approach discussed and applied by Achleitner et al. (2010, p. 18).[12] As the sample does not include the deal specific cost of debt, certain assumptions had to be made which are discussed in detail in Section 5. What is more, the unlevering formula accounts for the holding period (*HP*) of the GP and applies the average debt to equity ratio between entry and exit, being:

$$(6)\quad \frac{\overline{D}}{\overline{E}} = \frac{\left(\left(ND_{En} + ND_{Ex}\right)0.5\right)}{\left(\left(EqV_{En} + EqV_{Ex}\right)0.5\right)}$$

Following this the leverage effect can be extracted, denominated in TM points, simply being the difference between TM_{LEV} and TM_{UNLEV}. As a ratio the leverage effect is to be calculated as:

$$(7)\ Leverage\,effect = \frac{\left(TM_{LEV} - TM_{UNLEV}\right)}{TM_{LEV}}$$

[12] For a further discussion on how taxes, especially personal taxes, affect the valuation calculus under the German tax regime, please refer to Henke et al. (2010).

Before further differentiating between the various value drivers and thereby breaking down TM_{UNLEV} into its individual components, the focus in the next sub-section is put on IRR as the most common return measure of private equity investments.

4.2.1 Internal Rate of Return

Depending on the availability of data there are two ways of calculating the IRR, either on the basis of the equity values between entry and exit (Loos, 2006, p. 52) or on the basis of the gross cash flows to and from the GP. As the fund-of-funds due diligence data applied in this thesis includes the monthly gross cash flows the IRR calculation is based on the latter approach. This allows, in addition to the initial investment at entry and the cash proceeds received at exit, to account for equity injections contributed and dividends received by the GP during the holding period. Please note that all cash flows are reported on a gross basis, i.e. before the carried interest is distributed to the GP or management fees are deducted.

Applying the concept of distinguishing between the initial investment, equity injections, dividends and proceeds from the sale, as introduced above, the following is defined:

$$(8)\ \ If\ \sum posCF = 0\ AND \sum negCF < 0\ than\ IRR = -1$$

The first condition tests each individual deal on whether positive cash flows were received by the GP, if this is not the case, but there have been negative cash flows, obviously the investment was not successful at all (full write-off) and an IRR of -100% results. If the first condition does not apply, it is tested whether there have been equity injections or dividends. If this is the case the IRR is calculated as follows:

$$(9)\ \ If\ \sum negCF - Max(negCF) < 0\ OR \sum posCF - Max(posCF) > 0\ than...$$

$$IRR_{LEV} = \left(\frac{\sum posCF}{\sum negCF} \right)^{\left(\frac{1}{HP}\right)} - 1$$

What is more, it could be the case that for a given deal there have been no equity injections and no dividends; or due to netting, in a given month, dividends or injections could turn negative or positive, respectively. To avoid problems, when it comes to these exceptions, the IRR calculation is based on the formulas below, if the conditions defined previously are not met. In a first step, the levered IRR is calculated based on monthly cash flows. This is done by applying the IRR function of Microsoft Excel, as presented on the right-hand-side of the for-

mula shown below. This is conceptually equal to calculating the internal rate of return of all monthly cash flows that lead to a net present value of zero, as presented on the left-hand-side:

$$(10)\ NPV = \sum_{n=\frac{1}{months}}^{N} \frac{CF_{monthly}}{\left(1+IRR_{LEV_{monthly}}\right)^{n}} = 0 \quad with \quad IRR_{LEV_{monthly}} = IRR\left(CF_{monthly}\right)$$

In a second step, the monthly levered deal IRR was transformed into a yearly levered IRR by applying the following formula:

$$(11)\ IRR_{LEV_{yearly}} = \left(\left(1+IRR_{LEV_{monthly}}\right)^{12}\right)-1$$

As with the levered times money multiple, the levered IRR gets unlevered in the same way as shown previously. Again, in the underlying model tax shields are assumed to be risky and therefore cost of debt are included without accounting for the tax shield effect:

$$(12)\ IRR_{UNLEV} = \frac{IRR_{LEV} + \left(\left(\left(1+CoD\right)^{HP}\right)-1\right)\left(\frac{\overline{D}}{\overline{E}}\right)}{1+\left(\frac{\overline{D}}{\overline{E}}\right)}$$

Finally, it is to be noted that the link between the buyout IRR figures and the times money multiples, discussed in the previous sub-section, is represented by the dividends and equity injections, being derived from the cash flow pattern. Both are part of the times money multiple calculation (ownership-adjusted) and of the IRR calculation. Further, one could formulate the following relationships between cash flow and deal level data by means of equity values at entry and exit, respectively:

$$(13)\ EqV_{En} = \frac{Max\left(negCF\right)}{os\%} \quad AND \quad EqV_{Ex} = \frac{Max\left(posCF\right)}{os\%}$$

However, when it comes to the initial cash-outs and final cash-ins the variables included in these relationships do not fully reconcile due to various reasons (1) the equity values at entry already account for the final financing structure. Therefore the cash-out itself, obtained from the monthly cash flow pattern, might differ as they also include cash-outs of the GP which are rather treated as debt than equity, e.g. mezzanine financing in the form of shareholder loans, which is often applied; (2) in addition the equity values at entry will also differ from the cash flow information as the latter does not include the equity contribution of man-

agement, but the equity value does;[13] (3) in light of the final proceeds, the maximum cash-in, it could be the case that the GP sold its shareholding in more than one step and, thus, the maximum positive cash flow only represents parts of the proceeds from the sale of the company, and (4) with regard to the initial investment, the maximum cash-out, it could be the case that the GP increased its shareholdings successively.

With regard to restrictions three and four, one could argue that dividends and equity injections are overstated and hence the times money multiples are misleading. This is not regarded to be a problem as the formulas introduced above, both times money multiple and IRR, account for all cash-in and cash-outs, hence, it is rather a potential classification issue. Clearly there is a link between the deal level and the cash flow data; incorporating dividends and equity injections into the value creation model is regarded to make it more comprehensive. Due to the timing of cash flows and missing (qualitative) information on such, different financing instruments at entry as well as a potential multi-step sale and/ or investment process it is not possible to fully reconcile between equity values and cash flows.

4.2.2 Components of the Times Money Multiple

As outlined previously the leverage effect, in times money points, results from the difference between the levered and the unlevered times money multiple. The leverage effect over the levered times money multiple yields the portion of value creation which is attributable to financial engineering efforts undertaken by the GP.

$$(14)\quad Leverage\,effect = \frac{\left(TM_{LEV} - TM_{UNLEV}\right)}{TM_{LEV}}$$

The unlevered times money multiple (TM_{UNLEV}) is now further broken down into its individual components, being EBITDA growth, the free cash flow effect, multiple expansion and the EBITDA/ multiple combination effect. The individual effects are measured in terms of their variances between entry and exit and are put into relation of ownership-adjusted cash-outs, as discussed above. Further the contribution is measured in levered times money points as highlighted below.

[13] For example if the maximum cash-out derived from the cash flow pattern is €100m and the equity value at entry is €90m, assuming 100% ownership, it could be the case that the €10m difference are a shareholder loan which is classified as debt and not equity. This loan could also amount to €15m as €5m out of the total €90m equity belong to management and represent their share of sweet equity.

$$(15)\ TM_{UNLEV} = \frac{\left(\frac{EBITDA_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%}\right)}\right)}{TM_{LEV}} TM_{UNLEV} + \frac{\left(\frac{FCF_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%}\right)}\right)}{TM_{LEV}} TM_{UNLEV} + \ldots$$

$$\frac{\left(\frac{Multiple_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%}\right)}\right)}{TM_{LEV}} TM_{UNLEV} + \frac{\left(\frac{EBITDA/MultipleMix_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%}\right)}\right)}{TM_{LEV}} TM_{UNLEV}$$

While EBITDA growth and the free cash flow effect can be regarded as operational factors, the multiple variation/ multiple expansion effect is to be regarded as a value driver which is linked to exogenous factors, the market development, as well as the negotiation power of the GP. The combination effect between EBITDA and multiple represents a correction factor accounting for developments in the same or in the opposite directions, e.g. increasing EBITDA but decreasing multiple during ownership. The variances of the individual value drivers are split out in detail below. The EBITDA variance of each deal is calculated as the difference between exit and entry EBITDA multiplied with the EV/ EBITDA multiple at entry.

$$(16)\ EBITDA_{Var} = \left(EBITDA_{Ex} - EBITDA_{En}\right)\left(\frac{EV_{En}}{EBITDA_{En}}\right)$$

As highlighted before EBITDA growth can further be broken down into sales growth, EBITDA margin (*EBITDA%*) improvements and the combination effect (correction factor) between sales and margin, which is equal to:

$$(17)\ EBITDA_{Var} = Sales_{Var} + EBITDA\%_{Var} + Sales/EBITDA\%Mix_{Var}\ \ with$$

$$Sales_{Var} = \left(Sales_{Ex} - Sales_{En}\right)\left(\frac{EBITDA_{En}}{Sales_{En}}\right)\left(\frac{EV_{En}}{EBITDA_{En}}\right)\ and$$

$$EBITDA\%_{Var} = \left(\frac{EBITDA_{Ex}}{Sales_{Ex}} - \frac{EBITDA_{En}}{Sales_{En}}\right)\left(\frac{EV_{En}}{EBITDA_{En}}\right)Sales_{En}\ \ and$$

$$Sales/EBITDA\%Mix_{Var} = \left(\frac{EBITDA_{Ex}}{Sales_{Ex}} - \frac{EBITDA_{En}}{Sales_{En}}\right)\left(Sales_{Ex} - Sales_{En}\right)\left(\frac{EV_{En}}{EBITDA_{En}}\right)$$

In addition to EBITDA growth as the first operational value driver, which can be segregated into three individual components, the free cash flow effect represents the second operational value driver. According to Achleitner et al. (2010) the free cash flow effect relates to the cash generated at company level, this cash is used to pay down debt and pay dividends. Debt in this context is not related to leverage; this measure shows the amount of excess cash generated by the company and used to de-lever bank debt and satisfy equity shareholders by distributing dividends. The free cash flow variance (FCF_{VAR}) is determined as follows:

$$(18)\quad FCF_{Var} = \left(ND_{En} - ND_{Ex}\right) - \left(\frac{EqInj}{os\%}\right) + \left(\frac{Div}{os\%}\right)$$

The change in net debt (ND) over the holding period relates to the amount of excess cash utilised during ownership to pay down the financial burden of the company. If this change is negative, the company took on additional debt in this period. Equity injections, ownership-adjusted, are deducted as this cash was not generated through operating activities; ownership-adjusted dividends are added accordingly. The free cash flow effect and EBITDA growth represent the two operational value drivers in the applied framework. The multiple expansion effect is simply linked to the change in the EV/EBITDA multiple between entry and exit and is in addition to the negotiation skills of a GP driven by the overall market development of the industry:

$$(19)\quad Multiple_{Var} = \left(\frac{EV_{Ex}}{EBITDA_{Ex}} - \frac{EV_{En}}{EBITDA_{En}}\right) EBITDA_{En}$$

Finally, one has to account for the combination effect between EBITDA and multiple as the final component when segregating TM_{UNLEV} into its individual value drivers, being:

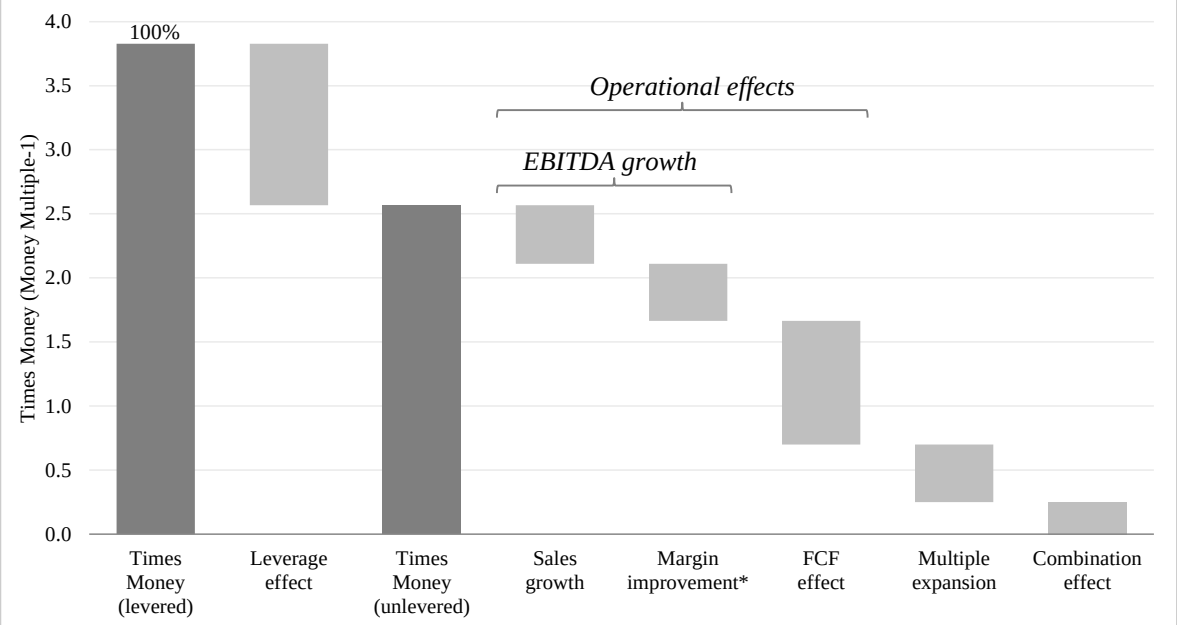
$$(20)\quad EBITDA/Multiple\,Mix_{Var} = \left(EBITDA_{Ex} - EBITDA_{En}\right)\left(\frac{EV_{Ex}}{EBITDA_{Ex}} - \frac{EV_{En}}{EBITDA_{En}}\right)$$

All the individual components derived above are presented in the form of the value creation bridge as illustrated in Figure 6. The left-hand scale shows times money multiple points, which represent 100% of the value generated during ownership.

What is more, as performed by Brigl et al. (2008), one could link unlevered IRR, as discussed in the previous sub-section, to the individual components and thereby express the individual value creation drivers in terms of IRR contribution. For the underlying thesis an ex-

pression in times money points is regarded to be more intuitive and therefore applied in the following.

Figure 6: The Value Creation Bridge



* Includes the combination effect between sales and EBITDA margin

Source: Own illustration

By indexing the total times money multiple at 100%, the value creation methodology allows to compare the relative rather than the absolute contributions of the individual financial and operational value drivers. For example, and as will be shown later, when comparing the value contribution between two sub-samples there might be significant differences in absolute terms. However, in such cases it is also of interest whether the relative contributions differ significantly between the sub-samples. The approach chosen allows answering both kind of questions.[14]

The following sub-section will put the rather theoretical formula-based value creation approach[15] into a nutshell, by means of a hypothetical transaction.

[14] For a proof of the methodological value creation framework introduced in this section please refer to Appendix 1.

[15] The methodological value creation approach applied is based on the thoughts suggested by Achleitner et al. (2010).

4.2.3 Exemplary Application of the Value Creation Framework

In order to demonstrate how the various value drivers are calculated, and to show how the underlying data is structured, Table 5 shows the key metrics of a hypothetical buyout transaction. Panel A shows the available deal data at entry and exit, which corresponds to the data points available in the underlying sample of the thesis. First, the entry and exit date of the respective transaction are provided, followed by enterprise value, net debt and the resulting equity value at entry and exit, respectively. As stated above, the net debt value at entry already reflects the new financing structure of the new owner. Further, key deal metrics at entry and exit include sales and EBITDA. On the basis of this EBITDA margin and the EV/EBITDA multiple can be calculated accordingly.

Table 5: Key Metrics - Hypothetical Buyout Transaction

Panel A: Deal data in €m	**Entry**	**Exit**
Date	01/01/2007	31/12/2009
Enterprise Value	410	820
Net debt	220	120
Equity Value	190	700
Sales	635	740
EBITDA	80	105
Sales/EBITDA margin	13%	14%
EV/EBITDA multiple	5.1	7.8
Panel B: Cash Flow data in €m	**@ownership**	**@100%**
Ownership	90%	100%
Total negative cash flows	216	240
Total positive cash flows	720	800
Initial investment at entry	171	190
Equity Injections	45	50
Dividends	90	100

Panel B of Table 5 shows the gross cash flow information, which is given for each deal on a monthly basis before carried interest and applicable management fees. In this example the GP acquired a stake of 90%, hence, all cash flow information is stated at the share of the GP, while the deal data presented in Panel A is reported at 100%.

The left hand column of Panel B shows the reported figures at the relevant ownership percentage, while for calculation purposes these have to get restated to 100% ownership as discussed above. Total negative cash flows less equity injections represent the initial cash-out

at entry, which is equal to the equity value at entry of €190m, once restated to 100% ownership. The same logic applies to total positive cash flows less dividends, which represents the final cash-in at exit. Applying the formulas discussed in the previous section yields Table 6 showing the individual value creation drivers of the exemplary buyout transaction.

Table 6: Value Creation - Hypothetical Buyout Transaction

Value Creation Components	**TM points**	**%**
Times Money (levered)	**2.33**	**100%**
Leverage effect	0.84	36%
Times Money (unlevered)	**1.49**	**64%**
EBITDA growth	0.34	15%
Multiple expansion	0.57	25%
Combination effect	0.18	8%
Free-Cash-Flow effect	0.40	17%
EBITDA growth		
Sales growth	0.18	8%
Margin improvement	0.14	6%
Combination effect	0.02	1%

The GP invested a total of €216m and received a total of €720m. On a net basis, all positive less all negative cash flows, the GP earned a gain of €504m. These €504m over €216m translate into a levered times money multiple of 2.33 as shown in Table 6. Hence, the private equity investor managed to more than double its aggregated investment over the holding period. Please note that in contrast to any IRR measure the times money multiple does not account for the time value of money. Applying the general IRR formula as presented above, which accounts for the three-year holding period of the investment, yields a gross IRR of 49%. The levered times money multiple equals 100% of total value generated and gets unlevered in a second step.

In the underlying example the relevant entry year is 2007 which goes along with cost of debt of 7.1%.[16] The resulting unlevered times money multiple of 1.49 solely relates to operational/ market factors and assumes that the company was financed with 100% equity; unlevering the IRR of 49% leads to an unlevered IRR of 39%. Accordingly the leverage effect accounts for 36% (in times money points) of total value generated or 0.84 times money points.

[16] In a sub-section 5.1 it is discussed in detail how the applicable cost of debt were determined.

Further, breaking down the unlevered multiple into its components reveals that 15% of total value generation are driven by EBITDA improvements. These, as shown at the bottom of Table 6, can be divided into sales growth and margin improvements. From Panel A in Table 5 one can see that absolute sales increased by €105m or ca. 17% (CAGR of 8%) and EBITDA margin increased by 1ppts from 13% to 14% between entry and exit. In terms of contributions to the value generated during ownership this translates into 8% sales growth and 6% margin improvements as well as 1% combination effect.

What is more, between entry and exit the EV/EBITDA multiple increased by 2.7 (52%) from 5.1 to 7.8. This increase reflects one-quarter of total value generated, together with the combination effect between EBITDA and EV/EBITDA the contribution is even higher (33%). As outlined, this increase could partially result from a market driven increase in the specific industry as well as the negotiation power of the GP. In light of the free cash flow effect 17% are contributed to overall value, which relate to the excess cash generated to de-lever the target company's debt (€100m) and to pay dividends (€100m) to its shareholders. Assuming that the net debt level would not have changed between entry and exit, this would impact all components in relative and absolute terms. Mainly this would result in a higher relative contribution of leverage to total value and in a lower FCF-effect contribution.

Please note that additional return measures, mainly IRR, are calculated based on the monthly pattern and are therefore more accurate compared to the general IRR formula applied in this example.

4.3 Abnormal Financial and Operational Performance

An important measure analysed throughout the thesis is the abnormal performance of the buyout company over an applicable benchmark company. Abnormal performance relates to a financial and an operational one and is based on the concept introduced by Acharya et al. (2013, p. 379f). The concept will get introduced in the first essay in a univariate context and determinants of operational abnormal performance are analysed in a multivariate setting in the second essay. How the relevant benchmark samples are constructed will be discussed in-depth in the next section.

Financial abnormal performance, which we call financial alpha, is defined as the difference between the levered IRR of the buyout sample and the levered IRR of the respective benchmark sample:

$$(21)\ \alpha_{fin} = IRR_{PE,Lev} - IRR_{Bench,Lev}$$

Operational abnormal performance, which we call operational alpha, represents the difference between the unlevered IRRs:

$$(22)\ \alpha_{ops} = IRR_{PE,Unlev} - IRR_{Bench,Unlev}$$

The hypothetical buyout transaction, as discussed in the previous section, shows a levered and unlevered IRR of 49% and 39%, respectively. For the time being it is assumed that this buyout transaction was matched with an appropriate benchmark company. This company represents a publicly listed entity and it is assumed that, following the opportunity cost of capital theory, the next best investment alternative from the perspective of the private equity sponsor, being both the GP and LP, would have been to invest in this company. The benchmark company shows a levered IRR of 35%; by applying the same cost of debt for unlevering purposes, but the specific average debt-to-equity ratio of the benchmark company, an unlevered IRR of 29% results.

Accordingly in terms of abnormal performance the buyout transaction outperforms the benchmark company by 14ppts in light of financial abnormal performance and by 10ppts in terms of operational abnormal performance. The latter abnormal performance figure is more reliable, it represents a like-for-like measure as it is assumed that both companies, buyout and benchmark, are 100% equity-financed. This means when disregarding any effects resulting from financial engineering efforts that the buyout company operationally performed better which translates into a 10ppts higher unlevered return.

As abnormal operational performance, referred to as operational alpha, is a like-for-like measure, which allows comparing returns between buyouts and benchmark companies, this measure is of key research interest in the underlying thesis.

5 Data Collection and Sample Construction

The underlying section deals with how the data was gathered and the samples were constructed. As the three research essays of the thesis are based on the same sample; it appears reasonable to describe the data collection and sampling process in detail upfront.

5.1 Deal Related Data

In order to generate the underlying sample of 124 deals a multi-step approach was required, which is highlighted in Table 7. Four different sources served as a starting point as shown in Panel A, being (1) the due diligence data from three fund-of-funds comprising a total of 1,318 deals between 1985 and 2010 for the relevant countries under review; including various types as early stage, expansion, seed or buyout transactions; (2) buyouts retrieved from MergerMarket; (3) buyouts retrieved from CapitalIQ and (4) buyouts retrieved from Thomson. Each transaction retrieved from the latter three sources either relates to an entry or exit of a specific buyout transaction, whereas the fund-of-funds due diligence data relates to matched entry and exit information. Due to this, and the fact that certain deals are included up to four times in each source, it does not appear reasonable to show a total number of deals across all sources. Additionally, Panel A highlights the available periods per source; it was decided to retrieve all deals up to 2013 from the databases as the last cash flow date per the fund-of-funds dataset might not necessarily match the announced closing date. To put it differently, if for a given buyout transaction the last cash flow date per the fund-of-funds dataset is 31/12/2010, but the announced closing date is later, choosing 31/12/2010 as the relevant cut-off date when retrieving data from the three commercial databases might not include this particular deal.

The individual sources include the following variables per deal: (1) fund-of-funds due diligence dataset: name of the target, fund manager, fund name, fund generation, type of fund, fund size, vintage year, type of investment, type of exit, industry code (ICB), country, date of first and last cash flow from/ to GP and whether or not it was a club-deal; enterprise value, equity value, net debt, sales, EBITDA, EV/EBITDA multiple and ownership at entry and exit, respectively; monthly cash flows from/ to GP; deal data retrieved from the three databases (2)-(4) include: date of entry and exit, fund manager, country, short description of the transac-

tion; enterprise value, equity value, net debt, sales, EBITDA, EV/EBITDA at entry and exit, respectively.

As highlighted in the previous section, when it comes to the value creation analysis, the underlying cash flows from the portfolio company to the GP are required. Therefore, the fund-of-funds due diligence dataset is dominating the other three sources, as the latter do not provide such cash flow information.

Table 7: Sample Collection and Composition

Panel A: Raw data	**Fund-of-Funds***	**MergerMarket****	**CapitalIQ****	**Thomson****
Period	*1985-2010*	*1998-2013*	*1990-2013*	*1990-2013*
Germany	1,025	2,599	4,811	5,257
Austria	70	345	1,407	352
Switzerland	198	500	716	719
Luxembourg	25	133	185	118
Total	**1,318**	**3,577**	**7,119**	**6,446**

Panel B: First clean-up	**Fund-of-Funds***	**Databases****
Period	*1985-2010*	*1990-2013*
Germany	599	482
Austria	45	41
Switzerland	100	53
Luxembourg	20	32
Total	**764**	**608**

Panel C: Final sample	**Final sample***	**as a %**
Period	*1995-2010*	
Germany	96	77.4%
Austria	7	5.6%
Switzerland	21	16.9%
Total	**124**	**100.0%**

* Deals relate to matched entry and exit information ** Deals relate to either entry or exit information

However, as certain deals in the fund-of-funds data as well as in the three databases are partially or fully incomplete, i.e. not every single data point listed above is available for each deal; the information retrieved from the three databases was applied to fill such gaps within the fund-of-funds dataset. In order to do so, in a first step, the deal information of the three databases presented in Panel A was merged into one dataset in order to achieve the maximum of entry and exit deal information in light of the variables highlighted above. Redundant entries as well as those deals that had no information in either of the databases were eliminated. The resulting number of entry and exit deal information per the three databases in aggregate is presented in Panel B of Table 7. The reduction from 17,142 individual entry or exit entries to 608 mainly results from the fact that the majority of entries, in all databases, does not com-

prise the relevant deal data. For the fund-of-funds database all non-buyout deals were disregarded as well as unrealised deals, reducing the sample from 1,318 to 764 deals. Partially realised deals were not excluded, as presented later this appears to be a reasonable approach as these deals are not significantly different from realised deals.

Before further merging the two sources, one additional step was required. The 764 fully or partially realised buyout deals include 181 deals without a name of the target company; the investment is only tracked by means of a deal ID, but in order to add further information to the deal the target name is required for research purposes. It is already required in order to make sure that the target company is based in one of the relevant countries and there is no mismatch in the fund-of-funds database. As information on the fund manager, fund generation, cash flow dates, ICB code and country was available for all of these deals, as well as certain financials for some of the deals, a manual lookup was performed by analysing the portfolios of the individual GPs through MergerMarket and by visiting their websites. The majority of target names was identified and the deal ID was replaced by the respective company name.

In a third step, the fund-of-funds data was merged with the database information and gaps within the fund-of-funds data were closed. Filtering the fund-of-funds data for only those deals with full details, i.e. all deal level data at entry and exit, respectively, and the full cash flow pattern, as well as eliminating for redundant entries would reduce the sample from 764 to 105 deals. Hence, the approach described above, by utilising the commercial databases, resulted in 19 additional deals. Panel C of Table 7 presents the final sample and the split by country. The majority of deals (96 or 77%) were carried out in Germany, followed by 21 deals (17%) in Switzerland and seven deals (6%) in Austria. Out of 124 deals, 37 are partially realised while 87 deals are fully realised. Please refer to Sub-Section 5.3.1 for a detailed descriptive presentation of the sample. Please further note that initially Luxembourg was also part of the scope as private equity sponsors tend to base the acquisition vehicle in Luxembourg for tax purposes, which only represents the holding company of the operating entity, which is based in one of the German-speaking countries. However, no Luxembourg-based company made it into the final sample.

Certain information was added to the final buyout sample through manual research, again by utilising MergerMarket and researching the GP's websites, being (1) the source of deal origin/ type of entry which is either family/ private, public-to-private, carve-out or institution-

al/ financial sponsor, and (2) M&A activity during PE ownership in order to distinguish between organic and inorganic (buy-and-build) deals.

What is more, even after eliminating for redundant entries, certain target companies are still included twice or even three times; this is explained by secondary/ tertiary buyouts, club-deals or additional investments in the same target company by the same GP with the same or a later fund, which was tracked separately in the fund-of-funds database.

As discussed in the previous section, explaining the methodological value creation framework, the levered times money multiple (TM_{LEV}) gets unlevered in order to differentiate between financial and operational value drivers, assuming risky tax shields. In doing so the following formula was applied:

$$(23)\ TM_{UNLEV} = \frac{TM_{LEV} + \left(\left((1+CoD)^{HP}\right)-1\right)\left(\frac{\overline{D}}{\overline{E}}\right)}{1+\left(\frac{\overline{D}}{\overline{E}}\right)}$$

While TM_{LEV}, TM_{UNLEV}, HP, and D/E are deal specific variables CoD represents the cost of debt for all financing instruments to finance the buyout transaction. As the underlying dataset does not comprise the individual cost of debt per transaction, the following approach was taken to surrogate this variable. Depending on the relevant period, various rates served as the applicable base rate. From January 1995 to December 1998 the Lombard rate published by the German Federal Bank was applied, from January 1999 to March 2002 the base rate according to the German Discount Rate Transition Act was applied, and from April 2002 onwards the marginal lending facility published by the European Central bank was applied. The annual base rate was determined on the basis of the monthly average rates. Prior to April 2002 only German interest rate information was applied, this appears reasonable given that 96 (or 77%) out of the final 124 deals relate to German target companies.

In a second step, all available financing information relating to syndicated loans between 1995 and 2008 was retrieved from Thomson. But only those where the proceeds are used for leveraged buyouts and the headquarters of the borrower are located in Germany. Again, as the majority of deals relate to German target companies this approach appears reasonable. From the total of 985 entries, spread information was available for 845 entries. However, this information partially relates to loan packages and thus various tranches, i.e. one deal might be included with 12 entries as these relate to various packages and various types of loans, being

term loans, working capital loans or capital expenditure loans. It was not adjusted for this and the average (median) was determined on the basis of these 845 entries. As will be shown later, robustness checks on the cost of debt will not change overall results significantly.

Based on the remaining entries the median spread per annum was determined and added to the respective annual average base rate calculated in a first step. For 1995 and 1996 no spread information was available, therefore the 1997 median spread was applied for these two years. The resulting annual rates range between 4.6% and 7.6%, as shown in Table 8, and were applied as the relevant cost of debt per transaction. The table additionally shows the median over the entire period which amounts to 6.2%. On a weighted basis, i.e. the annual rates weighted by the number of entries in a given year, overall average cost of debt of 5.9% would result.

Table 8: Derivation of Applicable Cost of Debt

Cost of Debt - in basis points and %				
Year	*Average base rate (bp)*	*Median Spread (bp)*	*Cost of Debt (bp)*	*Cost of Debt (%)*
1995	575	175	750	7.5%
1996	463	175	638	6.4%
1997	450	175	625	6.3%
1998	450	188	638	6.4%
1999	213	250	463	4.6%
2000	345	231	576	5.8%
2001	405	262	667	6.7%
2002	382	225	607	6.1%
2003	325	235	560	5.6%
2004	300	244	544	5.4%
2005	302	262	564	5.6%
2006	379	225	604	6.0%
2007	485	225	710	7.1%
2008	473	287	760	7.6%
Median	**394**	**228**	**616**	**6.2%**

5.2 Benchmark Data

As outlined previously, the main objective of the value creation framework applied is to analyse the relative contributions to the total value generated of a given buyout transactions.

However, the deal level and cash flow data additionally allows determining certain absolute return measures as the IRR or the money multiple. In order to assess the performance of the final buyout sample in comparison to other asset classes and to analysis potential financial and operational abnormal performance it requires benchmark information. There are multiple ways of constructing such benchmark samples, which are discussed in the following. For the underlying thesis three approaches were taken, being a nearest neighbour benchmark sample, an industry portfolio benchmark sample and the calculation of public-market-equivalents (PME). In an ideal world, the buyout companies and their respective benchmark companies would only differ with regard to their underlying governance structure, which than would allow to perfectly analysing differences in relevant metrics. However, as the applied benchmark techniques, to be introduced below, are based on publicly listed companies there are certain additional differences, as for example in regard of financial leverage or the impact of market dynamics on such listed peer companies, compared to privately held buyout companies. Nevertheless, the benchmark approaches applied are regarded to represent the best alternative from an academic point of view in order to approximate this "ideal world".

In general all three benchmark techniques are based on the opportunity cost of capital theory (Modigliani and Miller, 1958). Given that buyout investments are uncertain in nature and show a high risk-return profile the three benchmark techniques applied assume that the next best alternative to invest, from the GP's perspective, would be in public (rather than private) equity markets. The underlying risk-return profile of public equity investments is regarded to be similar to the one of buyout investments. Investments into debt markets are not regarded to serve as an appropriate benchmark given their lower risk-return profile. As discussed in the following, the major difference between the benchmarking techniques is increased diversification going from the nearest neighbour to the PME approach.

In terms of performance comparability between the buyout sample and the individual benchmark approaches, it is to be highlighted that they all abstract from transaction costs. Hence, the results can be compared with each other as the buyout sample does not account for carried interest or management fees and the benchmark samples do not account for fees associated with transactions on public capital markets.

5.2.1 Nearest Neighbour Benchmark Sample

The first benchmark technique applied is a modified nearest neighbour approach as suggested by Acharya et al. (2009a). Based on propensity scores the authors identify the ten near-

est neighbours for each deal out of their sample comprising a total of 94 deals in Western Europe (p. 9). The modified approach applied assumes that the GP would have invested its capital into a public company (1) that is undertaking business in the same industry, determined on the basis of the four-digit ICB classification, and (2) that shows a similar profitability, measured in terms of EBITDA/sales margin. In contrast to Acharya et al. (2009a) logged sales of the public benchmarks are not included as an additional identification criterion (p. 16). The underlying approach appears to be reasonable under the following assumptions/ conditions: (1) as with the private equity investment itself the cash is only invested into one public benchmark company. Therefore both investments, public and private, are exposed to the same risk in light of diversification; (2) it is assumed that the benchmark investment is over the same period as the private equity investment's holding period, i.e. both investments are exposed to the same systematic risk in terms of timing and market developments; (3) given that the buyout sample only covers German-speaking countries the benchmark companies are only selected from these countries, hence, both investments are exposed to the same country-risk; and (4) the neighbour is chosen in the same industry with a comparable profitability. Therefore industry-risk and profit and loss structure (up to EBITDA) are comparable between neighbour and buyout transaction.

The nearest neighbour approach can be defined as the most precise approach as will be shown later. At the same time, however, it is also regarded as the most specific approach when it comes to diversification, timing, industry and country-specific risks.

To identify the applicable neighbour for each buyout transaction, relevant financial information was retrieved through CapitalIQ for 957 companies listed in the XETRA Trading Platform with the primary geographic location being in Germany, Switzerland or Austria. Relevant financial information refers to those data points that allow applying the value creation framework for the benchmark companies, being sales, EBITDA, cash, debt, shares outstanding and share price. The share price times the shares outstanding is equal to the equity value, further adding debt (as a positive balance) to the equity value and deducting cash, from the latter subtotal, yields the enterprise value to be applied. For each of the 957 companies this information was pulled back to 1995 and financials were retrieved on an annual basis from 1995 to 2013 as of October 2013 accordingly. Following this approach in 1995 for only 202 companies financial information is available, this approach, however, is regarded to be suitable as it is the goal to ensure that an identified nearest neighbour is in existence over the holding period of the corresponding private equity investment.

One could argue that the initial raw data should be based on the annual composition of the XETRA from 1995 to 2013. This would not ensure that the benchmark company is listed over the holding period of the private equity investment. Based on this, and in light of a potential benchmark selection bias, it could be argued that the identified neighbours, for those transactions with early entry years, tend to perform better as they have been listed since and therefore the approach prevents from identifying neighbours that went bankrupt or got delisted for a variety of reasons. Consistency is higher rated than the potential bias here, defending this approach.

However, in order to apply the value creation framework in a consistent way for the public peers the corresponding dividends were additionally retrieved. These were calculated by multiplying the number of shares outstanding with the dividend per share. Detailed descriptive statistics of the nearest neighbour benchmark sample are presented later.

5.2.2 Industry Portfolio Benchmark Sample

A second benchmark technique applied is less precise in nature. In contrast to the nearest neighbour approach it is assumed that the GP would have invested its capital into a public industry portfolio of listed companies. Hence, the main differences to the nearest neighbour approach are diversification and profitability. In light of diversification the investment is not only exposed to the performance of one listed company (the nearest neighbour), but to the performance of several listed entities within the same industry. This approach does not apply profitability as a relevant selection criterion as it assumes the investment into a hypothetical portfolio of companies with varying EBITDA/sales margins.

The relevant raw data to build these public industry portfolios is the same as applied for the nearest neighbour approach. Again, all companies have to be listed over the holding period of the private equity investment. For the final sample of 124 buyout transactions there are 85 different hypothetical industry portfolios, explained by timing and industry differences. After these portfolios were built the corresponding value creation measures were determined. Detailed descriptive statistics of the industry portfolio benchmark sample are presented later.

5.2.3 Public-Market-Equivalent

A third and final benchmarking technique applied is a common one used to assess the performance of asset classes in general, the public-market-equivalent. Especially in light of

private equity fund performance this benchmarking approach is fairly often used, as for example by Kaplan and Schoar (2005, p. 1797) or Harris et al. (2014a, p. 1867). This approach compares the performance of the private equity investment to the performance of a hypothetical investment into a selected public index. In light of diversification, as discussed in the previous two sub-sections, the PME can be regarded as the most diversified benchmarking technique as it is neither based on industry nor profitability criteria. The PME figures calculated in the underlying thesis are based on the methodology as described and applied by Kaplan and Schoar (2005, p. 1797).

A PME greater than one indicates the private equity investment outperformed the investment into a selected index, while a PME below one indicates an underperformance of the buyout transaction accordingly. Consequently, a PME equal to one infers that there would not have been any difference between the two investment alternatives.

With 97 transactions (78%) the majority of the 124 deals in the final sample relate to Germany, therefore the German prime standard indices were applied, being the DAX, MDAX, SDAX and TecDAX. Another reason for not including the Swiss and Austrian prime standard indices (Swiss Market Index and Austrian Traded Index) is the fact that these, in contrast to the German prime standards, simply represent price indices and not performance indices. The latter type of index accounts for dividends, which get reinvested into the corresponding index. As in the method applied to analyse value creation, dividend payments are explicitly included and it appears consistent and acceptable to base the PME calculation solely on the German prime standard indices.

What is more, as the MDAX, SDAX and TecDAX indices were only introduced in January 1996, June 1999 and March 2003, respectively, but the first entry in the buyout sample was in 1995 more than one PME was calculated in these cases. In addition to a pure DAX PME three additional PMEs were calculated for the MDAX, SDAX and TecDAX. When no data was available, due to the later introduction of these indices, an investment into the DAX was assumed until the introduction of the respective index. The change in performance of the respective index is based on daily rates, which were determined by means of the first and last cash flow date of the corresponding buyout transaction.

