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The Effect of Private Equity Ownership on Firm-Level Productivity*

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Abstract

In this paper, we examine the effect of private equity ownership on target firm productivity, where productivity is measured in terms of total factor productivity and labor productivity. This is investigated by performing an event study on 80 Swedish investments during the years 2004 to 2013. We find abnormal productivity growth in private equity owned firms by approximately 10 percent during the investment holding period. The productivity growth seems to mainly derive from a transitory, albeit sustainable, effect, combined with a positively altered productivity growth path. Furthermore, the abnormal growth appears to be the result of two effects. Firstly, the first two years post buyout, target firms seem to increase output more than the counterfactual while maintaining inputs in line with the counterfactual. Secondly, year three post buyout and forward, we see indications of more efficient capital spending than the counterfactual.

Keywords: Private Equity, Productivity, Operational Performance

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Table of Contents

1. Introduction

The phenomenon of leveraged buyouts first emerged during the 1960's but started to gain more importance during the 1980's in the US. The term leveraged buyout (henceforth LBOs or buyouts) refers to a transaction where an investment company uses a mix of outside debt and equity to acquire a target company. The acquiring investment companies in LBOs are nowadays also known as private equity firms (Kaplan and Strömberg, 2009, Lichtenberg and Siegel, 1990). In most cases, private equity firms acquire majority control of the target company and keep the target private (or make private if public) during the holding period. Private equity should not be confused with venture capital companies that invest in minority stakes in young or emerging companies, whereas private equity firms focus on mature companies with established business models.

During the last decades, the private equity industry has grown immensely. In 2013, the global value of private equity buyout deals was USD 231 billion, a tremendous increase from USD 31 billion in 1995 (Bain & Company, 2014). Today, 8.4 percent of Sweden's Gross Domestic Product (henceforth GDP) is generated from private equity backed companies (SVCA, 2012). Evidently, the private equity industry has grown and gained more importance in today's society. This is also reflected in the frequent public debates about the effects of private equity ownership, sometimes negatively portrayed in general public contexts. For instance, in a debate article written by former Danish Prime Minister Poul N. Rasmussen (2008), he claims *"These 'leveraged buyouts' leave the company saddled with debt and interest payments, its workers are laid off, and its assets are sold. A once profitable and healthy company is milked for short-term profits, benefiting neither workers nor the real economy."* Given the industry's strong position in our society, we find it interesting to further investigate these effects of private equity.

Even though research has found a potentially negative effect of private equity on employment for the acquired firms (see for example Hodkinson, 2013; Weber, 2014; Kaplan 1989a and Lichtenberg & Siegel, 2001), other possible indirect factors benefiting the economic growth and welfare must be weighed against this. It is well documented in academia that private equity owned firms exhibit abnormal development in operational performance (Cumming et al., 2007), which ought to benefit the society directly and indirectly. Another potential indirect effect of private equity firms that has not been extensively studied is the effect on productivity. Productivity is a measure of the efficiency of production and is typically defined as a ratio of production output to inputs (Katayama et al., 2009). There is an incentive for individual firms to increase productivity, because a high and growing productivity is essential to survive in today's globalized economy. Since productivity has proven to be the main driver explaining the great dispersion of average GDP per capita across the world, we find it intriguing and necessary to study private equity firms' effect on productivity from a societal perspective.

Few studies have been conducted within this area, but existing research indicate that productivity increases in target firms relative to their peers after a buyout (Lichtenberg and Siegel, 1990; Amess, 2003; Harris et al., 2005; Davis et al., 2013). However, three of these papers studied mainly management buyouts (henceforth MBOs) as opposed to buyouts with a private equity sponsor. Additionally, all studies are based on firms only in the manufacturing sector and two of them focus on the US market. Furthermore, Lichtenberg and Siegel (1990) argue that it is possible that LBOs only have a transitory positive impact on productivity, which would decrease over time and maybe even, become negative after three years. This view on productivity as a transitory effect is also supported by Amess (2003). Also, among the few existing studies conducted within this area, three of them study datasets from the 1980's to the 1990's, which may not reflect the drastic development of private equity firms during the last two decades. Private equity firms have since the 1990's increasingly started to focus on 'operational engineering' as opposed to financial engineering (Kaplan and Strömberg, 2009). Thus, the shortage of studies on (i) private equity, (ii) with recent datasets, (iii) in Europe and (iv) the somewhat ambiguous results on private equity's effect on productivity lead us to examine this topic further.

In light of previously mentioned findings, we hypothesize that productivity in buyout target companies will exhibit abnormal growth. This hypothesis is also supported by previous studies concluding that private equity owned companies outperform relative peer groups in terms of operational performance, mainly driven by operational improvements (see for example Kaplan, 1989a; Harris et al., 2005; Bergström et al., 2007; Boucly et al., 2008).

Our empirical results are based on a sample of 80 Swedish private equity majority control investments across a wide range of sectors. The reason for focusing on Sweden is twofold. Firstly, Sweden is at the forefront of European private equity with sophisticated international private equity firms investing worldwide, which serves as a solid foundation for our analysis. Secondly, because productivity measures are complex and require reliable high quality data, we benefit from the conformity of and wide disclosure requirements on accounting data in Sweden.

We measure productivity using two measures, total factor productivity (interchangeably referred to as TFP) and labor productivity (interchangeably referred to as LP). The former is a multifactor measure and intends to capture the effect on output using a combination of several inputs. On the one hand TFP is a comprehensive measure of productivity, but on the other hand it involves measurement issues and may thus be distorted depending on the data. Because of the distortion risk with TFP, we include LP, which is a single factor measure that is simple to measure, but captures only the effect of labor on output. We include both measures and argue that these two complement each other well, providing robustness to our results.

From our results, we find that private equity owned firms exhibit abnormal TFP and LP growth of approximately 10 percent by the median during the holding period. This translates into a compounded annual abnormal growth rate of approximately 2 and 3 percent by the median for TFP and LP, respectively. Due to the productivity measuring issues in the services sector as documented by Maroto-Sánchez (2012), Baily and Zitzewitz (2001) among others, we base our conclusion on firms active in the goods-producing sector. Furthermore, the effect on productivity seems to mainly be an initial transitory, albeit sustainable, effect combined with a positively altered productivity growth path. Our graphical results of productivity show a sharp increase the first year post buyout and slower productivity development subsequent years.

Even though not statistically tested, we find that the abnormal productivity growth seems to be the result of two effects. During the first two years post buyout, the main effect appears to be a higher increase in output than the counterfactual while keeping inputs in line with the counterfactual. The other effect appears to be derived from more efficient capital spending, because despite increased output, target firms on average exhibit capital inputs in line with the counterfactual during the first three years post buyout and the subsequent years post buyout demonstrate a substantially lower capital input level than the counterfactual.

We cannot rule out the risk that what we capture partially stems from firm specific price changes in inputs and output. This is something we should be extra wary of in the case of private equity owned firms, as it is likely that the private equity firms initiate output price increases and procurement savings programs as part of their efforts to increase profitability. We thus acknowledge that part of the abnormal measured productivity growth may be due to price changes.

Additionally, even though it is well documented in academia that today's productivity measures have limited applicability to the services sector, mainly due to measurement issues, we cannot fully dismiss that the measured productivity for the service firms in our study is correctly represented. If so, our conclusions above would be more ambiguous and less robust. We speculate that what we capture may also be different value creation strategies initiated by the private equity firms. By comparing the mean output development across the two groups, we observe a substantially higher output growth for the services firms than that of the goods-producing firms. This discrepancy could indicate that for the services sector, private equity firms are driving value creation strategies focused on growth and expansion rather than operational efficiency. Going into further depth of this matter is beyond the scope of this paper, but we conclude that this could be an interesting area of further research.

Given private equity's strong position in our society, it comes as no surprise that the effects of private equity ownership are well debated. Although previous studies have shown a potential negative effect on employment, we believe that this needs to be put in context to our findings on productivity in this study. The strong connection between productivity growth and GDP growth would indicate long-term economic benefits of private equity ownership that ought to indirectly generate economic growth and increased employment.

2. Previous Research

2.1. Private Equity and its Impact on Productivity

In today's globalized economy, a high and growing productivity is essential in order to survive. From a firm perspective, productivity is considered to be the fundamental variable driving profitability and stock prices (Allen et al., 1989; Baily et al., 1990). Productivity is not only important for the individual firm, but is also essential from a societal perspective since it is considered to be the main driver explaining the wide dispersion of GDP per capita across the world.

In a study by Lichtenberg and Siegel (1990), they find that firms subject to leveraged buyouts experience significant increases in productivity after the buyout. The study is conducted by following changes in employment at manufacturing plants of 131 buyout firms, primarily management buyouts, between 1981 and 1986. The results show that there is a positive and significant effect on productivity during the first three years post the buyout event. However, results for year four and five after the buyout event show an insignificant or even negative effect on productivity. Lichtenberg and Siegel argue that it is possible that LBOs only have a transitory positive impact on productivity, which would decrease over time and maybe even, become negative after three years. They claim that the short-term improvement could be a result of reallocating resources from producing long-term intangible investments such as research and development to current output, which would subsequently decrease some years later. Another potential explanation is that following an MBO and organizational changes, a shock-therapy is created leading initially to temporary efficiency improvements that decline when manager and workers become accustomed to the new structure.

This transitory effect is also supported by Amess (2003), who studies productivity effects on UK manufacturing firms of MBOs. The results based on data for the years 1986 to 1997, indicates that firms subject to MBOs exhibit productivity increases of 7, 7.5, 4 and 7 percent in each of the first four years post buyout. However, these firms do not exhibit any superior productivity increases beyond the fifth year after the buyout. Amess argues that these results are consistent with MBOs creating management incentives that improve firm level performance.

Harris et al. (2005) study the TFP of manufacturing establishments in the UK before and after MBOs occurred between the years 1994 to 1998. They find that these plants experience a substantial increase in TFP after a buyout. This increase appears to be driven by initiates undertaken by new owners, such as reducing labor intensity of production by outsourcing of intermediate goods and materials. The authors argue that these pervasive findings across industries imply that MBOs enhance economic efficiency and reduce agency costs.

Davis et al. (2013) study the manufacturing sector at plant level and find that target companies closed plants with low productivity and opened new plants with higher productivity more aggressively than the control group. They find that target firms outperformed control firms in terms of productivity growth two years post buyout, not only driven by the restructuring to more efficient plants but also due to more efficient job reallocation. From previous studies, Davis et al. (2013) conclude four sets of insights regarding private equity and productivity. Firstly, sometimes private equity companies create few or no productivity gains as they fail to achieve their goals for target firms (see for example case studies by Jensen et al., 1990; Wruck, 1991). Secondly, as pointed out by Kaplan (1989b) tax savings can be an important source of value creation in LBOs as they can be of substantial amount. If tax savings were the primary motive for buyouts, there would be no compelling reason to expect productivity gains in target companies. Thirdly, many case studies show that substantial productivity improvements in target companies relate to improvements in existing operations (see for example Baker and Wruck, 1989; Luehrman, 2007). For instance, in the private equity firm Clayton, Dubilier and Rice's buyout of Hertz, they addressed operational inefficiencies by lowering overhead costs. This was done by reducing non-capital investments to industry standard levels, reducing expenses caused by inefficient labor and aligning management incentives with the private equity firm. In a successful implementation of a strategy like this, profitability increases and value creation is closely linked to productivity gains. Finally, in some cases, target companies have improved efficiency through divesting units instead of enhancing existing operations (see for example Baker, 1992; Luehrman, 1992). Increased profitability and value creation are also likely to involve productivity gains in these cases, however mainly through productivity-enhancing reallocation rather than operational improvements within continuing units.

2.2. Related Studies about Productivity

Solow (1957) first published his seminal paper about productivity in 1957. Productivity and how to measure it has since been subject of extensive research, both theoretically and empirically. There are several theories on how to measure productivity and one of the best-known measures is labor productivity, defined as output per unit of labor input (Lichtenberg and Siegel, 1990). However, LP does not consider the contribution of some other non-labor inputs to output such as capital and intermediate goods. Another common measure of productivity that considers the non-labor inputs capital and intermediate goods is total factor productivity.

In Syverson's (2004) study of US manufacturing plants, he finds a wide spread in productivity between these plants. The 90th percentile plant of the productivity distribution is almost twice as productive as the 10th percentile plant. This raises the question why productivity levels are so different across firms and businesses, and what is driving these differences? Syverson (2011) highlights several internal and external factors affecting firm productivity. Management and its practices, firm structure and decision making processes, information technology (henceforth IT) and research and development (henceforth R&D), and product innovation are considered to be some of the factors explanatory for differences in firm productivity. Furthermore, he argues that just the act of operating increases experience, allowing producers to identify possible process improvements, in other words learning-by-doing. A key factor further elaborated and discussed in Syverson's paper is the importance of management and its practices. Much of existing previous research suggests that management can affect productivity (see for example Lazear, 2000; Hamilton et al., 2003; Bandiera et al., 2007). Managers are responsible for coordinating inputs to the firm such as labor, capital and intermediate inputs. Naturally, a well-managed company can lead to increased productivity whereas the opposite can lead to decreased productivity.

A related study by Bushnell and Wolfram (2009) finds that the thermal efficiency of power plants is affected by its plant operators. They find that the best operators increase their plant's fuel efficiency with more than 3 percent, savings worth millions of dollars per year. However, the data is less clear about what specific actions and characteristics that comprise a good plant manager. Management practices and productivity are examined by Bloom and Van Reenen (2007) in a comprehensive study, by surveying and scoring managers from over 700 midsize firms in the UK, France, Germany and the US. Bloom and Van Reenen find that high-quality management practices (denoted with high scores) are correlated with different measures of firm performance and productivity. The correlation between the scores and productivity measured as TFP is statistically strong and significant.

Management and its practices are not measured as an input in most production functions, but are captured in the output measure and thus reflected in the productivity measure. Similarly, commonly measured inputs such as labor and capital can have quality differences affecting productivity that is not captured by standard input measures. There is a vast field of research on human capital and what factors affect the quality of labor such as education, training and overall experience. A smaller set has studied the effect of labor quality on productivity, but existing research unsurprisingly suggests that higher labor quality increases firm productivity (Ilmakunnas et al., 2004; Abowd et al., 2005).

2.3. Related Studies about Private Equity

Much of the previous research within private equity has been devoted to the ownership structure and its economic effects on the target companies; see for example Shleifer and Summers (1988), Kaplan (1989a) and Smith (1990). Jensen (1989) argues that private equity ownership in combination with a highly leveraged capital structure is superior to the typical public company that usually comprise many shareholders, low leverage and weak corporate governance. Bergström et al. (2007) also argues that private equity firms as owners differ on several factors from others, which affect value generation. An example of such a factor is private equity firms' holding period for the target investment. The holding period is considered long enough to implement restructuring measures and short enough for management to still have the energy to implement them. Other factors include attractive compensation packages for management, used in order to align incentives between management and shareholders (Bergström et al., 2007) and active governance from private equity firms, which can facilitate strategic and operational improvements (Berg and Gottschalg, 2003).

There is a general consensus of improved operating performance for target companies after an LBO transaction irrespective of methodology used, variables measured and time periods studied (Cumming et al., 2007). Kaplan (1989a) studies 48 large management buyouts completed between 1980 and 1986 in the US. His results show an unchanged operating income during the first two post-buyout years and 24 percent higher in the third year. Further, he argues that since the change in operating income does not control for post-buyout divestures, the true change may be underestimated. Other studies focused on buyouts in Europe also find that LBOs are associated with larger operating improvements than comparable peers (see for example Harris et al., 2005; Bergström et al., 2007; Boucly et al., 2008).

In contrast to these findings, a number of studies show that private equity ownership does not improve operating performance. Guo et al. (2011) find in their study of US buyouts completed between 1990 and 2006 that increased operating performances are either comparable to or slightly above the benchmark. These results are also supported by studies in the UK that similarly find small or insignificant improvements for public-to-private deals (Weir et al., 2007; Acharya et al., 2008).

In order to achieve operational improvements, many private equity firms examine how to increase employee efficiency. It is much debated whether private equity ownership leads to creation of new jobs or increased unemployment (Hodkinson, 2013; Weber, 2014). From a sample of 48 US LBOs during the 1980s, Kaplan (1989a) finds that employment decreases on an industry-adjusted basis from the year prior to the buyout to the year after, by a median of 12 percent. Lichtenberg and Siegel's (1990) results show a smaller decline of 1.2 percent per year in employment for target companies after the buyout event. Modest employment declines are also found in a study conducted in the UK by Amess and Wright (2007) as well as in a study tracking 26 reverse LBOs between 1983 and 1987 by Muscarella and Vetsuypens (1990).

Another common operational measure initiated by private equity firms is to replace management in order to improve performance (Berg and Gottschalg, 2003). Heel and Kehoe (2005) find in their study that in 83 percent of the top third of deals with respect to operational performance, the management team is changed or strengthened, whereas the figure for the worst performing third was only 33 percent. In a majority of the buyout deals, the private equity firm will initiate organizational restructuring in target firms in order to improve operational efficiency and enable better use of the firm's resources (Muscarella and Vetsuypens, 1990; Wright et al., 2001).

Private equity firms are also considered to reduce their targets' capital spending after the buyout. In a study by Jensen (1986), he presents a free cash flow theory arguing that buyout targets prior private equity ownership exhibited inefficient allocation of capital and were investing in projects with negative net present value. For those firms, Jensen hypothesizes that it would be beneficial to reduce investment levels in order to boost firm valuation. Jensen's hypothesis is confirmed by studies conducted by Kaplan (1989a) and Smith (1990). Kaplan finds that the capital expenditures are 20 percent lower in LBOs than non-LBO companies. Furthermore, in Baker and Wruck's (1989) buyout case study of a US lawn care producer, they show that capital spending that is funded by debt regulated by debt covenants, forces management to invest efficiently. A large debt burden and compensation based on cash measures give management the incentive to operate the firm in a cash generating way and thus be more cautious with capital expenditure.

As previously mentioned, many case studies show that productivity improvements are related to operational improvements. There are numerous actions that can be taken of which some have already been mentioned above. In a report about the private equity industry, Boston Consulting Group identifies and categorizes several operational value creation initiates into four broad areas; financial structure, bottom line (i.e. cost efficiency), top line growth of core business and top line growth through expansion (Boston Consulting Group, 2012). Generally, firms use a mix of initiatives depending on industry and what in-house capabilities are available. However, due to lack of time and energy, private equity firms tend to have more focus on either top-line or bottom-line initiatives. One can imagine that private equity firms have different strategies on how to improve operations depending on each investment case and industry. For instance, when acquiring a target in the retail industry, many buyouts have adopted an expansion strategy by opening additional stores, expanding the product offering and entering new markets (see for example Wruck, 1991). Whereas in some documented cases in the manufacturing and producing sector, private equity firms have focused on increasing margins through for instance allocating resources more efficiently, cost-cutting and divesting non-core businesses (see for example Baker and Wruck, 1989; Baker, 1992; Luehrman, 1992).

3. Delimitation and Hypothesis

There are several previous studies that analyze target performance post LBO transaction, but the majority of these studies focus on operating performance. In our study we have chosen to analyze the effect of private equity ownership on productivity of buyout companies. Studying productivity is important, as it is the main explanatory factor for GDP per capita differences between countries. Further, from a firm perspective, productivity is considered to be the fundamental variable driving profitability and stock prices (Allen et al., 1989; Baily et al., 1990).

