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# Private Equity Engineering

*A study of Value-Creating Actions Undertaken by Private Equity Firms in Sweden*

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# Abstract


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| **Keywords** | Private Equity, Value Creation, Financial Engineering, Operational Engineering, Governance Engineering |
| **Purpose** | The purpose of this study is to explore the effects of value-creating actions that are undertaken by PE-firms on their portfolio companies on the Swedish market. |
| **Methodology** | Quantitative method with a deductive approach. |
| **Theoretical perspectives** | Value Creation Framework including Financial, Governance and Operational Engineering. |
| **Empirical foundation** | The empirical foundation has been obtained from Bloomberg and the Swedish House of Finance. The sample consists of 74 PE acquisitions from 2007 to 2017, and a peer group of 74 public firms. |
| **Conclusions** | We conclude that a mix of operational and governance engineering primarily drives the value creation process during the holding period. Financial engineering, on the other hand, seems to be less important in terms of value creation. |

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Thank you!

Jimmy Enhammar

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## Innehållsförteckning

# 1. Introduction

## 1.1 Background

The worldwide private equity (henceforth, "PE") industry has grown rapidly since the 1980s when leveraged buyouts ("LBOs") became a popular strategy to take public companies private through debt-financed acquisitions. However, the popularity of such transactions has varied over time through different waves. The economic environment can explain most of the variations both in value and number of leveraged buyouts since the frequency of such transactions is highly influenced by levels of interest rates and debt availability (Gaughan, 2017).

The total number of worldwide leveraged buyouts reached an all-time high at the end of the sixth wave that took place between 2003-2007. Not only did the number of transactions peak, but also the value of the deals. Debt financing was relatively inexpensive thanks to a robust economy characterized by low interest-rates and a growing stock market which enhanced the availability of capital (Gaughan, 2017). When the global recession began in 2008, PE activity decreased dramatically. Companies that had been subject to buyouts was now facing a challenging future, and those firms that had undergone a leveraged buyout experienced increased insolvency risks (Wilson et al., 2012). The PE market, however, recovered after some years and rebounded strongly between 2013-2017 as the seventh wave emerged (Gaughan, 2017).

In 2017, Sweden had Europe's sixth highest PE investments as a percentage of GDP (Invest Europe, 2017). This ratio has decreased relative to other countries since 2007 when Sweden had the world's third highest PE activity, only surpassed by the US and UK (Bergström, Grubb & Jonsson, 2007). Despite this declining trend, PE activity is still a highly important mechanism for the domestic and international business environment. Particularly because it is a driving force behind productivity improvements and it enables firms to exploit expansion and investments opportunities. Through active ownership, long-term focused sustainable companies can be built and grown without funding from public markets (SVCA, 2017).

PE-backed firms (or "portfolio companies") tend to grow faster on average than comparable publicly held companies of similar size (SVCA, 2019). Consistent with early studies on the American market, authors have found evidence on highly significant overperformance of PE-backed firms' relative public companies (Kaplan, 1989b; Smith, 1990; Lichtenberg and Siegel, 1990). Similar studies during the 2000s covering the later waves have not found the same magnitudes of superior performance, however, PE firms still tend to create value as their portfolio companies perform better operationally than non-PE-backed firms (Kaplan & Schoar, 2005; Bergström et al., 2007; Phalippou & Gottschalg, 2009; Kaplan & Strömberg, 2009; Guo, Hotchkiss & Song, 2011). Despite these findings, previous research generally lacks evidence to support which key determinants that thoroughly can explain this superior performance and the value creation process.

## 1.2 Problem Discussion

The question of whether private equity is a superior organizational form has been discussed over the past decades through the significant amount of empirical research that has found evidence on overperformance among PE-backed firms relative to non-PE-backed firms. Advocates of private equity argue that the sources of superior value creation are actions within financial, governance and operational engineering (Jensen, 1989; Kaplan & Strömberg 2009). However, critics of private equity claim that PE firms do not create any true operational value but redistribute the value in their portfolio companies, or even destroy value in the long run. For example, it is argued that PE investors benefit at the expense of employees in the portfolio companies who could suffer layoffs or reduced wages (Kaplan & Strömberg, 2009).

Although previous research shows evidence on the superior operating performance of PE-backed firms, no consensus has been reached about what actions contribute the most to the added value. The general view is that PE firms once applied leverage as the main financial engineering instrument for achieving enhanced internal rates of return. However, the focus of value drivers has shifted towards operational engineering over the past two decades, while governance engineering constantly has played an important role (Kaplan & Strömberg, 2009; The Boston Consulting Group, 2016). The problem is that the scope of studies which support this view is scarce and lacks empirical evidence.

The only study that has ever been conducted on the Swedish PE market is the one by Bergström et al. (2007). The authors report a significant amount of value creation for portfolio companies, but there is no evidence on what determinants that can explain the positive change in the operating performance during the holding period. Instead, the authors remark upon the complexity with the PE industry (Bergström et al., 2007). Thus, the effects of PE-firms' value-creating actions are still a subject of uncertainty. There are also some shortcomings with this study, particularly regarding the choice of variables. For example, they hypothesize that reductions in labor force lead to improved operating performance, but if the portfolio company in question grow during the holding period, then the number of employees is likely to increase. Despite a possible initial reduction of labor, this could lead to misinterpretation of the results. In this case, we argue that it would be more reasonable to use a ratio such as 'revenue per employee' to capture labor productivity improvements and thus the true value creation process during the holding period.

We conduct the most comprehensive study to date on the Swedish PE market by focusing on the effects of PE actions. In addition, this study is unique because no one has ever framed it in a similar theoretical way by quantitatively investigate several determinants of value creation within financial, governance and operational engineering. We do not only use a unique set of variables, but also a completely new dataset of PE-backed firms since our time frame is ranging from 2007 to 2017. In contrast to the study of Bergstöm et al. (2007), we use a peer group consisting of public companies instead of private companies. Hence, our contribution is specific, relevant and value-adding as we distinguish our study from previous research.

## 1.3 Research Question

*What is the Effect of Financial, Governance and Operational Engineering on Private Equity-Backed Firms' Operational Performance in Sweden?*

## 1.4 Purpose

The purpose of this study is to explore the effects of value-creating actions that are undertaken by PE firms on their portfolio companies on the Swedish market. Thereby, this study sheds light on the impact of these sets of changes that PE firms apply to their portfolio companies to create value.

## 1.5 Scope and Delimitations

Following the purpose of this study, the scope is to specifically to research value creation on the Swedish PE market. Delimitations of the study include the chosen timeframe of ten years from 2007 to 2017 which encompasses years of economic recession, recovery, and stability. This enhances the level of analysis and the potential to unearth significant findings and trends. The study has an emphasis on Swedish companies given its well established PE market. Thus, this study strictly includes PE firms with a significant presence in Sweden and target firms registered as a Swedish company. Additionally, firms used to benchmark performance will have to be listed on a Swedish stock exchange to adhere to the study's geographic emphasis. Another limitation is that the study exclusively includes leveraged buyouts (LBOs) with majority ownership, and thus excludes management buyouts (MBOs), Venture Capital (VC), Real Estate funds and debt investments. This is to align the chosen deals with the value creation framework presented in this paper. Lastly, a limitation of the study is the availability of reliable financial data of private Swedish companies which to a certain degree has shaped the variables used in the study.

## 1.6 Target Group

The target group of this study is primarily academics and researchers. The study also aims to be relevant for professionals within the PE industry since it hopefully will nuance the view of PE firms' value creation.

## 1.7 Outline

***Introduction***

Chapter one introduces the subject of private equity and discusses problems related to this research area, which is followed by the research question and purpose of this study. Furthermore, this chapter contains the scope and delimitations and specifies the target group.

***Theoretical Framework***

Chapter two presents private equity fundamentals and a theoretical framework of value creation as well as a comprehensive compilation of previous research. The chapter also gives a critical evaluation of the chosen theoretical framework.

***Methodology and Data Description***

Chapter three describes the methodology and data of the study by presenting the research design, data collection, and the data sets. In addition, it presents the chosen statistical framework and the regression models, including a description of statistical tests, variables, and hypotheses. Lastly, criticism against the methodology is discussed.

***Empirical Results***

Chapter five presents the results based on the formulated hypotheses and statistical tests.

***Analysis and Discussion***

Chapter six discusses and analyzes the results using the theoretical framework and relates the results to previous research.

***Conclusion***

Chapter seven presents conclusions and provides answers to the research question. Finally, proposals for further research are given.

# 2. Theoretical Framework

## 2.1 Private Equity

Invest Europe, formerly European Private Equity and Venture Capital Association (EVCA), presents the following definition of private equity:

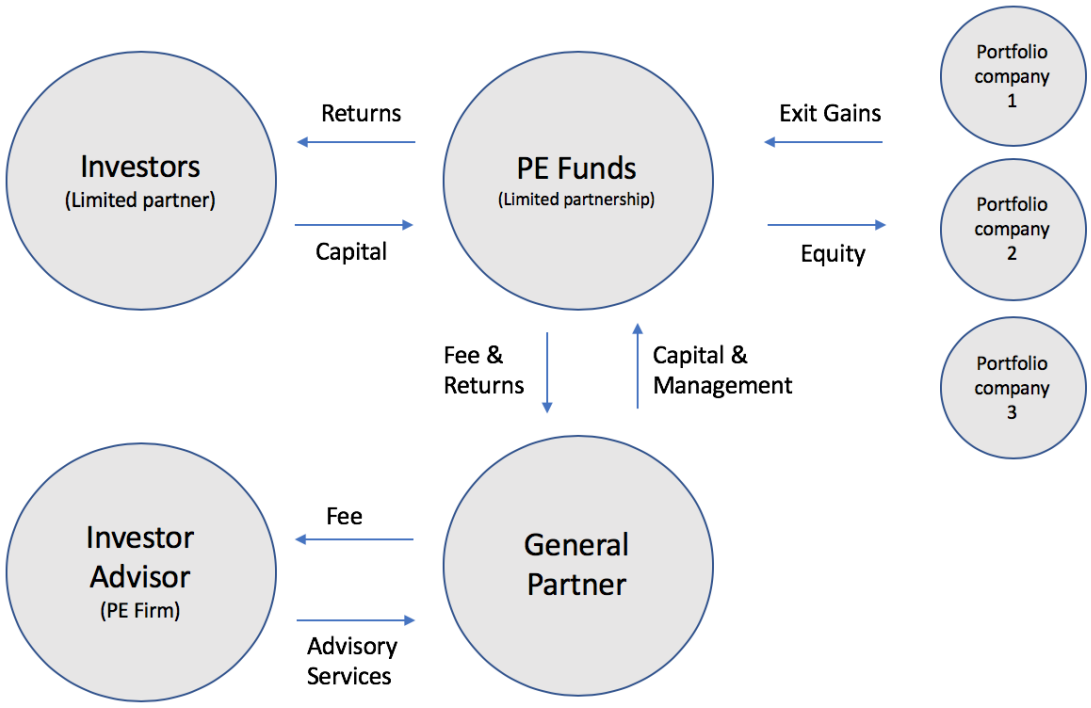
> *Private equity is a form of equity investment into private companies not listed on the stock exchange. It is a medium to long-term investment, characterized by active ownership. Private equity builds better businesses by strengthening management expertise, delivering operational improvements and helping companies to access new markets (Invest Europe, 2019).*

The following sections further introduce the subject and describe the essential terminology of private equity.

### 2.1.1 Private Equity Setup

PE funds are established as limited partnerships and have a life span between eight and 13 years in general. The general partner (GP), the PE firm and several investors or limited partners (LPs) run the PE funds where the GP is the manager of the fund. How these parties are going to profit from the fund's investments is specified in the agreements between the GP and LPs. The investment period for a fund usually ranges from three to five years. When the fund exits a portfolio company, the returns and exit gains are distributed back to the investors. The investors or LPs are primarily large institutions, pension funds, fund-of-funds, insurance companies, foundations, family offices and banks (Gaughan, 2017).

**Figure 1**. Private Equity Setup - A typical LBO Structure




As illustrated in figure 1, the GPs support the PE funds with capital and management and in return, they can earn either a fixed income (independent of the fund's performance) or variable income (a function of the fund's performance). One common type of fixed income is a management fee which is paid from the LP's committed capital. In addition to the capital commitment by LPs, management of the PE firms is also supposed to contribute with one to three percent of the total capital committed to the fund. Thereby, the LP's interests are aligned with those of the GP (Gaughan, 2017).

### 2.1.2 Private Equity Transactions

PE firms can acquire companies to their funds through several different kinds of transactions or buyouts. A deal where a public company is taken private is called a going-private transaction, or a public-to-private transaction. In most cases, these deals are financed with debt and equity. When most of the financing consists of debt, typically 60-90%, then the deal is referred to as a leveraged buyout (LBO). Moreover, a debt-financed buyout can also be done of a non-listed company (Gaughan, 2017). If the firm that has gone private via an LBO later reemerges as publicly traded

firm via a subsequent IPO of shares, the transaction is called a reverse leveraged buyout (Ogden, Jen & O'Connor, 2003).

After LBOs, the second most common type of transaction is a management buyout (MBO). That is when a firm sells the entire company or a business unit to a management group. In these transactions, a public firm divests a division and sells it to the unit's management as opposed to an outside investor. This transaction can also be referred to as an LBO if the managers rely mainly on debt to finance the deal. An institutional buyout, on the other hand, is when the owners of the formerly public company is a private firm (Gaughan, 2017).

### 2.1.3 Private Equity Business Model

PE firms and venture capital (VC) firms are organized in somewhat similar ways and they share several advantages, but there exist two key differences. First, the magnitude invested is much larger by PE firms. In 2007 when the PE market peaked, the average deal size exceeded $2 billion (Berk & DeMarzo, 2014). The size of transaction volume leads to the second difference that PE firms typically invest in more mature companies, whereas VC firms rather invest in young start-ups (Ogden, Jen & O'Connor, 2003). However, it is important to distinguish between various types of PE firms and their investments strategies across the business maturity cycle. For example, there are PE firms that also invest in companies in the start-up phase, while other PE firms invest in the growth phase, the maturity phase or the steady-state phase (Gaughan, 2017).