The potential sample selection bias argument that could be raised for the prior two benchmark techniques does not apply to the PME technique as it accounts for the relevant composition at any time. Altogether, it was decided to benchmark the buyout results through

several approaches in order to test robustness of potential abnormal performance in various ways.[17]

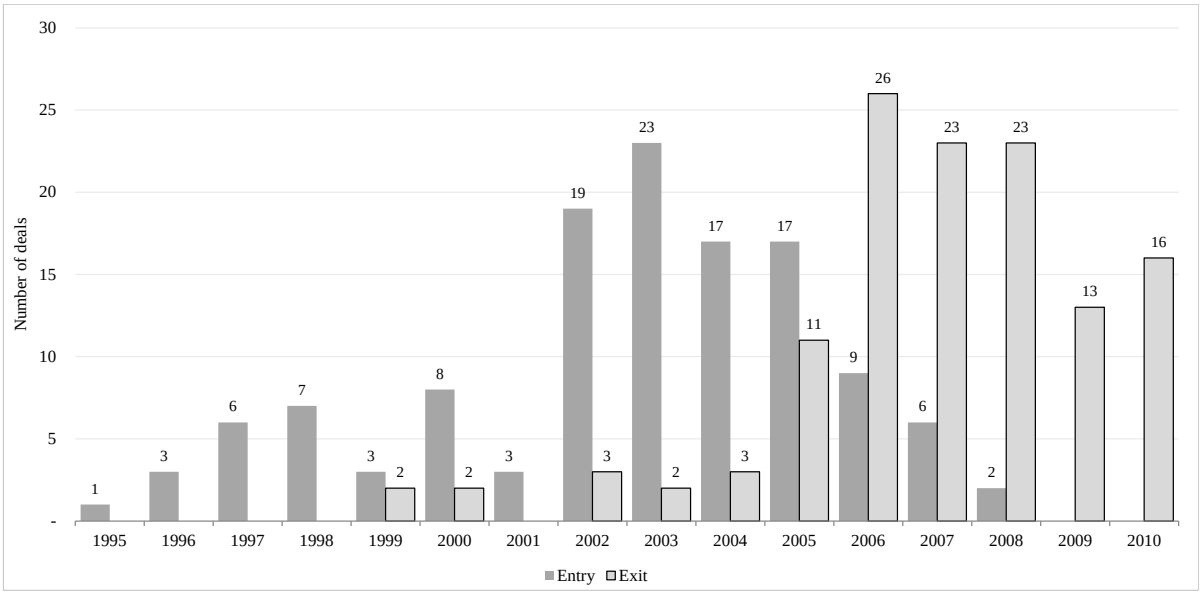
5.3 Descriptive Statistics

In the following the buyout sample and the benchmark samples are introduced in more detail including relevant descriptive statistics. In this section no statistical tests are performed as this will be covered in later sections addressing the relevant hypotheses outlined previously. Hence, the goal of this section is to get the reader more familiar with the samples applied throughout the thesis. Therefore the focus is rather put on key performance indicators, as deal characteristics and return measures, rather than value creation and performance drivers as explained previously.

5.3.1 Buyout Sample

The final sample comprises 124 realised or partially realised buyout transactions carried out between 1995 and 2010 by 33 different private equity houses in the German-speaking region.

Figure 7: Buyout Sample – Entry and Exit per Year



Source: Own illustration

[17] As will be discussed later, the nearest neighbour sample is the most suitable one. Hence, the PME calculations are not reflected in one of the three research essay. Hence, please refer to Appendix 2 of the thesis providing the calculations.

Please note that the selection criterion applied is only with regard to portfolio companies having their headquarters in the DACH region, while private equity sponsors could be based anywhere. Figure 7 shows the number of buyout transactions per year separated into entry and exit, respectively. In light of entries the majority of deals were initiated between 2002 and 2006 representing 69% of all entries, while 90% of the buyout transactions were exited between 2005 and 2010. With regard to the most recent global financial crisis it is to be emphasised that 42% of total buyouts were exited during or post the crisis.

Panel A of Table 9 shows reported mean and median figures for selected deal characteristics between entry and exit, respectively, as well as the corresponding standard deviation and range of these values. The buyout sample is very heterogeneous in terms of deal size (enterprise value), ranging from €2m to €7.1bn at entry, sales, ranging from €9m to €5.9bn at entry, as well as profitability and leverage ratios. Inherent to the leveraged buyout business model debt-to-equity ratios at entry are relatively high and decrease over the holding period.

Table 9: Buyout Sample – Descriptive Statistics[18]

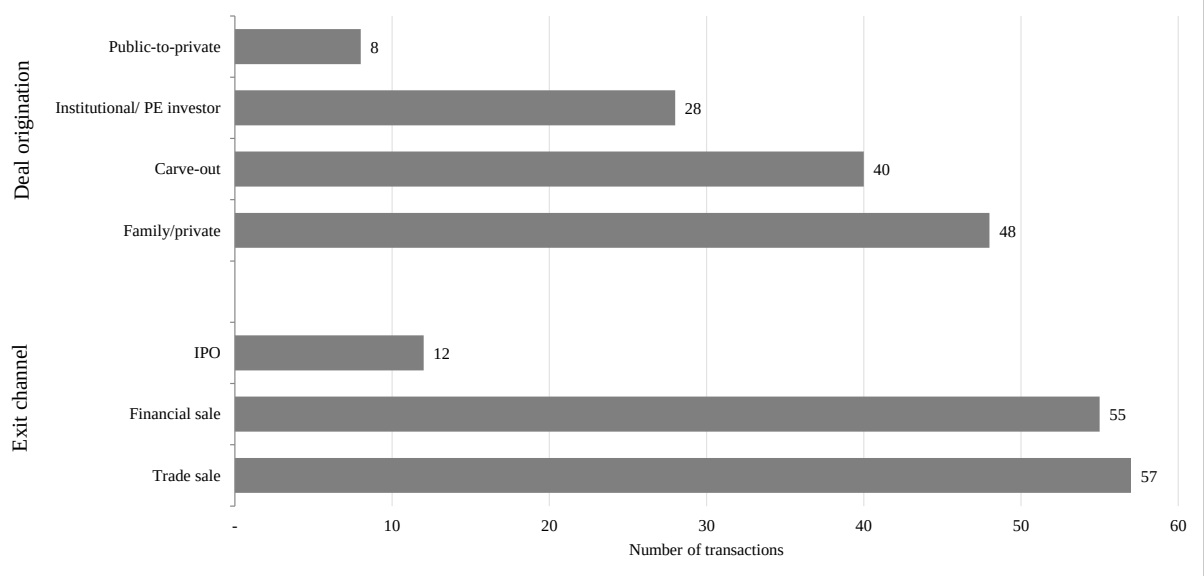
	Entry					Exit				
n = 124	Mean	Median	Std. Dev.	Min	Max	Mean	Median	Std. Dev.	Min	Max
Panel A: Deal Characteristics										
Enterprise Value (EV) (€m)	433.2	121.9	922.1	2.0	7,131.8	804.7	214.2	1,677.2	15.4	10,378.1
Equity Value (EqV) (€m)	169.1	46.1	358.7	2.5	2,004.2	520.6	150.3	1,234.7	-168.1	8,729.8
Net Debt (€m)	264.1	74.0	656.2	-12.1	5,441.3	284.0	57.8	681.5	-10.5	4,680.5
EV/EBITDA multiple	6.5	6.0	4.1	-22.8	26.7	7.9	7.9	9.6	-61.7	53.9
Sales (€m)	418.6	153.9	727.4	8.5	5,890.7	483.8	185.3	821.2	10.0	5,863.3
EBITDA (€m)	58.7	21.8	107.1	-2.2	744.6	88.4	29.5	168.9	-0.7	907.5
EBITDA/Sales margin	0.16	0.13	0.11	-0.03	0.72	0.17	0.16	0.10	-0.38	0.51
Debt/Equity ratio	2.26	1.70	5.01	-0.86	54.11	-0.70	0.41	13.84	-153.29	4.42
Debt/EBITDA ratio	3.53	3.45	2.46	-10.09	10.75	2.81	2.29	4.02	-16.71	33.59
Panel B: Return										
Holding period (years)						4.32	3.92	2.03	0.83	12.00
Money Multiple						4.81	3.29	7.71	-1.95	67.95
Times Money (Money Multiple-1)						3.81	2.29	7.71	-2.95	66.95
IRR (levered)						0.43	0.30	0.93	-0.75	8.52
IRR (unlevered)						0.28	0.19	0.38	-0.11	2.90

Panel B of Table 9 highlights that the sample comprises 11 transactions with negative IRRs, but also seven deals with IRRs exceeding 100%. For the overall sample median levered and unlevered IRRs amount to 30% and 19%, respectively, while the median times money multiple trades at 2.3. Also for unlevered returns the sample still comprises five deals with

[18] Please note that the second and third essay apply the full buyout sample comprising 124 deals, while for the first essay one outlier is dropped. Hence, the buyout sample comprises of 123 deals only in the first essay.

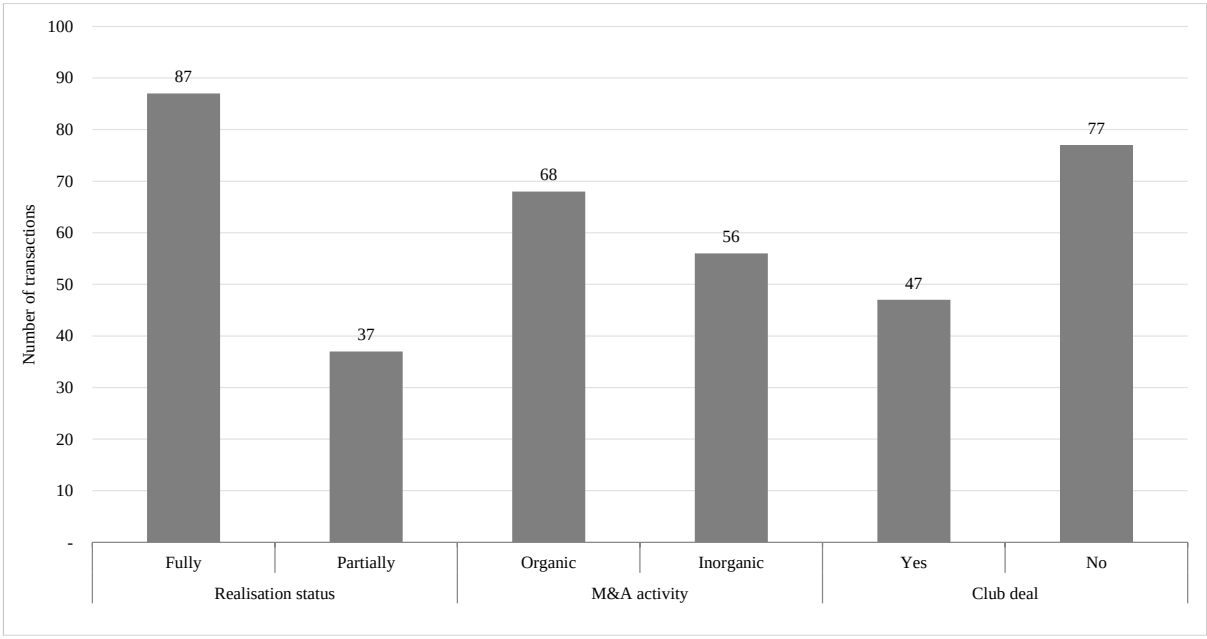
negative IRRs and five transactions with IRRs above 100%. Interestingly, the sample comprises one deal that was under private equity ownership for only ten months and one transaction that was exited after 12 years.

Figure 8: Buyout Sample – Deal Origination and Exit Channel



Source: Own illustration

Figure 9: Buyout Sample – Transaction Characteristics



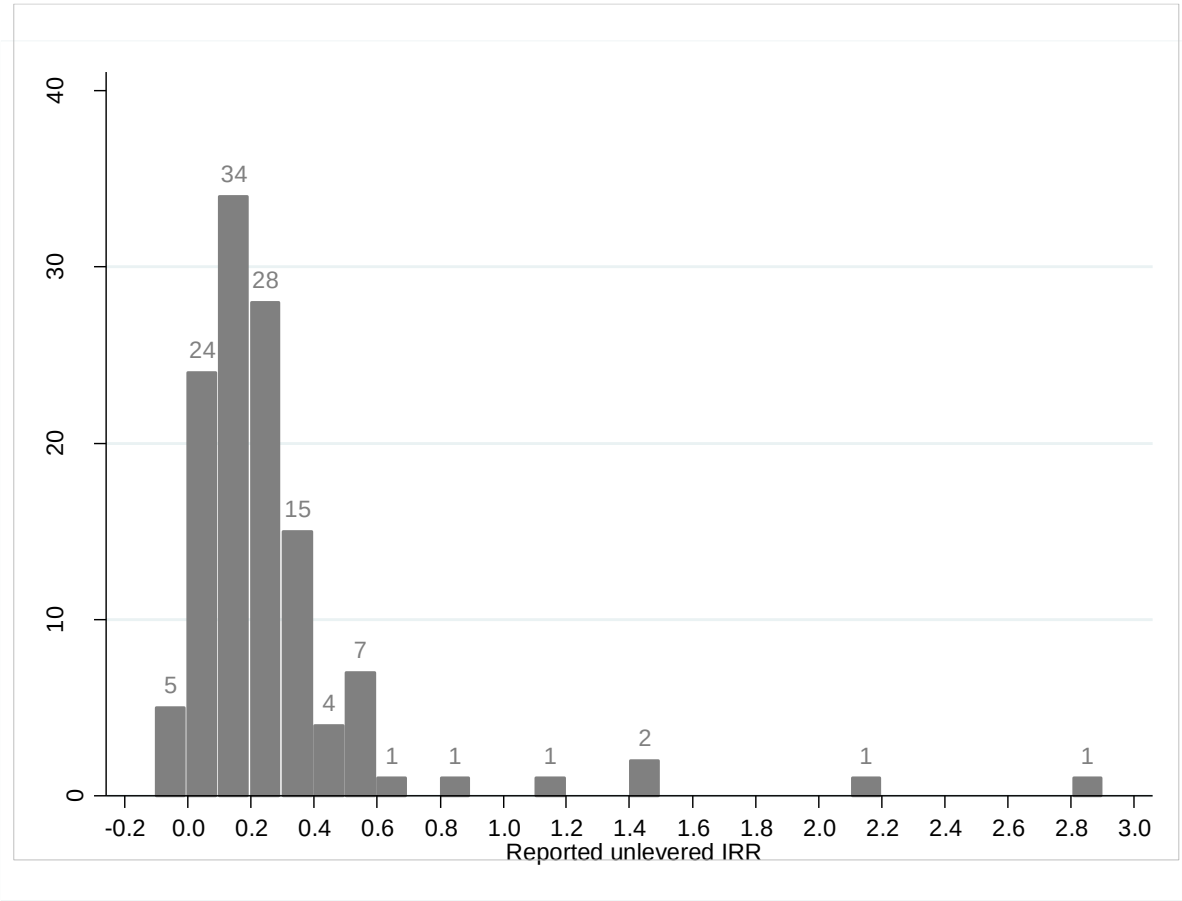
Source: Own illustration

Further, the sample is well-diversified in light of deal origin channel and exit channel as shown in Figure 8. It is to be emphasised that in contrast to the majority of private equity

studies carried out so far, the underlying sample only includes eight (7%) public-to-private transactions. Hence, there is no bias towards this sub-group of large LBOs. These deals are relatively uncommon in the German-speaking region.[19] Moreover, Figure 9 shows additional attributes of the sample being realised vs. partially realised, organic growth vs. buy-and-build as well as club vs. stand-alone transactions.

In terms of industry coverage the ICB classification was applied to cluster the buyout transactions accordingly. With 51% the majority of deals were carried out in the industrials sector, followed by consumer goods (21%) and consumer services (15%). Other industries include health care (8%), technology (2%), basic materials (2%) and telecommunication (1%). With regard to specific countries the sample comprises 96 (77%) German, 21 (17%) Swiss and seven (6%) Austrian buyout transactions.

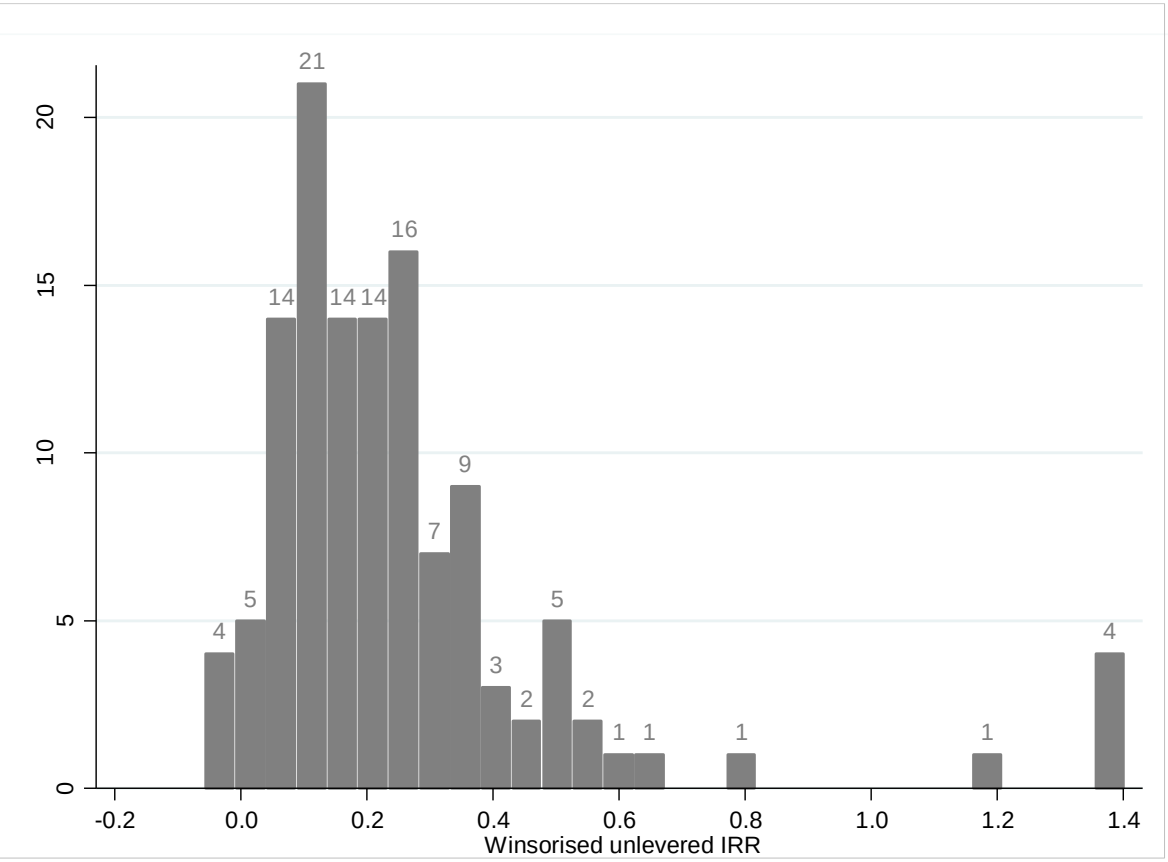
Figure 10: Buyout Sample – Histogram Reported Unlevered IRR



Source: Own illustration; Stata output

[19] This is potentially also driven by the fact that there are extensive notification requirements under German law, when an investor exceeds certain thresholds of ownership. For further details please refer to Renz and Rippel (2011, p. 237).

Figure 11: Buyout Sample – Histogram Winsorised Unlevered IRR



Source: Own illustration; Stata output

Figure 10 corresponds with the results shown in Table 9. The maximum unlevered IRR trades at 290%, while a total of five transactions show an IRR exceeding 100%. In terms of buyouts with a negative IRR the histogram includes five observations. Now, winsorising these results by applying a 3% fraction of total observations at both tails, for high and low values, the histogram shown in Figure 11 results. The winsorised unlevered IRR still comprises five deals with negative returns and five deals exceeding the 100% threshold, however, replacing for the extreme outliers changes the sample's mean from approximately 28% (reported) to 26% (winsorised). For regression purposes winsorisation is helpful as the impact of extreme outliers on the overall result is less pronounced. If a 5% fraction would be applied the winsorised unlevered returns would neither inlcude deals with negative IRRs nor deals with returns above 100%, the mean unlevered IRR would trade at 23%. For the various regressions performed later the independent variables were winsorised.

More in-depth descriptive analyses and statistical tests for the buyout sample are presented in the data sampling and descriptive statistic sections of the three essays in the main body of the thesis.

5.3.2 Nearest Neighbour and Industry Portfolio Benchmark Samples

Given the benchmarking techniques introduced in the previous section we find no differences between the buyout- and benchmark samples with regard to holding period and industry distribution. Additionally, as one can see from Tables 9 and 10, profitability at entry between the buyout- and the nearest neighbour sample is identical (13%) on median level and only slightly higher for buyouts on mean level (15% vs. 16%). This is explained by EBITDA margin as the key selection criterion for identifying the relevant neighbour company.

Tables 10 and 11 show the same descriptive statistics for the two benchmark samples as presented previously for the buyout sample (see Table 9). The industry portfolio benchmark sample shows aggregated values of all listed companies in a specific industry at the year of entry, consequently absolute values are significantly higher compared to the nearest neighbour sample. In terms of unlevered IRR the nearest neighbour sample includes 17 companies with a negative return and no observation exceeding the 100% threshold. Overall this implies a lower performance compared to the buyout sample, represented by a median (mean) unlevered IRR of 13% (16%) in Panel B of Table 10.

Table 10: Nearest Neighbour Benchmark Sample – Descriptive Statistics

	Entry					Exit				
n = 124	Mean	Median	Std. Dev.	Min	Max	Mean	Median	Std. Dev.	Min	Max
Panel A: Deal Characteristics										
Enterprise Value (EV) (€m)	3,657	641	10,300	10	78,180	5,661	954	14,100	12	105,200
Equity Value (EqV) (€m)	2,322	445	5,293	10	43,718	3,634	815	6,653	14	35,712
Net Debt (€m)	1,336	61	5,701	-633	40,984	2,026	84	8,275	-1,035	69,488
EV/EBITDA multiple	7.1	6.4	4.0	1.6	28.7	8.2	7.1	4.3	1.9	26.6
Sales (€m)	4,846	541	14,300	8	131,782	6,034	758	16,200	9	142,059
EBITDA (€m)	493	80	1,378	2	12,275	644	137	1,461	1	9,577
EBITDA/Sales margin	0.15	0.13	0.09	0.34	0.53	0.16	0.14	0.09	0.04	0.52
Debt/Equity ratio	0.47	0.13	1.23	-0.55	10.69	0.42	0.13	2.17	-0.28	6.81
Debt/EBITDA ratio	1.09	0.91	1.00	-5.02	13.24	1.34	0.68	2.33	-5.27	10.43
Panel B: Return										
Holding period (years)						4.32	3.92	2.03	0.83	12.00
Money Multiple						2.87	1.75	5.30	0.15	42.19
Times Money (Money Multiple-1)						1.87	0.75	5.30	-0.85	41.19
IRR (levered)						0.18	0.14	0.23	-0.70	0.84
IRR (unlevered)						0.16	0.13	0.19	-0.40	0.81

Table 11: Industry Portfolio Benchmark Sample – Descriptive Statistics

	Entry					Exit				
n = 124	Mean	Median	Std. Dev.	Min	Max	Mean	Median	Std. Dev.	Min	Max
Panel A: Deal Characteristics										
Enterprise Value (EV) (€m)	225,763	190,831	191,000	5,727	1,951,762	254,009	256,106	193,000	8,425	2,038,700
Equity Value (EqV) (€m)	173,520	153,689	163,000	5,874	1,736,024	200,978	191,998	141,000	6,807	1,489,133
Net Debt (€m)	52,243	39,456	52,500	-1,709	431,310	53,031	35,023	61,700	846	549,567
EV/EBITDA multiple	9.9	9.4	2.67	5.7	18.6	9.4	9.2	2.4	4.8	17.8
Sales (€m)	241,946	289,137	130,000	5,317	1,065,124	275,934	327,453	151,000	8,428	1,412,806
EBITDA (€m)	22,499	19,795	13,600	896	129,093	27,192	26,279	19,900	1,758	209,111
EBITDA/Sales margin	0.10	0.08	0.04	0.06	0.33	0.11	0.08	0.05	0.06	0.27
Debt/Equity ratio	0.31	0.21	0.25	-0.03	1.80	0.25	0.21	1.24	0.05	0.72
Debt/EBITDA ratio	2.04	1.77	0.18	-0.22	10.46	1.73	1.36	1.01	0.38	5.28
Panel B: Return										
Holding period (years)						4.32	3.92	2.03	0.83	12.00
Money Multiple						1.58	1.49	0.71	0.43	4.23
Times Money (Money Multiple-1)						0.58	0.49	0.71	-0.57	3.23
IRR (levered)						0.10	0.09	0.13	-0.41	0.51
IRR (unlevered)						0.10	0.09	0.11	-0.34	0.45

Comparing the two benchmark samples reveals that the nearest neighbour sample is performing better compared to the industry portfolio sample, which shows a median (mean) unlevered IRR of 9% (10%). Further, compared to the buyout sample, the differences between levered and unlevered IRRs reveal that leverage is not a signifcant driver of benchmark returns. Interestingly, the nearest neighbour sample shows lower EV/EBITDA multiples at entry and exit, but a higher EBITDA margin. Moreover, it can be seen that the change in EV/EBITDA multiple shows an increase for the nearest neighbour but a decrease for the industry portfolio sample.

As will be discussed in the next sub-section, the nearest neighbour sample is identified as the most appropiate one. Hence, further descriptive analyses are presented and relevant statistical tests are performed in the main body of the thesis.

5.4 Potential Sample Selection Bias

In light of a potential sample selection bias one could raise three different issues or a combination thereof: (1) the total number of observations in the final buyout sample is insufficient to represent buyout activity in the German-speaking region, (2) the sample is homogenous with regard to its characteristics and therefore biased as it only represents a certain group of leveraged buyout transactions, and directly related to this, (3) the overall buyout sample is

biased towards better performing transactions. In the following these three potential selection issues are discussed and where appropriate respective counter measures are introduced.

(1) Out of the total sample of 124 buyouts in the German-speaking region 96 transactions were exclusively initiated in Germany between 1995 and 2008. Analysing the annual statistics published by the German Association of Private Equity and Venture Capital investors (BVK) reveals that over this 14-year time period a total of 1,112 buyouts were initiated. This includes all transactions classified as MBO, MBI or LBO. Hence the underlying buyout sample covers approximately 8.6% of total German buyout activity over this time period; or broadly one out of ten deals. Therefore – and in light of general constraints with regard to data availability in private equity research – the sample is regarded as representative and extensive as a comparable dataset has – to the best of the author's knowledge – never existed in this form for research purposes before.

(2) The sample covers very small to very large buyouts, includes trade sales, secondary buyouts and IPOs in terms of exit channel and comprises private sales, public-to-private transactions, carve-outs and secondary sales in terms of deal origin. Further, the sample includes unsuccessful deals with negative returns, but also well-performing deals with IRRs above 100%. Hence, the sample is very heterogeneous and therefore not regarded to be biased towards a specific sub-group of leveraged buyout transactions.

(3) Regardless of the fact that the sample includes deals with negative returns and well-performing deals at the same time, the overall performance of the 124 buyout transactions is relatively high with a median levered and unlevered IRR of 30% and 19%, respectively. The information published in any private equity deal database is voluntary and self-reported by the GPs. Hence, there is a tendency to report rather successful than underperforming deals. However, this is not regarded to have a significant impact on the results obtained in light of the analyses conducted. First, the relative value drivers are analysed regardless of the absolute performance. Second, when analysing the drivers of unlevered returns the individual operational deal components are applied as determinants, their significance levels are not regarded to be impacted by the overall absolute deal performance. Third, when analysing the drivers of abnormal operational performance the nearest neighbour benchmark sample is applied, which, in contrast to the industry portfolio benchmark sample, is better performing. Hence a better performing deal sample is compared with an appropriate (better performing) benchmark sample, which should at least partially level out the tendency towards better performing buyout transactions.

Based on the above the sample is believed to be sufficiently representative and heterogeneous. In terms of a potential tendency towards better performing deals an appropriate benchmark sample serves as the relevant counter measure.

5.5 Robustness Checks

As highlighted in the previous sections some assumptions were applied in order to derive the final buyout sample. In the following these assumptions are discussed and altered to determine the impact of such changes on the overall results obtained.

Additional cash inflows resulting from tax savings due to high levels of interest (tax-shield effect) are neglected, as they are regarded being too risky in nature due to high leverage and increased financial risk. Incorporating the tax-shield effect into the unlevering formula introduced above and assuming a corporate tax rate of 31.2% would increase the mean (median) unlevered IRR from 27.9% (19.2%) to 30.9% (21.8%).[20] The unlevered times money multiple would increase accordingly.

Table 12: Unlevered IRR Sensitivity Analysis – Tax Shield Effects

Unlevered IRR (median)		**Tax rate**					
		0.0%	*10.0%*	*20.0%*	*30.0%*	*31.2%*	*40.0%*
Cost of debt	*0.0%*	16.8%	17.4%	18.1%	19.2%	19.4%	20.3%
	2.5%	17.7%	18.4%	19.2%	20.2%	20.3%	21.4%
	5.0%	18.8%	19.6%	20.3%	21.3%	21.4%	22.1%
	Variable	19.2%	20.0%	20.6%	21.7%	21.8%	22.4%
	7.5%	20.1%	20.7%	21.5%	22.2%	22.2%	22.8%
	10.0%	21.3%	21.8%	22.4%	22.9%	23.0%	23.8%

What is more, instead of applying the specific cost of debt information, as described in the beginning of the underlying section, one could assume a lump-sum cost of debt to be applied for all deals. Assuming cost of debt of 5% would decrease mean (median) unlevered IRR from 27.9% (19.2%) to 27.5% (18.8%). The unlevered times money multiple would decrease accordingly. This implies that the weighted average cost of debt, when applying the specific cost of debt information presented earlier in Table 8, trade slightly above 5%. Table 12 provides a sensitivity analysis showing the impact on median unlevered IRR when incor-

[20] According to the Bundesverband der Deutschen Industrie e.V. (BDI) the average German corporate tax rate traded at 31.2% in 2013. Please refer to http://www.bdi.eu/BDI-VCI-Steuerbelastung2013.pdf, p. 14.

porating the tax shield effect and assuming different combinations of tax rates and cost of debt, all else remaining equal.

Variable cost of debt refers to the specific annual cost of debt information presented in Table 8 and applied for the buyout sample. At a tax rate of 0%, this is equal to the assumption of no tax-shield, and at variable cost of debt the median sample unlevered IRR of 19.2% results. Assuming increasing tax rates unlevered IRR increases as additional cash inflows result from the tax-shield effect. The additional cash is either used in the form of dividends or to pay down additional debt, which consequently leads to increased returns. Assuming decreasing cost of debt unlevered returns are decreasing, mathematically this is explained by a lower numerator and an unchanged denominator. Economically this is explained by an increase in the relative contribution of the leverage effect to levered returns which results in a diminishing (unlevered) return on equity.[21]

The results obtained show that the sample is relatively robust to changes. While not incorporating the tax-shield effect is a general methodological assumption, changes in cost of debt have only a slight impact on returns. For the analyses conducted in the underlying thesis the impact is minor as changes in tax rates or cost of debt would also impact the benchmark results and as such the effects would level out each other.

One additional test to be performed is with regard to differences between the 87 realised and the 37 partially realised buyout transactions included in the sample. Performing difference tests on mean and median level for the unlevered IRR shows that the two categories are not statistically different from each other. The z-value of the two-sample Wilcoxon (Mann-Whitney) rank-sum test amounts to -0.871, while the t-value of the two-sample t-test amounts to -0.306. Mean (median) unlevered IRRs are 28.6% (21.3%) and 26.3% (17.7%) for realised and partially realised buyouts, respectively. Hence it can be concluded that the net asset values relating to the non-realised share are representative and the buyouts can be included for analytical purposes.

Based on the introduction of the methodology and the dataset, the following three sections comprise the individual research papers and as such represent the main body of the underlying thesis.

[21] Please refer to Modigliani and Miller (1958).

6 Essay 1 – Value Drivers in Buyout Transactions

Corporate Raiders at the Gates of Germany?
Value Drivers in Buyout Transactions

by

Fabian Söffge[22] and Reiner Braun[23]

Abstract

Until recently, research into private equity has mainly focused on the US, the UK, and on Europe as a whole region. In this paper, the German-speaking countries in Europe (DACH) are treated as a distinct economic region. We analyse a proprietary sample of deal level data for 123 leveraged buyout transactions in the DACH countries between 1995 and 2010. By distinguishing between financial and operational value drivers through unlevering the overall times money multiple, we find that two-thirds of generated value stem from EBITDA growth, excess cash generation and multiple expansion, whereas one-third of value generated stems from leverage. Buyouts are found to yield abnormal returns compared with public benchmarks. The overall average (median) operational alpha is 11.6ppts (5.7ppts) in our sample. Buyouts before the global financial crisis in 2008 show better performance, while post-crisis exits have a significantly higher operational alpha. Our analysis shows no significant variations in performance over different exit channels. Leverage is found to contribute most if the portfolio company is sold to another private equity investor in a secondary transaction.

Paper Type: Working Paper

JEL Classification Code: G11, G24, G32, G34

Keywords: leveraged buyouts, private equity, value creation drivers, abnormal performance

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6.1 Introduction

Over the last three decades, private equity (PE) has become a relevant asset class in all major economies around the globe. This development has been accompanied by controversial discussions about the PE business model and its implications for the companies acquired. In economies like the US or the UK, the public seems to hold a neutral opinion of PE, whereas in Germany the debate has been very controversial. PE firms are often perceived as locust-like corporate raiders who are driven by short-term, value-maximising goals, presumably to the detriment of other stakeholders. More recently, the turmoil triggered by the financial crisis revitalised this discussion. Some people even questioned whether the PE business model is actually sustainable in what seems to be a new kind of world. The ongoing controversy was not helped by the dearth of reliable empirical evidence on how value is actually created in German buyout transactions. Using a proprietary and up-to-date sample of 123 buyout transactions in DACH countries, we are attempting to fill this gap by shedding light on what actually happens in companies when PE firms are in the driver's seat. Our sample covers approximately one out of ten German buyout transactions initiated between 1995 and 2008, an extensive and up-to-date dataset that is analysed for the first time.[24]

While being focused on the DACH countries, our study also offers some general insights into PE. Research on PE emerged in the 1980s in the US, and throughout the 1990s and 2000s it has gained importance in the UK and in Continental Europe. In the process, two schools of research have emerged: one focusing on questions related to fund level, such as performance persistence or the structure of buyout funds; another focusing on questions related to deal level, such as value creation of PE deals during ownership, operating performance and efficiency changes, acquisition premiums paid by PE investors at time of entry. This article aims at contributing to the latter school of research, with a distinct emphasis on value creation in PE transactions.

There is only limited empirical evidence available on value creation, even though it is at the heart of explaining returns in buyout transactions (see Puche and Braun (2014), Acharya et al. (2013), Achleitner et al. (2010), Nikoskelainen and Wright (2007)). Achleitner et al.

[24] Our data source are the annual reports of the German Association of Private Equity and Venture Capital Investors (BVK) for the years 1995 to 2008. Annual MBO, MBI and LBO transactions were summed up, resulting in a total of 1,122 transactions. For the year 2003 alone, the available data covers 35% of all PE buyout activity in Germany. We only compare up to 2008 as this is the last year of entry in our sample.

(2010) emphasise that the majority of studies on value creation focus on the Anglo-Saxon markets, but that little work has been done on Western and Continental Europe.

One of the reasons why data is scarce is because neither limited partners (LP) nor general partners (GP) are obliged to publish their transactions. And even if deal level data can be obtained, additional constraints must be taken into account: does the gathered data relate to an appropriate value creation framework, i.e. is it possible to distinguish between financial and operational value drivers?

Recent studies by Puche and Braun (2014), Achleitner and Figge (2014), Acharya et al. (2013), Achleitner, Braun and Engel (2011) as well as Achleitner et al. (2010) have made an important contribution to filling this gap in regional research, by focusing on European buyouts and comparing North American and European value creation drivers. However, research into value creation and buyout performance in specific countries or regions is still a desideratum. To the best of our knowledge, there has been no previous analysis of buyout performance and value creation in the DACH countries. One should emphasise that research results from other economies are not necessarily transferable, for a number of reasons. The DACH region is characterised by medium-sized businesses, distinct cultural traditions and highly developed business acumen. In line with the general structure of the DACH economies, our sample of buyouts from this area contains a considerable number of small and medium private-to-private transactions. We hope that both academics and practitioners can benefit from research dedicated to the region that has been of the major drivers of the European economy in recent years.

By analysing a new and proprietary dataset, this article will (1) focus on private equity deal level performance in the DACH region; (2) benchmark the overall deal level performance to public peer companies, in order to assess potential abnormal performance of private equity investments as a standalone asset class; (3) analyse value creation on deal level by decomposing value creation into operational and financial drivers through the comprehensive approach suggested by Achleitner et al. (2010), and (4) distinguish between before and after the crisis as well as between various types of exit channels in light of deal level performance, abnormal performance and value creation drivers.

The empirical analysis is based on a proprietary and novel deal level dataset of 123 buyout transactions carried out in the DACH region between 1995 and 2010. We find (1) an average (median) gross equity IRR of 43% (31%) and a times money multiple of 3.83 (2.31) for

the entire sample; (2) buyouts to yield abnormal returns compared to public benchmarks with an overall average (median) operational alpha of 11.6ppts (5.7ppts); (3) that one-third of value generated stems from leverage and two-thirds from EBITDA growth, excess cash generation and multiple expansion, and (4) better performance of pre-crisis buyouts before 2008, but a significant higher operational alpha for post-crisis exits. Compared to findings from other studies, it seems that DACH buyouts are slightly more banking driven, i.e. by imposing leverage and generating free cash flow, than European transactions in general. Finally, our analyses reveal no significant differences in performance over different exit channels, but leverage contributes most if the portfolio company is sold to another private equity investor in a secondary transaction.

The remainder of this paper is structured as follows: Section 6.2 gives a concise overview about extant evidence on value creation in PE. We introduce the value creation methodology used and explain how we identified public benchmarks in Section 6.3. Section 6.4 introduces our sample and value creation results for our overall sample of DACH buyouts. In Section 6.5 value creation in DACH buyouts is compared to a sample of public benchmark. Section 6.6 analyses value creation in light of the global financial crisis. Section 6.7 examines differences in value creation by the type of exit channel. Section 6.8 concludes.

6.2 Literature Review and Focus on the DACH Region

In the past decade, a number of studies have been dedicated to performance at fund level.[25] Of the more recent studies on value creation and performance at deal level, many have been influenced by initial research conducted by Kaplan (1989), Kitching (1989), Smith (1990), Muscarella and Vetsuypens (1990), and Kaplan and Stein (1993), who mainly focused on US buyouts.

Table 13 presents an overview of the most recent studies in this field. The literature listed in Table 13 varies significantly in terms of sample size, periods under review and results found.[26]

[25] Harris et al. (2014), Jenkinson and Stucke (2011), Stucke (2011), Phalippou and Gottschalg (2009), Kaserer and Diller (2005), Kaplan and Schoar (2005), Lerner and Schoar (2004) Ljungvist and Richardson (2003).

[26] The dataset analysed by Puche and Braun (2014) differs from the dataset analysed for this paper.

Table 13: Literature Review

Value Creation and Performance on Deal Level - Main results

Author(s)	*Year*	*Region*	*Deals*	*Period*	*Result*
Puche and Braun	2014	Europe	1,395	1988-2011	Median IRR of 35% and money multiple of 2.5x. Value creation drivers: 30% leverage effect and 70% operational with 37% EBITDA growth, 13% FCF effect, 15% multiple expansion and 6% combination effect (mix)
Achleitner and Figge	2014	North America/ Europe	2,456	1990-2010	Median IRR of 29% and cash multiple of 2.7x for realised transactions; EBITDA growth between financial and other buyouts not significantly different, but financial buyouts show higher sales growth and lower margin improvements
Acharya et al.	2013	Europe	395	1991-2007	Median IRR of 43%; cash multiple of 3.0x; 15.4% median outperformance; EBITDA and multiple growth of deals outperform sector and are significant drivers of abnormal deal performance
Achleitner, Braun and Engel	2011	North America/ Europe	1,980	1986-2010	Median IRR of 26% and cash multiple of 2.5x for realised transactions; sales growth, margin improvement, multiple expansion, deal size and leverage drive equity returns; positive relation between sales growth and pricing at exit
Guo, Hotchkiss and Song	2011	US	192	1990-2006	Comparable performance or slighlty outperformance of PE deals compared to benchmarks firms
Achleitner et al.	2010	Europe	206	1991-2005	Median IRR of 33%; money multiple of 2.8x; value drivers are 32% Leverage, 31% EBITDA growth = 79% sales growth and 21% margin improvement, 15% FCF effect, 18% multiple expansion; 4% mix
Groh and Gottschalg	2009	US	133	1984-2004	Median IRR of 36%; Opportunity cost of capital of buyouts are on average 3.3% below S&P 500 returns
Brigl et al.	2008	Europe	32	2000-2006	Average IRR of 48% is driven by 46% sales growth, 10% margin improvements, 21% multiple expansion and 23% de-leverage
Nikoskelainen and Wright	2007	UK	321	1995-2004	Average equity IRR of 71%; Larger deals show higher returns; For large buyouts leverage negatively impacts equity returns; IPO exits perform better compared to trade sales and secondaries
Pindur	2007	Europe	42	1993-2004	Median IRR of 58%; outperformance of 50% (median) compared to DJ Stoxx; Value drivers: EBITDA growth 45%, FCF 22%, multiple expansion 28% and mix 5%
Loos	2006	US/ Europe	57	1981-2002	Average IRR of 78%; Value drivers: 83% leverage effect and multiple expansion, 25% sales growth and -8% negative margin effect

Note: Cash and money multiples can either be based on GP or company level.

