THE EVOLUTION OF SWEDISH PRIVATE EQUITY PORTFOLIO COMPANIES

AN ACCOUNTING-BASED PERFORMANCE AND VALUATION APPROACH

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Abstract:

This study provides a comprehensive overview of operating and financial performance, bankruptcy risk, and accounting conservatism in 95 Swedish portfolio companies acquired by Private Equity (PE) firms between 2001 and 2015. It further investigates whether equity value is created on a Swedish portfolio company level. Contrary to a large body of research, evidence suggests that operating profit margins and returns decrease, sales growth matures, and operating leverage declines significantly from pre-holding to holding period. Similar to previous studies, financial leverage doubles and remains sticky over the holding period. At the same time, bankruptcy risk in portfolio companies increased after the buyout, and there is no evidence of a systematic shift in accounting conservatism or release of hidden reserves under PE ownership. Moreover, PE firms seem to select companies with better operating business prospects, more leeway in the capital structure, and lower bankruptcy risk, but their performance trends towards non-PE-owned companies over the holding period. Using a novel Residual Income Valuation-based approach shows that not more or less equity value is created or destroyed in portfolio companies than in a comparable Swedish market portfolio.

Keywords:

Private Equity, Portfolio company, Residual Income Valuation, Performance, Accounting Conservatism

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1. Introduction

In 2020, Private Equity (PE) transactions made up 16% of global M&A value, and despite the COVID-related dip at the beginning of the year, an enormous surge in PE activity ensued in the second half of 2020 (Bain & Company, 2021). Consistently, industry professionals expect total Private Equity deal volume to pick up again in 2021, driven by deferred investments (Bain & Company, 2021; Skornas & Bautista Suarez, 2021). Considering that global investable capital has increased two- to four-fold in private equity funds since 2010, there is no reason to believe that growth in PE is coming to a halt (Bain & Company, 2021, Figure 12). Especially in the Nordics, capital raised climbed by over 55% year-on-year in 2020 (Mondesir & Patel, 2021). In particular, the Swedish market is the second largest proportionally to GDP and among the oldest in Europe (Copenhagen Economics, 2020). In addition, since 2007, more than 270,000 employees have worked in Swedish PE-owned companies, presenting around 7.5% of Swedish private employees (Naess-Schmidt, Heeboll, & Karlsson, 2017). Private Equity investments and PE-owned companies are therefore an essential part of the Swedish economy and society. Furthermore, a large body of academic research is focussed on PE fund returns and the ownership model partly because of Private Equity as an institutionalised, alternative asset class to public equities. However, it should be of at least equal interest to focus on performance and value creation in the underlying operating companies (portfolio companies) invested in. Receiving detailed knowledge about that would be relevant for various practitioners, such as investors and managers in PE funds, employees in portfolio companies, regulators, and strategic acquirers.

Considering the massive impact and magnitude of the PE industry in Sweden, this study ventures into a new field of PE research by providing a comprehensive picture of performance and value creation in firms under PE ownership. The study is based purely on accounting data and uses a novel approach by applying the Residual Income Valuation Model by Skogsvik (2002) to assess the portfolio companies' fair values. Therefore, opening a new field for discussions around whether PE firms create value in their Swedish portfolio companies. Hence, this study addresses two questions. First, how do operating and financial performance, accounting conservatism, and bankruptcy risk evolve in Swedish portfolio companies? Second, do PE firms create equity value on a Swedish portfolio company level?

Prior literature found ample evidence that portfolio companies exhibit superior operational performance to non-PE-owned peers driving equity value (Døskeland & Strömberg, 2018; Kaplan & Strömberg, 2009). Furthermore, although the size of leverage in PE transactions decreased since the 1980s (Guo, Hotchkiss, & Song, 2011), leverage is still a key component and remains high over the holding period (Cohn, Mills, & Towery, 2014; Kaplan, 1989b). Therefore, prior research focused on tax benefits, the disciplining function of debt, and favourable financing terms under PE ownership to

explain financial value creation (Ivashina & Kovner, 2011; Jensen, 1986; Kaplan, 1989b; Myers, 2001). In addition, previous studies suggest that PE-owned companies do not go bankrupt or come under financial distress more often than non-PE-owned peers (Strömberg, Hotchkiss, & Smith, 2011; Wilson & Wright, 2013). Nonetheless, PE owners seem to increase bankruptcy risk from previously comparatively low levels (Tykvová & Borell, 2012). Lastly, Swedish firms have a history of conservative accounting, which is still present under IFRS (Ball, Robin, & Sadka, 2008; Hellman, 2008, 2011). Moreover, PE-owned firms account more conservatively than non-PE-owned peers (Katz, 2009). Accounting conservatism can be quantified by the permanent measurement bias and integrated into the Residual Income Valuation model (Runsten, 1998; Skogsvik, 1998).

Nevertheless, previous research usually discusses different types of performance and value creation under PE ownership without considering bankruptcy risk. Furthermore, no extensive evidence exists on whether accounting conservatism noticeably shifts under PE ownership and whether this has any value impact. In addition, operating and financial performance, as well as value creation under PE ownership, were, to the best of our knowledge, rarely considered in an exclusively Swedish context before.

Contrary to previous research, this study presents evidence on decreasing operating margins, returns and risk, as well as sales growth. Those findings are paired with expected significant increases in financial liabilities in Swedish portfolio companies. The cost of debt under PE ownership is not lower than in comparable companies. Moreover, portfolio companies have a generally low but significantly higher 1-year probability of failure after the buyout. While no systematic inferences on changing levels of accounting conservatism under PE ownership can be made, this study shows that its consideration in the form of item-specific permanent measurement biases should not be understated in a private firm and PE context. Further, evidence suggests that PE firms select those portfolio companies with superior operating performance and financial characteristics before the holding period. Yet, superior performance in terms of operating profit margins, operating returns, growth in sales, and return on equity seems to regress towards industry levels over the holding period. Finally, from a portfolio company perspective, there is not more or less equity value created or destroyed in PE-owned companies than in a comparable Swedish market portfolio after the year 2000.

This study starts with a review of relevant literature about portfolio companies followed by an investigation of current research gaps and the two research questions (section 2). Section 3 contains the research design, data collection and sampling process, as well as definitions and explanations on the performance and value creation variables. Subsequently, those are analysed in section 4, which comprises a description of the findings and presents the test results. Finally, these results are discussed (section 5) and concluded (section 6).

2. Literature Review

In general, PE funds use a mix of equity and debt to purchase private companies or take public ones private. As active investors, they hold these portfolio companies for around five to six years and are deeply engaged in strategy and operations to sell them at a higher value afterwards. Whereas the equity portion comes from the fund, debt is usually provided by banks or high-yield investors.[1] The terms PE-backed firms, PE-owned firms, and portfolio companies are used interchangeably in the subsequent sections. These terms refer to the underlying operating firms PE funds invest in and exclude holding companies in this study.

Previous research investigates the performance and value effects in portfolio companies from different perspectives. While the amount of evidence in each differs, studies suggest the following about PE-owned companies.

2.1. Operational Value Creation

Generally, portfolio companies seem to exhibit significantly higher operating performance in comparison to non-PE-backed peers in their respective industries (Døskeland & Strömberg, 2018; Kaplan & Strömberg, 2009). Yet, the interpretation and measurement of operating performance differ.

Kaplan (1989a) shows that management buyouts (MBO) in the 1980s increased operating income before depreciation and net of industry changes by 24%, by the third year into the holding period. And as a ratio of sales by about 20% in the first three holding years. The author further finds significant capital expenditure reductions. Guo et al. (2011) follow Kaplan (1989a) methodologically and confirm increased operating performance over the holding period for public to private buyouts in the 1990s and early 2000s. For French deals in a similar time period, Boucly, Sraer, and Thesmar (2011) also identify higher operating profit margins as well as growth in capital employed and capital expenditures under Private Equity ownership. Bergström, Grubb, and Jonsson (2007) find complementary results for a Swedish set of portfolio companies exited between 1998 and 2006. They show that the industry-adjusted EBITDA margin (i.e., a pro-forma version of operating income) and return on invested capital (ROIC) are fitting measures to assess the impact of buyouts on portfolio companies' operating performance. In contrast, Cohn et al. (2014) did not identify significantly superior performance in operating income to sales terms (operating profit margin) around the event date and during the holding period compared to pre-buyout levels. Instead, they argue that high or low pre-buyout operating performance reverts to the industry mean during the initial years in the holding period

[1] For a detailed explanation of the private equity ownership model and market, please refer to Døskeland and Strömberg (2018).

(Cohn et al., 2014). Except for Kaplan (1989a) and Cohn et al. (2014), these studies further find significantly higher growth in sales.

Other literature presents further factors that explain the higher operating performance levels. These factors include highly capable Private Equity managers and PE-specific governance characteristics (Acharya, Gottschalg, Hahn, & Kehoe, 2013; Kaplan & Strömberg, 2009).

Furthermore, it is not only important whether operating performance in margin, return, or growth terms increases under PE ownership but also whether it contributes to firm and equity value. Kaplan (1989a) finds some correlation between the higher operating performance and the return to pre-buyout shareholder plus post-buyout total investor of 77% (pre- and post-total capital return) as well as the return to pre-buyout shareholders of 37% (pre-buyout equity return). In line with this, Guo et al. (2011) state that operating performance improvements explain 22.9% (18.5%) of the multi-year return to pre- and (post-)buyout total capital return of 72.5% (40.9%). The authors further advance Kaplan (1989a) by estimating the value impact over a longer time frame into the holding period. Achleitner, Braun, Engel, Figge, and Tappeiner (2010) suggest that EBITDA growth and a free cash flow effect account for 46% of total equity money multiple return.

In reference to the discussed papers, it remains inconclusive whether value creation through higher operating performance relies predominantly on efficiency-related approaches, such as margin improvement and capital expenditure reduction, or growth-oriented approaches. Nonetheless, it seems to be the case that modern Private Equity has moved away from reducing investments, making short-term value-focused decisions, or generating equity returns at the expense of other stakeholders, as suggested by earlier research in the 1980s and 1990s (Døskeland & Strömberg, 2018). What is more, Gompers, Kaplan, and Mukharlyamov (2016) confirm the importance of operating performance improvements as part of the Private Equity investment approach in a survey among Private Equity investors.

2.2. Financial Value Creation

One particular characteristic of Private Equity transactions is the magnitude of leverage used in buyouts, which indirectly facilitates financial value creation. Hence, theories of financial value creation are further elaborated below and relate to three main drivers: tax benefits, disciplining function of debt, and lower cost of debt.

By nature, Private Equity firms use a mix of debt and equity instruments to buy out a company. In PE transactions, leverage usually amounts to 60 to 90% in terms of total capital invested and is around three times as high as before the buyout (Guo et al., 2011; Kaplan & Strömberg, 2009). However, Guo et al. (2011) also discover that the size of leverage used in buyouts decreased since the 1980s. In addition, contrary to the idea that

Private Equity owners use excess cash flow to pay down the majority of debt, evidence suggests that debt levels are sticky over the holding period and represent 70-80% of initial buyout debt even after three years into the buyout (Kaplan, 1989b). Kaplan (1989b) believes this is because Private Equity firms continue profiting from the associated tax benefits by keeping leverage at an optimal level. Additionally, Cohn et al. (2014) confirm these discoveries for a sample of firms from the mid-90s to mid-00s in which even firms with high excess free cash flows do not decrease the leverage level after the buyout.

Consistent with Modigliani and Miller's (1963) corrected version of their general capital structure theory, Myers (2001) states that taxes matter in determining the optimal debt-equity mix based on trade-off theory. According to the trade-off theory, leverage increases equity value by creating a tax benefit (tax shield) that outweighs the increased risk of financial distress (Myers, 2001). In regards to this theory, Kaplan (1989b) identifies two sources of reducing pre-tax income in PE-owned companies, thus realising tax benefits originating from balance sheet adjustments. First, using high amounts of debt to increase absolute interest expenses. Second, stepping up assets to increase respective depreciation. He further states that these firms pay close to no taxes in the holding period.

As a second determinant of an optimal capital structure, Myers (2001) refers to agency costs (free-cash-flow theory), an idea originating from Jensen (1986). According to Jensen (1986), debt, which limits available cash flows through associated principal and interest payments, has a disciplining function in the corporate context. It restricts management from using available cash flows for negative net present value investments and motivates it to use the remaining funds more efficiently. As a case in point, Jensen (1986, 1999) sees debt and its disciplining function as an integral part of the Private Equity ownership and governance model. As mentioned above, Guo et al. (2011) interpret this debt function as a driver of operating performance and thus indirectly explain operational value creation.

In contrast to Kaplan (1989b), Axelson, Jenkinson, Strömberg, and Weisbach (2013) find for worldwide buyouts from 1980 to 2008 that leverage levels are driven by time-series effects in debt markets rather than by firm characteristics focused on in traditional capital structure theory. This is supported by Demiroglu and James (2010), who relate Private Equity fund reputation to buyout financing structure by market timing in debt markets. Nonetheless, Gompers et al. (2016) explain that optimal trade-off and market timing are equally important in determining the magnitude of leverage in Private Equity buyouts.

Therefore, irrespective of the determinant of high leverage levels in PE-buyouts, literature suggests that leverage contributes to shareholder value in the Private Equity setting. Yet, it is unclear whether it accrues to pre- or post-buyout shareholders (Kaplan, 1989b). Kaplan (1989b) mentions that tax benefits of debt explain 21 to 143% of the premium paid to pre-buyout shareholders but that post-buyout shareholders are those who realise the tax benefits. This likely decreases the latter's return. Furthermore, Guo et al. (2011)

attribute 34% (44.5%) of the 72.5% (40.9%) realised returns to pre-(post-)buyout capital to the tax shield effect. Additionally, Achleitner et al. (2010) state that leverage generates a third of the return to PE sponsors.

Ivashina and Kovner (2011) present the third source of financial value creation. That is, Private Equity firms are able to receive better loan spreads than stand-alone operating companies, thus decreasing the company's cost of debt. This is a consequence of their superior and long-term relationship with banks. Moreover, Demiroglu and James (2010) show that the reduction in loan spreads is especially observable for reputable Private Equity firms. Ivashina and Kovner (2011) further state that the decrease in cost of debt has an equity return impact of 4 to 9% to the Private Equity funds. In addition, Kaplan and Strömberg (2009) hypothesise that PE firms create or shift value by borrowing more when cost of debt in comparison to cost of equity is relatively low, thus exploiting an arbitrage opportunity in debt and equity markets.

2.3. Bankruptcy Risk in Portfolio Companies

Previous research presents evidence that 5 to 7% of PE-backed portfolio companies experienced financial distress or entered a formal or informal bankruptcy proceeding at some point during the holding period. For samples of UK and international portfolio companies acquired between the mid-1990s to 2010, the bankruptcy rate among PE-backed companies amounts to 5% (Strömberg et al., 2011; Wilson & Wright, 2013). Including earlier buyouts from the 1970s to 2007, Kaplan and Strömberg (2009) find a financial distress rate of 6 to 7%, which 'assuming an average holding period of six years, works out to an annual default rate of 1.2 percent'.

Moreover, while observed bankruptcy rates for non-PE-backed companies in these papers are usually slightly lower, the authors agree that this difference is not significant. Strömberg et al. (2011) state that PE-owned companies are not significantly more likely to default on loans or experience subsequent financial distress than non-PE-backed companies – not even those with comparatively high levels of financial debt. This is even more pronounced after the PE holding period when exited PE-owned companies exhibit the lowest bankruptcy rates. Wilson and Wright (2013) confirm this notion and only find significantly higher bankruptcy rates for PE-backed buy than non-PE-backed buyouts prior to 2003. Lastly, controlling for buyout and firm characteristics as well as economic factors, Tykvová and Borell (2012) also do not find a significant relationship between a buyout indicator variable and actual bankruptcy rates.

In addition, when PE-owned firms become distressed, research largely agrees that they can, together with their Private Equity owners, manage distress risk and insolvency proceedings better and are mostly able to turn around the company. Confirming Jensen (1989), Strömberg et al. (2011) show that PE-owned firms restructure more often and faster out of court and exit these companies as viable entities.