In general, the PE process consists of three steps; the initial transaction, the development of the portfolio company, and the exit of the company. The first step includes identification of target companies with attractive characteristics and improvement opportunities. Once an acquisition price is agreed to and the limited partners are convinced to invest in the PE fund, the GP secures debt capital from banks or public markets. The second step involves the value creation process during the holding period (Gaughan, 2017). For example, the focus could be to accelerate growth organically or through add-on acquisitions, to improve efficiency across entire operations or to expand operations by adding new product lines. PE firms do not run their portfolio companies day-by-day, but they govern these companies differently from the way public companies are governed, which is argued to be the key source of their superior performance (Koller, Goedhart & Wessels,

2016). In the third step after the average holding period of three to five years, the PE firm prepares the portfolio company for an exit. There are typically three forms of exit strategies; a sale to a strategic buyer, a sale to another PE firm (sponsor-to-sponsor deal; secondary buyout) or through an initial public offering (IPO). By exiting the investment, the PE fund realizes the profits and return these to all partners (Gaughan, 2017). In general, PE firms seek to achieve an internal rate of return of 20-25% (Arzac, 2008).

## 2.2 Conceptual Framework of Value Creation

There exist three sets of changes which are commonly applied by PE firms on their portfolio companies after a buyout in order to create value. Jensen (1989) and Kaplan (1989a, b) introduced financial and governance engineering, whereas Kaplan and Strömberg (2009) suggested operational engineering as the third form. These theories explain how PE firms use different kinds of mechanisms and strategies for the portfolio companies to perform more effectively under private ownership than in publicly held corporate form (Jensen, 1989).

Moreover, value creation is a term that has many definitions. Koller et al. (2016) define value creation as the change in value due to company performance - a definition that is applied throughout this study when referring to this term.

### 2.2.1 Financial Engineering

Interest rate volatility, tax rules, and regulatory changes and increased competition between investment banks has led to extensive changes in financial processes and instruments. These innovations in the design, development, implementation and formulation of financial solutions are commonly referred to as financial engineering in the academic and professional community (Finnerty, 1988). Corporate financial engineering is distinguished by three branches of activities. First, security innovation emphasizes the development of new forms of consumer products such as new types of bank accounts, mutual funds and innovative insurance products. Furthermore, it additionally includes instruments primarily developed for corporate finance applications, such as hybrid debt instruments, derivatives and other forms of risk management products. The second activity of financial engineering is the development of innovative financial processes, reducing the

cost of completing financial transactions. Generally, this branch is driven by technological or legislative and regulatory change. Lastly, the third branch revolves around creative solutions to corporate finance problems. It includes innovative debt and cash management strategies, and customized corporate financing structures such as multiple forms of asset-backed financing (Finnerty, 1988). Given PE firms' fondness of adding leverage in the capital structure of target firms (Gaugan, 2017), the latter of the three financial engineering branches is the most relevant in the context of PE owners.

Advocates of leveraged buyouts, such as Jensen (1989), postulate that PE firms' apply financial engineering through added leverage to portfolio companies improve operational performance and in extension create economic value (Kaplan & Strömberg, 2009). There are multiple arguments for why added leverage, the borrowing that is undertaken in conjunction with a transaction, is a key ingredient to improve operational performance. Given PE firms' expertise, relationships and knowledge of the capital markets, they are in a premier position to optimize the capital structure of the portfolio company. By leveraging their contacts in the financial industry, the terms of the portfolio company's new debt will be more beneficial than if negotiated without the PE firms' extensive network. This expertise is of additional importance in the Swedish market given the relative difficulty to access capital in comparison to for example the US market (Lerner & Tåg, 2013). As such, agency costs of debt can be reduced and there is less of an incentive for new equity owners to transfer wealth from creditors. Thus, a firm's capital structure is adjusted towards its optimal mix of equity and debt (Berg & Gottschalg, 2005).

Another argument supporting the benefits of added leverage is that it imposes pressure on management to limit the discretionary distribution of excess cash flows. Management must commit to meeting the principal and ongoing interest payments, effectively prohibiting managers in mature industries from investing excess cash flow in "pet projects" and not returning these to investors, consistent with the ideas presented by Jensen (1986). Furthermore, an additional consequence of higher leverage levels argued to benefit a firm is the resulting savings in corporate taxes given that interest payments are generally tax-deductible, which creates a tax shield on a firm's taxable income (Kaplan, 1989a). As interest payments are tax-deductible whereas dividend payments to equity holders are not, an increased portion of debt in a firm's capital structure lowers the weighted

average cost of capital and provides additional support for the benefits of optimizing the capital structure of a firm (Gaugan, 2017). Thus, the financial engineering of portfolio companies through added leverage is one primary argument to explain the success and continued existence of PE firms (Kaplan, 1989a).

### 2.2.2 Governance Engineering

The governance model that PE firms apply on their portfolio companies is argued to be the primary source of success and return, and something that publicly traded companies find difficult to imitate (Beroutsos, Freeman & Kehoe, 2007). In general, one purpose of implementing corporate governance mechanisms is to mitigate the principal-agent conflicts between management and shareholders which stems from the agency theory. The absence of an effective incentive structure within public firms leads to managers acting in a way to maximize their own utility at the expense of shareholders' wealth (Jensen, 1986; Jensen & Meckling, 1976). In addition to implementing a highly leveraged capital structure, PE firms also tend to apply performance-based managerial compensation and active governance to their portfolio companies. These post-buyout structures are considered to be more operationally efficient compared to the typical public firm which is characterized by weaker corporate governance (Jensen, 1989).

Compensation is argued to be one of the most important forms of incentives. The compensation systems in PE-backed companies tend to have higher upper limits than in public companies. Management bonuses in these firms are also more closely tied up to cash flow generation and debt retirement than to accounting earnings (Jensen, 1989).

PE firms can reduce misalignment and agency costs by increasing management's commitment to the portfolio company, particularly through stocks and options (Kaplan & Strömberg, 2009). Therefore, managers will experience higher personnel costs of inefficiency as they have a larger part of their personal wealth tied up to the firm's operational performance. The size of their ownership stake also tends to increase during the holding period as the PE firms want to increase the incentives (Kaplan, 1989b). Besides increasing the size of equity stakes, PE firms also want management to not only have a significant upside, but also a downside with their investment

(Kaplan & Strömberg, 2009). Thus, the common goal of future returns will be aligned between the parties.

Active ownership is also one part of governance engineering that is applied by PE firms (Jensen, 1989). PE owners are characterized by being more actively involved in terms of governance aspects than public company boards. In addition, PE-owned companies have smaller boards on average and have formal meetings more often compared to public companies of similar size (Gertner & Kaplan, 1996; Kaplan & Strömberg, 2009). Poorly performing CEOs are also replaced more frequently by PE investors to improve operating performance (Acharya et al., 2013).

### 2.2.3 Operational Engineering

During the 2000s, operational engineering has been increasingly applied by PE firms relative the two other sets of changes, and it is argued to be the main driver of improved operational performance (Heel & Kehoe, 2005). Enhanced industry expertise and operating knowledge have become an important factor for PE firms to identify investment opportunities as well as to find and implement value creating strategies for these investments (Kaplan & Strömberg, 2009). These strategies which aim to improve operational efficiency are often highly focused on cost-cutting such as wage reductions and employee layoffs (Berg & Gottschalg, 2005; Bergström et al., 2007). Repositioning, additional acquisitions or other strategic changes to improve productivity and margins are also components that can be included in such plans (Acharya et al., 2013).

Operational engineering focuses mainly on the left side of the balance sheet and on operating margins, whereas financial engineering rather focuses on the firm's capital structure and cost of capital. Optimization of corporate assets by improving the management of working capital is one way of operational engineering. This is achieved by improved control of inventory and accounts receivables which leads to lower levels of these items, thus improving the overall working capital ratio (Berg & Gottschalg, 2005; Magowan, 1989).

After a buyout, PE-backed firms do not only achieve smaller levels of working capital, but also restrictions regarding capital expenditures. The fear of being forced to divest underutilized assets or management wasting free cash flows on unprofitable investment programs leads to an

optimization of this policy (Berg & Gottschalg, 2005; Magowan, 1989). In practice, restructurings of production facilities are commonly exercised to increase operating performance (Seth & Easterwood, 1993).

All these factors that are generated through PE firms' superior industry expertise could be clustered into a concept called "parenting advantage" which is the essential foundation that supports operational improvements and add value (Berg & Gottschalg, 2005; Bergström et al., 2007).

## 2.3 Previous Research

To the best of our knowledge, no one has investigated the same research question as in this study, but there are some previous studies within this field. As mentioned, Bergström et al. (2007) conducted the last empirical study that has ever been made on the Swedish PE market. The authors investigated the impact of PE-sponsored buyouts and found that the PE process creates a significant amount of value when using changes in EBITDA-margin as a metric for operating performance. However, there is no evidence on what determinants that are generating the value. The limited explanatory power of the used variables is consequently linked to the complexity with the value creation process (Bergström et al., 2007). The authors use private companies as a comparison group, which contrasts most American studies that benchmark against publicly traded firms included in the S&P 500 stock market index (Kaplan & Schoar, 2005; Phalippou & Gottschalg, 2009).

One study by Heel and Kehoe (2005) found that in two-thirds of the LBO transactions, the primary source of new value was an improvement in the operating performance of the portfolio companies, relative to public peers, through better governance and interaction between the owners and the management team. In general, improved governance comes from PE firms introducing a stronger performance culture and making necessary management changes (Heel & Kehoe, 2005). In addition, PE firms spend more time on strategy and performance management, rather than compliance and risk avoidance as the boards of public companies tend to focus on (Acharya, Kehoe & Reyner, 2009).

Most of the previous research within the field of private equity has been made on the American and UK market. In one of the first studies by Kaplan (1989b), evidence was presented on significant overperformance for PE-backed firms three years after the buyout. These buyout firms experienced increases in the ratio of operating income to revenues relative public firms, followed by decreases in capital expenditures to sales and increases in net cash flow. In addition, the result was also derived from improved incentive programs rather than reductions of the labor force or managerial discretion at the expense of shareholders (Kaplan, 1989b). Similar studies also found significant post-buyout increases in operating cash flow to operating assets, decreases in capital expenditures to sales and increases in operational productivity (Smith, 1990; Lichtenberg & Siegel 1990)

Two general conclusions can be stated when comparing the results of earlier studies to those of the later studies in the 2000s; (1) PE-backed firms still overperform compared to non-PE-backed firms, but the overperformance does not seem to reach the same magnitudes, and (2) no key determinants can consistently explain the overperformance. Extensive speculations and discussions are rather presented on what mechanisms derived from theories that potentially can explain the value creation process (Kaplan & Strömberg, 2009). Consequently, the differences in results over time has led to the methods used in earlier research has been questioned and criticized by authors of later studies (Guo, Hotchkiss & Song, 2011; Harris, Jenkinson & Kaplan, 2014; Kaplan & Sensoy, 2015).

To sum up, previous empirical research has mainly investigated the effects of private equity since the industry evolved in the 1980s. There is still great uncertainty about the effects of actions that are practically undertaken by PE firms in order to create value. One of the most recent studies within this area by Gompers, Kaplan and Mukharlyamov (2016) surveyed 79 PE investors to explore what changes they say they apply on their portfolio companies. The authors ranked the result of the main sources of the added value in order of importance as follows; (1) increasing revenue, (2) improving incentives and governance, (3) facilitating a high-value exit or sale, (4) making additional acquisitions, (5) replacing management, and (6) reducing costs (Gompers et al., 2016). By clustering these factors into the theoretical framework of value creation, one can detect that operational engineering is highly applied combined with governance engineering, which is in

line with what Kaplan and Strömberg (2009) suggest. Hence, it is interesting to compare the results Gomper's et al. (2016) qualitative study with the results of this quantitative study. This also supports the purpose of this study and highlights the gap of what actions that are undertaken by PE firms on the Swedish PE market.

## 2.4 Theoretical Summary and Hypotheses Foundation

Previous research and literature within the field of value creation by PE firms are organized around three areas; financial, governance and operational engineering. These three sets of changes have been applied to the PE firms' portfolio companies since the 1980s. Financial engineering is argued to have had the highest impact on operating performance over the years, whereas operational engineering has become more important during recent years. Governance engineering, however, has played a central role since private equity arose, but the effect of these determinants has been relatively uncertain as some have been difficult to measure. The most fundamental determinants of engineering are summarized in Table 1 which should be seen as a foundation for the hypotheses development. In Chapter 3, the hypotheses will be formulated for the chosen determinants based on the theoretical framework.

**Table 1**. Summary of the theoretical framework and previous research.

| **Determinants of Value Creation** | **Previous Research & Sources** |
|---|---|
| **Financial Engineering**<br>1) Increased leverage<br><br>2) Decreased free cash flow<br><br>3) Increased operating cash flow | Finnerty, 1988; Gaugan, 2017; Jensen 1989; Kaplan and Strömberg, 2009; Lerner & Tåg, 2013; Berg & Gottschalg, 2005; Kaplan, 1989a, b; Gompers, Kaplan & Mukharlyamov, 2016. |
| **Governance Engineering**<br>1) Increased performance-based incentives for management<br><br>2) Increased active ownership and governance<br><br>3) Increased management ownership<br>… increased direct stock holdings | Beroutsos, Freeman & Kehoe, 2007; Jensen, 1986; Jensen & Meckling, 1976; Kaplan & Strömberg, 2009; Kaplan, 1989b; Bergström, Grubb & Jonsson, 2007; Gertner & Kaplan, 1996; Acharya et al., 2013; Gompers, Kaplan & Mukharlyamov, 2016. |

| | |
|---|---|
| … increased option holdings<br><br>4) Reduced size of the board<br><br>5) Change of CEO | |
| **Operational Engineering**<br>1) Enhanced industry expertise (governance effect)<br><br>2) Change in strategy (repositioning or refocusing)<br><br>3) Reduction of wage levels (cost-cutting)<br><br>4) Reduction of the labor force (cost-cutting)<br><br>5) Decreased levels of working capital<br><br>6) Decreased levels of capital expenditures<br><br>7) Increased productivity & revenues<br><br>8) Making additional acquisitions | Heel & Kehoe, 2005; Kaplan & Strömberg, 2009; Berg & Gottschalg, 2005; Bergström Grubb & Jonsson, 2007; Acharya et al., 2013; Magowan, 1989; Seth & Easterwood, 1993; Smith, 1990; Lichtenberg & Siegel 1990; Gompers, Kaplan & Mukharlyamov, 2016. |

## 2.5 Criticism of the Theoretical Framework

The conceptual framework of value creation has some limitations that need to be highlighted. Firstly, several determinants of value creation are difficult to separate since they could be divided into more than one type of engineering. For example, enhanced industry expertise among PE investors has a governance effect since they give advice through the board and to the management of the portfolio company. On the other hand, the effects of PE investors' advice are visible through operational improvements. Therefore, there exist some distinguishing challenges with some determinants.