Acharya et al. (2013) find a median IRR of 43% for their European sample of 395 deals and a median outperformance of 15.4ppts of PE deals compared to benchmarks, while Pindur (2007) finds a median IRR of 58% and a corresponding abnormal performance of 50ppts in Europe for 42 transactions. In contrast Guo, Hotchkiss and Song (2011) find a comparable performance or only a slight outperformance of 192 US PE deals. In light of value drivers, Achleitner et al. (2010) conclude for their European sample, comprising of 206 transactions, that approximately one-third stem from leverage, roughly 50% from operational improvements and ca. one-fifth from multiple expansion. Loos (2006) finds for his mixed US and European sample (57 deals) that only 17% are due to operational improvements, while the remainder results from leverage and multiple expansion between entry and exit.

The majority of studies aggregate deal level results into larger regions, such as Europe or North America. PE performance in the US has been covered extensively. Nikoskelainen and Wright (2007), as well as Acharya et al. (2013), through a sub-sample, devoted their studies exclusively to the UK. As of today no research has been done on specific regions or countries within Continental Europe. The purpose of this article is to partially fill this gap by focusing on the DACH countries, a region which has been a major driver of the Continental European economy in recent years.

The private equity industry in Germany has gained in significance over the last two decades. While in 1995, when our sample starts, all portfolio companies generated aggregated revenues of approximately €40bn and had 282k employees on their payrolls, these figures increased to €178bn and 900k, respectively, in 2014. In the same period, the importance of buyouts for the entire economy also increased considerably. In 1995, buyouts only accounted for 20% (€110m) of all investments (measured in Euros invested), in 2014 this percentage increased to 79% (€5.6bn).[27] Putting the number of people employed by German portfolio companies in 2014 in relation to the total number of people employed in Germany leads to the conclusion that approximately two and a half out of 100 people are employed in a company that is fully or partially owned by private equity investors.[28] These facts have led to a very

[27] For respective statistics please refer to the annual reports of the German Association of Private Equity and Venture Capital Investors (BVK), which provide the best available data on private equity activity in Germany (http://www.bvkap.de/privateequity.php/cat/42/title/Statistiken).

[28] According to the German Federal Statistical Office there were 38,306k employees in Germany in 2014. In the same year, 900,400 people were employed in portfolio companies in Germany, leading to a ratio of ca. 2.4%. Please refer to the website of the German Federal Statistical Office (https://www.destatis.de/DE/ZahlenFakten/GesamtwirtschaftUmwelt/Arbeitsmarkt/Erwerbstaetigkeit/TabellenErwerbstaetigenrechnung/ArbeitnehmerWirtschaftsbereiche.html).

controversial public discussion in Germany that was nicknamed the locust-debate.[29] Many employees, managers, journalists and politicians in Germany view private equity and hedge funds as ruthless short-term optimisers that do only care about returns without any consideration of other stakeholders' interest. The PE industry's opacity does not help in shedding light on what really happens to DACH companies while being owned by PE firms. This study wants to contribute the first empirical data for the ongoing controversy.

6.3 Value Creation Methodology and Public Benchmarks

We apply value creation methodology suggested by Achleitner et al. (2010), which measures value creation in terms of the times money (TM) multiple and distinguishes between a levered and an unlevered multiple. This is, in contrast to Loos (2006), Pindur (2007) or Brigl et al. (2008), a major advantage of this methodology. Acharya et al. (2013) apply a similar approach by unlevering their returns, with two minor differences: they measure performance exclusively in terms of IRR and do not regard tax shields as risky (p. 379). The unlevered times money multiple is further split into the value drivers EBITDA growth, free-cash-flow (FCF) effect and multiple expansion. We further split EBITDA growth into sales growth and EBITDA margin improvement (see Acharya et al. (2013), Achleitner et al. (2010), Brigl et al. (2008), Pindur (2007) or Loos (2006)).

In addition to the relevant deal level data at entry and exit consisting of enterprise value, net debt, equity value, sales, EBITDA and ownership percentage, our dataset includes the monthly gross cash flow pattern between the GP and the portfolio company. Therefore, in addition to the initial investment at entry (EqV_{En}) and the cash proceeds at exit (EqV_{Ex}), we account for equity injections (*EqInj*) contributed and dividends (*Div*) received by the GP during the holding period when computing the value generated over the holding period. The latter two variables are adjusted for ownership (*os%*) as the deal level data is reported at 100%, but the cash flow data is reported at the respective ownership percentage of the GP.

$$(24)\quad MM - 1 = TM_{LEV} = \frac{EqV_{Ex} - EqV_{En} - \frac{EqInj}{os\%} + \frac{Div}{os\%}}{\left(EqV_{En} + \frac{EqInj}{os\%}\right)}$$

[29] A former leader of the German Social Democratic Party contributed to the discussion by comparing private equity investors with locusts in an interview with the leading German tabloid newspaper (Interview with Franz Müntefering, 17.4.2005, Bild am Sonntag).

As we aim at comparing value generation between companies, such a levered times money multiple, as a measure of value creation, is subject to the financial risk taken by investors. In order to ensure comparability between companies we derive the unlevered times money multiple (TM_{UNLEV}) that would have been generated by a 100% equity-financed transaction. To this end we delever TM_{LEV} by applying the following formula:

$$(25)\ TM_{UNLEV} = \frac{TM_{LEV} + \left(\left((1+CoD)^{HP}\right)-1\right)\left(\frac{\overline{D}}{\overline{E}}\right)}{1+\left(\frac{\overline{D}}{\overline{E}}\right)}$$

In the above formula *CoD* represent the cost of debt, *HP* the holding period of the target company by the GP, and $\overline{D}/\overline{E}$ the average debt to equity ratio over the holding period.

Acharya et al. (2013) include the tax shield within cost of debt (p. 379). Due to the high leverage ratios at entry we do not regard the tax shields as being certain in nature and therefore do not account for a tax shield effect.[30]

Our dataset does not comprise the deal specific cost of debt of the individual transactions. Instead of applying a lump-sum cost of debt for all deals, we have approximated the applicable cost of debt via a two-step approach.

Firstly, we have applied the monthly marginal lending rate published by the German Federal Bank (January 1995 to March 2002) and the European Central Bank (April 2002 to December 2008) and calculated yearly average base rates. Secondly, we have retrieved syndicated loan information for leveraged buyouts through Thomson Reuters ONE Banker and calculated the annual median spread of these loans. The sum of the two served as the relevant cost of debt specified by the deal's year of entry.[31]

By calculating unlevered returns, we were able to analyse sample data without recourse to the financial structure of the sampled companies and without regard to the financial risk chosen by the GP at entry. This has allowed us to compare individual value drivers within certain sub-sets of data by focusing exclusively on operational and market effects during ownership. The first value driver is EBITDA growth, i.e. the change in EBITDA between entry and exit multiplied by the EV/EBITDA multiple at entry.

[30] For more detail see also Achleitner et al. (2010, p. 18).

[31] Results are robust to alternative ways of obtaining debt cost proxies, e.g. taking monthly LIBOR rates plus a 300 basis point spread as suggested by Ivashina and Kovner (2011, p. 2473).

Secondly, the FCF effect represents the portfolio company's ability to pay down debt and distribute dividends during the holding period. It is calculated as the change in net debt between entry and exit, plus dividends received and minus equity injections contributed by the GP. In contrast to EBITDA growth, this value driver relates to any excess cash generated by the company that can be used to fulfil the requirements of its stakeholders. This does not only refer to profit and loss amounts, as excess cash can also be generated through other means, for example through working capital improvements.

Thirdly, multiple expansion is the change in the EV/EBITDA multiple between exit and entry multiplied by the EBITDA at entry. As highlighted previously, we further break down EBITDA growth into sales growth and margin improvements. In the latter case, as well as when calculating EBITDA growth and multiple expansion, we calculate a combination effect to account for simultaneous changes of these value drivers.

Having computed the detailed value creation composition for each of our buyout transactions, we are interested in benchmarking these numbers to the value created in comparable public companies. To this end we have built a benchmark sample by applying a modified nearest neighbour approach as suggested by Acharya et al. (2009a). We follow the opportunity cost of capital theory by assuming that the next best alternative to invest, from the GP's perspective, would have been the public equity market in the same region. Through CapitalIQ we have retrieved the relevant financials of 957 listed companies in Germany, Switzerland and Austria enabling us to gauge the value creation process of these companies. The result is a hypothetical index of public listed companies for the German-speaking region from 1995 to 2010. It is worth noting that all relevant tickers were obtained in October 2013, and subsequently pulled back to 1995, thus reducing the number of companies from 957 to 202 in 1995. The maximum holding period in our sample is 12 years. Therefore, simulating a hypothetical investment into a public neighbour (peer) requires selecting those publicly traded companies that are in existence over the same period. We found this methodology suitable for ensuring that a selected neighbour is in existence over the entire holding period of the corresponding buyout transaction.

Given that our sample does not only include large public-to-private deals, but rather represents a variety of all deals, be they small private-to-private deals, secondary buyouts or public-to-private transactions, the criteria for selecting the relevant benchmark neighbour has to be chosen carefully. Due to the high averages of absolute profit and loss figures, such as sales or EBITDA, as well as high averages of market capitalisation or financial debt in the initial

public benchmark universe, these figures are not suitable to identify relevant public benchmarks for our buyout sample. We believe that profitability is the most reasonable figure for identification purposes.[32] Hence, we chose to apply a two-step approach to identify the relevant public neighbour in the year of entry for each buyout in our sample by (1) reducing the benchmark sample to the industry of the deal (ICB classification), and by (2) searching for the publicly listed peer with the closest EBITDA margin to the deal at entry. By repeating this procedure for each buyout, we constructed the benchmark sample and calculated the corresponding value creation drivers. In doing so, we also included dividends paid to shareholders in order determine benchmark performance in the same way as buyout performance.

6.4 Data Sampling and Descriptive Statistics

The final buyout sample was constructed using several sources. Sample construction began with initial proprietary data of 1,318 transactions from Germany, Switzerland and Austria from institutional investors. For these transactions, we observed monthly gross cash flows (before carried interest and fees) from the target company to the PE firm, including interim dividends and equity injections during ownership. Furthermore, the initial sample included selected information necessary for calculating value creation drivers. However, in order to compute the entire value creation bridge we required full information on enterprise value (EV), equity, net debt, sales, EBITDA, and EV/EBITDA multiple at entry and exit. Much of this information was obtained by searching the following commercial databases: MergerMarket, CapitalIQ, and Thomson Reuters ONE Banker.

Subsequently, non-buyout deals or deals showing an unrealised status (reducing the sample to 608 realised or partially realised DACH buyouts) were excluded from the initial proprietary sample. We ended up with a final buyout sample of 123 deals, each complete with all the necessary data points. These transactions were carried out between 1995 and 2010, with 96 being German (78%), 21 Swiss (17%) and six Austrian (5%) deals. These buyout transactions were carried out by 33 different private equity houses in eight different industries. In terms of deal origination and exit channel, the sample shows a heterogenous distribution. 38% of deals were sourced from private sellers, 33% relate to carve-out transactions, 23% are secondary deals and 7% are public-to-private deals, i.e. delistings of previously public companies. In terms of exit channel, 46% of target companies were sold to strategic buyers, 45% of

[32] Especially given that average sales of the benchmark sample at entry trade at ca. €4.9bn, compared to average sales of the buyout sample trading at €0.4bn.

exited deals relate to financial buyers (secondary transactions) and 9% were exited via an IPO.

With about three quarters of investments stemming from the period between 2002 and 2007, our sample covers the more recent wave of private equity transactions (Guo et al., 2011, p. 479). Additionally, our sample allows us to examine the effects of the global financial crisis of 2008 on value creation. 41% of all exits in our final sample took place during or after the crisis. For detailed descriptive statistics please refer to Table 14.

In the following Panel A, the average (median) holding period of the sample is shown to be 4.3 (3.9) years. Although slightly higher, this figure is broadly in line with the 3.9 (3.4) year holding period calculated for 385 exited European deals in a study conducted by Acharya et al. (2013, p. 376). It is also comparable to other recent studies (Achleitner and Figge, 2014, p. 418; Guo et al., 2011, p. 499; Achleitner et al., 2011, p. 153; and Achleitner et al., 2010, p. 20). The return measures shown in Panel A are gross deal returns, which means they do not account for management fees or carried interest. As inherent to the PE asset class, deal returns are positively skewed and our sample includes seven deals with IRRs above 100%. Nevertheless, we also observe 12 deals with IRRs below 0%, ensuring heterogeneity in our sample in terms of performance.

Overall, the deals in our final sample exhibit a levered average (median) equity IRR and money multiple (realised gross proceeds/cash invested) of 43.1% (30.8%) and 4.8 (3.3), respectively. For their sample of 395 European deals, Acharya et al. (2013) find a relatively higher gross average (median) IRR of 56.1% (43.2%), but a money multiple of 4.4 (3.0), which is broadly in line with our results (p. 376). A slightly higher gross IRR of 50.1% (35.7%) is obtained by Groh and Gottschalg (2009, p. 8) for their sample of 133 US transactions. Achleitner et al. (2011), who analysed 1,090 realised European and North American transactions, find an equity IRR of 31% (26%), which is slightly lower compared to our findings.

Table 14: Descriptive Statistics

Panel A presents the return characteristics of the buyout sample. We delever the levered IRR based on annual cost of debt, which were determined on the basis of the average base rates plus the median spread of buyout transactions in the applicable year. On the right hand side of Panel B, we show the p values for the two-sided t test (paired) and the Wilcoxon matched-pairs signed-rank test, for selected deal characteristics, used to test for the difference in mean and median, respectively. *, **, and *** indicate whether the tests are statistically significant at 10%, 5%, and 1% levels, respectively.

	Entry			**Exit**			**Test Statistic (p value)**	
n = 123	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	T Test	Wilcoxon
Panel A: Return								
Holding period (years)				4.32	3.92	2.04		
Money Multiple				4.83	3.31	7.74		
Times Money (Money Multiple-1)				3.83	2.31	7.74		
IRR (levered)				0.43	0.31	0.93		
IRR (unlevered)				0.28	0.19	0.38		
Panel B: Deal Characteristics								
Enterprise Value (EV) (€m)	436.3	124.1	925.2	809.7	220.0	1,683.1	0.00***	0.00***
Equity Value (EqV) (€m)	170.2	46.3	359.9	523.6	150.7	1,239.3	0.00***	0.00***
Net Debt (€m)	266.1	75.3	658.5	286.0	58.5	683.9	0.55	0.03**
EV/EBITDA multiple	6.8	6.0	3.2	7.9	7.9	9.6	0.22	0.00***
Sales (€m)	421.3	155.2	729.7	485.5	183.8	824.4	0.00***	0.00***
EBITDA (€m)	59.2	21.8	107.4	88.9	29.8	169.5	0.00***	0.00***
EBITDA/Sales margin	0.16	0.13	0.11	0.17	0.16	0.10	0.09*	0.00***
Debt/Equity ratio	2.27	1.70	5.03	-0.70	0.41	13.90	0.02**	0.00***
Debt/EBITDA ratio	3.61	3.45	2.28	2.83	2.30	4.04	0.07*	0.00***

Panel B of Table 14 shows the key metrics of deal level data at entry and exit and performs applicable statistical methods to test for the differences between entry and exit on mean and median level, respectively. While the average (median) enterprise value at entry amounts to €436m (€124m), our sample covers a variety of transaction sizes ranging from €2m to €7.1bn. The average (median) enterprise value at exit trades at €810m (€220m), and both statistical tests of differences - comparing the values at entry and exit, for the mean and median - are significant at the 1% level. This applies to the majority of differences in the key metrics between entry and exit, while the focus in interpretation should be put on median results, instead of mean, as we have neither logged nor winsorised the underlying variables for the statistical tests performed.

With regard to changes in the EV/EBITDA multiple, we observe an increase of ca. 32% (median values of 6.0x at entry and 7.9x at exit). At the same time, median EBITDA was increased by ca. 36%. A further investigation into the increase in EBITDA shows that both, sales and EBITDA margin, significantly increased between entry and exit.

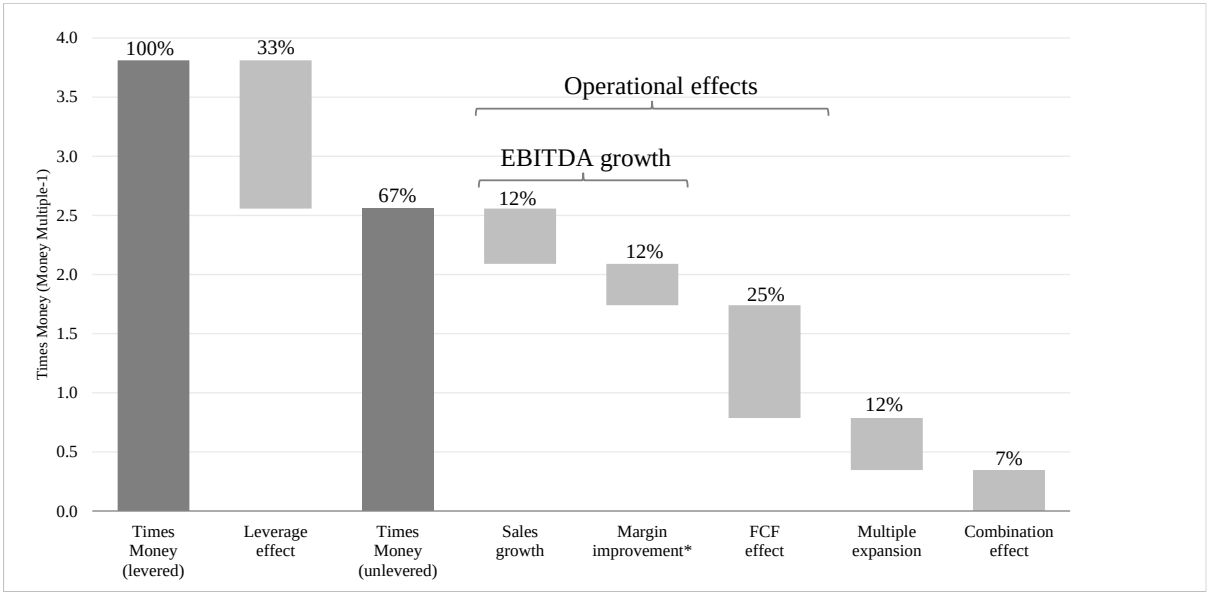
Additional deal metrics highlighted in Panel B of Table 14 relate to financing information: On average (median), the private equity sponsors were in the position to raise 3.6 (3.5) times EBITDA as debt at entry, while showing a median debt/equity ratio of 1.7. Over the holding period these ratios decreased significantly to 2.8 (2.3) debt/EBITDA and 0.4 median debt/equity, respectively. These findings are in line with Acharya et al. (2013), who find for their sub-sample of 354 transactions an average (median) debt/EBITDA ratio of 4.1 (4.1) at entry and 3.0 (2.5) at exit. With regard to the debt/equity ratio, the authors find for a sub-sample of 381 deals 2.2 (1.9) at entry and 0.8 (0.5) at exit (p. 376).

In an attempt to preempt enquiries into sample selection, we would like to point out that we are well aware that most of the data sampled relates to successful buyouts and above average performance. A likely reason is that information on transactions, in any PE database, is self-reported voluntarily by PE firms. However, we are confident that such a bias has no significant impact on our analysis. Rather than providing absolute numbers, we prefer to show relative contributions of value drivers. What is more, a specific advantage of our study is that transaction size is not limited to large transactions, as we do not focus on large public-to-private deals only. In addition, our sample shows a heterogenous distribution when it comes to the sources of deal origin and types of exit channel. Altogether, our final sample of 96 German transactions with entry years between 1995 and 2008 represents ca. 8.6% of the total

German buyout activity (in terms of number of transactions) in this period; i.e. we cover approximately one out of ten buyout transactions during this period.

Applying the value creation methodology to our final sample results in the value creation bridge as presented in Figure 12.

Figure 12: Value Creation Bridge – DACH Region



* Includes the combination effect between sales and EBITDA margin of 2%

Source: Based on Achleitner et al. (2010, p. 19); own illustration

The overall levered times money multiple across the entire sample of 123 deals, stated at 100%, can be segregated into financial engineering efforts of the GP and an unlevered times money multiple accounting for one-third and two-thirds, respectively. The individual components of the unlevered multiple, contributed 24% and 25% in terms of EBITDA growth and FCF effect, respectively. The multiple expansion between entry and exit contributed 19% (including combination effect) to the entire value generated. In summary, this means that only one-third of total value creation is driven by financial leverage. What is more, aggregating operational effects (EBITDA growth plus FCF effect) reveals that they contribute 49% to overall value. In terms of EBITDA growth, our results indicate equal contributions of 12% by top line sales growth and bottom line margin improvements, respectively. From the latter, one may infer that EBITDA growth is not only driven by cost-cutting measures or restructuring initiatives targeting margin improvements. While we do not have additional operational data, such as information on the number of employees, to prove this statement, intuition suggests that such measures would potentially stand in direct contrast to sales growth. Growing a com-

pany in terms of sales requires at least the same amount of back office and production capacity.

Puche and Braun (2014), who analysed a different global sample, which includes a European sub-sample of 1,336 deals with a median equity IRR of 35%, find that leverage contributed 30% to the total value generated and operational effects contributed 70% accordingly. Operational drivers are attributable to 37% EBITDA growth, 13% free-cash-flow effect and 21% multiple expansion (including the combination effect). Compared to our findings, this shows that financial engineering has a slightly higher impact on value generation in the DACH region. This requires higher de-leveraging efforts and leads to a higher FCF effect. One could therefore argue that the buyout business in German-speaking countries in particular is more banking driven, while in Europe the overall focus is on operational improvements. However, the majority of value generation is still attributable to operational drivers, rather than financial engineering.

6.5 Value Creation and Abnormal Performance

Panel A of Table 15 shows the relevant return and abnormal performance measures of the buyout and the benchmark sample.

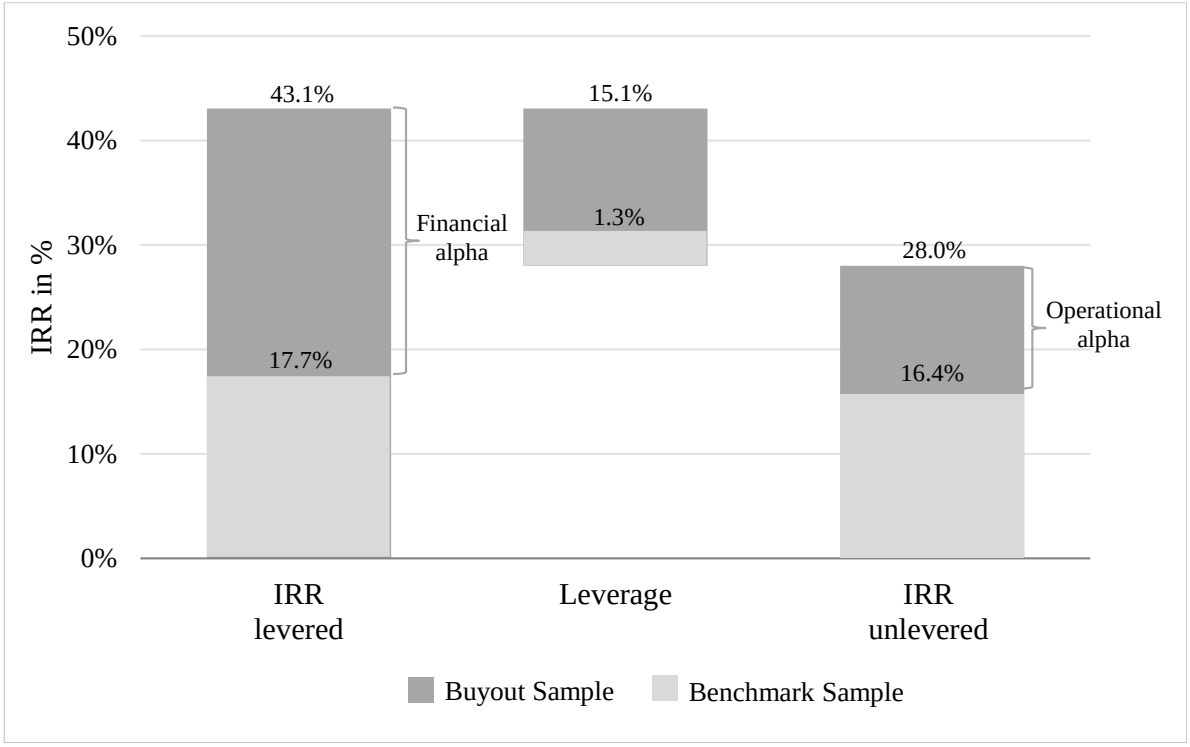
For the buyout sample we find a mean (median) levered IRR of 43.1% (30.8%), which clearly outperforms the IRR of the benchmark sample at 17.7% (13.8%). This difference is statistically different. The financial abnormal performance, called financial alpha, represents the difference between buyout and benchmark levered IRRs and trades at 25.3ppts and 12.5ppts on mean and median level, respectively. After unlevering, the buyout IRR trades at 28.0% (19.3%) and the benchmark IRR at 16.4% (12.6%), which leads to an operational abnormal performance of 11.6ppts (5.7ppts). Figure 13 shows an illustration on financial and operational alpha.

Table 15: Buyout Sample vs. Benchmark Sample

Panel A presents the return characteristics of the buyout and benchmark sample. Financial alpha measures the excess levered return of the private equity deal over the identified nearest neighbour company, serving as the applicable benchmark: $\alpha_{fin} = IRR_{PE,Lev} - IRR_{NN,Lev}$. Operational alpha measures the excess operational (unlevered) return of the private equity deal over the identified benchmark company: $\alpha_{ops} = IRR_{PE,Unlev} - IRR_{NN,Unlev}$. On the right hand side of Panels A and B, we show the p values for the two-sided t test (paired) and the Wilcoxon matched-pairs signed-rank test, used to test for the difference in mean and median, respectively. *, **, and *** indicate whether the tests are statistically significant at 10%, 5%, and 1% levels, respectively. For Panel B mean, median and standard deviation are based on absolute figures, while statistical tests are based on individual relative components. Panel B additionally shows these individual components for the mean values.

	Buyout-Sample				**Benchmark-Sample**				**Test Statistic (p value)**	
	n = 123				n = 123					
	Mean	Mean %	Median	Std. Dev.	Mean	Mean %	Median	Std. Dev.	T Test	Wilcoxon
Panel A: Return										
Money Multiple	4.83		3.31	7.74	2.88		1.74	5.32	0.02**	0.00***
Times Money (Money Multiple-1)	3.83		2.31	7.74	1.88		0.74	5.32	0.02**	0.00***
IRR (levered)	0.43		0.31	0.93	0.18		0.14	0.24	0.00***	0.00***
IRR (unlevered)	0.28		0.19	0.38	0.16		0.13	0.19	0.00***	0.00***
Financial alpha	0.25		0.13	0.96						
Operational alpha	0.12		0.06	0.43						
Panel B: Value Creation										
Times Money (levered)	**3.83**	**100%**	**2.31**	**7.74**	**1.88**	**100%**	**0.74**	**5.32**	**0.02****	**0.00*****
Leverage effect	1.26	33%	0.83	3.72	0.30	16%	0.09	2.22	0.03**	0.00***
Times Money (unlevered)	**2.57**	**67%**	**1.47**	**4.64**	**1.57**	**84%**	**0.66**	**4.11**	**0.03****	**0.00*****
EBITDA growth	0.90	24%	0.50	1.92	0.65	34%	0.35	4.01	0.42	0.01**
Multiple expansion	0.45	12%	0.33	1.82	0.59	32%	0.59	1.44	0.30	0.08*
Combination effect	0.25	7%	0.05	1.76	0.34	18%	0.00	4.47	0.54	0.24
Free-Cash-Flow effect	0.97	25%	0.39	2.91	-0.01	0%	0.08	1.35	0.18	0.00***
EBITDA growth										
Sales growth	0.46	12%	0.25	1.03	0.55	29%	0.26	0.91	0.57	0.00***
Margin improvement	0.36	9%	0.24	0.87	0.05	3%	0.05	1.51	0.34	0.50
Combination effect	0.08	2%	0.01	0.63	0.04	2%	0.00	2.32	0.32	0.99

Figure 13: IRR – Buyout Sample vs. Benchmark Sample



Source: Own illustration

As expected, higher leverage in buyout companies results in lower operational outperformance compared to financial outperformance. In terms of IRR, the leverage effect accounts for 35% (mean) of the levered buyout IRR, while for the benchmark sample the leverage effect only accounts for 7% (mean). This is also reflected by statistically significant different relative contribution of leverage to the times money multiple at the 1% and 5% level for the median and mean, respectively (see Table 15 Panel B). For the DACH region, we find a lower operational alpha than Acharya et al. (2013), who find a deal level abnormal performance of 19.8ppts (median: 15.4ppts) for their European sample (p. 383). Compared to the US study by Guo et al. (2011), our results are higher, as they find no or only a modest outperformance of buyouts compared to public benchmark firms (p. 514).

Panel B of Table 15 shows the individual value creation components of the times money multiple, while EBITDA growth is further broken down into its three components at the bottom of the table. We show mean and median information, the standard deviation as well as the relative mean contributions in percentages. Please note that the value creation bridge only reconciles with mean values. However, median results appear to be more reasonable, as we have neither winsorised nor logged our results. Therefore, and in light of our heterogenous

sample, when it comes to relevant statistical tests the non-parametric Wilcoxon, Mann-Whitney and Kruskal-Wallis tests appear to be more adequate for interpretation purposes. Nevertheless, we have included the relevant t-tests for the mean values. Apart for TM levered, significance levels for differences between the sub-samples, as displayed in Table 15, are for relative contributions to TM levered and not for absolute value drivers. Given that the magnitude in absolute terms is different between the sub-samples, it is of interest whether the relative value drivers differ significantly between the sub-samples.[33] These relative figures are depicted in Figure 14 and Panel B of Table 15. The percentages are calculated on the basis of mean figures.

Overall, Table 15 indicates a levered times money multiple for the buyout sample that is approximately 2.0 (1.6) times money points higher than the benchmark sample. This absolute difference is statistically significant for mean and median figures, at least at the 5%-level.

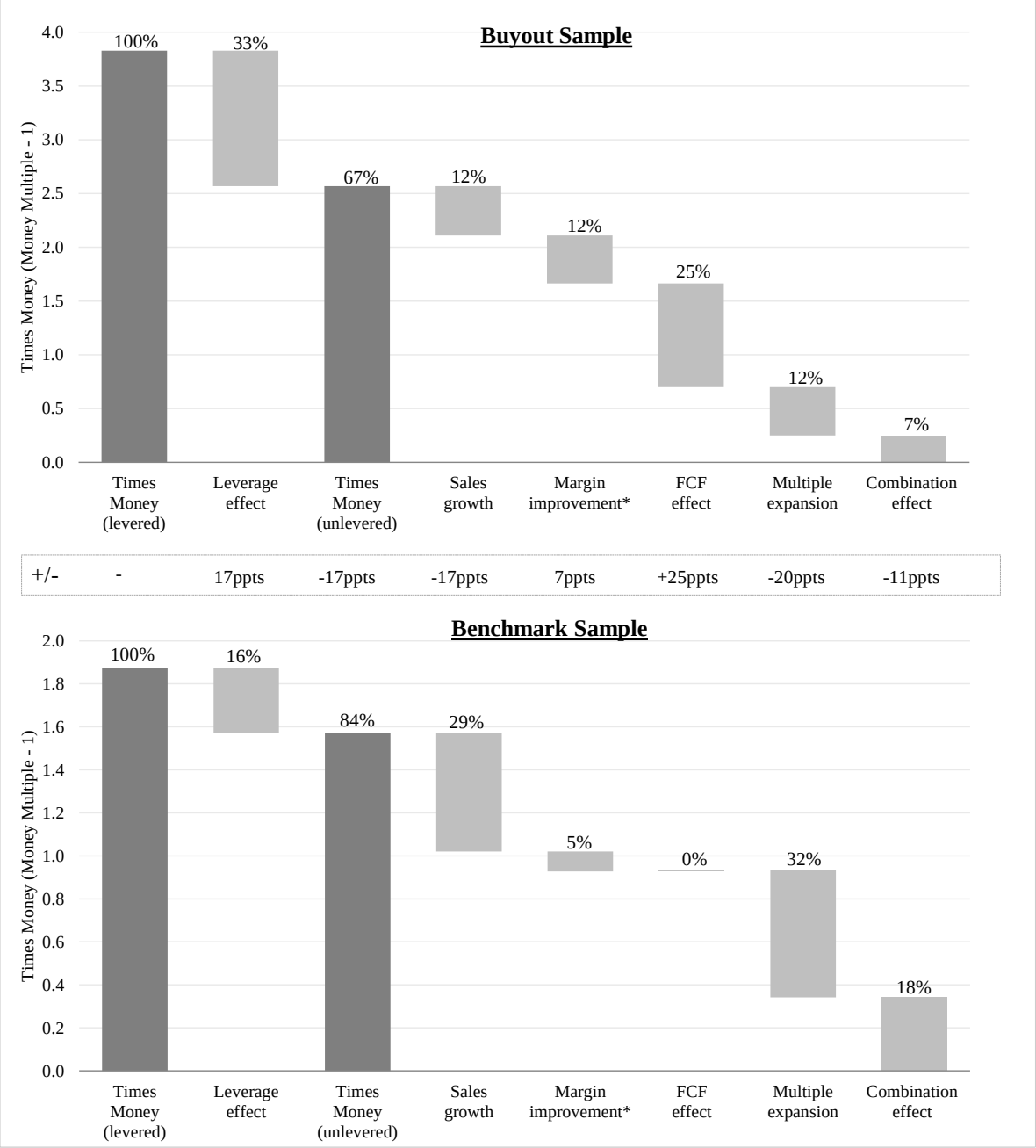
In Figure 14, the mean levered TM of 3.83 for buyouts and 1.88 for public benchmarks are set as 100%, as they represent the total value generated over the holding period. The box in-between the two value creation bridges, shown in Figure 14, reports the difference in relative value creation drivers between the buyout and benchmark sample in ppts. With regard to leverage, we find that the relative contribution of the leverage effect was 17ppts higher for buyouts than for public benchmarks. While less than one-sixth (16%) of value generated is attributable to leverage in the benchmark sample, financial engineering efforts contributed one-third to the value generated in the buyout sample. As stated, the differences in relative median leverage contribution between the buyout and the benchmark sample are significantly different at the 1% level (see Table 15 Panel B). Consequently, the relative importance of unlevered TM multiples differs significantly between the two samples.

With regard to EBITDA growth we find a statistically significant difference at the 5% level for the median relative contributions. This solely stems from a significantly different contribution of sales growth at the 1% level (see Table 15). While 29% (mean) of value generated in the benchmark sample is attributable to sales growth, Figure 14 demonstrates that only 12% (mean) of the total buyout value created over the holding period is driven by higher sales. The differences in margin improvement and sales-margin-mix are not statistically sig-

[33] In two given sub-samples EBITDA growth could amount to 0.5 and 1.0 times money points, respectively. However, in relative terms, both could contribute 30% to overall value.

nificant, even though their aggregate shows a 7ppts (mean) higher contribution for public enterprises, as opposed to buyout transactions.

Figure 14: Value Creation Bridges – Buyout Sample and Benchmark Sample



* includes the combination effect between sales and EBITDA

Source: Own illustration

Given the overall higher performance of the buyout sample and the fact that our statistical analysis is based on relative contributions, the above does not indicate that the benchmark deals perform better in terms of absolute EBITDA growth. Panel B in Table 15 reports the

absolute median times money contributions and reveals that 0.35 times money points are attributable to EBITDA growth in our public benchmark sample, while 0.5 times money points EBITDA growth is generated in the buyout sample.

The relative importance of the free cash flow effect, as the last pure operational value driver, between the two samples is significantly different at 1% (see Table 15). Figure 14 reports a negligible contribution, slightly above 0%, to overall value in the public benchmark sample, while one-fourth of value generated in the buyout sample is attributable to excess cash generated over the holding period. We believe this empirical pattern is in line with the explicit intention of PE firms to lever companies high at entry and to use deleveraging as a way of creating higher equity returns (see also the decrease in median debt/equity ratios from 1.70 to 0.41 among buyouts reported in Panel B of Table 14). We see no such deleveraging pattern among public benchmark companies (the median debt/equity ratio stays at 0.14). In turn, we observe a 52% increase in the absolute amount of debt among public companies. This negative free cash flow contribution gets almost fully offset by dividends paid to shareholders, which in turn results in the negligible free cash flow value contribution for the public benchmark sample.

Altogether, the empirical patterns for operational changes presented are in line with the seminal propositions of Jensen (1989), who argues that due to wrong incentive- and monitoring-systems management of a public company has no incentive to generate more excess cash than required. He claims that management of a public company will only generate sufficient levels of excess cash in order to pay the dividends demanded by its shareholders and points out it does not need to manage EBITDA as strictly as management of a private equity portfolio company would have to.

The multiple expansion effect is an exogenous and endogenous effect as it relates to both, the market-based increase of the EV/EBITDA (exogenous), but also to the ability of the PE firm to reposition a buyout company over the holding period, or to the ability of the PE firm to negotiate smartly during the acquisition or sales process (endogenous). Statistical tests reported in Panel B of Table 15 show that the relative contribution of the multiple expansion effect, disregarding the combination effect, between the buyout and benchmark sample, is significantly different at the 10% level. Analysing this effect together with the combination effect shows that 50% (mean) of the total benchmark sample value and 19% (mean) of the buyout sample value are attributable to this pricing effect (see Figure 14). Panel B of Table 15 indicates that even in absolute TM points (including the combination effect), the public

benchmark sample (median: 0.59) trades higher than the buyout sample (median: 0.38). However, median EV/EBITDA multiples for the public companies increased from 6.3 to 7.1 (unreported), compared to 6.0 to 7.9 over the same period for the buyout sample. This infers that private equity investors were able to realise a higher increase in the multiple (median) during ownership, compared to the public market. However, the absolute TM contribution is higher with the public benchmarks, which simply results from a higher median EBITDA at entry of €82m, compared to €22m for the buyout deals.

In general, the empirical findings on pricing are difficult to interpret given the inherent differences between private and public markets; and further research in this area remains a desideratum.

6.6 Value Creation and the Financial Crisis

In order to contribute to the ongoing debate on whether PE firms in the DACH region face "a new normal", we take advantage of our up-to-date sample and compare value creation in buyout transactions before and after the most recent global financial crisis.

51 transactions (41% of all buyouts) in our sample were exited after the start of the global financial crisis of 2008 (see Table 16). We have chosen this cut-off point as there is clear evidence from the German Ifo business climate index[34] for a recession period starting in 2008. According to the "Ifo business cycle clock" an economy is in recession if the current assessment of the business situation, and the expectations for the next six months, are negative (Abberger and Nierhaus, 2010, p. 4). Following a worsening of the Ifo business climate index in 2007, i.e. a downturn with a positive net balance (>100 points), the German economy was in recession from July 2008 onwards. The assessment of the business situation and the outlook for the next six months show a negative trend in July 2008, and traded below the critical threshold of 100 points. The recession reached its turning point in December 2008, with an all-time low of the German Ifo business climate index of 84.6 points.[35]

[34] The Ifo Institut für Wirtschaftsforschung is one of the leading economic research institutes in Germany and its business climate index is probably the most widely recognized indicator of economic sentiment.

