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Industry specialization, a competitive advantage for Private Equity firms

Keywords: Private Equity, Industry Specialization, Buyout Performance, Value Creation, Contingencies, Secondary Buyouts, Complementarities

Abstract

Rapid growth over the last two decades has made the Private Equity (PE) industry ever more competitive. This forces PE firms to increasingly rely on operational and strategic value changes rather than financial engineering for the creation of value. To remain competitive in this environment PE firms have developed differentiating capabilities. This research investigates the returns to one of those capabilities, industry specialization. Through a multilevel mixed effects model the impact of specialization on the performance of 246 UK portfolio companies is analyzed. A positive impact is found on turnover growth and operating profitability, but benefits differ greatly between PE firms and are highly concentrated in specific types of buyouts. Specifically, buyouts that are: (1) initially low performing, (2) during the financial crisis, or (3) secondary benefit from having a specialized owner. Further analysis reveals that PE firms only to a small extent adjust target selection to maximize specialization benefits, and do not operate in industries that perform better or worse than generalists. A second part of the paper analyzes complementarities in secondary buyouts (SBOs). In a sample of 101 UK SBOs it is found that turnover growth is higher in buyouts when: (1) a buyer is specialized in the target's industry while the seller is not, (2) the buying firm has more experience, and (3) the seller operates cross-border and the buyer has a local presence. Additionally, it is shown that SBOs between generalist sellers and specialized buyers not only outperform other SBOs but also primary buyouts.

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1. Introduction

The Private Equity industry is booming. Global assets under management swell from $500bn in 2000 to $2.8tn in 2017 (Preqin, 2018), and the number of active funds recently reached an all-time high (Financial Times, 2018). However, with record levels of fundraising and new entrants continuing to flood into the market, competition in the industry has become ever fierce (Financial Times, 2018). At the same time, corporations continue to make tough competitors with large amounts of cash at their disposal (Economist, 2017), while the institutionalization of PE strategies such as shareholder value focus and incentive realignment techniques by public corporations has reduced the amount of obvious investment opportunities (Weir, Jones, and Wright, 2015).

The result is a record number of market participants chasing after a group of ever lower quality investment opportunities. This forces PE firms to increasingly rely on operational and strategic changes rather than financial engineering or multiple expansion for value creation (Ghai et al., 2014; Forbes, 2018). To remain competitive in this environment, PE firms have developed differentiating capabilities and accumulated a diverse set of resources (Ghai et al., 2014). This has not gone unnoticed by academics. Recent research by Castellaneta and Gottschalg (2016) confirms that PE firms are heterogeneous in resource endowments and that this translates into heterogeneity in returns. It also concludes that this effect becomes stronger in situations where value creation is complex. Yet, despite such relevant findings, the research community is largely silent on what the exact sources of heterogeneity are.

This research contributes to existing literature by examining one of the potential sources of heterogeneity, industry specialization. By focusing on a specific sector PE firms stimulate the accumulation of industry specific knowledge, management abilities, and networks. Hypothetically, this can help PE firms with the sourcing and evaluation of new investment opportunities, as well as with the subsequent managing and advising of these targets.

However, previous academic research reports mixed results on the returns to industry specialization. In a pivotal paper, Cressy et al. (2007) show that UK buyouts backed by industry specialized PE firms have an 8.5% higher operating profitability over the 3 years post buyout compared to buyouts backed by generalist PE firms. Contrarily, Meuleman, Amess, Wright, and Scholes (2009), also study UK buyouts in a similar time period, but do not find specialization to

enhance target profitability. A possible explanation for this apparent discrepancy may stem from differences in methodology. Cressy et al. (2007) measure performance through a target's mean profitability ratio over a three-year period post buyout, while Meuleman et al. (2009) analyze the change in profitability ratio between the year of buyout and 3 years after the buyout. The approach by Cressy et al. (2007) is questionable, by only studying post-buyout profitability levels, nothing can be concluded on the relationship between PE specialization and target performance changes during the holding phase.

The mixed empirical results demonstrate the need for further research. As of today, no international or UK consensus on the impact of industry specialization on buyout performance exits. However, in a recent paper, published during the writing of this thesis, Nadant et al. (2018) shed new light on the impact of industry specialization by PE firms. Using a French sample of primary buyouts between 2001 and 2007, the authors find that industry specialization by PE firms can positively benefit both target profitability and turnover growth. Additionally, the authors find that benefits to specialization are larger among initially low and high performing targets.

This research makes a number of contributions to the above literature. First, it uses a superior research methodology that includes a difference-in-difference approach, the adjustment of performance metrics for industry and time effects, additional performance measures, and more control variables. This improves the reliability of research results, allows for comparison of performance between industries, and thereby provide answers for the mixed empirical evidence of Cressy et al. (2007) and Meuleman et al. (2009). Second, the UK sample allows a valuable cross-country comparison with the recent results of Nadant et al. (2018). Third, this research extends the work of Nadant et al. (2018) by studying a new contingency during which specialization benefits can increase, the recent financial crisis.

A second important recent development in the PE industry is the emergence of secondary buyouts (SBOs), transactions in which a PE firm buys a portfolio company from another PE firm. The last two decades saw SBOs evolve from a rarity in the 1990s to an integral part of the PE market today. This has not been exempt of criticism, both academics and practitioners have questioned the motives for such buyouts, as value creation opportunities are arguably already exploited by primary owners. In the past, academics have found contradicting results on value creation in SBOs, but

recently Degoerge, Martin, and Phalippou (2016) find a possible explanation for the contradiction in results. The authors find that the degree of value creation in SBOs depends on the motives for investment and the existence of complementarities between buying and selling PE firms. Specifically, SBO transactions between margin improvement and sales growth focused PE firms, between PE firms where GPs have different educational backgrounds or career histories, or between global and regional funds are found to outperform.

The above discussion illustrates the importance of studying both primary and secondary buyouts when analyzing the PE market. Both Cressy et al. (2007) and Nadant et al. (2018) focus solely on primary buyouts. Thereby the authors thus fail to illustrate the true effect of PE industry specialization in today's market. This research studies a sample that includes both primary and secondary buyouts and thereby make a fourth extension to the two studies. Additionally, it is tested if SBOs are actually a third contingency during which industry specialization benefits increase.

Furthermore, based on the earlier discussed benefits to specialization, one can hypothesize that industry specialization can form a complementary skill between buyers and sellers in SBOs. To test this hypothesis a second part of this research examines if SBO transactions between generalist sellers and industry specialized buyers outperform other SBOs and the general population of buyouts. In addition to that, four other potential sources of complementarities are analyzed. These are: PE firm size, experience, independence, and presence in the target's country.

The above questions are answered using a hand matched dataset of 246 UK buyouts completed from 2004 to 2013. For all of these buyouts performance is measures through four industry and time adjusted performance metrics: (1) Turnover growth, (2) Operating profitability change, (3) Working capital change, and (4) Sales per employee. To account for general differences between PE firms and their ability to leverage industry specialization as a resource, a multilevel mixed-effect model is estimated. In this model both the intercept and the coefficient of the industry specialization variable is allowed to vary.

The main findings of this research are that industry specialized PE firms are, on average, associated with significantly larger post-LBO turnover growth but not with improvements in operating profitability, working capital, or employee productivity. Additionally, results show that the positive relationship between industry specialization and turnover growth exhibits substantial

variation between PE firms and becomes stronger during times of economic downturn. Furthermore, it contributes to literature on SBOs by showing that value creation in SBOs increase when: (1) a buyer is specialized in the target's industry while the seller is not, (2) the buying firm has more experience, and (3) the seller operates cross-border while the buyer has a local presence. Last, it is shown that SBOs where targets transfer from generalists to specialist owners not only outperform other SBOs but also the general population of all buyouts.

2. Theoretical background

The Private Equity (PE) industry is a large, global, diverse and growing industry (Kaplan and Sensoy, 2015). Recent growth of the industry has spurred a surge in academic research (e.g. Phalipou and Gottschalg, 2008; Wood and Wright, 2009; Lerner, Sorensen, and Strömberg, 2011; Harris, Jenkinson, and Kaplan, 2014), increasingly this research emphasizes the heterogeneity and transformation of the industry (Cumming, Siegel, and Wright, 2007; Wood & Wright, 2009; Kaplan and Strömberg, 2009, Ghai et al., 2014). To gain a good understanding of these developments and corresponding avenues for further research, this section starts with a short description of the PE industry and its heterogeneity in investments and over geographies. Then follows a discussion on value creation of PE firms. Next, the historic and current developments in the industry will be summarized and the emergence of industry specialization and secondary buyouts will be discussed. Based on the existing academic literature and open questions for further research, hypotheses will then be developed.

2.1. Private equity investments

PE firms are investment management companies that raise capital through establishing PE funds. PE funds are usually non-publicly traded investment funds organized as limited partnerships. Historically, PE investments have been characterized by large, majority stake investments in companies that are private or become private as a result of the PE investment (Wood and Wright, 2009; Kaplan and Sensoy, 2015). However, since its emergence in the early 1980s, PE has grown into a multi-billion-dollar asset class with a presence across the globe (Puche and Lotz, 2015; Bain & Company, 2018). As the industry matured, competition grew stronger and other forms of investments such as club deals, minority investments, direct investments by limited partners, and investments in public companies have become more common (Puche and Lotz, 2015). Failing to distinguish between the different types of PE investment may lead to misleading results and flawed conclusions (Wood

and Wright, 2009). This research will focus on the classic investments of PE firms where they acquire a large, often majority, equity stake in private companies. This class has been chosen because it remains the largest class of PE investments in the UK and globally (BVCA, 2016; Bain, 2018); because these investments provoke most public discussion; and because such takeovers best allow PE firms to make the strategic, financial, and governance changes that are of interest in this research (Barber and Goold, 2007).

Within classic PE investments, a further distinction has to be made between Venture Capital (VC) investments and Leveraged Buyouts (LBOs) (Gilligan and Wright, 2008). The two transactions differ in various aspects but shortly summarized VC investments typically involve non-leveraged minority investments in start-up companies with growth prospects, while LBOs are often high-leveraged majority investments in mature companies with efficiency enhancements opportunities (Wood and Wright, 2009). Society also perceives the two types of PE investments differently; while VC is generally seen as vital and desirable asset class that funds start-ups and business growth, LBOs are often associated with large layoffs of employees and a type of unwanted predatory capitalism (Wood and Wright, 2009).

Because of the fundamental differences between VC and LBO investments, the two classes have to be analyzed separately (Cumming et al., 2007; Wood and Wright, 2009). This research focusses on the LBO investments of PE firms. This class is chosen because it represents the majority of PE investments in the UK and globally (BVCA, 2016; Preqin, 2017; Bain & Company, 2018), and because the effect of investor industry specialization has been more extensively studied among VC investments.

2.2. Cross-country differences

Since its emergence in the 1980s the PE industry has grown into a global industry with considerable presence in all developed economies (Wright, Renneboog, Simons, and Scholes, 2006; Bain & Company, 2018). As the industry expanded geographically, it also developed cross-country heterogeneity (Cumming et al., 2007). These geographical differences make it important to distinguish between geographies when examining PE literature.

The emergence of PE as an asset class did not occur simultaneously across the globe. As a result, significant cross-country differences exist in competition and industry professionalization.

Additionally, PE firms have displayed different investment motives and value creation strategies in different geographies. Furthermore, general differences in business environments such as economic growth, depth of capital markets, taxation, investor protection, corporate governance, and culture can impact the PE industry (Groh, Liechtenstein, and Lieser, 2010). These differences can also translate into different motives and levels of PE industry specialization. For example, operating in a small or less economically prosperous country may reduce investment opportunities and force PE firms to diversify investments more across industries.

The UK PE market emerged early in the 1980s and quickly matured in terms of size and professionalism (Wright et al., 2006). As a result, supporting infrastructure is well developed and competition is high, plausibly impacting asset prices and the availability of investment opportunities (Wright et al. 2006; PWC, 2017). In terms of investment motivation and strategies, UK GPs seem more entrepreneurial, with a larger focus on growth than US and continental European counterparts (Toms and Wright, 2005), and less reliant on tax benefits for returns than the US PE industry (Weir et al., 2005). In terms of general business environment, the common law and deep liquidity of capital markets make the UK second to only the US.

The various cross-country differences diverge returns and strategies between geographies (Cumming et al., 2010). Extrapolating research result across geographies should therefore be done with caution, and directly comparing literature on specific value drivers should preferably be done with same country results. This research will therefore follow Cressy et al. (2007) and study the UK buyout market. Underlying this choice is the superior data availability of private companies in the UK, the fact that the UK is Europe's largest and most developed PE market, and the relative similarity in PE environment of the UK and US, the world's largest PE market.

2.2. Value creation by Private Equity

Much of the controversy around PE revolves around the discussion if PE contributes to or extracts from society. Critics argue that PE firms extract value from other firm stakeholders while proponents assert that PE ownership provides benefits for companies in specific situations (Wood and Wright, 2009). Academics try to bring data to these claims and have over the years produced a large body of research using a variety of datasets, measures, and methodologies to examine the returns to PE (Kaplan and Sensoy, 2015).

When analyzing PE returns, an often made distinction is between financial and real returns. Financial returns are monetary returns that accrue to PE investors while real returns represent returns that benefit society as a whole (e.g. employment and innovation). Critics argue that the financial returns to PE investors come at the cost of real returns because PE firms redistribute value between stakeholders and sacrificing long-term firm prospects (Guo et al., 2011; Renneboog and Vansteenkiste, 2017). To provide a complete picture of the impact of industry specialization, this research examines the effect of PE industry specialization on both financial and real returns. This section therefore summarizes existing literature on PE's impact on the two type of returns, and describes how these returns are best measured. This provides guidance for constructing the performance measures used in this research.

2.2.1. Financial returns

Researchers of financial returns broadly fall in two categories. The first category analyses monetary returns to investors while the second studies PEs impact on accounting performance of portfolio companies.

Academics that study returns to investors analyze the cash flows between General Partners (GPs) and Limited Partners (LPs) on buyout or fund level. From this they usually calculate an absolute performance metric such has the internal rate of return (IRR), or a market adjusted performance measure like the public market equivalent (Kaplan and Sensoy, 2015; Robinson and Sensoy, 2016). Historically, US dominated research has found contradicting results when studying PE performance (Harris, Jenkinson, and Kaplan, 2014). However, more recent literature overwhelmingly concludes that PE funds outperform benchmark indices on a gross and net of fees basis (e.g. Nikoskelainen and Wright, 2007; Higson and Stucke, 2012; Acharya et al., 2013; Phalippou, 2014; Harris, Jenkinson, and Kaplan, 2014; Robinson and Sensoy, 2016). However, Academics argue that PE investments bare additional risks compared to public firm benchmark indices such as the S&P 500 (Sorensen and Jagannathan, 2013; Phalippou, 2014; Robinson and Senosy, 2016). Among these risks are operating, liquidity, and small firm risk. Some academics find that PE still outperforms post such risk-adjustment, but others find the contrary (Franzoni, 2012; Phalippou, 2014; Harris et al., 2014; Robinson and Sensoy, 2016).

Returns to creditors are less extensively studied, a result of poor data availability. Here, academics are forced to study default and credit recovery rates to access buyout debt attractiveness. Hotchkiss, Strömberg, and Smith (2014) conclude that leverage adjusted US buyout default rates are similar to other leveraged loan borrowers; while Citron, Wright, Ball, and Rippington (2003) report that recovery rates of UK MBOs are only slightly below recovery rates in comparable non-buyout firms. Contrarily, in a recent study Xiaping, Konan, and Khale (2018) use a unique dataset to analyze post-buyout bond performance on US LBOs, and conclude that PE-sponsored bonds underperform comparable benchmarks.

The second category of financial return research studies accounting performance of buyout firms. A difficulty with such measures is potential manipulation of financial statements around PE ownership (Cumming et al., 2007). Mao and Renneboog (2015) prove concerns of earnings management as they report significant negative earnings management in companies prior to buyout and positive earnings management in non-buyout companies. Additionally, Katz (2009) finds that during PE ownership buyouts engage less in earnings management and have higher earnings quality compared to non PE backed companies. Unfortunately, a solution or correction for such manipulation does not exist. Financial return results based on accounting measures should therefore be interpreted with some caution.

In a pivotal piece, Kaplan (1989) finds increases in operating income and net cash flow as well as decreases in capital expenditures post buyout. Since then, various academics have published similar literature using a variety of accounting performance measures. Most often used measures are sales growth; earnings before interest and taxes (EBIT); earnings before interest, taxes, depreciation, and amortization (EBITDA); asset productivity; net cash flow; and working capital efficiency measures (see for example Kaplan, 1989; Acharya et al. 2013; or the below summarized literature).

Over the years, these researches have found contradicting results between time periods, geographies and datasets; but more recently a general consensus seems to have been formed. Using different sample periods and both country specific as well as cross-country datasets, recent literature on buyouts concludes that PE ownership has a positive effect, on average, on accounting performance of portfolio companies (Kaplan and Strömberg, 2009; Cumming et al. 2010; Renneboog and Vansteenkiste, 2017). Renowned UK sample examples include Wright, Wilson, and Robbie (1996)

who find significant higher increases in return on assets among MBOs compared to non-MBO firms; Cressy et al. (2007) who show that in the three years post buyout operating profitability of PE buyouts is greater than that of comparable non-buyout companies; and a paper by Acharya et al. (2013), where authors report higher improvements in sales and operating margin during PE holding phase compared to quoted comparable firms.

However, recent academic publications by Guo et al. (2011) and Acharya et al. (2013) indicate that the advantage to PE ownership may be declining over time. This seems plausible given the continuous changes in the PE environment (Ghai et al., 2014), and underlines the importance of repeatedly replicating and improving research in more recent sample sets.

2.2.2. Real returns

In a quest to put data to discussions on PEs contribution to society, academics have come up with a variety of measures to proxy for short- and long-term contribution. Such proxies can be defined and measures in numerous ways. The most appropriate measure can vary between discussions, stakeholders, or geographies. However, three topics: economic efficiency, employment, and innovation repeatedly come back in public discussions and have received most academic attention. This section will therefore focus on these measures as proxies for real returns.

Economic efficiency, henceforth called productivity has historically been analyzed using firm-level data. Though this economically make sense, Cumming et al. (2007) identify two drawbacks that make this level of analysis inappropriate. First, productivity measures require comprehensive information on capital and intermediate materials, data which is typically not reported. Second, accurate measuring involves conversion to constant dollar terms. This requires accurate deflating of input and output prices, a rather difficult exercise because companies often operate across diverse industries and geographies (Cumming et al., 2007). Several authors have overcome these limitations by studying the productivity of individual plants of other type of physical firm units (e.g. Lichtenberg and Siegel, 1990; Harris, Siegel, and Wright, 2005; Bharath, Dittmar, and Sivadasan, 2014). Results are not unanimously positive but generally are in line with the consensus put forward by Cumming et al. (2007) that LBOs enhance productivity.

Public concern about PE's impact on employees has resulted in a significant body of academic research on measures such as employment growth, employee compensation, and work quality. Most

extensively researched is employment growth. Nathusius and Achleitner (2009) review 43 archival data, survey and case studies on the topic. Results paint an inconsistent picture across publications. A recent paper by Davis et al., (2014) provides answers to the apparent discrepancies by analyzing buyout level employment growth simultaneously from both a job creation and destruction perspective. Results indicate a much higher job reallocation pace than previously found and only 1% post adjustments net job losses. This leads them to the conclusion that PE firms catalyze the creative destruction process in labor markets, a conclusion few economics will classify as harmful for society.

Amess, Girma, and Wright (2008) study PEs impact on wages and find no significant effect. This is in congruence with a study by Lichtenberg and Siegel (1990), several survey studies reviewed by Nathusius and Achleitner (2009), and a paper by Bacon, Wright, Ball, and Meuleman (2012). In terms of work quality, limited academic evidence exists. However, though critics often hypothesize a decrease in resource allocation to employees based on value transfer theories, the evidence seem to point to the contrary as employee training and involvement are found to increase post buyout (Bacon, Wright, and Demania, 2004; Bruining, Boselie, Wright, and Bacon, 2007).

Research on post buyout innovation intensity is severely limited by data availability. Few firms disclose R&D expenditures, let alone specific allocations of these expenditures. Not surprisingly, studies based on R&D intensity generally fail to provide conclusive evidence about PEs impact on innovation (Lichtenberg and Siegel, 1990; Long and Ravenscraft, 1993). A more recent line of study examines PE's impact on innovation through patent activity and quality. Lerner, Sorensen, and Strömberg (2011) find that patents of LBOs receive more citations and become more concentrated in important areas of companies' innovative portfolios. Similarly, Amess, Stiebale, and Wright (2016) conclude that PE buyouts experience an increase in quality-adjusted patent stock in the 3 years post buyout. Hereby the two papers also directly provide evidence inconsistent with the criticism that PE firms sacrifice long-run performance for short-term financial profits.

Other academics point to the fundamental differences between innovation in public and private firms. Ferreira, Manso, and Silva (2014) develop a model through which they show that public ownership is optimal for firms exploiting existing ideas while private ownership structures are optimal when exploring new ideas. Link, Ruhm, and Siegel (2013) conclude that PE investments accelerate both development and commercialization of research-based technologies. While Popov and

Roosenboom (2009) find that PE investments account for 8% of aggregate industrial spending, but for as much as 12% of industrial innovation.

In conclusion, academic findings increasingly seem to be in accordance with a general consensus that PE generates positive and often outperforming financial and real returns. This conclusion poses the question how these returns are created. This forms the starting point for the next section.

2.2.3. Value creation

Value creation in LBOs is a combination of a variety of value generating levers that simultaneously and consecutively generate value over the timeline of a LBO (Berg and Gottschalg, 2005). The timeline of a LBO can be distinguished into three phases: the acquisition phase, holding phase, and divestment phase. Each phase provides opportunities to create value and thus room for outperformance by specialized PE firms. The following sections will therefore discuss each phase and its most prominent value creation levers.

2.2.3.1. Selection & acquisition phase

A PE investment process starts with the identification of possible target companies. Broadly, one can distinguish between three ways through which investment opportunities can end up on the desk of a PE manager. The first one is by actively searching for potential targets themselves. PE managers often have substantial financial, strategic or investment experience (Acharya et al., 2013), and use this to identify attractive targets (Kaplan & Strömberg, 2009). Secondly, PE firms rely on the network of GPs for the sourcing of deals. Through contacts from earlier investments or previous jobs PE managers can become aware of interesting opportunities. Thirdly, M&A advisory firms often reach out to PE firms with investment proposals. Because competition between buyers can drive up prices and reduce investment opportunities, PE firms prefer to generate "proprietary deal flow", deal flow in which a PE firm has the first chance to purchase a target (Gompers, Kaplan, and Mukharlyamov, 2016). Identifying targets through the first two paths is therefore generally seen as most value creating and preferred by PE firms.