Going beyond an investigation of actual bankruptcy rates, Tykvová and Borell (2012) apply and validate a selection of accounting-ratio-based bankruptcy prediction models. They show for primary PE transactions that bankruptcy risk increases significantly under PE ownership when comparing it in the first three years to pre-buyout levels. Tykvová and Borell (2012) also present that the bankruptcy risk does not exceed that for a sample of non-PE-owned control firms after three years into the buyout. One interpretation is that distress risk aligns with that of peers under PE ownership. This is consistent with the authors' findings that PE managers select companies with comparably low bankruptcy risk in the pre-buyout period. Wilson and Wright (2013) complement this by finding that PE firms select portfolio companies with higher cash flows and profits, as well as lower Debt-to-Total Asset ratios compared to non-PE-owned firms.

Nonetheless, views differ on whether capital structure ratios can truly be associated with a certain risk of financial distress. Early research suggests that Debt-to-Total Capital and Interest Coverage Ratios indicate financial distress in (highly) levered buyout transactions (Andrade & Kaplan, 1998; Kaplan & Stein, 1993). Conversely, Wilson and Wright (2013) find that while leverage in Total Debt to Total Assets terms is associated with increased insolvency risk for the entire sample of companies, this is explicitly not the case for the sample of PE-backed buyout insolvencies.

The actual effect of bankruptcy risk on PE portfolio company valuations and firm- or equity-capital returns has not been discussed extensively in prior literature. Generally, a company with higher bankruptcy risk should have a higher cost of capital, negatively impacting its firm and equity value. Andrade and Kaplan (1998) find that the benefits of leverage in highly levered transactions that became distressed in the 1980s still outweigh the cost of distress on a total capital return basis. However, there is an unequal division of pre- and post-buyout capital returns. Pre-buyout total capital generates significantly positive market- and industry-adjusted returns (8-12%). Post-buyout total capital and equity capital, i.e. Private Equity owners, earn significantly negative returns of -23 to -19% and -48 to -57% respectively over the holding period. The authors further associate roughly 10 to 20% of initial firm value to financial distress cost. In addition, using four different indicators, Strömberg et al. (2011) conclude that financial distress is less costly for PE-owned firms than comparable peers.

2.4. Value Creation and Effects of Accounting Conservatism

Swedish firms have an underlying tradition of conservative valuation of balance sheet items which was eased by the hard implementation of IFRS in 2005 (Hellman, 2011).[2] However, Hellman (2008) also describes that even if the IASB and FASB see conservatism as a non-desirable accounting practice, room for temporary conservatism exists under IFRS. From a balance sheet perspective, conservative accounting describes

[2] This is generally not the case for real estate companies who tend to value buildings at fair value.

underestimating the book values of net assets compared to their fair value (Hellman, 2008; Penman, 2013). It comprises, for example, earlier expensing of activities, such as R&D investments and advertising, earlier loss recognition, later gain recognition, and accelerated depreciation (Penman, 2013; Runsten, 1998).

Using an income statement-based approach, Ball and Shivakumar (2005) identify timely loss recognition as an indicator for conservatism in private firms from the UK. Furthermore, Katz (2009) examined timely loss recognition in a sample of US PE-owned firms from 1978 to 2005 that performed an IPO. He finds that PE-owned companies account more conservatively during the holding period than non-PE-owned peers. Concurrently, Ball et al. (2008) and Hellman (2011) signal the importance of considering conservatism in a Swedish PE context since Scandinavian firms have significantly higher levels of timely loss recognition and a tradition of conservatism.

Penman (2013) conceptualises the effect of conservative accounting on forward-looking accounting ratios and earnings in residual income valuation. In this context, conservative accounting leads to higher current expenses that depress current earnings but lead to higher future earnings. Hence, these expenses build up hidden profit reserves, especially in periods with growing investments, that are released in subsequent periods by slowing down the rate of investment (Penman, 2013; Penman & Zhang, 2002). Likewise, ratios, such as RONA or ROCE, appear higher in the future because future earnings are less depressed (nominator), and the asset base (denominator) increases by a slower rate (Penman, 2013). In addition, Penman and Zhang (2002) find that the market does not identify conservatism until reserves are liquidated.

However, Penman (2013) argues that only real economic profits create economic value. In other words, accounting profits do not impact economic value. This is because Residual Income Valuation models include the book value and forecasted residual earnings, whereby opposing accounting effects on both items offset each other when a steady state is predicted. Contrary to that, Runsten (1998) associates a permanent value difference between market and book value of equity to accounting conservatism. However, this permanent value difference is rather an accounting than economic value effect.

Specifically, Runsten (1998) conceptualises the permanent measurement bias (PMB) of certain assets and liabilities in Swedish public firms to ultimately explain the spread between the biased and unbiased book value of equity. This can be seen as an approach to account for the hidden reserves. Runsten's (1998) approach originates from the finding that different balance sheet items are treated differently under accounting methods. Hence, to identify changes in economic value, one has to adjust valuation models for these conservative accounting effects. In contrast to Penman (2013), Skogsvik (1998) considers the measurement bias ('cost matching bias') as an explicit component in Residual Income Valuation.

2.5. Research Gap and Research Question

Aside from the studies in the prior four sections, a large range of research focusses on Private Equity as an asset class. It mainly considers returns to the respective fund as well as limited partners and compares those to public equities or other asset classes to make a statement on superior Private Equity performance. Prominent empirical measures include internal rates of return on equity, multiple on invested capital (MOIC), and the public-market-equivalent (PME).[3] While still focussing on equity value, there is a need to investigate performance and value creation under PE ownership from a portfolio company rather than a PE fund centred perspective.

The literature review also shows that contemporary Private Equity research discusses value creation under financial sponsor ownership predominantly from an operational and financial perspective. This justifies the use of accounting-based performance and value measures but operating and financial value creation are often examined separately. Furthermore, research usually discusses different types of performance and value creation under PE ownership without considering bankruptcy risk. However, bankruptcy risk is especially important in the PE context to assess whether value is created (cf. section 2.3).

While research in operational and financial value creation by Private Equity firms is relatively mature by now, there is no extensive evidence on whether accounting behaviour becomes more conservative, liberal, or stagnates under PE ownership. Yet, it is important to examine whether there is a noticeable shift in accounting practices in portfolio companies over the PE holding period and whether this has any value impact. As noted by Katz (2009), the lack of research on private, and especially PE-owned, companies' accounting practices is likely due to the scarcity of publicly available financial information for private firms in many countries. Further, it is an interesting and relevant consideration given that an explicit connection between public equity values and an accounting measurement bias has already been made (Runsten, 1998). Nonetheless, this connection has not been investigated for PE-owned companies yet. More, owners of those may be interested in benefitting from undervalued assets, managing asset values over the holding period, or realising hidden reserves.

Hence, there is a need to study holistic performance and value creation on a portfolio company level while considering the influence of accounting practices. This is only feasible for private companies in countries such as Sweden, where financial accounting

[3] MOIC is usually calculated by dividing the sum of exit value and cash payouts during the holding period by the initial investment amount. It is a gross return on investment figure that does not consider the time value of money. Most PME specifications try to infer an alpha by comparing returns from an investment in a PE fund or portfolio to returns that could have been obtained in a public market portfolio (cf. Gredil, Griffiths, & Stucke, 2014). Based on the fair value of fund contributions, distributions and its net asset, the PME of Kaplan and Schoar (2005), KS-PME, seeks to indicate ‚how much wealthier […] an investor has become at time n by investing in the PE portfolio instead of a reference benchmark' Gredil et al. (2014). The concept may also be applied to the cash flows of individual transactions.

information is widely available. In Sweden, public and private limited companies (‘aktiebolag’), among others, must file an annual report with the Swedish Companies Registration Office (CRO, ‘bolagsverket’) including mandatory financial and non-financial information (Bolagsverket, 2021). What is more, performance and value creation have rarely been considered in an exclusively Swedish context before.

Therefore, based on the identified research gaps as well as theoretical and empirical findings presented in sections 2.1-4, two research questions arise and will be answered in this study. The first research question is:

RQ1: *How do operating and financial performance, accounting conservatism, and bankruptcy risk evolve in Swedish portfolio companies?*

By answering this research question, a comprehensive picture will be provided to examine Swedish PE-owned companies' operational and financial performance while investigating their bankruptcy risk and shift in accounting conservatism over the holding period. After providing the performance analysis, it is relevant to study whether value creation occurs on portfolio company level. This leads to the second research question:

RQ2: *Do PE firms create equity value on a Swedish portfolio company level?*

The findings from both research questions combined present a new perspective on performance and value creation under PE ownership in the Swedish context considering a comprehensive set of pure accounting-based metrics. Therefore, opening a new field for discussions around whether PE firms create value in their portfolio companies in Sweden.

3. Methodology

3.1. Research Design

To answer the two research questions, this study examines 95 Swedish PE-owned companies which were acquired between 2001 and 2015. The panel data set with firm-year observations is limited to primary PE transactions, thus excluding deals with prior financial sponsor ownership, to eliminate distortion from prior PE ownership. To each of the 95 PE-owned companies, non-PE-owned control firms have been matched. Furthermore, the performance and value creation assessment in the PE-owned and control firms follow a pure accounting-based approach.

The analytical time horizon is presented by event years (Figure 1). This means the effective year of the buyout is considered as event year $t \pm 0$. Hence, $t \pm 0$ determines the pre-holding and holding period, represented by $t-5,\ t-4,\ t-3,\ t-2,\ t-1$ and $t+1,\ t+2,\ t+3,\ t+4,\ t+5$, respectively. For some variables, $t-2$ and $t+4$ are chosen as representative points in time to analyse characteristics of the portfolio companies before (pre-holding) and after the majority of time under PE ownership (holding). The pre-holding year $t-2$ is chosen since accounting data in $t-1$ and $t \pm 0$ is likely distorted by acquisition effects expressed by relatively high outliers in performance metrics in $t-1$. Therefore $t-2$ provides the cleanest picture of the firms prior to PE ownership. For similar reasons, the holding year $t+4$ is chosen as it is the last year before the exit year $t+5$ for most companies in the sample.

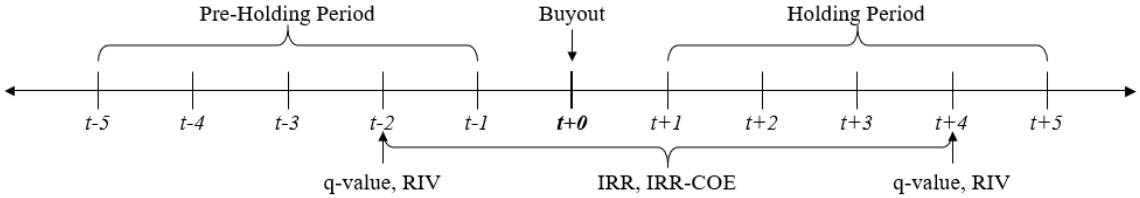

Figure 1 presents the timeline of this study to visualise which event years determine the buyout year, pre-holding period, and holding period. Furthermore, it shows for which event years the q-value, Residual Income Valuation model (RIV), and internal rate of return (IRR) are estimated (more detailed elaboration below). $t+3$ is the year in which q-value and RIV value were estimated for firms exited before $t+4$ and after $t+2$.

Figure 1. Timeline of reference periods and points of methodology components

In order to answer how operating and financial performance, accounting conservatism, and bankruptcy risk evolve in Swedish portfolio companies, the study examines four different areas affecting a portfolio company's performance. Accordingly, nine operating and eight financial accounting ratios are determined for the portfolio companies and control firms based on contemporary research to interpret their respective performance over the event years. Furthermore, to consider bankruptcy risk, the individual portfolio and control firm's 1-year probability of failure is estimated for each event year following the multivariate prediction model by Skogsvik (1990). Industry-adjusted ones extend

those 18 variables to adjust portfolio companies' performance metrics for industry trends and examine their performance compared to non-PE-backed peers. The conservatism and hidden reserves introduced in section 2.4 are proxied by Runsten's (1998) permanent measurement biases (PMB) and estimated according to the specifications by Skogsvik (2020) and Lembke and Lundberg (2020). The development of those PMBs indicates a shifting level of accounting conservatism and hidden reserves. After a characterisation of their developments over the event period, the variables in the four areas are tested applying a two-sided Wilcoxon rank sum test (Wilcoxon test). This test is used to assess whether they change significantly between the pre-holding and holding period. The Wilcoxon test is preferred to the t-test due to the highly significant Shapiro-Wilk test results rejecting the null hypothesis that the data is normally distributed.

To investigate whether Swedish PE firms create equity value on a portfolio company level, three steps were followed to compute a return spread between a hypothetical equity return in portfolio companies and a required market return. First, the Residual Income Valuation Model (RIV) by Skogsvik (2002) is used to provide accounting-information based fair value of equity estimates for the total sample of firms at event year $t-2$ and $t+4$. It further accounts for estimated accounting biases as well as firm-specific probability of failures. Second, the internal rate of return (IRR) inherent in the estimated RIV values is calculated as a proxy for equity value creation between the pre-holding and holding period. Third, Fama and French's (1993) (Fama-French model) allowed for an estimation of industry-peer-based required returns. The difference between the firm-specific IRR and the probability of failure adjusted, Fama-French model implied cost of equity depicts equity value creation by stating over- or underperformance as a positive or negative spread. Finally, the two-sided Wilcoxon rank sum test examines whether this spread varies significantly between the portfolio company and control sample. Ultimately, three robustness tests are performed to check whether certain assumptions result in the same findings if altered. For further motivations of individual methodology components, please see the respective following sections.

3.2. Data Set

3.2.1. Portfolio Company Sample Selection

The panel data for the study's portfolio company sample originates from two sources. First, Thomson Reuter's SDC Platinum database, which provides information about M&A and Private Equity transactions. Second, the Serrano database collecting and processing historical financial information for Swedish companies. SDC Platinum is used to identify Private Equity buyouts of Swedish companies and gather transaction details. Those identified target firms are combined with their respective yearly financial data using the Serrano database.

The SDC Platinum database initially provided *820* Private Equity buyouts with the following characteristics: (i) the target companies were incorporated in Sweden, (ii) the deals were executed between 1997 and 2019, and (iii) the acquirer is a Private Equity firm. Those deals are narrowed down to the years 2001 until 2015 in order to have sufficient financial accounting data available in the Serrano database pre- and post-buyout. Furthermore, to compare the data across the pre-holding and holding period without distortion of prior ownership, secondary Private Equity deals – deals where the seller is a financial sponsor – are excluded. The study, therefore, focuses on primary Private Equity deals to identify performance and value effects from primary PE ownership. In addition, the portfolio company sample only consists of completed deals for which majority ownership by the Private Equity firm was present or unknown. Hence, minority ownership is not considered since the minority owner's influence on value creation is expected to be more limited. Because of restricted public information, some deals' ownership percentage remains unknown. However, the potential of wrongfully including minority-owned firms is small since PE firms usually acquire majority stakes, wherefore the effect can be neglected.

Excluded from the portfolio company sample are also companies, which changed their incorporation during the observed time period from Sweden to another country or have undergone an extensive reorganisation because of, for instance, a merger of multiple companies under PE ownership. Furthermore, state-owned companies, real estate companies, and financial companies are not included in the portfolio sample because of their different financial statement structure and approach to value creation.[4]

The effective deal dates originating from the SDC Platinum database determine the study's time horizon. This means the year of the effective deal date is considered as the event year $t \pm 0$ and determines the pre-holding and holding period. The effective date is complimented with an exit date on deal-level obtained by manual research of public information. Research has shown that PE firms have an average holding period of 6 years, which is consistent with the average holding period of 5.5 years in the portfolio company sample (cf. Kaplan & Strömberg, 2009). In case PE-owned companies were exited before $t + 5$, the years following the exit date are omitted to prevent deformation of the holding period's value development due to new ownership.[5]

The prior observed deals are combined with the Serrano database providing annualised financial accounting data for the years 1997 to 2019 based on data from the Swedish Companies Registration Office ('Bolagsverket'), Statistics Sweden (SCB), Swedish Company Registration Office, and Bisnode's group register.[6] Therefore, the final

[4] Financial companies have an SIC code of 6000-6799 or Serrano code of 40

[5] Partial exits are not tracked by this study because of limited data availability.