[35] The Ifo business climate index is a monthly survey conducted amongst 7,000 companies which serves as an indicator for economic activity in Germany. It comprises two components: an assessment of the current business climate, and expectations going forward.

Table 16: Performance and Value Creation - Pre- and Post-Crisis

Table 16 distinguishes between private equity buyouts exited before and after (during) the financial crisis, while 2007 is regarded as the last pre-crisis year. Panel A presents and compares the return characteristics of the two sub-samples. IRRs and alphas are calculated as outlined previously. Panel B decomposes the respective times money multiple into its individual value drivers for mean and median values. Panel B also shows the relative contributions on the mean level. On the right hand side of Panel A and B, we show the p values for the two-sample two-sided t test with equal variances and the two-sample Wilcoxon rank-sum (Mann-Whitney) test, used to test for the difference in mean and median, respectively. *, **, and *** indicate whether the tests are statistically significant at 10%, 5%, and 1% levels, respectively. For Panel B mean, median and standard deviation are based on absolute figures, while statistical tests are based on individual relative components.

	Pre-Crisis 1995 - 2007				**Crisis/ Post-Crisis 2008 - 2010**				**Test Statistic (p value)**	
	n = 72				n = 51					
	Mean	Mean %	Median	Std. Dev.	Mean	Mean %	Median	Std. Dev.	T Test	Wilcoxon/ Mann-Whitney
Panel A: Return										
Money Multiple	5.79		3.65	9.37	3.47		2.66	4.29	0.10	0.00***
Times Money (Money Multiple-1)	4.79		2.65	9.37	2.47		1.66	4.29	0.10	0.00***
IRR (levered)	0.51		0.34	1.05	0.31		0.23	0.73	0.24	0.04**
IRR (unlevered)	0.29		0.21	0.32	0.27		0.17	0.45	0.80	0.10
Financial alpha	0.26		0.11	1.03	0.24		0.14	0.85	0.93	0.72
Operational alpha	0.06		0.03	0.35	0.19		0.10	0.52	0.11	0.06*
Panel B: Value Creation										
Holding period (years)	4.20		3.92	1.89	4.48		4.00	2.23	0.45	0.72
Times Money (levered)	**4.79**	**100%**	**2.65**	**9.37**	**2.47**	**100%**	**1.66**	**4.29**	**0.10**	**0.00*** **
Leverage effect	1.79	37%	0.98	4.68	0.51	21%	0.66	1.29	0.81	0.97
Times Money (unlevered)	**3.00**	**63%**	**1.67**	**5.34**	**1.95**	**79%**	**1.00**	**3.35**	**0.81**	**0.97**
EBITDA growth	0.88	18%	0.51	1.77	0.94	38%	0.48	2.14	0.09*	0.44
Multiple expansion	0.65	14%	0.42	1.45	0.17	7%	0.25	2.49	0.90	0.23
Combination effect	0.21	4%	0.11	0.78	0.31	12%	0.02	2.89	0.45	0.94
Free-Cash-Flow effect	1.27	26%	0.54	3.39	0.54	22%	0.08	2.02	0.50	0.06*
EBITDA growth										
Sales growth	0.46	10%	0.24	1.02	0.46	19%	0.27	1.05	0.57	0.70
Margin improvement	0.39	8%	0.22	0.93	0.33	13%	0.24	0.82	0.12	0.66
Combination effect	0.03	1%	0.01	0.52	0.16	6%	0.01	0.75	0.21	0.27

This trend is also reflected in the development of the German prime standard (DAX), which is comprised of the 30 major German listed companies. Between December 2007 and December 2008, the DAX lost approximately 40% or some 3,200 points. In our sample, we regard the period after 2007 (i.e. 2008 to 2010) as the crisis/ post-crisis period, and accordingly the period prior to 2008 (i.e. 1995-2007) as the pre-crisis period.

Table 16 presents return measures and absolute value creation drivers over time. In Panel A, based on median values, we find a significantly higher times money multiple and levered IRR for the pre-crisis sub-sample at the 1% and 5% level, respectively. We find a high mean (median) TM multiple of 4.79 (2.65) and a levered IRR of 51% (34%) for the period from 1995 to 2007. The corresponding returns, measured in the period after 2007, are 2.47 (1.66) and 31% (23%) and thus substantially lower than before the crisis. Interestingly, the drop in unlevered IRR from 29% (21%) to 27% (17%) is much less pronounced and only just statistically significant, in terms of median values pre- and post- financial crisis.

Similarly, having similar and not statistically different financial alphas for both subsamples implies that the decline in performance of the public benchmark sample after 2007 is higher than the drop in performance of buyout transactions. The drop in performance of buyout transactions is still statistically significant at the 5% level.

What is more, even though we obtain relatively high returns for the pre-crisis buyouts, the average (median) operational alpha only trades at 6.3ppts (3.7ppts) compared to 19.0ppts (8.9ppts) for the post-crisis sub-sample. The median values are statistically significantly different at the 10% level. Despite a decline in performance of both buyout deals and benchmark companies, exited buyout transactions post-2007 performed significantly better compared to their neighbours on an unlevered basis.

We believe this is driven by two factors: (1) a higher decline in public equity markets compared to the performance decrease of PE portfolio companies as discussed above, and (2) the GP's strategy of exiting those investments that were not heavily affected by the downturn. Obviously these two reasons are interlinked; if only the well-performing assets are sold the declining market is automatically outperformed. In light of the lower post-crisis return figures one could more aggressively argue that the GPs had to sell those assets in order to maintain their business model in times of low private equity activity, given the difficulties in access to debt at this time. This would imply that the underperforming portfolio companies, which were more heavily affected by the crisis, are still under ownership and our post-crisis sample is

somehow biased as it only represents the better-performing deals. Even in this case the results obtained are consistent, as our overall sample shows high return figures, which decrease significantly after the crisis.

Panel B in Table 16 presents details on value creation pre- and post- financial crisis. The statistical tests reveal that the relative contributions of the different value creation drivers have not much changed over time. As already indicated by various returns in Panel A of Table 16, the absolute levered TM has statistically significantly (at 1% level) dropped for deals exited after 2007. In relative terms, only the FCF effect has disproportionally decreased (at a 10% significance level). All other value creation components seem to have shrunken proportionally to the overall decrease in equity value created over the holding period.

6.7 Value Creation and Type of Exit Channel

As a last step, we analyse return measures and value creation drivers by type of exit channel. This is relevant because one could expect differences in value drivers depending on the respective buyer, e.g. higher or lower multiples paid by different investors, or certain improvement initiatives undertaken before going public.

We identified 57 (46%) trade sales to strategic investors, 55 (45%) financial sales to other PE firms (often called secondaries, tertiaries, and so on), and 11 (9%) Initial Public Offerings (IPOs) (see Table 17).

Panel A of Table 17 shows that on median level we find no significant differences between the type of exit chosen in DACH countries, neither for times money and IRR, nor for the abnormal performance measures. This is extremely surprising, given that there is extensive literature showing IPOs to outperform the other exit routes. However, for mean figures we find a statistically different times money multiple at the 10% level, which mainly results from a relatively high 8.0 TM multiple for IPOs, followed by 4.4 and 2.5 for financial and trade sales, respectively. With regard to abnormal operational performance, IPOs outperformed their neighbour companies on mean (median) by 17.4ppts (22.5ppts), while those companies sold to financial and strategic investors show an outperformance of 12.0ppts (6.5ppts) and 10.0ppts (3.6ppts), respectively. This empirical pattern suggests that IPOs in the DACH region offer the same upside return potential as anywhere in the world, but not necessary each IPO exit realises this full potential.

Table 17: Performance and Value Creation - Type of Exit

Table 17 shows the return characteristics and the breakdown of the times money multiple into its components in Panel A and B, respectively. IRRs and alphas are calculated as outlined previously. Further Panel B shows the relative contributions on the mean level. On the right hand side of Panel A and B, we show the p values for the one way Anova and the Kruskal-Wallis equality-of-populations rank test, used to test for the difference in mean and median. *, **, and *** indicate whether the tests are statistically significant at 10%, 5%, and 1% levels, respectively. For Panel B mean, median and standard deviation are based on absolute figures, while statistical tests are based on individual relative components.

	Trade sale				**Financial sale**				**IPO**				**Test Statistic (p value)**	
	n = 57				n = 55				n = 11					
	Mean	Mean %	Median	Std. Dev.	Mean	Mean %	Median	Std. Dev.	Mean	Mean %	Median	Std. Dev.	Anova	Kruskal-Wallis
Panel A: Return														
Money Multiple	3.49		2.93	2.55	5.38		3.47	9.54	9.03		3.31	13.14	0.07*	0.38
Times Money (Money Multiple-1)	2.49		1.93	2.55	4.38		2.47	9.54	8.03		2.31	13.14	0.07*	0.38
IRR (levered)	0.48		0.31	1.25	0.41		0.31	0.56	0.31		0.28	0.31	0.84	0.98
IRR (unlevered)	0.29		0.19	0.47	0.28		0.19	0.30	0.23		0.21	0.19	0.90	0.90
Financial alpha	0.26		0.11	1.26	0.24		0.11	0.64	0.26		0.28	0.32	0.99	0.31
Operational alpha	0.10		0.04	0.50	0.12		0.06	0.39	0.17		0.23	0.24	0.87	0.32
Panel B: Value Creation														
Holding period (years)	4.07		3.75	2.07	4.48		4.09	2.05	4.80		4.50	1.77	0.41	0.28
Times Money (levered)	**2.49**	**100%**	**1.93**	**2.55**	**4.38**	**100%**	**2.47**	**9.54**	**8.03**	**100%**	**2.31**	**13.14**	**0.07***	**0.38**
Leverage effect	0.78	31%	0.79	1.21	1.61	37%	1.00	5.27	1.99	25%	0.77	2.83	0.37	0.09*
Times Money (unlevered)	**1.70**	**69%**	**1.14**	**1.66**	**2.77**	**63%**	**1.47**	**4.74**	**6.03**	**75%**	**1.54**	**10.36**	**0.37**	**0.09***
EBITDA growth	0.58	23%	0.48	1.01	1.13	26%	0.52	2.23	1.45	18%	0.41	3.38	0.79	0.56
Multiple expansion	0.21	8%	0.33	2.39	0.66	15%	0.32	1.52	0.64	8%	0.46	1.27	0.42	0.55
Combination effect	0.48	19%	0.11	2.67	0.10	2%	0.04	0.93	-0.21	-3%	-0.12	0.92	0.68	0.30
Free-Cash-Flow effect	0.44	18%	0.31	1.25	0.87	20%	0.36	1.98	4.16	52%	1.51	7.78	0.28	0.24
EBITDA growth														
Sales growth	0.30	12%	0.21	0.42	0.60	14%	0.27	1.34	0.61	8%	0.33	1.42	0.46	0.26
Margin improvement	0.24	10%	0.23	0.74	0.44	10%	0.24	0.99	0.63	8%	0.30	0.99	0.72	0.76
Combination effect	0.04	2%	0.00	0.28	0.10	2%	0.01	0.71	0.22	3%	0.01	1.27	0.52	0.04**

When it comes to relative contribution of financial leverage to total value, as shown in Panel B of Table 17, we find a significant difference at the 10% level among the sub-samples. We find the lowest contribution for IPOs, maybe resulting from de-leveraging efforts before going public. Taking both, mean and median relative contributions into account, we obtain the highest leverage contribution for financial sales. This appears to be reasonable, as each private equity investor leverages the company to increase returns, which is further emphasised by the sequence of purchases from private equity owners. In 19 out of 51 cases, the deal represents at least a tertiary transaction, because it was bought from and sold to a private equity owner. Hence, there is a higher level of debt compared to the remaining buyout transactions. One could argue that private equity investors (as buyers) are not biased towards higher leverage, which reduces the de-leveraging efforts of the current owner prior to exit; assuming the type of buyer is already known. This is underpinned by a higher average debt/equity ratio for financial sales of 0.71 (median) compared to 0.67 and 0.60 for trade sales and IPOs, respectively. Again, IPOs show the lowest debt/equity ratio (average over the holding period), which is in line with the argument of de-leveraging efforts prior to the public offering. This is also reflected by a relatively high FCF effect over the holding for IPO exits, which on average (median) amounts to 4.2 (1.5) times money points. This means that on average, more than half of the total equity value generated in buyouts that ultimately went public is attributable to excess cash generated to pay down debt or to distribute dividends to shareholders.

While relative contributions to value creation for the majority of drivers are not statistically different by type of exit, Panel B in Table 17 displays some interesting facts in absolute terms. On average, we find that for trade and financial sales EBITDA growth contributes approximately one quarter, while for IPOs EBITDA improvements account for approximately one-fifth. Further, we find that for trade sales the average (median) times money contribution of EV/EBITDA multiple, plus the combination effect, amounts to 0.69 (0.44), which compares to 0.76 (0.36) and 0.43 (0.34) for financial and IPO exits, respectively. In average percentage contributions to the total value generated, this translates into 28% (23%), 17% (15%) and 5% (15%) for trade, financial and IPO exits, respectively. Therefore one could conclude that strategic investors tend to pay higher multiples due to anticipated synergies.

6.8 Conclusion

For our sample of 123 DACH buyouts, we find that one-third of total value generation is down to financial engineering efforts of the GPs, while operational and market factors ac-

count for the remaining two-thirds of value generation. Compared to benchmark public companies, leverage is significantly more important to private equity in generating value. At the same, EBITDA growth and excess cash are the main drivers of equity value generation. While being aware of a potential upside bias in our sample, we would still argue that criticising the PE business model for excess financial engineering and short-term orientation is not necessarily justified.

Supporting this argument in terms of operational abnormal performance, we find that buyout transactions outperformed their public benchmarks on average (median) by ca. 12ppts (6ppts). This mainly results from a higher outperformance during and post financial crisis by 19ppts (10ppts). Nevertheless, at the same time we find that buyout transactions performed significantly better prior to the financial crisis. As presumed by Achleitner et al. (2010, p. 26), we find a lower mean contribution of leverage to value creation for exits during and post financial crisis, and therefore an increased focus on operational drivers during this time.

When it comes to the exit channel, we find no significant differences in performance on the median level, but higher average returns for IPOs over financial sales and trade sales. In respect to leverage contribution to total value, we find significant differences, while financial sales show the highest contribution.

This paper presents one of the first studies of buyout transactions in the German-speaking private equity market. While our study offers interesting insights, we are aware that there is still much to be done. To begin with, our empirical findings on operational changes tell a somewhat positive story about the impact of PE. Future scholarly efforts need to link value creation details and returns to the stakeholders' perspective, for example by measuring employee numbers or general long-term success indicators. Potentially, other topics of interest in the context of value creation could be: the impact of fund manager experience, the interplay of deal origin and exit channel, a more in-depth analysis of pricing and leverage, as well as the analysis of changes in operational factors other than sales or EBITDA during ownership.

7 Essay 2 – Determinants of Abnormal Performance and Unlevered Returns

Buyout Transactions in the German-speaking Region: Determinants of Abnormal Performance and Unlevered Returns

by

Fabian Söffge[36] and Reiner Braun[37]

Abstract

Private equity is controversially discussed in the German-speaking region, but research on the topic is scarce at best. A novel and proprietary set of deal level data documenting of 124 buyout transactions that were initiated between 1995 and 2010 allow us to analyse determinants of abnormal operational performance and unlevered IRR. Overall, we find annualised benchmark-adjusted EBITDA margin growth to be the main driver. Our results further indicate that inorganic buyout transactions are expected to generate lower returns than organic deals. Compared to smaller deals, larger transactions yield higher returns. An analysis of the impact of operational determinants on (abnormal) buyout performance before and after the global financial crisis finds lower unlevered returns but higher operational alphas for transactions exited during or after the crisis.

Paper Type: Working Paper

JEL Classification Code: G11, G24, G32, G34

Keywords: leveraged buyouts, private equity, abnormal performance, performance drivers

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7.1 Introduction

Over the last decades, private equity sponsored leveraged buyouts have become a familiar phenomenon around the globe, including the German-speaking economy, also known as the DACH region. Prominent examples of companies that were acquired by private equity firms in this region are Kabel Deutschland, a cable television company, and Autoteile Unger (A.T.U.), a company selling spare parts for cars.

Even though the private equity business model is discussed very controversially in the DACH region, little is actually known about what really happens when these investors become the owners of private firms. This paper aims at explaining the drivers of performance in buyouts occurring in the DACH region. We are particularly interested in the effects that operational changes within the buyout companies have on returns to private equity investors. Over the holding period we look at sales growth, margin improvements in terms of EBITDA to sales ratio, and pricing multiple changes by looking at enterprise value (EV) to EBITDA ratio. Furthermore, we try to establish how determinants of performance differ – depending on private equity business models and transaction sizes, and whether the importance of determinants of performance has changed after the financial crisis in 2008.

When analysing performance, we focus on unlevered equity returns and abnormal operational performance, which we call operational alpha. We have adopted this analytical model because we are interested in explaining the actual impact private equity firms have as shareholders in companies. This kind of shareholder's impact on a company's development and returns cannot be told by simply observing changes in the company and changes in returns over the holding period. We are interested in what happens beyond the buyout company's development by benchmarking this development with comparable public companies in the same industry. To this end, we look at the return on equity of a hypothetical unlevered (100% equity-financed) buyout transaction and compute the unlevered equity IRR for each buyout transaction, in order to obtain a return measure that is comparable to applicable benchmark returns. For the latter we also unlever the equity returns to obtain a like-for-like measure enabling us to calculate the abnormal performance (operational alpha), which represents the difference between unlevered deal and benchmark equity IRR (Acharya et al., 2013).

First studies conducted in the late 1980s and early 1990s revealed that private equity creates additional value during ownership (e.g. Jensen, 1989; Kaplan, 1989; Smith, 1990, Muscarella and Vetsuypens, 1990). Acharya et al. (2013, p. 372) have pointed out that the economic

development at the beginning of the new millennium, in combination with the historical wave of PE transactions, have required researchers to re-examine the value creation proposition of private equity sponsors.

Among recent papers dedicated to performance drivers in leveraged buyout transactions Guo et al. (2011) find positive and significant returns for their sub-sample of 94 US public-to-private buyout transactions, completed by 2005 (p. 480). Even though gains resulting from operational improvements are still positive the authors find that they are substantially smaller compared to the first wave of deals in the 1980s and not always statistically different from applicable benchmarks. A paper by Acharya et al. (2013) analyses a sub-sample of 234 European buyouts, finding that significant determinants of abnormal performance during ownership are annualised sales growth and EBITDA margin and EV/EBITDA multiple improvements, compared to the sector. They also find relevant differences in performance drivers between organic and inorganic deals. Inorganic deals are those in which the private equity firm acquires a so-called platform company and subsequently acquires additional companies and merges these with this platform in order to realise growth. Such a private equity business model is also called buy-and-build. In contrast, organic deals are those where growth is targeted without purchasing further add-on companies. Another paper by Achleitner et al. (2011) researches the impact of various deal- and industry-specific variables on equity IRR, by analysing a global sub-sample of 603 buyout transactions (p. 9). They find that changes in the deal's sales, EBITDA margin and multiple are significantly and positively related to equity returns (p. 8).

However, none of the above-mentioned papers focuses on the DACH region as a specific regional economic environment. More importantly, none of them include recent deals, something that would allow for a comparison of transactions before and after the financial crisis. Some previous studies have looked at either very large or at public-to-private transactions (e.g. Kaplan, 1989; Muscarella and Vetsuypens, 1990). This makes a further case for a region-specific approach, since transactions of this type are relatively uncommon in the German-speaking region. Access to very recent data enables us to provide insights into private equity business as it is done right now, in the present. We have gathered a new proprietary dataset of 124 leveraged buyout transactions carried out in the German-speaking region between 1995 and 2010. This sample covers approximately 8.6% of buyout activity in Germany in the relevant time period. We have detailed information on the buyout companies' key financials as well as gross equity returns to investors. Having information at both levels, buyout company

level and investor level, enables us to run the analysis described above. Another strength of this dataset is that it includes a fair amount of very recent deals. We are therefore among the first to provide insights about the effects of the most recent financial crisis on the business of private equity.

Difference tests between the buyout and benchmark sample of comparable public companies have shown that there are statistically significant differences for all return measures, indicating that buyout transactions outperformed the public equity market for the time period under review. The difference between unlevered returns as a measure for abnormal operational performance, referred to as operational alpha, trades at 5.6ppts and 11.5ppts on median and mean level, respectively. We also find that all three operational determinants are statistically significant in explaining operational alpha. For the unlevered IRR, we find delta sales growth to have no explanatory power, but EBITDA margin and EV/EBITDA growth to be significant determinants. Regardless of the setup, we find that the most important determinant across our results was annualised EBITDA margin growth above the public benchmark. A given buyout transaction outperforming its nearest neighbour by 5ppts in annualised EBITDA margin growth, all else being equal, is expected to yield a 4.3ppts and 3.8ppts higher operational alpha and unlevered IRR, respectively, compared to a buyout transaction with a 0% growth rate above its public peer. We investigate the impact of these three determinants on operational alpha and unlevered IRR under two different growth strategies, organic and inorganic, executed by the private equity sponsor.

Firstly, we find that sales growth is a relevant driver of performance in inorganic deals, i.e. transactions that follow a buy-and-build growth strategy during ownership, but not in organic transactions. Margin and pricing multiple improvements play a significant role in both business models. We interpret these findings to be driven by increased operational requirements as the company has to internally manage above market growth and integrate the add-on company (companies) at the same time, which ultimately utilises a large amount of resources.

Secondly, we distinguish between small- and mid-to-large-cap transactions. We find operational alpha and unlevered IRR to be higher for mid-to-large than small-cap deals. A potential explanation is that larger companies have a superior ability to realise economies of scale and utilise fixed cost degression effects.

Thirdly, looking at the impact of the global financial crisis of 2008, we find drivers of operational alpha and unlevered IRR to be different before and after the financial crisis. The

EV/EBITDA growth rate was more relevant in the pre-crisis period, while EBITDA margin growth seems to have gained in importance in recent years, after the crisis. It seems that in times with a difficult market environment, focussing on internal efficiency improvements pays off in terms of performance, yielding better EBITDA to sales ratios.

The remainder of this paper is organised as follows: In Section 7.2 we introduce the underlying samples, being the buyout and the applicable benchmark samples, and present relevant descriptive statistics. We also discuss abnormal performance and introduce the methodology applied. In Section 7.3 we analyse the drivers of equity IRR and operational performance, while in Section 7.4 we do the same for two selected PE business models/ growth strategies. Section 7.5 takes a time-differentiated view and analyses performance drivers before and after the financial crisis of 2008. Section 7.6 concludes.

7.2 Data

7.2.1 Sampling and Descriptive Statistics

The underlying proprietary buyout sample used in this paper was derived in a multi-step approach. First we started with a set of deal data collected by several institutional investors as part of their due diligence efforts. This initial dataset comprised information on 1,318 transactions carried out in German-speaking countries. Many of these observations were either partly incomplete in terms of data points required, included non-buyout transactions or active (unrealised) investments. However, the analysis carried out in this paper requires full deal information, including enterprise value, equity, net debt, sales, EBITDA and EBITDA Multiple at entry and exit, respectively, as well as the monthly gross cash flows between the target company and the private equity firm, comprising dividends paid and equity injections contributed during ownership.[38]

In order to maximise the output, in terms of full deal information, we tried to fill the missing information for realised (i.e. exited) investments by searching three commercial databases (MergerMarket, CapitalIQ and Thomson Reuters ONE Banker). The final buyout sample, after eliminating for non-buyout and unrealised deals as well as complementing information from the three databases, comprises 124 fully or partially realised buyout transactions carried out between 1995 and 2010, as shown in Panel A of Table 18.

[38] Gross refers to cash flow information prior to carried interest and management fees.

Table 18: Buyout Sample Descriptive Statistics

Panel A shows the distribution of investments (entry) and divestments (exit) by private equity firms by year. Panel B displays descriptives on deal returns and characteristics. The holding period is calculated on the basis of month of entry and exit, respectively. The money multiple divides all positive cash flows (including dividends) over all negative cash flows (including additional equity injections). Internal rate of return (IRR) is the discount rate that makes the net present value of all cash flows from the transaction equal to zero. It was calculated based on monthly cash flow information gross of management fees and carried interest. The statistical tests reported on the right-hand side compare the entry and exit values for each variable. Enterprise value represents the sum of equity value and net debt. The latter comprises cash, cash equivalents as well as long-term and interest-bearing debt. The EV/EBITDA multiple is applied as the most common measure for valuation purposes and is calculated by dividing the total value of the firm (enterprise value) by the underlying EBITDA, being the earnings before interest, taxes, depreciation and amortisation. Debt/Equity and Debt/EBITDA ratio represent leverage ratios, while debt and equity in this context relate to the net debt figures and equity values shown in Panel B, respectively.

Panel A: Transactions by entry and exit years

	1995	1996	1997	1998	1999	2000	2001	2002	
Entry	1	3	6	7	3	8	3	19	
Exit	-	-	-	-	2	2	-	3	
	2003	2004	2005	2006	2007	2008	2009	2010	**Total**
Entry	23	17	17	9	6	2	-	-	**124**
Exit	2	3	11	26	23	23	13	16	**124**

Panel B: Return measures and deal characteristics

				Difference tests between exit and entry	
n = 124	Mean	Median	Std. Dev.	T test (t value)	Wilcoxon (z value)
Holding period (years)	4.32	3.92	2.03		
Money Multiple	4.81	3.29	7.71		
Times Money (Money Multiple-1)	3.81	2.29	7.71		
IRR (levered)	0.43	0.30	0.93		
IRR (unlevered)	0.28	0.19	0.38		
Enterprise value (€m entry)	433.2	121.9	922.1	4.13***	8.08***
Enterprise value (€m exit)	804.7	214.2	1,677.2		
Equity value (€m entry)	169.1	46.1	358.7	4.31***	8.64***
Equity value (€m exit)	520.6	150.3	1,234.7		
Net debt (€m entry)	264.1	74.0	656.2	0.61	-2.06**
Net debt (€m exit)	284.0	57.8	681.5		
EV/EBITDA multiple (entry)	6.53	5.96	4.13	1.46	5.77***
EV/EBITDA multiple (exit)	7.91	7.85	9.59		
Debt/Equity ratio (entry)	2.26	1.70	5.01	-2.22**	-8.12***
Debt/Equity ratio (exit)	-0.70	0.41	13.84		
Debt/EBITDA ratio (entry)	3.53	3.45	2.46	-1.60	-5.06***
Debt/EBITDA ratio (exit)	2.81	2.29	4.02		

The sample comprises 96 (77%) German, 21 (17%) Swiss and seven (6%) Austrian buyout transactions from the years 1995 to 2010. Panel A highlights that 90% of all deals were exited after 2004, while the majority of buyouts (69%) were initiated between 2002 and 2006.

Our sample thus has a distinct focus on the more recent wave of private equity deals. Interestingly, the dataset mainly covers private equity activity between 2002 and 2010.

Panel B of Table 18 presents relevant return measures and key deal ratios of the buyout sample. For the entire sample, we find a gross levered and unlevered median IRR[39] of 30% and 19%, respectively, while the median times money multiple amounts to approximately 2.3.

The lower part of Panel B shows that the median (mean) enterprise value (EV) at entry amounts to €122m (€433m). With EVs ranging between €2m and €7.1bn, our sample covers very small and large buyouts alike. What is more, enterprise and equity values between entry and exit differ at the 1% level in a statistically way. The same applies to the decrease in the median debt-to-equity ratio from 1.7 at entry to 0.4 at exit. On the median level, we observe statistically significant changes for all figures presented in Panel B between entry and exit.

The 96 German transactions included in the sample and initiated between 1995 and 2008, cover approximately 8.6% of the total German buyout activity in terms of numbers of transactions.[40] We are aware that our data reports deals with above-average performance, since most private equity deal databases rely on voluntary, self-reported information. However, we believe that this has no significant impact on the results obtained, because we analyse the impact of individual components on the stand-alone unlevered deal return. The same caution was applied when we analysed factors driving abnormal deal performance. In order to counteract the tendency towards the reporting of better performing deals, we have selected an appropriate benchmark sample of public companies. As highlighted previously, the deals sampled reflect a cross-section from small to large transactions, with heterogeneity in regard to deal origin and exit channel.

[39] The calculation of unlevered returns is introduced in the following section.

[40] We have retrieved this information from the annual statistics published by the German Association of Private Equity and Venture Capital investors (BVK) between 1995 and 2008 by summing up all MBO, MBI and LBO transactions which incurred in each year. This adds up to a total of 1,122 transactions. In 2003 we even cover 35% of total German buyout activity. We only compare up to 2008 as this is the last year of entry in our sample.

Table 19: Benchmark Samples

Panel A shows the return figures of the two public benchmark samples and results from difference tests between the buyout sample and the respective benchmark sample. The holding period is calculated on the basis of month of entry and exit, respectively. The money multiple divides all positive cash flows (including dividends) over all negative cash flows. Internal rate of return (IRR) is the discount rate that makes the net present value of all cash flows from the transaction equal to zero. It was calculated based on monthly cash flow information gross of management fees and carried interest. The calculation of unlevered IRR is introduced in the following section. Panel B shows the deal characteristics of the nearest neighbour sample. Enterprise value represents the sum of equity value and net debt. The latter comprises cash, cash equivalents as well as long-term and interest-bearing debt. The EV/EBITDA multiple is applied as the most common measure for valuation purposes and is calculated by dividing the total value of the firm (enterprise value) by the underlying EBITDA, being the earnings before interest, taxes, depreciation and amortisation. Debt/Equity and Debt/EBITDA ratio represent leverage ratios, while debt and equity in this context relate to the net debt figures and equity values shown in Panel B, respectively.

Panel A: Benchmark-Samples

	Nearest Neighbour Sample			Industry Portfolio Sample			Buyout vs. Nearest Neighbor		Buyout vs. Industry Portfolio	
n = 124	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	T test (t value)	Wilcoxon (z value)	T test (t value)	Wilcoxon (z value)
Holding period (years)	4.32	3.92	2.03	4.32	3.92	2.03				
Money Multiple	2.87	1.75	5.30	1.58	1.49	0.71	2.27**	4.95***	4.64***	7.58***
Times Money (Money Multiple-1)	1.87	0.75	5.30	0.58	0.49	0.71	2.27**	4.95***	4.64***	7.58***
IRR (levered)	0.18	0.14	0.23	0.10	0.09	0.13	2.94***	3.90***	3.96***	6.68***
IRR (unlevered)	0.16	0.13	0.19	0.10	0.09	0.11	2.95***	2.89***	5.26***	6.73***

Panel B: Characteristics of the Nearest Neighbour Benchmark-Sample

	Entry			Exit			Difference tests between exit and entry	
n = 124	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	T test (t value)	Wilcoxon (z value)
Enterprise value (€m)	3,657.1	640.7	10,300.0	5,660.6	954.3	14,100.0	3.35***	6.82***
Equity value (€m)	2,321.6	445.5	5,293.5	3,634.4	815.0	6,653.2	3.55***	6.10***
Net debt (€m)	1,335.5	60.8	5,700.6	2,026.2	84.2	8,275.2	1.58	2.48**
EV/EBITDA multiple	7.09	6.36	4.04	8.18	7.12	4.28	2.43**	2.84***
Debt/Equity ratio	0.47	0.13	1.23	1.09	0.91	2.17	3.69***	4.63***
Debt/EBITDA ratio	0.42	0.13	1.00	1.34	0.68	2.33	5.66***	5.28***

In order to assess the relative performance of our buyout sample, we require appropriate benchmark data. We have built two benchmark samples for this purpose: one by applying a modified nearest-neighbour approach as suggested by Acharya et al. (2009a), and one by building ICB industry portfolios. In general, we follow the opportunity cost of capital theory by assuming that the next best alternative from the perspective of the PE investor would have been to invest in public equity markets in German-speaking countries. We therefore constructed a hypothetical index for the German-speaking region, retrieving relevant financial information for 957 companies listed in this region as of October 2013. We then rolled-back this information to 1995, thereby reducing the number of companies to 202 in 1995. We think our approach is appropriate, because it ensures that a selected neighbour is in existence over the entire holding period of the corresponding PE investment. The left-hand part of Panel A in Table 19 presents the key return characteristics of the two benchmark samples, while the right-hand part shows the tests of difference between the respective benchmark and the buyout sample. When it comes to the construction of the nearest-neighbour benchmark sample, one has to carefully select the relevant identification criteria.

Our sample is not restricted to one group of buyouts. It comprises large public-to-private deals, secondary buyouts as well as small private-to-private transactions. Therefore the absolute figures of the benchmark universe would not represent applicable criteria to identify the relevant neighbour company. Hence we decided to apply EBITDA margin as the relevant identification criterion.

In a first step, we narrowed down the benchmark universe in the year of entry – deal-by-deal – to companies that trade in the same industry as the buyout transaction. We identified appropriate companies by using the ICB classification. In a second step, we eliminated all companies that were not in existence over the entire holding period – either because they went bust or got delisted. Finally, in a third step, we have identified the nearest neighbour by choosing the company with the closest EBITDA margin at the year of entry.

We have repeated this procedure for each deal and built the nearest neighbour sample this way. As highlighted earlier, our buyout returns consider dividends received and equity injections contributed by the PE investor. To ensure that the benchmark performance is determined equally, we have also included dividends paid in calculating return figures for the nearest neighbours.

The industry portfolio benchmark sample has been constructed in a similar way to the nearest neighbour sample. But instead of identifying a certain company, we assumed that the PE investor would have invested opportunistically in the entire industry at the year of entry. Again on a deal-by-deal basis, we used the ICB classifications to identify companies that were in existence over the entire holding period of the investment, calculating (hypothetical) industry portfolio returns by including dividends. The composition of the industry portfolio at the year of entry was applied for the entire investment horizon. We did not change the composition year-by-year and as such did not assume a divestment at the end of the year and a re-investment at the beginning of the next year into the modified industry portfolio.

As presented in Panel A of Table 19, the nearest neighbour benchmark sample shows a median money multiple, levered and unlevered IRR of 1.75, 14% and 13%, respectively. With a median times money multiple of 1.49 and a levered and unlevered IRR of 9%, the industry portfolio benchmark sample shows the lower performance of the two benchmark samples. For both benchmark samples we find, in contrast to the buyout sample, that leverage is not a driver of the overall return. Further, all return measures are significantly different (lower) from the buyout sample at the 1% level, as shown in Panel A. As mentioned earlier, we believe our data set to include above-average performing deals due to voluntary self-reporting of private equity sponsors. Hence, for benchmarking purposes, we decided to also apply the better performing benchmark sample – the nearest neighbour sample.

Therefore in Panel B of Table 19 we present the key characteristics of the nearest neighbour sample. For almost all financials we find significant differences between exit and entry at the 1% level. In contrast to the buyout sample, we find a significant increase in mean and median debt-to-equity as well as debt-to-EBITDA ratios, which underpins our finding that leverage is not driving benchmark returns. We see at median level that equity values increased by approximately 83% over the holding period of 3.9 years. This generally corresponds with the increase of major indices and share prices experienced over the last decades.

7.2.2 Abnormal Performance

Another aim of this paper is to analyse potential drivers of abnormal performance. Before doing so, we want to define abnormal performance and present a methodological approach. In a first step we determine the levered deal IRR based on the monthly gross cash flows, including initial investment, dividend payments, equity contributions and proceeds realised at exit. In a second step we unlever these levered equity returns by applying the following formula:

$$(26)\ IRR_U = \frac{IRR_L + \left(\left((1+r_D)^{HP}\right)-1\right)\left(\frac{\overline{D}}{\overline{E}}\right)}{1+\left(\frac{\overline{D}}{\overline{E}}\right)}$$

where r_D represent the cost of debt, *HP* the holding period, and $\overline{D}/\overline{E}$ the average debt to equity ratio over the holding period. Due to high leverage at entry, we regard cash flows resulting from the tax shield effect as uncertain and therefore have not accounted for the tax shield effect in the formula above.[41] Our sample does not include information on deal specific cost of debt. Hence, in a first step we approximated cost of debt by applying monthly marginal lending rates and calculated yearly average base rates. In a second step, we retrieved syndicated loan information for leveraged buyouts through Thomson Reuters ONE Banker, calculating an annual median spread that is added to the average base rate in order to derive annual-specific cost of debt. The corresponding year of entry for each deal in our buyout sample determined the interest rate to be applied.

Return figures for the nearest neighbour and the industry portfolio benchmark samples were derived by applying the equity values at entry and exit as the initial investment and the proceeds from the sale, respectively. Dividend payments were also considered. The resulting levered IRR was unlevered by means of the same formula as presented above for the buyout sample. For consistency purposes, we have applied the same cost of debt information throughout. We are able to derive two types of abnormal performance, a financial and operational one, as shown in Table 20.

Financial abnormal performance, which we call financial alpha, is defined as the difference between the levered IRR of the buyout sample and the levered IRR of the respective benchmark sample:

$$(27)\ \alpha_{fin} = IRR_{PE,Lev} - IRR_{Bench,Lev}$$

Operational abnormal performance, which we call operational alpha, represents the difference between the unlevered IRRs:

$$(28)\ \alpha_{ops} = IRR_{PE,Unlev} - IRR_{Bench,Unlev}$$

[41] For a detailed discussion on this approach please refer to Achleitner et al. (2010, p. 18).

In order to find out what is driving abnormal performance, we use operational alpha as the most adequate measure in terms of comparability. Our main reason for doing so is that buyout companies are typically much more levered than companies that are not fully recapitalised. Operational alpha is to be interpreted as the ppts outperformance of the buyout sample over the respective benchmark sample of a hypothetically fully equity-financed company, i.e. supposing that the buyout and the neighbour companies have the same capital structure (100% equity). Analysing the drivers of financial alpha would be misleading as we would have not eliminated for the noise resulting from financial engineering differences between buyout and public companies.

The right-hand columns of Table 19 show that the nearest neighbour benchmark sample is performing better than the industry portfolio benchmark, which is why we find higher alphas for the industry portfolio sample. Nevertheless, statistical tests for differences (see right-hand side of Table 20) indicate that buyouts in our sample outperform both public peer group samples in levered and unlevered terms. Our buyout sample shows a 12ppts and 6ppts higher financial and operational performance over the nearest neighbour sample, respectively, while the outperformance amounts to 18ppts and 10ppts compared to the industry portfolio sample (all median values).

Table 20: Financial and Operational Abnormal Performance

The Table presents financial and operational alphas between the two benchmark samples and the buyout sample and performs difference tests between the buyout sample and the respective benchmark sample. Financial alpha is the difference between the levered IRR of the private equity deal and the levered IRR of the benchmark company/portfolio, while operational alphas represent the difference between the corresponding unlevered IRRs.

						Tests for differences between Buyout and Public Benchmark Sample	
n = 124	Mean	Median	Std. Dev.	Min	Max	T test (t value)	Wilcoxon (z value)
Financial Alpha							
Nearest-Neighbour-Sample	0.25	0.12	0.95	-0.86	7.97	4.16***	3.83***
Industry-Portfolio-Sample	0.32	0.18	0.91	-0.81	8.01		
Operational Alpha							
Nearest-Neighbour-Sample	0.11	0.06	0.43	-0.56	3.03	4.65***	4.25***
Industry-Portfolio-Sample	0.18	0.10	0.39	-0.26	2.90		

7.3 Abnormal Performance and Unlevered IRR Drivers

What is driving unlevered equity returns and which factors explain why unlevered performance of buyout deals is 6ppts higher compared to the nearest neighbour benchmark sample? The operational performance of a company is commonly measured by means of its EBITDA, which in turn is driven by sales and the company's profitability. In the private equity industry, EBITDA is also a commonly used basis for company valuations and serves as a free cash flow equivalent. Assuming a constant net debt level and an unchanged multiple between entry and exit, an increase in EBITDA would result in higher enterprise and consequently equity values. Our regression setup therefore applies sales growth, EBITDA margin growth and EV/EBITDA growth as its three main independent variables. The first two variables together yield EBITDA and are purely operational in nature; the third variable indirectly accounts for changes in EBITDA, but also includes other elements, such as general market multiple development and negotiation power of the private equity firms.