Once opportunities have been identified the acquisition phase starts. PE firms perform rigorous financial and commercial due diligence through which they familiarize themselves with the company. PE manager scrutinize elements such as the company's management, role in the supply

chain, its competitive environment and long-term prospects. This process is key for overcoming information asymmetries and the valuation of a target (Gadiesh and MacArthur, 2010). The valuation and corresponding acquisition price that buyer and seller agree upon are probably the most important part of this phase (Berg and Gottschalg, 2005). The acquisition price determines the amount of invested capital by a PE firm and thereby sets the hurdle for returns. Achleitner, Braun, and Engel (2011) confirm this as they find that multiple expansion, and thus a low entry price is a key fundamental factor in explaining returns to buyouts. Additionally, Jenkinson, Morkoetter, and Wetzer (2018) show that key in this process is a PE firm's ability to time markets, and make investments when pricing conditions are favorable.

During this phase PE manager also already make plans for the subsequent holding phase (Berg and Gottschalg, 2005; Heel and Kehou, 2005). PE firms tap in their operating and industry knowledge to identify value creating opportunities for targets and cooperate with management to develop these into a business plan. Additionally, deal structuring decisions on the level of financial leverage, management's equity contribution, and incentive schemes are made in this phase.

The selection of targets, negotiating of acquisition prices, and developing of business plans are of such importance that academics have declared value generation in buyouts to be "front loaded" (Baker & Montgomery, 1994; Berg and Gottschalg, 2005). They argue that most of an investment's total value generation is already determined in this phase and hereby underline the importance of this phase.

2.2.3.2. Holding phase

During the holding phase PE investors make significant changes in portfolio companies and exploit a variety of value generating levers. Kaplan and Strömberg (2009) list three fundamental sets of changes through which PE firms create value during the phase: operational engineering, governance engineering, and financial engineering.

Operational engineering refers to the industry and operating expertise that PE firms lend to portfolio companies. PE managers often have previous PE investment experience or backgrounds in finance, consulting, or target industries; and actively use their financial, operational, strategic, or industry experience to the benefit of portfolio companies (Gompers et al., 2016). In addition to that,

PE firms often hire consultants to advise and implement operational improvements or to increase strategic distinctiveness (Kaplan and Strömberg 2009; Gompers et al., 2016).

Through a combination of among others cost cutting, more efficient use of existing assets, organic expansion, and M&A driven expansion, PE firms aim to realize both top- and bottom-line improvements in portfolio companies. Acharya et al. (2013) find that these operational improvements are important explanatory factors in explaining the postive abnormal performance of PE funds. The authors also identify heterogeinity among PE firms, as they find relations between the backgrounds of individual PE managers and the sources of abnormal performance in the buyouts they manage. Managers with an industry-related or consuling background are associated with outperformance through internal operational improvements while managers with a finance background outperform through mergers and acquisitions (M&A).

The other two changes, goverance and financial engineering are interrelated. The value creating levers of both of these strategies for a large part result from the remediation of agency problems. Agency problems are complications that result from the seperation of ownership and control in a firm. Due to the relatively small ownership stake of managers in large corporations, incentives of managers can be misaligned with those of shareholders (Fama & Jensen, 1983). This reduces managers' motivation to maximize shareholder value, and can even result in the undertaking of value destroying activities (Jensen, 1989). The risk of managers engaging in such value destroying activities increases with the availability of excess cash in businesses. PE managers therefore put substantial effort in reducing free cash flow and in realigning incentives between management and shareholders (Jensen, 1986; Wright, Hoskisson, and Busenitz, 2001; Kaplan and Strömberg, 2009).

Realigning incentives of portfolio management and shareholders is a value creating lever classified as governance engineering. PE firms typically grant portfolio management significant equity stakes or options in the company they manage and force management to co-invest a substantial amount of personal wealth at time of the buyout transaction (Kaplan, 1989; Kaplan & Strömberg ,2009; Acharya et al., 2013). As the managers effectively become co-owners of the companies, their incentives become better aligned with those of the PE managers and potential agency problems are reduced (Jensen, 1989; Renneboog, Simons, and Wright, 2007). Among academics, increasing managerial equity ownership is seen as one of the key drivers of post buyout outperformance by PE

(Wright, Gilligan, Amess, 2007). Futhermore, PE firms typically introduce a number of pay-to-performance measures for managers and other employees (Leslie and Oyer, 2008). Empirical support for the effectiveness of this strategy is provided by Wright et al. (1994) and Heel and Kehou (2005).

A second line of governance engineering value levers refers to the way in which PE investors control the boards of portfolio companies. PE managers generally exercise tighter control over companies and more actively monitor their performance than other type of shareholders (Wright et al., 2009). PE portfolio company boards are smaller and meet more frequently than those of comparable public companies (Acharya and Kehou, 2008; Cornelli and Karakas, 2008). PE firms are also more likely to replace inefficient or underperforming management teams (Acharya and Kehoe, 2008). Heel and Kehou (2005) find evidence for the effectiveness of such strategies as they report that 83% of the best performing but only 33% of the worst performing buyout deals either strengthened or completely changed the composition of their management team.

Financial engineering is the optimization of a company's capital structure. In practice PE firms almost always increase the leverage in portfolio companies when they acquire a company. Financial engineering levers are among the most widely used value levers by PE firms (Berg and Gottschalg, 2005), and are found to be one of the main sources shareholder wealth creation (Renneboog et al., 2007; Achleitner, Braun, Engel, Figge, and Tappeiner, 2010). However, its relative importance seems to be smaller in more recent buyouts time, this will be discussed in Section 2.3.

One of the advantages of increasing leverage is a reduction in agency costs. The enlarged debt burden results in higher interest payments and compels managers to service these. This reduces managers' possibilities to undertake non-value maximizing behavior and forces them to efficiently manage the company to avoid bankruptcy (Jensen, 1986; Stulz, 1990; Renneboog et al., 2007). Bankruptcy is especially costly for managers because they incur both financial losses, as well as severe reputational damage. This provides a strong incentive to work hard (Grossman and Hart, 1986). Further reductions in agency costs come from an increased governance by creditors. To protect their interests and ensure that companies are able to fulfill financing duties, creditors set strict debt covenants. Violation of these covenants can result in negative financial consequences for portfolio companies and thereby provides strong constraints for management.

A second key advantage of high leverage is the resulting tax shield it provides. Due to the tax-deductibility of interest payments higher interest payments can substantially enhance enterprise value. Support for the effectiveness of this value lever is provided by Achleitner, Andres, Betzer, and Weir (2010), but the size of its benenfit differs between geographies (Weir et al., 2005).

It should be mentioned that higher levels of leverage also come with costs such as financial distress and bankruptcy risk. Andrade and Kaplan (1998) study 31 highly leveraged transactions that became financially distressed, and identify high leverage as the primary cause of distress. Financial distress costs are estimated to be 10 to 20 percent of firm value, conditional on the firm becoming distressed. This seems large, but from an ex ante perpective, the expected costs of financial distress are modest compared to tax and incentive benefits (Andrade and Kaplan, 1998). Furthermore, Tykvova and Borell (2012) find that PE buyouts increase distress risk in firms, but that this risk does not translate into higher bankruptcy rates compared to comparable non-buyout companies.

A second cost to leverage may stem from a loss in profitable growth. Hitt, Hoskisson, and Ireland (1990) argue that managers of multi-divisional form (M-form) firms can be too focussed on efficiency enhancement activities and eliminate profitable expenditures and growth opportunities in the process. The decision making process in PE firms is very comparable with that of typical M-form firms. (Knill, 2009; Nadant et al., 2018). Thus, if PE firms rely too much on financial controls, then high leverage in LBOs may induce managers of short-termism (Hitt et al., 1990). Focussing primarily on interest and debt repayment obligations may then result in a disregard of strategic concerns (Long and Ravenscraft, 1993), and come at the cost of profitable growth.

2.2.3.3. Divestment phase

In the divestment phase a PE firm exits its investment. In this final phase everything resolves around the exit price as this deterimines the return on investment.

There are three succesful modes of exit for buyouts: Initial Public Offerings (IPOs); SBOs; and trade sales, sales to a strategic buyers (Rigamonti et al., 2016). Several papers document a positive link between exit value and the likelihood of exiting investments through an IPO (Gompers, 1995; Cumming and MacIntosh, 2003; Plagborg-Møller and Holm, 2017). This has led academics to portray IPOs as the preferred exit route, while SBOs were traditionally seen as exit of last resort for pressured PE firms (Wright et al., 2009; Arcot et al., 2015). However, recent literature suggests that this may be

mistaken and that preferred exit routes vary with market conditions and various portfolio characteristics (Jenkinson and Sousa, 2015).

Exiting through IPOs is only available for companies that signal of a wide variety of quality characteristics such as high profitability and independent growth prospects (Bienz and Leite, 2008; EY, 2017). Trade sales exits can be particularly interesting in situations where targets offers large synergic potential for buyers. SBOs are more suited for companies that are able to bear large amounts of debt or require long term development (Jenkinson and Sousa, 2018). Academic research has shown that, on average, market outpeforming returns are generated by buyouts with each mode of exit (Nikoskelainen and Wright, 2007). However, the differences between portfolio companies with different exit routes imply that key to maximizing these returns, is to shape portfolio companies towards a structure that optimizes its attractiveness for the spefic route of exit. Here a large role for PE managers exists. The best GPs select targets based on these criteria, shape companies towards this structre during the holding phase, and have the ability to credibly communicate resulting value potential to buyers in the divestment phase.

In addition to shaping companies, also the timing of exits plays an important role in maxizing return on investments. Research has shown how market conditions impact exit prices (Jenkinson and Sousa, 2015), and that PE firms benefit from market timing abilities (Jenkinson, Morkoetter, and Wetzer, 2018).

2.3 Changes in the Private Equity industry

Since its emergence in the early 1980s the PE market has developed substantially. Recent years have seen successive records of fund raising and deal value. Also in terms of investment behavior and strategies a lot has changed. Understanding what has shaped the PE industry is crucial when examining its current state or previous academic literature. This section will therefore provide an overview of the historic developments in the PE industry.

2.3. Private Equity industry development

Over the years, the boom and bust patterns in PE fund raising and transaction activity have led academics to believe that PE activity comes in waves (Kaplan and Strömberg, 2009). Generally, academics distinguish between a first wave that started in the 1980s and a second wave that emerged in the late 1990s (Wood and Wright, 2009). The coinciding of PE booms with high debt market

liquidity suggests that debt market conditions may play an important role in explaining PE activity. Kaplan and Strömberg (2009) identify several historic patterns consistent with this view. Ljungqvist, Richardson, and Wofenzon (2017) confirm this and find that the investment pace of established PE funds accelerates when credit market conditions loosen. A second reason for the cyclicality in PE activity seems to be lagged response of investors to recent returns (Kaplan and Strömberg, 2009), and general economic conditions.

Certainly, these reasons explain part of the historic variation in PE activity, but in each wave there were also time specific factors that drove investment behavior. The first buyout wave is generally seen as a response to intensified agency problems in corporations. The forming of diversified conglomerates had exacerbated these problems and resulted in inefficient, passive corporations which PE firms could quickly revitalize using financial and governance engineering (Jensen, 1989; Kaplan and Schoar, 2005). Contrarily, when the second wave emerged, the shareholder value focus and incentive realignment techniques that PE firms were famous for had largely been institutionalized by non-buyout corporations (Holmstrom and Kaplan, 2001; Weir and Wright, 2015). The lack of financial and governance engineering opportunities forced PE firms to increasingly rely on operational engineering and growth for value creation (Ghai et al., 2014). Other driving factors behind this second wave were firm undervaluation by public investors, and the natural advantage that private ownership offers to firms that undergo restructurings or to firms that are developing longer term opportunities (Wright et al., 2007; Renneboog, Simons, and Wright, 2007; Ferreira, Manso, and Silva, 2014).

The financial crisis and resulting liquidity crunch in credit markets seemed to put an end to the second PE wave. From 2007 to 2009 global buyout deal volume more than halved while deal value was less than 15% of 2007 records (Bain & Company, 2018). However, in subsequent years the PE market quickly rebounded. Key to this resurgence was the recovery of the credit market but also the increased focus of PE firms on operational engineering seems to have played a role. Through operational engineering PE firms create value, which provides them a permanent right to exist (Kaplan and Strömberg, 2009). Since then, the PE industry has experienced another boom. Recent years have seen successive records in PE fundraising around the world (Preqin, 2017). One could argue this recent boom a third wave. However, the industry's quick rebound after the worst financial crisis in almost a century points to a more permanent role for PE.

2.3.1. Heterogeneity and specialization

The second wave and post-financial crisis boom of PE came with new implications for the industry. Solid performance of the industry led to an increase in the number of PE firms, while at the same time public acquirers also became more active (Bain & Company, 2018). This resulted in increased competition with limited investment opportunities and target prices being driven up. These developments may explain the lower returns academics find in more recent samples (Acharya et al., 2013; Bain & Company, 2018).

Additionally, the institutionalization of shareholder value focus and incentive realignment techniques by non-buyout corporations significantly reduced the amount of obvious investment opportunities. As a result, PE firms increasingly dependent on operational engineering as a means of value creation. This has pressured PE firms to distinguish themselves and develop a competitive advantage over peers (Kaplan and Strömberg, 2009). In the pursuit of differentiating capabilities, PE firms specialized among the lines of industries, geographies, buyout types, buyout development stage, or investment horizon (Cressy et al., 2007; Lossen, 2007; Guo et al., 2011). By 2009, Kaplan and Strömberg (2009) reported that most top PE firms are organized around industries. Additionally, academics have identified several other sources of heterogeneity among VC and PE firms in terms of funds under management, age, size, managerial style, reputation, previous experience, and support intensity (Bottazzi et al., 2004; Jungwirth & Moog, 2004; Gompers et al., 2005; Manigart et al., 2006; Castellaneta and Gottschalg, 2016).

Even though the research community increasingly recognizes heterogeneity in the PE industry, few studies have actually quantified its impact on the performance of buyout companies (Cressy et al., 2007; Castellaneta and Gottschalg, 2016). In their recent study, Castellaneta and Gottschalg (2016) find that a significant portion of the variance in buyout performance depends on PE firm specific factors, and that this effect becomes stronger over time and in situations in which value creation is complex. This implies that PE firms are indeed endowed with different resources or capabilities, but the authors make no attempt to identify these endowments. A study by Acharya et al. (2013) fills this void by identifying that PE managers with operational backgrounds generate higher outperformance in buyouts that rely on organic growth, while managers with financial backgrounds outperform in inorganic M&A-driven strategies. Degeorge et al. (2016) confirm these findings in a sample of secondary buyouts, and additionally find divergence in returns as a result of PE

heterogeneity in strategies and geographical investment scope. Furthermore, in a renowned but questionable piece, Cressy et al. (2007) conclude that the level of industry experience relative to other PE firms positively correlates with target profitability in the first three years post buyout.

Despite these relevant findings, many questions about the sources of variance in buyout performance remain unanswered for academics and PE sponsors (Castellaneta and Gottschalg, 2016). Even PE houses themselves do not seem fully aware of their resources, as Acharya et al. (2013) report that PE houses do little skill matching between PE managers and deal strategies. Out of the partners with operating backgrounds, 34% is assigned to organic deals, while a similar 30% is assigned to inorganic deals. Nevertheless, identification and exploitation of such sources seems increasingly relevant. In the past, LPs relied on the existence of persistence in PE firm returns for identifying which funds to invest in (Ghai et al., 2014). However, recent literature finds that persistence of returns in recent samples may not be as strong as before (Harris, Jenkinson, Kaplan, Stucke, 2014). While a firm's track record may no longer be a reliable indicator, the reward for selecting the best PE firms remains substantial (Ghai et al., 2014; Castellaneta and Gottschalg, 2016).

This research ought to provide guidance to PE managers, LP investors, and target management by providing deeper insight into one of the main potential drivers of PE performance: industry specialization. If industry experience is found to be a valuable resource for PE firms, PE houses may want to review their industry-specific competences, increase industry specialization, and learn to credibly communicate such expertise to sponsors and targets. LP investors would have to invest in developing capabilities for identifying such expertise.

2.4. Private Equity industry specialization

To gain a good understanding of academics' current view on PE industry specialization and the resulting avenues for further research, this section starts with a summary of existing literature. It will then discuss the advantages to specialization, situations in which these advantages are larger, the possible impact of industry selection, and simultaneously advance the research hypotheses.

2.4.1. Existing literature

Despite its value potential and increasing importance, academics have only skimmed the surface of PE industry specialization. More research has been done on VC industry specialization, but the previously described differences between PE and VC impede extrapolation of results between

the two investment classes. Also with regards to industry specialization there may be significant differences between VC and PE firms. The higher risk and uncertainty of VC early growth investments can induce VC firms to specialize faster following the Resource-Based view (Norton and Tenenbaum, 1993), or instead diversify further as dictated by the Risk Diversification view. Additionally, as resources and opportunities in VC and PE firms differ substantially, so may the added value of an industry specialized owner.

To the best of my knowledge, Ljungqvist and Richardson (2003) were the first to study the effect of industry specialization among PE firms. They analyze 73 PE funds in which US institutional investors invested over the period 1981 to 1993. Though the authors find proof that PE funds tend to specialize in certain industries, they find no significant impact of industry specialization on fund returns. Lossen (2006) uses a sample of mostly first wave PE fund returns gathered by European fund-to-fund investors, and finds that PE fund returns increase with industry diversification, implying that specialization can negatively affect returns.

In a pivotal paper, Cressy et al. (2007) were the first to study the impact of PE firm industry specialization on individual buyout performance. The authors use a sample of 122 UK buyouts from 1995 to 2002 and identify specialization relative to other PE firms using the Index of Competitive Advantage (ICA). They find that buyouts backed by industry specialized PE firms have an 8.5% higher operating profitability over the 3 years post buyout compared to buyouts backed by generalist PE firms but find no effect on sales growth. Contrarily, Meuleman et al. (2009) also identify specialization using the ICA but do not find that industry specialization by PE firms enhances target profitability. Meuleman et al. (2009) use a sample of 238 UK buyouts transactions over the period 1993-2003. Furthermore, also Gottschalg and Wright (2011) conclude that industry focus of PE firms does not impact returns or value creation in investees.

The literature thus reports mixed empirical evidence on the impact of PE industry specialization. A possible explanation for these contradictions can be the different time periods in which the researches were conducted. First wave PE investments relied mostly on financial engineering for value creation. Operational engineering only gained importance during the second wave that emerged late in the 1990s (Ghai et al., 2014). As previously hypothesized, advantages to industry specialization for value creation through financial engineering are limited. It thus seems

plausible that the added value of an industry focus only signified during the second wave. This can possibly explain why Cressy et al. (2007), using a mostly second wave sample, finds a positive impact of industry specialization while Ljungqvist and Richardson (2003) and Lossen (2006) find negative or no effects.

Yet, such differences cannot explain the contradicting results of Cressy et al. (2007) and Meuleman et al. (2009). Cressy et al. (2007) use a UK sample of deals completed from 1995 to 2002, and Meuleman et al. (2009) examine UK buyouts between 1993 and 2003. Furthermore, both papers study portfolio company performance, proxy for industry specialization through the ICA and measure profitability by dividing operating profits with total assets. A possible explanation for the contradiction may be that Cressy et al. (2007) measure performance using the mean profitability ratio over a three-year period post buyout, while Meuleman et al. (2009) analyze the change in profitability ratio between the year of buyout and 3 years after the buyout.

The approach of Cressy et al. (2007) is questionable. The authors study absolute profitability levels during the holding phase, but do not examine the change in profitability levels during PE ownership. Hence, nothing can be concluded on the impact of PE specialization during the holding phase. This is further emphasized by their reporting that initial profitability levels account for 90% of variation in post-buyout profitability among firms in their sample. Cressy et al. (2007) argue that this thus emphasizes the importance of industry specialists' skills in selecting investments, but it can be questioned to what extent simply selecting highly profitable companies requires any skill. This methodological difference between Cressy et al. (2007) and Meuleman et al. (2009) may possibly explain their contradicting results, and raises concerns about the reliability of results by Cressy et al. (2007). Further emphasis is put on this issue by the fact that Cressy et al. (2007) do not find any impact of PE industry specialization on turnover growth, arguably the most obvious route for industry specialized PE firms to outperform in.

The mixed empirical results demonstrate the need for further research. As of today, no international nor UK specific consensus on the impact of industry specialization on buyout performance exits. However, in a recent paper, published during the writing of this thesis, Nadant et al. (2018) shed new light on the effect of industry specialization by PE firms. The authors use a sample of 217 French primary buyouts between 2001 and 2007 and identify specialization using the ICA.

Results indicate that buyouts backed by industry specialized PE firms experience a 7.5% larger increase in operating profitability than buyouts backed by generalist PE firms. Industry specialization is also found to contribute to target growth in situations where value enhancement opportunities are hard to reach. Additionally, they find that the magnitude of the industry specialization effects differ between PE firms, which further emphasizes heterogeneity between PE houses.

This research will contribute to existing literature by examining the effect of PE industry specialization on buyouts in the UK. Hereby it will provide solutions to the questions resulting from the mixed empirical evidence by Cressy et al. (2007) and Meuleman et al. (2009). Additionally, it will immediately extend the recently published paper of Nadant et al. (2018) by studying the effect of industry specialization in a different country and time period; by diving further into when and how specialization benefits companies; and by studying both primary and secondary buyouts, the importance of which will be explained in Section 2.5.

2.4.2. Advantages and disadvantages to industry specialization

The relationship between specialization and returns can be addressed through two different theoretical frameworks, the Risk Diversification view and the Resource-Based view. The former builds on the Modern Portfolio Theory argument that investment choices should be based on a simultaneous evaluation of a portfolio's risk and return. From this idea it follows that risk averse investors should maximize returns while simultaneously eliminating idiosyncratic risk by investing in a variety of assets (Norton & Tenenbaum, 1993). Through the same lens, PE firms can thus create value by reducing industry specific risk exposure by diversification across industries.

However, the Risk Diversification view builds on public market theories where investors cannot influence the performance of assets. Private Equity, on the contrary, is an active asset class, with proven impact on the performance of its investments. This impact is formalized through the Resource-Based view, this view states that each firm can be characterized by its own collection of resources and capabilities (Smit and Trigeorgis, 2004). If such resources are valuable, scarce, hard to imitate, hard to replace, and enable a firm to perform activities more efficiently than competitors, they can be a source of competitive advantage. The leveraging and scarcity of such firm-specific resources and capabilities are fundamental for the value creation of a firm, and will enable it to generate returns in excess of its cost of capital (Smit and Trigeorgis, 2004). Resource differences

between PE firms likely satisfy these requirements because they take significant time to develop and are long-lived due to low mobility of resources across firms (Castellaneta and Gottschalg, 2016).