[6] The database offers comparable calendar year observations per corporate ID (Weidenman, 2016). The match of the two databases is performed based on SDC Platinum's company names and the corresponding company ID ('organisationsnummer') in Serrano. Company names are matched to company IDs using

portfolio company sample consists of *95* Swedish PE-owned companies, corresponding to *963* firm-year observations.

3.2.2. Control Group Selection

The control sample to the portfolio companies is generated using Propensity Score Matching (PSM), whereby Serrano is used to construct a set of firm-year observation candidates to perform the matching on.

Downsizing the raw Serrano database with 12 million firm-year observations is necessary since it is too extensive, imbalanced, and includes irrelevant legacy firm data to perform the PSM viably. All firm observations are dropped if the company ID has ever been associated with the following characteristics proxied by available Serrano variables. First, if the company has gone inactive. Second, if the company is a financial or real estate company as well as when the industry is not identifiable. Third, similar to the portfolio companies, state-owned or other financial sponsor-owned companies are excluded. These criteria, but especially excluding inactive firms, decreased the size of the database by roughly two-thirds.

Furthermore, firm-year observations that meet the following criteria are excluded to not risk matching them to the respective portfolio company firm-year observation. First, observations are omitted when input variables to the operational and financial ratios are missing. This ensures a high degree of data availability in matched firms. Second, firms with a total asset size outside the minimum and maximum of the portfolio companies' are also ignored. Third, at least 11 firm-year observations, matching the length of the event period, for the remaining company IDs are required. This is necessary to not match a firm with a small amount of panel data and exclude all firms for which, due to the downsizing process, an imbalanced or incomplete panel of firm-year observations remained. Finally, the resulting set on which the matching would be performed encompasses *992,531* firm-year observations corresponding to *59,083* unique firms.

The PSM process follows Veenman (2019) and is performed based on the calendar year, industry classification, and total asset size of the portfolio company in event year $t-2$. Furthermore, it is a $k=5$ nearest neighbour (5NN) match to create a diverse set of control firms per industry classification and to represent the possibility of different developments of those peer firms after the calendar year corresponding to the $t-2$ event year. That results in a joint portfolio company and control sample of 9,725 firm-year observations. Further dropping firm-year observations outside the event period and after the PE exit

Retriever. If no unique company ID is observable for the target, for example in cases where single divisions were bought out by PE firms, the deal is disregarded. Furthermore, the selected target firms need sufficient financial reports for the prior determined event period of $t-5$ until $t+5$. Additionally, the Serrano database tracks whether a company is active or not, which is used to exclude inactive companies.

year leads to a final sample of *8,811* firm-year observations. This corresponds to *393* matched control firms to the *95* portfolio companies.[7]

3.2.3. Sample Characteristics

The panel data of 488 unique firms (8,811 firm-year observations) comprises ten distinct industries, excluding the Finance & Real Estate and Materials sector (cf. 3.2.1). Table 1 presents the split of firms between industries for the portfolio company and control sample, respectively. It shows that more than 50% of the portfolio company sample observations are allocated in the Industrial Goods and Shopping Goods sector, which could introduce a bias towards those industries. The control sample column, however, indicates that the matched peers follow the same industry distribution.

Table 1. Industry distribution of firms in portfolio company and control sample

	Portfolio Company (N=95)	**Control (N=393)**	**Overall (N=488)**
Industry			
Industrial Goods	25 (26.3%)	76 (19.3%)	101 (20.7%)
Shopping Goods	23 (24.2%)	104 (26.5%)	127 (26.0%)
Corporate Services	13 (13.7%)	53 (13.5%)	66 (13.5%)
Health & Education	10 (10.5%)	42 (10.7%)	52 (10.7%)
IT & Electronics	6 (6.3%)	27 (6.9%)	33 (6.8%)
Construction Industry	5 (5.3%)	27 (6.9%)	32 (6.6%)
Telecom & Media	5 (5.3%)	17 (4.3%)	22 (4.5%)
Convenience Goods	4 (4.2%)	20 (5.1%)	24 (4.9%)
Energy & Environment	1 (1.1%)	10 (2.5%)	11 (2.3%)
Other	3 (3.2%)	16 (4.1%)	19 (3.9%)
Materials	0 (0%)	1 (0.3%)	1 (0.2%)
Finance & Real Estate	0 (0%)	0 (0%)	0 (0%)

Table 1 shows the industry distribution of firms in absolute numbers and percentages of the respective sample. The control sample includes one unique firm in the industry 'Materials' because its industry affiliation has changed over time. Industry 'Other' includes firms with the Serrano code 98 (Other).

A similar pattern between portfolio and control firms is observable in Table 2. Table 2 presents the number of firm-year observations in the portfolio company and control sample by total asset size in SEK. These follow the same distribution except for small companies. Portfolio companies have an average total asset size of 171.7m SEK, whereas the overall sample has a median of 161.1m SEK. This different distribution of firm-year observations for smaller companies may introduce limitations in comparing smaller firms across the two samples.

[7] The number of matched firms is not a mere multiple of 95 as Veenman's (2019) STATA PSM process requires replacement for $k\ nearest\ neighbours > 1$

Table 2. Firm-year observation distribution of firm size in portfolio and control sample

	Portfolio Company (N=963)	Control (N=7848)	Overall (N=8811)
Total Asset Size (SEK)			
<5m	33 (3.4%)	1386 (17.7%)	1419 (16.1%)
5m - 50m	288 (29.9%)	2390 (30.5%)	2678 (30.4%)
50m - 100m	190 (19.7%)	876 (11.2%)	1066 (12.1%)
100m - 250m	261 (27.1%)	1627 (20.7%)	1888 (21.4%)
250m - 500m	114 (11.8%)	874 (11.1%)	988 (11.2%)
500m - 750m	42 (4.4%)	423 (5.4%)	465 (5.3%)
750m - 1bn	24 (2.5%)	160 (2.0%)	184 (2.1%)
1bn - 5bn	10 (1.0%)	109 (1.4%)	119 (1.4%)
>5bn	0 (0%)	2 (0.0%)	2 (0.0%)

Table 2 clusters the firms in the portfolio and control sample by their firm size in terms of total assets (in SEK). It shows the distribution of firm-year observations in absolute numbers and percentages for the respective samples.

3.3. Variables

3.3.1. Operational and Financial Ratios

Before elaborating on their definition, certain principles that hold for all the operating and financial accounting ratios need to be established. Generally, all ratios are constructed on a capital employed basis (Figure 2). Thereby the focus is on the financial sources that can be priced and are needed to run the company's operations. From an asset perspective, capital employed still includes financial assets such as associated companies and equity investments, assuming they are part of the operating business. Also, when necessary, income statement figures are redefined to ensure consistency with the capital employed concept. For example, operating income includes financial income as financial assets are part of capital employed.

Simplified Balance Sheet

Fixed Assets	Equity
	Financial Liabilities
Current Assets	Deferred Tax
	Non-interest bearing Liabilities

Capital Employed Approach

Capital Employed	Equity
	Financial Liabilities
	Deferred Tax
	Non-interest bearing Liabilities

Figure 2 depicts a generalised restatement of a simplified balance sheet and one in capital employed terms. Capital employed is determined by assets less operating liabilities or equity plus financial liabilities vice versa. Operating liabilities in this context refer to deferred taxes and non-interest-bearing liabilities.

Figure 2. Comparison of a simplified balance sheet with capital employed balance sheet

Furthermore, for ratios that consist of an income statement (period of time) and balance sheet (point in time) component, the latter, most often the denominator, is measured as the average (ø) of beginning and ending period values. This approach ensures consistency across time and accounts for significant growth in the balance sheet items. This is especially relevant in the case at hand as some portfolio companies may grow strongly under PE ownership. Lastly, given the study's general portfolio company focus and the fact that non-controlling interest (NCI) is not explicitly stated in the database, the entity theory is followed, wherefore NCI is assumed to be part of equity.

All operational and financial ratios presented below are winsorised at the 5^{th}/ 95^{th} percentile to reduce the effect of outliers. The winsorisation is performed differently for the portfolio company and control sample. On the one hand, the portfolio company sample ratios are winsorised per event year. On the other hand, the control sample ratios are winsorised per calendar year. Furthermore, NAs and other error types occurring because of missing values and division by zero are not imputed to keep the data as original as possible. However, precautions for negative input variables in the denominator are implemented to ensure logically consistent ratios.

Operating ratios

Table 3 contains the ratios that represent different forms of operating performance of a firm. These are chosen based on the research discussed in section 2.1 and their capability to depict different components and forms of a company's operational performance.

Table 3. Definitions of operating performance ratios

Variable	Name	Definition
OPM	Operating profit margin	$\frac{Operating\ Income\ (EBIT)_{i,t}}{Sales_{i,t}}$
ATO	Asset turnover	$\frac{Sales_{it}}{\emptyset\ Capital\ Employed_{i,t,t-1}}$
ROCE	Return on capital employed	$OPM_{i,t} \times ATO_{i,t}$
AR_WC	Accounts receivables ratio	$\frac{\emptyset\ Accounts\ Receivables_{i,t,t-1}}{Sales_{i,t}}$
INV_WC	Inventory ratio	$\frac{\emptyset\ Inventory_{i,t,t-1}}{COGS_{i,t}}$
AP_WC	Accounts payable ratio	$\frac{\emptyset\ Accounts\ Payables_{i,t,t-1}}{(COGS_{i,t} + \Delta Inventory_{i.t})}$
CH_SALES	Change in sales	$\frac{\Delta Sales_{i,t}}{Sales_{i,t}}$

Variable	Name	Definition
CMR	Contribution margin ratio	$\frac{Sales_{i,t} - VC_{i,t} + Other\ Op.Inc._{i,t} + Fin.Inc._{i,t}}{Sales_{i,t}}$
OLE_II	Operating leverage	$CMR_{i,t} \times ATO_{i,t}$

Table 3 depicts the individual operating ratios that were calculated for each portfolio and control firm-year observation. COGS refers to cost of goods sold and VC to variable costs. ROCE is considered on a pre-tax basis, given that all firms face the same tax regime. Indices: $i = company\ i, t = year\ t$

First, return on capital employed (ROCE) is an operating return metric that focuses on the business as a whole and its ability to generate economic returns to the totality of capital providers whose claim may be quantified. These are equity and financial debt holders. It excludes items such as supplier financing, which are part of operating liabilities. From an asset perspective, this measure describes the return generation capability of the operating business. Moreover, it can be broken down into an operating profit margin (OPM) and asset turnover (ATO) component. The former is an operating profitability measure of the firm, whereas the latter may be seen as an indicator for asset efficiency, or from a liability perspective, as total capital efficiency. In comparison to a return on operating net assets measure (Penman, 2013), ROCE includes excess cash and other financial assets that are part of the operating business. This is a more reasonable measure as the identification of excess cash, especially in PE-owned companies, is not easily done. Additionally, since PE firms often have a clear plan to change the business's operations and establish efficient cash management, one would not expect their portfolio companies to hold cash or financial assets that are not part of the new business plan.

Second, three standard working capital ratios relating to accounts receivables, inventory, and accounts payables are considered. Together, they make up common definitions of a firm's cash cycle, that is the ability to convert claims against customers and responsibilities vis-à-vis vendors into cash. There are many possible explanations why working capital ratios may be different in portfolio companies. One is that PE owners seek to manage cash to make early debt repayment, partially fund growth initiatives internally, or make early pay-outs.

Third, the change in ROCE can be broken down into the product of change in sales and operating leverage. The latter is then the product of the contribution margin ratio and the asset turnover. In this concept, operating risk is the variability in the change in ROCE over a given set of years and is thus determined by the interplay between sales and operating leverage. On the one hand, if sales do not fluctuate heavily, a high operating leverage from a high contribution margin ratio (low variable cost) or high asset turnover is not problematic. In other words, operating risk can still be limited if stable sales are paired with low variable costs or those sales are generated by a comparatively low amount of assets. On the other hand, if sales fluctuate heavily, high operating leverage will lead to high volatility in ROCE over the years. Hence, operations in ROCE terms are risky. In

case of fluctuating sales, operating risk can still be limited if the company has a low contribution margin ratio or a high capital employed base. That is, low operating leverage decreases the impact of fluctuating sales on the change in ROCE. In the case of portfolio companies, one may expect PE owners to want operating risk to decrease during the holding period. Yet, add-on acquisitions or radical operational restructurings can lead to ambivalent outcomes in this metric. In any case, an investigation of operating risk in the context of operating performance and value creation is necessary. This is because, from a portfolio company perspective, creating operating value while increasing operating risk at similar proportions is not in the long-term interest of the company.

Financial Ratios

Table 4 gives an overview of the financial ratios, including their corresponding formulas. A more detailed explanation of the financial ratios is presented below.

Table 4. Definitions of financial performance ratios

Variable	Name	Definition
FIN_LEV	Financial leverage	$\frac{Financial\ Liabilities_{i,t}}{Equity_{i,t}}$
EQ_RATIO	Equity ratio	$\frac{Equity_{i,t}}{Capital\ Employed_{i,t}}$
FIN_LIAB_RATIO	Financial liabilities ratio	$\frac{Financial\ Liabilities_{i,t}}{Capital\ Employed_{i,t}}$
FIN_LIAB_PCT	Financial liabilities percentage	$\frac{Financial\ Liabilities_{i,t}}{Total\ Liabilities_{i,t}}$
TAX_COST	Tax cost	$\frac{Tax\ Expenses_{i,t}}{Profit\ /\ Loss\ before\ Taxes_{i,t}}$
COD	Cost of debt	$\frac{Financial\ Expenses_{i,t}}{\emptyset\ Financial\ Liabilities_{i,t,t-1}}$
QUICK_RATIO	Quick ratio	$\frac{Cash_{it} + ST\ Investments_{i,t} + Acc.Receiv._{i,t}}{Current\ Liabilities_{i,t}}$
ROE	Return on equity	$ROCE_{i,t} + (ROCE_{i,t} - COD_{i,t}) \times \emptyset\ Financial\ Leverage_{i,t,t-1}$

Table 4 depicts the individual financial ratios that were calculated for each portfolio and control firm-year observation. ROE is considered on a pre-tax basis, given all firms face the same tax regime. Indices: $i = company\ i, t = year\ t$

The financial leverage ratio is used to assess the firm's capitalisation by comparing financial liabilities to the book value of equity. Financial liabilities consist of only financial debt, thus excluding operating liabilities, such as accounts payable, to ensure consistency with the capital employed concept. Financial leverage should be considered in this context because it is part of the PE ownership model to increase it. Moreover, in the ROE breakdown, financial leverage is a gearing of the spread between ROCE and

cost of debt. This means financial leverage amplifies the positive (negative) return on equity effect of the positive (negative) spread between the operating return and debt financing. It further increases the volatility of such equity returns, making them riskier.

The equity ratio of a firm shows the portion of capital employed financed by book value of equity. This is important to consider because PE firms tend to perform buyouts with high levels of debt financing, thus decreasing the portion of equity financing. In general, higher equity ratios are presumed to decrease bankruptcy risk. The financial liabilities ratio mirrors the equity ratio, wherefore the contrary arguments made for the equity ratio apply to the financial liabilities ratio.

A firm's financial liabilities percentage depicts the proportion of total liabilities financed by financial liabilities rather than non-interest-bearing liabilities and deferred taxes. This ratio is relevant in a PE context to observe the change in interest-bearing to non-interest-bearing liabilities. It indicates the degree to which financial financing displaces other forms of financing and types of liabilities.

The tax cost is determined by dividing tax expenses by the profit or loss before taxes. It is a measure of the effective tax rate of the portfolio companies. If a firm incurred losses before taxes, this ratio is assumed to be not applicable.

From a company perspective, the cost of debt represents the cost associated with taking on financial liabilities.[8] As part of the DuPont ROE composition, it describes the costs associated with generating a certain ROCE. This ratio consists of total financial expenses of the firm and its average financial liabilities in a period. Examining the cost of debt is of interest because of a more diverse debt mix in portfolio companies. Furthermore, cost of debt may significantly change under PE ownership (Ivashina & Kovner, 2011).