The first set of empirical analyses presented in Table 21 shows results when using operational alpha as the dependent variable in OLS regressions. In order to explain the outperformance, we have to include the differences in sales, margin and multiple growth, respectively, between deal and neighbour as explanatory variables. These variables were logarithmised and winsorised at the 3% level for regression purposes (see Table 27 in the Appendix of this paper for further details). The regression displayed in column (1) of Table 21 shows the coefficients of these three main independent variables without including further control variables. Both EBITDA margin and EV/EBITDA multiple growth, compared to the nearest neighbours, are statistically significant at the 1% level. In regression (2), we add (logarithmised) transaction size at entry and (logarithmised) initial leverage, i.e. the debt to EBITDA ratio at entry, as control variables. Transaction size has been shown to matter in terms of value drivers' relative contributions to equity returns in leveraged buyouts (Achleitner et al., 2010, p. 23). Regarding leverage, one could argue that deals with high levels of leverage have to realise higher EBITDA improvements than other buyouts in order to be able to serve the higher debt levels. However, the coefficients for the independent variables remain basically unchanged in economic and statistical terms.

In another regression, shown in column (3), we control for the holding period as it might play a role in implementing operational improvement initiatives to increase EBITDA and profitability. Moreover, we also control for entry year fixed effects, in order to account for the

fact that our sample is exposed to cyclical periods as, for example, the burst of the new economy bubble in the beginning of 2000 or the global financial crisis of 2008. Controlling for the time dimension, the coefficient of sales growth becomes statistically significant at the 10% level. However, economically, the effect is still much smaller than the profitability and pricing multiple effects.

These results remain unchanged when additionally controlling for four-digit ICB industry classification in column (4) and the realisation status in column (5). Realisation status indicates whether the PE firms' shareholding in the corresponding buyout company is fully or partially realised.

Table 21: Regression Results – Operational Alpha

This table presents the results of ordinary least squares regressions on the determinants of operational alpha. Operational alpha was winsorised at the 3% level, at both tails. The three main independent variables represent the differences between annualised buyout and neighbour sales, EBITDA margin and EV/EBITDA multiple growth, respectively, which were logged and winsorised at the 3% level, at both tails, accordingly. The variables are defined in detail in Table 27 provided in the Appendix of this paper. Appendix 3 of thesis provides further details on the regression setup. The figures in the upper rows represent the regression coefficients, *, ** and *** indicate p-values with significance levels of 10%, 5% and 1%, respectively. Standard errors are reported in the lower rows.

	Dependent variable: Operational alpha				
Independent variables	(1)	(2)	(3)	(4)	(5)
Log delta sales growth	0.180	0.145	0.184*	0.192*	0.192*
	(0.122)	(0.119)	(0.096)	(0.107)	(0.111)
Log delta EBITDA/Sales growth	0.853***	0.945***	0.825***	0.846***	0.891***
	(0.206)	(0.218)	(0.177)	(0.176)	(0.185)
Log delta EV/EBITDA growth	0.521***	0.561***	0.458***	0.453***	0.485***
	(0.117)	(0.120)	(0.102)	(0.104)	(0.111)
Control variables					
Log transaction size at entry		-0.026	-0.009	-0.006	-0.006
		(0.017)	(0.016)	(0.020)	(0.019)
Log debt/EBITDAat entry		0.021	-0.008	-0.013	-0.019
		(0.052)	(0.056)	(0.065)	(0.063)
Holding period			-0.023	-0.021	-0.015
			(0.018)	(0.018)	(0.018)
Entry year fixed effects	NO	NO	YES	YES	YES
Industry dummies	NO	NO	NO	YES	YES
Realisation status					0.094
					(0.063)
Constant	0.106***	0.382**	0.198	0.084	0.002
	(0.023)	(0.183)	(0.184)	(0.231)	(0.239)
Observations	124	122	122	122	122
R-squared	0.383	0.431	0.601	0.608	0.620

Controlling for relevant factors shows that all explanatory variables are significant and positively affect operational alpha. Using coefficients from regression (5), we find that a buyout transaction with a 10ppts annualised sales growth above its nearest neighbour yields a 1.8ppts higher operational alpha – compared to a buyout transaction with the same sales growth rate as its neighbour (ln(1.1)*0.192 = 0.018). For a given deal, a 10ppts higher performance in EBITDA margin and EV/EBITDA multiple growth, compared to an equally trading deal, results in a 8.5ppts and 4.6ppts higher operational alpha, respectively. Interestingly, profitability improvements, i.e. positive changes in EBITDA to sales over the holding period, above those of the benchmark company, are estimated to be the strongest driver of operational alpha. These results for the German-speaking region are similar to the results obtained by Acharya et al. (2013) in their European sample, who find a "positive and economically meaningful impact on abnormal performance" of sales, EBITDA margin and multiple (p. 390). In line with Acharya et al. (2013), we also find a significant impact of EBITDA margin and multiple growth, which show higher growth rates compared to their nearest neighbours.

Table 22 shows the same regression setup as presented in Table 21, but with unlevered buyout IRR as the dependent variable. Annualised EBITDA margin and EV/EBITDA multiple growth are significant drivers in explaining unlevered IRR, regardless of the variables included for controlling purposes. Again we find that EBITDA margin is the most significant (1% level) driver. A deal showing a 10ppts margin growth above its neighbour yields a 7.4ppts higher unlevered IRR compared to a deal with the same growth rate as its neighbour company.

For the regressions presented in Tables 21 and 22, neither transaction size nor debt/EBITDA at entry are estimated to significantly drive operational alpha or unlevered returns. Altogether, the level-log regressions in columns (5) of Table 21 and Table 22 show relatively high R-squared values with 62.0% and 53.1%, respectively. This provides additional comfort with regard to the interpretation and the robustness of the results obtained.

Table 22: Regression Results – Unlevered IRR

The table presents the results of ordinary least squares regressions on the determinants of unlevered IRR. Unlevered IRR was winsorised at the 3% level, at both tails. The three main independent variables represent the differences between annualised buyout and neighbour sales, EBITDA margin and EV/EBITDA multiple growth, respectively, which were logged and winsorised at the 3% level, at both tails, accordingly. Variables are defined in detail in Table 27 provided in the Appendix. Appendix 4 of thesis provides further details on the regression setup. The figures in the upper rows represent the regression coefficients, *, ** and *** indicate p-values with significance levels of 10%, 5% and 1%, respectively. Standard errors are reported in the lower rows.

	Dependent variable: Unlevered IRR				
Independent variables	(1)	(2)	(3)	(4)	(5)
Log delta sales growth	-0.028	-0.042	-0.013	-0.012	-0.012
	(0.104)	(0.108)	(0.083)	(0.089)	(0.092)
Log delta EBITDA/Sales growth	0.751***	0.837***	0.732***	0.745***	0.776***
	(0.201)	(0.211)	(0.163)	(0.166)	(0.176)
Log delta EV/EBITDA growth	0.255**	0.268**	0.180**	0.178**	0.200**
	(0.104)	(0.110)	(0.084)	(0.088)	(0.094)
Control variables					
Log transaction size at entry		-0.003	0.003	-0.003	-0.003
		(0.017)	(0.016)	(0.022)	(0.021)
Log debt/EBITDAat entry		-0.041	-0.051	-0.017	-0.021
		(0.051)	(0.054)	(0.061)	(0.060)
Holding period			-0.044***	-0.041**	-0.037**
			(0.015)	(0.016)	(0.015)
Entry year fixed effects	NO	NO	YES	YES	YES
Industry dummies	NO	NO	NO	YES	YES
Realisation status					0.063
					(0.059)
Constant	0.249***	0.340*	0.498***	0.399*	0.344
	(0.023)	(0.175)	(0.177)	(0.215)	(0.219)
Observations	124	122	122	122	122
R-squared	0.274	0.302	0.510	0.525	0.531

7.4 Performance Drivers under Different PE Business Models

Having identified buyout annualised EBITDA margin and EV/EBITDA multiple growth, as the most important determinants of abnormal operational performance and unlevered IRR, in relation to the neighbour sample, we are now interested to find out whether this also applies to different private equity business models. We analyse two dimensions in which PE business models differ: (1) buyouts with M&A activity during ownership (inorganic transactions) and buyouts without M&A activity during ownership (organic transactions); and (2) small-cap versus mid-to-large-cap buyout transactions.

M&A activity is defined as either divesting parts of the existing business or growing the company through the execution of a buy-and-build strategy, acquiring a so called platform

company and purchasing further add-on enterprises that are merged with the platform. For our sample of 124 buyout transactions we have manually researched the commercial databases MergerMarket, CapitalIQ and Thomson Reuters ONE Banker to obtain information on M&A activity of the portfolio companies during private equity ownership. For the 122 buyout deals used for regression purposes, we find M&A activity for 54 companies during ownership, while 68 companies show no such activity. Please note that for 48 out of 54 companies with M&A activity, i.e. the inorganic group, additional investments were undertaken during ownership, hence, in only six out of 54 cases, parts of the existing business were divested. For this reason, the sub-sample of buyout deals with M&A activity is predominantly characterised by companies pursuing growth through the acquisition of add-ons.

Regressions shown in columns (1) and (5) in Table 23 serve as the relevant starting point and are equal to the final regressions displayed in Tables 21 and 22, which were discussed in the previous section. Columns (2) and (6) in Table 23 show the regressions for the sub-sample of deals without M&A activity, while columns (3) and (7) present regressions for buyout transactions with M&A activity. Under both business models, EBITDA margin growth, i.e. improvement of the EBITDA to sales ratio over the holding period, is a significant driver of operational alpha. Interestingly, we find that sales growth is only significant as a determinant for buyouts without M&A activity, i.e. transactions with organic growth. This could result from various effects and is difficult to interpret, as has been noted by Acharya et al. (2013). They point out that "deals with significant follow-on M&A activity are subject to an error term due to distortion by the acquired entity" (p. 391). Although the coefficient on pricing multiple growth is significant in column (3), the general pattern reveals that its impact, in economic terms, is much more relevant for inorganic transactions than for organic ones.

Generally speaking, acquiring additional business should always lead to an increase in absolute sales and EBITDA. In contrast, profitability could increase, decrease or remain unchanged depending on the EBITDA margin of the add-on company (companies). Assuming an unchanged EV/EBITDA multiple at exit, the enterprise value is expected to increase as EBITDA increases. However, from a return and abnormal performance perspective, the financing of the purchase price(s) attributable to the add-on company (companies) plays a significant role. A potential equity injection of the private equity sponsor for acquisition purposes could level off the additional capital gained at exit through the acquisition. The same effect could result if the add-on is financed by means of additional leverage taken on by the portfolio company, which increases net debt and subsequently reduces the equity value at exit. All

these individual effects cannot be assessed and ultimately result in potential distortion, as noted by Acharya et al. (2013).

Table 23: Regression Results – Organic vs. Inorganic Buyout Transactions

The table presents the results of ordinary least squares regressions on the determinants of operational alpha and unlevered IRR by differentiating between buyouts with M&A activity during ownership, regressions (3) and (7), and buyouts with no M&A activity during the holding period, regressions (2) and (6). Variables are defined in Table 27, which is found in the Appendix. Appendix 5 of thesis provides further details on the regression setup. The figures in the upper rows represent the regression coefficients, *, ** and *** indicate p-values with significance levels of 10%, 5% and 1%, respectively. Standard errors are reported in the lower rows.

	Dependent variable: Operational Alpha				**Dependent variable: Unlevered IRR**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Independent variables	all	organic	inorganic	interaction	all	organic	inorganic	interaction
M&A Dummy				0.006				0.066
				(0.056)				(0.056)
Log delta sales growth	0.192*	0.645***	0.076	0.583***	-0.012	0.377**	-0.050	0.355**
	(0.111)	(0.151)	(0.103)	(0.138)	(0.092)	(0.149)	(0.108)	(0.145)
Interaction sales and M&A				-0.502***				-0.450**
				(0.177)				(0.172)
Log delta EBITDA/Sales growth	0.891***	0.982***	0.805***	0.940***	0.776***	0.844***	0.574**	0.931***
	(0.185)	(0.299)	(0.199)	(0.283)	(0.176)	(0.284)	(0.235)	(0.265)
Interaction EBITDA/Sales and M&A				-0.039				-0.260
				(0.358)				(0.353)
Log delta EV/EBITDA growth	0.485***	0.697***	0.384***	0.551***	0.200**	0.348**	0.134	0.298**
	(0.111)	(0.196)	(0.112)	(0.170)	(0.094)	(0.163)	(0.148)	(0.147)
Interaction EV/EBITDA and M&A				-0.117				-0.178
				(0.207)				(0.195)
Control variables								
Log transaction size at entry	-0.006	-0.022	0.048	-0.005	-0.003	-0.012	0.005	-0.011
	(0.019)	(0.037)	(0.035)	(0.020)	(0.021)	(0.036)	(0.044)	(0.021)
Log debt/EBITDA at entry	-0.019	-0.009	-0.155*	-0.071	-0.021	0.002	-0.160	-0.067
	(0.063)	(0.088)	(0.080)	(0.057)	(0.060)	(0.075)	(0.098)	(0.057)
Holding period	-0.015	-0.016	-0.009	-0.017	-0.037**	-0.046	-0.050**	-0.044***
	(0.018)	(0.031)	(0.029)	(0.017)	(0.015)	(0.029)	(0.023)	(0.014)
Entry year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Realisation status	0.094	0.166*	0.055	0.104*	0.063	0.071	0.050	0.073
	(0.063)	(0.088)	(0.089)	(0.059)	(0.059)	(0.074)	(0.088)	(0.056)
Constant	0.002	0.298	-0.114	0.183	0.344	0.680	0.813*	0.582**
	(0.239)	(0.509)	(0.412)	(0.258)	(0.219)	(0.478)	(0.458)	(0.232)
Observations	122	68	54	122	122	68	54	122
R-squared	0.620	0.700	0.808	0.658	0.531	0.632	0.740	0.593

In order to test whether the differences of the two business models are statistically significant, we run interaction models that are reported in columns (4) and (8). In our specifications we include a M&A activity dummy variable, which takes the value of one in the case of M&A activity and of zero if no M&A activity incurred during ownership. We also include three interaction terms, which represent the respective independent variable times the M&A dummy. In both models, the M&A Dummy is positive, but statistically not significant. This indicates that none of the two business models outperforms the other. In addition, it confirms the patterns from the sub-sample regressions, in that only the sales growth interaction term is

statistically significant. Thus, only the coefficient for the sales growth variable is statistically different between inorganic and organic transactions.

The winsorised median operational alpha and unlevered IRR of the 122 observations relevant for regression purposes is 6.1% and 19.4%, respectively. Our results indicate that a buyout transaction with M&A activity during ownership, and a 5ppts higher annualised growth rate over its neighbour for all three determinants, is expected to generate an operational alpha of 3.6% and an unlevered IRR of 21.7%.[42] Interestingly, these results change when assuming different annualised growth levels. Hence, we perform a sensitivity analysis at the end of this section to discuss the results in more detail.

In a next step, we analyse potential differences in determinants driving operational alpha and unlevered IRR, depending on transaction size. We are interested in whether transaction size and ultimately fund size have an impact on abnormal performance and return levels, since only larger funds are able to finance large transactions. However, there are no stringent enterprise criteria available that would permit us to distinguish between investors as being small-cap, mid-cap, or large-cap private equity sponsors. In order to retain a sufficient number of observations in the sub-samples, we split the buyout sample at the median enterprise value at entry of €122m. Deals with a value smaller than this value are considered to be small-cap deals, while those with an enterprise value larger than this are called larger-cap deals.[43] The median (mean) enterprise value in the small-cap sub-sample is €57.3m (€60.4m) at entry, while the one in the larger-cap sub-sample is 318.5m (€806.0m).

The regression setup as presented in Table 24 is similar to the one applied for M&A activity, except for transaction size being removed as a control variable. Regressions (2) and (6) show the results of the respective determinants on operational alpha and unlevered IRR, respectively, for the small-cap sub-sample, regressions (3) and (7) relate to larger buyout transactions. All three operational determinants are significant in explaining operational alpha, regardless of size. However, when looking at sub-samples based on EV, sales growth is not relevant in explaining unlevered IRR. Further, the only statistically significant difference between the drivers relates to EBITDA-to-sales margin improvements over the holding period. This driver is much more important, both in economic and statistical terms, for larger-cap

[42] The positive impact on unlevered IRR of 2.3ppts (21.7% less 19.4%) is calculated as follows: 0.066+(log(1+0.05)*-0.450)+ (log(1+0.05)*-0.260)+ (log(1+0.05)*-0.178) = 0.023

[43] Unreported tests show that our results are robust to using different cut-off values.

deals. The corresponding interaction terms in models (4) and (8) are both statistically significant.

Table 24: Regression Results – Transaction Size

The table presents the results of ordinary least squares regressions on the determinants of operational alpha and unlevered IRR by differentiating between buyouts with enterprise values equal to or greater than €122m, regressions (3) and (7), and buyouts with enterprise values less than €122m, regressions (2) and (6). Variables are defined in Table 27, which is found in the Appendix. Appendix 6 of thesis provides further details on the regression setup. The figures in the upper rows represent the regression coefficients, *, ** and *** indicate p-values with significance levels of 10%, 5% and 1%, respectively. Standard errors are reported in the lower rows.

	Dependent variable: Operational Alpha				**Dependent variable: Unlevered IRR**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Independent variables	all	small-cap	larger-cap	interaction	all	small-cap	larger-cap	interaction
Transaction size dummy				-0.003				-0.033
				(0.055)				(0.054)
Log delta sales growth	0.196*	0.384***	0.210**	0.346***	-0.010	0.105	-0.008	0.128
	(0.110)	(0.125)	(0.093)	(0.095)	(0.090)	(0.105)	(0.079)	(0.095)
Interaction sales and size				-0.213				-0.204
				(0.159)				(0.137)
Log delta EBITDA/Sales growth	0.887***	0.706**	1.265***	0.610***	0.774***	0.457*	1.155***	0.492**
	(0.185)	(0.284)	(0.219)	(0.231)	(0.174)	(0.260)	(0.227)	(0.222)
Interaction EBITDA/Sales and size				0.650*				0.669**
				(0.336)				(0.312)
Log delta EV/EBITDA growth	0.485***	0.558***	0.650***	0.385**	0.199**	0.244*	0.362**	0.134
	(0.111)	(0.189)	(0.128)	(0.158)	(0.093)	(0.143)	(0.159)	(0.123)
Interaction EV/EBITDA and size				0.231				0.171
				(0.214)				(0.204)
Control variables								
Log debt/EBITDA at entry	-0.027	-0.044	-0.167	-0.020	-0.025	-0.093	-0.155	-0.007
	(0.060)	(0.079)	(0.119)	(0.063)	(0.053)	(0.065)	(0.122)	(0.058)
Holding period	-0.015	-0.001	-0.059	-0.008	-0.037**	-0.038	-0.079**	-0.031*
	(0.018)	(0.034)	(0.037)	(0.019)	(0.015)	(0.032)	(0.029)	(0.016)
Entry year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Realisation status	0.094	0.097	0.106	0.111*	0.063	0.069	0.104	0.078
	(0.062)	(0.093)	(0.079)	(0.058)	(0.059)	(0.079)	(0.090)	(0.056)
Constant	-0.042	-0.012	0.842*	-0.126	0.322*	0.553**	1.061***	0.215
	(0.184)	(0.246)	(0.496)	(0.188)	(0.169)	(0.253)	(0.387)	(0.184)
Observations	122	60	62	122	122	60	62	122
R-squared	0.619	0.616	0.812	0.656	0.531	0.541	0.746	0.575

We show that annualised multiple growth over the nearest neighbour is a significant determinant for all transaction sizes (at the 1% level) and that the interaction terms are insignificant. But at the same time significance levels indicate that sales growth is economically more important in explaining operational alpha for smaller deals, and that margin growth is more important for larger deals. In a given buyout transaction with 5ppts annualised sales growth above its peer, a small-cap deal is expected to generate a 1.9ppts higher operational alpha compared to a buyout with the same sales growth as its peer. For larger deals such a 5ppts outperformance in sales growth is expected to only generate a 1.0ppts higher operational alpha. In contrast, assuming a 5ppts margin growth outperformance above its peer, a small-cap

buyout would generate a 3.4ppts higher operational alpha, which compares to a 6.2ppts higher operational alpha for mid- and large-cap deals.

Altogether, we find that larger buyout transactions, at higher assumed sales, margin and multiple growth rates of 5ppts above their neighbours, generate a 3.3ppts higher operational alpha compared to smaller deals. In light of unlevered IRR, we find a 0.1ppts higher return for larger buyouts contingent on these operational changes.

The results discussed for the two different business models assumed a simultaneous 5% higher annualised growth rate for sales, margin and multiple of the buyout transaction compared to its peers. However, calculating various scenarios by changing these assumptions yields different results, as illustrated in Table 25. Mathematically, the underlying calculations are identical to those used in preparation of Table 23.

Table 25: Sensitivity Analysis for Different Business Models

The table presents the results obtained for the impacts on operational alpha and unlevered IRR under the two business models when changing the assumptions for the determinants of regressions (4) and (8) presented in Tables 23 and 24. Assumptions refer to the rates applied for the annualised sales, margin and multiple growth of the buyout compared to its nearest neighbour. Each assumption relates to all three growth rates at the same time. The results are to be interpreted from the perspective of a buyout transaction with M&A activity, or from the perspective of a buyout transaction with an enterprise value equal to or above €122m, respectively.

Business Model		*Assumption: deal compared to neighbour for all three main independent variables*						
	Impact on	*-15ppts*	*-10ppts*	*-5ppts*	*0ppts*	*5ppts*	*10ppts*	*15ppts*
M&A: Inorganic growth buyout compared to organic growth buyout yields:	Operational alpha	11.00ppts	7.34ppts	3.88ppts	0.60ppts	-2.52ppts	-5.50ppts	-8.35ppts
	Unlevered IRR	20.90ppts	15.87ppts	11.11ppts	6.60ppts	2.31ppts	-1.79ppts	-5.70ppts
Transaction Size: A larger-cap buyout compared to a small-cap buyout yields:	Operational alpha	-10.91ppts	-7.07ppts	-3.44ppts	0.00ppts	3.27ppts	6.40ppts	9.38ppts
	Unlevered IRR	-13.40ppts	-9.74ppts	-6.28ppts	-3.00ppts	0.12ppts	3.10ppts	5.94ppts

The results displayed in Table 25 are based on different assumptions of the buyout's performance compared to the nearest neighbour, ranging from a simultaneous -15ppts under- to a 15ppts outperformance of the deal's annualised sales, margin and multiple growth. For example, if an inorganic and an organic deal both underperform their public peers by -15ppts, in the sense that all three growth rates are 15ppts lower, the inorganic transaction would obtain a 11.00 ppts higher operational alpha than the organic deal. Accordingly, in terms of unlevered

IRR, we find that a private equity sponsor would be indifferent to pursuing a buy-and-build and strategy if the outperformance of the portfolio company, in terms of operational drivers, is 7.8ppts. Interestingly, we find that inorganic growth is at the expense of unlevered returns if the (simultaneous) outperformance exceeds 7.8ppts.

Assuming an outperformance of 15ppts shows that the unlevered return in the buy-and-build case is 5.7ppts lower compared to a case with an organic growth strategy. A similar pattern is obtained for operational alpha. However, in case the buyout is performing only slightly above the neighbour, the growth strategy chosen has only a negligible effect on operational alpha. Interestingly enough, an inorganic growth strategy is the better choice when the portfolio company is expected to perform below the market (neighbour). A potential explanation for this M&A activity pattern could be that deals which highly outperform their neighbours and where acquisitions are pursued during PE ownership require a lot of resources, both in order to manage internal growth and to integrate the add-on companies. On the other hand, if the portfolio company grows with or below the market, add-on acquisitions could lead to synergies which increase returns.

With regard to transaction size, we find that the enterprise value at entry has no impact on operational alpha and unlevered IRR at a 0ppts and 4.8ppts outperformance of the deal, respectively. Furthermore, we find that larger deals show a higher operational alpha and unlevered IRR when the growth rates of the buyout exceed the ones of the nearest neighbour. In contrast, a larger deal is expected to show a 10.9ppts and 13.4ppts lower operational alpha and unlevered IRR, respectively, when the portfolio company is performing 15ppts below the neighbour. With regard to larger deals, economies of scale can be more easily achieved when the market is highly outperformed. However, when underperforming, larger companies are not able to react as quickly as small companies, given their high burden of fixed expenses.

7.5 Performance Drivers and the Financial Crisis

We aim to find out whether the impact of the three identified determinants changed significantly before and after the most recent global financial crisis. Out of a total of 124 buyout transactions, 52 deals were exited during or after the financial crisis, and 72 deals were exited prior to the crisis. We have chosen 2008 as the relevant cut-off year as there is clear evidence

for a recession period starting in 2008. This cut-off point matches information from the German Ifo Business Climate Index[44], which indicates a recession period starting in 2008.

Table 26 presents our findings on how the impact of the three determinants on operational alpha and unlevered IRR change over time, using almost the identical regression framework as in Tables 23 and 24. However, in order to see differences before and after the most recent financial crisis, we do not control for entry year fixed effects. Regressions (2) and (6) present the pre-crisis findings, while regressions (3) and (7) show findings for the post-crisis period. In columns (4) and (8) we include a financial crisis dummy variable which takes the value zero for the pre-crisis period, and the value one for the post-crisis period. We also include applicable interaction variables, as discussed previously.

Interestingly, in the specification displayed in column (4) we can see that the operational alpha is economically and significantly higher in deals after the financial crisis. This means that the operational performance of buyouts benchmarked to public peers has improved. A possible explanation is that buyout firms were better able to navigate through difficult economic times, at least relative to non-buyout companies. Again, we find that annualised sales growth has not been a significant determinant of operational alpha and unlevered IRR when differentiating buyout activity before or after the financial crisis. Although none of the interaction terms is statistically significant, comparing sub-sample regressions (for both dependent variables) suggests that EBITDA-to-sales margin improvements have recently become more important. In contrast, EV to EBITDA pricing multiple expansion over the holding period has lost some importance in explaining buyout performance.

The joint significance tests for regressions (4) and (8) yield F-values of 6.47 and 4.11, both being significant at the 1% level. Our results indicate that a buyout transaction exited during or after the financial crisis, which traded equally to its nearest neighbour (i.e. 0ppts outperformance), is expected to generate a 9.2ppts higher operational alpha and a -2.0ppts lower unlevered IRR compared to a buyout exited before the crisis.

[44] The Ifo Institut für Wirtschaftsforschung is one of the leading economic research institutes in Germany and its Business Climate Index is probably the most widely recognised indicator of economic sentiment.

Table 26: Regression Results – Financial Crisis

The table presents the results of ordinary least squares regressions on the determinants of operational alpha and unlevered IRR by differentiating between buyouts exited in or post 2008, regressions (3) and (7), and buyouts exited before 2008, regressions (2) and (6). Variables are defined in Table 27, which is provided in the Appendix. Appendix 7 of thesis provides further details on the regression setup. The figures in the upper rows represent the regression coefficients, *, ** and *** indicate p-values with significance levels of 10%, 5% and 1%, respectively. Standard errors are reported in the lower rows.

	Dependent variable: Operational Alpha				**Dependent variable: Unlevered IRR**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Independent variables	all	pre-crisis	post-crisis	interaction	all	pre-crisis	post-crisis	interaction
Financial Crisis Dummy				0.092**				-0.025
				(0.046)				(0.043)
Log delta sales growth	0.185	0.128	0.127	0.172	0.006	-0.084	-0.060	-0.041
	(0.138)	(0.226)	(0.102)	(0.227)	(0.114)	(0.179)	(0.122)	(0.197)
Interaction sales and Crisis				-0.042				-0.016
				(0.251)				(0.227)
Log delta EBITDA/Sales growth	0.947***	0.754***	0.905***	0.816***	0.807***	0.483*	1.015***	0.600**
	(0.204)	(0.270)	(0.317)	(0.274)	(0.191)	(0.243)	(0.369)	(0.243)
Interaction EBITDA/Sales and Crisis				0.208				0.441
				(0.460)				(0.441)
Log delta EV/EBITDA growth	0.542***	0.621***	0.316*	0.632***	0.238**	0.265*	0.271	0.253*
	(0.126)	(0.174)	(0.164)	(0.161)	(0.108)	(0.149)	(0.178)	(0.142)
Interaction EV/EBITDA and Crisis				-0.250				-0.005
				(0.239)				(0.227)
Control variables								
Log transaction size at entry	-0.020	-0.041**	-0.009	-0.022	-0.004	-0.019	-0.003	-0.006
	(0.021)	(0.019)	(0.054)	(0.020)	(0.020)	(0.017)	(0.061)	(0.020)
Log debt/EBITDA at entry	0.008	0.114	-0.000	0.047	-0.032	0.090	-0.068	-0.013
	(0.058)	(0.109)	(0.103)	(0.056)	(0.053)	(0.089)	(0.125)	(0.054)
Holding period	-0.025*	-0.035	-0.055***	-0.033***	-0.042***	-0.057***	-0.045**	-0.043***
	(0.013)	(0.022)	(0.016)	(0.012)	(0.010)	(0.018)	(0.018)	(0.011)
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Realisation status	0.053	0.036	0.108	0.071	0.070	0.062	0.067	0.061
	(0.053)	(0.073)	(0.079)	(0.051)	(0.051)	(0.061)	(0.093)	(0.049)
Constant	0.314	0.857***	0.282	0.198	0.293	0.726***	0.347	0.306
	(0.255)	(0.296)	(0.549)	(0.266)	(0.228)	(0.217)	(0.599)	(0.241)
Observations	122	72	50	122	122	72	50	122
R-squared	0.473	0.531	0.554	0.510	0.421	0.483	0.439	0.434

As discussed in the previous section, these results are also sensitive to changes in the outperformance assumption. Operational alpha is always predicted to be higher for post-crisis transactions, regardless of an assumed under- or outperformance (from -15ppts to 15ppts) of the deal compared to its nearest neighbour. This is explained by relatively low operational alphas prior to the crisis and the collapse of equity markets after the crisis. In light of unlevered IRR, we find that the same return for a pre- and post-crisis deal is expected at 4.7ppts higher annualised sales, margin and multiple growth.

7.6 Conclusion

This paper presents one of the first studies that comprehensively analyses the drivers of private equity performance in the German-speaking region. It provides a novel and proprie-

tary dataset of 124 leveraged buyout transactions initiated between 1995 and 2010 in the German-speaking region. Its contribution to private equity research is three-fold: Firstly, it contains an analysis of the impact of operational determinants on abnormal operational performance (operational alpha) and unlevered IRR in a multivariate setting. Secondly, it investigates whether the impact of these determinants changes with different private equity business models (organic versus inorganic growth strategies; small-cap versus mid-to-large-cap investors). Thirdly, it takes a time-differentiated perspective and provides evidence for the impact of operational drivers before and after the global financial crisis of 2008.

We have found that (1) annualised benchmark-adjusted EBITDA margin growth is the most significant determinant in abnormal operational performance and unlevered returns, regardless of the business model; (2) private equity firms executing a buy-and-build strategy are expected to generate lower unlevered returns when the benchmark company is clearly outperformed because of an expected constraint in resources; (3) mid-to-large-cap private equity firms are expected to generate higher unlevered returns and operational alphas than small-cap private equity firms when the benchmark company is clearly outperformed, under the assumption that larger companies have a higher fixed cost leverage than smaller ones; and we have found that (4) buyout transactions exited during or after the financial crisis yield higher operational alphas but lower unlevered returns compared to buyout transactions exited before the crisis, when the portfolio company underperforms its benchmark company.

EBITDA margin improvement was identified to be the strongest single determinant of performance. The authors recommend that future research will shed more light on the drivers of EBITDA margin improvements over the holding period. Special attention needs to be paid to the way changes in personnel expenses can affect margins. This would address the effect leveraged buyout activity can have on employees as the main stakeholder group, something that is currently being discussed very controversially.

Private equity activity in Continental Europe and especially in the German-speaking region is chronically under-researched. In addition to identifying EBITDA margin drivers, future scholarly efforts should aim at providing more insights on the effects of pricing and leverage on returns. Another research area, that to the best of our knowledge has not been examined yet, is the impact of fund managers' experience on deal performance. Switching from the deal level to the fund level performance, further research could also look at fund performance persistence in this region.

Appendix

Table 27: Definition and Description of Variables

The table presents the relevant definitions for the variables used throughout this paper.

Variable	Description
Buyout/ Neighbour margin growth	Represents the annualised margin growth between entry and exit of the buyout or the neighbour and is calculated as EBITDA margin at exit less EBITDA margin at entry over EBITDA margin at entry divided by the holding period.
Buyout/ Neighbour multiple growth	Represents the annualised multiple growth between entry and exit of the buyout or the neighbour and is calculated as EV/EBITDA multiple at exit less EV/EBITDA multiple at entry over EV/EBITDA multiple at entry divided by the holding period.
Buyout/ Neighbour sales growth	Represents the annualised sales growth between entry and exit of the buyout or the neighbour and is calculated as sales at exit less sales at entry over sales at entry divided by the holding period.
Debt/EBITDA ratio	The portfolio or benchmark companies ratio of Debt to EBITDA at entry or exit. For regression purposes we have logged this variable.
Debt/Equity ratio	The portfolio or benchmark companies ratio of debt to equity at entry or exit.
Delta EBITDA/sales growth	Represents the difference between the buyout's and the neighbour's annualised EBITDA margin growth. For regression purposes we have logged this variable, i.e. log(1 + delta EBITDA/sales growth) subsequent to winsorisation at the 3% level, at both tails.
Delta EV/EBITDA growth	Represents the difference between the deal's and the buyout's annualised multiple growth. For regression purposes we have logged this variable, i.e. log(1 + delta EV/EBITDA growth) subsequent to winsorisation at the 3% level, at both tails.
Delta sales growth	Represents the difference between the buyout's and the neighbour's annualised sales growth. For regression purposes we have logged this variable, i.e. log(1 + delta sales growth) subsequent to winsorisation at the 3% level, at both tails.
Entry year fixed effects	Time dummy to control for differences depending on the year of entry.
EV/EBITDA multiple	The buyout's or benchmark company's ratio of Enterprise Value to EBITDA at entry or exit
Financial alpha	Calculated as the difference between the levered IRRs of the buyout and the applicable benchmark company/ portfolio. It represents the abnormal levered (financial) performance of the buyout over the applicable benchmark.
Financial crisis dummy	Takes the value 1 if the buyout was exited in or post 2008, takes the value 0 of the buyout was exited prior to 2008.
Holding period	Time between entry (investment) and exit (divestment) of a Private Equity investor in a certain portfolio company/ buyout.
Industry dummies	Industry dummies based on ICB codes to control for differences among different industries (http://www.icbenchmark.com) .
Interaction variables/ terms	M&A dummy, transaction size dummy or finanical crisis dummy (depending on the regression model) multiplied with each independent variable other than control variables separately.
IRR (levered)	Gross equity internal rate of return (IRR) of a company at its given capital structure (levered). Calculated on the basis of monthly cash flows between the PE investor and the portfolio company before management fees and carried interest.
IRR (unlevered)	Represents the gross unlevered equity IRR of a hypothetical 100% equity financed company. We unlever the levered IRR by means of the average debt/equity ratio of the company and applicable cost of debt. We have winsorised this variable at the 3%, at both tails, level for regression purposes.
Transaction Size	Represents the enterprise value at entry. For regression purposes we have logged this variable.
Transaction Size dummy	Takes the value 1 if the transaction size (enterprise value) of the buyout at entry was greater or equal to €120m, which is approximately the median of the buyout sample. Takes the value 0 for enterprise values that are trading below €120m at entry.
M&A dummy	Takes the value 1 if the PE sponsor followed a buy-and-build strategy during ownership or parts of the business were divested (inorganic case). Takes the value 0 if no M&A activity occured (organic case).
Money Multiple	Is calculated as equity proceeds realised at exit (divestment) plus dividends received during ownership, divided by the initial equity investment at entry plus applicable equity injections during the holding period. Total proceeds are expressed as a factor of total invested capital (money).
Operational alpha	Calculated as the difference between the unlevered IRRs of the buyout and the applicable benchmark company/ portfolio. It represents the abnormal unlevered (operational) performance of the buyout over the applicable benchmark disregarding the financial structure. We have winsorised this variable at the 3% level, at both tails, for regression purposes.
Realisation status	Takes the value 1 if the buyout is fully exited (realised). Takes the value 0 if the buyout is only partially realised.
Times Money Multiple	Equal to the Money Multiple less one. Total Proceeds are expressed as a factor above total invested capital (money).

8 Essay 3 – Impact of Leveraged Buyouts on Stakeholders

Leveraged Buyout Transactions in the German-speaking Region – A Stakeholder Perspective

by

Fabian Söffge[45] and Reiner Braun[46]

Abstract

Analysing a novel dataset of 124 buyout transactions initiated in the German-speaking region between 1995 and 2008 we find annualised EBITDA margin growth to be the key driver of buyout abnormal operational performance and deal returns. We further find base benchmark performance to contribute 41% to levered returns, while incremental deal leverage and abnormal performance contribute 32% and 27%, respectively. For various sub-samples we are able to show that personnel expenses increased significantly between entry and exit and are not the main driver of margin improvements, rather economies of scale. Hence our results suggest that no significant restructuring programs were undertaken that lead to a reduction in workforce under private equity ownership. Finally, we find significantly higher interest expenses, but opposed to the prevailing opinion no significant reductions in tax expenses. Our results indicate that private equity activity does not necessarily lead to negative social or economic welfare effects in the German-speaking region.

Paper Type: Working Paper

JEL Classification Code: G11, G24, G32, G34

Keywords: leveraged buyouts, private equity, abnormal performance, performance drivers

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8.1 Introduction

When it comes to private equity research, and more specifically value and performance drivers of leveraged buyout transactions on the deal level, the majority of studies conducted finds that improvements in profitability over the holding period are one of the main drivers. Regardless of what is driving the higher buyout EBITDA margin[47] improvement, it ultimately comes back to Jensen's (1989) argumentation that managers in private equity owned companies are forced to have appropriate self-monitoring systems in place as a result of high amounts of debt and equity utilised at entry. The buyout company's management is incentivised to grow the EBITDA margin in order to serve the high debt levels above the mandatory repayment amount. Ultimately, this increases equity value and returns to private equity firms as investors. As buyout company managers are incentivised through sweet equity the goals of private equity sponsors, banks and management are aligned.

The relevance of this mechanisms has been confirmed in several empirical studies and is independent of any regional constraints: Acharya et al. (2013) find EBITDA to sales margin improvements above the sector to be a highly significant driver of IRR and abnormal operational performance for their sample of 234 European deals (p. 390); Achleitner et al. (2011) obtain similar results for their global sample of 603 buyout transactions and conclude that the change in EBITDA to sales margin is highly significant in explaining equity IRR (p. 155). Achleitner et al. (2010) find approximately 12% of the unlevered times money multiple to be driven by margin expansion for 206 European buyout transactions under review (p. 21).

Similarly, in recent studies using the same proprietary dataset of 124 buyout transactions in the German-speaking region (also known as the DACH region) the authors of this paper find margin improvements to contribute approximately 13% to the unlevered times money multiple (see Söffge and Braun, 2014a). Further, we find annualised margin growth in comparison to a benchmark sample to be the main, and in most cases a highly significant, driver of abnormal operational performance and unlevered IRR (see Söffge and Braun, 2014b).

Altogether, this body of literature shows that operational improvements are a key factor driving returns in private equity. Therefore, in the first set of analyses we provide more detail on the question of what is driving profitability improvements in the German-speaking region using this sample of 124 proprietary buyout deals from the DACH region.