The accumulation of such resources is a combination of resource acquisitions and organizational learning. This accumulation is stimulated when focused on specific areas, such as industries (Norton & Tenenbaum, 1993). If focusing on an industry results in a stronger network or better understanding of industry trends such as competition and technology, specialized PE firms will possess additional resources, and thus hold a competitive advantage over generalist peers. This advantage may help specialist PE firms outperform during each of the three investment phases.

The two theories hold contradicting views on the return to industry specialization. The Risk Diversification view dictates that investors should diversify across industries while the Resource-Based view states that investors should specialize. These apparent costs and benefits have led academics to argue that PE firms should optimize the two at the margin (Cressy et al., 2007). However, though the cost of reduced diversification is likely substantial on fund and firm level, the relevance of this for LP investors is questionable. LPs are usually invested in a variety of investment funds and hence can fully eliminate losses in diversification by allocating capital over PE firms that specialize in different industries, or even through investing in public markets. Therefore, the focus of this research lies on the potential benefits to specialization as a result of Resource-Based effects.

PE specialization can be viewed on three levels: at the level of individual GPs, at the fund level, or at the firm level. On all three levels academics have previously concluded that heterogeneity can impact PE returns (e.g. Gompers et al., 2009; Acharya et al., 2013; Humphery-Jenner, 2013; Nadant et al., 2018). However, Gompers et al. (2009) argue that the effect of firm level experience supersedes other levels as knowledge sharing has a disseminating effect on experience within firms. The plausibility of this argument is supported by the fact that the payoff structure of GPs usually depends on fund or firm level results rather than GP or buyout specific performance. This research will therefore analyze PE industry specialization on the firm level.

The additional resources of industry specialized PE firms can impact returns in various ways throughout the investment period. To provide a clear overview of the full possible impact of this resource, the following section will summarize its possible benefits and costs according to the same dimension as in Section 2.2.3.

2.4.2.1. Selection & acquisition phase

During the selection & acquisition phase industry specialists can benefit from several advantages and disadvantages. In terms of potential deal flow, industry specialization has an ambiguous effect. Restricting deal sourcing to a single industry will, by definition, shrink the universe of available investment opportunities. Though this effect can be offset if specialization results in a superior network and PE firms successfully lever this network in the sourcing of deals, it is unlikely that this can fully compensate the loss in available targets. In line with this reasoning, Gejadze, Giot, and Schwienbacher (2017) find that specialized PE firms take longer to build a portfolio of companies. On the other hand, the superior network of industry specialists may result in more proprietary deal flow. This can prove very valuable as such deals are typically associated with reduced competition and lower acquisition prices.

Regarding selection, Cressy et al. (2007) hypothesize that industry knowledge reduces information asymmetries between potential investment targets and PE firms. This stems from a better understanding of industry dynamics and previously acquired knowledge on the average company's private probability of success in an industry (Eisenhardt, 1989; Cressy et al., 2007). Furthermore, uncertainty is reduced because domain knowledge will give better insights into market prospects of target companies. This can improve the selection capabilities of PE firms. Fiet, Norton, and Clouse (2007) empirically confirm this hypothesis as they conclude that constrained systematic searches within a specialist's domains are superior to unbounded searches that rely on a state of heightened awareness to identify targets. Additionally, reduced uncertainty and information asymmetries can strengthen a PE firm's bargaining position and ability with vendors and other firm stakeholders.

In terms of investment timing, industry specialization can form a relevant advantage in this phase. Because specialists better understand industry dynamics, they may be able to see opportunities earlier or know when to postpone investments. Gompers, Kovner, Lerner, and Scharfstein (2008) find that investment activity by industry experienced VC firms is most responsive to favorable public market investment signals. However, the authors do not find a significant difference in success rates between deals done in hot and cold markets.

A last potential benefit in this phase may stem from superior deal structuring. The process of issuing debt is relatively homogenous across industries and a routinely performed activity by PE firms. Though some papers suggest that renowned PE firms are able to obtain slightly cheaper loans with looser covenants (Demiroglu and James, 2007; Ivashina and Kovner, 2008), value creation advantages to specialization seem limited here. Jenkinson and Stucke (2011) even find that leverage is so equally available to lenders that the majority of tax shield benefits accrue to vendors through higher takeover premiums. However, as Section 2.2.3.2 described, high levels of leverage come with both benefits and costs, and optimizing leverage forms a trade off that PE managers should optimize at the margin. The deep industry knowledge of specialized PE firms may help determine the optimal level of leverage and hereby create value for PE firms. Tykvova and Borell (2012) confirm the plausibility of this argument as they find lower bankruptcy rates among buyouts backed by experienced PE funds compared to unexperienced counterparts.

2.4.2.2. Holding phase

Specialization in a certain industry can help PE managers to develop a better understanding of technological, market, and competitive dynamics surrounding a portfolio company. This will allow PE firms to more effectively leverage target resources in all three of the engineering dimensions identified by Kaplan and Strömberg (2009).

In terms of governance engineering, the reduced information asymmetries around buyouts and their industries will help PE firms in controlling and monitoring buyouts. Additionally, a superior industry network will help with recruiting high-skilled management.

Financial engineering is a relatively easy method for value creation. As a result, it seems unlikely that specialization will result in improved exploitation of its benefits. However, industry specialization may enable PE firms to reduce the costs to leverage. As previously described, financial engineering bares the risk of failing to capitalize on profitable growth opportunities. This leads to an advantage for industry specialized PE firms. By focusing on a specific industry, PE firms can become aware of new avenues for growth and value creation. As a result, they will better balance financial and strategic value levers, and can strengthen strategic controls that encourage creativity and innovation in buyouts (Bruining, Bonnet, and Wright 2004).

In a similar reasoning, PE firms may capitalize on industry specific knowledge for operational engineering activities. Domain knowledge can be useful in a variety of fields such as cost management, marketing policies, identification of targets for buy-and-build strategies, and the general leveraging of a target's resources (Meuleman et al., 2009). Additionally, the superior network of specialists can provide targets access to new suppliers, clients and partners (Hochberg, Ljungqvist, and Lu 2007).

As previously described, it is important that PE firms use the holding phase to shape portfolio companies to the needs of potential buyers. Especially when PE firms plan to exit through trade sales, the industry knowledge of specialists can form a valuable resource. PE firms with an industry expertise can be better at identifying synergic potential, or can have superior understanding of industry dynamics and future avenues for value creation.

Furthermore, specialized PE firms can also be quicker in identifying and exploiting value opportunities. This can shorten the holding phase of buyouts and increase an investment's IRR. Knill (2009) provides support for this hypothesis as he finds that the time to exit of VC investments is delayed as VCs become more diversified.

To summarize, during the holding phase specialized PE firms and their portfolio companies can benefit from another set of advantages. However, the design of this research does not allow to fully disentangle between returns to specialization between the selection & acquisition phase and the subsequent holding phase. The advantages of the two phases are therefore jointly tested in the following main hypothesis:

H1: The post-LBO change in performance of targets backed by PE firms that are specialized in the target's industry show a greater positive effect compared to other buyouts.

2.4.2.3. Divestment phase

In timing an exit, a specialized PE firm is likely to enjoy similar advantages as in the timing of acquisitions. The deep industry knowledge of specialists can help recognize favorable pricing conditions, or with early identification of upcoming obstacles that can negatively affect firm value.

Furthermore, the network advantage of specialized PE firms may help in finding the best buyers for portfolio companies. Especially in case of trade sales a specialist is likely to benefit from its

more sophisticated network. Furthermore, the superior shaping of portfolio companies during the holding phase can increase a target's attractiveness, and improve the bargaining position of a PE firm. In line with these arguments, Rigamonti et al. (2016) find that industry specialized PE firms are more likely to exit in trade sales. Additionally, the authors find that industry specialists are more likely to exit through IPOs, the route that has generally been identified as most profitable. This likely reflects the superior performance of buyouts backed by specialists, as well as the ability of specialized PE firms to certify the quality and independent growth prospects of companies (Rigamonti et al., 2016).

Advantages during the divestment phase should thus be studied through exit prices rather than the performance of portfolio companies. This is not the focus of this research and required data is not readily available. Advantages to specialization stemming from the divestment phase are therefore not studied in this research and are left as an avenue for future research.

2.4.3. Situations of increased returns to specialization

Previous academic literature has shown that the importance of decisions and resources at the PE firm level depends on the context of buyouts (Acharya et al., 2013; Castellaneta and Gottschalg, 2016). In situations where ample and relatively simple opportunities for value creation exist the impact of PE firm resources on buyout performance will be small. Contrarily, when value creation is complex the decisions and resources of PE firms become more valuable and will have a large impact on buyout performance.

Castellaneta and Gottschalg (2016) identify three contingencies that increase the challenges faced in buyouts and make PE firm heterogeneity more important. These are: (1) a value creation strategy that is more based on value addition than selection; (2) operating in a developed rather than developing economy; (3) periods of strong economic downturn. Nadant et al. (2018) address the first contingency and argue that initially high or low performing companies present buyouts in which value addition is more important and more complex. Targets with high initial profitability are argued to have less and further away potential for improvements, while low initial profitably targets require more complex and risky transformational value generating initiatives. The authors hypothesize that PE resources such as industry specialization are more valuable for both group of companies. Based on these arguments they advance and test the below hypotheses. This research will follow their pioneering work and test the two hypothesis in a sample with a different timeframe and geography.

H2a. The positive relationship between PE firm industry specialization and a target's post-LBO performance changes will be stronger for firms with low initial profitability.

H2b. The positive relationship between PE firm industry specialization and a target's post-LBO performance changes will be stronger for firms with high initial profitability.

Furthermore, this research will extent existing literature by addressing the third contingency identified by Castellaneta and Gottschalg (2016), periods of strong economic downturn. The recent financial crisis presents a perfect opportunity to test the effect of this contingency. During 2008 and 2009 the UK economy contracted, this made it harder for PE firms to reach return benchmarks and may have forced them to undertake more complex and transformational value creation initiatives. The advantages to industry specialization as described in Section 2.4.1 may therefore have become more valuable as they can improve a PE firm's ability to respond to the foreseen or unforeseen challenges. Based on this reasoning the following hypothesis is advanced:

H3. The positive relationship between PE firm industry specialization and a target's post-LBO performance changes will be stronger for buyouts held and acquired during the financial crisis.

2.4.4 Selecting industries

As previously discussed, specialization to specific industries also shrinks the universe of available investment opportunities. This can be especially harmful when investment opportunities are poor in an industry. In such situations, generalist PE firms can reallocate capital to industries where value creation opportunities are large (Stein, 1997). In contrast, specialized PE firms will be unable to invest in other industries. The optimal decision for as specialist would then be to wait for better times, but in an effort to employ available capital, they may end up investing in industries with poor prospects (Stein, 1997).

On the other hand, it seems plausible that PE firms increase investment intensity in sectors when these have a favorable outlook. Hereby, they accumulate industry specific experience and thus build an industry specialization in specifically the best performing industries. Plausibly, this may explain the positive returns to specialization Cressy et al. (2007) find when analyzing non-industry-adjusted performance of PE buyouts.

The importance of the above two contradicting theories is underlined by Valkama, Maula, Nikoskelainen, and Wright (2013). The authors identify industry allocation as a central PE performance driver and report that industry growth is a substantial driver of buyout returns. These contradicting views lead to the advancement of the following hypotheses:

H4a. Industry specialized PE firms operate in industries that perform better than industries wherein non-specialized PE firms acquire targets.

H4a. Industry specialized PE firms operate in industries that perform worse than industries wherein non-specialized PE firms acquire targets.

2.5. Secondary Buyouts

In addition to the larger focus on operational engineering and the development of differentiating capabilities, the PE industry saw another change during the second wave: the emergence of secondary buyouts (SBOs). Historically, PE firms bought out companies that were publicly traded, divisions of corporations, or under non PE private ownership. These were companies that for the first time since incorporation came under PE ownership, primary buyouts (PBOs). Plausibly also driven by increased competition in both the acquisition and exit phase, the last 2 decades have increasingly seen PE firms sell companies to each other. Those companies then come for a second, or even third or fourth, consecutive time in the hands of PE firms, and are in this research all referred to as SBOs.

SBOs have evolved from a rarity in the 1990s to an integral part of the PE market today; over the last decade SBOs accounted for almost 40% of total exit volume (Cumming et al., 2007; Wright et al., 2009; EY, 2018). This growth has not been exempt of criticism, both academics and practitioners have questioned whether value creation motives can explain the surge in SBOs. This criticism is founded in arguments that operating performance opportunities in SBOs are already exploited by primary PE owners, the observation that the SBO growth coincides with booms in debt market liquidity and PE fund inflows, and concerns that SBOs are used to maximize management fees by investing excess capital near the end of PE fund investment periods (Cumming and MacIntosh, 2003; Cumming et al., 2007; Smit and Volosovych, 2013; Degeorge et al., 2016).

When trying to assess the differences between primary and secondary buyouts, academics have found contradicting results. Achleitner and Figge (2014) study a global sample of SBO

transactions and find no evidence of lower equity returns or fundamentally lower operational value creation in SBOs. Contrarily, Bonini (2015) uses a Western European sample and concludes that SBOs underperform their primary counterparts in terms of operational improvements. Wang (2012) and Smit and Volosovych (2013) confirm this finding in a UK sample. However, Smit and Volosovych (2013) also find that even though operating performance of targets does not improve, returns to SBO sponsors are still positive and statistically significant.

A second line of research studies the economic motivations and pricing of secondary buyouts. Both Wang (2012) and Arcot, Fluck, Gaspar, and Hege (2015) find that funds under pressure are more likely to exit through SBOs and that SBO buyers pay higher prices. Wang (2012) concludes that SBOs merely serve to alleviate financial needs of PE firms. Results of Arcot et al. (2015) confirm this view and additionally show that funds investing under pressure underperform.

In a recent paper Degoerge, Martin, and Phalippou (2016) combine the two lines of research and find a possible explanation for the contradiction in research results. The authors find that SBOs undertaken under pressure underperform and destroy investor value, while SBOs made under no pressure perform as well as others.

The results illustrate the differences between primary and secondary buyouts and the importance of distinguishing between the two when analyzing PE returns. Both Cressy et al. (2007) and Nadant et al. (2018) focus solely on PBOs. Because SBOs are nowadays an integral part of the PE industry, the authors thus fail to illustrate the true effect of PE industry specialization in today's market. By examining the effect of PE industry specialization on portfolio company performance in a sample of both primary and secondary buyouts, this research will contribute to existing literature, and provide a more complete view on the returns to industry specialization.

2.5.1. Value creation in secondary buyouts

As previously discussed, value creation opportunities in SBOs are plausibly smaller because the most obvious opportunities are already exploited by primary owners. As a result, value creation in SBOs can be more complex and to a larger extend depend on value addition than selection or capturing. One can therefore argue that it classifies under the first contingency of Castellaneta and Gottschalg (2016), and forms a situation where returns to PE industry specialization are larger. This argument is formalized in the following hypothesis:

H5. The positive relationship between PE firm industry specialization and a target's post-LBO performance changes will be stronger in secondary buyouts.

Contrary to the previously listed concerns on SBOs, proponents of SBOs argue that some companies are just better suited to PE than to public ownership (Degeorge, Martin, and Phalippou 2013), or that SBOs still have ample residual value creation potential (Wang, 2012). This residual value can stem from situations in which PE firms are forced to sell early due the finite lifetime of their funds (Strömberg, 2008; Robinson and Sensoy, 2013), or from complementarities in resources between acquiring and selling PE firms (Wang, 2012; Degeorge et al. ,2016). However, identification of the specific sources of heterogeneity between buyer and sellers that form such complementarities is a relatively unexplored area among academics.

Recently, Degeorge et al. (2016) have pioneered research in this area and identified complementary skills between PE firms that impact the degree of value creation in SBOs. The authors conclude that SBOs perform better when they occur between margin improvement and sales growth focused PE firms, between PE firms where GPs have different educational backgrounds or career histories, or between global and regional funds. The impact on returns are economically significant, further underlining the importance of research in this area.

This research will build further on the work of Degeorge et al. (2016) by examining if industry specialization forms a complementary skillset between primary and secondary PE firms. Section 2.4 summarized the advantages industry specialized PE firms may hold over generalized counterparts. In a similar reasoning these advantages may form a complementarity between selling and buying PE firms, help to realize residual value, and translate into larger performance improvement of SBO targets. This leads to the advancement of the following hypothesis:

H6a. SBOs in which the acquiring PE firm is specialized in a target's industry while the vendor is not realize a greater positive change in post-LBO performance.

Additionally, four other potential sources of complementarities will be analyzed. A first is PE firm size. The relation between PE firm size and performance is commonly discussed by academics. Larger PE firms may experience economies of scale in selecting targets, advising buyouts, or when raising capital (Kaplan and Schoar, 2005). However, research on the topic provides contradicting results. Using a global sample on fund returns, Cumming and Walz (2010) find a positive relationship

between PE size and performance. Contrarily, Ghai et al. (2014) and Lopez-de Silanes, Phalippou, and Gottschalg (2009) find no such correlation and conclude that returns in PE are not scalable. Research by Kaplan and Schoar (2005) and Robinson and Sensoy (2016) offers an explanation for these apparent disparities. In both researches the authors find a concave relationship between between PE fund size and performance. Larger funds perform better in the cross-section, but this effect diminishes as PE firms grow larger. Literature thus suggests that size can be a valuable resource for PE funds; and hence, that it may form a complementarity in SBOs. This leads to development of the following hypothesis:

H6b. SBOs in which the acquiring PE firm is larger than the vendor realize a greater positive change in post-LBO performance.

Another possible complementarity is PE firm experience. Several studies have examined the link between PE firm experience and performance. Both on the fund level as well as on the buyout level academics have documented positive effects to experience (e.g. Sorensen, 2007; Gompers, Kovner, Lerner, and Scharfstein, 2009; Gottschalg and Wright, 2008). Experienced PE investors may lend their buyouts relevant experience such as general management, business, or of course industry knowledge (Bottazzi, Da Rin, and Hellmann, 2008; Meuleman et al., 2009), may be able to reduce agency problems by better and more efficient monitoring (De Clercq and Sapienza, 2005), or can have better information networks (Scellato and Ughetto, 2013). These proven advantages illustrate the value of this resource and how it can form a complementarity between primary and secondary buyers. This argument is formalized in the following hypothesis:

H6c. SBOs in which the acquiring PE firm has more experience than the vendor realize a greater positive change in post-LBO performance.

A further heterogeneity that can facilitate the realization of residual value in SBOs is the degree of independence of PE firms. In the traditional and most common PE model, a PE firm raises the bulk of its funds from third party private investors and supplements this with personal wealth investments from GPs (Kaplan and Schoar, 2005). The personal investments of GPs and the pressure to perform in order to raise future subsequent funds aligns the motives of GPs with LPs towards the pursuit of quick financial returns (Gompers, 1996). Contrarily, other PE firms are financed by financial institutions, governments, or other public organizations. Affiliates of these funds experience less

pressure to maximize short term financial returns as they do not have to raise subsequent funds from outside investors (Abbot and Hay, 1995). These type of sponsors may also pursue other, non-financial-wealth-maximizing goals such as territorial development and employment growth (Cumming and Macintosh, 2006; Faccio and Hsu, 2017). This can result in residual value at a moment of exit. On the other hand, it can be hypothesized that portfolio companies financed by banks, governmental, and other public institutions may experience advantages in for example financing, legal, bureaucratic, or competition aspects. However, these advantages and disadvantages do not cancel each other, but instead can exist simultaneously. Hence, residual value may be larger among buyouts backed by captive PE firms and transferring those buyouts to independent PE firms may help to realize that value. This leads to the advancement of the following hypothesis:

H6d. SBOs in which the acquiring PE firm is independent while the vendor is not realize a greater positive change in post-LBO performance.

The last possible complementarity stems from the cultural and physical distance between PE firms and portfolio companies. The quality of selection and management of buyouts is likely sensitive to the distance between PE firm and targets (Sorenson & Stuart, 2001). As distance grows, so may cultural and institutional differences; especially when PE firm and target are located in different countries. This can exacerbate information asymmetries and agency problems between PE firms and portfolio companies, and hinder the creation of value (Scellato and Ughetto, 2013). To overcome these difficulties, PE firms syndicate with local partners or establish local offices (Meuleman and Wright, 2011). Consistent with these arguments, Scellato and Ughetto (2013) report that targets whose lead PE investor is located in the same country outperform other buyouts in post-buyout profitability improvements. On the other hand, PE firms that acquire companies in other geographies usually have a more global scope. This can result in the accumulation of superior resources such as multinational experience, which can help a buyout expand internationally (Meuleman and Wright, 2011). Degeorge et al. (2016) cover the second argument and confirm that SBO targets that transfer from local to global oriented PE firms outperform. This research will complement their work by studying if having an office in the country where a target is located or not forms a complementarity between PE firms. This is formalized in the following hypothesis:

H6e. SBOs in which the selling PE firm is located in a different jurisdiction than the target firm while the buyer is not realize a greater positive change in post-LBO performance.

Furthermore, given the aim of this research to analyze the full impact of industry specialization on target operating performance, it seems interesting to analyze how performance of SBOs between generalist sellers and specialized buyers compares to the general population of buyouts. Possibly, generalists' limited understanding of industry dynamics or too strong reliance on financial controls may result in a disregard of profitable growth opportunities results and build up of value creation opportunities in buyout targets. The above is formalized in the following hypothesis:

H7. Secondary buyouts in which the acquiring PE firm is specialized in a target's industry while the vendor is not outperform other buyouts.

3. Methods and data

The following section describes the research design, measuring of performance and industry specialization, construction of control variables, data sources, possible biases, and methodology. The end of this section provides the descriptive statistics and a first discussion of relationships between variables.

3.1. Research design

As previously discussed, this research will offer a significant improvement to the research of Cressy et al. (2007) by measuring all performance measures through a difference-in-difference analysis rather than as absolute metrics post buyout.

An important methodological choice is the time frame for measuring performance improvements. Preferably, one would measure the exact changes during holding phase and convert these to an annualized metric. However, though buyout entry and exit dates are generally available, accounting performance data for private companies is only available on an annual basis. This makes reliably converting performance to an annualized metrics difficult, especially when PE firms exit early in calendar years. This research will therefore operationalize performance measures over a fixed timeframe by comparing the average value of a measure during the 3 years post buyout with its average value 3 years before buyout. The time period of 3 years post buyout is in line with previous researches (e.g. Cressy et al., 2007; Acharya et al., 2013; Nadant et al., 2018) and allows sufficient time for the possible added value of specialists to materialize. By using average values over the 3 year

periods, the bias of using financial figures for only 1 year is avoided. Single year financial figures may be influenced by idiosyncratic factors that do not reflect performance (Nadant et al., 2018). The downside of using the fixed 3-year time window is that not all benefits may actually accrue to PE owners. Results should therefore be interpreted as general improvements to target companies. However, it can also be argued that higher growth and profitability post exit may have monetized for PE owners through a better exit prices.