The quick ratio, a measure of liquidity, compares available short-term cash and cash-like assets with short-term liabilities. Inventory is excluded because of its limited possibility to convert it into cash immediately when needed. However, accounts receivables are included because of consistency with the specifications by Penman (2013) and Berk and DeMarzo (2017). Consequently, the higher the quick ratio, the greater the liquidity and the coverage of short-term obligations, thus the less risky the firm in the short-term. Liquidity is important to consider in the PE context because of two reasons. First, PE companies usually focus on managing cash flows so that the increased debt burden from the buyout can be repaid and interest costs can be covered. Second, liquidity directly impacts the portfolio company's ability to cover its short-term financial obligations, thus implying the company's risk to miss the mandatory repayment of those, trigger debt covenants, or go into distress.

[8] In the specification in Table 4 and from an investors point of view, it resembles a promised yield on bonds, loans, and other forms of financial liabilities.

Consistent with the focus on capital employed, rather than the more stringent ONA, a DuPont-like approach for decomposing ROE is chosen. In essence, it shows whether the portfolio company's ROE is primarily driven by operating improvements (ROCE) or changes in the capital structure (financial leverage) and cost (COD). Generally, the ROE becomes riskier the smaller the return spread and the higher the leverage. As a widely applied performance indicator, ROE is a tool to measure returns to equity providers from a company perspective. While ROE is a suitable measure for shareholder returns at the portfolio company level, it should not be confused with cash-based PE fund returns.

3.3.2. Industry-adjusted Ratios

The operational and financial ratios are calculated for the portfolio companies per event year. Albeit their magnitude and development are of interest, changes in these ratios can be caused by trends in the underlying industries. In order to control for these industry trends, industry-adjusted ratios are determined for all operational and financial ratios of portfolio companies. Those industry-adjusted ratios are calculated by subtracting the industry-year specific median ratio of the control group from the portfolio company's operating and financial ratio (1.0). In other words, the median of all the control firms in a given industry and year are deducted from the same ratio of a particular portfolio company in the same industry and year.

$$Industry\ adjusted\ Ratio_{i,t} = Ratio_{i,t} - Median(Ratio)_{IND,CY} \qquad (1.0)$$

where
$\mathrm{Ratio}_{i,t}$ = operating or financial ratio of portfolio company i in event year t
$\mathrm{Median(Ratio)}_{IND,CY}$
= Control group median of the ratio in industry IND and calendar year CY

This means the control sample provides the industry-adjusted medians to control for changes in industry conditions.[9] Consequently, the industry-adjusted ratio displays the spread between the portfolio company's ratio and year-specific industry median. These ratios are winsorised according to the same methodology presented in 3.3.1.

3.3.3. Bankruptcy Prediction

The multivariate prediction model for Swedish firms from Skogsvik (1990) is used to assess probabilities of failure in the portfolio company and control sample. The bankruptcy prediction model is based on accounting data, making it applicable to Swedish private firms. Furthermore, the model was initially developed for Swedish industrial companies with an average total asset size of USD 23 million (Skogsvik, 1990). Consistent with the model, Table 2 shows that the average total asset size of the portfolio

[9] The industry code for matching those ratios originates from the Serrano data set and is based on the Swedish SNI07 Industry classification.

company sample is about SEK 171.7 million (USD 19.7 million[10]) and companies with the Serrano industry code for Industrial Goods and Construction make up 31% of the total sample. However, a limitation of the model is its original estimation on a sample comprising data from 1966 to 1980. The data in this study is from a more recent period.

The forecast horizon is set to one year because of the yearly assessment of the probability of failure and increasing prediction errors with time. The accounting ratios and estimated probit model coefficients used in the bankruptcy prediction are presented in Table 5.

Table 5. Multivariate bankruptcy prediction by Skogsvik (1990)– Accounting ratios and estimated probit model coefficients for a 1-year prediction horizon

Accounting ratios	**Definition**	**Estimated probit model coefficients**
Constant		-1.5
ROA	$\frac{Earnings\ before\ Taxes\ and\ Interest\ Cost_{i,t}}{\emptyset\ Total\ Assets_{i,t,t-1}}$	-4.3
COL	$\frac{Interest\ cost_{i,t}}{\emptyset\ Total\ Liabilities_{i,t,t-1}}$	+22.6
TIV	$\frac{\emptyset\ Inventory_{i,t,t-1}}{Sales\ Revenue_{i,t}}$	+1.6
ER	$\frac{Equity_{i,t}}{Total\ Assets_{i,t}}$	-4.5
E’	$\frac{\Delta Equity_{i,t}}{Equity_{i,t}}$	+0.2

Table 5 shows the accounting ratios and their formulas as well as the corresponding estimated probit model coefficients from the Skogsvik (1990) bankruptcy prediction model used to estimate the probability of failure for the portfolio and control sample on a yearly basis. The normalised difference between the value of COL is disregarded because of its values close to 0 and the small estimated coefficient of -0.1. Indices: $i = company\ i, t = year\ t$

Plugging firm-specific accounting ratios from Table 5 in the estimated probit model generates a failure index value V (2.0).

$$V_{i,t} = -1.5 - 4.3 \times ROA_{i,t} + 22.6 \times COL_{i,t} + 1.6 \times TIV_{i,t} - 4.5 \times ER_{i,t} + 0.2 \times E'_{i,t} \quad (2.0)$$

where
$V_{i,t}$ = failure index value V for company i in year t

Assuming a normal distribution of V, the V index value is then transformed using the *Z* table to infer a 1-year probability of failure (PROB_FAIL1). No further unbiased estimates of the probability of failure are calculated since the focus was on probability of failures over time. Moreover, portfolio company and control samples are equally biased

[10] USD/SEK exchange rate on 30th March 2021

concerning actual bankruptcy rates. Similar to the operational and financial ratios, industry-adjusted probabilities of failure are provided (cf. 3.3.2).

3.3.4. Permanent Measurement Bias and Q-Value

As discussed in section 2.4, Skogsvik (1998) and Runsten (1998) argue that conservative accounting causes an accounting measurement bias due to discrepancies between matching revenues and costs in the reported financial statements. Under a steady-state and going concern assumption, this measurement bias remains constant over time. In order to estimate the permanent measurement bias (PMB) in PE-owned companies, the following approach presented by Skogsvik (2020) and Lembke and Lundberg (2020) is applied. Consequently, four areas with significant PMBs – Depreciable assets, Research & Development, Inventory, and Deferred Income Tax Liabilities – are identified. In general, the difference between the unbiased (biased) and biased (unbiased) asset (liability) value is described as the PMB. The ratio of this PMB to equity is then referred to as the q-value.

Necessary information for estimating the PMBs is manually gathered from the income statements, balance sheets, and notes of the respective portfolio companies. The estimations are performed in calendar years corresponding to event year $t-2$ (pre-holding) and $t+4$ (during holding). Hence, they are seen as representative points in time for the pre-holding and holding periods.[11] If a company was sold before $t+4$, the prior year ($t+3$) is chosen as representative for the holding period.

Certain assumptions are required in order to estimate the partial PMBs. The Swedish corporate tax rate used in calculations is available on a yearly basis from 1990 to 2020 (FX Empire, 2020). Swedish Production Price Indices (PPI) provided by SCB (2021) proxy the changes in price levels for the different industries in the sample (Appendix 2).

Depreciable assets

Long-lived depreciable assets (DA) contain the asset classes (*k*) buildings & land (B&L) as well as machinery & equipment (M&E) and are usually valued at historical cost. Therefore, the magnitude of each asset's permanent measurement bias is a function of its economic life and age. It is further influenced by the respective asset's ownership period and change in industry production prices over this period. Other tangible fixed assets, such as construction in process, are excluded from the estimations due to their close valuation to fair value and no or unregular depreciation patterns. Consequently, contrary to M&E and B&L, no significant PMB will originate from those balance sheet items. The unbiased value for the DA is estimated according to the following process from Lembke and Lundberg (2020).

[11] An estimation for all event years would be beyond the scope of this work.

$$Economic\ Life_{DA_{i,k,t}} = \frac{Accumulated\ acquisition\ cost_{i,k,t}}{Depreciation_{i,k,t}} \quad (3.0)$$

$$Age_{DA_{i,k,t}} = Life_{DA_{i,k,t}} - Life_{DA_{i,k,t}} \times \left(\frac{Asset^{B}_{i,k,t}}{Accumulated\ acquisition\ cost_{i,k,t}}\right) \quad (3.1)$$

$$Asset^{UB}_{i,k,t} = Asset^{B}_{i,k,t} \times \frac{Price\ index_{IND,t}}{Price\ index_{IND,t-Age}} \quad (3.2)$$

where
$\text{Economic Life}_{\text{DA}_{\text{i,k,t}}}$ = est. economic life of asset class k for company i in year t
$\text{Age}_{\text{i,k,t}}$ = estimated age of asset class k for company i in year t
$\text{Asset}^{\text{B}}_{\text{i,k,t}}$ = carrying value of asset class k for company i in year t
$\text{Asset}^{\text{UB}}_{\text{i,k,t}}$ = estimated unbiased value of asset class k for company i in year t
$\text{Price index}_{\text{IND,t}}$ = price index for industry IND in year t

The PMB estimation for DA is further adjusted by the deferred tax liability component (DTL) because of its non-tax-deductible surplus value (equation 3.3 – 3.6).

$$Remaining\ Life_{DA_{i,k,t}}(RL) = Economic\ Life_{i,k,t} - Age_{i,k,t} \quad (3.3)$$

$$r_{d_{i,t}} = \frac{Financial\ Expenses_{i,t}}{\emptyset\ Financial\ Liabilities_{i,t}} \quad (3.4)$$

$$DTL\ Component_{DA_{i,k,t}} = \sum_{t=1}^{RL} \frac{\frac{Surplus_{DA_{i,k,t}}}{RL_{i,k,t}} \times Tax\ Rate_{i,t}}{\left(1 + r_{d_{i,t}}\right)^{RL_{i,k,t}}} \quad (3.5)$$

where
$\text{RL}_{\text{i,k,t}}$ = remaining life of asset class k in company i in year t
$\text{Surplus}_{\text{DA}_{\text{i,k,t}}}$ = difference between $\text{Asset}^{\text{UB}}_{\text{i,k,t}}$ and $\text{Asset}^{\text{B}}_{\text{i,k,t}}$

$$Net\ Asset^{UB}_{DA_{i,k,t}} = Asset^{UB}_{DA_{i,k,t}} - DTLComponent_{DA_{i,k,t}} \quad (3.6)$$

$$Q_{DA_{i,k,t}} = \frac{Net\ Asset^{UB}_{DA_{i,k,t}} - Asset^{B}_{DA_{i,k,t}}}{Equity_{i,t}} \quad (3.7)$$

where
$\text{Q}_{\text{DA}_{\text{i,k,t}}}$ = Depr. asset bias of asset class k for firm i in year t as a portion of equity

The total q-value associated with depreciable assets is then a sum of the q-value associated with buildings & land and machinery & equipment (equation 3.7a)

$$Q_{DA_{i,t}} = Q_{DA_{i,B\&L,t}} + Q_{DA_{i,M\&E,t}} \quad (3.7a)$$

Research and Development

According to Runsten (1998), directly expensed intangible assets, such as research and development (R&D), carry a sizeable permanent measurement bias. This is because R&D costs can be seen as an investment, similar to M&E, which may generate future revenue for the company. However, R&D is under common accounting standards usually expensed rather than capitalised and depreciated over its useful life. In order to estimate the PMB for R&D, Skogsvik (2020)approach is followed. Similar to Runsten (1998), it is expected that R&D investments have an extended useful life. Therefore, nine years of useful life were assumed for pharmaceutical and five years for all other companies. Hence, yearly R&D expenses will be capitalised, depreciated over time, and multiplied by the product of the corresponding changes in price indices (equation 4.0). The PMB for R&D is the surplus between the unbiased and biased asset adjusted by the deferred tax liability component (cf. equation 4.1).

$$Deprecitation\ Factor_{RD_{i,t}} = \frac{Useful\ Life_{i,t} - Years\ since\ investment_{i,t}}{Useful\ Life_{i,t}} \quad (3.8)$$

$$Growth_{RD_{i,t}} = \prod_{t=z}^{t} \left(1 + \Delta\ Price\ index_{IND,t}\right) \quad (3.9)$$

where
$z =$ number of years since initial investment in R&D for company i
Δ Price $\text{index}_{\text{IND,t}}$
$=$ change in the price index for industry IND over year t and $t-1$

$$Asset_{RD}{}_{i,t}^{UB} = \sum_{t=1}^{n} R\&D\ Expense_{i,t} \times\ Depreciation\ Factor_{i,t} \times Growth_{RD_{i,t}} \quad (4.0)$$

where
$n =$ useful life of R&D for company i in year t

$$Q_{RD_{i,t}} = \frac{Net\ Asset_{RD}{}_{i,t}^{UB} - Asset_{RD}{}_{i,t}^{B}}{Equity_{i,t}} \quad (4.1)$$

where
Net $\text{Asset}_{\text{RD}}{}_{\text{i,t}}^{\text{UB}}$ are calculated in the same way as for DA (cf. equation 3.5, 3.6)

Inventory

Inventory is split into raw materials, work in progress, and finished goods, all of which are recognised on the balance sheet at cost. However, for a company to create value, inventory needs to be sold with a margin. According to this logic, finished goods already experienced alteration bringing them closer to the final selling price. Yet, they are still reported at the, presumably lower, cost of acquisition. This creates the conservative bias inherent in inventory. To a lesser degree, the same applies to work in progress. Hence,

the markup attributes by half to the change in value for work in progress and in full to finished goods (equation 4.3).

$$Markup_{i,t} = \frac{Revenue_{i,t} - COGS_{i,t} - SG\&A_{i,t}}{COGS_{i,t}} \tag{4.2}$$

$$Inventory_{i,t}^{UB} = Raw\ Materials_{i,t}^{B} + Work\ in\ progress_{i,t}^{B} \times \left(1 + \frac{Markup_{i,t}}{2}\right) + Finished\ Goods_{i,t}^{B} \times \left(1 + Markup_{i,t}\right) \tag{4.3}$$

$$Q_{INV_{i,t}} = \frac{Inventory_{i,t}^{UB} - Inventory_{i,t}{}^{B}}{Equity_{i,t}} \tag{4.4}$$

where

$\text{Markup}_{\text{i,t}}$ = gross profit markup of COGS for company i in year t

Deferred Income Tax Liabilities

Another significant PMB originates from deferred income tax liabilities (DITL) caused by deferring the recognition of net income and associated tax payments. Under Swedish tax law, firms are allowed to build allowances 'tax allocation reserve' ('periodiseringsfond'), which must be reversed within six years (Business Sweden, 2020). These tax allocation reserves do not carry any interest costs (Runsten, 1998). Hence, contrary to the PMBs presented before, this leads to overstating liabilities rather than understating asset book values.

$$Liability_{i,DITL,t}^{UB} = \sum_{t=1}^{T} \frac{\frac{Liability_{i,DITL,t}^{B}}{Deferred\ time}}{\left(1 + r_{d_{i,t}}\right)^{t}} \tag{4.5}$$

$$Q_{DITL_{i,t}} = \frac{Liability_{i,DITL,t}^{B} - Liability_{i,DITL,t}^{UB}}{Equity_{i,t}} \tag{4.6}$$

where

$\text{Liability}^{\text{B}}_{\text{i,DITL,t}}$ = tax allocation reserve for company i in year t

Deferred time = years net income may be deferred (assumption: ∅ of 0 and 6 yrs)

Total q-value

The total q-value for the company i in time t is, therefore, the sum of all individual asset and liability q-values for the respective company.

$$Q_{TOTAL_{i,t}} = Q_{DA_{i,t}} + Q_{RD_{i,t}} + Q_{INV_{i,t}} + Q_{DITL_{i,t}} \tag{4.7}$$