Secondly, there exist measurements problems with several determinants, including the effects of industry expertise as discussed above. It is also diffuse what measurement affect additional

acquisitions through buy-and-build strategies have on other determinants of operational improvements. Previous research remark upon this quantification issue, which means that it could be more space for interpretation mistakes in what effect these actions, in fact, have on the PE-backed firms' operating performance. Thus, the theoretical framework gives room for speculation to some extent.

Thirdly, it could be argued that this framework is still under development since new types of engineering actions seem to emerge constantly. However, this makes the framework even more relevant to apply to this study. Particularly because several aspects are uncertain, which might be clarified by the results of this study.

# 3. Methodology and Data Description

## 3.1 Research Design

This quantitative study uses a deductive approach, meaning that theory practically guides the research. An alternative is an inductive approach which means the opposite – the theory is an outcome of the research. A deductive approach begins by formulating hypotheses based on existing theories (Bryman & Bell, 2011). In this study, the hypotheses rely on the value creation framework and findings in previous research. Existing theories thus create a foundation and guidance for the data collection process. Subsequently, the hypotheses can either be confirmed or rejected based on the findings, which enable a revision of the theories in the analysis. In addition, a deductive approach is also appropriate in quantitative studies in terms of validity and objectivity (Bryman & Bell, 2011).

The choice of the research strategy is mostly based on the aim of this study. To explore the effects of actions that are undertaken by PE firms, a quantitative research method appears to be the most appropriate one. If the aim of the study rather had been to investigate what PE investors say they do, then a qualitative study with an inductive approach could have been suitable.

The process of deduction is illustrated by Bryman and Bell (2011) in the following way:

1. Theory
2. Hypothesis
3. Data collection
4. Findings
5. Hypotheses confirmed or rejected
6. Revision of theory

## 3.2 Data Description

This section gives a presentation of the data collection process and the samples. Descriptive statistics are further presented in section *3.6 Descriptive Statistics*.

### 3.2.1 Data Collection

Given the aim and design of this study, the main data required for the analysis is yearly fundamental financial data for a sample of PE-backed/sponsored acquisitions, the "PE dataset", and financial data with the same years and similar industry, growth and operational nature for a group of comparable publicly traded companies, henceforth referred to as the "Benchmark dataset". The private nature and deal terms of PE limits the availability of financial and non-financial data available via financial data providers or services, compared to the multitude of data that is commonly available on public companies. Hence, a combination of financial databases has been utilized to collect, verify and analyze an up to date unbiased sample of PE-backed deals. The final decision was made to primarily screen for deals using the Bloomberg Terminal given the ease of creating custom search queries, the reputation of good data quality and filter functionality. In deals where the data required additional verification, Factset or Thomson Reuters Eikon accompanied financial statements, press releases, and PE firms' websites to confirm if a deal was suitable to include in the sample. The list of unique company identifiers generated by the Bloomberg search was used to extract fundamental and industry data from the Serrano database. Serrano is maintained by the Swedish House of Finance and is arguably the foremost financial database covering private companies in Sweden by standardizing the data and drawing upon information from multiple services, such as the Swedish Companies Registration Office, Statistics Sweden, Swedish Companies Registration Office and Bisnode's register (Data.houseoffinance.se, 2019).

### 3.2.2 PE dataset

Screening for eligible PE deals is one of the key tasks of this study and will in extension decide the composition of the benchmark dataset, industry split and other complementary data. As a mean to avoid excessive selection bias, only two broad restrictions were applied in the search – the time frame and certain deal characteristics.

The time frame was set to the 10 years between 2007 and 2017, which benefits the size of our sample set while also capping the number of observations to a reasonable level given this study's scope and time frame. Additionally, the chosen time frame starting in 2007, complements the paper by Bergström et al. (2007) that researched the years between 1998 and 2006. Given the period of 2007 to 2017, for a deal to qualify to be included in the sample, both the entry/majority investment and exit/majority divestment date must be within this time frame.

Entry is in this situation defined as the date when the deal was announced completed. Furthermore, no distinction has been made between founder-to-private, public-to-private, and secondary buyouts in which one PE firm buy a portfolio company from another PE or investment firm, assuming a controlling stake is acquired with the goal of improving operational performance (Gaughan, 2017). An exit is this context is therefore specified as to when a majority PE owner lists the portfolio company on a stock exchange, or when the company is sold to a strategic buyer or management. Secondary buyout exits are by this definition not included in the sample as it can be assumed that the financial, governance and operational engineering efforts must be continued by the new owner. Thus, the motivation of the sale stems from other drivers which may not be strictly financial, such as refreshment and rotation of portfolio firms, shifting investment focus and target markets.

Moreover, in combination with the time frame, another aspect of the screening for deals are some specific deal characteristics designed to keep the search open but specific enough for the study. Given the emphasis on the Swedish market, filters were applied to limit the search to solely Sweden-registered companies and PE acquirers with significant presence and focus in the region. In addition, the initial search delivered 191 deals, which were then manually filtered for desired deal characteristics according to the set delimitations of this study. These include the removal of acquisitions with holding periods of less than three years, acquisitions by specialist real estate funds, pure debt investments, minority investments and investments by VC funds.

The final sample of PE sponsored acquisitions consists of 74 deals based on the filtering discussed above. The table below shows the summary statistics of the sample based on the acquisition year and industry. Additional deal information is available in exhibit 1 of the appendix.

**Table 2**. PE acquisitions by year.

| Buyout year | % of Sample | Observations |
|---|---|---|
| 2007 | 24% | 18 |
| 2008 | 22% | 16 |
| 2009 | 5% | 4 |
| 2010 | 19% | 14 |
| 2011 | 12% | 9 |
| 2012 | 8% | 6 |
| 2013 | 3% | 2 |
| 2014 | 3% | 2 |
| 2015 | 4% | 3 |
| 2016* | 0% | 0 |
| 2017* | 0% | 0 |
| **Sample** | **100%** | **74** |

*Note: 2016 and 2017 are marked with a star (*) to indicate that these years have zero deals included in the sample, which is expected given the t-1 to t+3 event window of this study.*

**Table 3**. PE acquisitions by industry.

| Sector | % of Sample | Observations |
|---|---|---|
| Construction Industry | 4% | 3 |
| Convenience Goods | 8% | 6 |
| Corporate Services | 8% | 6 |
| Energy & Environment | 3% | 2 |
| Health & Education | 19% | 14 |
| Industrial Goods | 28% | 21 |
| IT & Electronics | 8% | 6 |
| Materials | 1% | 1 |
| Shopping Goods | 16% | 12 |
| Telecom & Media | 4% | 3 |
| **Sample** | **100%** | **74** |

As illustrated in Table 2, 2007 and 2008 had the most observations of acquisitions in the sample data. Furthermore, this is in line with PE statistics presented by Invest Europe (2018) regarding European deal activity, which showcases that 2006, 2007 and 2008 were record-breaking years in

terms of deal value and funds raised. Additionally, the substantial drop in 2009 follows the trend of global activity which came to a rapid halt given the rise of the financial crisis by the end of 2008 where credit markets got more constrained (Gaughan, 2017). Underlying market activity is not necessarily the sole driver of the figures in Table 2. Because we filter for deals where both entry and exit has occurred between 2007-2017, it will skew the acquisition sample towards the earlier years as these are more likely to have been exited as of the undertaking of this study. Three deals from 2015 are included in the sample as their financial statements for 2018 were available in the databases used.

Table 3 shows that the sample has three dominant industries: Industrial Goods, Health & Education, and Shopping Goods. The findings are expected given Sweden's strong tradition of industrial leadership, high-quality research into medical technology and stable economic situation which enables discretionary spending by consumers. Furthermore, the same three sectors are estimated to be among the top beneficiaries by PE ownership historically, which explains the appetite of PE firms to enter these markets (Copenhagen Economics, 2017).

### 3.2.3 Benchmark dataset (Peer group)

Accurate assessment of the performance of PE sponsored acquisitions requires a relevant and accurate control group that enables control of economic and industry effects. Additionally, this is especially important since the study includes the period of the global economic crisis triggered by sub-prime mortgages and the collapse of Lehman Brothers. Thus, the industry adjusted figures of this study equal the change or CAGR of each PE variable less the industry median for the benchmark company over the same t-1 to t+3 period.

Benchmark peer companies are selected on the basis of the PE sponsored firms' SNI07 sector/industry code in the Serrano database, and each peer company from the same code is selected manually in order to the greatest extent match their nature of operations, size and growth potential. Furthermore, the selection of companies has been filtered with the condition that they are Sweden-registered companies listed on a Swedish stock exchange. Like studies by Kaplan (1989b), Smith (1990), Lichtenberg and Siegel (1990), solely public firms are used in the benchmark group which provides a good foundation of analysis relative to theory and are in

contrast to the latest study in the Swedish market by Bergström et al. (2007) which solely used private companies.

## 3.3 Statistical Framework

To assess the effects of financial, governance and operational engineering for PE-backed firms, we used a Wilcoxon signed-rank test (also known as a Mann-Whitney test). It is an appropriate test for paired data to compare two matched samples (Wilcoxon, 1945). This test does not only analyze the signs of the observed differences, but it also incorporates the magnitudes of these differences via ranks (Körner & Wahlgren, 2015). The differences are generally calculated based on a before-and-after event - in this study; before buyout (t-1) versus three years after the buyout (t+3). One prerequisite with this method is that the numerical values of the differences have the same scale and are comparable. Thereafter, the difference scores are ranked based on absolute numbers (Körner & Wahlgren, 2015). Finally, test statistics for the significance of the medians are presented rather than for means (paired t-test) to control for outliers that affect the mean values significantly.

One advantage with the nonparametric Wilcoxon test is that there are no requirements for the observations to be normally distributed as the parametric t-tests postulate. Nonparametric methods allow statistical inference without assuming that the sample has been taken from a specific (normal) distribution (Körner & Wahlgren, 2015). Furthermore, Barber and Lyon (1996) evaluated whether parametric t-statistics or nonparametric Wilcoxon test statistics is the most appropriate to detect abnormal operating performance. The authors found that Wilcoxon test statistics is recommended to parametric t-statistics since these tests are more powerful regardless of operating performance measure (Barber & Lyon, 1996). Other similar studies by Kaplan (1989b) and Guo et al. (2011) have also used Wilcoxon tests to determine the statistical significance of the portfolio companies' operating performance relative to a comparison group.

In general, the Wilcoxon signed-rank test tests the null hypothesis that the median of the differences in performance is equal to zero, whereas the alternative hypothesis suggests that the median of the differences in performance is not equal to zero (Barber & Lyon, 1996). All significance levels (1% = ***, 5% = ** and 10% = *) are applied based on two-tailed tests,

although our hypotheses (see *3.4.3 Summary of hypotheses*) are expressed in a one-tailed way. This approach might be conservative as the null hypothesis, for example, assumes that the debt ratio post-buyout equals the debt ratio pre-buyout. Thus, one-tailed tests would probably generate more significant results since it is more difficult to reject the null hypothesis against the two-tailed alternative. However, we do not want to exclude the possibility of a result indicating that an increased debt ratio has a significant negative effect on operating performance.

Moreover, the time-window is ranging from one year before the buyout (t–1) to three years after the buyout (t+3). Operational improvements should probably be visible and detectable after three years if PE-investors have applied significant sets of changes on their portfolio companies. This argument is supported by Kaplan (1989b) who used the same range of time-window.

Finally, both in the Wilcoxon signed-rank tests and in the regression analysis, abnormal operating performance is defined as the realized performance of the PE-backed firm (t+3 - t-1) less the median performance of the peer group (i.e. the expected performance).

## 3.4 Description of variables

### 3.4.1 Dependent variables

Three operating metrics have been chosen as dependent variables, namely EBITDA-margin, return on invested capital (henceforth, "ROIC") and revenue growth. These dependent variables will only be used in the regression analysis as metrics for the change in operating performance to investigate what determinants (independent variables) that can explain the value creation process. The more firms can increase revenues and deploy capital at attractive rates of return, the more value do they create. The combination of growth and ROIC relative to its costs is what drives the value (Koller et al., 2016).

As mentioned, value creation is defined as the change in value due to company performance (i.e. the change in EBITDA-margin, ROIC and revenue growth) – a definition that is supported by Koller et al. (2016). All three dependent variables will, therefore, be measured as the difference between t-1 and t+3 to capture the value creation process.

***EBITDA-margin***

First, EBITDA-margin equals earnings before interest, taxes, depreciation of tangible assets and amortization of intangible assets divided by revenues. This variable is relevant when measuring operating profitability and EBITDA is widely used within the PE industry, especially in terms of EBITDA multiples (Arzac, 2008). These multiples are sometimes called cash flow multiples when EBITDA is used as a proxy for cash flows (Gaughan, 2017). One advantage is that EBITDA-margin is not affected by goodwill recognition, thus it should be least influenced by additional acquisitions relative to the other two dependent variables.

$$EBITDA - margin = \frac{Earnings\ before\ interest, taxes, depreciation\ and\ amortization}{Revenues}$$

***ROIC***

Second, ROIC equals earnings before interest and taxes less theoretical taxes divided by invested capital. Invested capital represents the cumulative amount the firm has invested in its core operations, primarily in working capital and property, plant and equipment (Koller et al., 2016). To separate all firms' operating assets from its operating liabilities is challenging due to relatively large sample size. ROIC could, therefore, be negatively affected by complications in measuring the size of invested capital. A simplistic, general formula has thus been consistently applied to calculate invested capital for all firms[1].

$$ROIC = \frac{EBIT(1 - Tax\ Rate)}{Invested\ Captial}$$

The returns on invested capital are primarily driven by competitive advantages that enable firms to utilize cost and capital efficiencies or a combination of these two components. If a firm succeeds in implementing a strategy that generates an attractive ROIC, there are good chances for the firm to maintain these return levels over time and through changing conditions. It is worth noting that this measure varies significantly between industries since certain industries are more likely to gain either high, medium or low returns (Koller et al., 2016). However, compared to EBITDA-margin

[1] Invested Capital = Inventory + Receivables + Other current assets + Tangible assets + Goodwill + Other intangible assets – Payables – Other current liabilities

and revenue growth, ROIC should theoretically give the most neutral comparison of operating profitability between the industries as it considers both profit margins and capital efficiency. One potential limitation is that this measure is affected by various accounting practices.