To minimize the influence economy and industry wide effects, all performance metrics in this research are adjusted for time and industry specific changes. This provides a better estimation of abnormal returns, enables the comparison of performance results across industries, and accounts for possible imbalances in the distribution of generalists and specialists PE firms over industries. The process of constructing the control group to necessary to calculate those changes involves several steps and will be described in detail in Section 3.2.

3.1.1. Measuring performance - Dependent variables

The literature review in Section 2.2.1 and 2.2.2 thoroughly discusses the different performance measures academics use to evaluate PE. Based this review 5 measures that proxy for buyout performance will be operationalized.

Sales growth – Sales growth reflects the growth of a target company during the holding phase (Cressy et al., 2007). By benefiting from strategic resources of PE firms target firms may redefine products and markets, pricing product quality, and customer service, with a positive impact on growth (Acharya et al., 2013). This measure has widely been used by academics and practitioners and is among the most important source of value creation for buyouts (Kaplan, 1989; Cressy et al., 2007; Acharya et al., 2013; Gompers, Kaplan, and, Mukharlyamov, 2016; Nadant et al., 2018).

EBITDA / Sales – The ratio of EBITDA over Sales provides an indication of a firm's fundamental operational earnings potential (Kaplan, 1989; Scellato and Ughetto, 2013). The ratio is often titled EBITDA margin and is widely used by practitioners and academics as a proxy for firm profitability (Acharya, 2013; Gompers et al., 2016; Nadant et al., 2018). Through operational, governance, and financial engineering tactics PE firm can positively influence this margin. EBITDA is preferred over Cash Flows as the latter is influenced by Working Capital and Capital expenditures. Further, EBITDA, in contrast to bottom line Net Profit is not influenced by a firm's capital structure and represents the

return to both equity and debt holders. Hereby it also immediately excludes financial engineering tax benefits and allows for measuring specifically the operational improvements. EBITDA is preferred over EBIT because Depreciation and Amortization (D&A) expenses can be subject of accounting manipulation. Especially when a firm experiences a transfer of ownership the value of its possessed assets can be written up or down, impacting future D&A expenses and impeding correct comparison of fundamental pre and post buyout performance.

Working Capital / Sales – In addition to operational profitability strategies, PE firms also frequently pursue capital efficiency strategies. By a more efficient use of capital they aim to reduce the capital tied in the firm and thus a company's return on capital. Key in this strategy is reducing the Working Capital (WC) of a firm (Weir et al., 2013). WC is the difference between a company's Current Assets and Current Liabilities and thus presents the amount of operating liquidity held. The WC position can be shrank through reducing Current Assets or growing Current Liabilities. This results in a one-time cash outflow to shareholders, reduces the capital tied in a firm and thereby improves investor returns. The tactic is often exploited by PE firms and has previously been analyzed by academics, though to a much smaller extend as Sales growth and Profitability measure (Smith, 1990; Wilson et al., 2012; Weir et al., 2013). Because the required levels of operating liquidity in a firm directly depend on the size of its operations, WC will be scaled by Sales. Alternatively, WC could be scaled by Total Assets but the size of Total Assets has a less direct relationship with required operating liquidity and is causally impacted by WC changes through both a positive and negative correlation.

The earlier discussed public concerns and academic literature highlight the importance of studying both financial and real returns to PE. However, the literature summarized in Section 2.2.2 point to the many challenges that come with constructing such measures. Productivity is best evaluated on lower firm unit levels, employment effects should be evaluated based on a simultaneously analysis of job creation and destruction levels, and innovation activity is best approached through analysis of patenting activity and quality. Despite efforts this data is unavailable to the author of this research. Therefore, a different measure to proxy for real returns is constructed.

Sales / Employees – By calculating Sales produced per Employee, this measure simultaneously studies productivity and employment effects. If, as indicated by Davis et al. (2014), PE firms catalyze the creative destruction process in labor markets, then PE ownership will increase employee

productivity. Hereby, this measure thus studies if PE firms improve productivity through better utilization of labor resources. The measure largely overcomes the two drawbacks of studying productivity on firm level identified by Cumming et al. (2007), because it does not require comprehensive information on capital and intermediate materials, and the number of employees does not require conversion to constant dollar terms. However, the possibility exists that the increased Sales output per Employee results from Employees working more hours rather than more productive. To the best of my knowledge, no research has studied PE's impact on working hours, but UK sample studies by Wright et al. (1990) and Bruinink et al. (2005) both find evidence of shift from full-time to part-time workers, indicating the contrary. Furthermore, it can be hypothesized that PE firms pay higher wages for the more productive employees, but academics have found no evidence of this (Amess, Girma, and Wright, 2008; Bacon et al., 2012). Besides, though higher wages would hurt financial returns for PE firms, the opposite holds in terms of real societal returns.

3.1.2. Measuring Industry Specialization - Independent variables

To measure industry specialization this research will follow the methodology used by Cressy et al. (2007). The authors use the Index of Competitive Advantage (ICA). This index is adapted from literature on international trade and technological specialization (Archibugi and Pianta, 1994). The ICA is computed as:

$$ICA_{ij} = (C_{ij}/C_{.j}) \ / \ (C_{i.}/C_{..})$$

where a . indicates summation over a subscript

- C_{ij} is the number of buyout investments by PE firm *i* in industry *j*
- $C_{.j}$ is the total number of buyout investments in industry *j* by all sample PE firms
- $C_{i.}$ is the total number of buyout investments by PE firm *i*
- $C_{..}$ is the total number of buyout investments by all sample PE firms (in all industries)

The numerator of this index is the share of PE firm *i*'s buyouts in industry *j* relative to the total number of sample PE firm buyouts in this industry, and the denominator is the share of PE firm *i*'s buyouts across all industries relative to all buyouts of all other PE firms in the sample. Hence, the ICA effectively measures a PE firm's industry specialization relative to all other PE firms in the sample.

Alternatively, one could adapt this measure by adjusting it for buyout size through proxies such as deal value, equity invested or target revenues. However, limited data availability, especially on smaller targets, would potentially bias this measure and significantly reduce sample size. Besides, though PE firms will give more importance to larger investments, the marginal increases of time spend per deal likely decreases with size. Furthermore, one large deal likely provides less learning experience than several small deals with a similar total sum in deal size.

The index value is converted to a dummy variable such that:

$$ICA_{ij} \begin{cases} \geq 1 \Leftrightarrow (C_{ij}/C_{.j}) \ \geq \ (C_{i.}/C_{..}) \\ < 1 \Leftrightarrow (C_{ij}/C_{.j}) \ < \ (C_{i.}/C_{..}) \\ = 0 \ \Leftrightarrow \ C_{ij} = 0 \end{cases}$$

A value of ICA_{ij} greater (smaller) than one thus identifies PE firm *i* as relatively industry specialized (unspecialized) in industry *j*.

A key methodological choice is the grouping of buyouts by industry. This categorization has to reflect the fundamental industry differences between target companies but must also practically match how PE firms usually specialize. This is increasingly difficult as companies that are traditionally classified as technology firms penetrate other industries, and companies from those other industries utilize a variety of technology applications to offer products and services (e.g. see developments in biotechnology, communication, financial service, and business service industries). To reduce the subjective and debatable choices of classifying companies into very specific industries, this research categorizes buyouts into 12 industries based on the first 4 digits of their primary NAICS codes. The broader industries also allow PE firms to accumulate a sufficient deal history per industry to reliably calculate their ICA. The constructed industries are: Business services, Communications, Computer software/Internet specific, Construction, Consumer related, Financial services, Health care/ Biotechnology, Industrial/Energy/Utilities, Manufacturing, Semiconductor/Electronics/Computer Hardware, Transportation, and Other.

In case of syndicated deals, the industry specialization dummy is constructed based on the investment history of the lead investor. This choice is based on previous UK literature showing that lead investors take a coordinating role and have most influence on buyouts (Wright and Lockett, 2003). Nonetheless, given the large heterogeneity among PE firms it seems plausible that syndicate

partners provide complementary resources. Focusing solely on the lead investor may therefore neglects possible industry expertise non leading partners bring to syndicates. Several academics have investigated syndication motives in VC and PE in European samples. These have found that partners primarily syndicate based on risk sharing, portfolio diversification, reputation benefits, competition reduction, and financial resource motives; but to a much smaller extent for knowledge sharing and managing of investments (Officer, Ozbas, Sensoy, 2010; Locket and Wright, 1999; De Vries and Block, 2011; Manigart et al., 2006). Additionally, when knowledge sharing is found to motivate syndication, such motives are only found among non-lead PE who try to lend knowledge resources from syndicate leaders (Manigart et al., 2006; Meuleman, Wright, Manigart, and Lockett, 2009). It is therefore assumed that focusing only on the investment history of lead investors sufficiently proxies for the level of industry experience possessed by syndicates. Lead investors are identified based on their equity stake, as previous US research shows that lead investors on average hold larger equity stakes (Cressy et al., 2007).

A last methodological choice is the time window of investment history used in calculating the ICA. Cressy et al. (2007) use a fixed window covering their entire deal sample period and two years afterwards. Through this method they create potential bias because success (or failure) of the buyout of interest may have led a PE firm to invest more (or less) in that industry in later years; this leads to a classification of specialist (generalist) while it was not at the time of investment. This research will therefore adapt the methodology and measure the ICA based on the investment history of PE firms up to the deal date.

3.1.3. Controlling for other effects - Independent variables

To prevent that the industry specialization measure proxies for other PE firm, target, or deal characteristics, a number of control variables are included in this research. The variables are summarized below.

PE firm - Size – The earlier discussion on the effect of PE firm size on returns describes the concave relationship between the variables. To proxy for this non-linearity, this research will include both a variable based on a PE firm's natural logarithm of size as well as quadratic version of this measure. Ideally this size proxy would be based on a fund's capital committed or invested at the time

of buyout. However, this data is not available in the accessible databases. The proxy is therefore constructed by taking the sum of a PE firm's deal value over the last 3 years prior to a buyout.

PE firm - Experience – As previously described, the impact of PE experience is well documented and proven to be positive. To control for this effect, a variable based on the natural logarithm of a PE firm's total number of investments at the time of buyout is included.

PE firm - Age – Older and more established PE firms may benefit from reputation effects such as better deal flow-access (Barry et al., 1990). Though part of this effect will be proxied for through the prior buyout experience control variable, some benefits may only come over time, and can be irrespective of investment activity. Furthermore, the fact that PE firms are still in business after longer periods of time may be an indicator of outperformance and thus skill. This seems especially likely given the (previous) believe of academics and PE sponsors that performance among PE firms is persistent (Harris, Jenkinson, Kaplan, and Stucke, 2014). The PE age variable will be operationalized based on the square root of a PE firm's number of years since incorporation at the time of buyout.

PE firm - Independent – As discussed, having an independent or captive owner can bring portfolio companies both advantages and disadvantages. This research controls for these effects by including a dummy variable that is equal to 1 when a PE firm is independent and 0 when it is related to financial, governmental, or other public institutions.

PE firm - Cross-border – The quality of selection and management of buyouts can be sensitive to physical and cultural distances between PE firms and targets. To proxy for these distances and their possible impact on value creation in buyouts, a dummy variable is included. Because all sample buyouts are located in the UK, this cross-border dummy is equal to 1 when a lead investor has no office in the UK, and 0 otherwise.

PE firm - Support intensity – Several academics show that funds with fewer projects per GP achieve higher returns (Wood and Wright, 2009; Lopez-de Silanes et al., 2015). This suggests that the quality of target selection or value adding during holding phase of a PE firm decreases when GPs have to manage larger portfolios. The possible importance of adjusting for this effect when measuring the impact of industry specialization is further illustrated by Humphery-Jenner (2013). The author finds that industry diversification by PE funds reduces returns if it spreads staff too thinly across industries. Several attempts have been made to reliably create a proxy for this effect but these were

unsuccessful. Data on historic PE firms' historic numbers of GPs proved difficult to obtain through Thomson One, PE firm websites and LinkedIn. Additionally, given the presence of several large and globally operating PE firms that simultaneous manage multiple funds in the research sample, this measure would preferably be constructed based on fund level. Collecting such information proved impossible with the available databases.

Target - Financial expenses – The benefits and costs to leverage are extensively described in Section 2.2.2. Higher leverage can have a disciplining effect and grow tax shields, but these benefits may come at the cost of financial distress and a loss of turnover growth. These effects can affect companies both pre- and post-buyout, but PE firms typically increase leverage, and thus the magnitude of these benefits and costs for portfolio companies. Usually, academics proxy for leverage by dividing measures such as Total Liabilities or Long Term Debt by Total Assets or Deal Value. However, Total Liabilities, Long Term Debt, and Deal Value data was not always available for the required measurement period, while defining total assets proved problematic as a result of the large number of holding companies PE firms typically use when acquiring targets. Instead, this research therefore proxies for leverage by measuring a firm's financial expenses as a percentage of turnover in the first post-buyout year. The downside of this measure is that it cannot be used to deleverage returns, but this does not form a problem for this research since the variable is only used to correct for the disciplining effect of leverage. Arguably, it may even form a superior measure to proxy for this effect because it measures exactly how stringent interest payments are for portfolio companies. It does however overlook the impact of debt repayment, but repayment levels likely correlate strongly with financial expenses and will thereby thus be accounted for. To verify the above assumptions, the correlation between this financial expenses measure and the Total Debt / Total Assets variable is computed. For the 163 buyouts with reliable data available, this proved to be 0.61. Because this is relatively high, it is assumed that the financial expenses variable sufficiently proxies for the leverage effects it is designed to correct for.

Target - Pre-buyout operating profitability – This research uses a difference-in-difference approach to examine the effect of PE specialization on buyouts, it thereby immediately accounts for pre-deal performance, and studies the change in performance rather than its absolute levels post buyout. However, pre-buyout performance such as initial levels of profitability can also impact the magnitude of changes in performance post buyout. Low previous profitability may entail larger but

perhaps riskier opportunities for the creation of value, while high initial profitability may limit room for improvements. Higher initial profitability may indicate smaller performance enhancement opportunities, and make value creation more challenging. The importance of accounting for initial performance in this research is underlined Nadant et al. (2018), who show that advantages to PE firm specialization are greater among initially high or low performers. To account for previous levels of operating profitability, three equally sized groups of initially low, medium and high performers are created. Buyout targets are allocated to either of the groups based their average industry adjusted EBITDA / Turnover during the 3 year prior to buyout. The 3-year time window provides a consistent benchmark with the dependent variables of this research and again avoids the bias of using single year financial figures (Nadant et al., 2018).

Target - Pre-buyout turnover growth – In a similar reasoning this research will also account for pre-buyout turnover growth. High recent turnover growth can be an indicator of large growth opportunities and thus value creation potential for a firm. On the other hand, low levels of growth may result from poor management or a lack of financial resources. This variable will be operationalized as industry adjusted turnover growth during the last 2 years prior to buyout. The choice for 2 years instead of 3 results from the availability of only 3 years of pre-deal turnover data. Because annual idiosyncratic factors are likely to have a smaller influence on turnover growth than profitability, this is not expected to bias results. Based on this measure three equally sized groups of initially low, medium and high growing firms are again constructed.

Target - Size – Following the discovery of the small firm effect, the relation between company size and performance has received wide attention in academic literature (e.g. Roll, 1981; Fama and French, 1995). Generally, academics conclude that smaller firms can grow faster when not financially constrained, and that profitability positively increases with size, suggesting better opportunities for the creation of value in smaller firms (Hall and Weiss, 1967; Carpenter and Petersen, 2002; Beck, Demirguc-Kunt, Laeven, and Levine, 2008; Lee, 2009). Other researchers have specifically examined the effect of company size within the buyout industry, they find contradicting results. Wright, Thompson, Robbie, Wong (1995) Nikoskelainen and Wright (2007) argue that buyout sponsors may focus time and effort on their larger investments because these contribute most to overall fund return. Additionally, larger firms may suffer from larger agency problems pre-buyout or can have superior access to leverage, increasing value creation opportunities (Valkama, Maula, Nikoskelainen,

and Wright, 2013). Consistent with this hypothesis they find that company size has a positive relation with buyout returns. However, the authors analyze total buyout-level returns instead of accounting performance, so other factors such as financing costs and multiple expansion can be of influence. Given the above stated hypothesis that GPs allocate more time and resources to larger investments, a proxy for size is preferably based on enterprise or equity value. However, because such information is unavailable for a large part of this sample, target size will be proxied for through the natural logarithm of a company's turnover in the last year before buyout.

Target - Age – In recent years, academics seem increasingly interested in firm age and its effect on performance (Coad, Holm, Krafft, Quatraro, 2018). These academics find positive relations between firm age and survival chances but negative correlations with growth, profitability, and innovation (Loderer and Waelchli, 2010; Coad et al., 2018). These relations are relevant for the buyout industry. Loderer and Waelchi (2010) find support for their hypotheses that organizational rigidities and the diffusion of rent-seeking behavior increase with firm age, indicating that the value creation potential for PE firms may be larger in older firms. Consistent with this, Meuleman et al. (2009) find a significant positive impact of firm age on changes in return on capital employed. The proxy for firm age will be operationalized through the square root of a target's age at the time of buyout.

Deal characteristic - Syndicated – As previously discussed, the primary motives for syndication are risk sharing, financing advantages, and reputational benefits rather than the sharing of knowledge or cooperation in managing investments. Additionally, when reputational and knowledge motives do play a role, this is mostly among non-lead PE firms. Hence, it is assumed that industry experience in syndicates will primarily come from leading partners. However, focusing solely on the lead firm may disregards other advantages syndication entails. Syndicate partners can bring superior deal flow or improved and cheaper access to leverage and thereby improve buyout performance (Hopp, 2009; Cumming and Walz, 2010). On the other hand, there are also disadvantages to syndication such as coordination difficulties and agency costs (Wright and Lockett, 2003; Meuleman et al., 2009). To account for such possible effects a syndication dummy is included. This dummy is equal to 1 when a target was bought out by two or more PE firms, and 0 if there was only one PE acquirer.

Deal characteristic - Secondary – The differences between PBOs and SBOs are extensively discussed in Section 2.5. This research will analyze SBOs both independently and compared to the general population of buyouts. To account for performance differences as a result of SBOs, models estimated in this research will include a SBO dummy. This dummy is equal to 1 when the vendor of a target is a PE firm and 0 otherwise. By implication, tertiary, quaternary etc. buyouts are hereby also classified as SBOs.

Deal characteristic - Financial crisis buyouts – As previously discussed this research analyzes if the recent financial crisis forms a situation in which benefits to PE firm industry specialization become stronger. To identify buyouts during the financial crisis a dummy variable is constructed that is equal to 1 for deals completed during 2006, 2007, and 2008. This group thus contains targets that were bought out in good times but went through the crisis in hands of PE firms, as well as targets that were bought out during the height of the financial crisis.

Table 1. Summary of dependent and independent variables

Variables	Definition
Dependent variables	
Turnover growth	Industry Adjusted growth in: Average Turnover [y1,y3] - Average Turnover [y-3,y-1]
Operating Profitability change	Industry Adjusted change in: Average EBITDA / Turnover [y1,y3] - Average EBITDA / Turnover [y-3,y-1]
Working Capital efficiency change	Industry Adjusted change in: Average Working Capital / Turnover [y1,y3] - Average Working Capital / Turnover [y-3,y-1]
Turnover per Employee change	Industry Adjusted change in: Average Turnover / Employees [y1,y3] - Average Turnover / Employees [y-3,y-1]
Independent variables	
PE firm related	
Industry Specialization	Index of Competitive Advantage based on lead PE firm ICAij = (Cij/C.j)/(Ci./C..) where a . indicates the summation over a subscript C_ij is the number of buyout investments of PE firm i in industry j up to deal date C_(.j) is the total number of buyout investments in industry j by all sample PE firms up to deal date C_(i.) is the total number of buyout investments of PE firm i up to deal date C_(..) is the total number of buyout investments by all sample PE firms (in all industries) up to deal date Converted to a dummy variable equal to 1 if ICA ≥ 1 and 0 otherwise
PE firm - Size LN	Natural Logarithm of: Sum of PE firm's total Deal Value in the 3 years before deal date
PE firm - Size LN ^ 2	Quadratic of Natural Logarithm of: Sum of PE firm's total Deal Value in the 3 years before deal date
PE firm - Experience LN	Natural Logarithm of: Total number of buyouts by PE firm up to deal date
PE firm - Age Sqrt	Square root of: Age of PE firm at deal date
PE firm - Independent	Dummy variable equal to 1 if PE firm is not related to a government of bank
PE firm - Involvement	Number of Portfolio Companies at the moment of buyout / Number of GPs
PE firm - Syndicated	Dummy variable equal to 1 when a buyout was carried out by 2 or more PE firms
PE firm - Cross border	Dummy variable equal to 1 when PE buyer does not have an office in the UK
Target related	
Target - Financial expenses	Financial expenses [y1] / Turnover [y1]
Target - Size LN	Natural Logarithm of: Target Turnover [y-1]
Target - Age Sqrt	Natural Logarithm of: Age of target company at deal date
Target - Secondary Buyout	Dummy variable equal to 1 for Secondary, Tertiary, Quaternary buyouts, etc.
Target - High pre-deal Operating Profitability	Dummy variable equal to 1 when industry adjusted pre-deal average EBITDA / Turnover [-3,-1] is in top tercile of sample firms
Target - Low pre-deal Operating Profitability	Dummy variable equal to 1 when industry adjusted pre-deal average EBITDA / Turnover [-3,-1] is in bottom tercile of sample firms
Target - High pre-deal Turnover Growth	Dummy variable equal to 1 when industry adjusted pre-deal average Turnover growth [-2,-1] is in top tercile of sample firms
Target - Low pre-deal Turnover Growth	Dummy variable equal to 1 when industry adjusted pre-deal average Turnover growth [-2,-1] is in bottom tercile of sample firms

3.2. Sample construction and data sources

To test the hypotheses advanced in Section 2.4 and 2.5 a unique, hand matched dataset has been constructed. The construction of this dataset can be divided into four phases, these will be outlined below.

In the first phase, the Zephyr M&A database of Bureau van Dijk (BvD) is used to identify all PE buyouts in the UK between 01/01/2004 and 31/12/2013. This 10-year timeframe is chosen because it provides a sufficient number of years pre and post financial crisis, and because having 2013 as latest year allows to collect 3 years of post-buyout performance data. The resulting deal sample includes 1658 buyouts. Unlike the deal samples of Cressy et al. (2007) and Nadant et al. (2018), this sample includes both primary and secondary buyouts. In this stage, deal information on target names, BvD ID numbers, deal date, PBO or SBO classification, and a deal synopsis are obtained. This deal synopsis is later used to hand collect acquirer names and syndication characteristics.