To our knowledge, only four studies, presented above in the Previous Research section, have explicitly studied the effect of buyouts on productivity. Out of these four, three mainly examine management buyouts, which may be of limited comparability to private equity firms, and use datasets from the 1980's to the 1990's. Additionally, two of them focus on the US market, of which Davis et al. (2013) is the most recent study, and two focus on the UK market. Finally, results are somewhat equivocal; even though all four studies find abnormal growth in productivity, two of them find that the abnormal effect may be transitory or even temporary. All of the above motivate the need for an up to date, private equity focused study with a European context. With the previous studies and their insights serving as a foundation, we want to empirically examine the effect of private equity ownership on productivity of buyout target firms and our hypothesis can be formulated as:

> *After a buyout, private equity firms will initiate operational improvement measures that will lead to abnormal productivity growth in buyout target companies during the investment holding period.*

Our main hypothesis is supported by previous studies concluding that private equity owned target companies outperform the counterfactual, proxied by peer groups, in terms of operational performance. This is mainly driven by operational improvement actions initiated by the private equity firms. Such actions include for example increasing employee efficiency, strengthen or change the management team, introduce attractive management compensation program to align incentives with the private equity firms and improve allocation of resources.

In addition to our main hypothesis we aim to investigate, although not test statistically, whether or not the potential abnormal productivity growth is due to a positively altered growth path, a transitory effect, a temporary effect or a combination of these. Similarly, we intend to detangle, but not confirm statistically, the constituents of the productivity growth. In other words, what in the functional relationship between the output and inputs are changing and what could be the underlying reason for this?

Further, we have chosen to delimit our study to Swedish buyouts for two reasons. The first reason is due to the strong presence of private equity firms in Sweden during the last two decades, which has resulted in a number of mature international private equity firms that invest worldwide. Today, private equity backed firms represent 8.4 percent of Sweden's GDP (SVCA, 2012). This creates a solid foundation for our analysis. The second reason is related to the measurement of productivity and the amount and quality of data it requires. We argue that we significantly benefit from the conformity of and wide disclosure requirements on accounting data in Sweden. All Swedish companies, private or public, are obliged to deliver financial statements to Swedish Companies Registrations Office (Swedish: *Bolagsverket*) according to Swedish law. These financial accounts are then made public. Thus, unlike many previous empirical studies primarily made in the US, our data is not limited to public companies and includes buyouts exited through trade sales, initial public offerings and bankruptcies.

4. Method

4.1. Research Design

In order to test our hypothesis presented in Section 3, we use a data-driven event study approach. An alternative approach would be to conduct one or several case studies of selected investments, in collaboration with a private equity firm that potentially could provide private data and information on a more detailed level. Since we seek to confirm a potential difference in productivity development statistically, we believe that the data driven event study approach is a better alternative. This is also in line with the approach used by previous studies related to our field such as Kaplan (1989a), Lichtenberg and Siegel (1990), Bergström et al. (2007) and Davis et al. (2013).

The event study was first presented by Dolley (1933) and has since been broadly and frequently applied by scientists across a wide range of research fields. In an event study, we start by defining the event and the event window, the period over which the event stretches. Once having decided which observations to include based on certain selection criteria, we retrieve the variables needed in order to test the hypothesis. Subsequently, the total abnormal growth and the abnormal compounded annual abnormal growth rate (henceforth abnormal CAGR) of the variable(s) during the event window is (are) calculated. The abnormal total growth and abnormal CAGR are defined as the actuals changes less the expected changes had the event not happened, the counterfactual. Finally, the statistical model(s) for studying the impact of the event is (are) determined. A correctly performed event study mitigates the endogeneity problem, or omitted variable bias, because nothing other than the event gives rise to the potential abnormal growth in the measured variable(s).

In our study, the event is defined as the private equity buyout and the event window is represented by the investment holding period, with some adjustments elaborated upon below. More specifically, the holding period starts at the buyout announcement date and ends at the exit announcement date. Alternatives to using the buyout announcement date as the initiation of the event window could be to use the actual date of the ownership change, the closing date, or the year prior to the acquisition, as advocated by Bergström et al. (2007). We use announcement dates rather than closing dates because announcement dates are almost always available, while actual closing dates seldom are publicly available. Using the year prior to the transaction is problematic for a number of reasons. Firstly, noise in the variables could be created as a result of the transaction because fixed assets may be restated and revalued, and goodwill will be recorded as part of the purchase price allocation procedure. Secondly, if the acquisition is a carve-out or the acquisition is in fact a number of simultaneous acquisitions to be combined in one group, it is difficult to match historical data with the financials of the newly created group. The end of the event window is defined as the year prior to the actual divestment year. The alternative would be to use the actual divestment year, but this would cause a number of complications. During the divestment year, the target company changes ownership, which means that the assets and goodwill are revalued again. Also, the new owner may change the date of the fiscal year end making the divestment year financials incomparable to previous years. Additionally, if only a few months of the fiscal year remain, the new owner may close the books with only consolidating the balance sheet. Furthermore, the divested company may be incorporated into a larger group that consolidates the accounts at a higher legal entity together with its other subsidiaries. Another issue related to using the actual divestment year is that targets divested in 2013 would be dropped from the sample because financial statements for fiscal year 2013 are not yet available. On the other hand, we realize that there is a risk of not capturing the full effects of the operational adjustments initiated by the private equity firm. Still, we argue that the risk of not capturing the full effects of the operational adjustments overweigh the potential noise caused and the loss of observations by using the actual divestment year.

As previously mentioned, we will measure and test productivity on a total abnormal growth and abnormal CAGR basis. A convincing case could be made for the use of either method and ultimately it boils down to whether or not you believe the effect of private equity firms on the targets' productivity to be transitory or in fact alters the productivity growth path. Productivity differs from most operational metrics, except perhaps from revenue growth, in the sense that it can be on a constant growth path that depends on factors such as technologies and labor skills. Given that no major structural change occurs altering the operating landscape, operational metrics such as earnings margins cannot grow infinitely, but will sooner or later reach some equilibrium level. Productivity on the other hand, should grow even by the mere existence of a company because of learning-by-doing and accumulation of skills (Syverson, 2011). Furthermore, as shown by Bloom and Van Reenen (2007), productivity growth increases with proper managerial practice. Additionally, previous research finds that altering the recurring investments in IT and R&D affects the productivity growth rate. No matter if the private equity firm decides to increase or decrease investments in IT and R&D spending, the decision should alter the productivity growth path. On the other hand, if one believes that private equity firms' effect on target productivity is merely transitory and that this transition may take different time on a case-by-case basis, total growth may better measure the effect on productivity. The potential existence of a transitory effect of buyouts on productivity is supported by the findings of Lichtenberg and Siegel (1990) and Amess (2003). It is likely that the private equity firm identifies a few potential 'quick fixes' in terms of efficiency in areas where the target firm deviates from best practices, which ought to show up as transitory effects on productivity, but at the same time initiate more long term initiatives intended to drive long term efficiency and productivity growth. We thus realize that in reality, the effect is likely to be a combination of a transitory effect and a changed growth path, why we believe that both total growth and CAGR measures are relevant to be tested statistically. We aim to illustrate the productivity development over time graphically, to understand how the two effects are combined.

4.2. Measuring Productivity

4.2.1. Introduction to Productivity Measures

As mentioned in the Introduction, there are several theories on how to measure productivity and it is typically expressed as an output to input ratio (Katayama et al., 2009). The theories can simply put be divided into two categories, single factor measures or multifactor measures. Single factor productivity measures the effect on output of one particular input. The most common measure is labor productivity. LP is easy to measure, but it is simple and excludes other input factors that may affect productivity. Such other input factors are for instance capital and intermediate goods. Depending on the definition of output in the LP measure, intermediate goods can be captured indirectly by using value added, output less intermediate goods, but the measure does still not fully account for changes in intermediate goods as the denominator still lacks its inclusion. The most common multifactor measure intended to capture the effect on output using a combination of several inputs is total factor productivity (Syverson, 2011). For the purpose of our study, we choose to use these two established measures of productivity, LP and TFP, and we argue that both measures complement each other. TFP relies on a number of restrictive assumptions, elaborated upon below, and involves several measurement issues, practical as well as econometric. Due to the complexity of measuring TFP, we complement with LP that is a simpler measure but with fewer measurement issues. We argue that the use of both measures provides additional robustness to our results.

4.2.2. Measuring Labor Productivity

LP is simply defined as

$$LP_{it} = \frac{Real\ Sales_{it} - Real\ Materials_{it}}{No.of\ Full\ Time\ Employees_{it}} \tag{1}$$

where *i* denotes the specific firm, *t* denotes the current year, sales is represented by reported sales and materials are proxied using the sum of the income statement line items cost of goods sold (Swedish: *kostnad sålda varor*), tradables (Swedish*: handelsvaror*) and consumables (Swedish: *råvaror och förnödenheter*). Companies generally use one of these metrics depending on what industry they are active in. Real values of sales and materials are generated by deflating reported sales and materials with a matched price index in order to remove the effect of price increases that would otherwise disturb the productivity measure.

Ideally, we would want different indices for inputs and output, as it is likely that price movements have not been correlated. On the other hand, assuming that companies transfer price changes of inputs to output prices, an industry level index would be sufficient. We use price indices tracking industries to the extent possible, otherwise indices tracking specific goods to proxy for industry level prices, why we are able to match each industry with an appropriate index. The labor input variable is proxied by the average number of equivalent full-time employees (henceforth FTEs), which is a measure that is based on the number of hours worked during the year. Ideally, we would want the actual quantities of output and input materials, but such data is not public and very hard to receive from private equity firms. Also, the number of unit output and input measures may be appropriate for the manufacturing and construction sector, but less applicable in for example the service sector.

4.2.3. Measuring Total Factor Productivity

Estimating TFP is preferably done at the establishment level with data on unit input and output. TFP is obtained by calculating the residual in the functional relationship where output depends on the inputs a company employs and its productivity (Katayama et al., 2009). Due to limited data availability, we use financial statement data along with industry-level deflators to proxy for input and output quantities, described in detail below, which is a well-established approach in academia. The functional form for the production function is generally written in the form of a Cobb-Douglas function, which is the approach we apply in this study. An alternative would be a more flexible transcendental logarithmic production function that theoretically is more proper as it is less restrictive in its assumptions. However, it has been shown that the restrictions of the Cobb-Douglas function do not make much of a difference numerically (Arnold, 2005). For the purpose of this study, we assume a Cobb-Douglas function as illustrated below:

$$Y_{ijt} = A_{ijt} K_{ijt}^{\beta_k} L_{ijt}^{\beta_l} M_{ijt}^{\beta_m} \qquad (2)$$

where β_k, β_l and β_m = 1 would imply constant returns to scale, Y_{ijt} represents a measure of output such as physical output, sales or value added of firm *i*, in industry *j*, in period t, while K_{ijt}, L_{ijt}, and M_{ijt}, represent the usage of capital, labor and materials, respectively, and A_{ijt}, is the efficiency level, or TFP, as it increases all factors' marginal product simultaneously. We use real sales as a proxy for the output, Y_{ijt}. Using value added, real sales less real materials, instead of real sales, imposes a loss of generality as we would have to assume additive separability of material inputs implicitly included in the value added measure. We subsequently transform equation (2) by using natural logarithms to allow for linear estimation. Henceforth lower cases will be used for natural logarithms. The linear production function then looks as follows:

$$y_{ijt} = \beta_0 + \beta_k k_{ijt} + \beta_l l_{ijt} + \beta_m m_{ijt} + \varepsilon_{ijt} \tag{3}$$

and

$$\ln(A_{ijt}) = \beta_0 + \varepsilon_{ijt}$$

while β_0 measures the mean efficiency level across companies and over time, ε_{ijt} is the time and company specific deviation from the mean, which can be further decomposed in to one observable, or at least predictable, and one unobservable factor, resulting in the following equation,

$$y_{ijt} = \beta_0 + \beta_k k_{ijt} + \beta_l l_{ijt} + \beta_m m_{ijt} + w_{ijt} + u_{ijt}^q \tag{4}$$

where w_{ijt} represents firm-level TFP and u_{ijt}^q is an independent and identically distributed component, representing unexpected deviations from the mean due to external circumstances, unexpected delays or measurement errors. Researchers typically estimate (4) and solve for $\widehat{w}_{ijt}$. The estimated TFP is then calculated as follows:

$$\widehat{w}_{ijt} = y_{ijt} - \hat{\beta}_k k_{ijt} - \hat{\beta}_l l_{ijt} - \hat{\beta}_m m_{ijt} \tag{5}$$

and productivity in levels is calculated as the exponential of $\widehat{w}_{ijt}$:

$$\widehat{\Omega}_{ijt} = e^{\widehat{w}_{ijt}} \tag{6}$$

The estimation of the production function can be done by using non-parametric, semiparametric or parametric methods (Van Beveren, 2012). We will apply a semi-parametric model developed by Levinsohn and Petrin (2003), further described below. A number of econometric problems related to the estimation of the production function and TFP arise due to the endogeneity or simultaneity problem (Marschak and Andrews, 1944), the survivorship bias (Wedervang, 1965) and the fact that we use using industry-level indices to proxy for firm-level prices (Katayama et al., 2009). The endogeneity or simultaneity problem means that ahead of a potential TFP shock, part of the TFP, represented by $\widehat{\Omega}_{ijt}$ above, will be observed by the company at a point in time early enough so as to allow the firm to change the factor input decision. If so, then profit maximization of the firm means that the realization of the error term of the production function can be expected to impact the choice of factor inputs. This implies that the regressors and the error term are correlated, which causes biases in the OLS estimates (Arnold, 2005). The survivorship bias arises when the dataset contains missing values for firms that have dropped out of the sample. If the firms are selected in a non-random way, such as going bankrupt and hence stops producing, the sample could become biased.

Olley and Pakes (1996) present a semi-parametric estimation model that mitigates both the survivorship bias and the simultaneity problem. They present a model that solves the simultaneity problem by using the firm's investment decision, where investments need to be positive, to proxy for unobserved productivity shocks. The selection bias is mitigated by introducing a fitted value for the probability of exiting from the sample, an exit rule. Because the Olley and Pakes model requires a positive value of the investment variable there is a risk that a large portion of the observations will be dropped and thus disturb the production function estimation. Because of the broad range of industries in our study, where some are less capital intensive, many observations for the production function estimations will have to be dropped. Therefore, we will use another semi-parametric model developed by Levinsohn and Petrin (2003).

The Levinsohn and Petrin approach also corrects for the simultaneity problem, but by using positive materials as a proxy for unobserved TFP shocks instead of investments. This approach fits our study better, as it is often more likely that firms will have a positive use of materials rather than investments. For both methods, the concept of using positive investments or capital to proxy for unobserved TFP shocks and mitigate the simultaneity problem relies on three assumptions, of which the main assumption is called the monotonicity condition. The monotonicity condition implies that materials and investments must increase in TFP, $\widehat{\Omega}_{ijt}$. The fewer observations the estimation method must reject, the more probable is the monotonicity condition to hold. In this sense, the Levinsohn and Petrin method is thus likely a better method to use for the estimation. On the other hand, the Levinsohn and Petrin method does not solve the selection bias problem, as it does not have an exit rule. However, the efficiency gains of using the Olley and Pakes exit rule compared to using panel data that includes firms that have exited the market are very small, as is shown in the study by Olley and Pakes (1996).

In order to apply the Levinsohn and Petrin method to estimate firm-level TFP, we identify all industries in which the target firms operate. Each target company is connected to a four-digit industry classification according to the European system *Nomenclature Statistique des Activités Économiques dans la Communauté Européenne* (henceforth NACE code). The companies select their NACE code classification on their own and the information is publicly available. The NACE system is based on layers of industry granularity, with the first four digits being European-wide. We believe that the tradeoff of more observations versus more similar companies should be done on a per industry basis in order to generate a suitable estimation of the production function. Hence, for industries with many companies, we narrow down the peer group by using the five-digit NACE code. For industries with very few companies, we broaden the industry by using the three-digit NACE code instead. This judgment is based on qualitative factors as well as number of firms in each group. We use the NACE code of the major operating entity to ensure that we capture the NACE code of the core business. Holding entities do generally not have the same classification as the core business of the company.

Furthermore, we restrict the geographic area to Sweden, because this is the main market of all our target companies. This approach is also utilized by Bergström et al. (2007). The alternative would be to use a European wide scope. However, basing the production function estimation on a wide range of European firms with potentially different accounting standards and disclosure requirements would imply a risk of getting too much noise in the data. We argue that using Swedish data for the estimation will result in more accuracy in the production function estimation. Additionally, using European peers would incur a risk that companies are affected by local shocks and events in the business environment. Even though Europe is often seen as one market, the economic development and environment differs widely across countries, which has been highlighted during and post the sovereign debt crisis.

We use the selected industry codes to gather firm-level accounting data on output, capital, labor and materials for all firms in each identified NACE code during a time span of 10 years and estimate each industry production function with the Levinsohn and Petrin semi-parametric approach. Because firms of different sizes within the same industry may respond very differently to changes in inputs, we introduce a lower cut-off point in terms of sales. For instance, small firms with few employees will likely have a relatively larger direct effect on output of one additional employee than what the larger firms in that sector will have due to a potentially diminishing marginal return on labor. This would distort the production function estimation and overestimate the return on labor for the larger firms. Therefore, we set a lower cut-off point of SEK 10 million in sales as per the investment year of each target. We argue that this level will be sufficient to mitigate most of the production function estimation issues while keeping enough observations to satisfy the monotonicity condition. Before estimating the production functions, similarly as for LP, we deflate the accounting based measures of output, materials and capital by price indices that are individually matched to each industry.

4.2.4. Measurement Issues with TFP and LP

There are several measurement issues that may arise when measuring productivity with TFP and LP. The simultaneity problem and the survivorship bias have already been discussed above. One additional issue arises when using industry-level prices indices to proxy for firm-level prices, because firms generally have different bargaining positions depending on the competitiveness of its products. Firms with more competitive products have a better position to increase prices, and vice versa for firms with less competitive products. This is something we need to be extra wary of when it comes to studying private equity owned firms because it is likely that private equity firms may introduce new output pricing strategies or simply just raise the price where the market power is high enough as well as entering fierce negotiations with suppliers in order to obtain lower input prices. Increased price or lower input prices would then falsely show up as increased productivity. The only realistic way to fully mitigate this would be to use quantity data rather than monetary financial data. However, this is not applicable to our study given our broad perspective across firms and industries.

Another measurement issue arises from the procyclicality of TFP as a result of capital- and labor-utilization fluctuations. The phenomenon of falling measured TFP as a result of a low labor utilization is called the labor hoarding hypothesis and occurs when a firm employs more labor than the minimum level required to produce a given good or service (Sbordone, 1996; Aizcorbe, 1992). However, procyclicality issues should not be a problem given our research is designed as an event study. Targets as well as the peer groups should both be affected by these swings simultaneously, why no differences between them should emerge.

In addition to the above mentioned measurement difficulties, Baily and Zitzewitz (2001) conclude that measuring TFP correctly for the services sectors is more difficult than for the goods-producing sectors, manufacturing and construction. Furthermore, in a comprehensive review of the existing research of productivity within the services sector by Maroto-Sánchez (2012), he highlights numerous studies focused on (i) the slow productivity growth (see for example Baumol, 1967; Bhagwati, 1984; Summers and Heston, 1988; Sichel, 1997; Wilber, 2001 and Wilber, 2002) and (ii) the productivity measurement issues related to the services sector (see for example Berndt et al., 2001; Berndt and Griliches, 1993; Ahmad et al., 2003; Lebow and Rudd, 2003). We further discuss the matter of productivity mismeasurement within the services sector below and split the samples between goods-producing and services in order isolate potential measurement errors within the services sector companies.