***Revenue CAGR***

Third, revenue CAGR equals compounded annual growth rate (CAGR) in revenues, which is a contributing metric for the value creation process by ultimately expanding EBITDA. The usage of CAGR enable a better comparison of growth rates over time and reduce the volatility effect in year-to-year growth (Koller et al., 2016). However, it can be argued that this variable is the weakest measure of value creation relative to the other two metrics since it does not consider the cost structure and thus not necessarily indicate pure improved operating performance.

$$Revenue\ CAGR = \left(\frac{Revenues_{t_n}}{Revenues_{t_0}}\right)^{\frac{1}{t_n - t_0}} - 1$$

### 3.4.2 Independent variables

The chosen independent variables are based on the determinants of value creation that the theoretical framework suggests in Table 1. Some variables, however, have been adjusted or reconstructed in a more efficient way to capture the value-creating effects over time. Optimally, the variables should also be of the same nature to be comparable between the two groups and over time. Therefore, several ratios are used instead of absolute numbers.

**Financial Engineering**

***Leverage***

The first measure of financial engineering used in this study is leverage (debt ratio), which we specify as the ratio of total long-term interest-bearing debt divided by the firms' total assets. Private equity sponsored acquisitions are primarily financed through two broad classes of interest-bearing debt: Senior debt and Subordinated intermediate-term debt. Both categories represent financing from a range of sources such as insurance companies, commercial banks, public markets and specialist debt funds, and typically has payback terms ranging from 5-10+ years (Gaughan, 2017). Thus, excluding the short-term (<1 year) portion of firms' total debt to reflect changes in the capital structure post-acquisition is a sound approach that allows an analysis of financial engineering

efforts in detail. In addition, short-term debt will be accounted for in the operational engineering section through the working capital ratio. Total assets are used in the denominator of the ratio to account for the long-term debt in relation to the firms' total capitalization. Given that total assets = total debt + equity, one could, in theory, use any of these measures interchangeably. However, the accounting effects of negative equity may artificially impact the second option, making total assets the preferred choice in this study.

$$Leverage = \frac{Total\ Long - Term\ debt}{Total\ Assets}$$

***Free Cash Flow to Firm (FCFF)***

Secondly, to capture additional financial engineering efforts besides capital structure changes, this study utilizes the ratio of free cash flow to firm, henceforth free cash flow or FCFF[2], relative to the firms' revenue. FCFF represents the cash flow generated by a firm's operations after deduction any new investments in the business and is one of the most commonly used measure to evaluate and value a business given that it represents the cash flow available to equity and debt investors alike, making it independent of a firm's capital structure and nonoperating items. Moreover, by excluding the effects of interest expenses, FCFF is a clean measure of operating performance that enables consistent analysis over time and across competitors (Koller et al., 2016). Lastly, FCFF is set in relation to a firm's total revenues to create a ratio that is comparable across firms of varying size, industry and future growth potential.

$$FCFF\ (ratio) = \frac{Free\ Cash\ Flow\ to\ Firm\ (FCFF)}{Total\ Revenue}$$

**Governance Engineering**

***Incentives***

First, capturing the incentive structure of non-public companies is more challenging compared to public companies which adore to reporting guidelines and rules set forth by stock exchanges and regulatory bodies. Given that Swedish annual reports for non-public companies are unique in the sense that they are easily accessible to the public, an analysis of all line-items relating to compensation concluded that the most suitable measure to use is tantiem. Tantiem is defined as the portion of a firm's earnings that are paid out as compensation in addition to regular salaries. In

[2] FCFF = EBIT x (1 - tax rate) + Depreciation - CapEx - ΔNWC

multiple ways, it is like a bonus, with the difference being that tantiem is the amount paid to board members, the CEO and other managers in leading positions (Unionen, 2019). This study sets the reported tantiem figures in relation to total revenue to create a ratio that is non-dependent on firm size. There are potential limitations in the measure given that the board and management incentive payments potentially could be paid out only after the PE sponsor has exited the deal and total returns are computed. However, given the design and data availability of this study, tantiem is determined to represent the most accurate proxy available.

$$Incentives = \frac{Tantiem}{Total\ Revenue}$$

***Change of CEO***

Secondly, the chosen PE-backed deals are manually examined through the Swedish Retriever Business database to determine if a CEO change occurred in either t=0, the year of acquisition, or in t=1, within one year of the acquisition. This dummy variable takes a value of 1 if a change has occurred and 0 if it has not.

**Operational Engineering**

***Productivity CAGR***

The first of three measurements to evaluate the productivity effects of operational engineering on operational performance is revenue per employee. It is expected that as time pass post a PE sponsored acquisition, both revenues and the number of employees can fluctuate due to outside factor in the general business environment. As such, absolute growth or decrease in revenues or employees say little about any operational improvements achieved during this period. Thus, revenue per employee is the superior measure as it gives an indication of how the effectiveness of the labor force has changed.

$$Productivity\ = \frac{Total\ Revenue}{Total\ number\ of\ Employees}$$

***Working Capital***

Second, the working capital ratio quantifies the operational capital management of a firm as the fraction of current assets divided by current liabilities. A ratio greater than one means that a company has more short-term assets than liabilities, often driven by large amounts of cash on hand.

Conversely, a ratio below one indicates a reliance on short-term funding to meet operational needs. Hence, working capital is a key driver in value creation and is a key component of the ROIC of a firm (Koller et al., 2016).

$$Working\ Capital\ (WC)\ ratio = \frac{Current\ Assets}{Current\ Liabilities}$$

***Capital Expenditure***

Third, capital expenditures (CapEx) includes the maintenance, upgrades, and acquisition of tangible or certain intangible assets which are vital for long-term value creation and growth (Koller et al., 2016). Given the limitations in the dataset of this study where the cash flow statements were not accessible, CapEx is defined as property, plant & equipment $_{t=n+1}$ - property, plant & equipment $_{t=n}$ + current depreciation. Moreover, the CapEx values are set in relation to revenue which enables an analysis of any change in the percentage of sales that are spent on future investments.

$$Capital\ Expenditure\ ratio = \frac{CapEx}{Total\ Revenue} = \frac{\Delta PP\&E\ +\ Current\ Depreciation}{Total\ Revenue}$$

**Control variables**

Finally, we also control for industry effects by including a control variable for SNI07, both in the Wilcoxon signed-rank test and in the regression analysis. The sample consists of ten different industries in total.

**Table 4**. Summary of variables.

| Variable | Description | Denotation |
|---|---|---|
| **Dependent variables** | | |
| ΔEBITDA-margin | Change in EBITDA-margin, measured as; EBITDA / Revenues | ΔEBITDA-margin |
| ΔROIC | Change in ROIC, where: ROIC = EBIT(1-Tax Rate) / Invested Capital where Invested Capital = Inventory + Receivables + Other current assets + Tangible assets + Goodwill + Other intangible assets – Payables – Other current liabilities | ΔROIC |

| | | |
|---|---|---|
| ΔRevenue CAGR | Change in revenue CAGR, measured as: $\left(\frac{Revenues_{t_n}}{Revenues_{t_0}}\right)^{\frac{1}{t_n - t_0}} - 1$ | ΔRevenue CAGR |
| **Independent variables** | | |
| ΔLeverage | Change in debt ratio (t-1 vs t+1), measured as:<br>Debt ratio = Total long-term debt / Total assets | ΔLeverage |
| ΔFree Cash Flow to Firm ratio | Change in free cash flow, measured as:<br>FCFF ratio = (EBIT(1-Tax Rate) + Depreciation – CapEx – Change in net working capital) / Total revenue | ΔFCFF |
| ΔPerformance-based compensation ratio | The incentive structure for the Board and the CEO, measured as:<br>Bonus-related income / Total revenue | ΔIncentives |
| Change of CEO | Dummy variable that equals 1 if the portfolio firm has changed CEO within one year after PE-entry; 0 otherwise. | CEO |
| ΔLabor productivity ratio | Change in revenue per employee, measured as:<br>Total Revenue / Total number of employees | ΔProductivity |
| ΔWorking capital ratio | Change in working capital ratio, measured as:<br>Current assets / Current liabilities | ΔWorkingCapital |
| ΔCapital expenditure ratio | Change in capital expenditure ratio, measured as: Capital expenditures / Revenue | ΔCapEx |
| Industry | Dummy variable to control for industry effects (10 different industries in the sample) | Industry |

Note: All variables are measured by the change between t-1 and t+3 except for *Change of CEO* which is a dummy variable and for *Leverage* where the change between t-1 and t+1 is measured.

### 3.4.3 Summary of hypotheses

The hypotheses development is based on the chosen determinants of value creation described in the previous section (i.e. independent variables). In turn, these determinants are based on the theoretical framework and previous research. A summary of the hypotheses that will be tested is presented below.

**Financial Engineering**

Jensen (1989) and Kaplan and Strömberg (2009) argue that PE firms add leverage to their portfolio companies to improve operating performance and in extension create value. Firstly, an increased debt ratio reduces agency costs of debt since there are fewer incentives for equity holders to transfer wealth from creditors (Berg & Gottschalg, 2005). Secondly, leverage constrains managers from wasting free cash flows on pet projects (Jensen, 1989). Thirdly, portfolio firms will also experience savings in corporate taxes given larger tax shields due to higher debt levels (Kaplan, 1989a). All three arguments imply that increased leverage among PE-backed firms improves operating performance.

*H1: Increased leverage leads to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group.*

Following the second argument above, lower levels of free cash flows because of new highly leveraged capital structures also put pressure on managers to make principal interest payments rather than undertake unprofitable investments opportunities (Jensen, 1989). Limiting available cash flows thus discipline managers in an efficient way, which enables operational improvements.

*H2: Decreased free cash flow ratio leads to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group.*

**Governance Engineering**

Performance-based compensation and bonuses among management in PE-backed firms tend to increase after a buyout. PE firms argue that this is one of the most effective governance tools to

incentivize management to be more operationally efficient. The incentive structure in PE-backed firms also tends to have higher upper limits than in public companies (Jensen, 1989).

*H3: Increased performance-based incentives for management leads to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group.*

PE firms' application of governance engineering also means being active owners. Replacement of CEO in the portfolio firm is one common action undertaken by PE firms immediately after the buyout (Jensen, 1989; Gompers et al., 2016). In addition, poorly performing CEOs are often replaced frequently (Acharya et al., 2013). A newly appointed CEO with a unique skill set has the ability to generate better results and create more value for PE investors.

*H4: Change of CEO leads to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group.*

**Operational Engineering**

Cost-cutting activities such as labor force reductions are commonly applied by PE firms to improve operational efficiency (Berg & Gottschalg, 2005). However, one can argue that the actual value is not created through employee layoffs or wage reductions. The objective should rather be to increase the productivity per employee and thereby generate value.

*H5: Increased labor productivity leads to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group.*

Optimization of corporate assets is another part of operational engineering, meaning improved management of working capital and restrictions of capital expenditures. Lower levels of working capital are achieved through enhanced control over inventory and receivables, whereas reduced capital expenditures are based on a stricter financial policy (Berg & Gottschalg, 2005; Magowan, 1989). Thereby, these actions are supposed to create value on the left side on the balance sheet and improve operating margins.

*H6: Decreased working capital ratio leads to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group.*

*H7: Decreased capital expenditure ratio leads to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group.*

## 3.5 Regression analysis

### 3.5.1 Regression models

The second statistical part of the quantitative method includes a multivariate regression analysis to assess whether financial, governance and operational engineering create value for PE-backed firms. This method allows for multiple independent variables ($x_1$, $x_2$… $x_k$) to affect the dependent variable ($y$). Woolridge (2013) suggests that the general multiple regression model can be written as:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_k x_k + u$$

where

- $y$ = Dependent variable
- $\beta_0$ = Intercept
- $\beta_k$ = Parameter associated with $x_k$
- $x_k$= Independent variables
- $u$ = Error term

Ordinary Least Squares (OLS) is the method that is applied to the cross-sectional datasets. The OLS estimates are basically chosen to minimize the sum of the squared residuals (Woolridge, 2013). Three OLS regressions have been run to assess the determinants of value creation. The different models are based on three different dependent variables as metrics for operating performance. In all three models, the same set of independent variables are used to potentially explain the change in operating performance for the PE-backed firms and thus the value creation process. Besides the explanatory variables, a control variable is also included to control for industry effects.

**Model 1 – EBITDA-margin**

$$\Delta\text{EBITDA} - \text{margin} = \beta_0 + \beta_1\Delta\text{Leverage} + \beta_2\Delta\text{FCFF} + \beta_3\Delta\text{Incentives} + \beta_4\text{CEO} + \beta_5\Delta\text{Productivity} + \beta_6\Delta\text{WorkingCapital} + \beta_7\Delta\text{CapEx} + \beta_j\text{Industry} + u \quad (1)$$

**Model 2 – ROIC**

$$\Delta\text{ROIC} = \beta_0 + \beta_1\Delta\text{Leverage} + \beta_2\Delta\text{FCFF} + \beta_3\Delta\text{Incentives} + \beta_4\text{CEO} + \beta_5\Delta\text{Productivity} + \beta_6\Delta\text{WorkingCapital} + \beta_7\Delta\text{CapEx} + \beta_j\text{Industry} + u \quad (2)$$

**Model 3 – Revenue CAGR**

$$\Delta\text{Revenue CAGR} = \beta_0 + \beta_1\Delta\text{Leverage} + \beta_2\Delta\text{FCFF} + \beta_3\Delta\text{Incentives} + \beta_4\text{CEO} + \beta_5\Delta\text{Productivity} + \beta_6\Delta\text{WorkingCapital} + \beta_7\Delta\text{CapEx} + \beta_j\text{Industry} + u \quad (3)$$

In these models, $\beta_0$ is the constant and *u* is the error term as the general multiple regression model implies. The definitions for all other variables are explained in Table 4 above.