Next, the BvD ID numbers are used to obtain financial data on buyout targets in Orbis, a public and private company database of BvD. The methodological structure of this research requires complete dependent variable data for a time window from 3 years prior to 3 years post deal date. Such information is unavailable for many of the buyouts as private companies are largely exempt from public disclosure requirements of financial data. The process therefore results in a significant reduction in sample size to 285 deals. PE firms typically acquire targets through new holding companies that are placed on top of existing entities, newcos. Accurate collection of financial data therefore requires identification of these newcos both before and post buyout. Once this process is completed, pre and post-buyout data is obtained on Sales, EBITDA, Total Assets, Employee numbers, Total Non-Current Liabilities, and Target Date of Incorporation.

The third phase involves collecting information on the PE acquirers. Because this information is only available in the Thomson One database each of the 285 deals were manually looked up in this database using target name, acquirer name, and deal date information. If a deal could not be found, it was discarded. This matching process leaves a total of 246 deals. For each of these deals acquirer information is collected on: buyout history, UK presence, government or bank affiliation, and date of incorporation.

In the last phase the performance measures for all remaining buyout companies are adjusted for time and industry-wide changes. To reliably do this peer groups are created based on a company's industry, size, and country. Size is included because Cressy et al. (2007) argue that levels of systemic risk change with company size, and because differences in size can significantly diverge returns between companies active in the same industry. The construction of peer groups involved several steps. First, for each buyout the entire population of companies in its industry are identified in Orbis. Industries are defined based a company's 4-digit NACE Rev. 2 code, the industry classification system used in the European Union. Within these industries companies are then split into deciles based on their size in the year of buyout. In the next step performance data on all companies in the relevant decile groups is obtained over the relevant 7-year time window, companies without complete performance data are dropped. In the last step, all companies outside the UK are excluded from the peer groups. If this last steps shrank a peer group to less than 20 companies this country requirement is relaxed to also include companies from Belgium, France, Germany, Ireland, Luxemburg, and The Netherlands.

For each of the remaining companies the performance change post buyout is then calculated using the same methodology as described in Section 3.1.2. Within each peer group the median change in performance is then identified for every variable. This median performance measure forms the proxy for time and industry effects and is subtracted from the respective variable of each buyout.

3.3. Sample selection bias

Like many other PE studies, this study is potentially subject of sample selection bias (Kaplan and Strömberg, 2009; Cumming and Walz, 2010). In this research sample selection bias can result from two sources. A first is the limited availability of post-buyout performance data. Especially data on smaller companies is hard to obtain because they are subject to less monitoring by the finance community (Wright et al., 1995), and have milder publication requirements. As a result, PE datasets are often skewed towards larger deals (Guo et al., 2011; Acharya et al., 2013). This forms a potential bias because of the relationship between buyout size and performance as outlined in Section 3.1.3.

A bias towards larger companies is especially relevant when comparing performance of PE-backed buyouts with non-buyout companies with the aim to infer information on the PE industry as a whole. However, when measuring performance differences between buyouts of industry

specialized and generalized firms, this data availability problem burdens both sample groups relatively equally. This mitigates the chances of selection bias impacting research results, but limits the extrapolation of results to the general PE industry.

The second potential source of sample selection bias is rooted in the methodology of this research. To measure the impact of PE specialization on performance, accounting data for 3 years post deal year is required. If such data is unavailable, the dependent variables cannot be calculated and the observation has to be dropped. An implication of this procedure is that companies that go bankrupt during those three years are seen as regular observations with missing data and will be excluded from the sample, creating the possibility for survivorship bias. Nadant et al. (2018) report that industry specialized PE firms more frequently buy out targets with low initial operating profitability. This indicates that specialists may take more risk and thus conceivably suffer more bankruptcies. Hence, exclusion of bankrupt companies may overstate returns to industry specialization.

To address potential selection bias, a two-stage Heckman estimation procedure is employed (Heckman, 1979). First, a probit model is estimated to describe a deal's likelihood for inclusion in the final deal sample based on its size and initial operating profitability. From this regression the inverse Mills ratio is computed. In the second step the inverse Mills ratio is included in the main regression model of this research, hereby it accounts for possible selection bias (Heckman, 1979). Preferably, the probit model is estimated on the full initial deal sample. However, data on pre-deal sales and profitability is available for only 600 of XXX full sample buyout deals. Though this is far from the entire sample, estimating the model with this reduced sample is the best alternative given data availability.

3.4. Methodology

The final deal sample contains 246 LBOs by 120 different PE firms. This results in some clustering of deals under the same PE firms. From 64 of the PE firms one buyout is included in the sample, from 30 firms two, from 9 firms three, from 8 four, and from the remaining 9 on average seven with a maximum of 13. Castellaneta and Gottschalg (2016) show that a significant proportion of buyout performance is explained by PE firm and fund specific effects. This provides proof for the heterogeneity among PE firms and implies that not all PE firms have the same resources or ability to leverage these resources, or the resources of LBO firms.

To account for this heterogeneity, this research follows Nadant et al. (2018) and uses a multilevel mixed-effect (MLME) model. A MLME model is well suited for this situation, as it allows the coefficients of the intercept or other variables to vary across groups within a sample. To account for general PE firm specific effects, the intercept is allowed to change between PE firms. Additionally, to test if PE firms differ in their ability to lever certain of their own or target's resources, it will be analyzed if allowing slope coefficient of dependent variables to vary between groups improves the model. A multilevel mixed-effect model with random intercepts and slopes results in the following regression equation:

$$y_{ij} = (\alpha_1 + \phi_{1j}) + (\beta_n + \phi_{jn})\, x_{ijn} + \beta_n\, x_{ijn} + \varepsilon_{ij}$$

In this equation, y_{ij} is the performance change of target i from PE firm j. $(\alpha_1 + \phi_{1j})$ is the random intercept where α_1 is the sample mean intercept and ϕ_{1j} represents PE firm j's deviation from this mean. $(\beta_n + \phi_{jn})$ is the random slope coefficient for variable n, if this variable's slope is allowed to vary between PE firms. Here, β_n is the sample mean slope for variable n, and ϕ_{jn} forms the deviation PE firm j's coefficient from this mean. If a variable's slope is not allowed to vary between PE firms, then it falls under the next component of the equation, where its slope coefficient only consists of sample average β_n. ε_{ij} are the residuals.

Based on likelihood-ratio tests it will be determined if estimated multilevel mixed-effect model offer significant improvement over ordinary linear regression models. Additionally, it will be analyzed for which variables the slope coefficients should be allowed to vary across PE firms. This decision will be based on AIC and BIC criteria.

3.5. Descriptive statistics

Figure 1 on the next page provides an overview of the distribution of deals over the years. In the years prior to the financial crisis the number of deals grows threefold from 13 in 2004 to 38 in 2007. During the financial crisis deal activity sharply dips with a low of 13 deals in 2009. Post financial crisis deal activity quickly recovers with a small dip during the height of the European Debt crisis. This pattern is largely consistent with other literature and industry activity by PE monitoring institutions such as the British Private Equity and Venture Capital Association (BVCA, 2013).

Figure 1. Number of sample deals per year

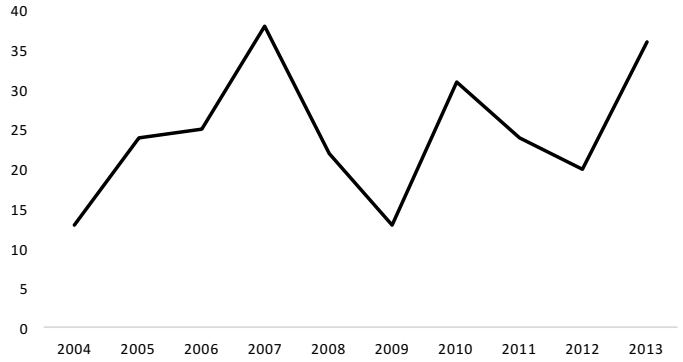

Table 2 provides an overview of deals per industry and the share of specialist PE firms within industries. The distribution of deals over industries is very similar to those reported by the BVCA during sample years (BVCA, 2007; BVCA, 2010; BVCA, 2013). The share of specialists per sector shows some variation between industries. Especially the Communications, Health care/ Biotechnology, Manufacturing and Semiconductor/ Electronics/ Computer Hardware industries show strong deviations from the sample mean of 54%. However, the sample size of these groups is too small to infer any fundamental differences between the presence of specialists within industries. Yet, the results do underline the importance of adjusting for industry-wide performance changes when analyzing the impact of industry specialists.

Table 2. Share of generalists and specialist PE firms by target industry

Target industry	ist	st	Total	specialist
Business services	20	15	35	43%
Communications	4	2	6	33%
Computer Software/Internet specific	12	8	20	40%
Construction	3	3	6	50%
Consumer related	22	47	69	68%
Financial services	8	10	18	56%
Health care/biotechnology	3	10	13	77%
Industrial/Energy/Utilities	9	10	19	53%
Manufacturing	6	16	22	73%
Other	3	0	3	0%
Semiconductor/Electronics/Computer Hardware	11	2	13	15%
Transportation	11	11	22	50%
Total	**112**	**134**	**246**	**54%**

Using the methodology outlined in Section 3.1, performance proxies and control variables are constructed for each of the 246 buyout firms. Table 3 provides a summary of those statistics split between generalists and specialists.

Table 3. Descriptive statistics
Five variables are transformed based on economic reasoning and normality tests. For these variables both the initial and transformed values are reported. T-tests are computed using equal or unequal variances depending on a prior F-test of equality in variance. For variable definitions, see Table 1.

	Generalists						Specialists						T test
	mean	median	sd	min	max	N	mean	median	sd	min	max	N	
Turnover growth	0.356	0.176	0.738	-0.889	3.854	112	0.680	0.302	1.731	-0.720	16.502	134	1.961*
Operating profitability change	-0.369	0.003	4.160	-43.961	1.384	112	0.016	-0.002	0.199	-0.385	1.909	134	0.980
Working Capital change	-0.022	-0.010	0.120	-0.871	0.403	112	0.024	-0.011	0.631	-1.143	6.886	134	0.814
Turnover per Employee growth	0.249	0.007	1.616	-0.885	12.318	108	0.171	0.042	0.708	-0.842	5.686	127	-0.463
PE - Size	2659	279	6267	0	42351	112	5471	538	16098	0	92701	134	1.860*
PE - Experience	135.1	51.0	288.7	0	1397.0	112	98.3	51.0	143.6	2.0	949.0	134	-1.227
PE - Age	19.4	13.8	16.5	0.3	63.5	112	18.3	17.0	11.3	0.7	59.1	134	-0.623
PE - Independent	0.866	1	0.342	0	1	112	0.821	1	0.385	0	1	134	-0.964
PE - Syndicated	0.107	0	0.311	0	1	112	0.052	0	0.223	0	1	134	-1.563
PE - Cross border	0.071	0	0.259	0	1	112	0.112	0	0.316	0	1	134	1.105
Target - Financial expenses	0.164	0.078	0.215	-0.026	1.124	112	0.141	0.071	0.234	-0.066	1.390	134	-0.796
Target - Size	70630	28136	139831	178	979969	112	183653	33343	1018172	930	11502000	134	1.271
Target - Age	18.9	14.0	18.1	3.1	109.0	112	22.0	17.5	17.1	3.0	86.0	134	1.407
Target - Secondary buyout	0.348	0	0.479	0	1	112	0.478	0	0.501	0	1	134	2.058**
Target - Low Profitability pre-LBO	0.375	0	0.486	0	1	112	0.291	0	0.456	0	1	134	-1.395
Target - High Profitability pre-LBO	0.304	0	0.462	0	1	112	0.351	0	0.479	0	1	134	0.782
Target - Low growth pre-LBO	0.339	0	0.476	0	1	112	0.336	0	0.474	0	1	134	-0.057
Target - High growth pre-LBO	0.313	0	0.466	0	1	112	0.358	0	0.481	0	1	134	0.753
Financial crisis buyout	0.411	0	0.494	0	1	112	0.291	0	0.456	0	1	134	-1.959*
Transformed variables													
PE - Size LN	5.2664	5.6343	3.0972	0.0000	10.6538	112	6.1716	6.2892	2.5221	0.0000	11.4371	134	2.481**
PE - Experience LN	3.3695	3.9512	1.9765	0.0000	7.2428	112	3.8177	3.9511	1.3225	1.0986	6.8565	134	2.047**
PE - Age Sqrt	3.9469	3.7204	1.9637	0.5683	7.9689	112	4.0364	4.1200	1.4058	0.8276	7.6860	134	0.403
Target - Size LN	10.3220	10.2448	1.2997	5.1805	13.7953	112	10.5472	10.4146	1.3907	6.8352	16.2580	134	1.303
Target - Age Sqrt	4.0012	3.7417	1.7004	1.7321	10.4403	112	4.4060	4.1829	1.6260	1.7321	9.2736	134	2.300**

A first comparison of mean performance statistics between generalists and specialists indicate some differences between the groups. In line with expectations as formalized in hypothesis 1, average turnover growth and operating profitability changes are considerably higher among buyouts backed by specialists. Contrarily, Working Capital improvements and Sales per Employee growth are slightly larger for buyouts with generalist owners. The difference in turnover growth is even statistically significant at the 10% level. However, when looking at median differences in performance, a more nuanced picture emerges. Differences are substantially smaller in turnover growth and practically nonexistent for changes in operating profitability, working capital and sales per employee; indicating that mean differences can be driven by outliers. This is confirmed by the reported high standard errors and large differences in maximum and minimum values, suggesting the possible need for winsorizing these variables. If the top and bottom outliers for operating profitability in the generalist group are excluded the mean change becomes 0.019 instead of -0.369. The impact of windsorizing transformations was tested in non-tabulated regression models but was not found to affect research results. It was therefore concluded not to transform the dependent variables.

The next rows summarize all control variables used in this research. The statistics indicate several variables with large positive outliers and problematically high standard errors, suggesting the need for transformation. Additionally, for some of the variables it seems unlikely that the relationship with buyout performance is linear. An increase in experience of PE firms from 1 to 10 deals likely has a larger impact than an increase from 1001 to 1010 deals. Based on this economic reasoning and normality tests it was therefore decided to transform PE size, PE experience, and target size by calculating their natural logarithm and PE Age and Target Age through their square root. Resulting statistics are summarized in the bottom 5 rows.

Post transformation it becomes evident that specialized PE firms are significantly larger, have more experience, and buy older targets. The results underline the importance of correcting for these effects as well as proving the transformation of variables to be fitting to the research. Furthermore, specialized PE firms are significantly more likely to undertake SBOs, and less likely to make acquisitions during or just prior to the financial crisis. Consistent with other literature over the sample period, the share of SBOs in the entire sample is 41.9%.

Table 4 on the next page summarizes the correlations between all dependent variables. The table reveals strong correlations between the PE firm Size, Experience, and Age proxies. These correlations are so strong that they may cause multicollinearity. Based on the similarity of the economic motivations behind including the PE experience and age proxy, it is therefore decided to exclude the PE Age variable from further analysis. The PE size and experience variable are both kept despite their high correlations because the variables are included to proxy for different effects. Several significant correlations are also found between these variables and the independence dummy; indicating that independent PE firms are smaller, younger, and have less experience. Furthermore, less experienced PE firms are more likely to syndicate, providing support for the argument that unexperienced PE firms syndicate to borrow resources from more experienced counterparts.

A last important variable that deserve attention is the secondary buyout dummy. The chance of undertaking secondary buyouts positively correlates with PE size and experience. This is in line with the hypotheses that larger and more experienced firms may hold additional resources and through these possibly realize residual value in SBOs. Captive PE firms undertake relatively few SBOs,

underlining the difference in investment motives between independent PE firms and PE firms related to banks or public institutions.

Table 4. Correlation matrix.
For variable definitions, see Table 1.

	PE - Industry specialist	PE - Size	PE - Size^2	PE - Experience	PE - Age	PE - Independent	PE - Syndica-tec	PE - Cross border	Target - Financial expenses	Target - Size	Target - Age	Target - Secondary buyout	Low Profitability pre LBO	High Profitability pre LBO	Low growth pre LBO	High growth pre LBO
PE - Industry specialist	1															
PE - Size	0.160*	1														
PE - Size^2	0.119	0.944***	1													
PE - Experience	0.134*	0.736***	0.679***	1												
PE - Age	0.0266	0.553***	0.524***	0.805***	1											
PE - Independent	-0.062	-0.221***	-0.209***	-0.245***	-0.206**	1										
PE - Syndicated	-0.102	-0.082	-0.075	-0.162*	-0.120	0.084	1									
PE - Cross border	0.069	-0.109	-0.096	-0.066	-0.045	-0.052	0.116	1								
Target - Financial expenses	-0.048	0.197**	0.180**	0.111	0.111	-0.074	-0.009	0.080	1							
Target - Size	0.083	0.282***	0.352***	0.097	0.098	0.017	0.058	0.006	-0.286***	1						
Target - Age	0.121	0.169**	0.152*	0.171**	0.188**	-0.098	-0.146*	0.046	0.019	0.129*	1					
Target - Secondary buyout	0.131*	0.232***	0.240***	0.161*	0.104	-0.173**	-0.122	0.124	0.058	0.082	0.007	1				
Target - Low Profitability pre-LBO	-0.089	-0.115	-0.116	-0.103	-0.056	-0.075	-0.008	0.072	-0.118	0.052	-0.032	0.036	1			
Target - High Profitability pre-LBO	0.050	0.010	0.028	-0.07	-0.009	0.0436	-0.0731	-0.136*	0.256***	-0.181**	-0.106	0.0190	-0.491***	1		
Target - Low growth pre-LBO	-0.003	-0.056	-0.079	-0.034	-0.118	-0.021	-0.078	0.066	-0.006	-0.084	0.044	-0.013	0.085	0.012	1	
Target - High growth pre-LBO	0.048	0.054	0.061	0.006	0.080	0.027	0.083	-0.022	-0.0464	0.083	-0.189**	0.057	-0.079	0.049	-0.509***	1
Financial crisis buyout	-0.125*	-0.039	-0.041	-0.054	-0.059	-0.036	0.046	0.002	-0.006	-0.002	-0.027	0.024	0.164*	-0.109	0.096	0.114

*** p<0.001, ** p<0.001, * p<0.05

4. Results and discussion

The following section presents the results of this study. First, the presence of sample selection bias will be tested by employment of a Heckman two-stage selection model. Then follows an analysis to verify if multilevel mixed effects models offer significant improvement over standard OLS models. After decisions on these methodological questions are made the advanced hypothesis will be tested and results will be discussed.

4.1. Heckman analysis

Table 5 on page 54 presents OLS and Heckman regressions for each of the four performance measures. For every dependent variable the first column summarizes the OLS model and the second column the Heckman model. The variables in italic represent the selection equation for the Heckman procedure.

The classification of the first step probit model seems good as both variables show strong explanatory power for the probability of inclusion in the final model. However, the Mills Lambda that is estimated in this first step equation is not significant in any of the models, suggesting that sample selection bias may not be a problem for the external validity of this research (Nikoskelainen and Wright, 2007). Additionally, coefficients and significance levels of the dependent variables seem practically unaffected by inclusion of the Lambda variable. Only the target size variable seems impacted, but this is not surprising given its inclusion as predictor in the first step. Changes in the coefficients of the main variable of interest, the industry specialization dummy, are negligible small.

Because none of the models shows an indication that sample selection bias significantly influences results it is concluded to not include the Mills Lambda in subsequent models.

Table 5. OLS and Heckman regressions.
For each of the four performance measures this table first shows a normal OLS model and then an Heckman regression. The variables for the Heckman first stage probit model are in italic. All performance measures are industry and time adjusted. For variable definitions, see Table 1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Turnover growth	Turnover growth	Operating profitability change	Operating profitability change	Working Capital change	Working Capital change	Turnover per Employee growth	Turnover per Employee growth
Industry Specialization dummy	0.318*	0.323*	0.157	0.169	0.038	0.037	-0.138	-0.138
	(0.170)	(0.183)	(0.368)	(0.425)	(0.062)	(0.060)	(0.167)	(0.161)
PE - Size	0.036	0.040	0.124	0.133	0.041	0.040	-0.057	-0.057
	(0.096)	(0.105)	(0.209)	(0.242)	(0.035)	(0.034)	(0.093)	(0.090)
PE - Size^2	-0.001	-0.001	-0.015	-0.015	-0.001	-0.001	0.004	0.004
	(0.009)	(0.009)	(0.019)	(0.022)	(0.003)	(0.003)	(0.008)	(0.008)
PE - Experience	-0.003	-0.003	0.097	0.097	-0.025	-0.025	0.035	0.035
	(0.076)	(0.082)	(0.164)	(0.189)	(0.028)	(0.027)	(0.073)	(0.071)
PE - Independent	0.214	0.252	0.087	0.177	0.111	0.102	0.146	0.145
	(0.233)	(0.253)	(0.505)	(0.586)	(0.085)	(0.083)	(0.226)	(0.219)
PE - Syndicated	-0.416	-0.407	-2.384***	-2.364***	-0.142	-0.144	-0.289	-0.289
	(0.319)	(0.345)	(0.692)	(0.799)	(0.117)	(0.113)	(0.312)	(0.301)
PE - Cross border	0.415	0.475	0.387	0.527	0.393***	0.379***	0.118	0.117
	(0.294)	(0.321)	(0.637)	(0.744)	(0.108)	(0.105)	(0.281)	(0.273)
Target - Financial expenses	-0.404	-0.296	0.399	0.649	-0.025	-0.050	-0.794*	-0.798*
	(0.382)	(0.408)	(0.827)	(0.945)	(0.140)	(0.135)	(0.419)	(0.413)
Target - Size	-0.190***	-0.377**	0.417***	-0.016	-0.057**	-0.015	-0.125*	-0.117
	(0.073)	(0.165)	(0.158)	(0.383)	(0.027)	(0.053)	(0.075)	(0.168)
Target - Age	-0.092*	-0.092	-0.014	-0.013	-0.021	-0.021	-0.001	-0.001
	(0.052)	(0.057)	(0.113)	(0.132)	(0.019)	(0.018)	(0.050)	(0.048)
Target - Secondary buyout	-0.070	-0.078	0.049	0.031	-0.059	-0.057	0.227	0.228
	(0.175)	(0.188)	(0.378)	(0.436)	(0.064)	(0.062)	(0.171)	(0.165)
Target - Low Profitability pre-LBO	-0.093	-0.045	0.070	0.180	-0.031	-0.042	0.143	0.142
	(0.204)	(0.223)	(0.442)	(0.517)	(0.075)	(0.073)	(0.196)	(0.191)
Target - High Profitability pre-LBO	-0.414*	-0.469**	-0.449	-0.575	-0.113	-0.101	-0.017	-0.016
	(0.214)	(0.234)	(0.463)	(0.541)	(0.078)	(0.077)	(0.207)	(0.202)
Target - Low growth pre-LBO	-0.333*	-0.383*	-0.019	-0.136	-0.063	-0.051	0.083	0.085
	(0.201)	(0.220)	(0.436)	(0.510)	(0.074)	(0.072)	(0.196)	(0.192)
Target - High growth pre-LBO	0.860***	0.829***	-0.507	-0.580	0.037	0.045	0.528***	0.529***
	(0.204)	(0.223)	(0.443)	(0.515)	(0.075)	(0.073)	(0.197)	(0.192)
Lambda		-2.378		-5.508		0.533		0.081
		(1.737)		(4.022)		(0.568)		(1.552)
Constant	2.456***	6.549**	-4.710**	4.768	0.528*	-0.389	1.304	1.147
	(0.866)	(3.171)	(1.877)	(7.343)	(0.317)	(1.031)	(0.885)	(3.141)
PredealTurnoverLN		0.114***		0.114***		0.114***		0.145***
		(0.036)		(0.036)		(0.036)		(0.037)
Predealprofitability		0.163*		0.163*		0.163*		0.126
		(0.093)		(0.093)		(0.093)		(0.090)
Constant		-1.382***		-1.382***		-1.382***		-1.725***
		(0.366)		(0.366)		(0.366)		(0.384)
Observations full model	246	246	246	246	246	246	235	246
Observations probit		600		600		600		589
R-squared	0.210		0.107		0.102		0.082	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2. Multilevel mixed-effect models

To account for the PE firm specific effects and possible heterogeneity in the ability of PE firms to lever resources MLME models are used. In the first step a variety of MLME models are estimated to find which variables should be allowed to vary between PE firms. Likelihood-ratio tests, AIC and BIC criteria, consistently point to a model where the intercept and coefficient of the industry specialization dummy are allowed to vary between PE firms as the best model. Table 6 summarizes these models. The bottom group of variables below the constant are the MLME statistics.