[47] If we argue about margins or EBITDA margins throughout this paper we refer to the EBITDA to sales ratio.

While this is a relevant question per se, there is still not much evidence on what implications these changes in profitability actually have for stakeholders of the buyout companies. This question is of major interest as, for example, increasing a company's efficiency might be very much in the interest of the private equity firm as the main shareholder, but not in the interest of the company's employees if it comes with mass layoffs. Hence, in a second step this paper aims at providing some descriptive evidence on the effects of operational changes in buyouts for the stakeholder groups of employees, tax authorities and banks (as debt lenders), respectively.

In terms of employees as a stakeholder group our main focus is on changes in personnel expenses between entry and exit to analyse the impact of buyout transactions on employees as a key stakeholder group. This is of particular interest as private equity investors in German-speaking countries have the widespread negative reputation that they carry out restructuring initiatives which cause the reduction of workforce and ultimately lead to profitability improvements and increased returns. Private equity sponsors are often seen as corporate raiders who behave opportunistic and do not act morally responsible.[48] Moral responsibility refers to not only maximising returns for private equity firms as major shareholders, but also to consider the needs of other stakeholders. In addition to employees we are interested in the impact of leveraged buyouts on two other stakeholder groups of the buyout company, being banks and the government. The latter stakeholder is represented by the government's tax authorities. Due to tax structuring efforts upon acquisition, private equity investors are deemed to optimise the tax burden of the portfolio companies through special purpose vehicles and holding companies in tax-haven jurisdictions. For a sub-sample of up to 30 buyout deals we were able to collect detailed information on the changes of personnel, tax and interest expenses over the holding period, i.e. between entry and exit of the private equity firms.

To the best of our knowledge, there are only a handful of studies available analysing changes of such additional measures other than sales, EBITDA margin or EV/EBITDA multiple. Smith (1990) analysis changes in operating cash flows per employee between the year prior to the entry and the first year after entry, for a sub-sample of 44 US public-to-private buyouts, he concludes that the significant increase of this measure is not driven by the reduction of employees. Kaplan (1989) finds for a sample of 42 large US public-to-private buyouts

[48] A statement of the former leader of the social democratic party in Germany contributed to this discussion as he compared private equity investors with Corporate Raiders (Interview dated 17th April 2005 in Bild am Sonntag).

between 1980 and 1986 that half of these companies increased the number of employees over the holding period. Even when benchmarking to industry numbers, Kaplan (1989) finds no evidence for the reduction of employees in buyouts. Similar results are obtained by Palepu (1990).

In another study Jensen et al. (1989) examine the impact of US LBOs initiated between 1979 and 1985 on tax revenues of the US treasury and find an average increase in such revenues of 61% from LBOs over pre-buyout tax payments. In his study, Palepu (1990) concludes that even due to increased tax shields and depreciation the aggregate net tax effect is positive in the long-run from the government's perspective. While these studies provide extremely valuable insights, they predominantly cover large US public-to-private transactions carried out in the 1980s. Consequently, they do not relate to the more recent wave of private equity transactions and have a distinct regional focus on the US and its institutional context for doing private equity business. Therefore, in this paper we look at very recent data from the specific economic perspective in the German-speaking region.

Our main findings are (1) annualised buyout EBITDA margin growth is positive and significantly correlated with the buyout's abnormal operational performance, i.e. buyout performance compared to appropriate public benchmark companies. (2) In terms of contribution to levered deal internal rate of return (IRR) we find that 31% are attributable to the base benchmark performance, 27% to operational outperformance and 32% to incremental deal leverage. (3) Opposed to the widespread negative reputation of private equity investors, the reductions in personnel expenses and workforce are not a driver of profitability improvements, the latter are rather driven by economies of scale. (4) Finally, we find that tax expenses as a percentage of EBITDA do not decrease considerably over the holding period; in fact, they increase.

The remainder of this paper is structured as follows: In Section 8.2 we describe the buyout sample applied as well as the benchmark sample and their key characteristics, further we present a correlation matrix of key deal attributes. Section 8.3 provides a decomposition of levered IRR into individual components by means of applicable benchmark figures. In Section 8.4 we present changes in operational performance figures, being sales, EBITDA margin and EV/EBITDA multiple, which serve as an introduction before analysing additional measures in Section 8.5. As outlined the latter section distinguishes between three different stakeholder groups: employees, banks and the government. Section 8.6 concludes.

8.2 Data Sampling and Descriptives

Starting with an initial proprietary sample of 1,318 transactions initiated in the German-speaking region and collected by several institutional investors in connection with their due diligence efforts we carried out a multi-step approach to derive the final sample applied.[49] The sample includes deal level data at entry and exit in the form of enterprise value, equity, net debt, sales, EBITDA, EV/EBITDA multiple as well as the cash flow pattern between portfolio company and GP being gross of management fees and carried interest, but including equity injections and dividends. First, we eliminated non-buyout (e.g. venture capital) and unrealised transactions reported at net asset value. Secondly, as information on the majority of remaining deals were incomplete we tried to fill the missing values by means of various commercial databases.[50]

The final buyout sample comprises 124 fully or partially realised transactions initiated between 1995 and 2008, including 96 German, 21 Swiss and seven Austrian buyouts. Reviewing the annual statistics published by the German Association of Private Equity and Venture Capital investors our sample represents approximately 8.6% of total German buyout activity in this period. With regard to transaction size, deal origin, exit channel and relevant industries, we apply a very heterogenous sample. As presented in Table 28 we observe rather successful deals, which is inherent to most, if not all, private equity databases as the information is voluntary self-reported and therefore biased towards better performing transactions. However, when it comes to the relative assessment of buyout deal performance we believe this potential sample selection bias not to be an issue as we have accounted for it by selecting an appropriate benchmark sample.

We have built two benchmark samples, one by applying a modified nearest neighbour approach, similar to the one suggested by Acharya et al. (2009a), and one by building industry portfolios. Both approaches assume that the next best investment alternative from the sponsor's perspective would have been to invest in public equity markets. Hence, we built a hypothetical index for the German-speaking region by retrieving, corresponding to the deal data, the relevant information for all companies being listed in the German-speaking region as of October 2013 and pulled this information back to 1995. Due to the delisting of companies and

[49] Please refer to Söffge and Braun (2014a) and Söffge and Braun (2014b) for a more in-depth description on how we derived the buyout and benchmark samples.

[50] Including MergerMarket, CapitalIQ and Thomson Reuters ONE Banker.

insolvencies the number available for benchmarking purposes reduces from 957 companies in 2013 to 202 companies in 1995. This, however, is regarded as an appropriate approach as we want to ensure that a given benchmark company is in existence over the holding period of the portfolio company. Especially given that we observe a maximum holding period of 12 years.

Table 28: Descriptive Statistics of Buyout and Benchmark Sample

The holding period is calculated on the basis of month of entry and exit of the private equity investor, respectively. The money multiple divides all positive cash flows (including dividends) over all negative cash flows (including additional equity injections). Internal rate of return (IRR) is the discount rate that makes all cash flows from the investment equal to zero and was determined on the basis of monthly cash flow information gross of management fees and carried interest. Financial (operational) alpha represents the difference between buyout levered (unlevered) and neighbour levered (unlevered) IRR, respectively. The right-hand columns shows difference tests between the neighbour and the buyout sample for mean and median values, respectively.

	Buyout Sample			**Nearest Neighbour Sample**			**Difference tests**	
n = 124	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	T test (t value)	Wilcoxon (z value)
Holding period (years)	4.32	3.92	2.03	4.32	3.92	2.03		
Money Multiple	4.81	3.29	7.71	2.87	1.75	5.30	2.27**	4.95***
Times Money (Money Multiple-1)	3.81	2.29	7.71	1.87	0.75	5.30	2.27**	4.95***
IRR (levered)	0.43	0.30	0.93	0.18	0.14	0.23	2.94***	3.90***
IRR (unlevered)	0.28	0.19	0.38	0.16	0.13	0.19	2.95***	2.89***
Financial alpha	0.25	0.12	0.95					
Operational alpha	0.11	0.06	0.43					

The nearest neighbour sample was derived by matching each buyout transaction with a public company that (1) operates in the same industry (ICB classification) and (2) shows a similar EBITDA margin in the year of entry. Given our heterogenous sample we believe profitability to be the most reasonable matching criterion compared to absolute sales or EBITDA.[51] The industry-portfolio benchmark sample has been built in a similar manner. We aggregated all companies in the buyout's industry at the year of entry to simulate an opportunistic investment into an industry-portfolio. In light of calculating relevant benchmark returns, for both samples, we included dividend payments to be methodologically consistent. Comparing the results (not reported) revealed that the nearest neighbour sample significantly (at the 1% level) outperforms the industry portfolio sample. Given the potential buyout sample selection issue highlighted above we use the better performing nearest neighbour sample for

[51] As presented later in Table 31: At the year of entry our buyout sample shows mean (median) sales and EBITDA of €419m (154m) and €59m (€22m), respectively, which compares to €4,846m (€541m) in sales and €493m (€80m) in EBITDA for the nearest neighbour sample.

benchmarking purposes in the remainder of this paper.[52] Table 28 provides a summary of the buyout and nearest neighbour sample's return measures as well as applicable tests of difference.

As the figures presented in Table 28 have neither been winsorised nor logged we recommend to focus on median values for interpretation purposes. For the buyout sample we find a levered and unlevered median IRR of 30.3% and 19.2%, respectively, which compares to 13.9% and 12.7% for the nearest neighbour sample. The differences are highly statistically significant at the 1% level. We calculate an unlevered IRR in order to obtain a like-for-like return measure for the buyout and benchmark which assumes a hypothetically 100% equity-financed company. This allows us to compare returns regardless of the financing structure. Hence, the difference between the two unlevered IRRs represents the abnormal operational performance of the buyout companies over the nearest neighbour companies, which we refer to as operational alpha. We find a median (mean) operational alpha of 5.6ppts (11.5ppts).[53] Financial alpha represents the difference in levered IRRs, but is distorted due to different financing structures, thus the emphasis is put on unlevered returns and operational alpha.

Table 29: Correlation Matrix

The table shows the pairwise correlation coefficients between operational alpha, levered buyout IRR, unlevered buyout IRR, levered neighbour IRR, unlevered neighbour IRR and for annualised deal sales, EBITDA margin and EV/EBITDA multiple growth. Annualised growth rates are calculated as value at exit less value at entry, divided by value at entry and divided by the holding period. *, **, and *** indicate whether the correlations are statistically significant at 10%, 5%, and 1% levels, respectively.

	Operational alpha	Buyout IRR (levered)	Buyout IRR (unlevered)	Neighbour IRR (levered)	Neighbour IRR (unlevered)	Deal sales growth	Deal margin growth	Deal multiple growth
Operational alpha	1							
Buyout IRR (levered)	0.73***	1						
Buyout IRR (unlevered)	0.89***	0.88***	1					
Neighbour IRR (levered)	-0.53***	0.03	-0.12	1				
Neighbour IRR (unlevered)	-0.49***	0.08	-0.05	0.95***	1			
Deal sales growth	0.26***	0.16*	0.23***	-0.14	-0.12	1		
Deal margin growth	0.30***	0.37***	0.39***	0.09	0.09	-0.07	1	
Deal multiple growth	0.01	0.10	0.10	0.14	0.18**	-0.12	0.06	1

The significance levels of the correlation coefficients between annualised margin growth and operational alpha/ unlevered buyout IRR confirm the findings discussed in the beginning

[52] Unreported tests show that all our results are robust to using the alternative benchmark sample.

[53] Please note that the difference between 19.2% and 12.7% does not yield 5.6ppts, as the latter represents the median operational alpha of all 124 differences. The same applies to mean values.

of the paper. The relationship is positive and highly significant at the 1% level, so is the one between annualised sales growth and operational alpha/ unlevered IRR; however, the margin coefficients are greater in absolute terms. In Section 8.4 we will elaborate on operational performance changes – in relation to the neighbour companies – in more detail. As Acharya et al. (2013) we find a negative and highly significant correlation between neighbour unlevered IRR and operational alpha (p. 384). We regard this finding as meaningful as one would expect a higher abnormal performance the lower the unlevered benchmark return. More interestingly, we find no significant relation between multiple growth and any of the buyout's performance measures.

8.3 Decomposing IRR

Before we more specifically examine changes in operational performance and margin drivers over the holding period we want to shed some more light on the various elements of the levered buyout IRR by taking the benchmark sample's return components into account. As presented in Table 30 the overall levered mean (median) IRR of 42.8% (30.3%) can be broken down into four individual components. The second row of Table 30 shows the unlevered IRR of the nearest neighbour sample, which we refer to as the base benchmark performance. This could also be interpreted as the base unlevered performance of the market.

Table 30: Decomposition of Levered IRR

The table presents the decomposition of the levered buyout IRR into its four components being: (i) Base benchmark operational performance, which is equal to the unlevered IRR of the nearest neighbour sample; (ii) Operational alpha, which is the difference between the unlevered deal IRR and the unlevered neighbour IRR; (iii) Base benchmark leverage, which is equal to the leverage of the neighbour, being the difference between the levered and unlevered neighbour IRR, and (iv) Incremental leverage, which is the difference between levered and unlevered buyout IRR less the base benchmark leverage. The column on the right-hand side presents the various components in % of total mean levered IRR. Adding (iii) and (iv) yields the total leverage effect of the buyout sample of 35%.

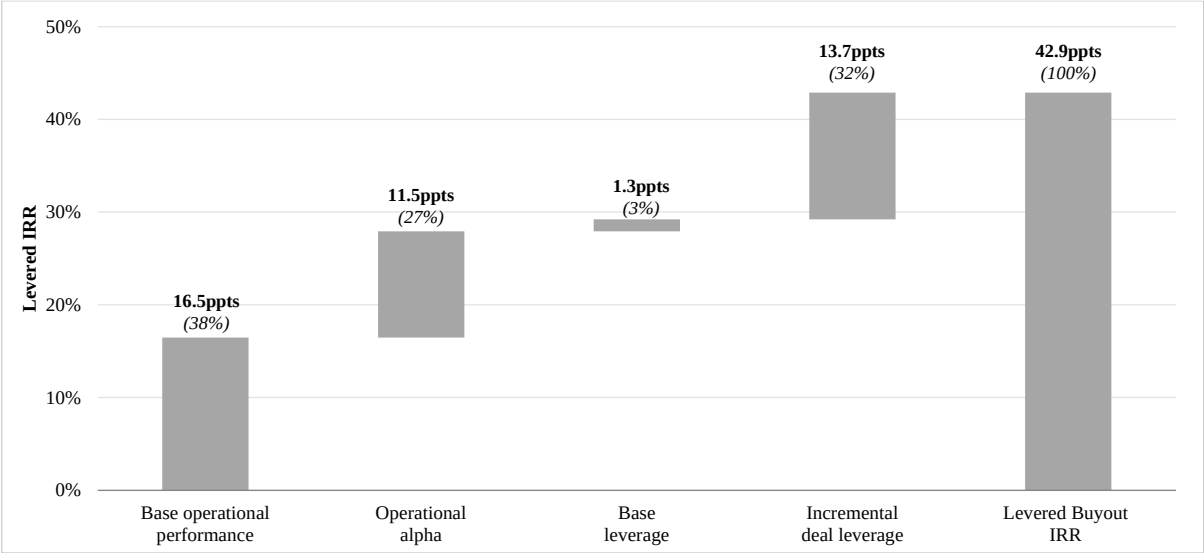
n = 124	Mean	Median	Std. Dev.	Min	Max	per IRR (mean)
1. Buyout IRR (levered)	**0.43**	**0.30**	**0.93**	**-0.75**	**8.52**	**100%**
2. Base benchmark operational performance	0.16	0.13	0.19	-0.40	0.81	38%
3. Operational alpha	0.11	0.06	0.43	-0.56	3.03	27%
4. Base benchmark leverage	0.01	0.00	0.08	-0.30	0.30	3%
5. Incremental deal leverage	0.14	0.06	0.63	-0.87	6.31	32%

In the third row we present operational alpha as discussed before. The sum of rows two and three yield the unlevered mean (median) buyout return of 27.9% (19.2%). Next, in row four, we present the contribution of market leverage, which we call base benchmark leverage,

to the overall levered buyout IRR. It represents the difference between levered and unlevered nearest neighbour IRR. Finally, in row five, we show the additional contribution to levered deal IRR due to financial engineering efforts of the GP. It is equal to the difference between levered and unlevered buyout IRR less the base benchmark leverage.

Figure 15: Decomposition of Levered IRR

The Figure presents the mean contributions in ppts and % (in parentheses) of the four individual components to the overall levered buyout sample IRR.



Source: Own illustration

The approach is similar to the one undertaken by Acharya et al. (2013, p. 381), however we regard our decomposition as being more intuitive and easier to interpret. To the very right of Table 30 and in the parentheses of Figure 15 we present the relative mean contributions of each component in terms of levered deal IRR. We find that 41% of total levered performance is attributable to the market; being 38% base performance and 3% base leverage. Additionally we find that 27% stem from abnormal operational performance (operational alpha) of the private equity portfolio company, which is regardless of the financing structure. Additional financial engineering efforts of the private equity sponsor contribute 32% to levered IRR. In summary, we find 65% and 35% being attributable to operating and financing efforts, respectively.

Interestingly enough, and which is to be read in conjunction with the potential sample selection issues highlighted above, our sample also includes non-performing buyout transactions, as shown in Table 30. The worst performing deal in our sample shows a levered IRR of -75.4% and the total sample includes 11 deals with negative IRRs. In contrast there are also seven deals with IRRs above 100%.

8.4 Changes in Operational Performance

As presented above in Table 29 we find annualised buyout sales and margin growth to be significantly correlated with abnormal performance and unlevered returns. This, however, does not apply to the buyout's annualised EV/EBITDA multiple growth. Further we find the neighbour's base operational performance to contribute a significant portion (38%) to the overall levered buyout IRR. Hence, it is of interest how these individual changes of the buy-out transactions compare to those of the nearest neighbour companies.

Table 31: Changes in Operational Performance

Panel A shows mean, median and standard deviation for buyout and neighbour sales, EBITDA, and EBITDA margin at entry and exit. Further, applicable difference tests on mean and median level are presented. Panel B shows three annualised growth rates for the buyout and neighbour sample as follows: (i) Sales growth represents an annualised growth rate and is calculated as sales at exit less sales at entry, divided by sales at entry and divided by the holding period. (ii) Margin growth represents an annualised growth rate and is calculated as EBITDA margin at exit less EBITDA margin at entry, divided by EBITDA margin at entry and divided by the holding period. (iii) Multiple growth represents an annualised growth rate and is calculated as EV/EBITDA multiple at exit less EV/EBITDA multiple at entry, divided by EV/EBITDA multiple at entry and divided by the holding period. The two columns on the right-hand side present difference tests between the buyout and the nearest neighbour sample for mean and median values, respectively.

		Entry			**Exit**			Difference tests between exit and entry	
Panel A: Entry vs Exit	n	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	T test (t value)	Wilcoxon (z value)
Buyout sales (€m)	124	418.6	153.9	727.4	483.8	185.3	821.2	3.82***	6.49***
Buyout EBITDA (€m)	124	58.7	21.8	107.1	88.4	29.5	168.9	4.24***	6.69***
Buyout EBITDA/sales	124	0.16	0.13	0.11	0.17	0.16	0.10	1.80*	4.08***
Neighbour sales (€m)	124	4,845.6	541.2	14,300.0	6,034.3	758.1	16,200.0	4.11***	7.48***
Neighbour EBITDA (€m)	124	492.8	80.2	1,378.4	643.8	136.9	1,461.0	3.07***	6.72***
Neighbour EBITDA/sales	124	0.15	0.13	0.09	0.16	0.14	0.09	0.87	0.97

							Difference tests between Buyout and Neighbour Sample	
Panel B: Annualised growth rates	n	Mean	Median	Std. Dev.	Min	Max	T test (t value)	Wilcoxon (z value)
Buyout sales growth	124	0.061	0.038	0.120	-0.294	0.549	-2.52**	-2.57**
Neighbour sales growth	124	0.125	0.066	0.255	-0.123	2.039		
Buyout margin growth	124	0.048	0.035	0.173	-0.967	0.515	0.724	2.70***
Neighbour margin growth	124	0.029	0.013	0.174	-0.256	1.633		
Buyout multiple growth	124	0.128	0.064	0.458	-1.644	4.227	0.805	0.120
Neighbour multiple growth	124	0.093	0.040	0.212	-0.456	0.768		

Panel A of Table 31 provides a summary of buyout and nearest neighbour sales, margin and multiple development between entry and exit. Sales and EBITDA show a highly significant increase for both deal and neighbour companies between entry and exit. While both samples show an increase in EBITDA margin over the holding period, this increase is only significant for the buyout sample.

In Panel B of Table 31, we find positive annualised growth rates for all three measures over the holding period on mean and median level for both (buyout and benchmark) samples. Interestingly, the median annualised sales growth amounts to 6.6% and 3.8% for the nearest neighbour and buyout sample, respectively. Hence, the public benchmark companies managed to realise an annualised sales growth which is 2.8ppts higher compared to the buyout transactions. The difference between the annualised sales growth rates is significant at the 5% level as indicated to the right of Panel B.

In contrast, the private equity portfolio companies managed to improve its EBITDA margin at an annualised median growth rate of 3.5%, which compares to only 1.3% for the nearest neighbour companies. The higher median margin growth rate of 2.2ppts is statistically significantly different at the 1% level. Even though the difference is statistically insignificant, we find that the median buyout EV/EBITDA multiple grew at 6.4% per annum, while the publicly traded benchmark companies managed to improve their trading multiple by 4.0% per annum over the holding period.

The higher annualised multiple growth rate for buyout companies could stem from the negotiation power of the PE investor, which is either a lower multiple – compared to the market – negotiated at entry and/ or a higher multiple – compared to the market – negotiated at exit. One could further argue, similar to the decomposition of the levered IRR, that 63% (4.0 over 6.4) of annualised buyout multiple growth are market driven, while the remaining 37% are attributable to the PE's negotiation skills and/ or synergies from the buyers perspective at exit. However, it is to be noted that these 63% would rather reflect public than private market effects. This is because the 4.0 median neighbour multiple change only relates to public companies, while the 6.4 median buyout multiple change mostly relates to private companies. Thus, we would suggest applying a more distinctive approach when analysing the individual components of multiple growth rates. For example, in order to assess the underlying market effects, included in the 6.4 median buyout multiple growth, it appears reasonable to gather the multiple information of private equity transactions differentiated by industry and year, rather than applying public multiple information which are ultimately based on market capitalisation and as such include various market effects which are not inherent to private transactions. In doing so one could assess the out- or underperformance of a given buyout sample in terms of multiple growth.

While it is difficult to assess the reasons for the higher annualised benchmark sales growth, there could be several reasons for the higher margin growth identified for buyout

transactions. Firstly, this could stem from the PE firm's ability to identify 'low hanging fruits' and translate these into operational improvements, especially given that our sample includes a number of very small and potentially – prior to the PE's entry – not well managed companies. In this vein, one could argue that, on average, smaller PE companies performed better in translating sales growth into economies of scale, assuming that the majority of the bigger neighbour companies have already realised such scaling effects. In contrast, one could argue that PE firms mainly improved margin through restructuring efforts and the reduction of headcount, as will be discussed in the next section.

8.5 Impact of Leveraged Buyouts on Stakeholders

In this section, we first examine whether changes in personnel expenses over the holding period are driving the identified and highly significant EBITDA margin improvements and how this impacts employees as an important stakeholder group in buyouts. Secondly, we analyse changes in interest expenses over the holding period to determine the impact of leveraged buyouts on debt providers (mainly banks) as a second stakeholder. Thirdly, and finally, we address the impact of buyouts on tax authorities representing the government as a third stakeholder.

For each buyout transaction, and the corresponding nearest neighbour, we have manually looked up commercial and freely accessible databases as well as the companies' websites to collect personnel, interest and tax expenses for the year of entry, the first year after entry and the year of exit.[54] We believe that the development between the first year following the year of entry, referred to as entry t+1, and the year of exit are also reliable as in most cases this is the first full year under PE ownership and potential operational initiatives have not been fully realised yet.

The heterogenous buyout sample includes a large number of very small companies, which are legally not obliged to publish their annual reports. Hence, the relevant financials could not be gathered for these companies. Further restrictions in the data collection process were imposed by means of the coverage of certain databases, with the majority only providing data from 2004 onwards. In regard of the buyout sample's composition 51 out of 124 deals were initiated in 2004 or later, hence this additionally limited the sub-sample available for this

[54] Databases include Markus, Amadeus, Hoppenstedt, the electronic German Federal Gazette and company websites. Please note that interest and tax expenses were retrieved from the statutory accounts. Hence, the figures do not represent the real cash-out, but statutory figures should serve as a reliable indication.

set of analyses. We were able to collect relevant data for six sub-samples, two for each stakeholder group, ranging from 20 to 30 observations. For each sub-sample we additionally present sales and EBITDA margin development of the buyout and the neighbour company as presented and discussed in the following.

8.5.1 Employees and Profitability Improvements

As outlined above it is difficult to assess the drivers of buyout sales growth. We believe it is a mixed effect including underlying market trends, re-negotiation of selling prices, inflation, product mix changes and innovation under PE ownership. In contrast to sales growth drivers, we are mainly interested in what is driving EBITDA margin improvements. Especially given that the buyout transactions – at a lower sales growth – significantly outperformed their benchmarks. As presented in Table 31 for the entire buyout sample we find a median profitability improvement of 2.6ppts from 13.0% EBITDA margin at entry to 15.6% at exit. This compares to a 1.5ppts median margin improvement for the nearest neighbour sample, from 12.8% to 14.2%. One reasonable driver of margin improvement could be economies of scale and resulting fixed cost degression effects following the sales growth, especially with regard to the composition of the buyout sample, including a number of very small buyouts presumably offering potential for such scaling effects.

One additional driver could result from workforce reduction programs triggered by the private equity sponsor. Employees are probably regarded as the stakeholder group for which potential negative impacts are most controversially discussed. Hence we are interested in whether such potential workforce reduction initiatives are a key driver of EBITDA margin improvements. We measure such a potential impact through the change of absolute personnel expenses as well as personnel expenses as a percentage of sales between entry (entry t+1) and exit. Both KPIs were collected for available deals and the corresponding nearest neighbours.

In Table 32 we display changes in personnel expenses over the holding period for two different samples. Panel A contains data for the 22 deals for which were able to collect information on personnel expenses in the entry and exit year, respectively. The numbers in Panel B are based on 30 buyouts for which we have personnel expenses information in the year after the entry year and the exit year, respectively. Irrespective of the sub-sample we find a significant increase in absolute personnel expenses between entry (entry t+1) and exit for mean and median figures, mainly at the 1% level. For the neighbour companies absolute median personnel expenses increased in both sub-samples, while mean values show a decrease. Howev-

er, the only significant (5% level) change is the median increase in Panel A. More interestingly, we find in Panel A that the median deal ratio of personnel expenses as a percentage of sales significantly (5% level) increased from 12% to 17% between entry and exit. In Panel B we find a slight but non-significant decrease of 3ppts on median level. Analysing the nearest neighbours in Panel A reveals that both ratios decreased, however, this change is statistically not significant and given the higher sales growth for neighbours this appears reasonable and could be explained through economies of scale. Additionally, in Panel B we find a rather flat development of the neighbours' ratios.

Table 32: Changes in Personnel Expenses

Panel A shows mean and median sales, EBITDA margin, personnel expenses and personnel expenses as a percentage of sales for a sub-sample of 22 buyout and nearest neighbour companies at entry and exit as well as difference tests for mean and median values, respectively. Panel B presents the same information for a sub-sample of 30 buyout and nearest neighbour companies between entry t+1 and exit.

		Entry			**Exit**			**Difference tests between exit and entry**	
Panel A: Sub-Sample I, Entry & Exit Year	n	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	T test (t value)	Wilcoxon (z value)
Buyout sales (€m)	22	824.7	491.7	854.4	1,023.2	296.5	1,179.7	2.37**	3.10***
Neighbour sales (€m)	22	2,310.7	403.7	4,640.9	2,588.0	559.2	4,939.9	3.67***	3.88***
Buyout EBITDA/sales	22	0.18	0.12	0.16	0.21	0.18	0.11	0.80	2.65***
Neighbour EBITDA/sales	22	0.17	0.12	0.13	0.16	0.13	0.12	-1.35	-0.89
Buyout personnel expenses (€m)	22	125.3	44.7	173.9	168.9	124.3	185.4	3.02***	2.84***
Neighbour personnel expenses (€m)	22	460.7	85.2	969.9	431.6	112.3	760.4	-0.49	2.35**
Buyout personnel expenses/sales	22	0.19	0.12	0.21	0.30	0.17	0.37	2.06*	2.16**
Neighbour personnel expenses/sales	22	0.25	0.24	0.12	0.23	0.21	0.14	-0.65	-1.45

		Entry t+1			**Exit**			**Difference tests between exit and entry t+1**	
Panel B: Sub-Sample II, Entry+1 & Exit Year	n	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	T test (t value)	Wilcoxon (z value)
Buyout sales (€m)	30	612.8	211.0	809.0	832.3	192.6	1,073.7	2.33**	2.38**
Neighbour sales (€m)	30	1,836.7	440.4	3,340.5	2,105.7	559.2	3,832.8	2.19**	3.16***
Buyout EBITDA/sales	30	0.19	0.14	0.14	0.19	0.17	0.11	0.27	2.13**
Neighbour EBITDA/sales	30	0.17	0.12	0.11	0.16	0.13	0.11	-1.60	-0.94
Buyout personnel expenses (€m)	30	348.3	39.9	1,426.9	412.1	48.8	1,569.3	2.27**	3.20***
Neighbour personnel expenses (€m)	30	453.8	96.8	878.1	444.6	128.9	758.8	-0.34	1.02
Buyout personnel expenses/sales	30	0.31	0.23	0.48	0.39	0.20	0.60	1.19	0.75
Neighbour personnel expenses/sales	30	0.26	0.24	0.14	0.26	0.25	0.07	-0.02	-0.53

From the results obtained we do not find evidence for a reduction in personnel expenses being a main driver of an improved EBITDA margin. For the sub-sample in Panel A our results even indicate the opposite, the 22 buyout transactions show a median EBITDA margin improvement of 6ppts from 12% at entry to 18% at exit, while the significant increase in personnel expenses is at the expense (-5ppts) of EBITDA margin. If the personnel expense ratio

would have remained flat between entry and exit we would even observe a median margin increase of ca. 11ppts. Median EBITDA margin for the sub-sample of 30 buyout transactions in Panel B increased from 14% to 17% between entry t+1 and exit. This 3ppts improvement could be exclusively driven, disregarding other offsetting effects, by the lower personnel expenses ratio (-3ppts). However, in absolute terms personnel expenses show a highly significant increase. Therefore, it can be concluded that a reduction of personnel expenses – and ultimately headcount – are not a driver of EBITDA margin improvements. The positive margin impact rather stems from scaling effects. Along with fixed cost degression the ratio of personnel expenses as a percentage of sales might support an increase in profitability, but given higher absolute levels there is no evidence that restructuring efforts initiated by PE owners in the German-speaking region lead to redundancies and profitability improvements.

8.5.2 Debt Providers – Banks and Other Lenders

Another important stakeholder group, especially in leveraged buyouts, are banks and other lenders as the key parties providing the debt required for leverage. Thus, we want to take a closer look on how interest burden changed over the holding period. Again, we apply two measures being absolute interest expenses and interest expenses as a percentage of EBITDA.

Interest expenses are inherent to the leveraged buyout business model. Following high leverage ratios at entry[55] we see a statistically significant increase in interest expenses between entry (entry t+1) and exit in Panel A and B of Table 33 for our two sub-samples of 20 and 30 buyout transactions, respectively. It is to be emphasised that de-leverage is an important value driver in buyout transactions, which implies that interest expenses decline with loan amortisation over the holding period. Hence, one would expect even higher levels of interest expenses during ownership. For the nearest neighbour companies we do not observe any significant development, which again is explained by the LBO business model. Interestingly, one can see the tremendous burden resulting from leverage: At exit median buyout interest expenses as a percentage of EBITDA account for 18% and 20% in Panel A and B, respectively, which compares to only 12% and 7% for the nearest neighbour companies.

[55] For the buyout sample we find a median debt/equity ratio of 1.70 and a median debt/EBITDA ratio of 3.45 at entry.

Table 33: Changes in Interest Expenses

Panel A shows mean and median sales, EBITDA margin, interest expenses and interest expenses as a percentage of EBITDA for a sub-sample of 20 buyout and nearest neighbour companies at entry and exit as well as difference tests for mean and median values, respectively. Panel B presents the same information for a sub-sample of 30 buyout and nearest neighbour companies between entry t+1 and exit.

		Entry			**Exit**			**Difference tests between exit and entry**	
Panel A: Sub-Sample I, Entry & Exit Year	n	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	T test (t value)	Wilcoxon (z value)
Buyout sales (€m)	20	734.0	210.2	879.7	938.3	159.6	1,223.9	2.24**	2.80***
Neighbour sales (€m)	20	2,488.7	458.6	4,828.1	2,754.0	577.3	5,147.9	3.09***	3.29***
Buyout EBITDA/sales	20	0.17	0.11	0.15	0.19	0.18	0.09	0.69	2.46**
Neighbour EBITDA/sales	20	0.16	0.12	0.12	0.14	0.12	0.11	-1.78*	-1.53
Buyout interest expenses (€m)	20	26.3	2.5	53.4	47.4	11.1	72.9	3.74***	3.40***
Neighbour interest expenses (€m)	20	15.9	6.8	19.6	43.2	10.1	71.4	1.87*	1.31
Buyout interest expenses/EBITDA	20	0.16	0.09	0.15	0.40	0.18	0.62	1.64	0.56
Neighbour interest expenses/EBITDA	20	0.11	0.08	0.10	0.18	0.12	0.17	2.22**	1.27

		Entry t+1			**Exit**			**Difference tests between exit and entry t+1**	
Panel B: Sub-Sample II, Entry+1 & Exit Year	n	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	T test (t value)	Wilcoxon (z value)
Buyout sales (€m)	30	603.0	165.9	814.5	843.5	192.6	1,069.7	2.53**	2.58***
Neighbour sales (€m)	30	1,768.2	440.4	3,323.6	2,016.6	559.2	3,821.4	2.00*	2.62***
Buyout EBITDA/sales	30	0.18	0.14	0.14	0.19	0.17	0.11	0.38	2.19**
Neighbour EBITDA/sales	30	0.17	0.12	0.11	0.16	0.13	0.11	-1.85*	-1.20
Buyout interest expenses (€m)	30	29.2	5.4	50.3	50.0	7.0	82.3	2.05**	1.76*
Neighbour interest expenses (€m)	30	24.7	4.7	40.6	22.9	6.6	51.3	-0.30	-0.67
Buyout interest expenses/EBITDA	30	0.54	0.19	1.16	0.39	0.20	0.52	-0.70	-1.02
Neighbour interest expenses/EBITDA	30	0.10	0.09	0.09	0.13	0.07	0.14	1.68	1.00

These high levels of interest expenses should lead to a lower pre-tax profit and ultimately lead to lower tax expenses, also known as the tax-shield effect. Hence, in the next section we want to analyse the impact of leveraged buyouts on tax expenses.

8.5.3 The Government and its Tax Authorities

One additional stakeholder of interest is the government represented by the tax authorities. In line with the reputation of cutting jobs, it is said that private equity investors structure transactions through various acquisition vehicles in tax-haven jurisdictions to minimise their tax burden. In addition to structuring efforts, the high levels of interest expenses observed in Table 33 are expected to reduce pre-tax profits and thereby additionally lower the overall tax burden. Therefore, we analyse two measures between entry (entry t+1) and exit, being changes in tax expenses and changes in tax expenses as a percentage of EBITDA. As presented in

Panels A and B of Table 34 we were able to collect two sub-samples including 21 and 28 buyout transactions, respectively.

Table 34: Changes in Tax Expenses

Panel A shows mean and median sales, EBITDA margin, tax expenses and tax expenses as a percentage of EBITDA for a sub-sample of 21 buyout and nearest neighbour companies at entry and exit as well as difference tests for mean and median values, respectively. Panel B presents the same information for a sub-sample of 28 buyout and nearest neighbour companies between entry t+1 and exit.

		Entry			Exit			Difference tests between exit and entry	
Panel A: Sub-Sample I, Entry & Exit Year	n	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	T test (t value)	Wilcoxon (z value)
Buyout sales (€m)	21	710.3	235.8	864.3	908.1	175.0	1,200.9	2.27**	2.94***
Neighbour sales (€m)	21	2,534.7	474.6	4,710.6	2,807.2	579.3	5,023.4	3.33***	3.42***
Buyout EBITDA/sales	21	0.16	0.11	0.15	0.19	0.17	0.09	0.70	2.56**
Neighbour EBITDA/sales	21	0.15	0.12	0.11	0.14	0.11	0.11	-1.82*	-1.55
Buyout taxes (€m)	21	9.3	4.7	12.9	36.1	4.9	58.8	2.36**	2.10*
Neighbour taxes (€m)	21	43.8	16.3	59.4	55.7	17.4	101.6	0.92	0.19
Buyout taxes/ EBITDA	21	0.10	0.09	0.07	0.24	0.15	0.37	1.72	1.20
Neighbour taxes/ EBITDA	21	0.18	0.18	0.10	0.18	0.14	0.10	-0.07	-0.54

		Entry t+1			Exit			Difference tests between exit and entry t+1	
Panel B: Sub-Sample II, Entry+1 & Exit Year	n	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	T test (t value)	Wilcoxon (z value)
Buyout sales (€m)	28	651.5	252.5	824.4	841.8	192.6	1,084.2	2.18**	2.23**
Neighbour sales (€m)	28	1,569.3	440.4	2,903.6	1,714.3	559.2	3,063.9	2.77***	2.47**
Buyout EBITDA/sales	28	0.17	0.13	0.12	0.19	0.17	0.11	1.18	2.76***
Neighbour EBITDA/sales	28	0.17	0.12	0.11	0.15	0.12	0.11	-2.40**	-1.71*
Buyout taxes (€m)	28	21.3	4.0	38.5	28.6	3.3	52.2	1.63	1.26
Neighbour taxes (€m)	28	41.4	12.6	72.0	20.2	16.0	19.9	-1.87*	-1.61
Buyout taxes/ EBITDA	28	0.20	0.14	0.38	0.21	0.15	0.32	0.04	-0.21
Neighbour taxes/ EBITDA	28	0.19	0.18	0.09	0.14	0.14	0.07	-3-31***	-2.54**

Opposed to the reputation of tax optimisation efforts initiated by the private equity sponsor at entry we obtain different results. For the sub-sample in Panel A we find a significant increase in mean and median absolute tax expenses between entry and exit. Even though the differences between tax expenses as a percentage of EBITDA are not significant we observe an increase on mean and median level. Interestingly, the neighbour companies were able to lower their median ratio by ca. 4ppts to 14% at exit. In Panel B we find a non-significant reduction of median buyout tax expenses, but at the same time a slight increase in the tax to EBITDA ratio. As in Panel A we find a decrease in the neighbours' tax expenses, which for this sub-sample is highly significant.

8.6 Conclusion

Applying a novel dataset of 124 buyout transactions initiated in the German-speaking region we decompose levered IRR into four individual components and find that 38% are attributable to the unlevered base performance of the nearest neighbour and 27% to abnormal operational performance of the buyout over its benchmark company. While only 3% of levered IRR are attributable to the leverage of the nearest neighbour, additional deal leverage contributes 32%. We further find that annualised EBITDA to sales margin growth is positive and highly significantly correlated with the buyout's abnormal operational performance. Comparing different annualised growth rates for sales, EBITDA margin and EV/EBITDA multiple between the buyout and nearest neighbour sample we obtain a statistically higher annualised median sales growth of 2.8ppts for the nearest neighbour companies over the buyout companies, while margin growth is significantly higher for buyouts outperforming the neighbour companies by 2.2ppts on median level. Similarly, even though not statistically significant, the EV/EBITDA growth (median of 2.4ppts) is higher for buyouts compared to public neighbour companies.