### 3.5.2 OLS Assumptions

Underpinned by a set of six assumptions, the Gauss-Markov theorem argues that the best linear unbiased estimator (BLUE) is given by the ordinary least squares (OLS) model. Failing one or more of the classical linear regression model (CLRM) assumptions may render the OLS model unsuitable as an estimation technique or warrant modifications to the raw data and model before hypotheses can be reliably tested (Brooks, 2008). The technical denotations of the six CLRM assumptions are the following:

1. $E(u_t) = 0$
2. $var(u_t) = \sigma^2 < \infty$
3. $cov(u_t, u_j) = 0$
4. $cov(u_t, x_t) = 0$
5. $u_t \sim N(0, \sigma^2)$
6. $corr(x_t, x_j, \ldots x_k) < 0{,}8$; $VIF < 5$

Assumption 1 requires that the average value of the error terms is zero. According to Brooks (2008), if a constant term is included in the model design, this assumption will not be violated. Thus, given that all three OLS regression models utilized in this study include a constant term, it can be concluded that assumption 1 holds.

The second assumption (2) is that the error terms have constant variance, also referred to as homoscedasticity. If the error terms do not have constant variance (heteroscedasticity), the OLS estimators will still give consistent and unbiased estimates but will no longer be BLUE. Heteroscedasticity can be dealt with by either transforming the variables into logs or deploying standard error estimates which are modified to account for heteroscedasticity (Brooks, 2008). The second option is commonly referred to as robust standard errors in most econometrics' software applications. To test for heteroscedasticity, this study utilizes the Breush-Pagan / Cook-Weisberg test in STATA on the error terms of each model based on the dependent variable ΔEBITDA-margin, ΔROIC and Revenue CAGR, respectively. Test results are summarized in Table 5 below:

**Table 5**. Breush-Pagan / Cook-Weisberg test results

| Dependent Variable | chi2 | Prob > chi2 | Error term variance |
|---|---|---|---|
| $\Delta EBITDA - margin$ | 22.21 | 0.1366 | Homoscedastic |
| $\Delta ROIC$ | 22.61 | 0.1246 | Homoscedastic |
| Revenue CAGR | 57.24 | 0.0000 | Heteroscedastic |

*Note: H0: Constant variance; H1: Non-constant variance*

Following the test above, we conclude that the error terms in the OLS models for ΔEBITDA-margin and ΔROIC have homoscedasticity and does not require any further action. The revenue CAGR model indicates Heteroscedasticity and the model will thus be adjusted to make use of robust standard errors.

CLRM's assumption 3 requires that the covariance among error terms over time is zero, also referred to as uncorrelated. If a correlation is present, the phenomena would be called autocorrelation or serial correlation. Ignoring the phenomena have similar consequences as ignoring heteroscedasticity – the OLS will still be unbiased, but the estimated coefficients will be

inefficient and not BLUE. Hence, any inferences made based on the coefficients may be wrong. It is intuitive that autocorrelation may be present in time series or panel-data where the models have observations over multiple time-periods. However, in a cross-sectional study the likelihood of autocorrelation is small and very complex to test for (Brooks, 2008). Given the scope, time and cross-sectional nature of this study, it is assumed that assumption 3 holds and that there is no autocorrelation present.

Assumption 4 specifies that the independent variables are non-stochastic, or non-random. Stochastic implies that there is a level of randomness to the observation which can be assigned a probability, whereas a non-stochastic process is fixed and without randomness (Brooks, 2008). Given the chosen independent variables of this study, which all are computed from financial data stemming from the firm's' operations, the study assumes non-randomness in the variables and therefore assumption 4 holds. When testing hypotheses on a model's parameters, it is assumed that the errors are normally distributed with symmetry around its mean value (Brooks, 2008). To test this assumption 5 in STATA, a Skewness/Kurtosis test for normality is performed on each of the three base OLS models in this study. The results are shown in Table 6 below:

**Table 6**. Skewness/Kurtosis error distribution normality test

| Dependent Variable | Prob > chi2 | Error term distribution |
|---|---|---|
| $\Delta\text{EBITDA} - \text{margin}$ | 0.1017 | Normal |
| $\Delta ROIC$ | 0.8709 | Normal |
| Revenue CAGR | 0.0621 | Normal |

*Note: H0: Errors are normally distributed; H1: Errors are not normally distributed*

The null hypothesis of the Skewness/Kurtoses test for normality is that the distribution is normal. Given that the Prob > chi2 is above the critical level of 5%, we fail to reject the null and conclude that the errors are normally distributed and assumption 5 holds. Additional histograms of the errors are shown in exhibit 2 of the appendix.

Lastly, what this study refers to as assumption 6 is the fundamental assumption when using an OLS estimator that the independent variables are not correlated. It is expected that there will be a

certain degree of correlation in the variables as zero correlation is very uncommon. What researchers want to avoid are datasets where the variables are highly correlated to each other, also referred to as multicollinearity (Brooks, 2008). The investigation into potential multicollinearity issues is performed in two steps. First, a correlation matrix of the independent variables is examined and secondly, the variance inflation factors (VIF) of the same variables are analyzed.

**Table 7**. Variance Inflation Factors (VIF)

| **Variable** | **VIF** |
|---|---|
| Δ Leverage | 1.09 |
| Δ FCFF | 1.06 |
| Δ Incentives | 1.25 |
| Δ CEO | 1.06 |
| Productivity CAGR | 2.20 |
| Δ Working Capital | 1.98 |
| Δ CapEx | 1.11 |
| **Mean VIF** | **1.39** |

From the correlation matrix displayed in exhibit 3 of the appendix, it can be concluded that our sample variables have no correlations above the 80% threshold commonly used by researchers to determine multicollinearity (Brooks, 2008). Moreover, the VIF measures the level of correlation between one variable and the remaining variables in the model, where higher values indicate potential issues in accurately assessing the individual contribution of a variable to the model. A VIF value of 4-5 is generally regarded as moderate and values of 10+ as high (Brooks, 2008). As illustrated in Table 7 above, the VIF values are well below the moderate level and combined with the results from the correlation matrix we can conclude that assumption 6 holds and that there are no multicollinearity issues present.

## 3.6 Descriptive Statistics

Table 9 shows descriptive statistics for the PE sponsored firms prior to industry adjustment and Table 10 present the evolution of selected key variables adjusted for industry effects.

**Dependent Variables**

First, the descriptive statistics in Table 9 show a median EBITDA-margin of 8,6% the year prior to the acquisition which increases to 10,3% three years post-acquisition. Adjusting the difference for the performance of the benchmark group in table 10 show a median increase of 1,0 percentage points (pp), with a relatively low standard deviation of 10,6 percentage points.

Second, ROIC illustrates some interesting behavior in Table 9 which warrants further analysis. One year prior to the acquisition, the median ROIC is 10,8%, higher than the average for the same period of 9,6%. However, looking at three years after the acquisition, the magnitude changes and the median of 7,2% is lower than the average of 15,4%. Additionally, as evident in Table 10, the change in ROIC adjusted for industry effects in the five-year period is 4,0 percentage points. Still, the findings should be interpreted with caution as the standard deviation and difference between the 1st and 3rd quartile is very high. Although, given that ROIC is a function of both profitability and capital management, there are multiple inputs affecting the results even within the same industry and thus the descriptive statistics of this variable is expected be relatively volatile.

Third, it's particularly interesting to highlight the strong median revenue CAGR of 7,8% shown in Table 9 given that a large part of the sample is from years of economic recession and recovery. As evident in Table 10, the PE sample overperformed the benchmark group with 1,7 percentage point. Nonetheless, these results imply that the benchmark group had a revenue CAGR of 6,1%, which although relative to the PE group is lower, should be considered a very solid result. Lastly, there are a few aspects to be cautious about with these statistics. One is that the standard deviation is relatively high in both Table 9 and Table 10, indicating that the strong growth is not necessarily applicable to the whole sample but potentially driven by a few firms. The second aspect is that the revenue CAGR figures presented do not filter out organic growth, hence the figures may be boosted by acquisitions, accounting rules and foreign exchange effects.

**Independent Variables**

On both an average and median basis, Table 9 shows that leverage increased from t-1 to t+1 for the unadjusted PE sample. Following adjustments for industry effects in Table 10, leverage marginally increased with 0,4 percentage points.

Furthermore, unadjusted FCFF as a percentage of revenue declined with 1,5 percentage points, but what is more noticeable is that as seen in Table 9, the standard deviation decreased to below 10% after the five-year event period, providing additional reliability in the statistics following the PE acquisition. Additionally, Table 10 show an industry-adjusted increase of 3,2 percentage points, albeit the standard deviation is relatively high at 20,3 percentage points so caution should be exercised when interpreting the results.

As presented in Table 9 the median of incentives is 0,0% both prior to and after a PE acquisition. Moreover, this figure marginally increases to 0,4 percentage points when adjusted for industry effects (Table 10). It is, however, important to acknowledge the fact that incentives are measured as tantiem / revenue, and thus the ratio is expected to be small across the sample and may not fully be reflected when displaying the values to one decimal point. What is more interesting to note in Table 9 is that the unadjusted standard deviation of incentives has increased from 0,1% to 0,8%. Additionally, in Table 10, the standard deviation of the variable is 1,9 percentage point. Thus, although the median has remained stable over the event window, the standard deviation indicates that there have been changes made to the incentive structure to several firms in the PE sample.

Displayed in Table 8 below, the second measurement of governance engineering in the form of a dummy variable shows that more than one-third of firms in the PE sample had a change of CEO in close connection to the change of ownership. More precisely, 38% of firms change CEO within one year of a PE acquisition and 62% did not change.

**Table 8**. Change of CEO descriptive statistics

| CEO Change | % of Sample | Observations |
|---|---|---|
| Yes | 38% | 28 |
| No | 62% | 46 |
| **Sample** | **100%** | **74** |

Table 10 shows that the PE-owned firms' labor productivity CAGR adjusted for industry effects has overperformed the benchmark group by 3,5 percentage points. However, caution should be exercised as there is a large spread between the 1st and 3rd quartile with a relatively high standard deviation of 40,3 percentage points.

The descriptive statistics in Table 9 and Table 10 show that there was minimal change in the median working capital ratio over the event window, with a minor overperformance by PE-backed firms when adjusted for industry effects. What is noticeable is that the standard deviation of the observation has increased significantly, warranting caution when interpreting the statistics.

Finally, on an unadjusted basis as evident in Table 9, CapEx as a percentage of revenue decreased to 1,2% and 0,5%, respectively. Moreover, the standard deviation decreased to below 5%, indicating less dispersion of the variable three years after an acquisition compared to one year before it. However, on an industry-adjusted basis in Table 10, the results are more mixed. The average shows a decrease of 2,3 percentage points compared to the benchmark group whereas the median is relatively unchanged with an increase of 0,2 percentage points. Although, the standard deviation of 23,1 percentage points and the difference between the first and third quartile of 2.0 percentage points indicate a substantial spread in the results. Hence, certain sectors have potentially been performing better than others.

**Table 9**. Descriptive statistics of the selected buyouts sample

| Variable | Average | Median | Standard Deviation | 1st Quartile | 3rd Quartile |
|---|---|---|---|---|---|
| **Dependent** | | | | | |
| EBITDA-margin (t+3) | 11,5% | 10,3% | 11,8% | 5,4% | 13,9% |
| EBITDA-margin (t-1) | 6,4% | 8,6% | 15,8% | 2,6% | 12,8% |
| ROIC (t+3) | 15,4% | 7,2% | 55,9% | -12,3% | 28,8% |
| ROIC (t-1) | 9,6% | 10,8% | 42,4% | -4,9% | 29,8% |
| Revenue CAGR | 15,7% | 7,8% | 28,7% | 2,7% | 23,8% |
| **Independent Financial Engineering** | | | | | |
| Leverage (t+1) | 17,5% | 5,7% | 23,7% | 0,0% | 29,8% |
| Leverage (t-1) | 12,4% | 2,6% | 18,0% | 0,0% | 20,5% |
| FCFF (t+3) | 4,1% | 2,6% | 9,7% | -0,3% | 7,0% |

| | | | | | |
|---|---|---|---|---|---|
| FCFF (t-1) | 7,9% | 4,1% | 19,6% | 0,6% | 9,8% |
| **Governance Engineering** | | | | | |
| Incentives (t+3) | 0,1% | 0,0% | 0,8% | 0,0% | 0,0% |
| Incentives (t-1) | 0,0% | 0,0% | 0,1% | 0,0% | 0,0% |
| **Operational Engineering** | | | | | |
| Productivity CAGR | 17,9% | 5,7% | 40,3% | -0,3% | 22,0% |
| Working Capital (t+3) | 2,7x | 1,4x | 7,4x | 1,0x | 2,4x |
| Working Capital (t-1) | 1,6x | 1,4x | 0,8x | 1,1x | 2,0x |
| CapEx (t+3) | 1,2% | 0,5% | 4,8% | -0,1% | 1,2% |
| CapEx (t-1) | 3,9% | 0,8% | 23,4% | 0,0% | 3,0% |

**Table 10**. Evolution of key variables industry adjusted by the respective peer group

| Variable | Average | Median | Standard Deviation | 1st Quartile | 3rd Quartile |
|---|---|---|---|---|---|
| **Dependent** | | | | | |
| Δ EBITDA-margin | 3,5 | 1,0 | 10,6 | -1,9 | 5,5 |
| Δ ROIC | 10,9 | 4,0 | 50,7 | -15,1 | 55,6 |
| Revenue CAGR | 9,7 | 1,7 | 29,1 | -3,5 | 18,0 |
| **Independent** | | | | | |
| **Financial Engineering** | | | | | |
| Δ Leverage | 5,5 | 0,4 | 23,2 | -5,2 | 8,9 |
| Δ FCFF | -2,8 | 3,2 | 20,3 | -8,2 | 6,4 |
| **Governance Engineering** | | | | | |
| Δ Incentives | 0,5 | 0,4 | 1,9 | -0,2 | 1,0 |
| **Operational Engineering** | | | | | |
| Productivity CAGR | 15,7 | 3,5 | 40,3 | -2,5 | 19,9 |
| Δ Working Capital | 1,1x | 0,1x | 7,4x | -0,4x | 0,7x |
| Δ CapEx | -2,3 | 0,2 | 23,1 | -1,0 | 1,0 |