Table 6. Multilevel mixed-effect maximum likelihood models.
For each of the four performance measures this table shows a MLME maximum likelihood model. The constant and industry specialization dummy received random coefficients. Chi squared test results and mixed effect parameters are in italic. All performance measures are industry and time adjusted. For variable definitions, see Table 1.

	(1)	(2)	(3)	(4)
	Turnover growth	Operating profitability change	Working Capital change	Turnover per Employee growth
Industry Specialization dummy	0.384*	0.014	0.076	-0.172
	(0.216)	(0.061)	(0.090)	(0.155)
PE - Size	-0.010	0.036	0.015	-0.015
	(0.073)	(0.024)	(0.013)	(0.099)
PE - Size^2	0.000	-0.004	-0.001	0.003
	(0.007)	(0.002)	(0.001)	(0.009)
PE - Experience	0.039	0.009	0.001	0.009
	(0.056)	(0.031)	(0.010)	(0.086)
PE - Independent	0.147	-0.363	0.013	0.122
	(0.213)	(1.148)	(0.039)	(0.309)
PE - Syndicated	-0.301	0.008	-0.021	-0.291
	(0.214)	(0.046)	(0.038)	(0.299)
PE - Cross border	-0.132	0.421	0.042	0.133
	(0.256)	(0.989)	(0.049)	(0.297)
Target - Financial expenses	0.053	0.024	-0.024	-0.893**
	(0.266)	(0.052)	(0.048)	(0.390)
Target - Size	-0.096*	-0.016	-0.006	-0.201***
	(0.053)	(0.010)	(0.010)	(0.072)
Target - Age	-0.067*	-0.008	0.002	0.002
	(0.038)	(0.008)	(0.007)	(0.047)
Target - Secondary buyout	-0.033	-0.014	0.004	0.194
	(0.122)	(0.020)	(0.022)	(0.157)
Target - Low Profitability pre-LBO	0.016	0.012	0.009	0.079
	(0.142)	(0.023)	(0.025)	(0.180)
Target - High Profitability pre-LBO	-0.270*	-0.075***	-0.038	-0.111
	(0.157)	(0.026)	(0.028)	(0.192)
Target - Low growth pre-LBO	-0.285**	-0.025	-0.022	0.144
	(0.144)	(0.026)	(0.026)	(0.181)
Target - High growth pre-LBO	0.765***	-0.037	0.003	0.520***
	(0.142)	(0.025)	(0.025)	(0.179)
Constant	1.371**	0.051	-0.026	2.079**
	(0.635)	(1.119)	(0.115)	(0.899)
Chi2(2)	602.140	595.850	293.580	3.460
Prob > chi2	0.000	0.000	0.000	0.1775
Var Industry Specialization dummy	2.739	0.126	0.613	0.000
	(0.541)	(0.035)	(0.101)	(0.000)
Var Constant	0.000	1.600	0.000	0.534
	(0.000)	(0.267)	(0.000)	(0.237)
Var Residuals	0.559	0.008	0.017	0.931
	(0.063)	(0.001)	(0.002)	(0.154)
Observations	246	246	246	235
Number of groups	120	120	120	119

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

With the exception of the Sales per Employee model, the chi-squared tests consistently confirm that MLME models offer significant improvement over a linear regression with only fixed effects. These tests confirm the general PE firm effect and the heterogeneity among PE firms in their ability to leverage industry specialization as a valuable resource for turnover growth, operating profitability and working capital changes. The random-effects parameters show that the industry specialization coefficients vary about 3 standard errors for the turnover growth and operating profitability models, and even 6 standard errors for the working capital model. The intercept coefficient varies only in the operating profitability model, but here varies more than 7 standard errors. The impact of this variation is economically significant as the standard deviation of the

industry specialization coefficients (165.5% for turnover growth, 35.5 points of operating profitability, and 78.3% for working capital) are substantial for the dependent variables.

The heterogeneity in PE firms' ability to improve post-buyout operating performance illustrates the strategic importance of resources such as industry specialization for PE firms. Some PE firms are more successful in leveraging their industry experience and thereby gain a competitive advantage. Based on these results it is concluded to continue further analyses with the MLME models.

4.3. Testing the hypotheses

This section presents and discusses the regression models used to validate the hypotheses as outlined in Section 2.4 and 2.5. The first one being:

> *H1: The post-LBO change in performance of targets backed by PE firms that are specialized in the target's industry show a greater positive effect compared to other buyouts.*

To test this first general industry specialization hypothesis MLME models with the performance measures as dependent variables and the industry specialization dummy as dependent variables are estimated. These have already been presented in table 6. It should be noted that the chi squared test for sales per employee indicates that the MLME model does not offer significant improvement over the normal OLS model as presented in column 7 of table 5, but the significance of coefficients is hardly affected.

Results show that the industry specialization dummy is of significant positive explanatory power for turnover growth. The coefficient shows that LBOs with an industry specialized sponsor add on average an additional 38.4 percentage points in turnover growth. This is of a similar magnitude as the 33.6% Nadant et al. (2018) report in a recent publication. Though the finding is economically large, it should be interpreted with some caution as it is only significant at the 10% level. For all three of the other performance measures the industry specialization dummy holds no significant explanatory power. Hypothesis 1 is thus only weakly corroborated.

Other variables that hold significantly explanatory power are target size and age. Both have a negative relationship with turnover growth. These findings are in line with the general firm performance literature discussed in Section 3.1.3 that larger and older firms grow slower. Target size is also negatively correlated with growth in sales per employee. This indicates that small firms may

be less efficiently managed and thus that opportunities for productivity enhancement and societal value creation are larger.

The level of financial expenses holds no explanatory power for the first three performance measures. This is surprising given its theoretically important role in improving operating profitability, but not unlike results found by other researchers. Nikoskelainen and Wright (2007), Meuleman et al. (2009), and Nadant et al. (2018) all find no impact or an only weakly significant and economically negligibly impact of leverage on a subset of their performance measures. It is important to realize that all of these papers, and this one, examine the relationship between leverage and returns within a sample of buyouts. The results therefore do not mean that financial engineering by PE firms does not impact target performance or buyout returns at all. Rather, they show that diversion from the mean levels of LBO leverage do not have a consistent impact on returns. Arguably, this illustrates that optimal levels of leverage differ between targets. Furthermore, it should be mentioned that this research ignores the tax shield benefits of higher leverage and therefore does not represent the entire financial engineering benefits.

Contrarily, levels of financial expenses do significantly correlate with the turnover per employee. The coefficient's negative sign may fuel PE criticism. Apparently, high levels of leverage hurt productivity per employee, but this does not translate in lower operating profitability, as shown in column 2. This raises the question how PE firms compensate for this efficiency loss; critics may argue that the most obvious suspect is lower wages. Investigation of this effect is outside the scope of this research, but to provide some answers, the same model with the industry adjusted average change in wages as dependent variable is estimated. Results are summarized in column 1 of table A1 in the appendix. The coefficient of financial expenses is not significant, indicating that higher levels of leverage do not negatively impact employee compensation.

Coefficients of the PE size variable and its quadratic version are not significant in any of the models. However, table 4 shows that several other control variables significantly correlate with PE firm size, particularly target size. As a test, target size is therefore excluded from the models. This exclusion has significant impact on the operating profitability model. As displayed in column 2 of appendix table A1, the PE size variables now confirm the concave relationship with performance as predicted by previous literature (Kaplan and Schoar, 2005; Roninson and Sensoy, 2016). This poses

the question if the relationship found by academics was driven by PE firm or target size. An answer is provided in columns 3 to 5. The models show that the coefficient of target size becomes negative and significant when PE firm size is excluded, but do not provide evidence that the concave relation is primarily driven by target rather than PE size related factors. Further tests were performed to test the presence of multicollinearity problems but no such indication was found. Based on the above, and because the two size proxies are included with different theoretical motivations, it is therefore decided to further analysis with both PE size and target size as control variables.

The other PE firm characteristics display no significant explanatory power for any of the performance measures, a finding that proved robust to the exclusion of correlated variables. This lack of explanatory power contradicts with existing literature on the returns to PE experience, independence, and cross-border acquisitions; but is in line with the argument that PE firms do not syndicate based on knowledge sharing and target management motives. The latter also supports the assumption that focusing only on the industry specialization of lead investors sufficiently proxies for the level of industry knowledge in a syndicate.

The lack in significance of the secondary buyout dummy indicates that, on average, value creation in SBOs is similar to PBOs. This contradicts with previous UK research by Wang (2012) and Smit and Volosovych (2013). An explanation for this apparent contradiction may lie in the different sample periods of the listed literature and this research. Both papers study SBOs completed in the late 1990s and first 8 years of the 2000s. Perhaps SBOs during that period were undertaken with different motives, or PE firms were less successful in leveraging resources or benefiting from complementarities between seller and buyer. Further exploration of this difference over time is outside the scope of this research, but SBOs will later be discussed in detail in 4.3.3.

The pre-LBO performance dummies prove significant in several models. Most of the significant coefficient's sign are in line with expectations as outlined in Section 3.1.3. An exception is the high initial profitability dummy in the sales growth model. Here a positive sign was expected because high initial profitability is likely to limit value creation opportunities through further margin improvements and may therefore force a more turnover growth oriented value creation strategy in such buyouts. Additionally, high profitability may supply the necessary financial resources to capitalize on growth opportunities. A possible explanation for this unexpected result can be that PE

firms try to maintain the high profitability, and therefore only capitalize on opportunities with similarly high levels. However, this is just speculation by the author of this paper and would need further analysis that is beyond the scope of this research.

The industry specialization dummy has no explanatory power for working capital changes or sales per employee growth. This result proved robust in all of the expanded models discussed in the next sections. It is therefore concluded that industry specialization does not impact performance as measured through the two metrics. Hence, models with these measures as dependent variables will not be reported in further analysis.

4.3.1. Situations of increased returns to specialization

In a situation where value creation is more complex the benefits of having an industry expertise may be larger. One of these situations may be when buying out initially high or low performing companies. This was formalized in the following hypotheses:

> *H2a. The positive relationship between PE firm industry specialization and a target's post-LBO performance changes will be stronger for firms with low initial profitability.*
>
> *H2b. The positive relationship between PE firm industry specialization and a target's post-LBO performance changes will be stronger for firms with high initial profitability.*

To verify these hypotheses, two interaction variables are included in the model. The first is between the industry specialization and initially low pre-buyout profitability dummies, and the second between the specialization and initially high performing companies. Results for the turnover growth model are summarized below in table 7 column 1 on the next page.

The coefficient of the normal specialization dummy, which now represents the effect of specialization in the medium performers group, is 36.6% but no longer statistically significant. For initially high performers the coefficient is 29.5% (with an unreported standard error of 28.0) and neither significant. Contrarily, for initially low performers the coefficient is 49.4% (standard error of 27.5) and significant at the 10% level. This indicates that initially low performing buyouts by specialists outperform initially low performing buyouts by generalists. However, because the interaction variable itself is not significantly different from zero the turnover model thus does not officially support either hypothesis 2a or 2b.

Table 7. Extended multilevel mixed-effect maximum likelihood models.
This table exhibits three extensions to the multilevel mixed-effect maximum likelihood models. All performance measures are industry and time adjusted. For the sake of synthesis, PE control variables, Target control variables, constants, and MLME coefficients are not reported. PE firm control variables are: Size, Size^2, Experience, Independent, Syndicated, Cross-border. Target control variables are: Financial expenses, Size, Age, Secondary buyout, Low profitability pre-LBO, High profitability pre-LBO, Low growth pre-LBO, High growth pre-LBO. For variable definitions, see Table 1.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Turnover growth	Operating profitability change	Turnover growth	Operating profitability change	Turnover growth	Operating profitability change
Industry Specialization dummy	0.366	-0.052	0.121	0.038	0.298	-0.016
	(0.275)	(0.069)	(0.227)	(0.064)	(0.239)	(0.062)
Industry Specialization dummy * Target - Low Profitability pre-LBO	0.128	0.119***				
	(0.290)	(0.046)				
Industry Specialization dummy * Target - High Profitability pre-LBO	-0.071	0.063				
	(0.306)	(0.049)				
Financial crisis buyout			-0.305**	0.030		
			(0.152)	(0.034)		
Industry Specialization dummy * Financial crisis buyout			0.784***	-0.068		
			(0.249)	(0.044)		
Industry Specialization dummy * Target - Secondary buyout					0.209	0.075*
					(0.248)	(0.045)
Target - Secondary buyout	-0.029	-0.011	-0.021	-0.013	-0.115	-0.060*
	(0.123)	(0.020)	(0.120)	(0.020)	(0.156)	(0.034)
PE - Control variables	yes	yes	yes	yes	yes	yes
Target - Control variables	yes	yes	yes	yes	yes	yes
MLME model	yes	yes	yes	yes	yes	yes
Observations	246	246	246	246	246	246
Number of groups	120	120	120	120	120	120

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Column 2 presents the operating profitability model. From the results it follows that the effect of having an industry specialized owner is not significant for any of the three groups. The coefficient for the base group of initially medium performers is -5.2 points, but this is not significant at conventional levels. For initially high performers the coefficient is -1.1 points (standard error of 7.1) and for initially low performers 6.7 points (standard error of 6.9), but these too are not significant. However, when those effects are contrasted, it becomes evident that having an industry specialized owner results in an 11.9 points larger improvement in operating profitability for initially low performers than for medium performing counterparts. This difference is significant at the 1% level. Between the medium and high pre-buyout performers no significant differences exist. The operating profitability model thus provides strong support for hypothesis 2a but no support for hypothesis 2b.

Yet, despite the support for hypothesis 2a, even the 6.7 points difference of initially low performers is still not significantly different from similar generalist buyouts. The hypothesized effect that specialized PE firms improve portfolio company performance thus seems absent in the operating profitability model. This contradicts with recent findings from Nadant et al. (2018). An explanation for this apparent discrepancy could be that the sample of Nadant et al. (2018) contains only PBOs

while this sample includes both PBOs and SBOs. Yet, exclusion of SBOs from the model does not change the above results.

A second reason could be cross-country differences between the French and UK datasets. Nadant et al. (2018) report that generalist buyouts on average experience a substantial decline in operating profitability. For all three groups of initially low, medium, and high performers the authors reported a decline in profitability. For high performers this decline is even statistically significant. In the sample of this research no such decline is found. Initially low performing generalist buyouts experience a 3.63 points increase and medium 5.97. High performers experience an average decline of 132.89 points but this is driven by a single large outlier. If this outlier is excluded, the average profitability decline is a mere 3.59. This indicates that the contradiction in research result may result from cross-country differences in the performance of generalist rather than specialists. Plausible, UK specialists compete with more skilled generalists PE firms than their French counterparts, making it more difficult for the UK specialists to outperform.

A second contingency that can increase the impact of PE firm heterogeneity is a period of economic downturn. This led to the advancement of the following hypothesis:

H3. The positive relationship between PE firm industry specialization and a target's post-LBO performance changes will be stronger for buyouts held and acquired during the financial crisis.

This hypothesis is tested by interacting the specialization dummy and financial crisis buyout dummy. Results are summarized in column 3 and 4 of table 7. The inclusion has important implications for the turnover growth model. In line with expectation, financial crisis buyouts are found to grow significantly less than the base group. Crisis buyouts grow 30.5% less than buyouts completed in 2004, 2005, or from 2009 to 2013. In this model the coefficient for the base group reduces to only 12.1% and is no longer significant. Contrarily, for crisis buyouts, having an industry specialized owner does prove valuable. Among this subset of buyouts, having an industry specialized specialized owner results in an additional 90.5% in turnover growth (standard error of 26.9). What follows is that the previously identified positive impact of industry specialization on turnover growth is driven by superior performance of specialist buyouts during the financial crisis. Based on the above, hypothesis 3 is thus corroborated.

It should be noted that financial crisis buyouts by specialists not only outperform financial crisis buyouts of generalists, but also significantly outperform normal specialist buyouts by realizing an additional 48.0% in turnover growth (standard error of 19.8), and normal generalist buyouts by even 60.0% (standard error of 26.0). This is somewhat surprising as it exceeds the previously discussed expectations that led to the advancement of the hypotheses, and will therefore later be discussed in more detail.

Contrarily, the operating profitability model does not indicate any return to specialization. The coefficient for industry specialization among the base group is 3.8 points and insignificant. For financial crisis buyouts it reduces to -3.0 points (standard error of 6.7) and remains insignificant. Contrasting these results yields a 6.8 points difference, but this too proves insignificant and thus provides no support for hypothesis 3.

A third situation in which the return to specialization may increase is in SBOs. This was formalized in the following hypothesis:

> *H5. The positive relationship between PE firm industry specialization and a target's post-LBO performance changes will be stronger in secondary buyouts.*

To test the above hypothesis, an interaction variable between the industry specialization dummy and secondary buyout dummy is included in the models. Results are summarized in column 5 and 6 of table 7. In the Turnover model the coefficient of the specialization dummy reduces to 29.8 and loses its significance, while the negative coefficient of the SBO dummy increases in magnitude form -3.3% to -11.5% but remains insignificant. For secondary buyouts the total benefits of having an industry specialized owner is an additional 50.7% in turnover growth (standard error of 26.1), which is statistically significant at the 5% level. However, because the interaction term itself is only 20.9% and not significantly different from zero the turnover model does not support hypothesis 5 itself.

Contrarily, the operating profitability model does provide support hypothesis 5. Inclusion of the interaction variable reduces the coefficient of the industry specialization to -1.6 points and that of the SBO dummy to -6.0, the latter now being statistically significant. Interestingly, the coefficient of the interaction variable is 7.5 and significant at the 10% level. This indicates that SBOs are indeed a situation in which value creation is more complex. In this complex situation, generalist PE firms

realize significantly lower improvements, while specialists PE firms realize a similar level of improvements as in the less complex PBOs.

4.3.1.1. Deal selection by specialists

Above results show that returns to industry specialization depend on the situation of a buyout. The additional resources of industry specialists are especially valuable for initially low performing targets, targets bought and held during the financial crisis, and SBOs. To investigate if PE firms are aware of this advantage and optimize their buyout activity in accordance, this section will investigate buyout activity of specialists and generalists in those situations. Starting with the first contingency, table 8 shows the distribution of specialists and generalist per group of initially low, medium, and high performers.

Table 8. Distribution of generalists and specialists by groups of initially low, medium, and high operating profitability targets.

	Low operating profitability pre-LBO	Medium operating profitability pre-LBO	High operating profitability pre-LBO	Total
Generalists	36	45	35	116
	31.03%	38.79%	30.17%	100.00%
Industry specialists	50	40	50	140
	35.71%	28.57%	35.71%	100.00%
Total	86	85	85	256
	33.59%	33.20%	33.20%	100.00%

At a first glance there appear to be some differences between the groups. To statistically confirm this a Pearson chi square test is performed. The Pearson chi2 statistic (2) is 6.83 (significance probability of 3.29%) and thus confirms that distributions are significantly different. Hence, industry specialized and generalist PE firms buy different targets. LBOs by industry specialists are more frequently found among initially low and high performers, while buyouts by generalists are more likely among medium pre-deal performers. The results are promising; specialist PE firms are more likely to acquire the initially low performing targets for which their resources are most valuable. However, the results cannot be interpreted as evidence that specialists knowingly maximize the returns to their competitive advantage. For such a conclusion further research is necessary. It may well be specialized PE firms are actually forced to acquire initially low or high performers due to a limited number of obvious investment targets within their specialized domain.

For the second and third contingency a similar analysis is performed. Results are summarized in table 9, and show that the share of financial crisis buyouts is significantly higher among generalists than specialists. To further investigate this difference, the group of crisis buyouts is split up into two groups: buyouts completed in 2006 and 2007 H1, when investors were unaware of the upcoming economic downturn; and buyouts completed in 2007 H2 and 2008, when investors were aware of the already ongoing crisis. Results show that the significant difference in the total financial crisis buyout group is almost entirely driven by a lower buyout activity of industry specialists during 2007 H2 and 2008, when all investors were aware of the crisis. Industry specialists thus responded to the financial crisis by lowering buyout activity. At first sight this seems unfortunate as previous analysis proved that the financial crisis presents a contingency during which the value of specialists resources are larger. However, this lower investment activity of specialists may actually also be a result of their additional resources. Arguably, only a small number of targets with very specific resources or situations will be attractive during economic downturn. Perhaps the deep industry knowledge of specialists allows them to select specifically those targets, while generalists fail to pick out such targets.

Furthermore, table 9 shows that specialists PE firms engage in a significantly larger share of SBOs. This is a promising result as earlier analysis showed that generalists underperform in SBO compared to PBO while specialists perform just as well in both classes. However, these results can again not be interpreted as prove that PE firms are aware of their advantages and actively exploit these. It may well be that the larger share of SBOs by specialists results from a lack of PBO investment opportunities in their specialized domain.