4.3. Abnormal Productivity Metrics

Having determined the two productivity measures, we create the abnormal productivity growth metrics on which we apply statistical tests and infer conclusions regarding our hypothesis. The abnormal productivity growth metrics are defined as each target's productivity growth less the expected productivity growth had the event not happened, the counterfactual. The counterfactual is defined as the corresponding abnormal productivity measure for a matched group of peers, explained in detail in the next section. We construct the variables based on (i) total growth during the investment holding period and (ii) compound annual growth rate. The total growth abnormal productivity growth metric is constructed the following way:

$$AbnormalPMtg_i = TargetPMtg_i - E(TargetPMtg_i) \tag{1}$$

where

$$TargetPMtg_i = \frac{PM_i^{Exit}}{PM_i^{Entry}} \tag{2}$$

and expected target total growth productivity is proxied by

$$E(TargetPMtg_i) = PeerGroupPMtg_i = Average_i^a\left(\frac{PM_{ij}^{Exit}}{PM_{ij}^{Entry}}\right) \tag{3}$$

where *PM* represents the two productivity measures TFP and LP, *i* represents each sample observation, j represents each peer observation in the peer group and *a* represents the three different peer group averaging methods, mean, median and sales weighted mean.

The compound annual growth rate variable is constructed the following way:

$$AbnormalPMcagr_i = TargetPMcagr_i - E(TargetPMcagr_i) \tag{4}$$

where,

$$TargetPMcagr_i = \left(\frac{PM_i^{Exit}}{PM_i^{Entry}}\right)^{\frac{1}{Holding\ Period_i}} \tag{5}$$

and expected target total growth productivity is proxied by

$$E(TargetPMcagr_i) = PeerGroupPMcagr_i = Average_i^a \left(\frac{PM_{ij}^{Exit}}{PM_{ij}^{Entry}}\right)^{\frac{1}{Holding\ Period_i}} \tag{6}$$

where *PM*, i, j and a are defined as above and $Holding\ Period = Year_i^{Exit} - Year_i^{Entry}$.

4.4. Peer Group Creation

The TFP development of the identified targets are adjusted for the counterfactual TFP development by assigning each of the targets a peer group with similar characteristics in terms of business model, size and geography. We select the target peer groups from their respective NACE code (see industry discussion above) and include only Swedish companies. Regarding this geographic restriction, the same arguments used for the production function estimation are applied for the peer selection. We realize there is a risk that in some industries, the target companies will be far larger than their peers, but argue that the pros of using only Swedish peers, as discussed above, outweigh the risk of having peer groups with too small firms.

Before identifying and selecting the closest peers to the targets, we clean the data in a number of ways. Firms with zero employees during any year of the event window are removed, as these observations are either erroneous or stems from an unconsolidated holding company. Also, we trim the data including targets and all peers before selecting the closest peers by setting a lower and a higher threshold. In terms of TFP and LP, we set an upper limit of a 300 percent increase in TFP and LP, and we also remove companies whose TFP or LP fall by more than 99 percent. These thresholds correspond approximately to the upper and lower 1 percent of the peer universe. By trimming the data we aim to generate more accurate estimates of the population mean and median, as discussed by Stigler (1973) and Tukey and McLaughlin (1963). An alternative would be to Winsorize the data. Crow and Siddiqui (1967) argue that for samples that have misrepresented observations and where the extent of misrepresentations is unknown, a trimmed data set may be more appropriate than a Winsorised one. While we strive to remove the majority of potentially erroneous observations, we are careful not to perform excessive trimming and remove correctly represented observations.

Having filtered the data, we select the 20 closest peers in terms of sales at the buyout event. In some industries, the above mentioned filters may result in peer groups that include fewer than 20 peers. It can be argued whether or not selecting peers based on sales is the most proper approach. Barber and Lyon (1996) argue that performance-based matching of peers is beneficial, but also mention that past-performance based approaches in many cases result in similar explanatory power as size-based matching. We argue that using sales is a more reliable and tangible measure to use in our case than performance based measures and our approach is also supported by Bergström et al. (2007). Additionally, we manually go through the peer groups to remove other private equity owned firms, the target itself and subsidiaries to the target.

In order to generate matched observations from the peer groups to our target firm sample, we need to determine how to average each peer group. The methods at hand would be the arithmetic mean (henceforth the mean), the median or the sales (or potentially other proxies for size) weighted mean. To understand which approach is the most appropriate to use, we seek to analyze the data samples in a number of ways. Already, we can conclude that the trimming of our samples will partly mitigate the potential issue of extreme outliers that would otherwise bias the average and partially also the weighted mean. On the other hand, the range of a 300 percent increase and a 99 percent decrease in terms of the productivity measures must be considered as rather wide, why outliers may still be an issue. Another factor affecting the selection is the relative size of the target firms with respect to the firms in their respective peer group. As private equity firms generally buy one of the dominant firms within an industry, we expect that the targets generally are larger than most of its peers, i.e. that 10 larger peers do not always exist in the industry. This would be an argument to use the sales weighted mean. Then again, several industries may include major international companies that would be given a disproportionate weight if the sales weighted mean would be used. To fully understand which approach is the most appropriate, our samples must be analyzed. Hence, we will conduct statistical tests using all three of the above mentioned averaging approaches and in the analysis determine which method should be assigned most weight. Irrespective of our findings from the samples and relative weights assigned, including all three measures will provide transparency to the reader and robustness to our results.

The targets and their respective peer groups should be as similar as possible and thus react in similar ways to common time-varying shocks and events. Ideally, the only thing differing between the target and the peer group should be the target event. In reality, that is rarely possible other than in controlled experiments or some natural experiments. If the targets and their respective peer groups do not react the same way to shocks and events, then the true effects of the buyout event may be over- or understated and results from the statistical tests will be biased. Our approach with peer firms from the same NACE code, same geography and similar size should mitigate much of this potential issue. Furthermore, potential survivorship bias in the peer groups is mitigated by the fact that the peers in each group remains the same during the event window and thus naturally include the descent of potentially non-performing firms over time.

Another approach to selecting peers could be to limit the peer universe to listed companies only, as presented by Acharya et al. (2008). They argue that using listed firms increases data availability and enables users to control for firm-specific events such as acquisitions, differences in capitalization policies and financing differences. They also stress that public firms are more scrutinized and thus have to report financials in a more rigorous manner than most non-public firms. For the purpose of our study, we do not believe this approach would be suitable. As we have restricted the peer universe to Sweden, data availability is not really an issue. Additionally, we argue that the peer universe of Swedish listed firms would be too small to find proper peer groups for some of the targets. It should also be noted that our chosen approach already includes, but do not limit to, listed companies.

4.5. Industry Segmentation

The phenomenon of lower measured productivity levels and growth within the services sector compared to the manufacturing sector is well documented in previous research (see for example Baumol, 1967; Bhagwati, 1984; Summers and Heston, 1988; Sichel, 1997; Wilber, 2001 and Wilber, 2002). Several papers argue that this phenomenon is explained by mismeasurement issues related to the sector. Maroto-Sánchez (2012) categorizes these measurements issues into three components that relates to (i) the choice of inputs, (ii) the choice of output and (iii) the estimation of aggregate productivity growth, where the former two is of interest for our firm level study.

The first component related to inputs includes the relationship between labor input and intermediate goods and services input, which is particularly relevant for firms with a tendency to outsource. Measurement issues may arise indirectly through the input to output stream of goods and services. Consider for example the flow of goods through the value chain of distributive service companies such as wholesalers, retailers and other middlemen. The services the retailer provides to both producers and consumers is rarely explicitly charged, rather, the retailers get remuneration by introducing a spread between retail prices and wholesale costs (Oi, 1992). Another services sector exhibiting same potential mismeasurement issues is financial services, which is shown in studies by Fixler (1993) and Colwell and Davis (1992).

The second measurement component is associated with the choice of output. One of the main difficulties is related to the issues with isolating price effects that are caused by pure price changes from changes in the quality or mix of services, and furthermore, how to adjust for such quality changes in the price index (McGukin and Stiroh, 2001; Swick et al., 2006). Even though this problem should also exist within the manufacturing sector, it is considered to be a larger issue within the services sector.

Furthermore, as discussed by Baily and Zitzewitz (2001), the services sector is often neglected in cross sectional productivity comparisons, because there is a belief that output is likely to be mismeasured due to the reasons mentioned above. They argue that in addition to difficulties with measuring output correctly, it is also difficult to get reliable estimates of capital. Hence, many productivity studies have focused on labor productivity. The potential mismeasurement error should consequently have a larger effect on TFP due to its inclusion of capital inputs, but may also distort LP due to mismeasured output.

To conclude, the currently available measures of productivity may have limited applicability to the services sector due to the above-mentioned issues. In an attempt to clean the sample from these potential mismeasurements, we perform tests on goods-producing sectors (manufacturing and construction) and services sectors separately. While the main reason for the split up is to remove potential mismeasurements from the test, it may also offer interesting insights on potential differences in productivity development between the two sectors by looking at the LP measure, which ought to be less biased than TFP.

4.6. Model Specification

To test our hypothesis that private equity owned firms exhibit abnormal growth in productivity we apply parametric as well as non-parametric tests. We utilize the non-parametric Wilcoxon signed-rank test (henceforth the Wilcoxon test) along with the parametric Student's t-test (henceforth the t-test). As for the variables tested, we test TFP and LP on a total growth as well as CAGR basis, as specified in section 4.3.

To determine if one of the two tests is more suitable than the other, we will test the samples for normality, as the t-test assumes that the samples stem from normally distributed populations. If the samples are not normally distributed, results are likely to be biased. The Wilcoxon test is less restrictive in its assumptions as compared to parametric tests such as the t-test and regression analysis. The Wilcoxon test requires no assumptions regarding the sample distribution, but generates slightly weaker statistics than the t-test. Additionally, as Barber and Lyon (1996) conclude, the Wilcoxon test is superior to the t-test in the presence of extreme values.

The t-test requires the assumptions that the data is continuous, the population is normally distributed, the variances of the populations are equal and the samples have been randomly picked from the populations. While we can conclude that the data is continuous, we do not know whether the samples originate from normally distributed populations. Hence, we perform normality tests with the Shapiro-Wilk test that utilizes the null hypothesis principle to test whether a sample come from a normally distributed population. In a study by Razali and Wah (2011) they conclude that the Shapiro-Wilk test has the best power for a given significance, when comparing the Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests.

After the test, we determine the relative importance of the t-test compared to the Wilcoxon test. Ideally, both tests render the same conclusion and we can reject the null hypothesis on a robust basis. Both the t-test and the non-parametric Wilcoxon test are widely used by academics in adjacent fields (see for example Kaplan 1989a; Dann et al., 1991; Barber and Lyon, 1996; Bergström et al., 2007). Furthermore, we do not consider regression analysis appropriate with the data due to the significant assumptions required on for example variable linearity, sample distribution and uncorrelated errors. Also, a difference-in-difference regression that tests the difference between the targets and the counterfactual on a yearly basis would not be appropriate for this kind of study, because the initiatives of private equity firms generally take a few years to implement and may show up in the numbers a few years after the acquisition and in different years.

The Wilcoxon test is performed by ranking observations with respect to the absolute value of pair-wise differences in performance that returns a vector of differences ordered by magnitude. Subsequently, the ranks corresponding to the positive and negative pairwise differences, respectively, are summed. The smallest value of these sums is denoted as the Wilcoxon test statistic (henceforth T). When the number of pairs exceeds 20, T is approximately normally distributed (Carlson et al., 2007). Hence, the decision rule to reject the null hypothesis is:

$$-z_{critical} > Z > z_{critical} \tag{9}$$

where,

$$Z=\frac{T-\mu_T}{\sigma_T} \text{ and where, } \mu_T=\frac{N(N+1)}{4} \text{ and, } \sigma_T=\sqrt{\frac{N(N+1)(2N+1)}{24}} \tag{10}$$

and, N is equal to the number of non-zero pair-wise differences.

5. Data

A majority of previous empirical studies have used US datasets, which impose potential sample biases. In the US, disclosure of accounting data for private public companies is voluntary and therefore seldom done. Thus, many US datasets are based on buyouts that have exited through IPOs. Furthermore, there is a potential bias when selecting peer groups that are all public companies. Our dataset overcomes these issues as it includes both private and public companies. Under Swedish law, both private and public companies must provide annual accounts to Swedish Companies Registrations Office (Swedish: *Bolagsverket*) that are made public.

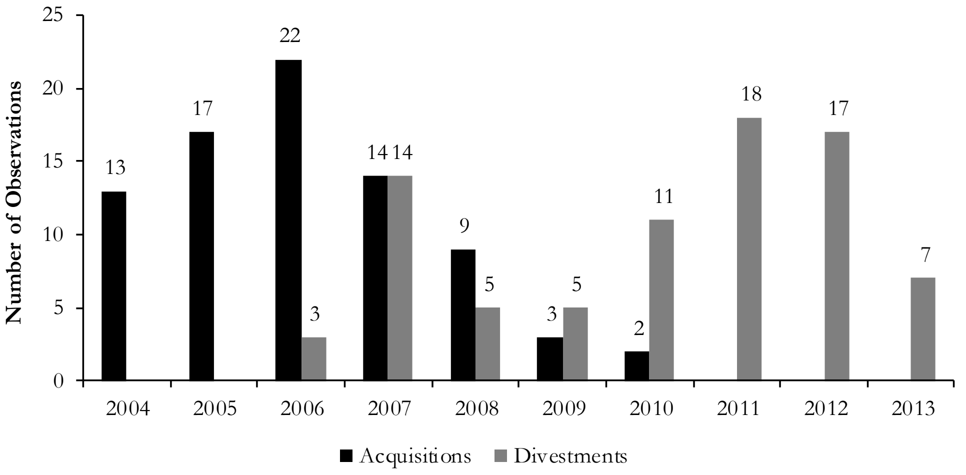
We are granted access to the dataset used in a previous study by Drewsen and Moss (2013), containing data of 199 Scandinavian majority control investments and their operational metrics for the time period 1994 to 2012. The dataset used by Drewsen and Moss is based on a dataset originally compiled by Gulliksen et al. (2008) that was further complemented by Adler and Norberg (2012). Gulliksen et al. gather information about the transactions by identifying private equity firms through membership lists with Scandinavian trade associations, and corresponding investments are then identified from the private equity firms' websites, complemented by third-party sources such as the mergers and acquisition database Mergermarket, to avoid selection bias arising from voluntary reporting. Adler and Norberg (2012) add transactions between 2008 and 2010 to the dataset and exclude existing venture capital and minority investments. Drewsen and Moss (2013) are granted access to this dataset that includes 218 Scandinavian buyouts. They thoroughly review and examine each individual transaction of this dataset as well as complement it with overlooked transactions and add transactions divested in 2011 and 2012. They add 86 transactions and deduct 105 transactions, resulting in a final dataset of 199 transactions. The additions are mainly the result of the extended sample period. Deductions derive from transactions in the dataset that could not be verified in any way and transactions that exhibited low quality financial data and new data could not be retrieved.

For the purpose of our study and as defined in the Method section, we use only the data of Swedish buyouts and in particular the data related to the transactions. Unfortunately, there is limited overlap of the financial statement data used in the study by Drewsen and Moss (2013) and the data needed for our study. We are therefore required to gather new financial statement data for each transaction, as well as data on every industry peer. The available databases with the kind of detailed data necessary for our study only provide data for the last ten years. Hence, we only use the transactions from 2004 and onwards from Drewsen and Moss' (2013) dataset, in total 57 transactions. We thoroughly go through and confirm each of the remaining transactions. We also conduct a separate review of transactions involving private equity firms since the year of

2004 from Mergermarket along with manual searches on private equity firms' webpages. We only consider companies that have undergone a full holding period after 2004. By including only exited investments and excluding current holdings we ensure that the private equity firms have completed their respective strategies for their target companies. Additionally, we include buyout companies that went bankrupt during the holding period in our sample to avoid potential survivorship bias. In total we add another 36 transactions to the selected transactions obtained from Drewsen and Moss' (2013) dataset and deduct 13 from the gross list of 93 transactions. The transactions that we add are mainly due to transactions that seem to have been overlooked or actively excluded for some reason, but also because we add transactions from the end of 2013. Because our study requires other financial data than the study of Drewsen and Moss, we are forced to exclude some of the transactions that lack the data we require. There is a possibility that all deals are not covered by the database Mergermarket and the obtained data set, but there is no reason to believe that there is any systematic exclusion. We end up with 80 unique LBO transactions with a Swedish target that was acquired and divested by a private equity firm between 2004 and 2013. Ideally, the time period should be long enough to include investment entries and exits in different phases of the business cycle. However, as mentioned above, data availability restricts our time period to ten years.

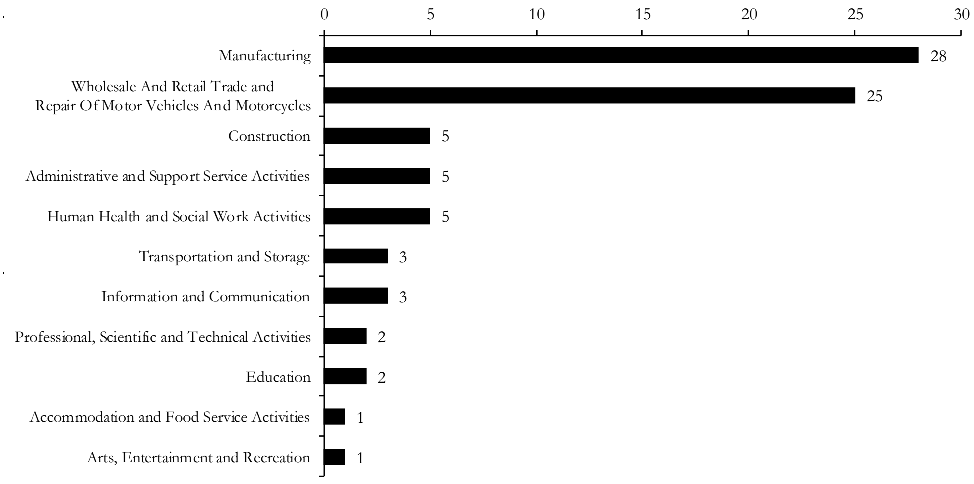
Exhibit 1. illustrates the distributions of acquisitions and divestments during the time span. We see that a majority (63) of the investments was done before the financial crisis and fairly few (17) were exited before the crisis hit. This is a potential source of biases, as some of the companies acquired before the crisis and exited after, have struggled amid slowing demand and high debt burdens. This should partially be mitigated by the fact that we conduct an event study, implying that external factors such as the financial crisis affect the target companies and the selected peers simultaneously. The potentially higher debt burden in private equity owned firms should on the other hand make them more vulnerable to downturns and potential financial distress may have spillover effects on the operations of the firm. Furthermore, we see that the majority of the investments are made within the manufacturing and the wholesale and retail industry, as can be seen in Exhibit 2. These industries are very broad compared to many of the other industries, why this distribution is not unexpected. The holding period distribution, which includes the entry year, is presented in Exhibit 3. We note that almost 50 percent of the observations have a holding period of up to three years, including entry year, and that the average holding period is four years.