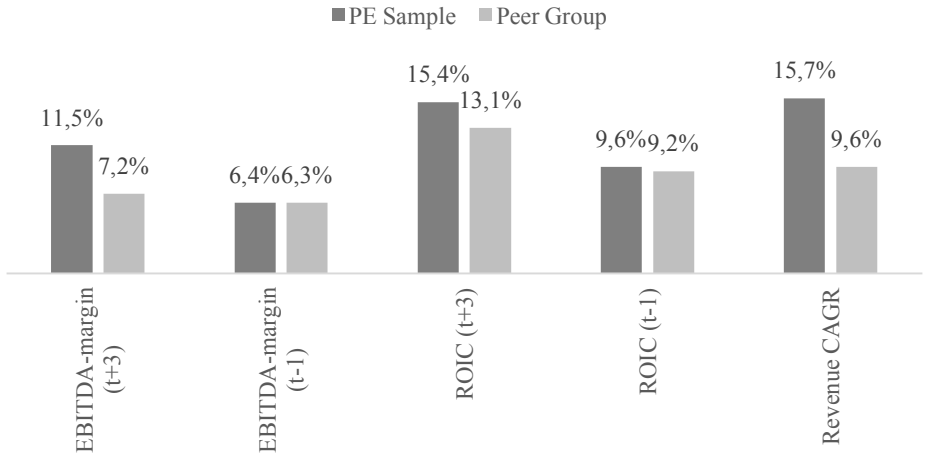
*Note: All figures except ΔWorking Capital are in percentage points (pp)*

In summary, across the sample data, there is noticeable dispersion in some variables, particularly ROIC and productivity. Although, this result is not necessarily negative or unexpected. Rather, it is likely rooted in the mix of business models and industries that the sample is comprised of. First, notwithstanding that the sample has been adjusted for industry effects, there can still be considerable differences between the companies belonging to the same industry code (SNI07) given their broad classification conditions. For example, in the industry Health & Education,

there are both medical device companies with high R&D costs included, as well as private school providers where human capital instead are of importance. Secondly, the dispersion of the variables can be influenced by how mature the companies are in the sample set. A young industrial company with one breakthrough product may experience very rapid revenue growth over a short time frame whereas a mature, multi-product industrial company may focus more on stable revenue growth and margin expansion.

Figure 2 below shows an average value comparison of key variables of value creation for the PE sample and peer group.

**Figure 2**. Average key variables of value creation




Firms acquired by Private Equity firms and those listed publicly on average have similar EBITDA-margin and ROIC the year before the PE acquisition. Three years post the acquisition, the PE-owned firms on average outperform the public firms operationally. A similar pattern is seen in revenue growth, with indications of faster growth in PE-owned firms. As mentioned in the previous discussion on the descriptive statistics of the sample, the growth figures should be interpreted with caution as it includes both organic and acquired growth.

Table 11 below shows descriptive statistics grouped by acquisition year and adjusted for industry effects. Firms acquired in 2007 and 2010 particularly show strong improvements across EBITDA-margin, ROIC and revenue growth. 2013 also display very good improvements in key

variables, however, given that the sample only includes two acquisitions for this year, it is likely that the deals are one-offs and not fully representative of PE sponsored performance.

**Table 11**. Median descriptive statistics by year adjusted for industry effects

| Buyout Year | ΔEBITDA-margin | ΔROIC | Revenue CAGR | ΔLeverage | ΔFCFF | ΔIncentives | Productivity CAGR | ΔWorking Capital | ΔCapEx |
|---|---|---|---|---|---|---|---|---|---|
| 2007 | 2,4 | 10,0 | 12,4 | 0,4 | -0,1 | 0,3 | -0,6 | 0,2x | 0,3 |
| 2008 | -0,2 | 0,6 | -2,2 | 4,9 | -1,2 | -0,1 | 5,3 | 0,0x | -0,2 |
| 2009 | -1,6 | -62,0 | 1,3 | 6,4 | 5,2 | 0,1 | 9,5 | -0,1x | 0,4 |
| 2010 | 5,5 | 7,2 | 8,1 | 0,4 | 3,2 | 0,0 | 4,6 | 0,0x | -0,1 |
| 2011 | 0,8 | 4,3 | 0,4 | -6,4 | -8,7 | 0,0 | 4,3 | -0,1x | 2,8 |
| 2012 | -0,7 | 1,4 | 5,6 | 0,4 | -9,5 | 0,0 | -1,2 | 0,4x | 0,4 |
| 2013 | -6,6 | 39,8 | 19,9 | -5,8 | 2,7 | 0,0 | 131,5 | 31,4x | -0,3 |
| 2014 | 3,5 | -9,5 | 18,2 | 17,2 | 16,8 | -0,7 | 18,8 | -1,0x | 2,6 |
| 2015 | -3,7 | -15,5 | -3,5 | 0,4 | 2,1 | 0,0 | -0,1 | 0,1x | 0,6 |

*Note: All figures except ΔWorking Capital are in percentage points (pp)*

Finally, Table 12 shows that the industries with improvements in all three operational metrics are Corporate Services, Energy and Environment, Health and Education and Shopping Goods. It is worth highlighting that incentives changed significantly more in the IT & Electronics industry compared other industries in the sample.

**Table 12**. Median descriptive statistics adjusted for industry effects and grouped by industry

| Industry | Δ EBITDA-margin | Δ ROIC | Revenue CAGR | Δ Leverage | Δ FCFF | Δ Incentives | Productivity CAGR | Δ Working Capital | Δ CapEx |
|---|---|---|---|---|---|---|---|---|---|
| Construction Industry | -0,1 | 2,7 | 17,5 | -11,9 | -7,0 | 0,0 | -4,0 | 0,2x | -11,6 |
| Convenience Goods | 3,0 | 36,9 | -0,4 | -4,2 | 1,8 | 0,0 | 17,0 | -0,3x | 0,6 |
| Corporate Services | 9,2 | 5,6 | 27,6 | 3,0 | 4,1 | -0,3 | 18,8 | 0,1x | 0,5 |
| Energy & Environment | 11,1 | 1,3 | 9,3 | -3,3 | -7,4 | 0,0 | -1,4 | 0,5x | 17,3 |
| Health & Education | 2,6 | 6,2 | 12,9 | 0,4 | 5,8 | 0,0 | 4,4 | -0,2x | -0,2 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Industrial Goods | -0,2 | 1,3 | -0,8 | 0,4 | -3,4 | 0,0 | -0,1 | 0,0x | 0,0 |
| IT & Electronics | -1,2 | 70,0 | 4,3 | 5,1 | -0,5 | 3,2 | 7,3 | 0,0x | -1,5 |
| Materials | -0,3 | -6,1 | -67,8 | 9,4 | -4,8 | 0,0 | 24,8 | 0,7x | -5,5 |
| Shopping Goods | 4,1 | 3,6 | 13,3 | 0,4 | -1,6 | 0,0 | 6,0 | 0,4x | 0,6 |
| Telecom & Media | -3,7 | 55,8 | 1,0 | 0,5 | 3,9 | 0,0 | 16,3 | -0,2x | 0,6 |

*Note: All figures except ΔWorking Capital are in percentage points (pp)*

## 3.7 Criticism of the Methodology

Bryman and Bell (2011) state that three of the most prominent criteria for the evaluation of research are reliability, replicability, and validity. These criteria will be discussed to assess the quality of this study. But first, some general limitations and implications will be presented.

### 3.7.1 General Limitations

There are extensive measurement problems in quantifying some determinants such as industry expertise and additional acquisitions. One criterion for the chosen variables is that they should be quantifiable, which might indicate selection bias. Nevertheless, we believe that this is the most appropriate methodology to follow due to the delimitations of this study, and this problem rather illustrates the complexity with the value creation process in the PE industry. Furthermore, there is limited data available for several variables, for example, management ownership. This has caused problems with including variables that could have contributed to the findings and conclusions.

To be consistent, results have only been reported given the chosen time window ranging from t-1 to t+3. Therefore, this study excludes the potential effects that occur and are detectable four or five years after the buyout. On the other hand, the longer the time window is, the more noise can be included or affect the results. The sample size would also be significantly reduced since a minority of observations in the sample have a holding period of at least five years, which would make the results more unreliable.

### 3.7.2 Reliability and Replicability

The term reliability examines whether the results of the study are repeatable, which in extension mean that the same conclusions can be obtained, regardless of the researchers that performed the study. It is a common issue in connection with quantitative studies where researchers are concerned with the question of whether the chosen measures are stable or not (Bryman & Bell, 2011). Because this study mainly uses accounting measures, the level of reliability is sound. Other researchers would probably have obtained the same findings if they had used the same metrics and ratios, given the same calculations, time windows and sample. Accounting data should also be the same no matter of what source one uses. The stability of all measures is also enhanced due to the nature of the variables. In other words, they cannot be influenced by the researchers' interpretations to the same extent as qualitative data can become.

Replicability is a closely related concept to reliability. A study must be capable of replication to enable other researchers to replicate the findings, for example, if the results do not match other evidence that is relevant (Bryman & Bell, 2011). Given the discussion about reliability, one can conclude that this study is highly replicable as well. This could be valuable for researchers within the field of private equity that want to use a similar methodology as ours.

### 3.7.3 Validity

One of the most important criteria of research is validity which is a concept that could be divided into two main types; internal and external validity. Internal validity is mainly related to the issue of causality, which concerns the question of how sure we can be that $x$ (independent variable) can explain the variation in $y$ (dependent variable) if we suggest that $x$ causes $y$, and not something else that is producing a causal relationship between the two variables (Bryman & Bell, 2011). In other words, how does variable $y$ change if variable $x$ is changed, but all other relevant factors are fixed (Woolridge, 2008). From a theoretical perspective, all independent variables have the right characteristics to be able to explain changes in the dependent variables. It should, however, be highlighted that there are several other factors in the error term that also drive operating performance and thereby have the potential to explain the variation in the dependent variables.

A major problem for causality is the endogeneity issue, or reverse causality, which occurs when we do not know whether *x* causes *y* or vice versa (Woolridge, 2008). According to this study, PE firms should not be capable of improving EBITDA-margin, ROIC or revenue CAGR (dependent variables) without improving some of the independent variables. This argument supports that *x* could have a causal effect on *y,* and not vice versa, even if it, for example, can be argued that a change of a CEO can be explained by negative development of operating performance. However, we have dealt with these issues by choosing relevant variables and formulating precise hypotheses to be able to find causality.

External validity is concerned with the question of whether the specific findings of a study can be generalized beyond the research context (Bryman & Bell, 2011). This issue is dealt with by generating a representative sample of Swedish PE-backed firms and an optimally matched peer group. The sample sizes of 74 PE-backed firms and 74 peer companies are also relatively large. Therefore, the results of this study can be generalized across countries within the research field of private equity.

Overall, we would argue that the validity of this study is good, even if it might exist a few arguments that suggest a decent level of validity regarding the relationship between some variables.

# 4. Empirical Results

## 4.1 Wilcoxon Signed-Rank Test

In this section, the results of the Wilcoxon signed-rank tests are presented. The median values are adjusted by industry and performance of the peer group.

**Table 13**. Wilcoxon signed-rank test (median values) – Industry adjusted

| Variable | Observations | Median | Statistic test (z) |
|---|---|---|---|
| **Financial Engineering** | | | |
| ΔLeverage | 74 | 0.004* | 1.813 |
| ΔFCFF | 74 | 0.032** | 2.001 |
| **Governance Engineering** | | | |
| ΔIncentives | 74 | 0.004*** | 5.994 |
| **Operational Engineering** | | | |
| ΔProductivity | 74 | 0.035*** | 3.488 |
| ΔWorking Capital | 74 | 0.101* | 1.921 |
| ΔCapEx | 74 | 0.002 | 0.822 |

*Note: The table reports the results of the Wilcoxon signed-rank test for all variables besides Change of CEO. The median values, i.e. the median abnormal operating performance, are measured as the change in performance between t-1 and t+3 for the PE-backed firms less the median performance of the peer group. *** significance at 1%, ** significance at 5%, * significance at 10%.*

From the results displayed in Table 13, there is evidence of significant changes for five out of six variables relative to the peer group. First, at the 10% significance level, the median increase in debt ratio (Δ*Leverage*) is 0.4 percentage points. This indicates a slightly positive increase in leverage between one year before the buyout and one year after the buyout. The magnitude of the change in free cash flows (Δ*FCFF*) is larger with a median increase of 3.2 percentage points, which is significant at the 5% level. However, this result is not in line with the expectation that free cash flows would decrease during the holding period.

Second, the results of governance engineering show, on a 1% level of significance, that the median increase of the performance-based compensation (Δ*Incentives*) is 0.4 percentage points for PE-backed firms relative to the peer group. The magnitude seems reasonable since the incentive structure is measured as the bonus-related income divided by revenue, meaning that it will have relatively small values on average. Thus, an increase of 0.4 percentage points in performance-based compensation three years after the buyout could indicate economic significance as well.

Third, the results of the operational engineering variables differ. The median increase in labor productivity (Δ*Productivity*) is 3.5 percentage points relative to the peer group, indicating a statistically significant increase in revenue per employee at the 1% level of significance. The working capital ratio (Δ*Working Capital*) also shows a significant increase during the holding period but at the 10% significance level. The magnitude of 10.1 percentage points increase in the working capital ratio is substantial, and not in line with the expectations. Nor is the increase in the capital expenditure ratio (Δ*CapEx*), but this median change of 0.2 percentage points is not statistically significant.

## 4.2 Regression Analysis

Table 14 presents the results based on the estimation of the three OLS regression models, adjusted by industry and performance of the peer group. In general, three out of seven explanatory variables are significant at the 1% and 5% level, respectively, based on Model 1 (*EBITDA-margin*), whereas two out of seven explanatory variables are significant at the 1% level based on Model 3 (*Revenue CAGR*). Model 2 (*ROIC*) only generates one significant explanatory variable, although at the 1% level of significance. Based on these significant explanatory variables, five out of six have the expected sign.