Table 9. Distribution of generalists and specialists over financial crisis and secondary buyouts.

	Generalists	Industry specialists	Total	T-test
Financial crisis buyout	40.18%	29.10%	34.15%	-1.959*
Bought in 2006 and 2007 H1	17.86%	16.42%	17.07%	-0.298
Bought in 2007 H2 and 2008	22.32%	12.69%	17.07%	-1.968*
Secondary buyouts	34.82%	47.76%	41.87%	-2.058**

4.3.2. The impact of industry performance and selection

A second way through which specialized PE firms can outperform generalist counterparts is by simply specializing in the most prosperous industries. However, by confining investments to specific industries, specialized PE firm can also obstruct themselves from reallocating capital between

industries when the investment environment changes. Based on the above the following two hypotheses were advanced:

H4a. Industry specialized PE firms operate in industries that perform better than industries wherein non-specialized PE firms acquire targets.

H4a. Industry specialized PE firms operate in industries that perform worse than industries wherein non-specialized PE firms acquire targets.

This research isolates the PE firm specific and industry specialization effects by adjusting all performance metrics measures for industry and time effects. However, from an investor perspective the metric that ultimately matters most is a buyout's unadjusted IRR (ignoring systemic risk). Hence, the impact of industry performance, which has so far been ignored in this research and is unaddressed by Nadant et al. (2018), also deserves attention.

To verify the above hypotheses, the performance of industries from buyouts backed by specialists is compared with the performance of industries in which generalists operate. It should be noted that this analysis uses the more specific industry classification constructed for adjusting performance measures rather than the broad classification for categorizing PE firms. The 246 sample firms operate in 134 different industries, but because 7-year measurement period for industry performance changes with the buyout date of companies, each LBO has its own industry performance measure. Results are summarized in table 10 below.

Table 10. Industry performance of targets by generalists and specialists.

	Generalists			Specialists			
	Mean	Median	St. dev	Mean	Median	St. dev	T stat
Industry Turnover growth	0.227	0.216	0.131	0.221	0.196	0.124	-0.331
Industry Operating profitability change	0.001	0.002	0.015	0.002	0.002	0.016	0.549

At a first glance, few difference seem to exist between industries of generalists and specialists. This is confirmed by the insignificance of both t test statistics. It is worth noting that the mean turnover growth for both groups is relatively large, the average of 22.38% translate into a 4.14% annual growth, substantially above average annual UK GDP growth. This indicates that both generalists and specialists enter industries with above average growth rates. The flat changes in operating profitability paint another picture and illustrate the difficulty of identifying industries in

which overall profitability structurally improves. This is not surprising as competitive forces will likely drive back any industry wide changes in profitability to equilibrium levels.

Based on the insignificant results above it cannot be concluded if hypotheses 5a and 5b are both false or both true and offset each other. Further analysis is therefore performed by comparing the proportion of specialists and generalists in the top and bottom quintile industries. The top quintile industry will be favored by both specialists and generalists so cannot provide conclusive evidence on hypothesis 5a. The bottom quintile will be shunned by both groups; but as hypothesized, specialists may be forced to invest here anyway due to their chosen specialism. A significant difference in the share of specialists in this quintile can thus provide conclusive evidence on hypothesis 5b.

Table 11. Distribution of generalists and specialists in the top and bottom quintile performing industries.

	Buyouts by generalists	Buyouts by specialists	Share of specialists	T-test
Turnover growth - Top quintile industries	22	27	55.10%	0.093
Turnover growth - Bottom quintile industries	23	26	53.06%	0.102
Operating profitability - Top quintile industries	27	22	44.90%	1.013
Operating profitability - Bottom quintile industries	27	22	44.90%	1.013

The results of table 11 indicate that the share of specialists in both the top and bottom quintile turnover growth industries is very close to the population average of 54.47%. Contrarily, in the operating profitability quintiles the share of specialists is somewhat below average, but not sufficiently to be statistically significant. The robustness of these results was tested and confirmed in quartile and decile groups. The findings thus do not support hypothesis 5b. The top quintile results can be interpreted as evidence that generalists and specialists posses similar quality skills with regards to picking top performing industries. On the other hand, it can be interpreted as indication that the value creation in PE resolves around picking the right target rather than the right industry. The latter is supported by findings of Castellaneta and Gottschalg (2016) that industry effects account for a mere 1% of variance in buyout performance while buyout effects account for 40.2%.

4.3.3. Complementarities in secondary buyouts

To study complementarities in SBOs data on both primary and secondary PE owners is required. For each of the 103 SBOs the primary owners were therefore manually identified in

Thomson One following the same process as described in Section 3.2. This proved successful for 101 of the SBOs.

To verify the hypotheses outlined in Section 2.5 MLME regressions were estimated with the same set of dependent and control variables. However, contrary to earlier regressions, chi square tests did not indicate that MLME models offer improvement over OLS models with fixed effects only. This seems counterintuitive because if PE firms possess complementary resources, one would expect the PE firm specific effects to be even larger in SBOs. An explanation may come from the reduced sample size and limited grouping of deals under PE firms. The 101 SBOs were made by 67 different PE firms. Of the 67 PE firms, 48 undertook only one SBO, 13 completed two SBOs, 4 firms four, 1 firm five, and 1 firm six. Because of this limited grouping and chi square test results it was decided to test the below hypotheses using regular OLS techniques without random intercepts or slopes. Results are summarized in table 12 on the next page.

H6. Secondary buyouts where vendor and buyer possess complimentary resources show a greater post-LBO change in performance compared to other secondary buyouts.

H6a. SBOs in which the acquiring PE firm is specialized in a target's industry while the vendor is not realize a greater positive change in post-LBO performance.

H6b. SBOs in which the acquiring PE firm is larger than the vendor realize a greater positive change in post-LBO performance.

H6c. SBOs in which the acquiring PE firm has more experience than the vendor realize a greater positive change in post-LBO performance.

H6d. SBOs in which the acquiring PE firm is independent while the vendor is not realize a greater positive change in post-LBO performance.

H6e. SBOs in which the selling PE firm is located in a different jurisdiction than the target firm while the buyer is not realize a greater positive change in post-LBO performance.

The turnover growth model provides strong evidence that complementarities between buying and selling PE firms can be a source of value creation in secondary buyouts. The dummy variable that identifies deals where an industry specialized buyer acquires a target from a generalist seller is positive and significant. In the full model this complementarity results in a 33.91% larger turnover growth compared to SBOs where buyer and seller were of the same category. Size does not prove to form a complementarity between PE firms. The results did not change in non-tabulated

Table 12.

OLS models for a subset of secondary buyouts.

All performance measures are industry and time adjusted. For variable definitions, see Table 1.

	Turnover growth						Operating profitability change					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Specialist buyer & Generalist seller	0.526***					0.339**	0.039					0.076
	(0.170)					(0.169)	(0.048)					(0.051)
Generalist buyer & Specialist seller	0.025					-0.121	-0.026					-0.010
	(0.181)					(0.177)	(0.051)					(0.053)
Difference PE - Size		0.011				-0.073		-0.007				0.000
		(0.069)				(0.068)		(0.019)				(0.021)
Difference PE - Size2		-0.001				-0.004		-0.001				-0.001
		(0.006)				(0.005)		(0.002)				(0.002)
Difference PE - Experience			0.071**			0.106**			0.002			-0.005
			(0.032)			(0.042)			(0.009)			(0.013)
Independent buyer & Not independent				-0.088		-0.108				-0.037		-0.052
				(0.286)		(0.252)				(0.077)		(0.075)
Not independent buyer & Independent				-0.215		-0.285				-0.035		-0.094
				(0.204)		(0.195)				(0.055)		(0.058)
Not Cross border buyer & Cross border					1.425***	1.178***					0.004	-0.038
					(0.317)	(0.328)					(0.092)	(0.098)
Cross border buyer & Not Cross border					-0.221	-0.019					0.167***	0.216***
					(0.210)	(0.232)					(0.061)	(0.065)
PE - Syndicated						-0.051						0.028
						(0.345)						(0.104)
Target - Financial expenses	-0.516*	-0.620**	-0.605**	-0.575**	-0.464*	-0.150*	0.193**	0.182**	0.188**	0.189**	0.160**	0.149*
	(0.267)	(0.283)	(0.272)	(0.279)	(0.255)	(0.079)	(0.076)	(0.076)	(0.075)	(0.076)	(0.074)	(0.076)
Target - Size	-0.193***	-0.179***	-0.170***	-0.174***	-0.128**	-0.164***	-0.044***	-0.046***	-0.042***	-0.042**	-0.047***	-0.054***
	(0.057)	(0.062)	(0.058)	(0.059)	(0.055)	(0.059)	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)	(0.017)
Target - Age	-0.011	0.004	0.018	0.009	0.006	0.016	-0.000	0.001	0.001	0.002	-0.000	0.000
	(0.047)	(0.049)	(0.048)	(0.049)	(0.044)	(0.044)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Target - Low Profitability pre-LBO	0.021	0.013	0.048	0.023	0.034	0.154	0.098**	0.100**	0.096**	0.098**	0.091**	0.107**
	(0.168)	(0.177)	(0.172)	(0.176)	(0.158)	(0.160)	(0.047)	(0.048)	(0.048)	(0.048)	(0.046)	(0.048)
Target - High Profitability pre-LBO	-0.115	-0.098	-0.060	-0.116	-0.128	-0.105	-0.065	-0.063	-0.064	-0.066	-0.054	-0.043
	(0.169)	(0.179)	(0.174)	(0.177)	(0.160)	(0.158)	(0.048)	(0.048)	(0.048)	(0.048)	(0.046)	(0.048)
Target - Low growth pre-LBO	-0.443**	-0.319*	-0.225	-0.342*	-0.315*	-0.281	-0.071	-0.056	-0.058	-0.063	-0.070	-0.078
	(0.174)	(0.183)	(0.183)	(0.180)	(0.162)	(0.172)	(0.049)	(0.049)	(0.051)	(0.049)	(0.047)	(0.051)
Target - High growth pre-LBO	1.001***	0.982***	1.072***	0.973***	0.801***	0.937***	-0.057	-0.058	-0.055	-0.061	-0.067	-0.072
	(0.175)	(0.183)	(0.183)	(0.184)	(0.171)	(0.181)	(0.049)	(0.050)	(0.051)	(0.050)	(0.049)	(0.054)
Constant	2.448***	2.330***	2.111***	2.319***	1.789***	1.985***	0.494***	0.498***	0.468**	0.472**	0.516***	0.572***
	(0.642)	(0.694)	(0.661)	(0.670)	(0.617)	(0.662)	(0.182)	(0.188)	(0.183)	(0.182)	(0.178)	(0.190)
Observations	101	101	101	101	101	101	101	101	101	101	101	101
R-squared	0.506	0.455	0.479	0.458	0.558	0.621	0.265	0.262	0.256	0.260	0.313	0.366

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

models where the target size variable was excluded or when only the normal or only the quadratic size proxy was included. Contrarily, SBOs where the buying PE firm has more experience than the seller do result in significantly larger turnover growth. The coefficient of 10.55% in the full model translates into an additional 24.54% of turnover growth for a one standard deviation larger experience. Differences in fund sponsor type do not prove a valuable complementarity. A switch from a captive to independent owner, or the contrary, does not significantly impact turnover growth in SBOs. This does not necessarily mean that differences in independence of PE firm are irrelevant for turnover growth. Possibly the costs and benefits of both type of owners outweigh each other. Last, a reduction in physical and cultural distance between PE firms and portfolio companies proves a strong driver of turnover growth in SBOs. SBOs where the acquiring PE firm has a UK office while the seller does not show a 117.84 turnover growth compared to buyouts where with no change in PE firm proximity. To summarize, the turnover provides strong support for hypotheses 6a, 6c and 6e. Hence, the above model uncovers 3 new complementarities in SBOs that were previously unidentified by academics.

Contrary to turnover model, the operating profitability model does not provide support for any of the hypotheses outlined above. None of the coefficients of interest prove of any explanatory power. An exception is the significant coefficient for the group of SBOs where a locally present PE firms sells to an oversees buyer. This finding is surprising as it contradicts with expectations based on intensified agency problems in cross-border buyouts. A possible explanation for this finding is that the dummy may also proxy for buyouts that transfer from a regional to global oriented PE firm. Such SBOs have been found to create additional value compared to other SBOs (Degeorge et al., 2016).

The lack of explanatory power for the PE characteristics in the operating profitability model is in line with earlier findings in the larger sample. However, it should be noted that the SBO sample of 101 buyouts is relatively small. Results should therefore be interpreted with some caution and do not provide conclusive evidence that the characteristics definitely do not form a valuable complementarity. The dummy that identifies SBOs where an industry specialized buyer acquires a target from a generalist for example is already borderline significant with a probability value of 10.3%.

Other variables that deserve attention are the target size and the leverage proxy. The target size variable proves highly significant in both the turnover growth and operating profitability model.

The coefficient in the turnover model is very similar to previous models but in the profitability model such a negative and significant effect had not been identified before. This further underlines the differences between firms with different size, and indicates that PBOs and SBOs differ in terms of investment opportunities and returns.

Contrary to earlier results, the financial expenses variable now proves of significant explanatory power for both dependent variables. The coefficients indicate a negative relationship with turnover growth and positive relationship with operating profitability. These effects are in line with expectations as described in Section 2.2.3, but somewhat surprising given that they were not found in the full sample models. Because SBO targets are already owned by PE firms one would expect that leverage is already higher and thus that financial engineering value levers are already exploited. To dig deeper into this observation, table 13 compares the changes in financial expenses between PBOs and SBOs.

Table 13. Comparison of pre- and post-deal leverage levels between primary and secondary buyouts.

	Primary buyouts	Secondary buyouts
Pre-deal financial expenses as percentage of revenue	2.01%	7.84%
Post-deal financial expenses as percentage of revenue	18.39%	25.75%
Change in financial expenses as percentage of revenue	16.37%	17.91%

As expected, pre-deal financial expenses as percentage of revenue are higher in SBOs than in PBOs. However, contrary to expectations, the change in financial expenses in SBOs is also higher than in PBOs. As a result, post-deal financial expenses as percentage of revenue in SBOs are 40.1% higher than in PBOs. This increase may possibly reflect intentions of secondary buyers to exploit residual value in financial engineering levers, or merely result from the leverage necessary to finance buyouts. Further analysis of this observation is beyond the scope of this research, but the effects are economically relevant. The full model coefficients are -15.0 for turnover growth and 14.9 for profitability. This translates into a loss of -3.4% in turnover growth and improvement of 3.4 points in operating profitability ratio for a one standard deviation change in financial expenses.

4.3.4. SBOs with complementarities in industry specialization compared to the full buyout sample

The above results raise the question how the performance of SBOs with a generalist seller and specialist buyer compare to the general population of buyouts. To answer this question three full sample models are compared. The first one includes the variables that identify SBOs where a target

transfers from a generalist to specialist and vice versa, the second one includes the interaction term between the general specialization and normal secondary buyouts dummy (this is the same model as in table 7 column 5), the third one includes all these variables. Because table 12 reports no returns to complementarities in terms of operating profitability, further analysis will be continued with only the turnover growth model. Results are summarized in table 14.

Table 14. Multilevel mixed-effect maximum likelihood models.
All performance measures are industry and time adjusted. For the sake of synthesis, PE control variables, Target control variables, constants, and MLME coefficients are not reported. PE firm control variables are: Size, Size^2, Experience, Independent, Syndicated, Cross-border. Target control variables are: Financial expenses, Size, Age, Secondary buyout, Low profitability pre-LBO, High profitability pre-LBO, Low growth pre-LBO, High growth pre-LBO. For variable definitions, see Table 1.

	Turnover growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Industry Specialization dummy	0.314	0.298	0.292	0.057	0.036	0.021
	(0.223)	(0.239)	(0.239)	(0.231)	(0.248)	(0.247)
SBO - Specialist buyer & Generalist seller	0.577**		0.550**	0.587**		0.546**
	(0.260)		(0.280)	(0.256)		(0.275)
SBO - Generalist buyer & Specialist seller	0.137		0.163	0.205		0.246
	(0.224)		(0.247)	(0.222)		(0.245)
Industry Specialization dummy * Target - Secondary buyout		0.209	0.077		0.207	0.118
		(0.248)	(0.295)		(0.243)	(0.290)
Financial crisis buyout				-0.335**	-0.304**	-0.337**
				(0.151)	(0.151)	(0.151)
Industry Specialization dummy * Financial crisis buyout				0.793***	0.783***	0.797***
				(0.246)	(0.248)	(0.246)
Target - Secondary buyout	-0.168	-0.115	-0.202	-0.178	-0.103	-0.230
	(0.149)	(0.156)	(0.198)	(0.146)	(0.154)	(0.195)
PE control variables	yes	yes	yes	yes	yes	yes
Target control variables	yes	yes	yes	yes	yes	yes
MLME model	yes	yes	yes	yes	yes	yes
Observations	246	246	246	246	246	246
Number of groups	120	120	120	120	120	120

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Model 4, 5, and 6 follow the same steps but also include the variables for financial crisis because these were earlier found to impact turnover growth. All previously found results, including that on buyout performance during the financial crisis, prove robust. In the final model the coefficient of the basic industry specialization dummy reduces to a mere 2.1% and is not significant. The coefficient of the SBO specialized buyer and generalist seller dummy remains of similar magnitude and significance. This group of SBOs significantly outperforms specialists SBOs where the primary owner was also specialist by 54.6%, and SBOs between two generalists by 68.5% (standard error of 33.2). In addition to that, the group also outperforms PBOs. It realizes an additional 43.3% in turnover growth compared to specialist PBOs (standard error of 25.1) and 45.5% (standard error of 25.4) compared to generalist PBOs. Furthermore, the model still shows that financial crisis buyouts underperform, and that specialists are able to compensate for this loss. Financial crisis buyouts by

specialists are also still found to outperform PBOs. Compared to generalists PBOs they grow an additional 48.1% (standard error of 21.7), and compared to specialist PBOs an extra 46.0% (standard error of 19.5).

The results thus indicate that specialist financial crisis buyouts and SBOs between specialist buyers and generalist vendors not only outperform their generalist counterparts but also the base group of normal situation buyouts. This is somewhat surprising. Based on the discussed literature it was hypothesized that SBOs and financial crises present situations in which value creation is more complex, and that this leads to an advantage for specialist as their additional resources would help realize the hard to reach value. However, following this argument it was only expected that complementary secondary and financial crisis buyouts by specialists would outperform such buyouts by generalists. Not that the two groups of specialist buyouts also outperform normal generalist and specialist buyouts. The finding that they do underlines the importance of the selection phase for PE firms and creates a further advantage for specialists. Targets in the complementary secondary or financial crisis buyout groups not only have more complex value creation opportunities, but within this group there are apparently also buyouts with larger than average value creation potential. This leads to another advantage for specialist. Specialist PE firms have the ability to select exactly these buyouts with high value potential during the selection phase and then successfully capitalize on their (complex) value creation opportunities during the holding phase.

Plausibly, buyouts with higher value creation potential may also entail higher risks, and outperformance of these buyouts may at least partly form the reward for that additional risk. In that case, the results of this research overstate the true benefits to industry specialization, as performance measures are not risk adjusted. On the other hand, the sector expertise of specialists may actually reduce the risks faced when acquiring high risk high return targets. The deep industry knowledge can improve the understanding of a target's private probability of success in an industry, and reduce information asymmetries. Investigation of these hypotheses is an important given the results of this research. However, as it is beyond the scope of the current paper it remains a topic for future research.

5. Conclusion

Using a sample of 246 UK LBOs this study seeks to understand the impact of PE industry specialization on the performance of portfolio companies. Overall, a positive return to specialization is found, but benefits are highly concentrated in specific situations and are only found among a subset of performance measures.

Contrary to results of Cressy et al. (2007) it is shown that buyouts backed by industry specialized PE firms are associated with 38.4% larger changes in post-LBO turnover growth, but not with significant improvements in operating profitability. Furthermore, no relationship between industry specialization and working capital levels or employee productivity was found. These results provide answers to questions stemming form the mixed empirical evidence on the impact of industry specialization by Cressy et al. (2007) and Meuleman et al. (2009). The positive relationship between specialization and operating profitability as identified by Cressy et al. (2007) may have resulted from methodological flaws or the failure to adjust performance metrics for industry and time effects.

Building on the recent work of Castellenata and Gottschalg (2016), it is found that the positive effect of industry specialization exhibits strong variation between PE firms and contexts. A multilevel mixed effects model reveals that differences in buyout performance depend on PE firm specific effects and their ability to leverage industry expertise as a valuable resource. However, contrary to Nadant et al. (2018), the positive impact of specialized PE firms on turnover growth does not seem concentrated in initially low or high performers. A second contradiction with Nadant et al. (2018) is the finding that targets backed by industry specialists in general do not realize higher changes in operating profitability compared to generalist backed buyouts. However, it is found that benefits of having and industry specialized owner are significantly larger for targets that were initially low performing. Further analysis reveals that the contradiction in results with Nadant et al. (2018) may be caused by differences in the capabilities of French and UK generalist rather than specialists. Either way, the contradiction illustrates the cross-country heterogeneity of the PE industry, and underlines that academics should be cautions when extrapolating PE research results across geographies.

The research then makes further valuable contributions to existing literature by showing that the benefits of having an industry specialized owner are substantially larger during financial crises and in SBOs. Financial crisis buyouts from specialists outperform those of generalist by realizing an

additional 90.5% in turnover growth, while SBOs by specialists achieve a 5.9 points higher change in operating profitability ratio than SBOs by generalist counterparts. This provides support for the hypothesis that returns to industry specialization are especially large in situations where value creation is more complex.

Analysis of buyout activity by generalists and specialists during certain situations reveals that specialists are more likely to buy targets that are initially low or high performing, undertake relatively more secondary buyouts, and become less active during financial crises. It can however not be concluded to what extend such differences are caused by motives to exploit the benefits of specialization, or merely by the lack of obvious investment opportunities in their specialized domain.

Furthermore, the performance of industries in which specialists are active is compared to the performance of industries where generalists are active. Neither group seems to outperform the other in terms of average improvements or share in top or bottom quintiles. The results thereby do not indicate that specialist PE firms specifically specialize in the most favorable industries, or that sector restrictions force specialists to invest in industries with poor prospects.

In addition to the general industry specialization literature the present paper also contributes to research on secondary buyouts. By studying the impact of a change in resources between selling and buying PE firms this paper builds further on the pioneering work of Degeorge et al. (2016), and identifies a new set of complementary skills in secondary buyouts. Specifically, it is concluded that SBOs outperform other SBOs when: (1) a buyer is specialized in the target's industry while the seller is not, (2) the buying firm has more experience, and (3) the seller operates cross-border while the buyer has a local presence.