EXHIBIT 1. ACQUISITION AND DIVESTMENT YEARS



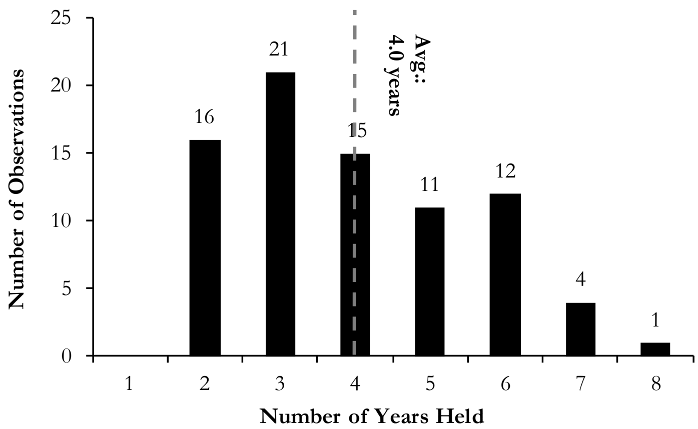
Notes: Illustrates the sample distribution of acquisitions and divestments during the studied time span.

EXHIBIT 2. INDUSTRY DISTRIBUTION OF TARGETS



Notes: The above figure presents the target company industry distribution.

EXHIBIT 3. HOLDING PERIODS



Notes: The figure shows the distribution of holding periods in years, including the acquisition year.

The kind of data necessary for our study differs significantly from that of Gulliksen et al. (2008), Adler and Norberg (2012) and Drewsen and Moss (2013). The procedure and data amounts necessary for obtaining firm-level TFP and LP are extensive. For each target, we collect *all* Swedish firms registered in each industry NACE code, in total 67 industry NACE codes (differs from 80 due to NACE code overlap across targets). We do this for a time span of ten years and include the variables presented in Exhibit 4. Before estimating production functions for each industry, we identify and obtain indices for each NACE code to be able to convert nominal values to real values for all firms in all NACE codes during the ten-year period. After excluding firms with sales below SEK 10 million for each NACE code at the acquisition year, we estimate the production functions and predict firm level TFP according to the Levinsohn and Petrin model as well as LP.

All financial statement data is gathered from the Swedish database Retriever; a database containing detailed firm level financial statement data. Because operators manually enter the figures into the database, we manually enter and crosscheck the data for each of the target companies from the actual annual reports that are available for download from Retriever. When companies have a different fiscal year end than December, Retriever matches the annual account to the calendar year during which a majority of the operations were carried out. This matching gives a maximum lag of six months. Because of this short maximum lag, we argue that that the problem with distorted data that arises from non-calendarized data has a small impact on estimating productivity and can therefore be disregarded.

For each target company there is a corresponding four-digit industry NACE code that is also collected from Retriever. The industry codes are used to gather firm level data across the target industries from Retriever and estimate the corresponding industry production function. We include companies that are bankrupt and in a liquidation process in order to mitigate the selection bias problem (Van Beveren, 2012). Data for companies that have been fully liquidated and thus unregistered from the Swedish Companies Registrations Office is not available to collect. Our data should thus mitigate some of the survivorship bias problem. Descriptive statistics for the target and peer group variables can be found in the Appendix in Exhibit 23.

As mentioned above, the monetary variables obtained from financial statements are deflated using industry-level indices. We collect these industry-level indices mainly from Statistics Sweden, where we use constituents of the Consumer Price Index ("CPI"), the Producer Price Index ("PPI"), the Service Price Index ("SPI") and the Construction Index ("CI") (Swedish: *Entreprenadindex*). Exhibit 4. summarizes the definition of the input variables and the corresponding sources for financial data and indices. A detailed specification on what explicit index has been used for each NACE code can be found in Appendix in Exhibit 24., together with transaction information, NACE code and industry definition.

EXHIBIT 4. DEFINITIONS OF VARIABLES

Variable	Variable Name	Definition	Sources: Accounting Data	Sources: Price Indices*
Y	Real output	Deflated net sales (SEK x1,000)	Retriever	Statistics Sweden
L	Employment	Number of employees (full-time equivalent employees)	Retriever	Statistics Sweden
M	Real materials	Deflated materials consumables and traded goods (SEK x1,000)	Retriever	Statistics Sweden
K	Real capital	Deflated total material fixed assets (SEK x1,000)	Retriever	Statistics Sweden

* Except for the index related to the industry NACE code 8531, Secondary Education, where the nationwide price list of yearly contributions (Swedish: *Riksprislistan*) per pupil distributed by the State to private schools is used as a proxy for price developments.

As our data consists of financial statements data, there is some underlying noise in the data. Under Swedish GAAP, companies have the freedom to choose either a functional or a cost based form of the income statement. The functional form generally distributes the materials constituents to the respective function within the firm and is therefore not captured in our measure of materials. We do not know the extent of this caveat, but at least it is reasonable to assume that companies do not change accounting method over time very often, why consistency should prevail and thus cause less noise. Another source of potential noise in our capital input variable is the fact that companies can choose to either lease or invest in fixed material assets, where the latter always requires balance sheet capitalizing. If companies lease the asset, it can either be an operating lease or a financial lease. Companies using the operating lease method will not book the asset to the balance sheet, while the financial lease method requires that the assets are booked to the balance sheet. This discrepancy means that our measure of capital will fail to recognize the capital input from operating leases.

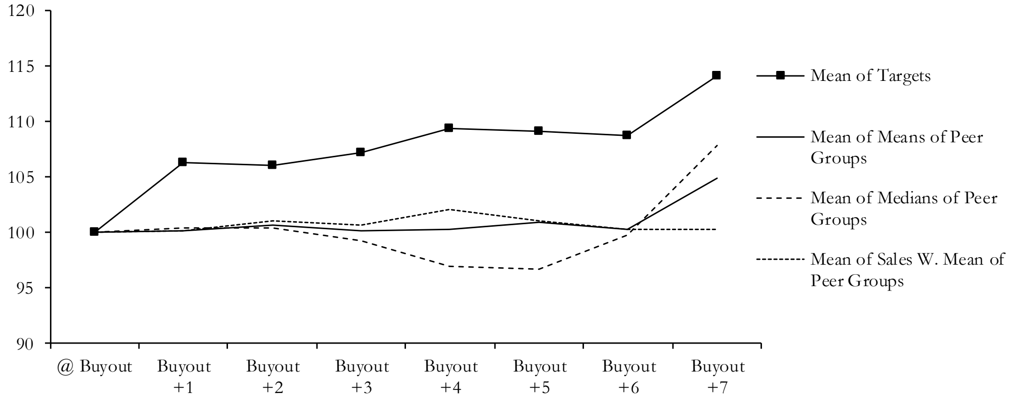
6. Results and Analysis

6.1. Results

6.1.1. Graphical Presentation of Full Sample Results

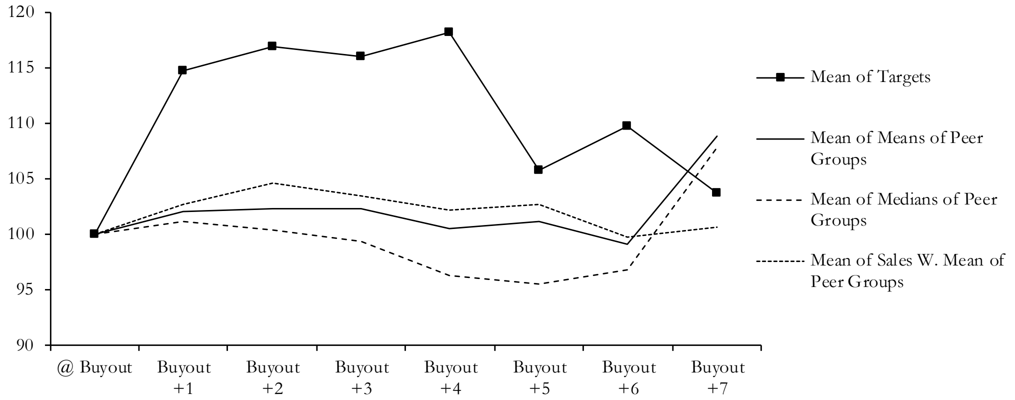
Before presenting the statistical results of our tests, we illustrate the preliminary results graphically in order to provide additional depth to the tests. Exhibit 5. and 6. illustrate the normalized mean development of the target firms' and the peer groups' TFP and LP development, respectively, post the buyout event. Note that the number of observations fall each year depending on the length of the holding period.

EXHIBIT 5. NORMALIZED MEAN TFP DEVELOPMENT



No. of Obs.	**80**	**80**	**79**	**61**	**39**	**26**	**13**	**3**
Std. Dev. Targets	**–**	**22**	**27**	**33**	**32**	**38**	**22**	**17**
Std. Dev. Peer Groups*	**–**	**5**	**7**	**10**	**8**	**7**	**9**	**10**

EXHIBIT 6. NORMALIZED MEAN LP DEVELOPMENT



No. of Obs.	**80**	**80**	**79**	**61**	**39**	**26**	**13**	**3**
Std. Dev. Targets	**–**	**41**	**52**	**55**	**58**	**48**	**53**	**16**
Std. Dev. Peer Groups*	**–**	**9**	**13**	**15**	**10**	**10**	**11**	**11**

Notes: Exhibits 5. and 6. represent the normalized mean development of the target firms' and the peer groups' TFP and LP development, respectively, post the buyout event. Three different averaging methods for the peer groups are included. Below each chart, the number paired observations are displayed. Additionally, standard deviations of each sample each year are presented below the chart.

* Refers to the mean of means of peer groups.

Exhibit 5. indicates that targets perform better than the peer groups irrespective of holding period. Note however that, the dispersion across target TFP observations is large, with standard deviations ranging from 17 to 38 index points. Exhibit 6. presents a picture of targets strongly outperforming the peer groups in terms of LP. However, the target standard deviations for LP are even larger than those of TFP. Furthermore, we note that the effect on both productivity measures seem to be transitory. Both measures leap during the first year and exhibit lower or oven negative development in subsequent years. Referring back to our discussion in the Method section, this indicates that relatively more weight should be assigned to the tests based on total growth rather than those on CAGR. CAGR based variables may unfairly dilute this transitory effect on productivity.

6.1.2. Full Sample Test Results

As outlined in the Method section, the main results include test results for the Wilcoxon test and the t-test applied on variables based on total growth and CAGR as well as the three different averaging methods of the peer groups. After presenting the results, we determine the relative weights to be assigned to the tests and averaging methods, and then interpret the results. Variable values presented for the Wilcoxon test constitute the median of all observations, while the corresponding for the t-test constitute the averages, due to the nature of the tests. The variables that present the target and peer group values individually are only included to provide further depth to the analysis. The variables indicating the abnormal growth are the only variables that can lead us to any conclusion about our hypothesis. Because we already from the graphical illustration of our results find indications of a transitory effect on productivity, we present results based on total growth variables first.

Exhibit 7. presents our main results using variables based on total growth. Our first conclusion from the results is that the t-test renders significant results at least at the 10 percent significance level for abnormal TFP and LP total growth irrespective averaging method of peer groups. This abnormal growth is on average 6 to 8 and 11 to 16 percent for TFP and LP respectively, depending on which averaging method we apply. Looking at the Wilcoxon test, results are more ambiguous. Abnormal TFP total growth is significantly different from zero at the 15 percent significance level only in the specification using the medians of peer groups, (1.1), with a median value of 2.8 percent. Abnormal LP total growth is significantly different from zero at the 5 and 10 percent significance level for specification (1.1) and (1.2), respectively and with median values of around 5 percent. We further observe that all of the target TFP and LP total growth variables are statistically different from zero at least at the 10 percent significance level.

EXHIBIT 7. MAIN TEST RESULTS (TOTAL GROWTH)

(P-VALUES IN PARENTHESES AND STANDARD ERRORS IN BRACKETS)

		Wilcoxon Signed-rank test			Student's t-test		
		(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(2.3)
Productivity		Median	Mean	Sales W.	Median	Mean	Sales W.
Measure	Variable	of Peers	of Peers	Mean of Peers	of Peers	of Peers	Mean of Peers
	TargetTFPtg	5.8%**	5.8%**	5.8%**	8.2%***	8.2%***	8.2%***
		(0.08)	(0.08)	(0.08)	(0.02)	(0.02)	(0.02)
		NA	NA	NA	[3.5%]	[3.5%]	[3.5%]
Total	PeerGroupTFPtg	0.9%	1.8%**	2.3%***	0.2%	1.4%*	2.4%***
Factor		(0.51)	(0.06)	(0.03)	(0.86)	(0.13)	(0.03)
Productivity		NA	NA	NA	[0.9%]	[0.9%]	[1.1%]
	AbnormalTFPtg(1)	**2.8%***	**3.5%**	**-0.0%**	**8.0%***	**6.8%****	**5.8%****
		(0.12)	**(0.23)**	**(0.26)**	**(0.02)**	**(0.06)**	**(0.10)**
		NA	**NA**	**NA**	**[3.4%]**	**[3.5%]**	**[3.4%]**
	TargetLPtg	12.1%****	12.1%****	12.1%****	17.2%****	17.2%****	17.2%****
		(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
		NA	NA	NA	[5.5%]	[5.5%]	[5.5%]
	PeerGroupLPtg	-1.1%	1.3%***	4.6%****	0.9%	3.7%***	6.3%****
Labor		(0.97)	(0.04)	(0.00)	(0.55)	(0.03)	(0.00)
Productivity		NA	NA	NA	[1.4%]	[1.6%]	[2.1%]
	AbnormalLPtg(1)	**4.5%*****	**5.4%****	**-2.7%**	**16.3%******	**13.5%*****	**11.0%****
		(0.02)	**(0.08)**	**(0.34)**	**(0.00)**	**(0.02)**	**(0.07)**
		NA	**NA**	**NA**	**[5.6%]**	**[5.7%]**	**[5.9%]**
N		80	80	80	80	80	80

Notes: The significance levels are represented by 15% (*), 10% (**), 5% (***) and 1% (****) and refer to two sided Wilcoxon signed-rank tests of whether median values are different from zero and the Student's t-test of whether average values are different from zero. The variables are based on a total growth basis.
Total growth values presented as medians and means of the observations for the Wilcoxon and the Student's t-test, respectively.
(1) Because AbnormalTFP and LP total growth are calculated as the difference between each paired observation of targets and peer groups and the median of this value is presented for the Wilcoxon test, this number does not equal the difference of the means of the target and peer group samples.

We present our main results on a CAGR basis in Exhibit 8. As one would expect, results are generally weaker, due to the dilutive nature of CAGR on the seemingly transitory effect of private equity firms on productivity. We directly conclude that for no specification of abnormal TFP CAGR can we reject the null hypothesis. Regarding the abnormal LP CAGR, the results are significantly different from zero at the 10 percent level only in the specifications utilizing medians of peer groups, (3.1) and (4.1). We further note that Target TFP CAGR median and mean values are significantly different from zero at least at the 15 percent level. Target LP CAGR median and mean values are both significantly different from zero at the 5 percent level.

EXHIBIT 8. MAIN TEST RESULTS (CAGR)

(P-VALUES IN PARENTHESES AND STANDARD ERRORS IN BRACKETS)

		Wilcoxon Signed-rank test			Student's t-test		
		(3.1)	(3.2)	(3.3)	(4.1)	(4.2)	(4.3)
Productivity		Median	Mean	Sales W.	Median	Mean	Sales W.
Measure	Variable	of Peers	of Peers	Mean of Peers	of Peers	of Peers	Mean of Peers
	TargetTFPcagr	1.8%**	1.8%**	1.8%**	1.9%*	1.9%*	1.9%*
		(0.10)	(0.10)	(0.10)	(0.14)	(0.14)	(0.14)
		NA	NA	NA	[1.2%]	[1.2%]	[1.2%]
Total	PeerGroupTFPcagr	0.3%	0.6%***	1.1%***	0.2%	0.5%	0.6%
Factor		(0.22)	(0.05)	(0.01)	(0.56)	(0.27)	(0.27)
Productivity		NA	NA	NA	[0.4%]	[0.4%]	[0.5%]
	AbnormalTFPcagr	**0.9%**	**1.2%**	**-0.1%**	**1.6%**	**1.4%**	**1.3%**
		(0.24)	**(0.29)**	**(0.44)**	**(0.18)**	**(0.30)**	**(0.33)**
		NA	**NA**	**NA**	**[1.2%]**	**[1.3%]**	**[1.3%]**
	TargetLPcagr	3.9%***	3.9%***	3.9%***	4.3%***	4.3%***	4.3%***
		(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
		NA	NA	NA	[2.0%]	[2.0%]	[2.0%]
	PeerGroupLPcagr	-0.4%	0.5%*	1.8%****	0.7%	1.6%***	2.4%***
Labor		(0.98)	(0.11)	(0.00)	(0.31)	(0.05)	(0.01)
Productivity		NA	NA	NA	[0.7%]	[0.8%]	[1.0%]
	AbnormalLPcagr(1)	**2.0%****	**1.4%**	**-0.8%**	**3.6%****	**2.7%**	**1.9%**
		(0.07)	**(0.27)**	**(0.56)**	**(0.09)**	**(0.21)**	**(0.40)**
		NA	**NA**	**NA**	**[2.1%]**	**[2.2%]**	**[2.2%]**
N		80	80	80	80	80	80

Notes: The significance levels are represented by 15% (*), 10% (**), 5% (***) and 1% (****) and refer to two sided Wilcoxon signed-rank tests of whether median values are different from zero and the Student's t-test of whether average values are different from zero. The variables are based on a compound annual growth rate basis.
CAGR values presented are medians and means of the observations for Wilcoxon and the Student's t-test, respectively.
(1) Because AbnormalTFP and LP CAGRs are calculated as the difference between each paired observation of targets and peer groups and the median of this value is presented for the Wilcoxon test, this number does not equal the difference of the means of the target and peer group samples.

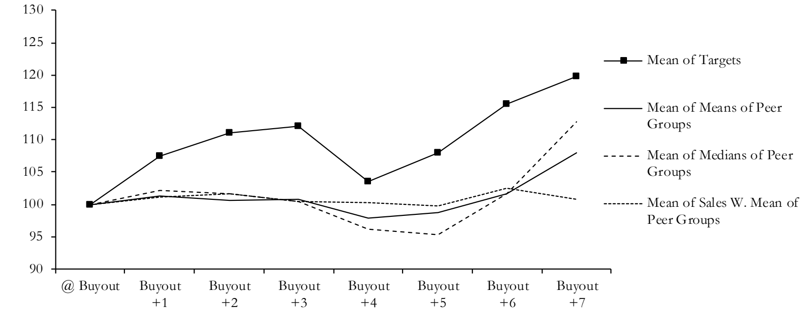
6.1.3. Graphical Presentation of Split Sample Results

As discussed in detail in the Method section, productivity measures and in particular TFP, can in general be easily mismeasured for a number of reasons. Potential measurement issues are considered to be more severe when it comes to the services sector (see for example Baily and Zitzewitz, 2001; Maroto-Sánchez, 2012). Numerous studies even question the applicability of today's productivity measures to the services sector due to these measurement issues. In order to isolate these potential mismeasurements, we perform the Wilcoxon test and the t-test for a split sample consisting of a goods-producing group, Group I, and a services group, Group II. Even though TFP as well as LP may be mismeasured in the services group, LP ought to be less biased and may provide insights on whether productivity development differs across the two groups.