**Table 14**. Regression analysis.

| Variables | Expected sign | Model 1 EBITDA-margin | Model 2 ROIC | Model 3 Revenue CAGR |
|---|---|---|---|---|
| Constant | n.a. | 0.132** | -0.025 | 0.122*** |
| | | (0.066) | (0.360) | (0.039) |
| **Financial Engineering** | | | | |
| ΔLeverage | + | -0.023 | -0.117 | 0.089 |
| | | (0.056) | (0.308) | (0.230) |
| ΔFCFF | - | -0.001*** | 0.000 | -0.000 |
| | | (0.000) | (0.002) | (0.001) |
| **Governance Engineering** | | | | |
| ΔIncentives | + | -0.832 | 8.049 | 8.855*** |
| | | (1.797) | (9.841) | (3.308) |
| Change of CEO | + | 0.022 | 0.350** | -0.025 |
| | | (0.024) | (0.133) | (0.074) |
| **Operational Engineering** | | | | |
| ΔProductivity | + | 0.136*** | -0.171 | 0.113 |
| | | (0.043) | (0.234) | (0.141) |
| ΔWorking Capital | - | -0.006** | 0.003 | 0.003 |
| | | (0.002) | (0.012) | (0.006) |
| ΔCapEx | - | -0.039 | 0.101 | 0.201*** |
| | | (0.028) | (0.155) | (0.062) |
| Observations | | 74 | 74 | 74 |
| R-Squared | | 0.398 | 0.217 | 0.384 |
| Adjusted R-Squared | | 0.229 | 0.038 | - |
| Robust standard errors | | NO | NO | YES |
| Industry dummies | | YES | YES | YES |

*Note: The table reports the results based on the three OLS regression models for the sample of PE-backed firms relative to the peer group. Standard errors in the parentheses (robust standard errors for Model 3). *** significance at 1%, ** significance at 5%, * significance at 10%.*

Table 14 presents the results based on the estimation of the three OLS regression models, adjusted by industry and performance of the peer group. In general, three out of seven explanatory variables are significant at the 1% and 5% level, respectively, based on Model 1 (*EBITDA-margin*), whereas two out of seven explanatory variables are significant at the 1% level based on Model 3 (*Revenue CAGR*). Model 2 (*ROIC*) only generates one significant explanatory variable, although at the 1% level of significance. Based on these significant explanatory variables, five out of six have the expected sign.

Δ*Leverage* is the only variable that is not significant regardless of model, and it also has a negative sign in two cases indicating that an increased debt ratio has a negative impact on EBITDA-margin and ROIC. Therefore, there is no support that increased leverage leads to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group (Hypothesis 1). This result is not in line with neither Jensen's (1989) nor Kaplan's and Strömberg's (2009) argument that added leverage is value-creating action as it apparently was before.

Based on Model 1, there is evidence that Δ*FCFF* is statistically significant at the 1% level with a coefficient of -0.001. This implies that a 1 percentage point decrease relative to the peer group in free cash flow ratio, on average, leads to a 0.1 percentage point's relative increase in EBITDA-margin over the time window. The magnitude can thus be questioned since it does not appear to be economically significant. However, the result supports that a decreased free cash flow ratio leads to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group (Hypothesis 2). Both Kaplan (1989b) and Lichtenberg and Siegel (1990) also found decreases in capital expenditures to sales during the holding period.

The third explanatory variable, Δ*Incentives*, is also statistically significant at the 1% level based on the estimation of Model 3. The coefficient of 8.855 implies that a 1 percentage point increase relative to the peer group in the ratio of performance-based compensation, on average, leads to an 885% points' relative increase in revenue CAGR over the time window. The sizeable magnitude of the coefficient can be explained by the fact that a 1 percentage point increase in this ratio is unlikely given that tantiem is tied up to revenue and generally only represents a fraction of a percentage. Disregarding this speculation, there is evidence that supports that increased

performance-based incentives for management lead to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group (Hypothesis 3). This supports Jensen's (1989) evidence that the incentive structure in PE-backed firms tends to have higher upper limits compared to public firms, which serves as an important governance tool to incentivize management to accelerate revenue growth during the holding period.

*Change of CEO* was the only variable the could not be used in the Wilcoxon signed-rank test due to its dummy variable characteristics. Estimating the impact of this variable on operating performance, the result from Model 2 shows that it is statistically significant on the 5% level and has the expected sign. A change of CEO relative to the peer group, on average, leads to a 35 percentage points' relative increase in ROIC over the time window. This evidently supports the fact that replacing a CEO leads to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group (Hypothesis 4), which is in line with the findings in the studies by Gompers et al. (2016) and Heel and Kehoe (2005).

Both Δ*Productivity* and Δ*Working Capital* are statistically significant at the 1% and 5% level, respectively, based on Model 1. First, the coefficient of 0.136 implies that a 1 percentage point increase relative to the peer group in the labor productivity ratio, on average, leads to a 13.6 percentage points' relative increase in EBITDA-margin. Second, working capital coefficient of -0.006 implies that a 1 percentage point decrease relative to the peer group in the working capital ratio, on average, leads to a 0.6 percentage points' relative increase in EBITDA-margin. These two results have a reasonable economic impact and indicate that sets of operational changes have been applied to the portfolio companies during the holding period. Additionally, this supports that increased labor force productivity and decreased working capital ratio lead to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group (Hypothesis 5 & 6). Because these sets of changes improve operating margins, the results are consistent with those of Berg and Gottschalg (2005) and Magowan (1989).

The third operational explanatory variable, Δ*CapEx*, is also statistically significant but based on the estimation of Model 3. Notably, this is the only significant result that does not have the expected sign. At the 1% level of significance, the coefficient of 0.201 implies that a 1 percentage

point increase relative to the peer group in the capital expenditures ratio, on average, leads to a 20.1 percentage points relative increase in revenue CAGR over the time window. The magnitude of 20.1 percentage points further implies a substantial economic significance. However, it does not support the last hypothesis that a decreased capital expenditure ratio leads to a positive and significant effect on the operating performance of PE-backed firms relative to the public peer group (Hypothesis 7). In contrast to Berg's and Gottschalg's (2005) findings, this result does not indicate that restrictions on capital expenditures create value.

R-Squared for Model 1, Model 2 and Model 3 takes values of 39.8%, 21.7%, and 38.4%, respectively. Interpreting R-Squared for Model 1, we can conclude that 39.8% of the variation in EBITDA-margin can be explained by the explanatory variables. Thus, it is likely to believe that there are several other factors included in the error term that also can explain the variation in the dependent variables. Adding more independent variables to the regressions would probably have increased R-Squared. However, R-Squared does not tell us anything about causality.

# 5. Analysis and Discussion

## 5.1 Financial Engineering

The results from the three OLS regression models show a mix of results on the impact of financial engineering on operating performance. Regarding the unexpected sign of leverage, an increase in leverage will, contrary to Hypothesis 1, lead to a decrease in EBITDA-margin and ROIC. However, there is no statistical evidence that debt has the expected disciplinary effect on management due to insignificance. Theoretically, this is in opposition to the theories laid forward by Jensen (1989) and Kaplan and Strömberg (2009), which argues that increased debt leads to improved operating performance. However, an important aspect to keep in mind as a potential cause of our results is the time of the sample group.

Previous studies by Jensen (1989), and Kaplan and Strömberg (2009) consists of deals completed pre-2007, whereas this study investigates the operational effects between 2007 and 2017. As argued by Gaughan (2017), PE acquisitions completed before the 2008 financial crisis were pursued aggressively with debt-packages accounting for up to 90% of the total deal value. This changed after the crisis because of constrained credit markets, high-profile LBO-failures and increased competition from equity-focused pension funds. As such, banks started to require higher equity participation from the PE firms to minimize their own credit risk (Gaughan, 2017). Our results thus indicate that increased debt is of less importance for a firms' increase in value compared to pre-2008 and the late 1990s.

Compared to leverage, the change in free cash flow shows a significant effect and the expected sign from Hypothesis 2 on EBITDA-margin. Moreover, the results indicate that on average, a 1 percentage point decrease in free cash flow ratio increases EBITDA-margin by 0.1 percentage point. This is in line with the free cash flow hypothesis presented by Jensen (1989) and show that an optimized capital structure where discretionary cash flow spending on pet projects is limited, will benefit a firm operationally. However, the magnitude of the coefficients and lack of significance on the coefficients on ROIC and revenue growth calls into question the validity of the effect. Logically, as discussed on the theoretical section on financial engineering in this paper,

lower levels of free cash flow are to a large extent dependent on increasing debt levels where interest payments act as the suppressor of cash flows. Thus, given the discussion in the section above where capital structures have gone from highly to moderately levered, it comes as no surprise that the change in free cash flows is insignificant and small in magnitude relative to improved operating performance.

In summary, the results indicate that in the last decade, financial engineering has been less important as a factor that influences the increase in operating performance among PE-backed firms, especially compared to earlier leading studies in the subject by Jensen (1989), and Kaplan and Strömberg (2009). Instead, the increase in operational performance must stem from governance or operational engineering efforts, a view supported by Gompers et al. (2016) which we will explore further in the following sections.

## 5.2 Governance Engineering

In general, the results show that the effects of governance engineering actions have significant effects on PE-backed firms' operating performance relative to public companies. The governance model that PE firms apply to their portfolio companies seems to be superior to the ones that public firms use as Beroutsos et al. (2007) argue. This can be supported by Jensen's (1989) argument that a typical public firm is characterized by weaker corporate governance relative to PE-backed firms, although this is a vaguely specified and generally formulated conclusion. One could rather argue that public firms have a different governance focus since they need to mitigate some principal-agent conflicts differently compared to private companies. According to Acharya et al. (2009), public firms primarily focus on compliance and risk avoidance, whereas PE-owned firms put more effort into strategy and performance management. Thus, it is reasonable that governance factors have a positive and significant effect on the operating performance of PE-backed firms relative to public peers as the results illustrate.

According to the results of Gompers et al. (2016) survey, PE investors claim that the main source of the added value in portfolio companies is "increasing revenue" followed by "improving incentives and governance". This is highly related to our results since increased performance-based compensation for management has a significant positive impact on the revenue growth of the

portfolio companies. Hence, there is a possibility that management's performance-based compensation in PE-backed firms is tied up to revenues, which to some extent contradicts Jensen's (1989) argument that their bonuses usually are tied up to cash flow generation and debt retirement rather than to accounting earnings. It is perhaps more likely that public companies tie up management's bonuses and compensation to KPIs that are not influenced by accounting practices since these firms are extensively monitored by their shareholders and other market participants. Private PE-backed firms, on the other hand, do not necessarily have to mitigate the same type of potential agency conflicts that can arise, thus it could be fewer complications of having incentive structures based on revenue growth if this is considered to be value creating.

Being active owners in terms of governance is also a source of value creation, specifically in making decisions regarding the replacement of CEO, which is in line with what PE firms say they do (Gompers et al., 2016). The effect of changing the CEO immediately after a buyout is significant, both economically and statistically, given the positive impact on ROIC. The ROIC measure considers both profit margins and capital efficiency – a balance which the newly appointed CEO obviously knows how to optimize to create value. This indicates that PE firms have knowledge and ability to pick the right CEOs with a unique and relevant skill set who can execute operational improvements in line with the PE firms' preferences. However, it is not confirmed that all newly appointed CEOs in the sample have worked for a portfolio company before and thereby know how to generate value for the PE investors. In addition, one cannot conclude that the pre-buyout CEOs have been replaced due to poor performance as Acharya et al. (2013) remark, but this is only a potential cause or motive to the change. What is ensured is that a change of CEO has a positive impact on the return on invested capital for the portfolio firms relative to publicly held companies.

## 5.3 Operational Engineering

It is uncertain whether operational engineering is the main driver of improved operating performance, as Heel and Kehoe (2005) argue, even if there exists some support for the argument according to the results. However, it can be stated that PE firms' enhanced industry expertise and operating knowledge has a positive effect on the operating business and the value creation process. PE firms seem to have a parenting advantage relative to public companies, not only to find and

formulate value-creating strategies but also to implement these strategies to realize the effects in their portfolio companies.

Kaplan and Strömberg (2009) claim that superior operating knowledge also enable PE firms to identify investment opportunities. This supports the result indicating that a relative increase in capital expenditure ratio has a positive effect on revenue growth, even though it did not match our expectations. Restrictions and limitations on capital expenditures to reduce the risk of managers wasting free cash flows on unprofitable investments should intuitively improve operational metrics. But growth could be accelerated if the management is capable to identify profitable investment opportunities thanks to PE advisors. A stricter financial policy does not necessarily mean that capital expenditures need to med reduced, but instead making production facilities more efficiently and thoughtfully utilized, for example through restructurings as Seth and Easterwood (1993) suggest. It is also notable that the positive effects of upgrades and acquisitions of tangible and certain intangible assets can be realized over the three years' period after the buyout, which also underlines PE firms' unique expertise.

The question of whether cost-cutting activities such as employee layoffs create or destruct value within portfolio companies will probably continue to be frequently debated. The result for our modified labor variable relative to previous research, however, shows that regardless of whether they dismiss staff, PE firms tend to increase the value of each employed individual. This is a pure sign of value creation since it is related to increased labor productivity, rather than solely employee layoffs or in extension wage level reductions. Increasing revenue per employee thus increases EBITDA-margin for PE-backed firms, which probably is the most significant determinant of value creation according to the results.

Among the operational engineering determinants, a decreased working capital ratio seems to have the second greatest effects for PE-backed firms relative to their public peers. This could primarily stem from enhanced control over inventory and accounts receivables, which Magowan (1989), as well as Berg and Gottschalg (2005) discuss. However, we should not exclude other optimizations such as for accounts payables through extended credit days against suppliers, which leads to lower working capital levels. Like the other two operating determinants, there is evidence on superior

management of operational accounting items. A newly appointed CEO who knows how to improve ROIC reasonably also knows how to deal with current assets versus current liabilities since working capital is a key component of the ROIC.

# 6. Conclusion

## 6.1 Conclusion

Our findings support the general view of what type of engineering PE firms apply to their portfolio companies to create value. According to previous research, adding leverage has been used as an essential instrument since the evolvement of the PE industry. Today, financial engineering in general, and leverage particularly seem to be of less importance in terms of value creation. Given the effects of financial engineering, no significant value is created through optimization of the capital structure. Focusing on improvements regarding items on the left side of the balance sheet and on operating margins in combination with governance have more significant and positive effects on the operational performance of portfolio companies.

There is evidence that PE firms have a parenting advantage relative to public firms in the way they create value, which can be linked to their superior industry expertise. We argue that the positive effects of operational actions would not necessarily occur without governance improvements. As a result, a more lucrative incentive structure and a change of CEO can form the basis for the operational improvements of PE-backed firms. Thus, a mix of operational and governance engineering primarily drives the value creation process during the holding period.