In line with the results of previous studies we find EBITDA margin development to be the main driver of performance in leveraged buyouts. In this paper we further investigated whether changes in personnel expenses between entry and exit are driving these margin improvements. In addition to analysing the impact of buyouts on employees, as one important stakeholder group, we examine changes of interest and tax expenses to address the impact on lenders and the government as additional stakeholders. For six sub-samples we analyse the changes in personnel, interest and tax expenses between entry (t+1) and exit. With regard to personnel expenses we find a significant increase in absolute personnel expenses for both subsamples and a significant increase in the personnel expenses to sales ratio between entry and exit. Our results do not indicate that changes in personnel expenses are a significant driver of EBITDA margin improvements. Further, the significant increase in absolute expenses provides no evidence that private equity sponsors undertake restructuring initiatives during ownership that lead to redundancies.

Opposed to the reputation of tax optimisation efforts we find no significant reduction in tax expenses between entry and exit, even if measured as a percentage of EBITDA. Overall the results obtained from the sub-samples indicate that the controversially discussed private equity activity in the German-speaking region does not bring negative welfare effects in the

form of redundancies and lower tax revenues. Hence, we conclude that the results obtained serve as an indication that restructuring initiatives leading to redundancies and tax optimisation efforts resulting in tax savings are not key levers to maximise profitability, cash flows and ultimately equity returns for leveraged buyouts in German-speaking countries.

We are aware that given our sub-sample sizes the results obtained in analysing the impact on stakeholders are indicative only and further research in this area is required. In addition to personnel expenses further studies should focus on potential additional margin drivers, such as the impact of operating efficiency initiatives, the development of advertising or research and development expenses over the holding period.

9 Case Study – The Buyout of Deutz Power Systems

Before summarising the results obtained in the main part of the thesis, a case study is introduced to discuss a buyout transaction carried out in Germany between 2007 and 2010. It should serve as an example to reflect some of the findings obtained above. The case presents the buyout of the Deutz Power Systems GmbH by 3i plc. Deutz Power Systems was carved out of the Deutz AG, a publicly listed manufacturer of engines, in August 2007, subsequently got rebranded to MWM GmbH and finally sold to Caterpillar by 3i in October 2010. Today the company operates under the name Caterpillar Energy Solutions GmbH.

The information and results presented in the following are based on several sources: (1) various press releases by 3i, MWM and Caterpillar as well as additional press articles published in light of the acquisition and disposal process; (2) financial information of MWM published in the German Federal Gazette, on MergerMarket and in the annual report of Deutz AG prior to the sale as presented in Tables 35 and 36, and (3) a short interview conducted with Peter Wirtz, Managing Director of 3i Germany, as of 19 December 2013[56].

MWM is a mechanical engineering company, based in Mannheim Germany, which produces gas and diesel engines for the generation of electrical energy and provides after sales services. Further the company provides additional services, such as consulting or engineering services for power plants. Before discussing qualitative information on the buyout it is elaborated on the deal's value drivers, Table 35 highlights the most relevant deal and return figures of the buyout transaction collected from various sources.

According to MergerMarket 3i bought the company in August 2007 for an enterprise value of €360m; the company was sold at an enterprise value of €580m in October 2010. Applying the FY09/10 EBITDA as presented in Table 36 an EV/EBITDA multiple of ca. 17.8 results at exit, which compares to an entry multiple of ca. 19.9. From the balance sheet as of June 2010 one can approximate the closing values for cash, pensions, tax liabilities and bank debt at closing, which add up to ca. €98m of (indicative) net debt, disregarding other potential debt-like provisions or liabilities as well as other cash-like assets. From this an equity value at exit of €482m results. According to a 3i press release a 2.2x return on the investment as well

[56] The interview with Peter Wirtz was conducted by the author of the underlying thesis and solely relates to qualitative matters regarding the buyout; the following citations in this section are based on meeting notes, which were summarised by the author of the thesis in the form of a one-pager and were approved by Peter Wirtz by mail on December 24th 2013.

as an IRR in excess of 25% was realised.[57] Based on the approximated equity value at exit and the cash multiple of 2.2 the equity value at entry of ca. €219m can be estimated. Calculating backwards, the latter translates into a net debt figure of ca. €141m at entry. However, as the closing balance sheet is not available these numbers are indicative only. Applying the equity values at entry and exit an IRR of 28.2% results, which is in line with the above 25% IRR as reported by 3i.

Table 35: Deal and Return Figures

The figures presented below were obtained from the annual report of Deutz AG, a 3i press release upon exit and the German Federal Gazette and are therefore indicative only. EBITDA at entry was approximated by applying the EBITDA to EBIT ratio of the last financial year (2006) to the nine months EBIT figure and annualising this figure afterwards. Sales were annualised following the same approach. Net debt figures were derived from the balance sheet as of June 2010. For the calculation of net debt other potential debt-like provisions or liabilities as well as other cash-like assets were disregarded as the level of detail is not available.

€ in millions	Aug-2007 Entry	October-2010 Exit	Cash Multiple	TM Multiple	IRR
Sales	276.13	284.36			
EBITDA	18.09	32.63			
EV/EBITDA Multiple	19.91	17.77			
EV	**360.00**	**580.00**			
Cash	n.a.	21.63			
Pension liabilities		-2.47			
Tax liabilities		-0.79			
Bank debt		-116.67			
Net debt	**-141.06**	**-98.31**			
Equity Value	**218.94**	**481.69**	2.20	1.20	28.2%

Based on the figures presented in Table 36 and assuming that the forced net debt figure at entry exclusively relates to bank debt the value creation drivers can be calculated accordingly. In a first step unlevering the times money multiple by applying cost of debt of 7.1%, as presented in Table 8, an unlevered times money multiple of 0.89 result. As such the leverage effect contributed 25% of total value generated, or 0.31 in times money points, while 75% relate to operational drivers. Further segregating the unlevered times money multiple shows that 0.99 times money points relate to EBITDA effects, or 110% and 82% of the unlevered and levered times money multiple, respectively. This can be further broken down into sales growth, amounting to 0.04 or 3% of the levered times money multiple, and margin improve-

[57] Please refer to http://www.3i.com/news/corporate-news/3i-sells-mwm-caterpillar.

ments of 0.95 or 79% of levered times money including the combination effect. Comparing the EV/EBITDA multiples, between entry and exit, translates into a negative value contribution from the multiple expansion effect, -0.24 times money points, including the combination effect. However, regardless of the decrease the absolute multiples are still very high. Finally, the free cash flow effect contributes 0.15 times money points or 12% to the levered multiple. The latter is exclusively driven by de-leverage as no information on dividends or equity injections is available.

Table 36: Financial Information MWM GmbH – FY06/07 to FY09/10

The table presents the profit and loss statement of MWM GmbH for three financial years from FY07/08 to FY09/10 retrieved from the German Federal Gazette. Please note that FY07/08 only represents a short financial year from August 2007 to June 2008, while the two remaining business years are from July to June. Hence, for CAGR calculation purposes the 11 months figures for the period FY07/08 were annualised by dividing by 11 and multiplying with 12. Please note further that employees represent average employees for the full financial year. FY06/07 was derived indicatively for valuation purposes only, as discussed before.

€ in millions	FY 2006/07	FY 2007/08	FY 2008/09	FY 2009/10	CAGR 07/08 - 09/10
Sales	**276.13**	**214.16**	**291.26**	**284.36**	**10.3%**
Change in inventory & capitalised expenses		-9.00	-8.59	2.47	n.m.
Material expenses		-122.07	-168.59	-165.40	11.4%
Gross profit		**83.09**	**114.08**	**121.44**	**15.7%**
Gross margin		*38.8%*	*39.2%*	*42.7%*	
Personal expenses		-41.35	-57.75	-56.19	11.6%
Other operating expenses		-32.41	-49.34	-37.99	3.7%
Other operating income		1.99	8.39	5.37	57.3%
EBITDA	**18.09**	**11.32**	**15.39**	**32.63**	**62.5%**
EBITDA margin	*6.5%*	*5.3%*	*5.3%*	*11.5%*	
Depreciation and Amortisation	-5.55	-17.56	-18.35	-16.14	-8.2%
EBIT	**12.53**	**-6.24**	**-2.96**	**16.49**	**n.m.**
EBIT margin	*4.5%*	*-2.9%*	*-1.0%*	*5.8%*	
Finanial result		-10.22	-11.54	-12.58	6.2%
EBT		**-16.45**	**-14.50**	**3.91**	**n.m.**
EBT margin		*-7.7%*	*-5.0%*	*1.4%*	
Taxes		-0.04	4.86	-0.08	32.1%
Net income		**-16.50**	**-9.64**	**3.83**	**n.m.**
Average employees (full year)		808	880	886	4.7%
Sales per employee (in €k)		265	331	321	10.0%

The results obtained on value creation drivers of the Deutz Power System buyout are generally in line with the results obtained in the first essay of the thesis. First, leverage does not represent the most significant value driver as it only contributes one quarter, which is below the mean leverage contribution of one-third for the entire buyout sample as discussed in

the first research essay. According to Wirtz (2013), and as also indicated by the relatively low EBIT margin at entry of 4.5%, as shown in Table 36, "following the carve-out the new company was not even able to obtain higher levels of debt". Second, operational drivers are the most significant drivers. In this example especially margin improvements contribute the most (79%) to the total value generated. The latter is in line with the findings obtained in the second essay of the thesis; changes in EBITDA margin are the most significant driver of unlevered returns and abnormal performance.

As analysed in the third essay of the thesis it is of key interest what exactly is driving EBITDA margin. To further examine on this topic Table 36 presents the profit and loss statements of MWM for three financial years, covering the holding period and ownership under 3i. Available figures for FY06/07 represent those financials relevant for valuation purposes at entry. First of all, one can see that the global financial crisis also affected MWM, which translates into a sales decrease of ca. 15% between FY06/07 to FY07/08. However, the company managed to increase sales back to pre-crisis levels in FY09/10, which is represented by a CAGR of ca. 10%. According to Wirtz (2013) several factors and initiatives contributed to the recovery of the top-line, being (1) "the access of new markets, mainly in Central Eastern Europe and China"; (2) "the reorganisation of the distribution structure", and (3) "the expansion in two client segments: company power plants and public utility companies".

In terms of margin improvements the company introduced several programs to improve its efficiency such as lean management and process optimisations. This is mainly emphasised by a 4ppts increase in gross margin over the holding period and a reduction in other operating expenses as a percentage of sales. In line with these initiatives additional employees were hired as presented in Table 36. During 3i's ownership the number of employees increased by 76 which is equal to a CAGR of 4.7%. Further, the various initiatives led to an increased output, comparing the ratios of sales per employee between entry and exit shows an increase from €265k in FY07/08 to €321k in FY09/10. Overall these measures led to a significant increase in absolute EBITDA and profitability.

Further qualitative factors additionally contributed to the success of the buyout, being "the replacement of top management", "the rebranding to MWM, which created a new identity and motivated employees", "an open communication as well as the inclusion of the works council and the union in the decision making process" (Wirtz, 2013).

The case is a good example of private equity investors being able to generate growth through optimised efficiency and increased sales, but at the same time being able to create additional employment and earn a good return on their equity investment at a modest level of leverage at entry. In the underlying example this is especially remarkable as the investment was negatively impacted by the global crisis just after the entry of the equity sponsor, who paid a very high multiple at entry.

10 Conclusion, Future Research and Outlook

The first sub-section of the conclusion, divided into four parts, provides a detailed summary of the individual results obtained by means of the research questions and hypotheses formulated at the beginning of the thesis, which were allocated to the three research essays. The last part of the first sub-section provides an integrated summary of all results obtained and aims at summarising the results in a nutshell. The second sub-section addresses areas of future research and studies to be conducted in connection with private equity activity in the German-speaking region. A third and final sub-section discusses the status quo of private equity activity in this region and provides a brief outlook.

10.1 Summary of Results

10.1.1 Value Drivers in Buyout Transactions

The first research essay "Corporate Raiders at the Gates of Germany? Value Drivers in Buyout Transactions" addressed two research questions. Firstly, "what are the most relevant deal level drivers of the value generated in private equity buyout transactions in the German-speaking region?" and secondly, **"**is there an abnormal financial and/ or operational performance of private equity buyout transactions compared to public benchmark companies in the German-speaking region? Further, do value drivers change and abnormal performance levels differ when analysing buyouts pre vs. post the financial crisis and by type of exit channel chosen?". In addition, the analyses conducted on value creation drivers was performed from various perspectives, as for example the type of exit channel or by taking a time-differentiated perspective as a result of the most recent global financial crisis. The two leading research questions were broken down into nine hypotheses; the corresponding results are as follows:

Hypothesis 1.1*: Operational improvements contribute significantly more to the overall buyout value generated than financial engineering efforts.*

Measured in times money points, the results revealed that for the underlying sample of 123 leveraged buyout transactions, initiated between 1995 and 2008, only one-third of total value generated relates to the leverage effect, and hence financial engineering efforts, while two-thirds relate to operational and market-driven factors. The latter relates to the multiple

expansion effects, which is not purely operational in nature. Regardless of the latter this hypothesis can be confirmed accordingly.

***Hypothesis 1.2**: EBITDA growth over the holding period does not solely stem from margin improvements.*

On a stand-alone basis the results show that EBITDA growth contributes 21% to the total levered times money multiple and thus to total value generated. Further breaking down EBITDA growth into its components shows that 51% and 49% stem from sales growth and margin improvements (including the combination effect), respectively. Thus, as being almost equally weighted with sales growth, margin improvements are an important factor, but not the only component driving EBITDA over the holding period. As such the hypothesis can be confirmed.

***Hypothesis 1.3**: Given the private equity business model de-leverage is a main driver of value creation.*

One additional value driver is the free-cash-flow effect, which was derived by including dividend payments, subtracting equity injections and adding the change in net debt between entry and exit. The latter component represents de-leverage and accounts for the majority of the entire FCF effect. Overall the FCF effect contributed one quarter to total value generated. Following the leverage effect the FCF effect is the second most important value driver. Accordingly, and inherent to the LBO business model, de-leverage is an important value driver and the hypothesis is confirmed.

***Hypothesis 1.4**: On a relative basis, operational improvements contribute significantly less to the overall value generated in buyout transactions compared to benchmark companies.*

When assessing the contribution of buyout value drivers in comparison to an applicable benchmark (nearest neighbour) sample the results show that operational drivers contribute 67% and 84% to total buyout and benchmark levered times money multiples, respectively. Accordingly the hypothesis is confirmed, however, the lower relative contribution for the buyout sample simply stems from the fact that the contribution of leverage is more strongly pronounced in leveraged buyouts, which is inherent to the business model. Leaving the relative perspective and switching to abnormal performance measures, based on IRRs, the buyout sample outperforms the benchmark sample by 5.7% and 12.5% on median unlevered and levered IRR, respectively.

Hypothesis 1.5*: Buyout returns are significantly lower post (during) than prior to the financial crisis, but abnormal operational performance is expected to be higher.*

This hypothesis is confirmed as the results obtained show that the median levered IRRs trade at 33.9% and 23.4% before and after the crisis, respectively. In light of unlevered IRR 21.4% are obtained for the pre-crisis sub-sample, while post-crisis buyouts show 16.9%. Interestingly enough, the median abnormal performance measures trade higher post 2008 as compared to the pre-crisis period, which is believed to be mainly result from the collapse of equity markets following the crisis. The results show a median operational alpha of only 2.7ppts for the pre-crisis period, which increases to 9.8ppts post 2008.

Hypothesis 1.6*: The relative contribution of leverage and de-leveraging efforts to overall value is smaller post (during) than prior to the financial crisis.*

Analysing the aggregate mean contribution shows that 64% of total pre-crisis value generated relates to the leverage effect (37%) and the free cash flow effect (26%), while this percentage decreases to 43% after the crisis, being split into 21% leverage and 22% free cash flow effect. Thus, the hypothesis can be confirmed. It is believed that this is driven by two factors (1) management and the GP put more emphasis on operational improvements post- as compared to the pre-crisis period, and (2) in addition to a dilution effect following the latter, excess cash for additional de-leverage was not available to the extent before the crisis.

Hypothesis 1.7*: Buyout returns vary significantly depending on the exit channel, with the assumption that IPOs perform better than trade sales or secondary buyouts.*

In terms of IRRs the results reveal no significant differences between the types of exit channel chosen by the GP. Trade sales, financial sales and IPOs show a median unlevered IRR of 18.9%, 19.3% and 21.4%, respectively. However, when defining returns as the times money multiple, which in contrast to IRR does not account for the time-value of money, we find a significant higher mean multiple for the IPO exit route of 8.0x, which compares to 4.4x and 2.5x for financial and trade sales, respectively. As such, depending on the selected return measure, the underlying hypothesis can only be confirmed partially.

Hypothesis 1.8*: If, upon exit, a portfolio company is sold to another financial investor (secondary buyout), leverage is expected to contribute significantly more to overall value compared to other exit channels.*

This hypothesis can be confirmed. The relative median contribution of the leverage effect to total value generated is significantly higher, at the 10% level, for financial sales compared to the remaining exit routes. In addition the debt-to-equity ratio at entry is also higher for financial sales compared to other exit types. It is argued that private equity investors, as a buyer, are not biased towards higher levels of leverage at exit, which, in case the type of buyer is already known, reduces the de-leveraging efforts of the owner during the holding period. Interestingly, on mean level, the leverage effect contributes only one quarter in the case of an IPO, but the free cash flow effect some 50%. It is concluded that this might stem from additional de-leveraging efforts prior to the public offering.

***Hypothesis 1.9**: If a portfolio company is sold to a strategic investor (trade sale) multiple expansion is expected to contribute significantly more to overall value compared to other exit*

In light of relative mean EV/EBITDA contributions, including the combination effect between EBITDA and EV/EBITDA, this hypothesis can be confirmed. While for financial sales and IPO the mean contributions amounts to 17% and 5%, respectively, this ratio trades at 28% for trade sales. It is concluded that strategic investors are willing to pay higher multiples as a result of anticipated synergies. Hence, this hypothesis can be confirmed.

The main results obtained in the underlying research essay, representing one of the first studies of buyout transactions in the German-speaking private equity market, which also covers the more recent wave of buyout transactions, are manifold: (1) it is found that buyout transactions outperformed the public equity market by ca. 12.5ppts and 5.7ppts with regard to levered and unlevered returns, respectively, between 1995 and 2010; (2) even though the absolute return level of buyouts decreased post 2008 the outperformance increased, which is believed to be mainly driven by the collapse of equity markets, and (3) one-third of value creation is dedicated to financial engineering efforts, while ca. 50% stem from operational factors and ca. 18% from multiple expansion.

The results are broadly in line with the findings of Puche and Braun (2014) and Achleitner et al. (2010), who find a relative contribution of leverage of 30% and 32%, respectively. In light of relative operational contribution Puche and Braun (2014) obtain 50% as in the underlying sample, while Achleitner et al. (2010) find 46%. It can be concluded that the composition of value drivers in the German-speaking region is similar to the one of these European studies. However, financial engineering has a slightly higher impact in the German-speaking

region, which is underpinned by a higher ratio (one-third) per se, but also by a higher contribution of the free cash flow effect. For the latter Puche and Braun (2014) and Achleitner et al. (2010) find 13% and 15%, respectively, which compares to 25% in the underlying sample. What is more, in line with the latter, the seminal proposition of Jensen (1989), management has no incentive to generate any excess cash beyond the dividend demands of the companies' shareholders, can be confirmed, as we find a negligible free cash flow effect for the public benchmark sample.

The results show, that private equity sponsored leveraged buyout transactions in the German-speaking region generate value, which do not solely stem from financial engineering efforts, and do outperform the public equity market, which is regarded as the next best alternative to invest in.

10.1.2 Determinants of Abnormal Performance and Unlevered Returns

Based on the univariate results obtained in the first essay, the second paper was dedicated to further analyse drivers of abnormal performance and unlevered returns in a multivariate setting. This second research essay "Buyout Transactions in the German-speaking Region: Determinants of Abnormal Performance and Unlevered Returns" addressed three research questions. Firstly, "what are determinants of abnormal operational deal performance and unlevered returns in leveraged buyout transactions in the German-speaking region?". Secondly, "is the impact of private equity performance drivers in the German-speaking region different under various business models, defined as (1) organic vs. inorganic growth strategies and (2) small vs. larger cap private equity investors?" and thirdly, "does the impact of private equity performance drivers in the German-speaking region differ between deals exited pre and post the global financial crisis of 2008?". As discussed in detail in this second paper, as well as in the introduction of the thesis, the nearest neighbour benchmark sample was applied for regression purposes. However, please additionally refer to Appendix 8 presenting the regression results when applying the industry portfolio benchmark sample.[58] The research questions highlighted above were broken down into nine hypotheses; the corresponding results are as follows:

[58] The results differ as the nearest neighbour benchmark sample is performing significantly better than the industry portfolio benchmark sample. However, even if applying the industry benchmark sample, EBITDA margin is the most important determinant in explaining operational alpha and unlevered IRR.

In addition please refer to Appendices 3 to 7, which present the detailed, formula-based, regression setup applied in this research paper.

Hypothesis 2.1*: The differences between deal and benchmark annualised growth rates for sales, EBITDA/sales and EV/EBITDA multiple are significant determinants of operational abnormal performance (operational alpha).*

The OLS regressions conducted with operational alpha as the independent variable and the annualised growth rates, differences between buyout and benchmark companies, for sales, EBITDA margin and EV/EBITDA as the main independent variables, revealed that all three variables are significant determinants in explaining the operational abnormal performance. However, the annualised sales growth is only significant at the 10% level, while the other two variables are highly significant at the 1% level. It is to be noted that the annualised sales growth only turned to be a significant determinant once it is controlled for the buyout's holding period as well as entry year fixed effects. Even though different significant levels were found, the hypothesis can be fully confirmed.

Hypothesis 2.2*: The differences between deal and benchmark annualised growth rates for sales, EBITDA/sales and EV/EBITDA multiple are significant determinants of the unlevered buyout IRR.*

In order to analyse this hypothesis, the same regression setup was applied as for the determinants of operational alpha. The results obtained, however, are different. It was found that the annualised sales growth, regardless of what additional variables are included for controlling purposes, has no significant impact in explaining the unlevered IRR. EV/EBITDA annualised multiple growth, of the buyout over the benchmark company, is a statistically significant determinant in explaining unlevered buyout returns, at least at the 5% level. The annualised EBITDA margin growth rate was found to be a highly significant driver of unlevered IRR at the 1% level. The hypothesis can only be partially confirmed as the annualised sales growth is not found to have a significant impact.

Hypothesis 2.3*: For buyouts conducting a buy-and-build growth strategy annualised benchmark-adjusted sales growth is not a significant determinant of abnormal performance and unlevered returns as additional sales do not necessarily result in higher returns and a higher operational alpha.*

As already pointed out by Acharya et al. (2013, p. 391), M&A activity during the holding period leads to an error term as the add-on companies distort the overall picture. Accordingly, the results obtained show that annualised sales growth is not a significant determinant, of neither operational alpha nor unlevered IRR. When running the interaction OLS regression the

sales growth interaction term is highly significant, this indicates that the two private equity business models (organic vs. inorganic) are different with regard to annualised sales growth as a determinant in explaining abnormal performance and buyout returns. Thus, the hypothesis can be confirmed.

Hypothesis 2.4: *For buyouts pursuing an organic growth strategy the differences between deal and benchmark annualised growth rates for sales, EBITDA/sales and EV/EBITDA multiple are significant determinants of operational alpha and unlevered buyout IRR.*

All three main independent variables are statistically significant in explaining operational alpha and unlevered IRR for buyouts pursuing an organic growth strategy, at least at the 5% level. Given the results discussed for hypothesis 2.3 this is not surprising. Again, even though the significance levels are varying, the hypothesis can be confirmed.

Hypothesis 2.5: *Buyout transactions pursuing a buy-and-build strategy show lower operational alphas and unlevered returns compared to buyout transactions growing organically when the benchmark company is clearly outperformed in regard of annualised sales, EBITDA/sales, and EV/EBITDA multiple growth.*

Assuming a simultaneous outperformance, of the buyout company over its corresponding nearest neighbour, for the three main independent variables, it is found that deals pursuing a buy-and-build strategy are expected to show lower levels of abnormal performance and unlevered returns. It is concluded that these results appear reasonable as a portfolio company that has to manage the market growth on the one hand and integrate the add-on company (companies) on the other hand is exposed to limited resources, which ultimately can result in lower returns. At a simultaneous outperformance of 10ppts above its peer an inorganic buyout, compared to an organic deal, is expected to show a 5.5ppts and a 1.8ppts lower operational alpha and unlevered IRR, respectively. Hence, this hypothesis can be confirmed.

Hypothesis 2.6*: Regardless of transaction size, the differences between deal and benchmark annualised growth rates for sales, EBITDA/sales and EV/EBITDA multiple are significant determinants of operational alpha and unlevered buyout IRR.*

When it comes to the determinants of operational alpha the hypothesis can be confirmed as all three variables are highly significant regardless of transaction size. However, sales growth is economically more important for smaller transactions and EBITDA margin growth for larger ones. In light of unlevered returns, annualised sales growth has no significant im-

pact, while EBITDA margin and EV/EBITDA multiple growth have a modest (10% level) impact for smaller transactions. For larger transactions these two independent variables are significant at the 1% and 5% level, respectively. Even though individually statistically significant, at different significance levels, under both business models, in explaining operational alpha and unlevered IRR, the results reveal that the EBITDA margin interaction term is significant, at the 10% level. The results imply that annualised EBITDA margin is more important when it comes to larger deals. From the above it is to be concluded that the hypothesis can only get partially confirmed.

Hypothesis 2.7*: Larger buyout transactions show higher (lower) levels of abnormal performance and unlevered returns compared to smaller buyouts when the benchmark company is clearly outperformed (underperformed) in regard of annualised sales, EBITDA/sales, and EV/EBITDA multiple growth.*

When comparing a smaller and a larger buyout, in terms of operational alpha and unlevered IRR, by assuming a 10ppts outperformance over the corresponding neighbour, simultaneously for all three main independent variables, the larger buyout is expected to show a 6.4ppts and 3.1ppts higher operational alpha and unlevered IRR, respectively. Accordingly, a simultaneous underperformance is expected to yield a lower operational alpha and unlevered return for larger transactions. The results obtained appear reasonable as larger companies are expected to achieve economies of scale more easily when the market (neighbour) is highly outperformed. In contrast, in times of market (neighbour) underperformance smaller companies are expected to be able to react more quickly, compared to larger companies, given their lower fixed cost burden. Hence, the hypothesis can get confirmed.

Hypothesis 2.8*: For buyout transactions exited during or post the financial crisis of 2008 EBITDA/sales growth is a significantly higher pronounced driver of operational alpha and unlevered returns compared to buyouts exited prior to the crisis.*

Reviewing the significance levels of the interaction terms reveals that there are no significant differences with regard to the impact of EBITDA margin in explaining operational alpha or unlevered IRR. However, while EBITDA margin is a highly significant (1% level) determinant in explaining operational alpha, for the pre- and the post-crisis sub-samples, economically it has become important more recently. In light of unlevered IRR, EBITDA margin is only significant at the 10% level for the pre-crisis period, but at the 1% level for deals exited post or during the financial crisis. It is believed that this is driven by higher post-crisis opera-

tional improvements at the portfolio companies as a reaction to the negative effects associated with the crisis, e.g. a top-line decrease. Hence, the hypothesis can be confirmed accordingly.

> ***Hypothesis 2.9****: EV/EBITDA multiple growth as a determinant for operational alpha and unlevered IRR is less significantly pronounced for deals exited during or post the financial crisis compared to buyout transactions exited before the crisis.*

Again, the significance levels of the EV/EBITDA interaction terms do not indicate that different models have to be applied before and after the crisis. However, the annualised multiple growth is a highly significant (1% level) determinant of operational alpha up to 2008, while it is only significant at the 10% level for the post-crisis period. In light of unlevered IRR, multiple growth is significant at the 10% level up to 2008 and is not regarded as a significant determinant after 2008. The results obtained appear reasonable as one would expect to find lower multiples paid following the economic downturn. Therefore the hypothesis can be confirmed.

Overall, the results obtained in the second research essay are in line with those of Acharya et al. (2013), who also find, for their European sub-sample of 234 deals, EBITDA margin and EV/EBITDA multiple to be the most important and significant determinants of abnormal performance and IRR (p. 389f.). As in the underlying results the authors find that sales growth is not a significant determinant in explaining abnormal performance and IRR for inorganic deals, while this variable is significant for organic buyouts. In analysing the determinants of equity IRR, for a sub-sample of 603 global buyout transactions, Achleitner et al. (2011) find the buyout's change in sales, EBITDA margin and multiple between entry and exit to be highly significant determinants (p. 156).

10.1.3 Impact of Leveraged Buyouts on Stakeholders

Motivated by the results obtained in the first two essays, it was the goal of the third and last essay to shed more light on how various stakeholders are actually affected by leveraged buyouts and, especially, whether EBITDA margin improvements, as the most important performance determinant in buyout transactions, are on the expenses of employees. Accordingly, this third research essay "Leveraged Buyout Transactions in the German-speaking Region – A Stakeholder Perspective" addressed two research questions. Firstly, "how do changes in operational performance of the buyout company compare to those of applicable benchmark companies and what are relative contributions in terms of levered buyout returns?" and secondly,

"what is the effect of leveraged buyout transactions in the German-speaking region on the main stakeholders involved, other than the private equity sponsor?". In addition the paper provided a decomposition of levered IRR, by applying applicable benchmark figures, and presented a correlation matrix of relevant return measures. The two research questions were broken down into eight hypotheses; the corresponding results are as follows:

***Hypothesis 3.1**: In decomposing the levered buyout IRR the underlying benchmark leverage contributes less than the buyout leverage to the overall levered buyout return.*

In line with the findings obtained in the first paper, i.e. the leverage effect as a value driver in the benchmark sample only contributed 16% to overall value vs. one-third in the buyout sample, it is found that the base benchmark leverage only contributes 3% to the levered buyout IRR. This result appears meaningful as leverage only plays a minor and non-significant role when it comes to return drivers of public listed entities. Therefore this hypothesis can be confirmed, accordingly.

***Hypothesis 3.2**: In decomposing the levered buyout IRR operational effects contribute more to the overall levered buyout return than leverage effects in aggregate.*

Overall it was found that 65% and 35% of levered IRR are driven by operational and financial effects, respectively. With 58% the majority of the operational effects are attributable to the base operational performance, i.e. the benchmark sample, while 42% are attributable to the excess operational performance, operational alpha, of the buyout transactions. In other terms, 27% of total levered buyout IRR is driven by the deal's operational abnormal performance over its peer company. Hence, the hypothesis can be confirmed.

***Hypothesis 3.3**: The annualised buyout sales growth is significantly higher than the applicable benchmark growth.*

For the 124 buyout transactions and their corresponding nearest neighbour companies a mean (median) annualised sales growth of 6.1% (3.8%) and 12.5% (6.6%) was obtained, respectively. Hence, on mean and median level, the peer companies show a 6.4ppts and 2.8ppts higher annualised sales growth over the holding period, with the differences being significant at the 5% level. Consequently, the hypothesis is to be fully rejected.

***Hypothesis 3.4**: The annualised buyout EBITDA/sales growth is significantly higher than the applicable benchmark growth.*

In contrast to the annualised sales growth, the mean (median) annualised EBITDA margin growth for the 124 buyout transactions and their peers trades at 4.8% (3.5%) and 2.9% (1.3%), respectively. Thus, the buyout companies outperformed the peer companies by 1.9ppts and 2.2ppts on mean and median level, respectively. While the median difference is highly significant at the 1% level, the mean difference is insignificant. This result is generally in line with the findings obtained in the second paper, having identified EBITDA margin growth over the benchmark sample as the most important determinant of buyout returns and abnormal performance. The hypothesis can be confirmed accordingly.

Hypothesis 3.5*: The annualised buyout EV/EBITDA multiple growth is significantly higher than the applicable benchmark growth.*

The mean (median) buyout and benchmark annualised EV/EBITDA multiple growth trades at 12.8% (6.4%) and 9.3% (4.0%), respectively. Accordingly the private equity portfolio companies outperformed the benchmark companies by 3.5ppts (2.4ppts), this difference, however, is statistically insignificant, neither on mean nor on median level. Hence, the hypothesis is to be rejected. However, regardless of the significant levels the results indicate that private equity investors are in the position to realise a higher multiple growth compared to public companies.

Hypothesis 3.6*: The personnel expense development of private equity portfolio companies between entry and exit is not a significant driver of EBITDA/sales improvements. Consequently there is no indication for significant headcount reductions following private equity ownership.*

Based on the results obtained, by means of two sub-samples comprising 22 and 30 deals, respectively, this hypothesis is to be confirmed. For both sub-samples the median increase in absolute personnel expenses between entry and exit is highly significant, while the increase for the neighbour companies is only significant, at the 5% level, for one sub-sample. Further, the mean increase in the ratio of buyout personnel expenses to sales is significant (5% level) for one sub-sample. Opposed to the prevailing opinion, the results serve as an indication that a reduction in personnel expenses, and consequently headcount, are not driving EBITDA margin and that potential improvement initiatives, including headcount reduction, do not boost margin. It is concluded that rather economies of scale and other operating improvement initiatives, including the identification of low hanging fruits, are driving margin improvements.

Hypothesis 3.7*: Inherent to the leverage buyout business model interest expenses show a significant increase between entry and exit.*

For two sub-samples, comprising 20 and 30 buyout transactions, the increase in interest expenses, on mean and median level, is highly significant, which is not observed for the neighbour companies. These results, however, are not surprising and inherent to the LBO business model. Therefore, the hypothesis can be confirmed. More interestingly is the question whether the higher interest burden leads to a lower pre-tax profit and consequently lower tax expenses.

Hypothesis 3.8*: Tax expenses will decrease significantly between entry and exit as a result of tax-optimisation and tax-structuring efforts undertaken by the GP.*

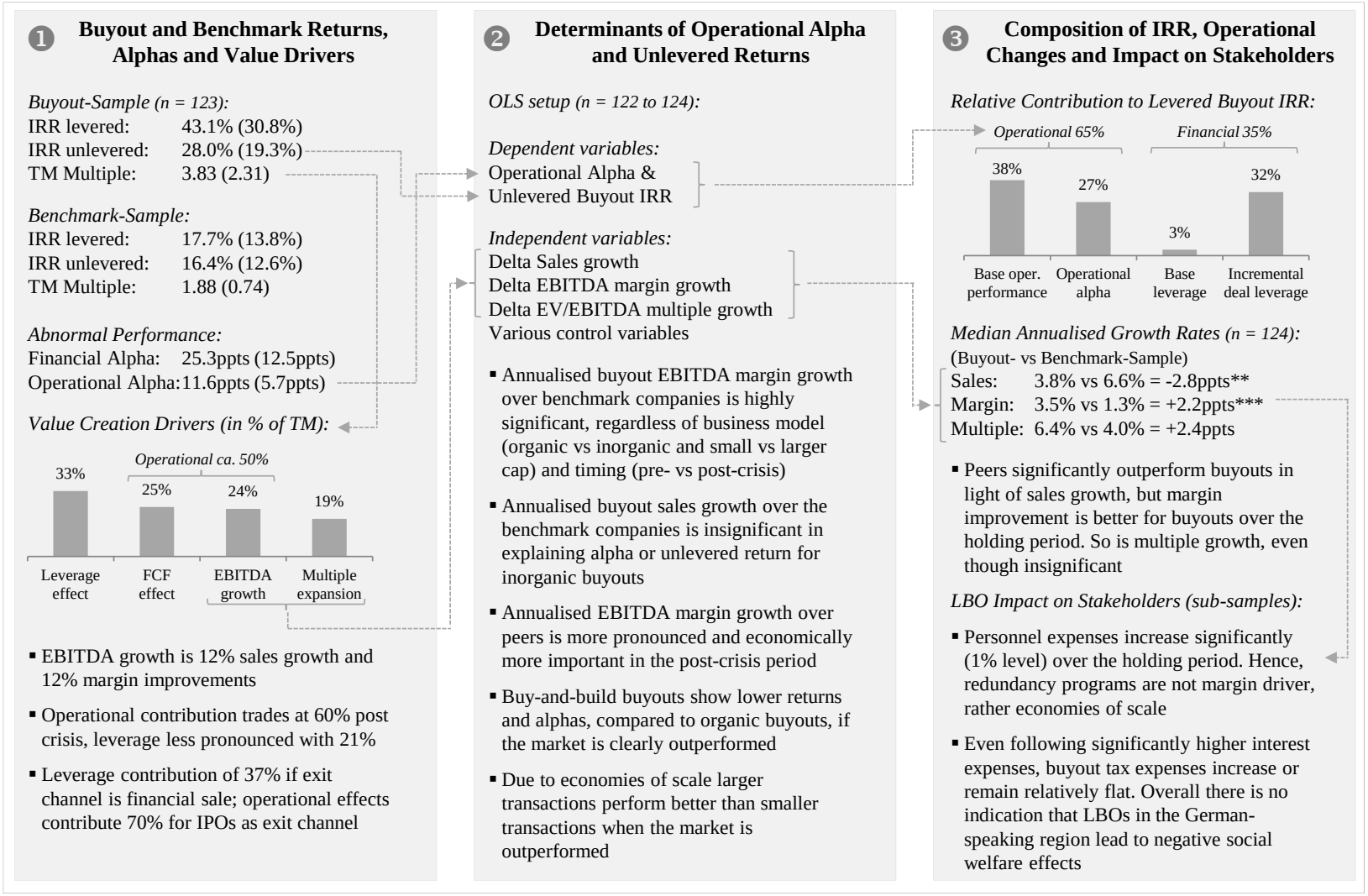
For two sub-samples, comprising 21 and 28 buyout transactions, different results are obtained. The first sub-sample shows a significant, at the 5% (mean) and 10% (median) level, increase in tax expenses, while the second sub-sample shows an insignificant decrease. Opposed to private equity's reputation of tax-structuring efforts at acquisition this hypothesis is to be rejected.

The results obtained in the third paper are in line with the findings of Smith (1990), Kaplan (1989) or Jensen et al. (1989), who either find no negative impact on employees, as one of the most important stakeholder groups, or find no decrease in tax expenses. Therefore, it is argued, on the basis of the results obtained from the various sub-samples, that there is no indication that private equity activity in the German-speaking region leads to negative social welfare effects.

10.1.4 Overall Summary and Conclusion

The underlying thesis, mainly represented by the three research essays, made an essential contribution to private equity research by applying a novel and proprietary dataset of 124 leveraged buyout transaction carried out in the German-speaking region between 1995 and 2010. The academic contribution is regarded substantial as private equity activity in German-speaking countries has not been subject to academic research in this level of detail before. Particularly considering that economically private equity owned companies represent a considerable part in this region. The thesis contributed by analysing and discussing the individual value drivers of LBO transactions, the determinants of abnormal performance and unlevered returns as well as the impact of private equity sponsored LBOs on various stakeholders.

Figure 16: Summary of Results



Source: Own illustration

The individual results of the three research essays were discussed in detail in the preceding sub-sections by means of the individual hypotheses. Figure 16 makes an attempt to summarise the most relevant results obtained in a nutshell and to show the connections between the three research papers.

The first paper started with the discussion of the relevant return measures of the buyout sample as well as those of the most appropriate benchmark sample, the nearest neighbour benchmark sample. It was found that leveraged buyout transactions outperformed the market, surrogated by nearest neighbour companies, by ca. 12ppts (6ppts) on an unlevered basis on mean (median) level. Unlevered returns were applied for such comparative purposes as they represent a like-for-like measure, which disregards the noise and risk resulting from financial engineering efforts undertaken by the private equity sponsor. Not accounting for the time value of money, a levered mean (median) times money multiple of 3.8 (2.3) was derived. In a second step this levered multiple was segregated into its individual value drivers by applying the comprehensive value creation framework as suggested by Achleitner et al. (2010).