Similarly as for the full sample results, we present graphical illustrations of the preliminary results. These illustrations are presented in Exhibits 9., 10., 11. and 12. Looking at Group I, we see that the normalized mean target TFP, Exhibit 9., is constantly above the mean of the peer groups. Also, it is no longer obvious that the effect on TFP is transitory, as TFP increases gradually during the first three years to almost 115, substantially higher than for the full sample. For the normalized mean target LP, Exhibit 10., we still see signs of a transitory or even temporary effect. Bear in mind though, that the mix of companies included in the mean changes from year to year, why the gradually falling target LP is likely due to divestments of firms with strong LP development. We further notice that the target standard deviations have fallen for Group I compared to the full sample.

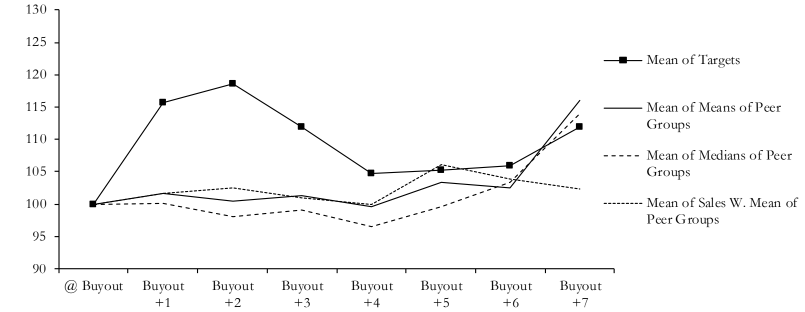
Even though Group II normalized mean target TFP, Exhibit 11., is constantly above the mean of the peer groups, the difference is smaller than that of Group I. We further notice the relatively higher standard deviations compared to Group I, especially in year four and five. Observing normalized mean target LP development, Exhibit 12., the targets seem to significantly outperform the development of the peers. What should be noted here though is the significant standard deviation, reaching levels of 70 index points in year six post buyout.

EXHIBIT 9. NORMALIZED MEAN TFP DEVELOPMENT GROUP I



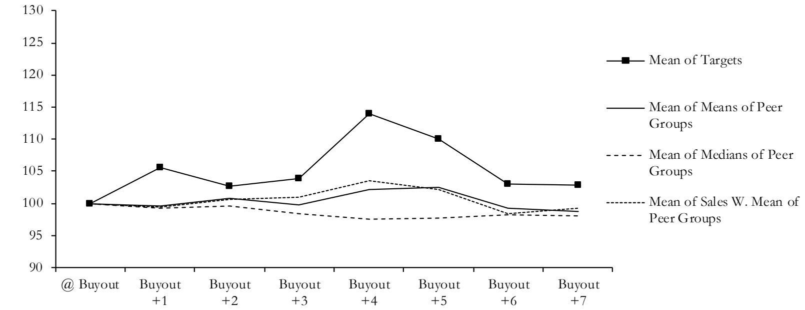
	@ Buyout	Buyout +1	Buyout +2	Buyout +3	Buyout +4	Buyout +5	Buyout +6	Buyout +7
No. of Obs.	**33**	**33**	**32**	**25**	**17**	**11**	**6**	**2**
Std. Dev. Targets	**–**	**16**	**22**	**31**	**20**	**29**	**27**	**19**
Std. Dev. Peer Groups*	**–**	**6**	**6**	**13**	**10**	**10**	**9**	**7**

EXHIBIT 10. NORMALIZED MEAN LP DEVELOPMENT GROUP I



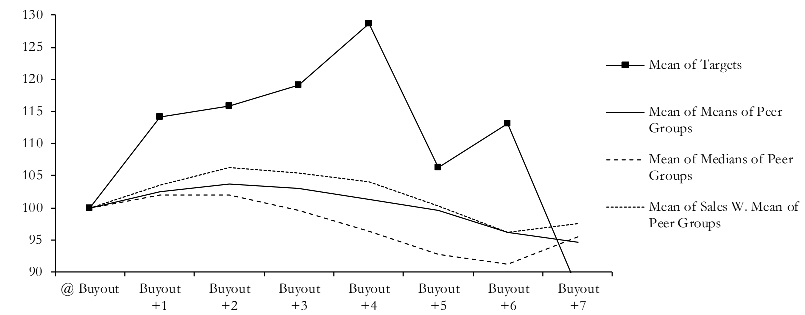
	@ Buyout	Buyout +1	Buyout +2	Buyout +3	Buyout +4	Buyout +5	Buyout +6	Buyout +7
No. of Obs.	**33**	**33**	**32**	**25**	**17**	**11**	**6**	**2**
Std. Dev. Targets	**–**	**35**	**34**	**38**	**35**	**31**	**27**	**10**
Std. Dev. Peer Groups*	**–**	**9**	**13**	**18**	**10**	**10**	**9**	**5**

EXHIBIT 11. NORMALIZED MEAN TFP DEVELOPMENT GROUP II



	@ Buyout	Buyout +1	Buyout +2	Buyout +3	Buyout +4	Buyout +5	Buyout +6	Buyout +7
No. of Obs.	**47**	**47**	**47**	**36**	**22**	**15**	**7**	**1**
Std. Dev. Targets	**–**	**25**	**30**	**34**	**39**	**45**	**16**	**–**
Std. Dev. Peer Groups*	**–**	**6**	**8**	**7**	**10**	**10**	**6**	**–**

EXHIBIT 12. NORMALIZED MEAN LP DEVELOPMENT GROUP II



	@ Buyout	Buyout +1	Buyout +2	Buyout +3	Buyout +4	Buyout +5	Buyout +6	Buyout +7
No. of Obs.	**47**	**47**	**47**	**36**	**22**	**15**	**7**	**1**
Std. Dev. Targets	**–**	**44**	**61**	**64**	**69**	**58**	**70**	**–**
Std. Dev. Peer Groups*	**–**	**11**	**15**	**14**	**11**	**11**	**10**	**–**

Notes: Exhibits 9., 10., 11. and 12. represent the normalized mean development of the target firms' and the peer groups' TFP and LP development, respectively, post the buyout event, for Group I and II. Three different averaging methods for the peer groups are included. Below each chart, the number paired observations are displayed. Additionally, standard deviations of each sample each year are presented below the chart.

* Refers to the mean of means of peer groups.

6.1.4. Split Sample Test Results

To understand how the graphical developments translate into statistical results, we conduct tests on both groups with the Wilcoxon test and the t-test applied on variables based on total growth and CAGR as well as the three different averaging methods of the peer groups.

Exhibit 13. and Exhibit 14. present the test results for the total growth variables and CAGR variables, respectively. We note that the 80 observations from the full sample are split to 33 in Group I and 47 in Group II. Looking at the results, we find that for Group I, the goods-producing firms, irrespective of test and weight of peers, abnormal TFP development measured on a total growth basis is significant at the 5 percent level. When measured on a CAGR basis, abnormal TFP development is significant at least at the 15 percent level. Results for abnormal LP growth are almost significant at least at the 15 percent level across all specifications. We note that results are strongest for the specifications using medians and means of peer groups. Additionally, we observe sharp increases in terms of magnitude for median and mean values of the abnormal TFP and LP compared to the full sample.

We further note that results for Group II, services, are significant only in 2 out of 24 tests, (6.1) and (6.2), at the 10 and 15 percent level.

EXHIBIT 13. SPLIT SAMPLE TEST RESULTS (TOTAL GROWTH)

(P-VALUES IN PARENTHESES AND STANDARD ERRORS IN BRACKETS)

			Wilcoxon Signed-rank test			Student's t-test		
			(5.1)	(5.2)	(5.3)	(6.1)	(6.2)	(6.3)
	Productivity		Median	Mean	Sales W.	Median	Mean	Sales W.
Group	Measure	Variable	of Peers	of Peers	Mean of Peers	of Peers	of Peers	Mean of Peers
Group I: Goods-Producing	TFP	AbnormalTFPtg(1)	10.6%***	8.1%****	8.3%***	10.9%***	11.0%***	9.7%***
			(0.03)	(0.01)	(0.03)	(0.02)	(0.01)	(0.03)
			NA	NA	NA	[4.3%]	[4.0%]	[4.2%]
	LP	AbnormalLPtg(1)	11.3%***	10.0%***	3.9%*	17.1%***	14.7%***	12.0%**
			(0.01)	(0.03)	(0.10)	(0.01)	(0.03)	(0.10)
			NA	NA	NA	[6.3%]	[6.5%]	[7.0%]
N			33	33	33	33	33	33
Group II: Services	TFP	AbnormalTFPtg(1)	-2.7%	-4.8%	-2.6%	6.1%	3.9%	3.0%
			(0.91)	(0.70)	(0.66)	(0.22)	(0.46)	(0.56)
			NA	NA	NA	[4.9%]	[5.2%]	[5.1%]
	LP	AbnormalLPtg(1)	1.9%	-0.5%	-5.7%	15.8%**	12.6%*	10.3%
			(0.29)	(0.56)	(0.79)	(0.07)	(0.15)	(0.25)
			NA	NA	NA	[8.5%]	[8.6%]	[8.8%]
N			47	47	47	47	47	47

EXHIBIT 14. SPLIT SAMPLE TEST RESULTS (CAGR)

(P-VALUES IN PARENTHESES AND STANDARD ERRORS IN BRACKETS)

			Wilcoxon Signed-rank test			Student's t-test		
			(7.1)	(7.2)	(7.3)	(8.1)	(8.2)	(8.3)
	Productivity		Median	Mean	Sales W.	Median	Mean	Sales W.
Group	Measure	Variable	of Peers	of Peers	Mean of Peers	of Peers	of Peers	Mean of Peers
Group I: Goods-Producing	TFP	AbnormalTFPcagr(1)	3.0%**	3.3%***	2.5%**	2.8%**	3.2%***	3.0%*
			(0.05)	(0.01)	(0.05)	(0.10)	(0.05)	(0.10)
			NA	NA	NA	[1.6%]	[1.5%]	[1.8%]
	LP	AbnormalLPcagr(1)	3.7%***	3.1%**	0.7%	6.6%***	5.7%***	5.0%*
			(0.02)	(0.06)	(0.23)	(0.03)	(0.04)	(0.10)
			NA	NA	NA	[1.6%]	[2.7%]	[2.9%]
N			33	33	33	33	33	33
Group II: Services	TFP	AbnormalTFPcagr(1)	-0.6%	-1.5%	-1.4%	0.8%	0.1%	0.1%
			(0.96)	(0.63)	(0.65)	(0.64)	(0.95)	(0.98)
			NA	NA	NA	[1.7%]	[2.0%]	[1.8%]
	LP	AbnormalLPcagr(1)	0.9%	-0.1%	-2.3%	1.5%	0.6%	-0.3%
			(0.69)	(0.92)	(0.82)	(0.64)	(0.85)	(0.92)
			NA	NA	NA	[3.1%]	[3.1%]	[3.1%]
N			47	47	47	47	47	47

Notes (Exhibit 13. and 14.) : The significance levels are represented by 15% (*), 10% (**), 5% (***) and 1% (****) and refer to two sided Wilcoxon signed-rank tests of whether median values are different from zero and the Student's t-test of whether average values are different from zero. CAGR and total growth values presented are medians and means of the observations for Wilcoxon and the Student's t-test, respectively.
(1) Because AbnormalTFP and LP are calculated as the difference between each paired observation of targets and peer groups and the median of this value is presented for the Wilcoxon test, this number does not equal the difference of the means of the target and peer group samples.

6.2. Analysis

6.2.1. Selecting Statistical Test and Averaging Method

In order to conclude whether or not private equity owned firms increase productivity more than the counterfactual, we need to further examine the data to understand which of the above tests to emphasize the most. More specifically, we need to determine (i) if our samples stems from normally distributed populations and thus the applicability of the t-test, and (ii) which method of averaging each peer group is most appropriate.

We test the normality of our samples by performing Shapiro-Wilk tests and the results are presented in Exhibit 15. The null hypothesis that the population distribution is normal can be rejected for our samples. Hence, leading us to the conclusion that the t-test is likely to be distorted and more weight should be assigned to the Wilcoxon test. The results of the t-tests should thus mainly be seen as robustness tests to complement the Wilcoxon test.

EXHIBIT 15. SHAPIRO-WILK NORMALITY TEST

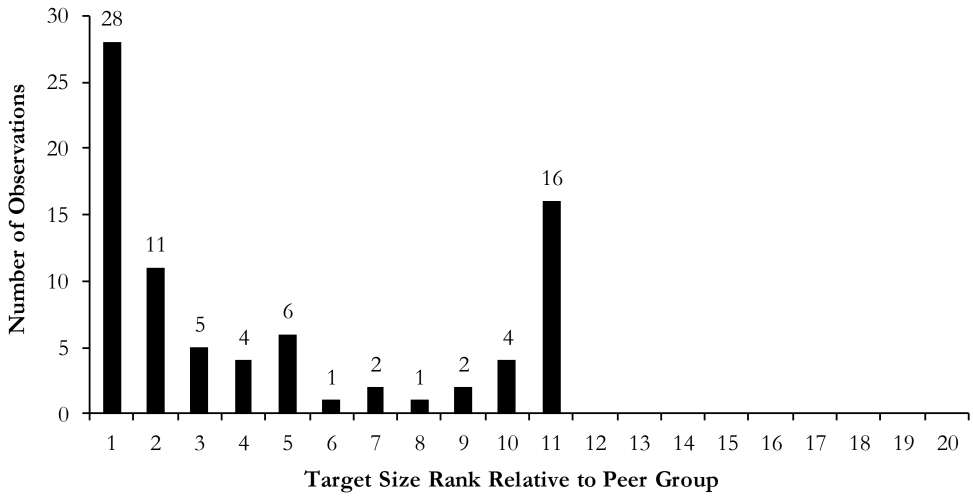
(P-VALUES IN PARENTHESES)

	Test Statistic: W			
		Averaging Method		
Variable		Median	Mean	Sales W. Mean
TargetTFPtg	86.8%**** (0.00)	NA	NA	NA
PeerGroupTFPtg	NA	97.1%** (0.07)	97.2%** (0.08)	96.7%*** (0.04)
TargetLPtg	91.4%**** (0.00)	NA	NA	NA
PeerGroupLPtg	NA	90.0%**** (0.00)	91.9%**** (0.00)	96.7%*** (0.04)
TargetTFPcagr	97.2%** (0.08)	NA	NA	NA
PeerGroupTFPcagr	NA	92.7%**** (0.00)	93.2%**** (0.00)	86.3%**** (0.00)
TargetLPcagr	97.1%** (0.07)	NA	NA	NA
PeerGroupLPcagr	NA	81.4%**** (0.00)	92.4%**** (0.00)	92.1%**** (0.00)

Notes: Presents the Shapiro-Wilk normality test for all of the full samples with different growth base and averaging methods of the peer groups.

To understand what relative weights should be assigned to the different methods of averaging peer groups when interpreting the results, we seek answers in the data samples. Exhibit 16. illustrates the targets' relative ranking with respect to its peers. We find that in a majority of cases (28 out of 80), the target is larger than all of its peers. This is expected, because private equity firms often invest in industry leaders. Recalling our method of selecting peers, if available, we choose the 10 closest larger and smaller peers in terms of sales. In 16 cases, 10 larger peers are available, resulting in rank 11 for the target.

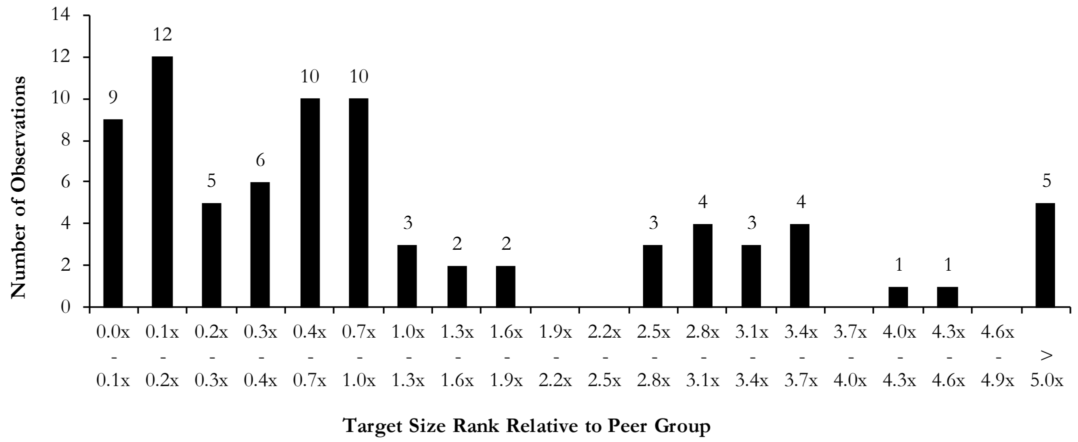
EXHIBIT 16. TARGETS' RELATIVE RANKING



Notes: The above chart presents the targets' relative ranking with respect to its peers.

From Exhibit 17., we find some support for the use of the sales weighted mean of peer groups, in order to assign more weight to the larger firms within the peer groups. On the other hand, in 52 cases, there is a potential risk of including a major international company that would significantly distort the sales weighted mean. Exhibit 17. aims to shed light on the potential presence of such dominant players within each industry. We see that in 26 cases, the target is less than or equal to 0.3 times, or 33 percent, the size of the largest peer, implying sizes of at least above 3 times the size of the target. For 0.2 times and 0.1 times the corresponding numbers would be 5 and 10 times the size of the target. This information is preferably complemented with the descriptive statistics in Exhibit 23. in Appendix. From that table we observe that for several targets, the largest peer firm is much larger than the target size.

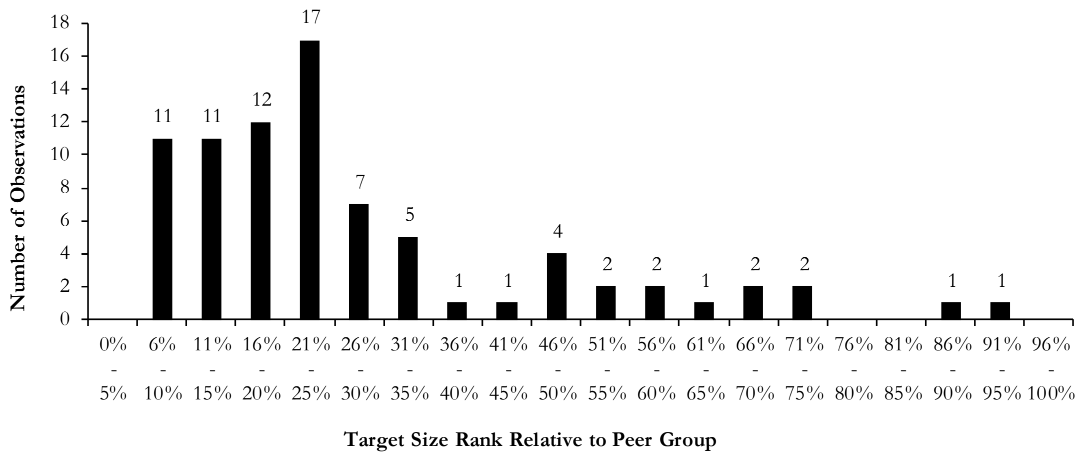
EXHIBIT 17. TARGETS' RELATIVE SIZE TO LARGEST PEER



Notes: The above chart illustrates the distribution of the relative size of the targets in terms of sales to the largest peer.