3.3.5. Fama-French 3-Factor Implied Cost of Equity

The 3-factor model by Fama and French (1993) is used to estimate a benchmark equity return in the portfolio companies. First, coefficients of the Fama-French model are estimated for different industries consistent with the Serrano industry specification (Swedish SNI07 Industry classification). The two main input factors are daily Fama-French factor returns provided by the Swedish House of Finance for the Swedish Stock Market and daily NASDAQ Stockholm industry indices, which represent the 11 industries in this sample for the years 2000 to 2019 (cf. Aytug, Fu, and Sodini (2020), Appendix 3). The estimated Fama-French 3-factor models can be found in Appendix 4. Second, industry- and year-specific annual returns are generated using expected annualized 3-factor returns and inserting them in the respective Fama-French models estimated for each industry (equation 5.0). The expectation in those three-factor returns is constructed based on the average of the maximum available number of annualized factor returns of previous years.

$$R_{IND,t} = \alpha_{IND} + \beta_{1,IND}\left(R_{M,t} - R_{f,t}\right) + \beta_{2,IND}SMB_t + \beta_{3,IND}HML_t + R_{f,t} \qquad (5.0)$$

where

$R_{IND,t} = \text{Implied Fama} - \text{French cost of equity for industry IND in year t}$

$\alpha_{IND} = \text{Intercept of linear estimation model for industry IND}$

$\beta_{1,2,3,IND} = \text{Estimated Fama} - \text{French coefficients for industry IND (Appendix 4)}$

$R_{M,t} = \text{Expected annualized Return on Swedish SIX Index}$

$R_{f,t} = \text{Exp. annualized risk} - \text{free rate proxied by one month Swedish T} - \text{bill rate}$

$SMB_t = \text{Exp. annualized Fama} - \text{French Small Minus Big Portfolio return in year t}$

$HML_t = \text{Exp. annualized Fama} - \text{French High Minus Low Portfolio return in year t}$

Third, the liquidity premium is added to the whole range of estimated cost of equities as it is particularly relevant in the private firm setting. In fact, Abudy, Benninga, and Shust (2016) show that one should apply a private firm equity premium to a comparable public firm of at least 2%. Likewise, private equity owners require a liquidity premium of around 2-3% from not being able to liquidate their exposure to the investment for a prolonged time (Franzoni, Nowak, & Phalippou, 2012). The estimation of both of these premia is non-trivial and beyond the scope of this study. Therefore, a constant risk premium of 2.5% is added to capture the higher required return by investors for private companies and illiquidity (5.1). These considerations result in year- and industry-specific expected cost of equity (Appendix 5).

$$R'_{IND,t} = R_{IND,t} + LP \qquad (5.1)$$

where

$LP = \text{Liquidity premium } of\ 2.5\%$

Based on a respective year-industry index, these expected cost of equity measures are associated with the portfolio and control firms' event years. Lastly, adjusting them with

firm-year specific probabilities of failure makes the cost of equity firm-year-specific and carry a premium for failure risk:

$$r_{E,IND,t} = R'_{IND,t} \tag{5.2}$$

$$r^{*}_{E,i,t} = \frac{r_{E,IND,t} + p_{fail,i,t}}{1 - p_{fail,i,t}} \tag{5.3}$$

where
$r^{*}_{E,i,t} = \text{failure} - \text{adjusted, FF implied cost of equity for firm i in year t}$
$r_{E,IND,t} = \text{FF implied cost of equity for the firm's industry IND and year t}$
$p_{fail,i,t} = 1 - \text{year probability for firm i in year t}$

Ultimately, to estimate a cost of equity measure, the Fama-French model is preferred over a more straightforward CAPM approach for a few reasons. Firstly, it incorporates more empirically relevant risk factors that explain the returns of a given reference security *i* or, in this case, an alternative return in a comparable industry. Secondly, remote in-time access to CAPM beta coefficients was not available.[12]

3.3.6. Residual Income Valuation Model

In order to make any statement about value creation in portfolio companies, a value observation or estimation is necessary. As the former is often not available to external stakeholders in private equity transactions, especially private to private and mid-market ones, the value accruing to equity holders must be estimated. To do so, the Residual Income Valuation model as specified by Skogsvik (2002) presents several advantages. First, despite being inferred from the dividend discount model and assuming the Clean Surplus Relation (CSR) holds, the RIV model concentrates on the value generative ability of net assets. Thereby, value is a direct function of the business activity rather than sole cash pay-outs to shareholders. In other words, the focus is on evaluating the asset, which fits the pure portfolio company focus. Second, from a practical perspective, it is more applicable to a large set of firm-year observations than a free-cash-flow (FCF), adjusted present value (APV), or leveraged buyout (LBO) valuation. In each of those cases, firm-specific re-accounting is necessary to estimate periodical expected cash flows. Third, it is an accounting-based valuation model and captures accounting specifics such as accruals and measurement biases. Moreover, Anesten, Möller, Skogsvik, and Skogsvik (2020) found that the RIV model is especially applicable for Scandinavian firms and exhibits high pricing accuracy when inputs are based on historical information.

Hence, the RIV model is applied to estimate a firm-specific equity value for the portfolio companies at the event years $t - 2$ as well as $t + 4$ ($t + 3$ where applicable). Generally,

[12] A mechanisation of the CAPM model would have been possible using Aswath Damodaran's (NYU) European unlevered industry betas but was found to be suboptimal to calculate the cost of equity firms face in the Swedish market (cf. Damodaran, 2021).

its output is an equity value based on the current book value of equity, future residual income, and q-value of owners' equity at the horizon point in time:

$$V_{i,0} = B_{i,0} + \sum_{t=1}^{T} \frac{\overbrace{B^*_{i,t-1}\left(R^*_{E,i,t} - r^*_{E,i}\right)}^{RI^*_{i,t}}}{\left(1 + r^*_{E,i,0}\right)^t} + \frac{B^*_{i,T} q_{i,T}}{\left(1 + r^*_{E,i,0}\right)^T} \tag{6.0}$$

where
$V_{i,0} =$ estimated RI value of firm i at valuation point in time 0
$B^*_{i,t} =$ Conditional book value of equity of firm i at the end of valuation period t
$R^*_{E,i,t} =$ Conditional Return on Equity of firm i in period t
$r^*_{E,i,0} =$ Prob. of failure adjusted cost of equity of firm i at valuation point in time 0
$RI^*_{i,t} =$ Residual Income in period t
$q_{i,T} = Q_{TOTAL_i}$ at T[13]

The specification of the valuation components with the asterisks describes their conditioning on survival. Also, in the model specification, $t = 0$ refers to either event year $t - 2$ or $t + 4$ ($t + 3$ where applicable), which refer to differing calendar years.

Cost of equity

The probability of failure adjusted cost of equity $r^*_{E,i,0}$, including the liquidity premium, is based on the Fama-French Model approach discussed in the previous chapter (cf. 3.3.5). For valuation purposes, the estimated firm-year specific cost of equity at the valuation point in time is held constant over the valuation horizon until $T = 5$.

Expected return on equity

A Martingale prediction generated an estimate of return on equity in $t = 1$ for the firms in the sample. That is, return on equity is expected to be constant in the period after the valuation period:[14]

$$R^*_{E,i,1} = R_{E,i,0} \tag{6.1}$$

Further, $R^*_{E,i,t}$ for the valuation periods between $t + 2$ and T needs to be predicted. As suggested by Skogsvik (2002), first a return on equity in steady-state ($R^*_{E,i,T+1}$) is estimated, and then the returns on equity $R^*_{E,i,2}$ to $R^*_{E,i,T}$ are linearly interpolated using:

$$R^*_{E,i,T+1} = r^*_{E,i,0} + q_{i,T}\left(r^*_{E,i,0} - \delta\right) \tag{6.2}$$

$$R^*_{E,i,t} = R^*_{E,i,1} + (t - 1)\frac{\left(R^*_{E,i,T+1} - R^*_{E,i,1}\right)}{T} \tag{6.3}$$

[13] $q_{i,T}$ in the original specification of the model includes the PMB as well as expected goodwill/badwill of owners' equity at horizon point T. As section 3.3.4 forestalled and also specified further below in the 'Horizon' section, $q_{i,T}$ is assumed to only consist of Q_{TOTAL_i} i.e. the PMB as a portion of equity.
[14] Extreme starting values in $R_{E,i,1}$ were limited to -100% and $+100\%$.

where
$r^{*}_{E,i,0}$ = firm year specific cost of equity at valuation point $t = 0$
$R^{*}_{E,i,T+1}$ = expected return on equity in steady − state
$R^{*}_{E,i,t}$ = conditional return on equity in valuation periods t
δ = expected annual growth in owners′ equity after valuation year t = T

The annual growth in owners' equity in steady-state δ is assumed to be 2% which represents the Swedish inflation target (Riksbank, 2021). Other possibilities to estimate $R^{*}_{E,i,t}$ include holding $R_{E,i,0}$ constant or using some non-linear regressive function for interpolation. Whereas the former assumes that competitive advantages or disadvantages remain, the latter assumes they disappear more easily (faster decrease in early forward-looking periods). In the case of portfolio companies, there is no strong reason to suggest that these two options should be preferred over simple linear interpolation.

Book values of equity

Lastly, assuming that the Clean Surplus Relation holds and no new equity is issued, periodical future growth in future book value of owners' equity is estimated via expected return on equity and pay-out share of equity.

$$\frac{B^{*}_{i,t}}{B^{*}_{i,t-1}} - 1 = R^{*}_{E,i,t} - ps_{i,0} \tag{6.4}$$

where
t refers to the forward − looking valuation periods
$ps_{i,0}$ = constant expected payout share per firm i at valuation point t = 0

The constant pay-out share $ps_{i,0}$ for the future periods from the valuation point in time is estimated using the average pay-out share in the previous three periods.

$$ps_{i,t} = \frac{D_{i,t}}{B^{*}_{i,t-1}}$$

$$ps_{i,0} = \frac{ps_{i,t} + ps_{i,t-1} + ps_{i,t-2}}{3} \tag{6.5}$$

where
$ps_{i,t}$ = actual payout shares in calendar years before valuation point t = 0

Going forward from $B^{*}_{i,0}$, $B^{*}_{i,t}$ is then calculated using the resulting expected yearly growth rates (equation 6.4) until terminal valuation year T.

Horizon

The standard horizon point in the RIV model is set at $T = 5$ as many of the firms in the sample exhibit high abnormal profitability, which is not expected to sustain until a much later point, for example $T = 10$. Moreover, it is assumed that $q_{T,i}$ only consists of the permanent measurement bias at the valuation points in time. This rests on two assumptions. First, there will be no business goodwill beyond the horizon point. Second,

in reference to the constant PMB until T, the asset structure remains largely constant over time. From a company perspective, this is a realistic assumption given that at event year $t-2$ PE ownership is not yet expected, and at event year $t+4$, any operating business restructuring has to the largest part been concluded in anticipation of an exit in the following years. Additionally, q-values for control companies are imputed using industry- and year-specific medians of the portfolio company sample. This is done to reduce the high q-value estimation effort for an additional high number of companies.[15]

3.3.7. Internal Rate of Return

The following internal rate of return on the RIV value in event years $t-2$ and $t+4$ ($t+3$ where applicable) as well as respective intermediary net dividends functions as the gross measure of equity value creation in this study:[16]

$$0 = -V_{i,t-2} + \sum_{t+1}^{T} \frac{NDIV_{i,t}}{(1+IRR_i)^t} + \frac{V_{i,T}}{(1+IRR_i)^{\mathrm{T}}} \qquad (7.0)$$

where
$\mathrm{V_{i,t-2}}$ = RIV value of equity for firm i at event year $\mathrm{t-2}$
$\mathrm{NDIV_{i,t}}$ = Dividends net of shareholder contributions for firm i at year t
$\mathrm{IRR_i}$ = Internal rate of return of firm i at year $\mathrm{t+4}$ or $\mathrm{t+3}$ where applicable
T = year $\mathrm{t+4}$ or $\mathrm{t+3}$ dependent on holding period

Since there is no clearly defined event-period for the control firms, 95 groups, each consisting of the portfolio company and its five nearest neighbours from the PSM, are constructed. Using the same event-period as for the matched portfolio company, it is thereby possible to calculate IRRs for the control firms over the event year period $t-2$ to $t+4$.[17] Furthermore, it is essential to note that this IRR measure is not the typical PE fund IRR based on cash pay-outs during the holding period and entry/exit prices of the portfolio company. Instead, it should be seen as an IRR implied by the RIV values treated as the respective entry and exit prices.

Fitting to the pure focus on portfolio company value creation, the IRR is not influenced by current market valuations, entry discounts or exit premia, or effects from 'multiple arbitrage'. Multiple arbitrage refers to two different processes. First, PE firms buy similar firms at a lower valuation multiple than the platform investment and consequently integrate the add-on companies and the platform investment. Second, PE firms ‚play the market' by buying firms in a low and selling them in a high valuation environment. The rise in valuations, partly due to increases in investable capital and the low-interest

[15] While this makes a comparison of conservative accounting practices between portfolio company and control sample impossible, it is a best effort approach considering that control firms were matched to portfolio companies and should, therefore, exhibit similar accounting characteristics.
[16] IRR based on R function *jrvFinance::irr* which uses the standard Newton-Raphson method to find the root. If not applicable, it uses a bisection algorithm (Varma, 2019).
[17] IRR is a 5-year IRR for those firms that were exited in t+3. Shorter IRRs were not calculated.

environment, has especially contributed to the second (Bain & Company, 2021). Moreover, selling a company to for example a strategic acquirer with high synergy potential may lead to higher exit values. These market-sided processes are usually additional factors in PE returns on a fund level.

To arrive at an excess measure of equity value creation in the portfolio company, the required return by investors is deducted from the IRR of each firm:[18]

$$Adjusted\ IRR_i = IRR_i - \emptyset\ r^*_{E,i,t} \tag{7.1}$$

where

$\emptyset\ r^*_{E,i,t}$ = average failure adjusted cost of equity during years $t-2$ to $t+4$

This adjusted IRR (IRR-COE) is a measure of excess return and indicates value creation if positive or value destruction if negative. The IRR-COE is ultimately the measure considered in statistical tests whether PE firms create equity value on portfolio company level and indicates significantly different excess returns between control and portfolio companies.

[18] The required return by investors is the average of the year- and industry-specific Fama-French implied cost of equity during the event years $t-2$ to $t+4$.

4. Analysis

4.1. Description of Data

4.1.1. Operational and Financial Ratios

In the following description of operating and financial ratios, the term 'ratio' refers to the operating and financial ratios based on the portfolio company sample, while the industry-adjusted ratios follow the methodology explained in section 3.3.2. The median values of the pre-holding and holding period can be found in Appendix 6.

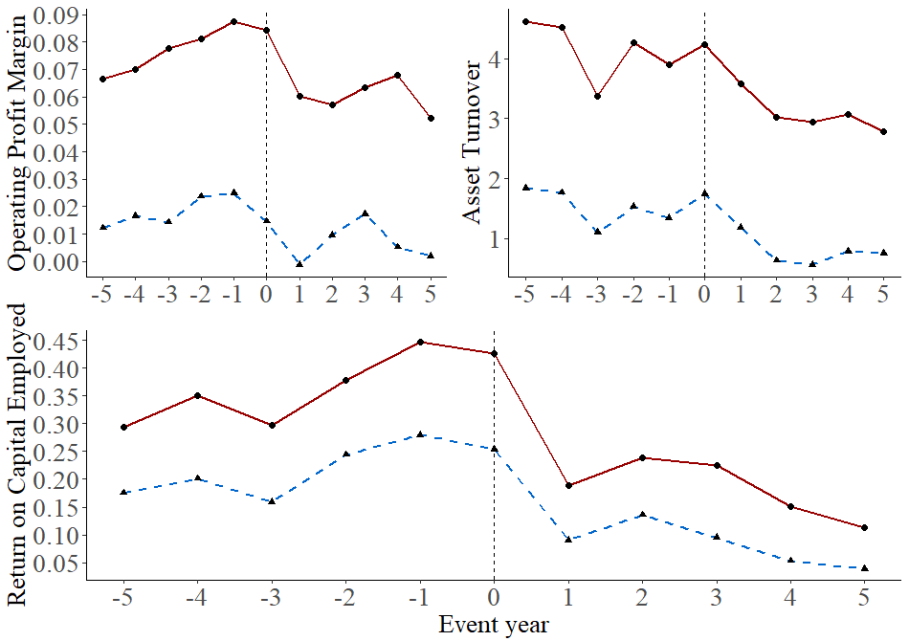

Figure 3: The solid line presents the median of the portfolio company's ratio for each event year. The dotted line is the industry-adjusted ratio, thus the spread between the portfolio company's ratio and its year-specific industry median. Both are expressed as median values per event year.