Finally, our unique findings shed light on the complexity of the value creation process reflected in the challenging quantification and identification of explanatory variables. The aim of this study is thus fulfilled since our contribution to previous research is of importance.

## 6.2 Further Research

Despite our unique results, one cannot ignore the fact that PE firms' value creation process is still complex. Thus, there are motives for investigating other determinants that can potentially explain the superior performance of PE-backed firms. Given the quantification issues with several variables, there could be more appropriate to conduct a case study to dig deeper into a few PE-sponsored buyouts to capture more aspects in terms of value creation. Thereby, it would be

possible to investigate the effects of qualitative variables, for example within active ownership and strategy implementation. Differences in ownership characteristics, size and implementation strategies between different PE firms can also be identified by conducting a comparative study. Especially since some PE firms tend to focus on buying companies in the early stages of the business maturity cycle, whereas others acquire more mature companies in later stages.

Another interesting area related to PE firms' value creation process, or non-value creation process, is a subject called multiple arbitrage. Practically, it means that the value of the portfolio company increases disproportionately relative to the operational improvements that have been realized. The PE firm is thereby arbitraging the multiple at which the portfolio company is bought and sold. This is an unexplored research area today, although it is a highly relevant phenomenon within the PE industry.

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# Appendix

### Exhibit 1. List of deals included in the sample

| Deal # | Private Equity Acquirer(s) | Target Company | Acquisition Year | Benchmark Company | Industry |
|---|---|---|---|---|---|
| 1 | ACCENT | Mont Blanc Industri AB | 2008 | Precomp Solutions AB | Industrial goods |
| 2 | ACCENT | Akademibokhandeln AB | 2015 | Venue Retail Group Aktiebolag | Shopping goods |
| 3 | ACCENT | Textilia AB | 2014 | Saxlund Group AB | Corporate services |
| 4 | ACCENT | Bergteamet AB | 2011 | Eolus Vind Aktiebolag | Constructi on industry |
| 5 | ACCENT | Autotube AB | 2011 | CTT Systems AB | Industrial goods |
| 6 | ACCENT | Höoks Hästsport AB | 2011 | MQ AB | Shopping goods |
| 7 | ACCENT | Troax AB | 2010 | Nederman Holding Aktiebolag | Industrial goods |
| 8 | ACCENT | Å&R Carton AB | 2008 | ProfilGruppen AB | Materials |
| 9 | ACCENT | Nordic Shelter Solutions AB | 2008 | Safe at Sea AB | Industrial goods |
| 10 | ACCENT | Crem International AB | 2008 | Svedbergs i Dalstorp AB | Shopping goods |
| 11 | ACCENT & EQT | Scandic Hotels AB | 2007 | Radisson Hospitality AB | Shopping goods |
| 12 | ACCENT | Inredningsglas Skandinavien AB | 2007 | FM Mattsson Mora Group AB | Industrial goods |
| 13 | ALTOR | Apotek Hjärtat AB | 2010 | MedicPen Aktiebolag | Health & Education |
| 14 | ALTOR | Åkers AB | 2008 | Sandvik Aktiebolag | Industrial goods |
| 15 | ALTOR | Vatus Medical AB | 2007 | Elos Medtech AB | Health & Education |
| 16 | BRIDGEPOINT | Nordic Cinema Group AB | 2015 | Bredband2 i Skandinavien AB | Telecom & Media |
| 17 | BRIDGEPOINT | Memnon Networks AB | 2012 | Genesis IT AB | IT & Electronics |
| 18 | BRIDGEPOINT & VALEDO | Solhagagruppen AB | 2010 | Camanio Care AB | Health & Education |
| 19 | CAPMAN | Swereco Group AB | 2010 | Clinical Laserthermia Systems AB | Health & Education |
| 20 | CAPMAN | Samsa AB | 2009 | AlphaHelix Molecular Diagnostics AB | Health & Education |
| 21 | CAPMAN & LITORINA | Orkla Care AB | 2008 | Acando AB | Corporate services |
| 22 | CAPMAN | Crayon AB | 2008 | Feelgood Svenska Aktiebolag | Health & Education |

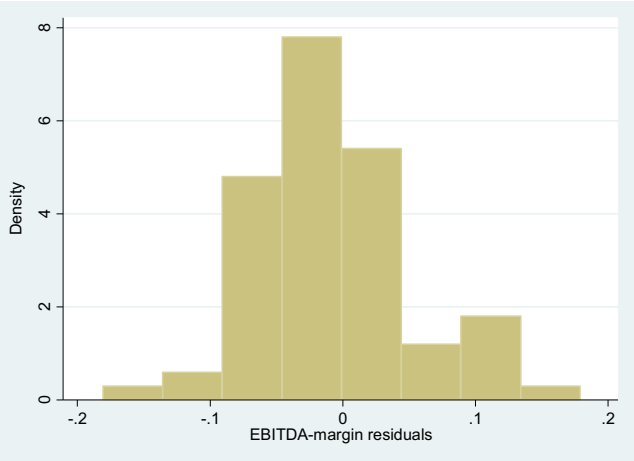
| | | | | | |
|---|---|---|---|---|---|
| 23 | CAPMAN | Proxima AB | 2007 | Mycronic AB | IT & Electronics |
| 24 | CAPMAN | Nanoradio AB | 2007 | Modern Times Group MTG AB | Telecom & Media |
| 25 | CARLYLE & VALEDO | BTI Studios AB | 2013 | Bergman & Beving Aktiebolag | Industrial goods |
| 26 | CREDELITY | QleanAir Scandinavia AB | 2007 | Glycorex Transplantation AB | Health & Education |
| 27 | EQT | Atos Medical AB | 2011 | Mekonomen Aktiebolag | Shopping goods |
| 28 | EQT | Dometic AB | 2011 | Skånska Energi Aktiebolag | Energy & Environment |
| 29 | EQT | Swedegas AB | 2010 | Rejlers AB | Corporate services |
| 30 | EQT | Securitas Direct AB | 2008 | Clas Ohlson Aktiebolag | Convenience goods |
| 31 | EQT | Granngården AB | 2008 | VBG Group AB | Industrial goods |
| 32 | EQT | Titanx AB | 2008 | Cloetta AB | Convenience goods |
| 33 | EQT | Candyking Sverige AB | 2008 | Odd Molly International AB | Shopping goods |
| 34 | EQT | Lundhags Skomakarna AB | 2007 | RLS Global AB | Health & Education |
| 35 | EQT | AcadeMedia AB | 2010 | Guideline Geo AB | Energy & Environment |
| 36 | FAGERBERG & DELBY | BIG BAG AB | 2007 | GHP Specialty Care AB | Health & Education |
| 37 | FAGERBERG & DELBY | Yrkesakademin AB | 2010 | Ambia Trading Group AB | Shopping goods |
| 38 | LITORINA | Ocay AB | 2012 | WeSC AB | Shopping goods |
| 39 | LITORINA | Eton AB | 2012 | Beijer Alma AB | Industrial goods |
| 40 | LITORINA | Sveba-Dahlen Group AB | 2011 | New Wave Group AB | Shopping goods |
| 41 | LITORINA | Björnkläder AB | 2010 | Challenger Mobile AB | Telecom & Media |
| 42 | LITORINA | Semantix Group AB | 2009 | MedicaNatumin AB | Convenience goods |
| 43 | LITORINA | Coromatic Group AB | 2007 | NOVOTEK Aktiebolag | Corporate services |
| 44 | LITORINA | Pahlens AB | 2007 | AQ Group AB | Industrial goods |
| 45 | NORDIC CAPITAL | Thule Group AB | 2007 | KABE Group AB | Shopping goods |
| 46 | NORDIC CAPITAL | Nefab AB | 2007 | AAK AB | Industrial goods |
| 47 | PRIVEQ | Anläggning & Kabel Entreprenad I Malmö AB | 2015 | Exalt AB | Construction industry |

| | | | | | |
|---|---|---|---|---|---|
| 48 | PRIVEQ | Internatural AB | 2013 | Skåne-möllan Aktiebolag | Convenience goods |
| 49 | PRIVEQ | MYBW Office Management Facility Services AB | 2012 | Softronic Aktiebolag | IT & Electronics |
| 50 | PRIVEQ | El-Björn AB | 2011 | Hexagon Aktiebolag | Industrial goods |
| 51 | PRIVEQ | San Sac AB | 2008 | Trelleborg Aktiebolag | Industrial goods |
| 52 | PRIVEQ & CAPMAN | Silex Microsystems AB | 2008 | Fingerprint Cards AB | IT & Electronics |
| 53 | PRIVEQ | Sydtotal AB | 2007 | NCC Aktiebolag | Construction industry |
| 54 | PROCURITAS | Osby Glas AB | 2012 | Image Systems AB | Industrial goods |
| 55 | PROCURITAS | Oral Care AB | 2010 | CellaVision AB | Health & Education |
| 56 | PROCURITAS | Däckia AB | 2009 | XANO Industri AB | Industrial goods |
| 57 | PROCURITAS | KGH Customs Services AB | 2007 | Concordia Maritime Aktiebolag | Corporate services |
| 58 | PROCURITAS | TPPG The Perimeter Protection Group AB | 2011 | Impact Coatings AB | Industrial goods |
| 59 | RATOS | Biolin Scientific AB | 2010 | Getinge AB | Health & Education |
| 60 | RATOS | Mobile Climate Control Sverige AB | 2007 | ALLGON AB | Industrial goods |
| 61 | SEGULAH | DOCU Nordic Group AB | 2014 | AdCityMedia AB | Corporate services |
| 62 | SEGULAH | Scan Coin AB | 2010 | Paynova AB | IT & Electronics |
| 63 | SEGULAH | eTRAVELI (Seat24 Travel AB) | 2010 | Unlimited Travel Group UTG AB | Shopping goods |
| 64 | SEGULAH | Kronans Droghandel Apotek AB | 2010 | Ellen Aktiebolag | Health & Education |
| 65 | SEGULAH | Almondy AB | 2008 | Kopparbergs Bryggeri Aktiebolag | Convenience goods |
| 66 | SEGULAH | Skandinavisk Kommunalteknik AB | 2008 | NIBE Industrier AB | Industrial goods |
| 67 | SEGULAH | Exotic Snacks AB | 2008 | Midsona AB | Convenience goods |
| 68 | SEGULAH | Isaberg Rapid AB | 2007 | Swedol AB | IT & Electronics |
| 69 | SEGULAH | Kemetyl AB | 2007 | Alfa Laval AB | Industrial goods |
| 70 | VALEDO & EQT | Evidensia Djursjukvård Holding AB | 2012 | HomeMaid AB | Shopping goods |
| 71 | VALEDO | Akademikliniken AB | 2011 | PROBI Aktiebolag | Health & Education |
| 72 | VALEDO | Perten Instruments AB | 2010 | Dignitana AB | Industrial goods |

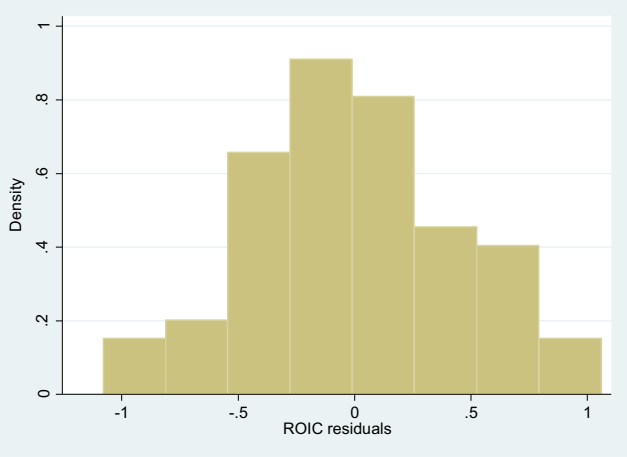
| | | | | | |
|---|---|---|---|---|---|
| 73 | VALEDO | Inom-Innovativ Omsorg I Norden AB | 2009 | Vitrolife AB | Health & Education |
| 74 | VALEDO & CAPMAN | Aspen I Jönkoping AB | 2007 | Gunnebo Aktiebolag | Industrial goods |

**Exhibit 2. Histograms of residual distribution**

**EBITDA-margin**




**ROIC**




**Revenue CAGR**

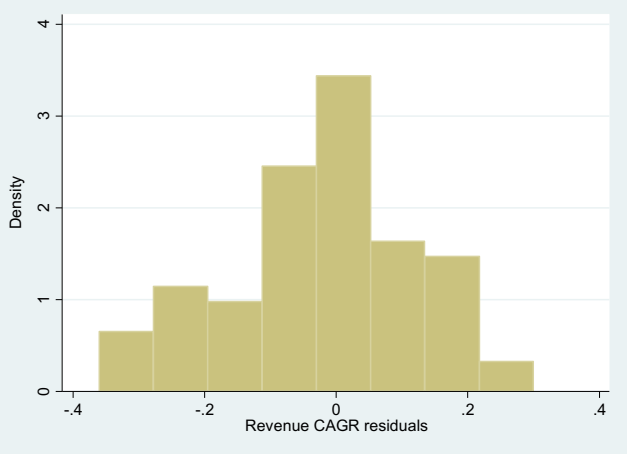


**Exhibit 3. Correlation Matrix of independent variables**

| Correlation Matrix - Independent Variables | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **ΔLeverage** | **ΔFCFF** | **ΔIncentives** | **CEO** | **Productivity CAGR** | **ΔWorking Capital** | **ΔCapEx** |
| **ΔLeverage** | 1,0000 | | | | | | |
| **ΔFCFF** | 0,1455 | 1,0000 | | | | | |
| **Incentives** | 0,1114 | 0,1035 | 1,0000 | | | | |
| **ΔCEO** | -0,0107 | -0,0684 | 0,1265 | 1,0000 | | | |
| **Productivity CAGR** | 0,0208 | 0,1148 | 0,3104 | 0,1526 | 1,0000 | | |
| **ΔWorking Capital** | -0,0952 | -0,0293 | -0,0095 | 0,1475 | 0,6546 | 1,0000 | |
| **ΔCapEx** | -0,2349 | -0,0733 | -0,1601 | 0,0975 | -0,1218 | 0,0056 | 1,0000 |