To further illustrate the extent of this issue, Exhibit 18. presents the distribution of the sales weight of the largest peer in each peer group, where all peer groups with fewer than 20 peers have been rebased to reflect the weight it would have in a 20 firm peer group. The equal weight thus corresponds to 5 percent. We see that in 15 cases, the sales weight is larger than 45 percent, which may be unreasonably high, considering that the remaining 19 peers would together have a sales weight of only 55 percent or less. This serves as an argument not to use the sales weighted mean for the peer groups.

EXHIBIT 18. DISTRIBUTION OF LARGEST PEER WEIGHTS



Notes: The above chart presents the distribution of the sales weight of the largest peer in each peer group. The equal weight would correspond to 5%.

When comparing the averaging methods medians and means, it comes down to the potential presence of outliers in the samples. On the one hand, we already trim the samples for extreme outliers, creating a range of increases of up to 300 percent and decreases down to 1 percent. This might potentially serve as an argument for using means. On the other hand, productivity should not be a very volatile measure and therefore this span will likely be considered as rather wide, why outliers can still be considered to exist, making a case for using medians rather than means. We argue that both measures should be assigned similar weight when interpreting our results and that both are preferred to the sales weighted mean.

6.2.2. Interpretation of Full Sample Test Results

Let us revisit and interpret the results with these new insights regarding the tests and averaging approaches at hand. Focusing on the Wilcoxon test and tests using the mean and median of peer groups, we can conclude that for the full sample using variables based on total growth in Exhibit 7., we find varying support for our hypothesis. The abnormal TFP total growth is significant at the 15 percent level when using median weighted peer groups, (1.1), but insignificant when using the mean of peer groups, (1.2). Thus, no robust support for our hypothesis can be found looking at TFP. The results for LP based on total growth variables show positive values of abnormal Target LP and are significant at the 5 and 10 percent level, respectively, when using medians, (1.1), and means, (1.2), of peer groups. Conclusively, when testing the abnormal Target TFP and LP on a total growth basis using the Wilcoxon test, three out of four tests render significant results, providing some support for our hypothesis.

Interpreting the results based on CAGRs, presented in Exhibit 8., we find no support for our hypothesis when measuring productivity as TFP. With regards to LP, the results are ambiguous as the test using the median of peer groups, (3.1), rejects the null hypothesis at the 10 percent significance level, while the test using the mean of peer groups renders no such support. Interestingly, the p-values for these two differ substantially, indicating a much larger dispersion across the peer group observations when using the mean of peer groups and thus potentially a presence of outliers.

One should bear in mind that the CAGR based tests are more prudent than those based on total growth. But on the other hand, looking back at the charts presented in Exhibit 5. and 6., we see that the TFP and LP development seems to be somewhat transitory, with both measures leaping the first year, but exhibiting a slower growth subsequent years. If the effect of private equity firms on firm productivity is merely transitory, which is supported by findings of Lichtenberg and Siegel (1990) and Amess (2003), total growth would be the more appropriate measure to look at. All in all, results for the full sample are equivocal, but given the seemingly transitory effect on productivity and the resulting focus on total growth variables, we find some support for our hypothesis.

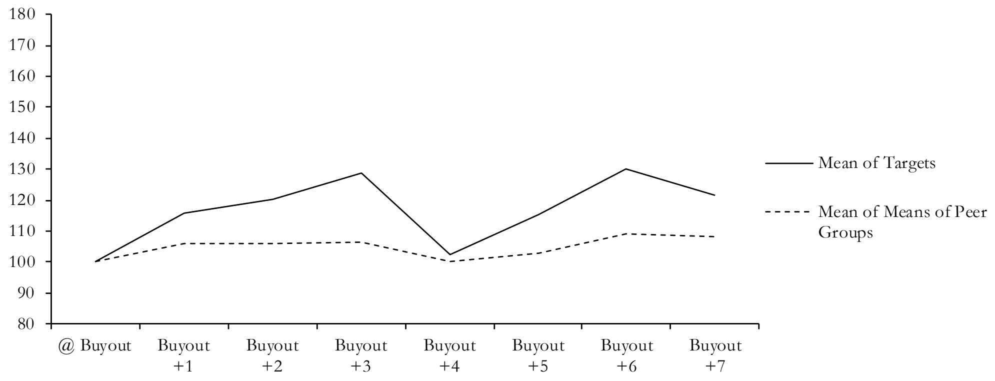
6.2.3. Interpretation of Split Sample Test Results

Recall that it is much debated in academia whether or not today's productivity measures appropriately measure productivity for the services sector. Numerous studies highlight the measurement issues for services companies. These issues may render erroneous productivity measures in our sample. This is the main reason to why we introduce and test the split samples. Revisiting these results in Exhibit 13. and 14., we note that the Wilcoxon test using the median and mean of peer groups in Group I render significant results at the 10, 5 and even 1 percent level for both TFP and LP, irrespective of growth basis and averaging approach. Even when using the sales weighted mean, we find significant results, thus indicating robust support for our hypothesis.

Regarding the results for Group II, the results are insignificant for every test of focus, (5.1), (5.2), (7.1) and (7.2). However, we expect that these results are likely to be distorted due to the limited applicability of the productivity measures to this sector. We realize that there is a probability that we actually capture some of the true effects for this industry. If the productivity in the services sector is correctly measured, we can only speculate what could be the reason for these differences between the two industry groups.

We speculate that we may actually capture different value creation strategies of the private equity firms. It may be reasonable to assume that private equity firms employ value creation strategies for manufacturing firms that are more focused on streamlining and improving the efficiency of the production processes by introducing lean processes, capital spending rationalization processes, working capital rationalizations, etc. For the services sector on the other hand, which includes wholesale and retail, and pure services companies, it may be reasonable to assume that value creation strategies more often are focused on geographic and product offering expansion, thus creating value quickly by growing earnings in absolute numbers, but perhaps at the same or lower margins, why productivity levels may not change substantially during the holding period. To examine this speculation, we introduce two charts, Exhibit 19. and Exhibit 20., which display the development of the normalized mean of real sales for the two groups. Interestingly, we find some support for our speculations. The firms in the services sector on average exhibit far stronger growth than do the firms in the manufacturing sector. Going into further depth of this matter is beyond the scope of this paper, but we conclude that this could be an area of further research, where qualitative data on applied value creation strategies is complemented with data driven productivity analysis.

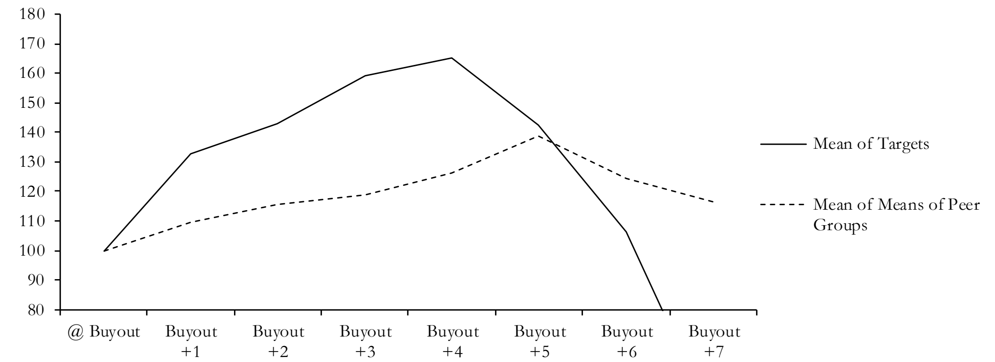
EXHIBIT 19. NORMALIZED REAL SALES GROUP I



No. of Obs.	33	33	32	25	17	11	6	2

Notes: Presents the normalized mean development of real sales of targets and peer groups of Group I.

EXHIBIT 20. NORMALIZED REAL SALES GROUP II



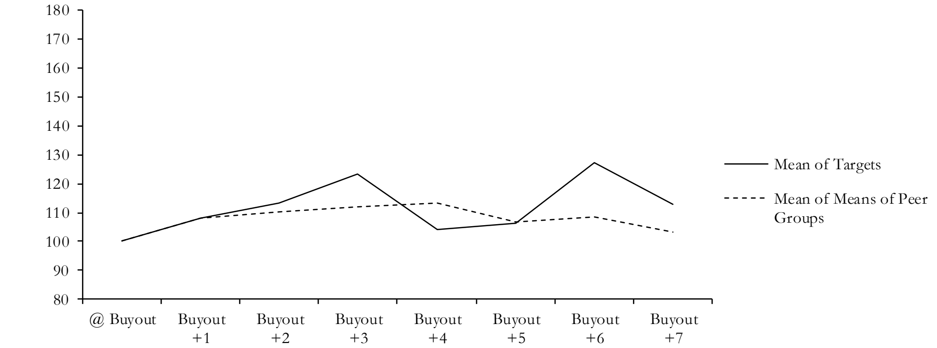
No. of Obs.	47	47	47	36	22	15	7	1

Notes: Presents the normalized mean development of real sales of targets and peer groups of Group II.

6.2.4. Productivity Drivers

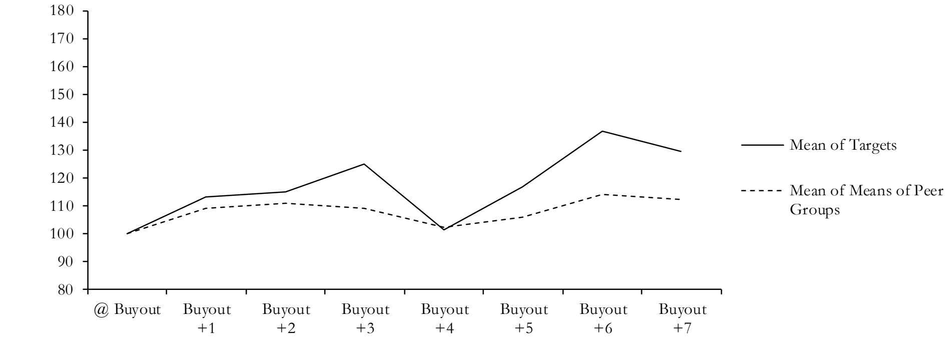
We have found that private equity owned firms exhibit abnormal growth in measured productivity, which we base on our sample with firms active in the manufacturing sector. To further examine this conclusion, we seek to shed light on what is driving this abnormal growth. Exhibit 21., 22. and 23. present the normalized mean development of inputs for Group I.

EXHIBIT 21. NORMALIZED INPUT VARIABLES GROUP I: NO. OF EMPLOYEES



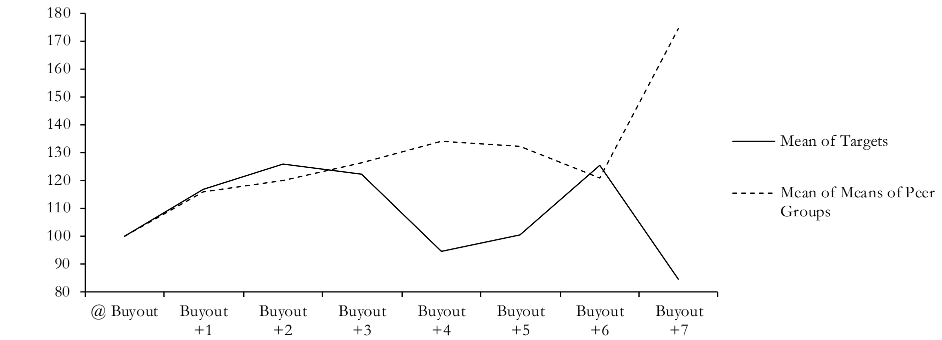
No. of Obs.	33	33	32	25	17	11	6	2

EXHIBIT 22. NORMALIZED INPUT VARIABLES GROUP I: REAL COGS



No. of Obs.	33	33	32	25	17	11	6	2

EXHIBIT 23. NORMALIZED INPUT VARIABLES GROUP I: REAL CAPITAL



No. of Obs.	33	33	32	25	17	11	6	2

Notes: Exhibit 21., 22. and 23. present the normalized mean developments of the of the targets' and peer groups inputs.

From Exhibit 19. we conclude that targets grow sales stronger than their peers. Looking at Exhibit 21., 22. and 23., we see that during the first two years, neither of the inputs differ much from that of the peer groups. Only during year three there is a relative uptick in the number of employees and real COGS inputs, combined with a further increase in real sales. For the companies still included in the sample in year four and forward, the real sales growth is somewhat lower, but input variables also decrease. In particular, real capital is well below the development of the peer groups, which should lead to a stronger TFP relative to the peer groups. To conclude, it appears that the abnormal productivity growth is the result of two effects; one being the concept of increased output but maintained inputs and the other being increased capital efficiency.

A discussion related to the drivers of the abnormal productivity growth is that of firm-specific output and input price changes. It is not unlikely that what we see is the combined effect of firm specific price changes of inputs and outputs, and a more efficient use of inputs. As discussed in the Method section, it can reasonably be assumed that private equity owned firms introduce creative pricing strategies as well as enter fierce negotiations with suppliers to obtain the highest possible output price and lowest input prices. Furthermore, as previously stressed, we cannot mitigate these potential firm level issues with the data at hand, but instead have to assume that the output and input prices of the private equity owned firms follow the development of the industry in general, by deflating monetary values over time with industry level indices.

6.2.5. Concluding Remarks

At this point, we are able to conclude the main findings of this paper. We find significant and robust support for our hypothesis that private equity owned firms exhibit abnormal growth in productivity. More specifically, private equity owned firms display abnormal growth in measured TFP and LP of approximately 10 percent by the median, during the entire investment holding period. We base this broad conclusion mainly on the results of firms active in the manufacturing sector, because changes in productivity is deemed to be more correctly represented in this part of the sample. The limited and flawed applicability of productivity measures of the services sector led us to disregard this part of the sample to be used as a basis for our conclusions.

Furthermore, the effect of private equity firms on abnormal productivity growth in their target companies seems to be mainly transitory, albeit sustainable. Productivity increases sharply the first year post buyout and at a slower pace subsequent years. These findings are consistent with those of Lichtenberg and Siegel (1990) and Amess (2003). Additionally, the abnormal measured productivity growth seems to be the result of two effects, with one being the concept of increased output but maintained inputs and the other being increased capital efficiency, which in some sense overlap. The findings of these two effects are supported by existing literature. A skilled management team is required to be able to increase output more than the counterfactual without increasing inputs more than the counterfactual. Much of the previous research suggests that qualified a management team and its practices can increase firm productivity (see for example Lazear, 2000; Hamilton et al., 2003; Bandiera et al., 2007). Related to the other effect of increasing capital efficiency, previous studies support our finding that private equity firms tend to reduce their targets' capital spending after the buyout (Kaplan, 1989a; Smith, 1990). Furthermore, a large debt burden and compensation based on cash measures give management the incentive to operate the firm in a cash generating way, thus being more cautious with capital expenditure (Baker and Wruck, 1989).

However, we cannot rule out the risk that what we capture in the productivity measures is the effect of price changes of output and inputs, as industry level deflators are used to deflate firm level monetary values. This is something we should be extra wary of in the case of private equity owned firms, as they tend to pull every lever possible to increase profitability. In the end, we believe that we capture the mixed effect of increased productivity and firm level prices, but the results are of such magnitude that a major part of the increase is likely due to increased productivity.

Furthermore, even though we have strong support from academia regarding the limited applicability of productivity measures to the services sector (see for example Baily and Zitzewitz, 2001; Maroto-Sánchez, 2012), we cannot rule out that productivity is correctly represented in the services sector. Should this be the case, we speculate that what we capture are different value creation strategies of the private equity firms, having different implications for the development of productivity. Should the data be available, a study combining information on strategic initiatives and establishment-level quantity data per company would be able to shed further light on the extent of the caveats potentially present in our study. Additionally, a study like that could be complemented with a more suitable measure of productivity for the services sector. No such measure is generally established in academics as of today, but a number of suggestions to alternative measures exist, which better capture the contribution of the services sector to overall economic growth. For alternative approaches to measure productivity in services, see for example De Bandt, 1991; Elfring, 1988; Griliches, 1992; Van Ark, 2002.

Private equity and its well established position in today's society is well debated. There is a consensus in academia that private equity firms improve operational performance, which may come at the expense of employment. Studies have found that private equity owned firms reduce employment (Kaplan, 1989a; Harris et al., 2005; Davis et al., 2013). In the study by Davis et al. (2013) they find decreasing employment at existing target plants, but they also find that buyout firms created new jobs at new establishments and increased productivity, mainly driven by efficient reallocation of resources. In light of this, the effect on employment needs to be put in context to our findings on productivity in this study. The strong connection between productivity growth and GDP growth would indicate long term economic benefits of private equity ownership that ought to indirectly generate jobs in other sectors.

7. Conclusion

The purpose of our study is to broaden and extend the understanding of private equity firms' effect on productivity and in extension, the contribution to economic growth and welfare. Specifically, we seek to investigate whether private equity owned firms exhibit abnormal productivity growth during the investment holding period, using a sample of 80 Swedish private equity control investments across a wide range of sectors. In light of previous studies (e.g. Lichtenberg and Siegel, 1990; Amess, 2003; Davis et al. 2013), we hypothesize that productivity in buyout target companies will exhibit abnormal growth. This hypothesis is also supported by previous studies concluding that private equity owned companies outperform relative peer groups in terms of operational performance, mainly driven by operational improvements (e.g. Kaplan, 1989a; Bergström et al., 2007). Similar to previous research we find that private equity owned firms exhibit an abnormal transitory, albeit sustainable, productivity growth of approximately 10 percent by the median during the holding period when measured in TFP and LP. From a societal perspective, due to the strong connection between productivity growth and GDP growth, our findings indicate long-term economic benefits of private equity ownership.

This abnormal growth for private equity owned firms appears to be driven mainly by two effects, (i) by increasing output more than the counterfactual while keeping inputs in line with the counterfactual and (ii) by more efficient capital spending. These findings are supported by previous studies showing how skilled management and its practices can increase productivity by coordinating efficient use of inputs (see for example Lazear, 2000; Bandiera et al., 2007), and that private equity firms tend to reduce their targets' capital spending after the buyout (Kaplan, 1989a; Smith, 1990). However, we acknowledge that part of the abnormal growth may partly be due to firm specific price changes in inputs and outputs, which we cannot control for.

We base our conclusions mainly on the results of firms active in the goods-producing sectors, because of the limited and flawed applicability of productivity measures to the services sector as discussed by Maroto-Sánchez (2012), Baily and Zitzewitz (2001) among others, lead us to disregard these firms in our sample in the belief that the productivity observations likely are misrepresented. However, we cannot fully dismiss the risk what we measure is the actual productivity changes in the services sector. From our results we observe a substantially higher output growth for the services firms than that of the goods-producing firms and thus we speculate that what we measure may be the result of different value creation strategies initiated by the private equity firms. This could indicate that for the services sector, private equity firms are driving value creation strategies focused on growth and expansion rather than operational efficiency. Going into further depth of this matter is beyond the scope of this paper, but we conclude that this could be an interesting area of further research. This could be done by combining data on strategic initiatives and establishment-level input and output quantity data. Such a study could also be complemented with a more suitable measure than productivity for the services sector that better captures the sector's contribution to economic growth.

8. References

Abowd, J. M., Haltiwanger, J., Jarmin, R., Lane, J., Lengermann, P., McCue, K., McKinney, K. and Sandusky, K. (2005), "The Relation among Human Capital, Productivity, and Market Value: Building Up from Micro Evidence", In *Measuring Capital in the New Economy*, pp. 153–98, University of Chicago Press.