Figure 3. Portfolio company's and industry-adjusted OPM, ATO, and ROCE

The operating profit margin drops from a median of 7.8% in the pre-holding period to 6.3% in the holding period. The industry-adjusted OPM remains positive across all event years except for $t + 1$. However, it also drops in median value from pre-holding to holding period by 1.0 percentage point. Although the asset turnover is relatively high in the pre-holding period with a median of 4.2x, the graph shows a decreasing trend over the event years. The median value falls from 4.6x in $t - 5$ to 2.8x in $t + 5$. The same is true for the industry-adjusted ATO, which exhibits a positive median performance of 1.6x in the pre-holding period but halves to 0.8x in the holding period. ROCE increases from median 29.4% in $t - 5$ to 44.7% in $t - 1$. However, from event year $t - 1$ to $t + 5$ it drops by 75% to a median value of 11.3%. The industry-adjusted ROCE is strongly positive at 21.0% in median in the pre-holding period, whereas the holding period median

of 7.7% demonstrates a decline towards the industry-median. Despite the one-time drop in OPM, the median industry-adjusted ratios for those three ratios remain positive over all event years. (Figure 3)

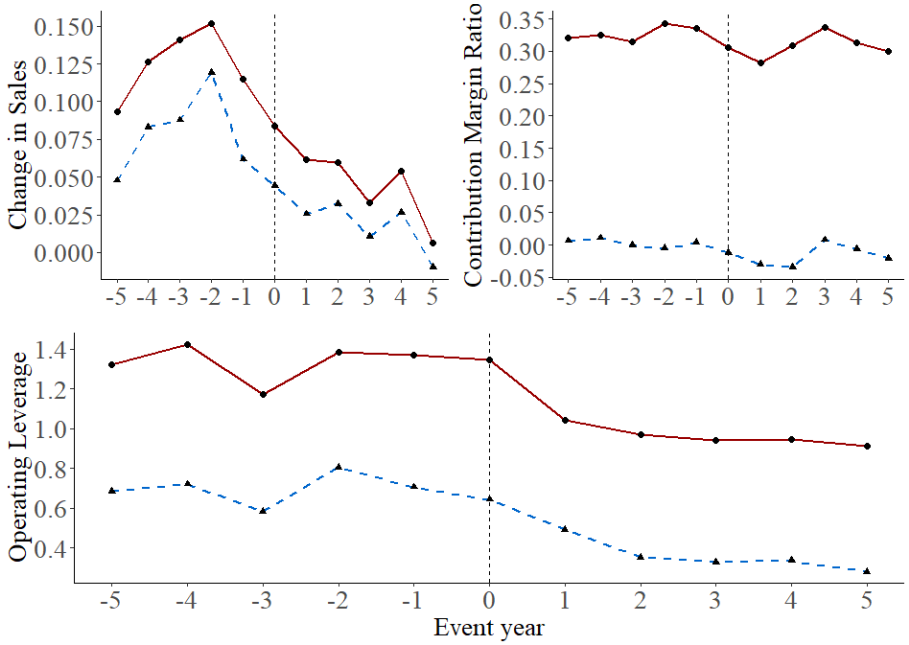

Figure 4: The solid line presents the median of the portfolio company's ratio for each event year. The dotted line is the industry-adjusted ratio, thus the spread between the portfolio company's ratio and its year-specific industry median. Both are expressed as median values per event year.

Figure 4. Portfolio company's and industry-adjusted change in sales, CMR, and operating leverage

The change in sales in the pre-holding period is 12.4% in median but declines from $t-2$ onwards to a median value of 0.6% in $t+5$. Despite the low median in $t+5$, the change in sales is constantly positive and above the Swedish 2% inflation target for all other event years. Furthermore, the industry-adjusted change in sales converges towards 0% at the end of the holding period. That is PE-owned firms' change in sales trends towards that of the control sample. The contribution margin ratio remains almost constant over the pre-holding and holding period, with median values of 32.5% and 31.1%, respectively. However, it fluctuates slightly more in the holding period. The industry-adjusted CMR decreases from a positive median value of 0.4% before the buyout to -2.1% after the buyout. Median operating leverage values diminish from 1.31x in the pre-holding period to 0.96x in the holding period, representing a decline of around 30%. An even greater change is observable in the industry-adjusted operating leverage but levels out at the median value of 0.28x in $t+5$. (Figure 4)

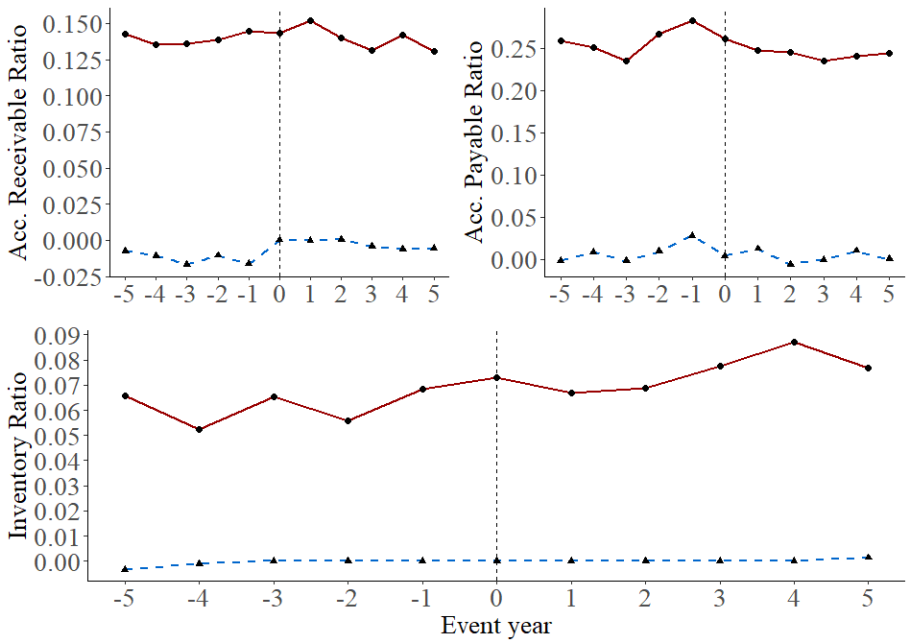

Figure 5: The solid line presents the median of the portfolio company's ratio for each event year. The dotted line is the industry-adjusted ratio, thus the spread between the portfolio company's ratio and its year-specific industry median. Both are expressed as median values per event year.

Figure 5. Portfolio company's and industry-adjusted working capital ratios

The accounts receivable ratio is similar in median in both periods with 13.9% and 14.0%, respectively. Simultaneously, the respective industry-adjusted ratio rises by over 83% from the pre-holding to holding period, even though the median for both periods remains negative. The median inventory ratio also increases from 6.5% in the pre-holding to 7.5% in the holding period, whereas its industry-adjusted ratio hovers around 0% across all event years. On the contrary, the accounts payable ratio declines by 8.1% in median from $t-5$ to $t+5$, fluctuating around 0%. (Figure 5)

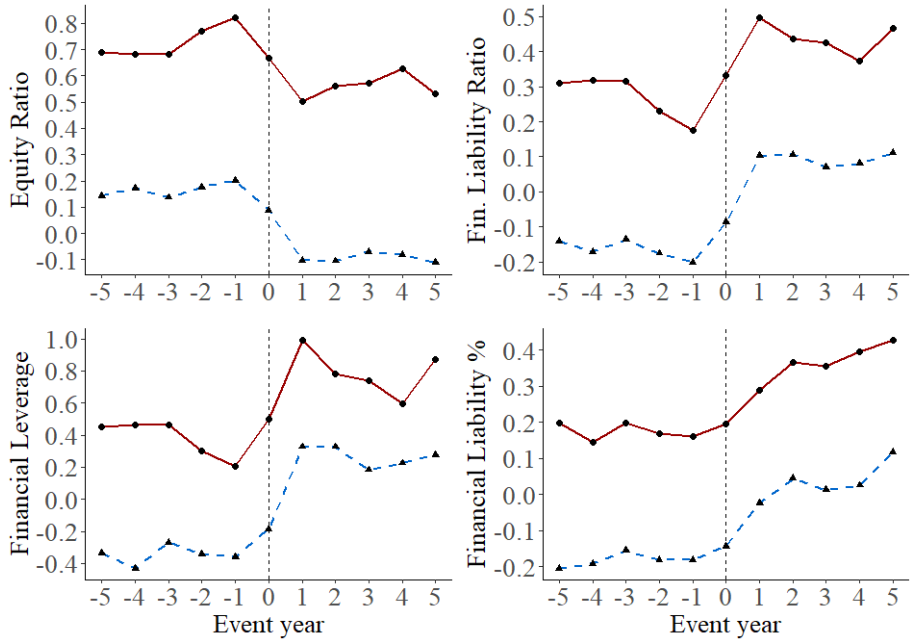

Figure 6: The solid line presents the median of the portfolio company's ratio for each event year. The dotted line is the industry-adjusted ratio, thus the spread between the portfolio company's ratio and its year-specific industry median. Both are expressed as median values per event year.

Figure 6. Portfolio company's and industry-adjusted capital structure ratios

The equity ratio (financial liability ratio) decreases (increases) in median from 72.6% (27.4%) to 56.2% (43.8%) from the pre-holding to holding period. Compared to the control group, this decreases leads to a decline of -159.9% in the industry-adjusted equity ratio from the pre-holding to holding period. The industry-adjusted equity ratio even becomes negative (-10.9%) in median across the holding period. Consistent with expectations, the financial leverage experiences a similar change increasing over 174.2% in median from the pre-holding to holding period. The industry-adjusted financial leverage ratio jumps from a median of -34.3% in the pre-holding period up to 25.4% in the holding period. The financial liabilities percentage grows from 19.8% in $t-5$ median to 42.9% in $t+5$. Similarly, its median industry-adjusted ratio of -18.2% in the pre-holding period turns positive and becomes 3.3% in the holding period. (Figure 6)

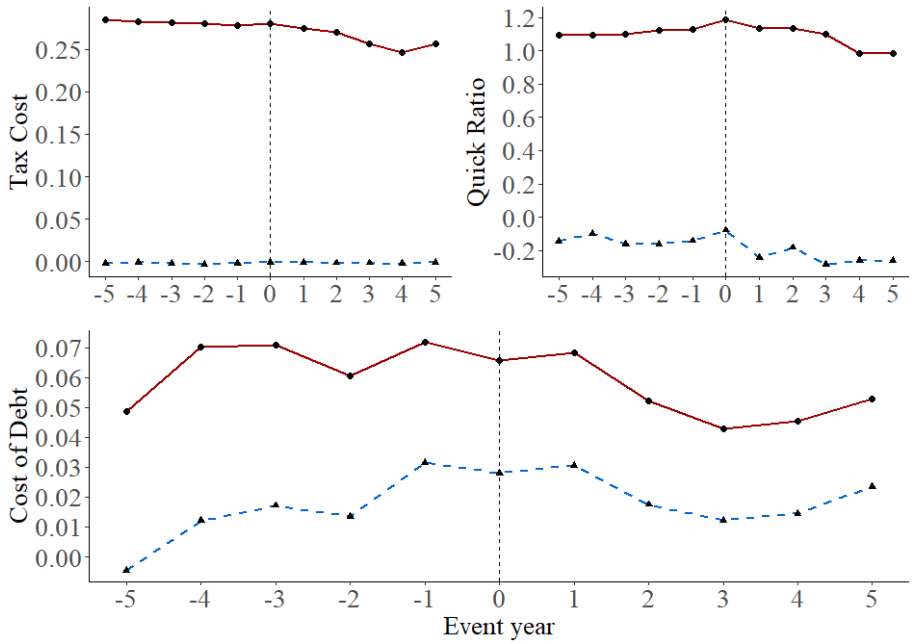

Figure 7: The solid line presents the median of the portfolio company's ratio for each event year. The dotted line is the industry-adjusted ratio, thus the spread between the portfolio company's ratio and its year-specific industry median. Both are expressed as median values per event year.

Figure 7. Portfolio company's and industry-adjusted tax cost, quick ratio, and COD

Consistent with the decrease in Swedish tax rates over time, the median tax costs between the pre-holding and holding period also drop from 28.1% to 26.7%. However, the industry-adjusted tax costs remain around 0% for all event years. Liquidity expressed as the quick ratio stays in median at 1.1x during the pre-holding and holding period. Its industry-adjusted ratio also drops in median values from -0.1x in the pre-holding period to -0.3x in the holding period. Cost of debt for the portfolio company sample decreases from a median of 6.3% in the pre-holding period to 5.2% in the holding period. Despite the fluctuations in the industry-adjusted cost of debt, the median increases by 34.4% from the pre-holding to holding period. (Figure 7)

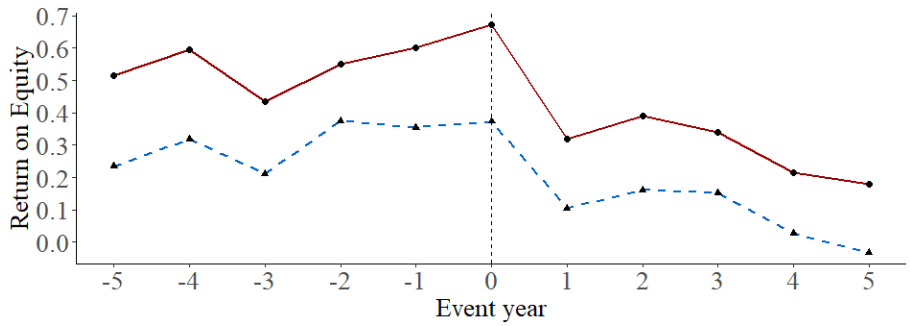

Figure 8: The solid line presents the median of the portfolio company's return on equity for each event year. The dotted line is the industry-adjusted ratio, thus the spread between the portfolio company's ratio and its year-specific industry median. Both are expressed as median values per event year.

Figure 8. Portfolio company's and industry-adjusted return on equity

The return on equity (ROE) experiences a large drop of 40.7% in median, falling from 53.7% in median over the pre-holding period to 31.8% over the holding period. While the industry-adjusted ROE declines by 54.9% in median between the pre-holding and holding period, it remains positive until ending up at -3.2% in median in $t + 5$. (Figure 8)

4.1.2. Bankruptcy Prediction

Figure 9 presents the development of the portfolio companies' and industry-adjusted probability of failure with a 1-year prediction horizon.

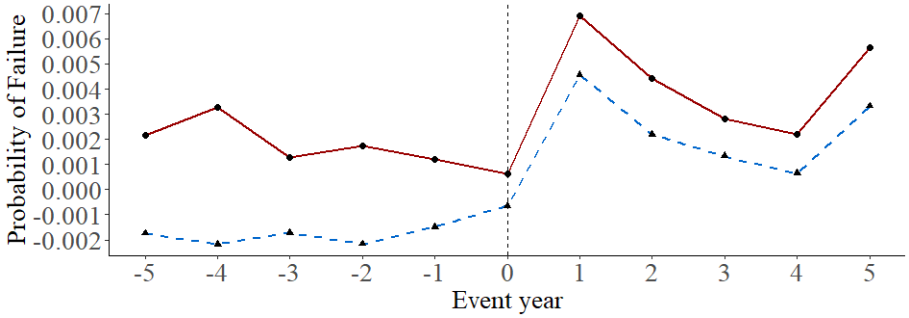

Figure 9. The solid line presents the median of the portfolio company's probability of failure for each event year. The dotted line is the industry-adjusted probability of failure, thus the spread between the portfolio company's ratio and its year-specific industry median. Both are expressed as median values per event year.