As shown in Figure 16 it was found that leverage contributes one third to overall value, while the free cash flow effect, in addition to dividends received and equity contributions made over the holding period mainly driven by de-leverage, contributes one quarter, EBITDA growth 24% and multiple expansion 19%, including the combination effect between EBITDA growth and multiple expansion. Further the 24% EBITDA growth can be broken down into 12% sales growth and 12% margin improvements (including mix effects), respectively. These value drivers were compared to the benchmark sample, which revealed that leverage does not represent a major value driver for public companies. Overall it was concluded that the majority (two thirds) of value generated in buyout transactions relates to operational and market effects.

In a next step the value creation methodology was applied by analysing differences depending on the exit channel chosen by the GP and by differentiating between the pre- and post-crisis period. Major results obtained are that leverage shows the highest (37%) relative contribution when the portfolio company is sold to another PE investor (financial sale) and the highest (70%) contribution of operational factors when a public offering is initiated by the GP. Further, it was found that the value contribution of leverage with 21% is less pronounced after the crisis as the operational focus increased. Having identified operational factors to be the main value driver it was of interest, in the second paper, to analyse determinants of ab-

normal operational performance, referred to as operational alpha, and unlevered returns in a multivariate setting.

The three main independent variables identified to explain these two performance measures were annualised sales, EBITDA margin and EV/EBITDA multiple growth, i.e. the respective annualised growth rate of the buyout company over the holding period less the annualised growth rate of the corresponding nearest neighbour company. Additional control variables included leverage at entry, deal size, holding period, entry year fixed effects and industry dummies. In both OLS regression models, for operational alpha and unlevered IRR, the annualised EBITDA margin growth was found to be the most significant driver, followed by the EV/EBITDA multiple growth and sales growth. Annualised sales growth, however, was not found to be a significant determinant of unlevered buyout returns.

What is more, by including interaction variables the regression setup distinguished between organic and inorganic buyouts, as a distinct PE business model. It was found that sales growth is not a significant determinant, of operational alpha and unlevered returns, for buyouts pursuing a buy-and-build strategy, while it is highly significant for organic buyouts. Again, EBITDA margin growth is the most significant determinant. In light of a sensitivity analysis conducted it was concluded that organic buyouts are expected to perform better than inorganic buyouts when the nearest neighbour company is clearly outperformed in terms of sales, margin and multiple growth over the holding period. This appears reasonable as the company has to manage the general external growth and, at the same time, integrate the acquired add-on companies, which obviously requires a lot of resource. The results suggest that, in regard of unlevered IRR, a GP would be indifferent to pursuing a buy-and-build strategy if the simultaneous outperformance of the buyout over the neighbour company trades at 7.8ppts.

Another GP business model, which was subject to analysis, was the differentiation between small and larger cap transactions, defined by means of the median enterprise value at entry of €122m. In light of operational alpha, as the dependent variable, it was found that sales growth is economically more important for smaller transactions, while margin growth is more important for larger transactions. The latter finding also applies to unlevered returns. It was concluded that, in times of market outperformance, i.e. when the buyout clearly outperforms the benchmark company, a larger transaction is expected to generate a higher abnormal performance and higher unlevered returns. In times of market underperformance, smaller transactions are expected to perform better. This appears reasonable as smaller companies are able to react more quickly to a declining demand given their lower burden of fixed expenses.

Finally, the same regression setup was performed by taking a time-differentiated perspective, being the pre- and post-crisis period. The major finding, which is in line with the findings obtained in the first research essay, is that the buyout annualised EBITDA margin growth over the benchmark company is economically more important in the post-crisis period.

Based on the findings obtained in the previous two research essays, the third research essay was mainly dedicated to the analysis of changes in various operational figures between entry and exit. In addition to sales and EBITDA margin this analysis also comprised personnel expenses, interest expenses and tax expenses. However, due to several data constraints, the latter three expense positions were only analysed for certain sub-samples. In addition the levered buyout IRR was decomposed into meaningful elements by applying the nearest neighbour benchmark sample.

As presented in Figure 16 it was found that operational effects contribute 65% to levered IRR, while 35% are driven by financial factors. This basically reflects the results obtained in light of the value driver analysis, by means of the levered times money multiple, conducted in the first paper. The operational effects mainly stem from the base benchmark (nearest neighbour) performance of 38%, while the operational abnormal performance is contributing 27%. In terms of leverage (financial effects) only 3% of levered IRR contribution stem from the benchmark leverage, while 32% are explained by incremental buyout leverage. The latter emphasises the differences in the role of leverage between public companies and buyout transactions.

Comparing the annualised growth rates between the buyout and the nearest neighbour sample revealed that the benchmark sample's sales growth is trading 2.8ppts higher compared to the buyout sample, being significant at the 5% level. However, in light of EBITDA margin growth the buyout companies significantly (1% level) outperformed their peer companies by 2.2ppts. For the EV/EBITDA multiple growth buyouts also traded 2.4ppts above their peers, this difference was not found to be significant. Generally this finding is in line with Jensen's (1989) argumentation, who argues that the management of buyout companies (compared to publicly listed companies) is incentivised and required to generate high EBITDA margins in order to serve the high levels of debt. Additionally, this univariate analysis reflects the OLS results obtained in the second paper.

The paper continued by analysing the impact of leveraged buyout transactions on various stakeholders, being employees, lenders (banks) and the government, represented by the tax

authorities. Especially the first stakeholder group was of interest as (1) reduction of employees could be one driver of an improved EBITDA margin at exit, and (2) in the German-speaking region private equity investors have the negative reputation of initiating restructuring programs that ultimately affect this stakeholder group.

For two sub-samples changes in buyout and benchmark personnel expenses were calculated, as well as changes in the personnel expense to sales ratio. It was found that personnel expenses increased significantly, at the 1% level, over the holding period. So did the personnel expenses to sales ratio (5% level). Hence, the results indicate that there is no evidence that lower personnel expenses, following restructuring efforts, lead to an increase in EBITDA margins. Rather the results suggest that operating efficiency programs and economies of scales are driving EBITDA margin improvements.

Finally, in regard of the remaining two stakeholder groups, it was found that interest expenses increase significantly over the holding period, which is inherent to the LBO business model. Surprisingly, such higher interest expenses, which consequently lead to lower pre-tax profits, did not result in lower tax expenses. On the contrary, for one sub-sample tax expenses even increased significantly at the 10% level. Overall it was concluded that the results obtained serve as an indication that LBOs in the German-speaking region do not bring negative social welfare effects.

10.2 Areas of Future Research

In general being chronically under-researched, this thesis made a first contribution to private equity research in German-speaking countries as a distinct economic region. The author is aware of the fact that private research in this region is still in its infancy and that there is a long way to go with regard to further research to be conducted. In light of such further studies it should be the goal to collect additional buyout data and to refine the results obtained throughout the thesis in light of value creation drivers, determinants of performance and the impact of buyouts on various stakeholder groups.

As highlighted, at various points throughout the underlying thesis, it is recommended that future areas of research on the deal level should be dedicated to the following: (1) a detailed analysis of multiple expansion drivers, which distinguishes between underlying market effects, by means of private (not public) transactions, and other factors, such as the negotiation skills of private equity sponsors, in order to differentiate between an exogenous expan-

sion component and the GPs negotiation power; (2) differences in buyout performance, when differentiating between small and larger cap transactions, while both are pursuing a buy-and-build growth strategy; (3) the impact of soft skills of private equity managers on buyout performance in the German-speaking region, i.e. are ex-consultants able to generate higher buyout returns compared to ex-bankers or is the right team-mix a crucial factor to the overall LBO performance?; (4) what are the relevant, and statistically significant, determinants of leverage and pricing at entry, this type of analysis is recommended to be conducted in connection with some of the preceding points, i.e. are different backgrounds of PE manager's relevant in explaining the leverage level at entry?; (5) in light of EBITDA margin improvements during ownership, what is the contribution of operating efficiency initiatives on plant level?, or (6) does the degree of innovation change under private equity ownership?

As discussed in the beginning of the thesis, there are broadly two research streams when it comes to private equity research, the deal and the fund level stream. While the underlying thesis contributed to the first research stream, it would be of particular interest to analyse fund performance as well as performance persistence of such funds in the German-speaking region. Further research should be contributed to the development of fund terms in this region.

10.3 Outlook

Private equity sponsors have become a major player in the German-speaking economy, with a total of €39bn under management and funds of €40bn as of 2014. These numbers only relate to German-based private equity sponsors and do not account for buyout activity undertaken in this region by foreign investors, which additionally underpins the importance of private equity. Especially the increase in buyout volume over the last decade indicates that private equity has become a well-established asset class in this region, whose influence has to be taken seriously from a practical as well as an academic perspective.

The private equity industry has been exposed to various boom and bust cycles ever since, including the burst of the technology bubble in 2000 or the more recent global financial crisis of 2008. As private equity activity in the German-speaking region only accelerated in the early 2000s the burst of the new economy bubble did not affect the private equity business in this region as negative as it was impacted in other regions on the globe. Following the economic recovery, and an accelerated buyout activity, the German buyout volume increased from ca. €1.7bn in 2003 to €2.6bn in 2006 and peaked with €6.2bn and €4.8bn in 2007 and 2008, respectively. As a result of the 2008 global financial crisis the German buyout volume traded

with only €1.6bn in 2009 on its 2001 level. Consequently the impact of the most recent crisis was economically significant for the private equity industry. However, the industry managed to increase buyout volumes to €4.8bn in 2011 and €5.6bn in 2014.

Regardless of the increase in buyout volume post the global financial crisis, practitioners claim that the industry faces a so-called "new normal", which in essence is characterised by the fact that private equity sponsors do not obtain debt levels as high as prior to the crisis. In other words, the importance of leverage as a value driver has decreased since and PE managers are thus forced to increase their focus on operational improvements to generate value. Therefore, one critical question is how the debt markets will develop in the future and how this impacts overall value generation in leveraged buyout transactions.

Another determining factor for the development of the private equity industry in the German-speaking region is rather of a structural nature. Successful mid- to large-cap funds experienced an increase in fund size of their follow-on funds over the last decade. The number of large buyouts, however, is limited in this region and the backbone of the economy is clearly represented by small to medium sized companies. Hence, it will be of key interest whether these funds are still able to generate sufficient returns in order to satisfy their investors. Given the structural and cultural setup of the economy in this region there might be a trend towards small cap private equity investors with no Anglo-Saxon roots. Further, and as can be already observed, an increase in industry-focused funds, as for example with a distinct focus on health care or technology assets, might continue as a result of increased competition.

Regardless of how the private equity industry will develop in the German-speaking region and how the investors cope with the "new normal", private equity is expected to remain a significant asset class in this region and to represent a major part of the economy.

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Appendices

Appendix 1: Proof of the Methodological Value Creation Framework

In line with the discussion of the methodological framework of value creation, adapted from Achleitner et al. (2010), and the formula-based derivation in Section 4.2.2, this Appendix will proof the relationships set out above by means of the numbers presented in the exemplary application of the value creation framework in Section 4.2.3.

(1) The overall unlevered times money multiple is described as comprising of the following four components:

$$TM_{UNLEV} = \frac{\left(\frac{EBITDA_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%} \right)} \right)}{TM_{LEV}} TM_{UNLEV} + \frac{\left(\frac{FCF_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%} \right)} \right)}{TM_{LEV}} TM_{UNLEV} + \ldots$$

$$\frac{\left(\frac{Multiple_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%} \right)} \right)}{TM_{LEV}} TM_{UNLEV} + \frac{\left(\frac{EBITDA/MultipleMix_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%} \right)} \right)}{TM_{LEV}} TM_{UNLEV}$$

(2) In a first step dividing by TM_{UNLEV} and multiplying by TM_{LEV} yields:

$$TM_{LEV} = \frac{EBITDA_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%} \right)} + \frac{FCF_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%} \right)} + \ldots$$

$$\frac{Multiple_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%} \right)} + \frac{EBITDA/MultipleMix_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%} \right)}$$

(3) Replacing TM_{LEV} in (2) with its original definition yields:

$$\frac{EqV_{Ex} - EqV_{En} - \frac{EqInj}{os\%} + \frac{Div}{os\%}}{\left(EqV_{En} + \frac{EqInj}{os\%}\right)} = \frac{EBITDA_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%}\right)} + \frac{FCF_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%}\right)} + \ldots$$

$$\frac{Multiple_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%}\right)} + \frac{EBITDA/Multiple\,Mix_{Var}}{\left(EqV_{En} + \frac{EqInj}{os\%}\right)}$$

(4) Multiplying (3) with the ownership-adjusted cash outflows yields:

$$EqV_{Ex} - EqV_{En} - \frac{EqInj}{os\%} + \frac{Div}{os\%} = EBITDA_{Var} + FCF_{Var} + Multiple_{Var} + EBITDA/Multiple\,Mix_{Var}$$

(5) Decomposing the variation elements to the right of (4) yields:

$$EqV_{Ex} - EqV_{En} - \frac{EqInj}{os\%} + \frac{Div}{os\%} = \left(EBITDA_{Ex} - EBITDA_{En}\right)\left(\frac{EV_{En}}{EBITDA_{En}}\right) + \ldots$$

$$\left(ND_{En} - ND_{Ex}\right) - \left(\frac{EqInj}{os\%}\right) + \left(\frac{Div}{os\%}\right) + \ldots$$

$$\left(\frac{EV_{Ex}}{EBITDA_{Ex}} - \frac{EV_{En}}{EBITDA_{En}}\right)EBITDA_{En} + \ldots$$

$$\left(EBITDA_{Ex} - EBITDA_{En}\right)\left(\frac{EV_{Ex}}{EBITDA_{Ex}} - \frac{EV_{En}}{EBITDA_{En}}\right)$$

(6) Multiplying the expressions to the right of (5) and eliminating for ownership-adjusted equity injections as well as dividends (to the left of (5) and as part of the FCF_{VAR}) yields:

$$EqV_{Ex} - EqV_{En} = EBITDA_{Ex}\frac{EV_{En}}{EBITDA_{En}} - EBITDA_{En}\frac{EV_{En}}{EBITDA_{En}} + ND_{En} - ND_{Ex} + \ldots$$

$$\frac{EV_{Ex}}{EBITDA_{Ex}}EBITDA_{En} - \frac{EV_{En}}{EBITDA_{En}}EBITDA_{En} + \ldots$$

$$EBITDA_{Ex}\frac{EV_{Ex}}{EBITDA_{Ex}} - EBITDA_{Ex}\frac{EV_{En}}{EBITDA_{En}} - EBITDA_{En}\frac{EV_{Ex}}{EBITDA_{Ex}} + EBITDA_{En}\frac{EV_{En}}{EBITDA_{En}}$$

(7) Eliminating for redundant elements in (6) yields:

$$EqV_{Ex} - EqV_{En} = -EBITDA_{En}\frac{EV_{En}}{EBITDA_{En}} + EBITDA_{Ex}\frac{EV_{Ex}}{EBITDA_{Ex}} + ND_{En} - ND_{Ex}$$

(8) Substituting the EBITDA times multiple elements in (7) with the respective Enterprise Values yields:

$$EqV_{Ex} - EqV_{En} = -EV_{En} + EV_{Ex} + ND_{En} - ND_{Ex}$$

(9) Rearranging (8) yields:

$$EqV_{Ex} - EV_{Ex} + ND_{Ex} = EqV_{En} - EV_{En} + ND_{En}$$

(10) Finally replacing the variables with the values from the hypothetical buyout transaction presented in Table 5 provides the mathematical proof:

$$700 - 820 + 120 = -410 + 190 + 220$$

$$0 = 0$$

Even without the numbers from the example the proof is given as the equity value minus the enterprise value plus net debt always adds up to zero, regardless of entry or exit.

Appendix 2: Public-Market-Equivalent (PME) Calculations

The PME is calculated by dividing the total proceeds of each buyout transactions, being the equity value realised at exit plus the dividends received during ownership, over the amount that would have resulted if the total amount invested into the buyout company, being the equity value at entry and the equity injections, would have been invested into the respective index. For example: If a private equity sponsor invests €100m into a company on 1st of June 2005 and realises €200m on 31st of May 2007 he would have earned an IRR of 41%. Investing the same €100m into the DAX over the same period would have grown to €176m, as the DAX increased by 76% during this period. Hence a PME of 1.14 results (200 divided by 176), indicating that the buyout was the better investment. Assuming the same number as above, but now selling at the end of May 2009 would increase the PME to 1.81. However, the IRR would decrease to 19% due to the longer holding period.

Table 37: Public-Market-Equivalent

The table presents four different PMEs by applying the German prime indices.

n = 124	Mean	Median	Std. Dev.	Min	Max
Panel A: PME					
PME DAX	3.60	2.02	6.77	-1.66	59.67
PME DAX & MDAX	3.15	1.71	6.41	-1.85	52.37
PME DAX & SDAX	3.51	1.93	6.56	-2.34	52.69
PME DAX & TecDAX	3.82	2.14	8.04	-1.46	78.05

Appendix 3: Regression setup – Operational Alpha

$$win(3\%)\left(IRR_{PE,UNLEV} - IRR_{NN,UNLEV}\right) = \alpha + \ldots$$

$$\beta_1 \cdot \log\left(1 + win(3\%)\left(\left(\frac{\left(\frac{Sales_{Ex,PE} - Sales_{En,PE}}{Sales_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{Sales_{Ex,NN} - Sales_{En,NN}}{Sales_{En,NN}}\right)}{HP}\right)\right)\right) + \ldots$$

$$\beta_2 \cdot \log\left(1 + win(3\%)\left(\left(\frac{\left(\frac{EBITDA\%_{Ex,PE} - EBITDA\%_{En,PE}}{EBITDA\%_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{EBITDA\%_{Ex,NN} - EBITDA\%_{En,NN}}{EBITDA\%_{En,NN}}\right)}{HP}\right)\right)\right) + \ldots$$

$$\beta_3 \cdot \log\left(1 + win(3\%)\left(\left(\frac{\left(\frac{EV/EBITDA_{Ex,PE} - EV/EBITDA_{En,PE}}{EV/EBITDA_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{EV/EBITDA_{Ex,NN} - EV/EBITDA_{En,NN}}{EV/EBITDA_{En,NN}}\right)}{HP}\right)\right)\right) + \ldots$$

$$\beta_4 \cdot \log(1 + EV_{En,PE}) + \beta_5 \cdot \log\left(1 + D/EBITDA_{En,PE}\right) + \beta_6 \cdot HP + \beta_7 \cdot EntryYear + \beta_8 \cdot ICB + \beta_9 \cdot Realisation$$

Appendix 4: Regression setup – Unlevered IRR

$$win(3\%)\left(IRR_{PE,UNLEV}\right)=\alpha+...$$

$$\beta_1\cdot\log\left(1+\left(win(3\%)\left(\left(\frac{\left(\frac{Sales_{Ex,PE}-Sales_{En,PE}}{Sales_{En,PE}}\right)}{HP}\right)-\left(\frac{\left(\frac{Sales_{Ex,NN}-Sales_{En,NN}}{Sales_{En,NN}}\right)}{HP}\right)\right)\right)\right)+...$$

$$\beta_2\cdot\log\left(1+\left(win(3\%)\left(\left(\frac{\left(\frac{EBITDA\%_{Ex,PE}-EBITDA\%_{En,PE}}{EBITDA\%_{En,PE}}\right)}{HP}\right)-\left(\frac{\left(\frac{EBITDA\%_{Ex,NN}-EBITDA\%_{En,NN}}{EBITDA\%_{En,NN}}\right)}{HP}\right)\right)\right)\right)+...$$

$$\beta_3\cdot\log\left(1+\left(win(3\%)\left(\left(\frac{\left(\frac{EV/EBITDA_{Ex,PE}-EV/EBITDA_{En,PE}}{EV/EBITDA_{En,PE}}\right)}{HP}\right)-\left(\frac{\left(\frac{EV/EBITDA_{Ex,NN}-EV/EBITDA_{En,NN}}{EV/EBITDA_{En,NN}}\right)}{HP}\right)\right)\right)\right)+...$$

$$\beta_4\cdot\log(1+EV_{En,PE})+\beta_5\cdot\log\left(1+D/EBITDA_{En,PE}\right)+\beta_6\cdot HP+\beta_7\cdot EntryYear+\beta_8\cdot ICB+\beta_9\cdot Realisation$$

Appendix 5: Regression setup – M&A Activity: Operational Alpha and Unlevered IRR

$$(1)\, win(3\%)\left(IRR_{PE,UNLEV} - IRR_{NN,UNLEV}\right) \quad (2)\, win(3\%)\left(IRR_{PE,UNLEV}\right) = \alpha + \beta_1 \cdot MandADummy + ...$$

$$\beta_2 \cdot \log\left(1 + \left(win(3\%)\left(\left(\frac{\left(\frac{Sales_{Ex,PE} - Sales_{En,PE}}{Sales_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{Sales_{Ex,NN} - Sales_{En,NN}}{Sales_{En,NN}}\right)}{HP}\right)\right)\right)\right) + \beta_3 \cdot InteractionVariable + ...$$

$$\beta_4 \cdot \log\left(1 + \left(win(3\%)\left(\left(\frac{\left(\frac{EBITDA\%_{Ex,PE} - EBITDA\%_{En,PE}}{EBITDA\%_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{EBITDA\%_{Ex,NN} - EBITDA\%_{En,NN}}{EBITDA\%_{En,NN}}\right)}{HP}\right)\right)\right)\right) + \beta_5 \cdot InteractionVariable + ...$$

$$\beta_6 \cdot \log\left(1 + \left(win(3\%)\left(\left(\frac{\left(\frac{EV/EBITDA_{Ex,PE} - EV/EBITDA_{En,PE}}{EV/EBITDA_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{EV/EBITDA_{Ex,NN} - EV/EBITDA_{En,NN}}{EV/EBITDA_{En,NN}}\right)}{HP}\right)\right)\right)\right) + \beta_7 \cdot InteractionVariable + ...$$

$$\beta_8 \cdot \log(1 + EV_{En,PE}) + \beta_9 \cdot \log\left(1 + D/EBITDA_{En,PE}\right) + \beta_{10} \cdot HP + \beta_{11} \cdot EntryYear + \beta_{12} \cdot ICB + \beta_{13} \cdot Realisation$$

Note: *MandADummy* is zero for organic deals and one for inorganic deals. *InteractionVariable* stands for the previous explanatory variable times the *MandADummy*.

Appendix 6: Regression setup – Transaction Size: Operational Alpha and Unlevered IRR

$$(1)\, win(3\%)\left(IRR_{PE,UNLEV} - IRR_{NN,UNLEV}\right) \quad (2)\, win(3\%)\left(IRR_{PE,UNLEV}\right) = \alpha + \beta_1 \cdot TransactionSizeDummy + ...$$

$$\beta_2 \cdot \log\left(1 + \left(win(3\%)\left(\left(\frac{\left(\frac{Sales_{Ex,PE} - Sales_{En,PE}}{Sales_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{Sales_{Ex,NN} - Sales_{En,NN}}{Sales_{En,NN}}\right)}{HP}\right)\right)\right)\right) + \beta_3 \cdot InteractionVariable + ...$$

$$\beta_4 \cdot \log\left(1 + \left(win(3\%)\left(\left(\frac{\left(\frac{EBITDA\%_{Ex,PE} - EBITDA\%_{En,PE}}{EBITDA\%_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{EBITDA\%_{Ex,NN} - EBITDA\%_{En,NN}}{EBITDA\%_{En,NN}}\right)}{HP}\right)\right)\right)\right) + \beta_5 \cdot InteractionVariable + ...$$

$$\beta_6 \cdot \log\left(1 + \left(win(3\%)\left(\left(\frac{\left(\frac{EV/EBITDA_{Ex,PE} - EV/EBITDA_{En,PE}}{EV/EBITDA_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{EV/EBITDA_{Ex,NN} - EV/EBITDA_{En,NN}}{EV/EBITDA_{En,NN}}\right)}{HP}\right)\right)\right)\right) + \beta_7 \cdot InteractionVariable + ...$$

$$\beta_8 \cdot \log\left(1 + D/EBITDA_{En,PE}\right) + \beta_9 \cdot HP + \beta_{10} \cdot EntryYear + \beta_{11} \cdot ICB + \beta_{12} \cdot Realisation$$

Note: *TransactionSizeDummy* is zero for deals with enterprise values below €120m and one for deals with enterprise values equal or greater than €120m. *InteractionVariable* stands for the previous explanatory variable times the *TransactionSizeDummy*.

Appendix 7: Regression setup – Financial Crisis: Operational Alpha and Unlevered IRR

$$(1)\, win(3\%)\left(IRR_{PE,UNLEV} - IRR_{NN,UNLEV}\right) \quad (2)\, win(3\%)\left(IRR_{PE,UNLEV}\right) = \alpha + \beta_1 \cdot FinancialCrisisDummy + ...$$

$$\beta_2 \cdot \log\left(1 + \left(win(3\%)\left(\left(\frac{\left(\frac{Sales_{Ex,PE} - Sales_{En,PE}}{Sales_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{Sales_{Ex,NN} - Sales_{En,NN}}{Sales_{En,NN}}\right)}{HP}\right)\right)\right)\right) + \beta_3 \cdot InteractionVariable + ...$$

$$\beta_4 \cdot \log\left(1 + \left(win(3\%)\left(\left(\frac{\left(\frac{EBITDA\%_{Ex,PE} - EBITDA\%_{En,PE}}{EBITDA\%_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{EBITDA\%_{Ex,NN} - EBITDA\%_{En,NN}}{EBITDA\%_{En,NN}}\right)}{HP}\right)\right)\right)\right) + \beta_5 \cdot InteractionVariable + ...$$

$$\beta_6 \cdot \log\left(1 + \left(win(3\%)\left(\left(\frac{\left(\frac{EV/EBITDA_{Ex,PE} - EV/EBITDA_{En,PE}}{EV/EBITDA_{En,PE}}\right)}{HP}\right) - \left(\frac{\left(\frac{EV/EBITDA_{Ex,NN} - EV/EBITDA_{En,NN}}{EV/EBITDA_{En,NN}}\right)}{HP}\right)\right)\right)\right) + \beta_7 \cdot InteractionVariable + ...$$

$$\beta_8 \cdot \log(1 + EV_{En,PE}) + \beta_9 \cdot \log\left(1 + D/EBITDA_{En,PE}\right) + \beta_{10} \cdot HP + \beta_{11} \cdot ICB + \beta_{12} \cdot Realisation$$

Note: *FinancialCrisisDummy* is zero for deals with exit years prior to 2008 and one for deals with exit years in or after 2008. *InteractionVariable* stands for the previous explanatory variable times the *FinancialCrisisDummy*.

Appendix 8: Regression Analyses Applying the Industry Portfolio (IP) Benchmark Sample

As outlined in the data collection and sample collection section as well as in the individual essays there are two separate benchmark samples, the nearest neighbour and the industry portfolio sample. As discussed above, as a counter measure to account for the buyout sample's tendency towards better-performing deals the also better-performing nearest neighbour sample was applied in light of analyses conducted in the three essays. In the following the regression analyses conducted in the second research essay are re-performed by applying the industry portfolio sample as the relevant benchmark sample.

Table 38: Regression Results – Operational Alpha (IP)

The table presents the results of ordinary least squares regressions on the determinants of operational alpha. The variables are defined in Table 27, but the industry portfolio and not the nearest neighbour sample is applied for benchmarking purposes. The figures in the upper rows represent the regression coefficients, *, ** and *** indicate p-values with significance levels of 10%, 5% and 1%, respectively. Standard errors are reported in the lower rows.

	Dependent variable: Operational alpha				
Independent variables	(1)	(2)	(3)	(4)	(5)
Log delta sales growth	0.992***	0.933***	0.801***	0.842***	0.854***
	(0.247)	(0.246)	(0.270)	(0.312)	(0.312)
Log delta EBITDA/Sales growth	0.916***	0.970***	0.829***	0.915***	0.951***
	(0.174)	(0.188)	(0.192)	(0.195)	(0.195)
Log delta EV/EBITDA growth	0.673***	0.739***	0.583***	0.614***	0.616***
	(0.136)	(0.154)	(0.156)	(0.163)	(0.158)
Control variables					
Log transaction size at entry		-0.008	-0.001	-0.001	-0.000
		(0.014)	(0.015)	(0.019)	(0.019)
Log debt/EBITDAat entry		0.034	0.020	0.007	0.004
		(0.029)	(0.034)	(0.035)	(0.035)
Holding period			-0.022	-0.020	-0.018
			(0.017)	(0.016)	(0.016)
Entry year fixed effects	NO	NO	YES	YES	YES
Industry dummies	NO	NO	NO	YES	YES
Realisation status					0.060
					(0.049)
Constant	0.065***	0.117	0.176	0.041	-0.021
	(0.016)	(0.167)	(0.172)	(0.203)	(0.209)
Observations	124	122	122	122	122
R-squared	0.501	0.523	0.587	0.613	0.619

Table 39: Regression Results – Unlevered IRR (IP)

The table presents the results of ordinary least squares regressions on the determinants of unlevered IRR. The variables are defined in Table 27, but the industry portfolio and not the nearest neighbour sample is applied for benchmarking purposes. The figures in the upper rows represent the regression coefficients, *, ** and *** indicate p-values with significance levels of 10%, 5% and 1%, respectively. Standard errors are reported in the lower rows.

	Dependent variable: Unlevered IRR				
Independent variables	(1)	(2)	(3)	(4)	(5)
Log delta sales growth	0.956***	0.908***	0.752***	0.876***	0.884***
	(0.256)	(0.259)	(0.276)	(0.329)	(0.329)
Log delta EBITDA/Sales growth	0.937***	0.972***	0.907***	0.948***	0.974***
	(0.177)	(0.189)	(0.183)	(0.197)	(0.199)
Log delta EV/EBITDA growth	0.568***	0.617***	0.464***	0.504***	0.505***
	(0.126)	(0.142)	(0.127)	(0.146)	(0.142)
Control variables					
Log transaction size at entry		-0.003	-0.000	0.005	0.005
		(0.016)	(0.016)	(0.020)	(0.020)
Log debt/EBITDAat entry		0.013	0.009	0.014	0.011
		(0.027)	(0.029)	(0.033)	(0.032)
Holding period			-0.036**	-0.035**	-0.033**
			(0.014)	(0.014)	(0.014)
Entry year fixed effects	NO	NO	YES	YES	YES
Industry dummies	NO	NO	NO	YES	YES
Realisation status					0.044
					(0.052)
Constant	0.170***	0.194	0.456**	0.294	0.249
	(0.015)	(0.182)	(0.181)	(0.213)	(0.223)
Observations	124	122	122	122	122
R-squared	0.453	0.465	0.570	0.584	0.587

Table 40: Regression Results – Organic vs. Inorganic Buyout Transactions (IP)

The table presents the results of ordinary least squares regressions on the determinants of operational alpha and unlevered IRR by differentiating between buyouts with M&A activity during ownership, regressions (3) and (7), and buyouts with no M&A activity during the holding period, regressions (2) and (6). The variables are defined in Table 27, but the industry portfolio and not the nearest neighbour sample is applied for benchmarking purposes. The figures in the upper rows represent the regression coefficients, *, ** and *** indicate p-values with significance levels of 10%, 5% and 1%, respectively. Standard errors are reported in the lower rows. For further statistical details on how the interaction terms in (4) and (8) are calculated and interpreted please refer to Wooldridge (2013, p. 242 f.) as well as Angrist and Pischke (2009, p. 49 f.).

	Dependent variable: Operational Alpha				**Dependent variable: Unlevered IRR**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Independent variables	all	organic	inorganic	interaction	all	organic	inorganic	interaction
M&A Dummy				0.003				0.021
				(0.051)				(0.052)
Log delta sales growth	0.854***	1.504***	0.088	1.453***	0.884***	1.482***	-0.009	1.464***
	(0.312)	(0.395)	(0.542)	(0.423)	(0.329)	(0.406)	(0.583)	(0.453)
Interaction sales and M&A				-1.115**				-1.088*
				(0.531)				(0.599)
Log delta EBITDA/Sales growth	0.951***	0.513**	0.972***	0.525**	0.974***	0.588**	0.916**	0.577**
	(0.195)	(0.251)	(0.326)	(0.254)	(0.199)	(0.239)	(0.359)	(0.263)
Interaction EBITDA/Sales and M&A				0.608*				0.553
				(0.339)				(0.363)
Log delta EV/EBITDA growth	0.616***	0.509**	0.681**	0.506**	0.505***	0.426**	0.513**	0.426**
	(0.158)	(0.189)	(0.249)	(0.205)	(0.142)	(0.178)	(0.239)	(0.210)
Interaction EV/EBITDA and M&A				0.193				0.107
				(0.323)				(0.330)
Control variables								
Log transaction size at entry	-0.000	-0.006	0.011	-0.002	0.005	0.009	0.010	0.002
	(0.019)	(0.031)	(0.032)	(0.018)	(0.020)	(0.031)	(0.036)	(0.019)
Log debt/EBITDA at entry	0.004	0.039	-0.090*	-0.008	0.011	0.031	-0.082	-0.000
	(0.035)	(0.041)	(0.048)	(0.027)	(0.032)	(0.035)	(0.058)	(0.027)
Holding period	-0.018	-0.022	-0.034	-0.019	-0.033**	-0.037	-0.054*	-0.035***
	(0.016)	(0.023)	(0.023)	(0.013)	(0.014)	(0.022)	(0.027)	(0.012)
Entry year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Realisation status	0.060	0.118*	0.034	0.087*	0.044	0.070	0.044	0.068
	(0.049)	(0.061)	(0.069)	(0.046)	(0.052)	(0.068)	(0.079)	(0.049)
Constant	-0.021	0.109	0.503	0.025	0.249	0.136	0.579	0.297
	(0.209)	(0.424)	(0.377)	(0.181)	(0.223)	(0.409)	(0.439)	(0.198)
Observations	122	68	54	122	122	68	54	122
R-squared	0.619	0.733	0.817	0.672	0.587	0.719	0.783	0.635

Table 41: Regression Results – Transaction Size (IP)

The table presents the results of ordinary least squares regressions on the determinants of operational alpha and unlevered IRR by differentiating between buyouts with enterprise values equal to or greater than €122m, regressions (3) and (7), and buyouts with enterprise values less than €122m, regressions (2) and (6). The variables are defined in Table 27, but the industry portfolio and not the nearest neighbour sample is applied for benchmarking purposes. The figures in the upper rows represent the regression coefficients, *, ** and *** indicate p-values with significance levels of 10%, 5% and 1%, respectively. Standard errors are reported in the lower rows.

	Dependent variable: Operational Alpha				**Dependent variable: Unlevered IRR**			
Independent variables	(1) all	(2) small-cap	(3) larger-cap	(4) interaction	(5) all	(6) small-cap	(7) larger-cap	(8) interaction
Transaction size dummy				-0.032				-0.021
				(0.041)				(0.041)
Log delta sales growth	0.854***	0.728*	0.855	0.712**	0.878***	0.849*	0.799	0.800**
	(0.312)	(0.415)	(0.663)	(0.329)	(0.332)	(0.420)	(0.705)	(0.339)
Interaction sales and size				0.467				0.364
				(0.610)				(0.627)
Log delta EBITDA/Sales growth	0.950***	0.832**	1.281***	0.631**	0.979***	0.776**	1.319***	0.611**
	(0.197)	(0.359)	(0.198)	(0.245)	(0.199)	(0.338)	(0.231)	(0.239)
Interaction EBITDA/Sales and size				0.728**				0.838**
				(0.349)				(0.360)
Log delta EV/EBITDA growth	0.616***	0.572**	0.848***	0.406*	0.505***	0.468*	0.666***	0.313
	(0.158)	(0.278)	(0.193)	(0.212)	(0.140)	(0.244)	(0.222)	(0.198)
Interaction EV/EBITDA and size				0.381				0.318
				(0.278)				(0.288)
Control variables								
Log debt/EBITDA at entry	0.003	-0.017	-0.082	0.001	0.015	-0.019	-0.084	0.010
	(0.033)	(0.054)	(0.066)	(0.034)	(0.031)	(0.054)	(0.076)	(0.031)
Holding period	-0.018	-0.023	-0.060**	-0.014	-0.033**	-0.034	-0.085**	-0.028*
	(0.016)	(0.026)	(0.027)	(0.016)	(0.014)	(0.024)	(0.032)	(0.014)
Entry year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Realisation status	0.060	0.088	0.020	0.054	0.043	0.076	0.010	0.035
	(0.048)	(0.078)	(0.057)	(0.047)	(0.052)	(0.080)	(0.066)	(0.049)
Constant	-0.026	0.223	0.688**	-0.080	0.292**	0.211	1.075***	0.245
	(0.148)	(0.200)	(0.292)	(0.152)	(0.142)	(0.191)	(0.350)	(0.152)
Observations	122	60	62	122	122	60	62	122
R-squared	0.619	0.650	0.803	0.656	0.587	0.627	0.766	0.627

Table 42: Regression Results – Financial Crisis (IP)

The table presents the results of ordinary least squares regressions on the determinants of operational alpha and unlevered IRR by differentiating between buyouts exited in or post 2008, regressions (3) and (7), and buyouts exited before 2008, regressions (2) and (6). The variables are defined in Table 27, but the industry portfolio and not the nearest neighbour sample is applied for benchmarking purposes. The figures in the upper rows represent the regression coefficients, *, ** and *** indicate p-values with significance levels of 10%, 5% and 1%, respectively. Standard errors are reported in the lower rows.

	Dependent variable: Operational Alpha				**Dependent variable: Unlevered IRR**			
Independent variables	(1) all	(2) pre-crisis	(3) post-crisis	(4) interaction	(5) all	(6) pre-crisis	(7) post-crisis	(8) interaction
Financial Crisis Dummy				0.042				-0.021
				(0.037)				(0.038)
Log delta sales growth	0.933***	1.137**	0.784**	1.126**	0.941***	1.128***	0.787**	1.173***
	(0.268)	(0.430)	(0.293)	(0.472)	(0.279)	(0.390)	(0.344)	(0.431)
Interaction sales and Crisis				-0.314				-0.360
				(0.533)				(0.511)
Log delta EBITDA/Sales growth	1.008***	0.981***	1.027***	0.989***	0.965***	0.894***	0.988***	0.951***
	(0.174)	(0.265)	(0.247)	(0.273)	(0.177)	(0.241)	(0.293)	(0.260)
Interaction EBITDA/Sales and Crisis				0.054				0.051
				(0.370)				(0.382)
Log delta EV/EBITDA growth	0.715***	0.860***	0.603***	0.821***	0.560***	0.753***	0.475**	0.713***
	(0.146)	(0.236)	(0.171)	(0.221)	(0.140)	(0.200)	(0.211)	(0.182)
Interaction EV/EBITDA and Crisis				-0.205				-0.269
				(0.303)				(0.291)
Control variables								
Log transaction size at entry	-0.008	-0.036**	0.015	-0.008	-0.003	-0.025	0.006	-0.004
	(0.018)	(0.016)	(0.050)	(0.018)	(0.019)	(0.017)	(0.058)	(0.020)
Log debt/EBITDA at entry	0.024	0.131**	-0.024	0.033	0.016	0.109**	-0.022	0.020
	(0.030)	(0.062)	(0.055)	(0.031)	(0.029)	(0.051)	(0.066)	(0.031)
Holding period	-0.017*	-0.036**	-0.024	-0.020**	-0.032***	-0.054***	-0.032*	-0.034***
	(0.010)	(0.015)	(0.016)	(0.010)	(0.010)	(0.015)	(0.019)	(0.010)
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Realisation status	0.043	0.011	0.066	0.049	0.056	-0.001	0.074	0.044
	(0.038)	(0.065)	(0.064)	(0.042)	(0.040)	(0.062)	(0.077)	(0.043)
Constant	-0.007	0.531**	-0.186	-0.050	0.028	0.651***	-0.026	0.059
	(0.229)	(0.205)	(0.576)	(0.250)	(0.238)	(0.196)	(0.657)	(0.263)
Observations	122	72	50	122	122	72	50	122
R-squared	0.565	0.585	0.652	0.573	0.538	0.625	0.561	0.554