Acharya, V., Gottschalg, O., Hahn, M. and Kehoe, C. (2008), "*Corporate Governance and Value Creation: Evidence from Private Equity*", Working Paper, Department of Finance, New York University.

Adler, V. and Norberg, R. (2012), *"Do Parents Matter?"*, Master Thesis, Department of Accounting and Department of Finance, Stockholm School of Economics.

Ahmad, N., Lequiller, F., Marianna, P., Pilat, D., Schreyer, P. and Wölfl, A. (2003), *"Comparing Labour Productivity Growth in the OECD Area"*, OECD Statistics Working Paper 2003/5, OECD, Paris.

Aizcorbe, A. M. (1992), "Procyclical Labour Productivity, Increasing Returns to Labour and Labour Hoarding in Car Assembly Plant Employment", *The Economic Journal*, vol. 102, no. 413, pp. 860-873.

Allen, F., Faulhaber, G. R. and MacKinlay, A. C. (1989), *"Unbalanced Growth Redux"*, Unpublished Working Paper, The Wharton School, University of Pennsylvania.

Amess, K. (2003), "The Effects of Management Buyouts on Firm-Level Technical Inefficiency: Evidence From a Panel of U.K. Machinery and Equipment Manufacturers", *Journal of Industrial Economics*, vol. 51, no. 1, pp. 35-44.

Amess, K. and Wright, M. (2007), "The Wage and Employment Effects of Leveraged Buyouts in the UK", *International Journal of the Economics of Business*, vol. 14, no. 2, pp. 179-195.

Arnold, J. M. (2005), "Productivity Estimation at the Plant Level: A Practical Guide", Unpublished manuscript.

Baily, M. N, Schultze, C. L., Jorgenson, D. W. and Hall, R. E. (1990), "The Productivity of Capital in a Period of Slower Growth", *Brookings Papers on Economic Activity, Microeconomics*, pp. 369-420.

Baily, M. N. and Zitzewitz, E. (2001), "Service Sector Productivity Comparisons: Lessons for Measurement", In *New developments in productivity analysis*, pp. 419-464, University of Chicago Press.

Bain & Company (2014), "*Global Private Equity Report 2014".* Bain & Company, Boston.

Baker, G. P. (1992), "Beatrice: A Study in the Creation and Destruction of Value", *Journal of Finance*, vol. 47, no. 3, pp. 1081-1119.

Baker, G. P. and Wruck, K. H. (1989), "Organisational Changes and Value Creation in Leveraged Buyouts: The Case of The O.M. Scott & Sons Company", *Journal of Financial Economics*, vol. 25, no. 2, pp. 163-190.

Bandiera, O., Barankay, I. and Rasul, I. (2007), "Incentives for Managers and Inequality among Workers: Evidence from a Firm-Level Experiment", *The Quarterly Journal of Economics*, vol. 122, no. 2, pp. 729-773.

Barber, B. M. and Lyon, J. D. (1996), "Detecting Abnormal Operating Performance: The Empirical Power and Specification of Test Statistics", *Journal of Financial Economics*, vol. 41, no. 3, pp. 359-399.

Baumol, W. (1967), "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis", *The American Economic Review*, vol. 57, no. 3, pp. 416-426.

Berg, A. and Gottschalg, O. (2003), *"Understanding Value Generation in Buyouts"*, Working Paper, INSEAD.

Bergström, C., Grubb, M. and Jonsson, S. (2007), "The Operating Impact of Buyouts in Sweden: A Study of Value Creation", *The Journal of Private Equity*, vol. 11, no. 1, pp. 22-39.

Berndt, E. R. and Griliches, Z. (1993), "Price Indexes for Microcomputers: An Exploratory Study", In *Price measurements and their uses*, pp. 63–100, University of Chicago Press.

Berndt, E. R., Cutler, D. M., Frank, R. G., Griliches, Z., Newhouse, J.P. and Triplett, J. E. (2001), "Price Indexes for Medical Care Goods and Services: An Overview of Measurement Issues", In *Medical Care Output and Productivity*, pp. 141-200, University of Chicago Press.

Bhagwati, J. N. (1984), "Splintering and Disembodiment of Services and Developing Nations", *The World Economy*, vol. 7, no. 2, pp. 133–143.

Bloom, N. and Van Reenen, J. (2007). "Measuring and Explaining Management Practices across Firms and Countries", *The Quarterly Journal of Economics*, vol. 122, no. 4, pp. 1351–1408.

Boston Consulting Group (2012), *"Private Equity: Engaging for Growth: The 2012 Private-Equity Report"*, Boston Consulting Group, Boston.

Boucly, Q., Sraer, D. and Thesmar, D. (2008), *"Do Leveraged Buyouts Appropriate Worker Rents? Evidence from French Data"*, Unpublished Working Paper, HEC Paris.

Bushnell, J. B. and Wolfram, C. (2009), "The Guy at the Controls: Labor Quality and Power Plant Efficiency", In *International Differences in the Business Practices and Productivity of Firms*, pp. 79-102, University of Chicago Press.

Carlson, W. L., Newbold, P. and Thorne, B. (2007), *Statistics for Business and Economics,* Pearson Education, New Jersey.

Colwell, R. J. and Davis, E. P. (1992), "Output and Productivity in Banking", *Scandinavian Journal of Economics*, vol. 94, pp. 111-129.

Crow, E. L. and Siddiqui M. M. (1967), "Robust Estimation of Location", *Journal of the American Statistical Association*, vol. 62, no. 318, pp. 353-389.

Cumming, D., Siegel, D. S. and Wright, M. (2007), "Private Equity: Leveraged Buyouts and Governance", *Journal of Corporate Finance*, vol. 13, no. 1, pp. 439-460.

Dann, L. Y., Masulis, R. W. and Mayers, D. (1991), "Repurchase Tender Offers and Earnings Information", *Journal of Accounting and Economics*, vol. 14, no. 3, pp. 217-251.

Davis, S. J., Haltiwanger, J. C., Handley, K., Jarmin, R. S., Lerner, J. and Miranda, J. (2013), *"Private Equity, Jobs, and Productivity"*, Working Paper No. 19458, National Bureau of Economic Research.

De Bandt, J. (1991), *"Les Services: Productivité et Prix"*, Economica, Paris.

Dolley, J. C. (1933), "Characteristics and Procedure of Common Stock Split-Ups", *Harvard Business Review*, vol. 11, no. 3, pp. 316-326.

Drewsen, C. and Moss, G. (2013), *"Is Bigger Always Better? A Study of Value Creation in Private Equity"*, Master Thesis, Department of Accounting and Department of Finance, Stockholm School of Economics.

Elfring, T. (1988), *"Service Sector Employment in Advanced Economies: A Comparative Analysis of Its Implications for Economic Growth"*, Gower, Aldershot.

Fixler, D. J. (1993), "Measuring Financial Service Output and Prices in Commercial Banking", *Applied Economics*, vol. 25, no. 7, pp. 983–993.

Griliches, Z. (1992), "Introduction to 'Output Measurement in the Service Sectors", In *Output Measurement in the Service Sectors*, pp. 1-22, University of Chicago Press.

Gulliksen, A. V., Falk Hansen, O. and Audestad Wara, K. (2008), *"The Operating Performance of Scandinavian Private Equity Companies"*, Master Thesis, Department of Finance, Norwegian School of Economics and Business Administration.

Guo, S., Hotchkiss, E. S. and Song, W. (2011), "Do Buyouts (Still) Create Value?", *The Journal of Finance*, vol. 66, no. 2, pp. 479-517.

Hamilton, B. H., Nickerson, J. A. and Owan, H. (2003), "Team Incentives and Worker Heterogeneity: An Empirical Analysis of the Impact of Teams on Productivity and Participation", *Journal of Political Economy*, vol. 111, no. 3, pp. 465-497.

Harris, R., Siegel, D. S. and Wright, M. (2005), "Assessing the Impact of Management Buyouts on Economic Efficiency: Plant-Level Evidence From the United Kingdom", *The Review of Economics and Statistics*, vol. 87, no. 1, pp. 148-153.

Heel, J. and Kehoe, C. (2005), "Why Some Private Equity Firms do Better than Others", *The McKinsey Quarterly*, no. 1, pp. 24-26.

Hodkinson, P. (2013), "Job creation or job destruction. Which is it?", Financial News, Avialable at: http://www.efinancialnews.com/story/2013-04-04/job-creation-or-job-destruction-which-is-it [Last Accessed: 19 May 2014]

Ilmakunnas, P., Maliranta, M. and Vainiomäki, J. (2004), "The Roles of Employer and Employee Characteristics for Plant Productivity", *Journal of Productivity Analysis*, vol. 21, no. 3, pp. 249-276.

Jensen, M. C. (1986), "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers", *The American Economic Review*, vol. 76, no. 2, pp. 323-329.

Jensen, M. C. (1989), "Eclipse of the Public Corporation", *Harvard Business Review*, vol. 67, no. 5, pp. 61-74.

Jensen, M. C., Burkhardt, W. and Barry, B. (1990), *"Wisconsin Central Ltd. Railroad and Berkshire Partners (A): Leveraged Buyouts and Financial Distress"*, Harvard Business School Case no. 9-190-062.

Kaplan, S. N. (1989a), "The Effects of Management Buyouts on Operating Performance and Value", *Journal of Financial Economics*, vol. 24, no. 2, pp. 217-254.

Kaplan, S. N. (1989b) "Management Buyouts: Evidence on Taxes as a Source of Value," *The Journal of Finance*, vol. 44, no. 3, pp. 611-632.

Kaplan, S. N. and Strömberg, P. (2009), "Leveraged Buyouts and Private Equity", *The Journal of Economic Perspectives*, vol. 23, no. 1, pp. 121-146.

Katayama, H., Lu, S. and Tybout, J. R. (2009), "Firm-level Productivity Studies: Illusions and a Solution", *International Journal of Industrial Organization*, vol. 27, no. 3, pp. 403-413.

Lazear, E. P. (2000), "Performance Pay and Productivity", *The American Economic Review*, vol. 90, no. 5, pp. 1346–61.

Lebow, D. and Rudd, J. (2003), "Measurement Error in the Consumer Price Index. Where Do We Stand?" *Journal of Economic Literature*, vol. 41, no. 1, pp. 159–201.

Levinsohn, J. and Petrin, A. (2003), "Estimating Production Functions Using Inputs to Control for Unobservables", *Review of Economic Studies*, vol. 70, no. 2, pp. 317-341.

Lichtenberg, F. R. and Siegel, D. (1990), "The Effects of Leveraged Buyouts on Productivity and Related Aspects of Firm Behavior", *Journal of Financial Economics*, vol. 27, no. 1, pp. 165-194.

Luehrman, T. (1992), *"Kaiser Steel Corporation, 1987"*, Harvard Business School Case no. 293-019.

Luehrman, T. (2007), *"The Hertz Corporation (A)"*, Harvard Business School Case no. 208-030.

Maroto-Sánchez, A. (2012), "Productivity in the Services Sector: Conventional and Current Explanations", *The Service Industries Journal*, vol. 32, no. 5, pp. 719-746.

Marschak, J. and Andrews, W. H.(1944), "Random Simultaneous Equations and the Theory of Production", *Econometrica*, vol. 12, no. 3-4, pp. 143-205.

McGukin, R. and Stiroh, K. (2001), "Do Computers Make Output Harder to Measure?" *The Journal of Technology Transfer*, vol. 26, no. 4, pp. 295–321.

McLaughlin, D. H. and Tukey, J. W. (1963), "Less Vulnerable Confidence and Significance Procedures for Location Based on a Single Sample: Trimming/Winsorization 1", *Sankhya: The Indian Journal of Statistics, Series A*, vol. 25, no. 3, pp. 331-352.

Muscarella, C. J. and Vetsuypens, M. R. (1990), "Efficiency and Organizational Structure: A Study of Reverse LBOs," *The Journal of Finance*, vol. 45, no. 5, pp. 1389-1413.

Oi, W. (1992), "Productivity in the Distributive Trades: The Shopper and the Economics of Massed Reserves", In *Output Measurement in the Service Sectors*, pp. 161–191, University of Chicago Press.

Olley, G. S. and Pakes, A. (1996), "The Dynamics of Productivity in the Telecommunications Equipment Industry", *Econometrica*, vol. 64, no. 6, pp. 1263-1297.

Rasmussen, P. N. (2008), "Taming the Private Equity 'Locusts'", *Project Syndicate/Europe's World 8* (Spring), pp. 130-133.

Razali, N. M. and Wah, Y. B. (2011), "Power Comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests", *Journal of Statistical Modeling and Analytics*, vol. 2, no. 1, pp. 21-33.

Sbordone, A. M. (1996), "Cyclical Productivity in a Model of Labor Hoarding", *Journal of Monetary Economics*, vol. 38, no. 2, pp. 331-361.

Shleifer, A. and Summers, L. H. (1988), "Breach of Trust in Hostile Takeovers", In *Corporate Takeovers: Causes and Consequences*, pp. 33-68, University of Chicago Press.

Sichel, D. E. (1997), "The Productivity Slowdown: Is a Growing Unmeasurable Sector the Culprit?", *Review of Economics and Statistics*, vol. 79, no. 3, pp. 367–370.

Smith, A. J. (1990), "Corporate Ownership Structure and Performance: The Case of Management Buyouts", *Journal of Financial Economics*, vol. 27, no. 1, pp. 143-164.

Solow, R. M. (1957), "Technical Change and the Aggregate Production Function", *Review of Economics and Statistics,* vol. 39, pp. 312-320.

Stigler, S. M. (1973), "The Asymptotic Distribution of the Trimmed Mean", *The Annals of Statistics*, vol. 1, no. 3, pp. 472-477.

Summers, R. and Heston, A. (1988), "A New Set of International Comparisons of Real Product and Product Levels: Estimates for 130 Countries, 1950–1985", *Review of Income and Wealth*, vol. 34, no. 1, pp. 1–25.

SVCA (2012), *"Private Equity Performance Study 2012"*, SVCA, Stockholm.

Swick, R., Bathgate, D., and Horrigan, M. (2006), "Service Producer Price Indices: Past, Present and Future", Paper Presented at the 2006 NBER/CRIW Summer Institute.

Syverson, C. (2004), "Product Substitutability and Productivity Dispersion." *Review of Economics and Statistics*, vol. 86, no. 2, pp. 534–550.

Syverson, C. (2011). “What Determines Productivity?”, *Journal of Economic Literature*, vol. 49, no. 2, pp. 326-365.

Van Ark, B. (2002), “Measuring the New Economy: An International Perspective”, *Review of Income and Wealth*, vol. 48, no. 1, pp. 1–14.

Van Beveren, I. (2012), “Total Factor Productivity Estimation: A Practical Review”, *Journal of Economic Surveys*, vol. 26, no. 1, pp. 98-128.

Weber, L. (2014), “Fact Check: Does Private Equity Kill Jobs?“, *The Wall Street Journal*, Available at: http://blogs.wsj.com/atwork/2014/04/25/fact-check-does-private-equity-kill-jobs/ [Last Accessed: 19 May 2014]

Wedervang, F. (1965), *“Development of a Population of Industrial Firms: the Structure of Manufacturing Industries in Norway 1930-1948”*, Universitetsforlaget, Oslo, Norway

Weir, C., Jones, P. and Wright, M. (2007), *“Public to Private Transactions, Private Equity and Performance in the UK: An Empirical Analysis of the Impact of Going Private”*, Working Paper, Nottingham University.

Wilber, S. (2001), *“Are Services Bad for Growth. Evidence from a panel of OECD economies”*, Mimeo, Georgetown University.

Wilber, S. (2002), *“The Service Sector and Long-run Economic Growth”*, Mimeo, Georgetown University.

Wright, M., Hoskisson, R. E. and Busenitz, L. W. (2001), “Firm Rebirth: Buyouts as Facilitators of Strategic Growth and Entrepreneurship”, *The Academy of Management Executive*, vol. 15, no. 1, pp. 111-125.

Wruck, K. (1991), “What Really Went Wrong at Revco?”, *Journal of Applied Corporate Finance*, vol. 4, no. 2, pp. 79-92.