Last, it is shown that the advantages for specialists during the financial crisis or when completing a SBO with a generalist seller are so large that these buyouts even outperform normal situation buyouts. This indicates that the two groups of buyouts not only have more complex value creation opportunities, but that the size of these opportunities is also larger.

The importance of the above results has never been greater. Competition in the PE industry has forced firms to increasingly rely on operational and strategic changes for the creation of value. Having a competitive advantage in this aspect has therefore become ever more relevant, and will impact the returns PE firms generate for investors. Research results thus provide guidance to PE firms

on how to maximize returns and utilize their resources, but may also help target management when selecting their financial backers, or PE sponsors in their quest for alpha. Furthermore, the upcoming Brexit, with its accompanying business turmoil and possible economic downturn, may present a new situation during which benefits to industry specialization increase.

As with any study in the PE context, this research contains some limitations that can guide further research. First, this research focusses exclusively on the effect of industry specialization on target performance. Other buyout level return drivers such as multiple expansion, add-on acquisitions, and tax shield benefits are thereby neglected. Additionally, this approach ignores possible benefits or costs at the PE firm level such as reduced portfolio diversification. Second, even though Heckman tests give no indication of sample selection bias, the presence of such cannot be fully ruled out with certainty and may still have biased results. Third, the identified cross-country heterogeneity in the PE industry underlines the difficulties with extrapolating PE research results across geographies. A future research could therefore further improve findings by use of a multi-country sample. Fourth, the exclusion of possible relevant control variables may have biased results. Especially the omitted proxy for PE support intensity seems relevant in the context of this research. Fifth, this research does not disentangle the effects of superior deal selection and management skills by specialists. It can therefore not draw any conclusions on the relative importance of the two. Sixth, as earlier pointed out, it would be interesting to investigate and plausibly adjust for different levels of risks in buyouts. Perhaps the outperformance of specialist financial crisis buyouts and SBOs with specialization complementarities actually forms a reward for higher levels of risk in such investments.

6. References

Abbot, S., Hay, M. (1995). Investing for the Future. *FT-Pitman, London.*

Acharya, V., Gottschalg, O., Hahn, M., Kehoe, C. (2013). Corporate governance and value creation: Evidence from private equity. *The Review of Financial Studies* 26 (2), 368-402.

Achleitner, A., Andres, C., Betzer, A., Weir, C. (2010). Wealth effects of Private Equity Investments on the German Stock Market. *European Journal of Finance* 17 (3), 217-239.

Achleitner, A., Braun, R., Engel, N., Figge, C., Tappeiner, F. (2010). Value creation drivers in private equity buyouts: Empirical evidence from Europe. *The Journal of Private Equity* 13 (2), 17-27.

Achleitner, A., Figge, C. (2014). Private equity lemons? Evidence on value creation in secondary buyouts. *European Financial Management* 20 (2), 406-433.

Amess K., Girma, S., Wright, M. (2008). What are the wage and employment consequences of leveraged buyouts, private equity and acquisitions in the UK? *Nottingham University Business School Research Paper No. 2008-01.*

Amess, K. Stiebale, J., Wright, M. (2016). The impact of private equity on firms' patenting activity. *European Economic Review* 86, 147-160.

Archibugi, D., Pianta, M. (1994). Aggregate convergence and sectoral specialization in innovation. *Journal of Evolutionary Economics* 4 (1), 17-33.

Arcot, S., Fluck, Z., Gaspar, J., Ulrich, H. (2015). Fund managers under pressure: Rationale and determinants of secondary buyouts. *Journal of Financial Economics* 115 (1), 102-135.

Bacon, N., Wright, M., Demania, N. (2004). Management buyouts and human resource management. *International Journal of Employment Relations* 42 (2), 325-347.

Bacon, N., Wright, M., Ball, R., Meuleman, M. (2012). Private equity, HRM, and employment. *Academy of Management Perspectives* 27 (1), 7-21.

Bain & Company (2018). Global private equity report 2018. http://www.bain.de/Images/BAIN_REPORT_2018_Private_Equity_Report.pdf

Barber, F., Goold, M. (2007). The strategic secret of private equity. *Harvard business review September 2007.*

Beck, T., Demirguc-Kunt, A., Laeven, L., Levine, R. (2008). Finance, firm size, and growth. *Journal of Money, Credit, and Banking* 40 (7), 1379-1405.

Berg, A., Gottschalg, O. F. (2005). Understanding value generation in buyouts. *Journal of Restructuring Finance* 2 (9), 9-37.

Bharath S., Dittmar, A., Sivadasan, J. (2014). Do going-private transactions affect plant efficiency and investment? *The Review of Financial Studies* 27 (7), 1929-1976.

Bonini, S. (2015). Secondary buyouts: operating performance and investment determinants. *Financial Management* 44 (2), 431-470.

Bottazzi, L., Da Rin, M., Hellmann, T. (2008). Who are the active investors? Evidence from venture capital. *Journal of Financial Economics* 89 (3), 488-512.

Bruining, H., Boselie, P., Wright, M., Bacon, N. (2005). The impact of business ownership change on employee relations: Buy-outs in the UK and The Netherlands. *The International Journal of Human Resource Management* 16 (3), 345-365.

BVCA (2006). The Economic Impact of Private Equity in the UK. *British Private Equity and Venture Capital Association.*

BVCA (2007). Private equity and venture capital report on investment activity. *British Private Equity and Venture Capital Association.*

BVCA (2010). Private equity and venture capital report on investment activity. *British Private Equity and Venture Capital Association.*

BVCA (2013). Private equity and venture capital report on investment activity. *British Private Equity and Venture Capital Association.*

BVCA (2016). Private equity and venture capital report on investment activity. *British Private Equity and Venture Capital Association.*

Castellaneta, F., Gottschalg, O. (2016). Does ownership matter in private equity? The sources of variance in buyouts' performance. *Strategic management journal* 37 (2), 330-348.

Carpenter R.E., Petersen, B.C. (2002). Is the growth of small firms constrained by internal finance? *Review of Economics and Statistics* 84 (2), 298-309.

Citron, D., Wright, M., Rippington, F., Ball, R. (2003). Secured creditor recovery rates from management buy-outs in distress. *European Financial Management* 9 (2), 141-162.

Cressy, R., Munari, F., Malipiero, A. (2007). Playing to their strengths? Evidence that specialization in the private equity industry confers competitive advantage. Journal of Corporate Finance 13, 647-669.

Cumming, D., Macintosh, J.G. (2003). Venture capital exits in Canada and the United States. *University of Toronto Law Journal* 53, 101-200.

Cumming, D., Macintosh, J.G. (2006). Crowding out private equity: Canadian evidence. *Journal of Business Venturing* 21, 569-609.

Cumming, D., Siegel, D., Wright, M. (2007). Private equity, leveraged buyouts and governance. *Journal of Corporate Finance* 13 (4), 439-460.

Cumming, D., Walz, U. (2010). Private equity returns and disclosure around the world. *Journal of International Business Studies* 41, 727-754.

Davis, S.J., Haltiwanger, J.C., Handley, K., Jarmin, R.S., Lerner, J., Miranda, J. (2014). Private equity, jobs, and productivity. *American Economic Review* 104 (12), 3956-3990.

De Clercq, D., Sapienza, H. J. (2005). When do venture capital firms learn from their portfolio companies. *Entrepreneurship: Theory & Practice* 29 (4), 517-535.

Degeorge, F., Martin, J., Phalippou, L. (2013) Is the rise of secondary buyouts good news for investors? Oxford University Working paper.

Degeorge, F., Martin, J., Phalippou, L. (2016). On secondary buyouts. *Journal of Financial Economics* 120 (1), 124-145.

EY (2018). EY capital briefing February 2018.

Faccio, M., Hsu, H. (2017). Politically connected private equity and employment. *The Journal of Finance* 72 (2), 539-574.

Fama, E. (1980). Agency Problems and the Theory of the Firm. *Journal of Political Economy* 88 (2), 288-307.

Fama, E., French, K. (1995). Size and book-to-market factors in earnings and returns. *The Journal of Finance* 50 (1), 131-155.

Fama, E., Jensen, M. (1983). Agency problems and residual claims. *The Journal of Law & Economics* 26 (2), 327-349.

Ferreira, D., Manso, G., Silva, A.C. (2014). Incentives to innovate and the decision to go public or private. *The Review of Financial Studies* 27 (1), 256-300.

Franzoni, F., Nowak, E., Phalippou, L. (2012). Private equity performance and liquidity risk. *The Journal of Finance* 67 (6), 2341-2373.

Gadiesh, O., MacArthur, H. (2006). Private Equity: 6 lessons for each company. *Bain and Company, Inc.*

Gejadze, M., Giot, P. Schwienbacher, A. (2017). Private equity fundraising and firm specialization. *The Quarterly Review of Economics and Finance* 64, 259-274.

Ghai, S., Kehoe, C., Pinkus, G. (2014). Private equity: Changing perceptions and new realities. *McKinsey Quarterly, April.*

Gompers, P., Kaplan, S., Mukharlyamovd, V. (2016). What do private equity firms say they do? *Journal of Financial Economics* 121 (3), 449-476.

Gompers, P., Kovner, A., Lerner, J., Scharfstein, D. (2008). Venture capital investment cycle: the impact of public markets. *Journal of Financial Economics* 87, 1-23.

Gottschalg, O., Wright, M. (2011). Understanding the buyers' role in private equity returns - The influence of skills, strategy and experience. *Conference, New York City, United States.*

Grossman, S.J., Hart, O. (1986). Corporate financial structure and managerial incentives. In J.J. McCall. *The Economics of Information and uncertainty,* 107-140.

Guo, S., Hotchkiss, E., Song, W. (2011). Do Buyouts (Still) Create Value? *Journal of Finance* 66, 479-517.

Hall, M., Weiss, L. (1967). Firm size and profitability. *The Review of Economics and Statistics* 49 (3), 319-331.

Harris, R.S., Jenkinson, T., Kaplan, S.N. (2014). Private equity performance: What do we know?. *The Journal of Finance* 69 (5). 1851-1882.

Harris, R.S., Jenkinson, T., Kaplan, S.N., Stucke, R. (2014). Has persistence persisted in private equity? Evidence from buyout and venture capital funds. *Darden Business School Working Paper No. 2304808*.

Harris, R.S., Siegel, D.S., Wright, M. (2005). Assessing the impact of management buyouts on economic efficiency: plant level evidence from the United Kingdom. *The Review of Economics and Statistics* 87, 148-153.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica*, 53-161.

Hochberg, Y.V., Ljungqvist, A., Lu, Y. (2007) Whom you know matters: Venture capital networks and investment performance. *The Journal of Finance,* 62 (1), 251-301.

Holmstrom, B., Kaplan, S. (2001). Corporate governance and merger activity in the United States: making sense of the 1980s and 1990s. *The Journal of Economic Perspective,* 121-144.

Hotchkiss, E.S., Strömberg, P., Smith, D.C. (2014). Private Equity and the Resolution of Financial Distress. *Working paper, Stockholm School of Economics.*

Jensen, M. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review* 76 (2), 323-329.

Jensen, M. (1989). Eclipse of the Public Corporation. *Harvard Business Review*.

Jenkinson, T., Sousa, M. (2015) What determines the exit decision for leveraged buyouts? *Journal of Banking and Finance* 59, 399-408.

Jenkinson, T., Stucke, R. (2011). Who benefits in leveraged buyouts? University of Oxford Working paper.

Jenkinson, T, Morkoetter, S., Wetzer, T. (2018). Buy low, sell high? Do private equity fund managers have market abilities? University of St. Gallen, School of Finance Research Paper No. 2018/13.

Jungwirth, C., Moog, P. (2004). Selection and support strategies in venture capital financing: high-tech or low-tech, hands-off or hands-on? *Venture Capital* 6 (2-3), 105-123.

Kaplan, S. (1989). The effects of management buyouts on operating performance and value. *Journal of Financial Economics* 24 (2), 217-254.

Kaplan, S.N., Schoar, A. (2005). Private equity performance: returns, persistence and capital flows. *The Journal of Finance* 60 (4), 1791-1823.

Kaplan, S.N., Sensoy, B.A. (2015). Private equity performance: A survey. *Annual Review of Financial Economics* 7, 597-614.

Kaplan, S.N., Strömberg, P. (2009). Leveraged Buyouts and Private Equity. *Journal of Economic Perspectives*, 121-146.

Katz, S.P. (2009). Earnings quality and ownership structure: The role of private equity sponsors. *The Accounting Review* 84 (3), 623-658.

Lee, J. (2009). Does size matter in firm performance? Evidence from US public firms. *International Journal of the Economics of Business* 16 (2), 189-203.

Leslie, P., Oyer, P. (2008). Managerial incentives and value creation: Evidence from private equity. *NBER Working Paper.*

Lerner, J., Sorensen, M., Strömberg, P. (2011). Private equity and long-run investment: The case of innovation. *The Journal of Finance* 66 (2), 445-477.

Leslie, P., Oyer, P. (2008). Managerial incentives and value creation: Evidence from private equity. *NBER Working paper.*

Lichtenberg, F.R., Siegel, D.S. (1990). The effect of leveraged buyouts on productivity and related aspects of firm behavior. *Journal of Financial Economics* 27, 165-194.

Ljungqvist, A., Richardson, M.P., Wofenzon, D. (2017). The investment behavior of buyout funds: Theory and evidence. *ECGI - Finance Working Paper No. 174/2007.*

Lopez-de-Silanes, F., Phalippou, L., Gottschalg, O. (2015). Giants at the gate: investment returns and diseconomies of scale in private equity. *Journal of Financial and Quantitative Analysis* 50 (3), 377-411.

Long, W.F., Ravenscraft, D. (1993). LBOs, debt and R&D intensity. *Strategic Management Journal* 14, 119-35.

Manigart, S., Lockett, A., Meuleman, M., Wright, M., Landström, H., Bruining, H., Desbrières, P., Hommel, U. (2006). Venture capitalists' decision to syndicate. *Entrepreneurship: Theory and* Practice 30 (2), 131-153.

Mao, Y., Renneboog, L. (2015). Do managers manipulate earnings prior to management buyouts? *Journal of Corporate Finance* 35, 43-61.

Meuleman, M., Amess, K., Wright, M., Scholes, L. (2009). Agency, strategic entrepreneurship, and the performance of private equity-backed buyouts. *Journal of Entrepreneurship Theory and Practice* 33 (1), 213-239.

Nadant, A.L., Perdreau, F., Bruining, H. (2018). Industry specialization of private equity firms: a source of buy-out performance heterogeneit. *Venture Capital* 20 (3), 237-259.

Nathusius, E., Achleitner, A. (2009). Angels or demons? Evidence on the impact of private equity firms on employment. *CEFS working paper series 2009-10.*

Nikoskelainen, E., Wright, M. (2007). The impact of corporate governance mechanisms on value increase in leveraged buyouts. *Journal of Corporate Finance* 13 (4), 511-537.

Officer, M.S., Ozbas, O., Sensoy, B.A. (2010). Club deals in leveraged buyouts. *The journal of Financial Economics* 98, 214-240.

Plagborg-Møller, E., Holm, M. (2017). IPO or SBO?: The increasing importance of operational performance for private equity exits following the global financial crisis of 2007–08. *Journal of Applied Corporate Finance* 29 (1), 115-121.

Popov, A.A., Roosenboom, P. (2009). Does private equity investment spur innovation? Evidence from Europe. *ECB Working Paper No. 1063.*

Puche, B., Lotz, C. (2015). Private equity minority investments. *The Journal of Private Equity* 18 (4), 46-55.

Phalippou, L. (2014). Performance of buyout funds revisited. *Review of Finance* 18 (1), 189-218.

Phalippou, L., Gottschalg, O. (2009). The performance of private equity funds. *The Review of Financial Studies* 22 (4), 1747-1776.

Preqin (2017). Preqin global private equity and venture capital report.

PWC (2017). Private equity trend report 2017. *Price Waterhouse Couper.*

Renneboog, L., Simons, T., Wright, M. (2007). Why do public firms go private in the UK? The impact of private equity investors, incentive realignment and undervaluation. *Journal of Corporate Finance* 13, 591-628.

Renneboog, L., Vansteenkiste, C. (2017). Leveraged buyouts: Motives and sources of value. *Annals of Corporate Governance* 2 (4), 291-389.

Rigamonti, D., Cefis, E., Meoli, M., Vismara, S. (2016). The effects of the specialization of private equity firms on their exit strategy. *Journal of Business Finance & Accounting* 43 (9-10), 1420-1443.

Robinson, D., Sensoy, B. (2013). Cyclicality, performance measurement, and cash flow liquidity in private equity. Work. Pap., Ohio State Univ.

Roll, R. (1981). A possible explanation for the small firm effect. *The Journal of Finance* 36 (4), 879-888.

Scellato, G., Ughetto, E. (2013). Real effects of private equity investments: Evidence from European buyouts. *Journal of Business Research* 66 (12), 2642-2649.

Smith, A.J. (1990). Corporate ownership structure and performance: The case of management buyouts. *Journal of Financial Economics* 27 (1), 143-164.

Smit, H., van den Berg, W. (2006). Private equity waves. *Tinbergen Institute Discussion Paper, TI 2006-053/2.*

Smit, H.T., Volosovych, V. (2013) Secondary buyout waves. Working paper, Erasmus 61 University Rotterdam.

Sorensen, M. (2007). How smart is smart money? An empirical two-sided matching model of venture capital. *Journal of Finance,* 62 (6), 2725-2762.

Sorensen, M., Jagannathan, R. (2013). The public market equivalent and private equity performance. Working paper, Columbia University and Northwestern University.

Strömberg, P. (2008). The new demography of private equity. *The Global Impact of Private Equity Report. World Economic Forum: New York*, 3-26.

Stulz, R.M. (1990). Managerial discretion and optimal financing policies. *Journal of Financial Economics* 26 (1), 3-27.

Toms, S., Wright, M. (2005). Divergence and convergence within Anglo-American corporate governance systems: evidence from the US and UK 1950-2000. *Business History* 47, 267-295.

Valkama, P., Maula, M., Nikoskelainen, E., Wright, M. (2013). Drivers of holding period firm-level returns in private equity-backed buyouts. *Journal of Banking & Finance* 37 (7), 2378-2391.

Wang, Y. (2012). Secondary buyouts: Why buy and at what price? *Journal of Corporate Finance* 18, 1306-1325.

Weir, C., Jones, P., Wright, M. (2015). Public to private transactions, private equity and financial health in the UK: an empirical analysis of the impact of going private. *Journal of Management & Governance* 19 (1), 91-112.

Weir, C., Laing, D., Wright, M. (2005). Undervaluation, private information, agency costs and the decision to go private. *Applied Financial Economics* 15 (13), 947-961.

Wilson, N., Wright, M., Siegel, D. S., Scholes, L. (2012). Private equity portfolio company performance during the global recession. *Journal of Corporate Finance* 18 (1), 193-205.

Wood, G., Wright, M. (2009). Private equity: A review and synthesis. *International Journal of Management Reviews* 11 (4), 361-380.

Wright, M., Chiplin, B., Thompson, S. Robbie, K. (1990). Management buy-outs, trade unions and employee ownership. *Industrial Relations Journal* 21, 136-46.

Wright, M., Gilligan, J., Amess, K. (2007). The economic impact of private equity: what we know and what we would like to know. *Venture capital* 11 (1), 1-21.

Wright, M., Hoskisson, R., Busenitz, L. (2001). Firm rebirth buyouts as facilitators of strategic growth and entrepreneurship. *Academy of Management Executive* 15 (1), 111-125.

Wright, M., Renneboog, L., Simons, T., Scholes, L. (2006). Leveraged buyouts in the U.K. and Continental Europe: retrospect and prospect. *Journal of Applied Corporate Finance* 18 (3), 38-55.

Wright, M., Wilson, N., Robbie, K. (1996). The longer term effects of management-led buyouts. *Journal of Entrepreneurial and Small Business Finance* 5, 213-234.

Wright, M., Wilson, N., Robbie, K., Ennew, C. (1994). Restructuring and Failure in buy-outs and buy-ins. *Business strategy review* 5 (2), 21-40.

7. Appendix

Table A1. Multilevel mixed-effect maximum likelihood models.
All performance measures are industry and time adjusted. For variable definitions, see Table 1.

	(1)	(2)	(3)	(4)	(5)
	Average wage change	Operating profitability change	Operating profitability change	Operating profitability change	Operating profitability change
Industry Specialization dum	-0.043	0.006	0.019	0.019	0.014
	-0.035	-0.062	-0.061	-0.062	-0.061
PE - Size	0.017	0.042*			0.034
	-0.019	-0.024			-0.024
PE - Size^2	-0.001	-0.004*			-0.003
	-0.002	-0.002			-0.002
PE - Experience	0.011	0.013	0.015	0.016	0.008
	-0.015	-0.032	-0.026	-0.026	-0.031
PE - Independent	-0.027	-0.353	-0.358	-0.355	-0.36
	-0.05	-1.146	-1.147	-1.146	-1.147
PE - Syndicated	0.081	0.002	0.009	0.012	0.01
	-0.063	-0.046	-0.047	-0.046	-0.046
PE - Cross border	0.037	0.423	0.417	0.415	0.42
	-0.058	-0.988	-0.989	-0.988	-0.989
Target - Financial expenses	-0.107	0.06	0.004	0.013	0.027
	-0.085	-0.046	-0.05	-0.051	-0.052
Target - Size	-0.005		-0.019*	0.029	0.014
	-0.015		-0.01	-0.056	-0.057
Target - Size^2				-0.002	-0.001
				-0.003	-0.003
Target - Age	-0.009	-0.01	-0.005	-0.006	-0.008
	-0.01	-0.008	-0.008	-0.008	-0.008
Target - Secondary buyout	-0.037	-0.014	-0.013	-0.013	-0.015
	-0.035	-0.021	-0.021	-0.02	-0.02
Target - Low Profitability pre	0.01	0.014	0.016	0.017	0.012
	-0.04	-0.023	-0.023	-0.023	-0.023
Target - High Profitability pre	-0.002	-0.064**	-0.077***	-0.079***	-0.076***
	-0.043	-0.026	-0.027	-0.027	-0.026
Target - Low growth pre-LBO	0.036	-0.022	-0.016	-0.013	-0.022
	-0.04	-0.026	-0.025	-0.025	-0.026
Target - High growth pre-LBO	0.002	-0.035	-0.036	-0.034	-0.035
	-0.04	-0.025	-0.025	-0.025	-0.025
Constant	0.071	-0.135	0.101	-0.154	-0.107
	-0.182	-1.111	-1.118	-1.155	-1.157
Observations	235	246	246	246	246
Number of groups	119	120	120	120	120

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1