Figure 9. Portfolio company's and industry-adjusted probability of failure (1yr)

The probability of failure for the portfolio companies experiences its maximum one year after the buyout in $t + 1$ when the median value reaches 0.7%. However, during the pre-holding and holding period, the probability of failure has median values of 0.18% and 0.39%, respectively, thus staying way below its maximum value. The industry-adjusted probability of failure (1-year) increases by 36 basis points from -0.17% to 0.19% in median between the pre-holding and holding period. (Figure 9)

4.1.3. Q-Value

Table 6 shows the mean and median q-values as well as their 1st (Q1) and 3rd quartile (Q3) for portfolio companies in the pre-holding and holding period.

Table 6. Portfolio companies' q-values for pre-holding and holding period

q-value	Pre-Holding (N=95)	Holding (N=89)	Overall (N=184)
Total			
Mean	0.849	0.604	0.731
Median	0.450	0.445	0.445
[Q1, Q3]	[0.156, 0.924]	[0.0382, 0.725]	[0.0803, 0.841]

q-value	Pre-Holding (N=95)	Holding (N=89)	Overall (N=184)
Depreciable Assets			
Mean	0.359	0.280	0.321
Median	0.0813	0.0663	0.0754
[Q1, Q3]	[0.00721, 0.445]	[0.00358, 0.445]	[0.00614, 0.445]
R&D			
Mean	1.98	0.954	1.52
Median	0.640	0.353	0.455
[Q1, Q3]	[0.294, 4.37]	[0.198, 0.671]	[0.263, 2.99]
Inventory			
Mean	0.192	0.182	0.187
Median	0.0531	0.0314	0.0428
[Q1, Q3]	[0, 0.224]	[0, 0.173]	[0, 0.201]
Def. Income Tax Liabilities			
Mean	0.0339	0.0287	0.0314
Median	0.00984	0	0.00383
[Q1, Q3]	[0, 0.0564]	[0, 0.0331]	[0, 0.0401]

Table 6 presents q-values for the pre-holding period estimated at event year t-2 and for the holding period at t+3 or t+4. N represents the number of firm-year observations included in the estimation per period. However, the number can deviate for the respective q-values. Especially, the R&D q-value could not be estimated for a majority of the firms because of limited information available in their annual reports and because many firms did not expense R&D.

The median total q-value of the portfolio companies is 0.45 in the pre-holding and holding period. The median depreciable assets and R&D q-values are lower in the holding than in the pre-holding period. They are also the highest among the specified q-values. Notably, the mean q-value from expensed R&D is comparatively high in both periods for those firms for which it could be specified. Even so, it further exhibits the largest drop between the pre-holding and holding period by about 45% in median terms. The q-value from inventory and deferred income tax liabilities are small in the pre-holding period, with around 0.05 and 0.01 in median, respectively. While the q-value in deferred income tax liabilities in mean and median terms seems to remain constant before and towards the end of the holding period, inventory q-values in portfolio companies seem to exhibit a drop of up to 41% in mean terms.[19]

Since companies in different industries generally have different asset structures, investigating the estimated q-values by industry is reasonable (Appendix 7; Appendix 8). The four highest total q-values span in median from 0.44 to 0.49 in the pre-holding and 0.40 to 1.04 in the holding period, with Shopping and Industrial Goods consistently remaining the largest. The group of industries with the four largest median q-values in the pre-holding period are Shopping Goods, Industrial Goods, Construction Industry, and

[19] The q-values are generally larger in mean suggesting a positive skew by single observations

Corporate Services. Firms in the Health & Education and IT & Electronics generally exhibit the highest median q-value associated with expensed R&D positions, which likely drives up the firm-specific q-values but is not observable in the industry's median total q-value. Inventory-related median q-values are highest in the Shopping Good industry (consumer discretionary). For firms in this industry, it rises in median from 0.14 in the pre-holding to 0.16 in the holding period. The q-value associated with depreciable assets is highest for portfolio companies in the Shopping and Industrial Goods Industries in both periods. Also, in the holding period, total q-values differ more extensively across industries than in the pre-holding period.

4.1.4. Equity Values and Returns

The outcome of the Residual Income Valuation on an aggregated level is assessed using the RIV-to-Book ratio. Essentially, it is a comparison of an intrinsic fair value versus a book value of equity. Table 7 displays descriptive statistics on the RIV/BV measure.

Table 7. RIV-to-Book Ratio for portfolio companies and control firms

	Portfolio Companies		**Control Group**		**Overall**	
	Pre-Holding (N=95)	**Holding (N=89)**	**Pre-Holding (N=291)**	**Holding (N=291)**	**Pre-Holding (N=386)**	**Holding (N=380)**
RIV/BV						
Mean	4.26	4.48	3.56	2.91	3.72	3.25
Median	3.30	3.27	1.75	1.78	2.06	1.87
[Min, Max]	[0, 26.3]	[0, 42.7]	[0, 43.3]	[0, 26.3]	[0, 43.3]	[0, 42.7]
Q1, Q3	1.69, 4.90	0.85, 5.77	1.00, 3.73	0.96, 3.61	1.02, 4.07	0.92, 4.01

Table 7 shows the mean and median values, as well as the minimum, maximum, 1st quartile (Q1), and 3rd quartile (Q3) of the RIV-to-Book ratio for the portfolio companies, control firms and the overall sample. 'Pre-holding' refers to the end of event year t-2, whereas 'Holding' refers to the end of event year t+3 or t+4 as the estimation point in time.

For portfolio companies, RIV/BV stays roughly the same in mean (4.3 to 4.5x) and median (3.3x) terms before and after the buyout. Albeit the mean drops for the set of control firms, a constant RIV/BV ratio is observable for those in median terms (1.8x) as well. In general, portfolio companies seem to be valued almost twice as high as control firms before and during the holding period in median terms. (Table 7)

Table 8 shows the IRR and IRR-COE, essentially the spread between the IRR and Fama-French model implied cost of equity, for the portfolio and control companies. With 11.3%, the portfolio companies seem to generate a slightly higher internal return rate in median terms than the control companies (9.7%). Conversely, the mean IRR for PE-owned firms is lower than for control firms by 5.1 percentage points. In general, the spread between mean and median IRR is more sizable for control firms than for PE-owned firms. This could originate from the broader interquartile range, with more positive outliers and a higher standard deviation in the control group.

Table 8. Internal Rate of Return, IRR-COE spread and Winners vs. Losers

	Portfolio Companies (N=89)	**Control Group (N=291)**
IRR		
Mean (SD)	0.115 (0.246)	0.166 (0.451)
Median [Q1, Q3]	0.113 [-0.0201, 0.232]	0.0965 [-0.0694, 0.272]
Missing	22 (24.7%)	2 (0.7%)
IRR-COE		
Mean (SD)	-0.0812 (0.249)	-0.0316 (0.449)
Median [Q1, Q3]	-0.0913 [-0.228, 0.0654]	-0.0899 [-0.257, 0.0697]
Missing	23 (25.8%)	5 (1.7%)
WL		
Loser	44 (66.7%)	185 (64.7%)
Winner	22 (33.3%)	101 (35.3%)

Table 8 shows the mean and median values, the 1st quartile (Q1) and 3rd quartile (Q3) for PE-owned and control firms for the two variables IRR and IRR-COE as well as a distribution of winners and losers in the two samples. For a calculation of IRR-COE, please refer to section 3.3.7. Winners are defined by IRR-COE $>$ 0, Losers by IRR-COE $\leq$ 0. Unavailable RIV values explain the missing observations as a consequence of which an IRR is not calculable. Unavailable RIV values in turn stem from any unavailable or not meaningful inputs to equation 6.0.

The median IRR-COE is on aggregate -9% for PE-owned as well as control firms in the sample. The mean IRR-COE, however, is 4.9 percentage points lower and also considerably lower than 0 for portfolio companies. Interestingly, the interquartile range and standard deviation in portfolio companies' IRR and IRR-COE values are smaller than in control firms but still rather high. In a binary winner and loser sense, portfolio companies do not seem to be better or worse off than control firms. Only about one third seem to perform better than their benchmark required return over the event-period $t-2$ to $t+4$. (Table 8)

4.2. Results

4.2.1. Research Question 1: Performance

The development of the (industry-adjusted) operating and financial ratios, as well as the (industry-adjusted) probability of failure and q-values, were described in chapter 4.1. But, in order to answer RQ1 – *How do operating and financial performance, accounting conservatism, and bankruptcy risk evolve in Swedish portfolio companies?* – these developments are tested. The significant difference in their values between the pre-holding and holding period are tested applying a Wilcoxon test, of which results are presented in Table 9.

Table 9. Results of Wilcoxon test for difference in (industry-adjusted) operating and financial performance ratios between pre-holding and holding period

	Portfolio Company Ratios			Industry-adjusted Ratios		
Ratio	**Estimate**	**p-value**	**Significance**	**Estimate**	**p-value**	**Significance**
OPM	−0.0201	0.0040	**	−0.0145	0.0440	*
ATO	−0.9055	0.0001	****	−0.7319	0.0010	**
ROCE	−0.1583	0.0000	****	−0.1442	0.0000	****
CH_SALES	−0.0968	0.0000	****	−0.0738	0.0000	****
CMR	−0.0185	0.2170	ns	−0.0187	0.1720	ns
OLE_II	−0.2783	0.0001	***	−0.2688	0.0004	***
AR_WC	0.0016	0.7380	ns	0.0090	0.1190	ns
INV_WC	0.0000	0.5470	ns	0.0039	0.2390	ns
AP_WC	−0.0098	0.3360	ns	−0.0052	0.6420	ns
FIN_LEV	0.2695	0.0000	****	0.5516	0.0000	****
EQ_RATIO	−0.1085	0.0000	****	−0.1877	0.0000	****
FIN_LIAB_RATIO	0.1085	0.0000	****	0.1877	0.0000	****
FIN_LIAB_PCT	0.1156	0.0000	****	0.1391	0.0000	****
TAX_COST	−0.0136	0.0006	***	0.0029	0.2560	ns
QUICK_RATIO	−0.0850	0.0390	*	−0.1416	0.0020	**
COD	−0.0083	0.0370	*	0.0034	0.4510	ns
ROE	−0.2072	0.0001	***	−0.1687	0.0020	**

Table 9 presents the results of the two-sample, two-sided Wilcoxon rank sum test performed to see whether the respective ratios in both specifications change significantly between the pre-holding and holding period. The two-samples 'pre-holding' and 'holding' in this test comprise observations from $t-5$ *to* $t-1$ *and* $t+1$ *to* $t+5$*, respectively. The estimates display the difference of the medians between a sample of the pre-holding and holding period. This is not the exact difference in medians in both samples, wherefore a focus in interpretation is put on the sign and magnitude of the estimate. The number of firm-year observations (N) for variables in the pre-holding and holding period are 468 and 400, respectively. The explanation of the ratio names can be found in Table 3 and Table 4. The significance levels are determined as: 'ns'* $p \geq 0.05$*, ** $p < 0.05$*, *** $p < 0.01$*, **** $p < 0.001$*, and ***** $p < 0.0001$*.*

The downward sloping trend in (industry-adjusted) OPM, ATO and ROCE over the event years (cf. section 4.1.1) is supported by their significantly negative estimates in Table 9. Furthermore, the three ratios of portfolio companies experience a statistically significant decline at the $p < 0.01$, $p < 0.0001$, and $p < 0.0001$ levels, respectively. However, the significance level decreases to $p < 0.05$ and $p < 0.01$ for OPM and ATO respectively when performing the same test for industry-adjusted ratios. This suggests that well-selected PE-backed firms operate significantly worse in the holding period in terms of ROCE, likely driven by diminishing operating profit margins as well as less asset efficiency (ATO). Particularly the decrease in ATO from $t+0$ to $t+1$ may result from higher post-buyout capitalization and consequently higher capital employed. The margin over the control group, indicated by the corresponding industry-adjusted ROCE, is also

significantly smaller in the holding period compared to the pre-holding period. But, portfolio companies still perform better than their non-PE-backed peers (cf. Figure 3).

The test results in Table 9 confirm the declining growth in sales, constant contribution margin ratio and decreasing operating leverage (cf. section 4.1.1). The CMR, which remained almost constant in median over both periods at around 30%, did not change significantly from pre-holding to holding period. On the one hand, it shows that PE-backed firms managed to keep the CMR constant. On the other hand, they did not improve it either. The same is true for its industry-adjusted ratio, which remains at around 0%. This means PE-backed firms generate similar margins as non-PE-backed firms and do not necessarily adjust their core cost structure. However, change in sales and operating leverage for portfolio companies decrease significantly between pre-holding and holding period at levels of $p < 0.0001$ and $p < 0.001$, respectively. The significance levels for the industry-adjusted change in sales and operating leverage remain the same ($p < 0.0001, p < 0.001$). The slowing growth in PE-backed firms indicates that they mature and trend towards control firm growth levels in $t + 5$ (industry-adjusted ratio). By definition, variation in operating leverage stems from underlying variation in CMR and ATO. Since CMR remains constant, the decrease in operating leverage is driven by the significant decline in ATO.

The working capital ratios (accounts receivable, inventory, accounts payable) are not significantly different between the holding versus the pre-holding period. This is consistent with the comparatively stable development over the event years investigated before (cf. section 4.1.1.). The corresponding median industry-adjusted ratios hover around 0%, implicating that portfolio companies' working capital management is not significantly different from their non-PE-backed peers (cf. Table 9).

The financial leverage ratio, financial liabilities ratio, and financial liabilities percentage ratio increase highly significantly between the pre-holding and holding period ($p < 0.0001$). Complimentary to that, the equity ratio drops significantly in median ($p < 0.0001$). The same applies to their respective industry-adjusted ratios, which underscores that PE buyouts significantly impact the portfolio companies' capital structure. Furthermore, control firms had a higher proportion of financial liabilities in the pre-holding period than PE-owned firms (negative industry-adjusted financial liabilities percentage), yet this proportion reversed significantly after the buyout (cf. Figure 6). This further suggests that capitalization shifts away from operating and towards financial liabilities after the buyout. In addition, the industry-adjusted financial leverage ratio, equity ratio, and financial liabilities ratio disclose that the portfolio companies had a much less levered capital structure before the buyout compared to the control firms. However, due to the significant increase (decrease) in leverage (equity), these industry-adjusted ratios became positive (negative) in the holding period meaning portfolio companies' ratios are higher (lower) than for the control firms. Hence, as a consequence of the change in capital structure, PE-backed firms are expected to become riskier after the buyout.

Tax costs for portfolio companies drop significantly from the pre-holding to holding period ($p < 0.001$). However, once adjusted for industry trends, they do not change significantly from pre-holding to holding period. As expected, the decline in portfolio companies' tax costs is driven by the general reduction in Swedish corporate taxes over the years. The persistently negative industry-adjusted quick ratio shows that control firms have higher liquidity than PE-owned firms. The significant drop (negative estimate) in the portfolio companies' median quick ratio ($p < 0.05$) shows that liquidity constraints even increase in the holding period. Therefore, the industry-adjusted ratio becomes even more negative, as exemplified by the significantly negative change at a level of $p < 0.01$. The cost of debt for portfolio companies falls in median value between pre-holding and holding period bolstered by the finding that its change is significant at $p < 0.05$. However, the change in cost of debt from pre-holding to holding period is not significant when adjusted for the control firms' (industry-adjusted ratio). Hence, the decline in cost of debt is rather industry-driven than driven by PE ownership. Since the holding period includes more recent years, the insignificance in the industry-adjusted COD is consistent with the decrease in general interest rates in the past decade. Nonetheless, the COD for portfolio companies remains higher compared to the COD of non-PE-backed firms.

As shown in Table 9, the (industry-adjusted) return on equity decreases significantly for portfolio companies from pre-holding to holding period. By comparing the significance levels of $p < 0.001$ and $p < 0.01$ for ROE and industry-adjusted ROE respectively, it is observable that PE-backed firms perform significantly worse after the buyout, however, still better than their non-PE-backed peers (positive industry-adjusted ROE). This may result from the increased buyout capitalization, which decreases the ATO, consequently ROCE, and in turn negatively impacts the ROE. Overall, the portfolio companies' ROE regresses in median towards the control sample's median ROE over the holding period.