EXHIBIT 23. TARGET AND PEER GROUP DESCRIPTIVE STATISTICS

	Target Data at Buyout Year				Peer Group Data at Buyout Year												
	No. of	Real	Real	Real	No. of	No. of Employees			Real Sales			Real COGS			Real Capital		
Target	Employees	Sales	COGS	Capital	Peers	Max.	Min.	Average	Max.	Min.	Average	Max.	Min.	Average	Max.	Min.	Average
Actic	145	183,657	–	40,992	20	390	10	94	506,883	10,997	119,090	13,763	–	3,290	73,386	3,849	22,263
Ahlsell	4,077	14,761,182	11,150,193	441,435	20	764	32	215	4,284,473	189,433	873,920	3,393,674	106,564	680,295	128,916	606	24,713
Aleris	2,479	1,689,513	–	146,200	12	631	3	120	389,175	21,651	121,516	49,828	–	15,637	49,785	72	13,438
Alignment Systems	307	321,611	118,629	53,072	13	421	22	143	1,053,931	88,403	328,897	707,681	18,190	192,088	62,778	980	23,052
Annas Pepparkakor	51	124,376	46,633	37,371	20	520	9	101	946,708	11,349	189,061	352,674	1,165	79,255	276,708	1,196	63,237
Anticimex	909	1,242,983	66,680	95,745	20	326	3	41	395,727	10,046	46,343	334,615	–	28,085	25,101	345	4,225
AP&T	317	419,456	348,333	96,586	16	173	1	34	358,434	14,248	62,775	102,883	1,464	27,337	46,260	206	6,680
Ariterm	190	217,426	92,358	21,050	20	118	1	28	220,979	9,491	56,944	121,748	2,906	31,842	13,782	63	3,596
Atos Medical	176	322,125	107,442	19,565	20	19,143	7	1,076	14,259,135	43,478	955,154	8,915,722	–	565,463	6,165,850	600	353,854
Attendo	3,740	1,871,000	102,017	98,147	19	1,610	23	234	686,577	17,241	110,324	31,095	–	2,700	41,201	–	7,843
Bergteamet	313	623,434	198,110	65,046	19	241	2	77	175,785	109,021	138,266	150,495	–	56,812	203,162	681	29,283
Bravida	8,066	8,666,145	7,332,031	33,590	20	344	34	99	388,767	74,193	146,366	158,673	–	74,146	14,765	114	3,590
Broadcast Text International	73	72,008	–	4,242	20	148	3	34	186,585	15,686	43,433	13,518	–	1,704	3,522	33	419
BYGGmax	493	1,258,700	931,781	26,951	19	348	2	39	497,590	33,831	96,575	320,566	24,079	70,402	43,559	560	5,946
Cloetta/ Leaf	404	882,464	5,442	145,853	5	111	4	32	329,724	10,131	72,530	2,829	26	482	58,586	307	12,166
Com Hem	581	2,843,325	1,163,746	1,770,959	20	6,768	6	513	31,413,706	45,928	3,138,141	24,284,120	–	1,860,075	2,227,416	40	297,469
COOR	1,898	2,461,690	2,047,259	68,589	20	67	4	27	103,076	16,224	43,272	1,041	–	208	1,770	–	1,159
Coromatic	140	772,709	493,649	15,778	20	538	22	165	14,643,352	490,726	2,143,908	13,826,936	65,239	1,833,730	63,149	401	14,437
CREM International	183	266,887	144,627	14,861	20	367	44	120	511,023	89,423	222,833	385,647	47,796	147,326	110,833	1,520	23,270
CTEK	103	308,262	100,066	14,084	20	362	23	75	2,452,736	177,863	606,230	2,027,269	106,590	456,088	104,288	252	16,045
Däckia	333	557,733	316,458	55,588	19	457	6	69	814,340	16,871	119,518	468,130	8,121	71,421	137,984	141	12,157
Dynapac	1,999	3,803,316	2,940,108	267,108	5	4,251	44	358	19,251,970	76,837	1,396,271	14,592,141	25,443	1,037,788	1,179,256	519	102,219
Elfa	531	612,644	410,658	112,470	20	357	4	73	714,042	11,597	108,725	464,559	2,980	71,977	96,654	378	23,182
Eltel Networks Infranet	5,955	6,553,023	5,879,272	188,171	20	67	8	25	75,898	14,721	31,568	12,632	–	5,398	8,095	27	2,467
Emotron	161	202,359	103,782	13,322	20	109	12	43	261,266	25,985	86,574	186,206	12,813	55,633	26,140	433	6,490
Espresso House	253	137,558	41,533	30,521	20	1,027	49	217	678,622	82,772	192,238	648,671	16,742	85,764	449,491	830	45,708
eTRAVELi	74	116,675	28,981	1,650	20	151	3	33	226,653	71,456	125,206	154,634	–	35,244	2,146	10	656
EuroFlorist	95	505,087	433,822	4,297	20	109	7	28	356,520	26,795	100,570	312,732	18,933	79,668	6,021	391	2,183
Exotic Snacks	25	112,388	79,566	436	20	82	5	29	259,006	62,211	117,153	190,172	–	84,091	32,268	122	5,890
Findus	1,024	1,824,347	13,740	385,768	20	1,176	1	121	2,904,614	14,569	297,363	14,529	61	1,961	473,812	–	40,484
Finnveden Bulten	3,384	4,902,500	4,055,400	1,105,100	20	205	6	76	512,948	173,818	305,473	385,948	93,668	219,605	55,897	–	8,473
Fiskarhedenvillan	32	221,638	171,776	1,080	20	95	5	41	275,958	193,011	225,531	229,844	100,572	173,570	85,583	–	16,982
FlexLink	564	944,409	616,470	32,475	20	1,194	65	282	3,251,078	132,908	683,508	2,847,714	44,896	534,051	815,765	1,603	90,996
Frösunda Omsorg	1,941	747,134	16,797	14,112	20	2,636	138	486	632,582	59,292	146,299	150	–	10	12,509	–	2,106
Grycksbo	499	1,616,509	964,979	520,016	20	1,443	89	586	6,072,335	484,259	2,204,730	3,009,538	–	1,081,248	5,519,285	29,488	1,427,975
Hemtex	284	826,083	488,088	32,183	20	813	4	50	1,995,091	12,801	117,251	1,135,353	6,411	67,580	267,518	42	14,788
HMS Industrial Networks	88	160,305	84,492	4,685	14	15,697	4	855	78,330,848	10,013	4,213,553	40,173,028	2,579	2,240,896	549,856	97	36,491
Inflight Service	154	569,663	397,298	6,609	20	494	1	47	612,198	10,891	63,670	176,923	4,481	22,102	171,730	102	14,588
INR	41	112,227	66,613	2,861	20	599	6	141	1,008,838	34,861	244,532	788,447	14,333	166,996	229,233	86	38,375
Isaberg Rapid	1,118	822,045	550,610	122,329	20	1,495	23	207	5,502,925	48,256	524,219	2,158,502	9,857	296,900	1,655,628	1,796	123,148
JB Education	930	825,955	291,208	35,824	19	180	25	66	284,194	24,083	63,399	18,795	–	1,523	20,992	58	3,516
Jetpak	268	830,630	–	16,382	19	1,495	30	258	6,414,536	552,461	1,551,991	6,274,819	–	764,183	403,511	514	59,702

	Target Data at Buyout Year				Peer Group Data at Buyout Year												
	No. of	Real	Real	Real	No. of	No. of Employees			Real Sales			Real COGS			Real Capital		
Target	Employees	Sales	COGS	Capital	Peers	Max.	Min.	Average	Max.	Min.	Average	Max.	Min.	Average	Max.	Min.	Average
Joy Shop	197	249,101	104,491	7,541	19	271	15	134	623,815	132,984	269,319	278,638	71,929	136,832	162,074	1,628	26,166
KappAhl	2,340	3,860,300	1,732,000	562,100	12	781	10	155	1,319,267	107,070	295,461	642,004	37,741	150,947	120,079	611	21,857
Karlssons Varuhus	18	203,747	147,277	11,014	20	1,018	3	222	2,594,255	10,682	609,476	2,132,430	7,565	434,922	90,170	51	21,332
KGH Customs Services	333	209,133	–	22,765	20	334	11	55	284,710	178,598	219,437	189,651	–	32,382	43,589	404	13,833
Lekolar	228	952,087	636,899	28,205	20	3,392	19	283	6,239,044	170,597	687,344	4,852,012	107,347	498,932	883,414	678	69,932
LensOn	6	16,473	17,579	–	18	33	1	9	36,214	10,917	20,098	22,519	–	9,139	4,539	30	1,020
LGT Logistics	197	583,239	491,248	83,615	20	375	23	125	1,187,052	328,806	668,246	617,364	–	36,668	268,179	381	41,052
Medstop	827	2,677,441	2,058,848	40,549	20	5,655	5	486	25,358,326	11,384	2,069,694	20,337,974	7,102	1,635,449	397,384	–	41,274
Mölnlycke Health Care	277	3,514,959	2,439,896	19,251	18	1,441	6	336	14,331,698	779,471	2,482,798	13,997,820	481,070	1,940,070	979,043	71	156,218
MQ Retail	483	528,036	293,717	55,293	20	825	48	224	1,376,377	194,231	408,503	629,634	86,772	196,307	198,361	4,180	42,384
Myresjöhus	400	1,513,865	1,152,759	42,670	20	205	30	89	527,341	83,969	242,781	440,038	43,691	160,394	81,171	800	22,554
Närkes Elektriska	1,842	1,778,390	823,239	47,480	20	1,643	49	354	2,147,521	100,209	387,520	1,952,840	–	254,490	28,233	198	6,918
Nexus Marine	4	34,866	24,290	2,621	20	29	4	10	40,604	31,498	35,460	29,992	–	21,462	8,521	74	1,467
Nimbus	506	761,928	436,250	101,929	20	136	4	39	211,923	15,236	62,175	150,544	4,408	38,069	77,649	–	14,107
Nordic Modular Group	188	445,246	353,969	339,694	20	151	4	55	386,238	73,914	178,570	347,672	–	79,580	997,032	738	87,293
Norrwin	89	295,934	170,826	24,556	20	239	14	79	520,137	231,421	347,077	412,361	115,326	217,020	83,271	–	14,773
Norvida	21	679,245	542,969	1,456	–	46	2	18	408,442	48,901	152,210	377,854	38,201	134,418	7,421	52	2,837
NVS Installation	1,745	2,603,408	2,393,598	66,644	19	374	1	86	433,475	74,931	140,458	160,091	–	73,043	14,009	18	3,242
Pahlén	55	128,846	70,756	1,913	20	376	28	135	896,220	76,746	258,255	580,197	35,907	166,202	73,424	1,049	20,402
Pax Electroproducts	39	72,914	38,726	8,008	14	69,523	8	5,069	126,992,944	16,595	9,252,205	96,292,480	7,259	7,006,167	18,230,938	2,459	1,322,023
Permobil	506	708,254	248,803	97,949	16	127	8	52	387,772	10,344	101,175	311,961	–	65,052	33,269	536	9,186
Phadia AB (first owner)	1,130	2,064,641	990,074	646,138	20	189	4	41	640,798	9,393	120,260	279,453	2,507	62,376	181,427	52	20,831
Phadia AB (second owner)	1,206	2,169,798	814,537	687,592	20	181	4	46	608,155	16,358	143,506	247,650	2,076	63,636	209,233	391	26,324
Previa	995	830,530	–	25,341	5	349	2	58	284,883	26,131	59,364	70,685	–	6,777	18,187	25	3,056
Proxima	129	58,315	14,826	10,113	20	2,389	20	228	1,141,500	36,086	177,461	71,963	–	14,862	50,450	1,083	13,498
Pysslingen Förskolor och Skolor	1,725	743,470	54,789	49,969	19	565	28	102	178,600	22,865	41,838	5,793	–	1,056	25,370	–	2,104
Q-MATIC	178	269,542	106,863	31,282	20	771	9	83	2,038,000	17,744	171,617	1,610,000	6,313	127,656	71,000	119	9,983
Relacom	13,793	8,477,307	7,735,068	265,869	20	6,734	6	447	32,320,322	37,096	2,278,878	23,616,780	–	1,549,633	1,141,005	60	166,703
ScandBook	123	188,288	84,713	81,985	19	774	7	193	1,625,532	104,803	387,550	1,317,120	56,654	238,906	248,576	929	50,957
Securitas Direct	4,943	3,883,168	2,361,730	1,402,691	20	926	9	146	1,197,790	16,595	170,917	743,231	–	63,033	180,824	230	14,454
Semantix	80	250,033	137,722	550	20	102	3	24	161,707	12,331	33,711	21,416	–	2,732	1,933	16	371
Skandinavisk Kommunalteknik	10	82,134	45,115	543	20	54	1	22	100,842	60,479	79,765	70,260	–	55,466	84,368	–	8,207
Sydtotal	164	296,549	241,379	3,538	20	4,253	8	359	4,828,480	53,593	533,210	2,895,268	–	280,743	357,128	97	20,580
Thule	1,946	2,460,000	1,652,000	525,000	20	864	76	328	2,845,177	259,062	767,976	2,337,240	145,540	580,633	480,300	4,413	109,915
Tolerans	34	143,629	56,694	683	20	207	15	64	207,925	56,265	130,124	178,276	30,457	75,249	33,804	37	9,185
Troax	113	209,147	156,197	77,653	20	500	33	123	588,956	107,974	200,041	319,274	43,160	119,576	220,061	661	45,411
Videokonferensbolaget	31	132,561	89,044	1,266	20	384	4	67	5,235,892	72,779	899,127	4,338,272	42,928	652,115	298,158	120	17,467
Wernersson Ost	30	435,293	347,321	16,635	20	738	3	54	2,826,785	21,729	247,281	1,761,883	18,059	169,271	604,148	–	33,131

Notes: The above table presents descriptive statistics of the target companies and their respective peer groups. Values are in SEK x1,000, except for number of employees. Values are as of the acquisition year.

EXHIBIT 24. TRANSACTIONS, INDUSTRIES AND INDICES DATA

Target	Entry Year	Exit Year	NACE Code	Industry Definition	Price Index
Actic	2007	2012	93130	Fitness facilities	Service Price Index 93 + 95 - 96
Ahlsell	2006	2012	46434 &	Wholesale of electrical equipment & plumbing and heating equipment	Construction Index 132 & 151
Annas Pepparkakor	2004	2008	1072	Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes	Producer Price Index 1072
Aleris	2005	2010	8622	Specialist medical practice activities	Consumer Price Index 062
Alignment Systems	2006	2012	26510	Manufacture of instruments and appliances for measuring, testing and navigation	Producer Price Index 2651
Anticimex	2005	2012	81290	Other cleaning activities	Service Price Index 812
AP&T	2004	2009	28410	Manufacture of metal forming machinery	Producer Price Index 2841
Grycksbo	2006	2010	1712	Manufacture of paper and paperboard	Producer Price Index 1712
Ariterm	2006	2011	28210	Manufacture of ovens, furnaces and furnace burners	Producer Price Index 2821
Atos Medical	2005	2011	32501	Manufacture of medical and dental instruments and supplies	Producer Price Index 325
Attendo	2004	2006	8730	Residential care activities for the elderly and disabled	Consumer Price Index 062
Bergteamet	2009	2011	43120	Site preparation	Construction Index 11
Bravida	2007	2012	43221	Installation of heating and sanitary equipment	Construction Index 13
Broadcast Text International	2008	2013	74300	Translation and interpretation activities	Service Price Index
BYGGmax	2006	2010	47521	Retail sale of wood and other building materials in specialised stores	Producer Price Index 16
Cloetta / Leaf	2005	2012	1082	Manufacture of cocoa, chocolate and sugar confectionery	Producer Price Index 1082
Com Hem	2006	2011	61100	Wired telecommunications activities	Service Price Index 58 + 61 - 63
COOR	2005	2007	82110	Combined office administrative service activities	Service Price Index 93 + 95 - 96
Coromatic	2008	2011	46510	Wholesale of computers, computer peripheral equipment and software	Producer Price Index 26
CREM International	2008	2012	28290	Manufacture of other general-purpose machinery n.e.c.	Producer Price Index 2829
CTEK	2008	2011	46434	Wholesale of electrical equipment	Producer Price Index 26
Däckia	2009	2012	45204	Tyre service	Producer Price Index 221
Dynapac	2005	2007	28920	Manufacture of machinery for mining, quarrying and construction	Producer Price Index 2892
Elfa	2005	2008	25720	Manufacture of locks and hinges	Producer Price Index 257
Eltel Networks Infranet	2005	2007	61900	Other telecommunications activities	Service Price Index 58 + 61 - 63
Emotron	2007	2011	27110	Manufacture of electric motors, generators and transformers	Producer Price Index 2711
Espresso House	2006	2012	56100	Restaurants and mobile food service activities	Service Price Index 5500-5699
EuroFlorist	2004	2007	46220	Wholesale of flowers and plants	Producer Price Index 011
eTRAVELi	2007	2010	79110	Travel agency activities	Consumer Price Index
Exotic Snacks	2008	2011	46360	Wholesale of sugar and chocolate and sugar confectionery	Consumer Price Index 0118
Findus	2006	2008	1039	Other processing and preserving of fruit and vegetables	Producer Price Index 1039
Finnveden Bulten	2004	2011	46741	Wholesale of hardware	Construction Index 132
Fiskarhedenvillan	2007	2012	46731	Wholesale of wood and other construction materials	Producer Price Index 16
FlexLink	2005	2011	28220	Manufacture of lifting and handling equipment	Producer Price Index 2822
Frösunda Omsorg	2007	2010	8810	Social work activities without accommodation for the elderly and disabled	Consumer Price Index 062
Hemtex	2004	2007	4753	Retail sale of carpets, rugs, wall and floor coverings and home furnishing textiles in specialised stores	Consumer Price Index 052
HMS Industrial Networks	2004	2007	26300	Manufacture of communication equipment	Producer Price Index 26
Inflight Service	2005	2010	47999	Retail sale not in stores, stalls or markets n.e.c.	Consumer Price Index
INR	2007	2010	231	Manufacture of glass and glass products	Producer Price Index 231
Isaberg Rapid	2007	2009	25730	Manufacture of tools	Producer Price Index 257
JB Education	2008	2013	85311	General secondary education	Swedish: *Riksprislistan**
Jetpak	2006	2012	52290	Other transportation support activities	Service Price Index 5229

Target	Entry Year	Exit Year	NACE Code	Industry Definition	Price Index
Joy Shop	2006	2009	4771	Retail sale of clothing in specialised stores	Consumer Price Index 031 & 032
KappAhl	2004	2006	4771	Retail sale of clothing in specialised stores	Consumer Price Index 031 & 032
Karlssons Varuhus	2006	2010	47199	Other retail sale in non-specialised stores n.e.c.	Consumer Price Index
KGH Customs Services	2007	2013	52290	Other transportation support activities	Service Price Index 5229
Lekolar	2005	2007	46499	Wholesale of other household goods n.e.c.	Consumer Price Index 053
LensOn	2006	2012	4791	Retail sale via mail order houses or via Internet	Consumer Price Index
LGT Logistics	2005	2009	52290	Other transportation support activities	Service Price Index 5229
Medstop	2010	2013	47730	Dispensing chemist	Consumer Price Index 061
Mölnlycke Health Care	2005	2007	46460	Wholesale of pharmaceutical goods	Consumer Price Index 062
MQ Retail	2006	2010	4771	Retail sale of clothing in specialised stores	Consumer Price Index 031 & 032
Myresjöhus	2005	2007	16231	Manufacture of prefabricated wooden buildings	Producer Price Index 162
Närkes Elektriska	2006	2010	43210	Electrical installation	Construction Index 15
Nexus Marine	2006	2008	46521	Wholesale of electronic components	Producer Price Index 26
Nimbus	2006	2012	30120	Building of pleasure and sporting boats	Producer Price Index 301
Nordic Modular Group	2005	2007	77390	Renting and leasing of other machinery, equipment and tangible goods n.e.c.	Service Price Index 773
Norrwin	2007	2012	46420	Wholesale of clothing and footwear	Consumer Price Index 031 & 032
Norvida	2006	2012	46320	Wholesale of meat and meat products	Producer Price Index 0112
NVS Installation	2006	2008	43221	Installation of heating and sanitary equipment	Construction Index 13
Pahlén	2008	2012	28250	Manufacture of non-domestic cooling and ventilation equipment	Producer Price Index 2825
Pax Electroproducts	2005	2013	27510	Manufacture of electric domestic appliances	Producer Price Index 275
Permobil	2006	2013	30920	Manufacture of bicycles and invalid carriages	Producer Price Index 30
Phadia AB (first owner)	2004	2006	20590	Manufacture of other chemical products n.e.c.	Producer Price Index 2059
Phadia AB (second owner)	2007	2011	20590	Manufacture of other chemical products n.e.c.	Producer Price Index 2059
Previa	2004	2007	86212	Other general medical practice activities	Consumer Price Index 062
Proxima	2007	2011	8622	Specialist medical practice activities	Consumer Price Index 062
Pysslingen Förskolor och Skolor	2009	2011	85100	Pre-primary education	Service Price Index 127
Q-MATIC	2004	2007	27900	Manufacture of other electrical equipment	Producer Price Index 279
Relacom	2005	2011	61100	Wired telecommunications activities	Service Price Index 58 + 61 - 63
ScandBook	2006	2010	18122	Book printing and other printing	Producer Price Index 1700-1899
Securitas Direct	2008	2011	80200	Security systems service activities	Service Price Index 80
Semantix	2006	2009	74300	Translation and interpretation activities	Service Price Index
Skandinavisk Kommunalteknik	2008	2011	46742	Wholesale of plumbing and heating equipment	Construction Index 132
Sydtotal	2007	2011	43222	Installation of ventilation equipment	Construction Index 13
Thule	2004	2007	29320	Manufacture of other parts and accessories for motor vehicles	Producer Price Index 293
Tolerans	2006	2012	28990	Manufacture of other special-purpose machinery n.e.c.	Producer Price Index 2899
Troax	2010	2013	25110	Manufacture of metal structures and parts of structures	Producer Price Index 2511
Videokonferensbolaget	2007	2011	46432	Wholesale of radio, television and video equipment	Producer Price Index 26
Wernersson Ost	2004	2007	46330	Wholesale of dairy products, eggs and edible oils and fats	Producer Price Index 1051

Notes: The above table shows the taget firms, the years of acquisitions and divestments, the chosen NACE codes, the industry definitions as defined by Statistics Sweden and the selected price indices
* The index related to the industy NACE code 8531, Secondary Education, where the nationwide price list of yearly contributions (Swedish: Riksprislistan) per pupil distributed by the State to private schools is used as a proxy for price developments.