Table 10. Results of Wilcoxon test for difference in (industry-adjusted) probability of failure (1-year) between pre-holding and holding period

	Probability of Failure (1yr)			**Industry-adjusted Probability of Failure (1yr)**		
Ratio	**Estimate**	**p-value**	**Significance**	**Estimate**	**p-value**	**Significance**
PROB_FAIL1	0.0002	0.0010	***	0.0044	0.0000	****

*Table 10 shows the test results of difference in changes in the (industry-adjusted) probability of failure (1-year horizon) between the pre-holding and holding period. The same test as specified in the note to Table 9 was applied. N for pre-holding and holding period are 468 and 400 firm-year observations, respectively. The estimates display the difference of the medians between a sample of the pre-holding and holding period. This is not the exact difference in medians in both samples, wherefore a focus in interpretation is put on the sign and magnitude of the estimate. The significance levels are determined as: 'ns' p ≥ 0.05, * p < 0.05, ** p < 0.01, *** p < 0.001, and **** p < 0.0001.*

As described in section 4.1.2, the probability of failure with a prediction horizon of 1-year is relatively low. Nevertheless, its increase from pre-holding to holding period is significant at a level of $p < 0.001$, which signals a hike in bankruptcy risk for PE-backed companies (cf. Table 10). The industry-adjusted probability of failure is negative in the

pre-holding period suggesting PE firms select portfolio companies with comparatively lower bankruptcy risk than their peers. However, the industry-adjusted probability of failure increases even more significantly than the portfolio companies' from pre-holding to holding period ($p < 0.0001$). Hence, portfolio companies are selected with comparably lower bankruptcy risk but end up above the control group's bankruptcy risk. Moreover, the probability of failure for portfolio companies develops consistent with their significant changes in capital structure.

Table 11. Results of Wilcoxon test for difference in portfolio companies' q-value between pre-holding and holding period

q-value	Estimate	p-value	Significance
Total	−0.0453	0.2470	ns
Depreciable Assets	−0.0000	0.5080	ns
R&D	−0.1286	0.2450	ns
Inventory	−0.0001	0.8700	ns
Def. Income Tax Liabilities	−0.0001	0.1420	ns

*Table 11 presents the results from the Wilcoxon-test for the different q-values assessed in this study and whether they change significantly between the pre-holding and holding period. The same test as specified in the note to Table 9 was applied to the respective q-values. The estimates display the difference of the medians between a sample of the pre-holding and holding period. This is not the exact difference in medians in both samples, wherefore a focus in interpretation is put on the sign and magnitude of the estimate. The significance levels are determined as: 'ns' $p \geq 0.05$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, and **** $p < 0.0001$.*

From the previous section 4.1.3, it seems that the portfolio companies' median total q-value stays constant from pre-holding to holding period. At the same time, individual asset and liability q-values decrease, as further indicated by the negative estimates in Table 11. This finding could signify the release of hidden reserves and less conservative accounting under PE ownership. Lower q-values imply that the portfolio companies report their financial numbers closer to fair value accounting in the holding period than the pre-holding period, meaning they could have higher values on the balance sheet only because of accounting practices. However, the performed Wilcoxon test reveals that the decrease in q-values from pre- to holding period is not significant. Hence, there is neither clear evidence that conservative accounting biases decrease in the portfolio companies nor evidence that accounting becomes less conservative towards the end of the holding period. This also suggests that there is no systematic release of hidden reserves in the holding period to improve performance or value of portfolio companies temporarily.

In general, operating and financial performance in Swedish PE-owned firms deteriorates over the holding period. However, PE-owned firms still seem to operate better than their non-PE-owned peers in most cases. Furthermore, PE-owned firms become significantly more levered after the buyout. Simultaneously, bankruptcy risk for those firms increases but remains reasonably low, while accounting biases do not change significantly under PE ownership.

4.2.2. Research Question 2: Value Creation

The development of the RIV-to-Book Value of equity, IRR, and IRR-COE spread were described in chapter 4.1.4. But, in order to answer RQ2 – *Do PE firms create equity value on a Swedish portfolio company level?* – these developments were tested. As for the previous variables, the Shapiro-Wilk test has shown that the IRR-COE data is not normally distributed ($p < 0.0001$). Hence, the non-parametric Wilcoxon test seems more reliable to test the difference in IRR-COE between the portfolio company and control group. However, for better interpretation of the IRR-COE spread, a t-test was also performed (Table 12).[20]

By definition, the constructed IRR measure increases due to higher RIV values in event year $t + 4$ than in $t - 2$ and positive net dividends in intermediary years. Nevertheless, a positive IRR, as presented in Table 8, remains a gross indicator of value creation. Hence, the observations made on the gross IRR for portfolio companies and control group are not necessarily telling of value creation in portfolio companies. The testing procedure is, therefore, focused on the IRR-COE spread.

As observed in section 4.1.4, the IRR-COE spread seems to be higher (i.e. less negative) for the sample of control firms. The negativity of the spread further suggests that there might be some form of value destruction over the holding period for both the portfolio and control firms and that this is more pronounced for PE-owned firms. However, the independent t-test shows that the negative mean IRR-COE for the control firms is statistically insignificant from zero (Appendix 10). For the sample of PE-backed companies, it is only significantly different from zero at the $p < 0.05$ level. The insignificance of the mean IRR-COE from zero for control firms is consistent with the idea that an equally weighted portfolio of those would, in expectation, not generate an excess return beyond the one expected in the industry. This finding underscores the viability of the control sample as a private market portfolio to compare PE-backed companies' excess returns to. Interestingly, the Wilcoxon tests on the respective portfolio company (-0.09, $p < 0.01$) and control sample (-0.08, $p<0.0001$) find highly significant differences of IRR-COE from zero (Appendix 10). This is consistent with around two-thirds of firms in both samples generating a negative IRR-COE spread (cf. loser specification, Table 8).

[20] The t-test should be applicable since N is large enough to expected that the central limit theorem holds.

Table 12. T-test and Wilcoxon test results for difference in IRR-COE between portfolio companies and control group

	T-Test			Wilcoxon Test		
Ratio	**Estimate**	**p-value**	**Significance**	**Estimate**	**p-value**	**Significance**
IRR-COE	0.0496	0.2230	ns	−0.0017	0.9760	ns

*Table 12 shows the two-sample, two-sided t-test and Wilcoxon test results for the IRR-COE spread between PE-backed firms and control firms. The two samples comprise IRR-COE observations from the portfolio and control companies, respectively. The number of company observations (N) is 291 in the control sample and 89 in the portfolio company sample. The estimates for the Wilcoxon test display the difference of the medians between a sample of the pre-holding and holding period. This is not the exact difference in medians in both samples, wherefore the focus in interpretation is put on the sign and magnitude of the estimate. The significance levels are determined as: 'ns' $p \geq 0.05$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, and **** $p < 0.0001$.*

Both joint tests deliver insignificant differences in mean (t-test) and median (Wilcoxon rank sum test) IRR-COE spread between control firms and PE-owned firms (Table 12). Generally, the insignificantly different median and mean IRR-COE between portfolio and control firms suggest that equity value on a Swedish portfolio company level is neither created nor destroyed more than in non-PE-owned peers.

4.3. Summary of Findings

The findings in this study can be summarized as follows. PE-owned companies exhibit significantly worse operating performance in the holding period in return on capital employed, operating profit margin, and asset efficiency terms than before being acquired by PE firms. This holds after adjusting for industry effects. Nevertheless, PE-owned firms seem to perform better than the control firms across all event years, especially before the holding period. PE-backed firms experience a significant decline in sales growth, consistency in their contribution margin, and a significant drop in operating leverage beyond industry trends, indicating that operating risk decreases in portfolio companies. In addition, working capital components of Swedish portfolio companies do not develop significantly different from those of non-PE-backed firms.

The PE-owned firms' capital structure changes significantly from pre-holding to holding period. In particular, PE-owned firms had less levered balance sheets before the buyout, but their equity (debt) decreases (increases) significantly after the buyout. Nonetheless, industry-adjusted tax costs are insignificant between PE-owned firms and control firms. Furthermore, portfolio companies have more restrained liquidity before the buyout compared to their non-PE-backed peers. This is even more pronounced after the buyout. Despite the PE-backed firms' significant decrease in median cost of debt after the buyout, the cost of debt does not differ significantly from its control group. Additionally, PE-owned firms generate a significantly worse return on equity after the buyout, however, still better than their non-PE-backed peers.

Pre-buyout, the probability of failure for PE-owned firms is lower than for control firms but increased significantly afterwards and ended up above the control group's. Q-values do not decrease significantly from pre-holding to holding period therefore no systematic evidence for releasing hidden reserves or less conservative accounting under PE ownership is found.

Since the mean IRR-COE is insignificantly different from zero for control firms, the expectation holds that an equally weighted portfolio of those does not generate an excess return over the one expected in the industry. Hence, the control sample is applicable as a comparable private market portfolio. Furthermore, PE-backed firms' IRR-COE spread is not significantly different from that of control firms in mean and median terms. In conclusion, the portfolio companies' value creation or destruction is not different from the control firms'. Moreover, only about one-third of firms in the sample, irrespective of being PE-owned or not, deliver excess equity returns.

4.4. Robustness Tests

Despite the many efforts to gather and structure the underlying data and analysis as close to empirical reality as possible, further robustness checks are necessary. In general, they are performed to see whether the conclusions hold for a differing data set, under different methodological specifications or inclusion of correlated factors. In total, three robustness checks were executed.

First, an alternative control sample to the portfolio companies was generated, based on the same specification but matching 10 (10NN) instead of 5 nearest neighbours. This makes it possible to depict a larger variability in control firms' performance over the event horizon to which the portfolio companies' performance is compared. Using a larger control sample did not alter the results. The significance levels and directions of the estimates of difference in the (industry-adjusted) performance ratios between pre-holding and holding period for the PE-backed companies did not change under the 10NN control group specification (Appendix 11). Moreover, the estimates in tests in difference of IRR-COE between PE-owned and control companies still remained insignificant in both the joint t-test and the Wilcoxon test (Appendix 12). Therefore, the results do not seem to be driven by a narrow or ill-sampled control group.

Second, since the RIV model is sensitive to the choice of the horizon point in time, the whole set of RIV values with the horizon point in time $T = 7$ instead of $T = 5$ was re-estimated.[21] Re-estimating the RIV values with $T = 7$ is consistent with the fact that a portion of investors has a longer holding period and thus may model value more explicitly. Most importantly, this robustness check shows whether the overall median

[21] Shifting the horizon point further into the future pronounces high (low) RIV values, since the linear interpolation of periodical $R^*_{E,i,t}$ from a high (low) $R^*_{E,i,1}$ to lower (higher) $R^*_{E,i,T+1}$ is spread over more explicit forecasting periods.

negativity of the IRR-COE spread and its insignificant difference between portfolio company and control group results from the specific RIV model. Appendix 13 shows that this is generally not the case. In fact, while the median IRR-COE spread is slightly more negative for control firms and less negative for the PE-backed firms than in the original model specification, the latter is still not significantly different from that of the former. The IRR-COE stays insignificantly different between control and PE-backed firms when testing the difference in means (t-test). This is expected as the IRR specification incorporates the higher $T = 7$ RIV values as the entry and exit value.

Third, since the probability of failure during the holding period is not considered in most PE valuations in practice, the last robustness test excludes it from the cost of equity estimation.[22] This also means that investors would not expect to be compensated for increased bankruptcy risk. In fact, based on the presented findings that bankruptcy risk rises under PE ownership, bankruptcy-adjusted cost of equity is likely higher for the portfolio companies, which may depress their IRR-COEs. Hence, it is interesting to investigate the significant difference in control and portfolio companies' IRR without considering bankruptcy risk. Using the unadjusted cost of equity, no different results than when using the bankruptcy-adjusted, firm-specific cost of equity can be observed. The differences in mean and median IRR-COE between portfolio company and control group remain insignificant (Appendix 14).

[22] Based on personal exchange with industry practitioners and experience. Not a comprehensive or reliable survey.

5. Discussion

5.1. Decreasing Operational Superior Performance of Portfolio Companies

In contrast to many of the studies in section 2.1, which find improving operating profit margins and operating returns (ROCE), the Swedish portfolio companies in this sample exhibit significantly lower performance in these terms after acquisition by PE firms (Achleitner et al., 2010; Boucly et al., 2011; Guo et al., 2011; Kaplan, 1989a). In fact, the findings in this study stand in stark contrast to Bergström et al. (2007), who ascribe a significantly positive effect on operating performance in EBITDA margin and ROIC terms to Swedish buyouts. Still, the falling operating profit margins are consistent with Cohn et al. (2014).

This dissonance with a large body of prior operating performance research is surprising, but there are explanations for it. While this study focused on accounting-based metrics following the capital employed approach, others used different balance sheet classifications (cf. Figure 2). Most relevant though, the decrease in ROCE in the 95 portfolio companies is, apart from the decrease in operating profit margins, heavily driven by a decrease in asset turnover. This decrease in asset turnover originates from an increase in capital employed, considering that growth in sales for most portfolio companies continues to be positive in the holding period. Similarly, Boucly et al. (2011) find growth in capital employed as part of the higher firm capitalization in buyouts. Therefore, it is not surprising to examine such a drop in operating return metrics when the denominator (capital employed) suddenly increases in the initial years after the buyout. Interestingly, the increase in the denominator does not seem to be matched with a proportional increase in the nominator. That is, growth in operating income in the following holding event years would, at least partly, lead ROCE back to pre-buyout levels. Actually, ROCE decreases significantly on a non- and industry-adjusted basis and seems to continue to do so over the holding period (cf. Figure 3, Table 9).

While operating returns are presumably still high in absolute terms and in comparison to the control group, this development is at least worrisome. It is further inconsistent with the more general idea that managers under PE ownership or governance structures improve operations. Nonetheless, most PE-owned firms in this study seem to continue performing slightly better than control firms in the holding period, given their positive industry-adjusted operating performance ratios.

Also, this study suggests that factors driving operating risk (volatility in the change in ROCE) decrease in portfolio companies. First, the fact that growth in sales is significantly lower than before the buyout for the sample of PE-owned companies is inconsistent with most studies on operating performance (Bergström et al., 2007; Boucly et al., 2011; Guo

et al., 2011). In this case for Swedish firms, it seems as though portfolio companies mature under PE ownership. This is consistent with the sample including small firms that grow strongly in the pre-buyout period and are thus more likely to be in later stages of the company life cycle during the holding period. Second, the decrease in growth in sales is paired with a decrease in operating leverage under PE ownership (cf. Figure 4, Table 9). The significant decrease in ATO primarily drives this significant decrease in operating leverage while the difference in pre-holding and holding period CMR is insignificant (cf. Table 9). On the one hand, this suggests that portfolio companies‘ operating risk decreases in comparison to before the buyout. On the other hand, this decrease in operating risk largely originates from the decrease in sales growth and a rising capital employed. From an operating risk and return perspective, one might have expected portfolio companies to exhibit a higher decrease in risk than returns in favour of their owners. In this case, it is not clear which effect is more pronounced, a decrease in operating returns (ROCE) or their volatility. Nonetheless, it seems as though both, or at least their main drivers, simply decrease significantly in portfolio companies. In general, these observations are primarily a result of the higher capitalisation, that is capital employed. In other words, operating returns and risk are distributed over a broader capital base.

It thus seems that this study cannot confirm superior operating performance by PE-owned companies as previous studies have found. Yet, this study bases operating performance solely on accounting information, excluding, for instance, wage levels or employee numbers used in previous studies. Furthermore, this is in terms of a pre- and post-buyout event year comparison and after adjusting for industry performance. The presented literature in section 2.1 focussed on a more direct PE-owned vs non-PE-owned company performance rather than an extensive comparison of performance over the event-period.

5.2. Typical Capital Structure Development but Deteriorating ROE

The highly significant changes in the capital structure ratios confirm previous studies‘ findings of a drastic increase in leverage as part of the buyout (cf. Table 9). This is not surprising since it is by definition an integral part of the Private Equity ownership model. Nonetheless, the size of leverage under PE ownership in this study differs. During the holding period, the median financial liability ratio is 0.44, while previous studies found 0.6 to 0.9 of Debt-to-Total Capitalization (Guo et al., 2011; Kaplan & Strömberg, 2009). In other words, previous studies find that financial leverage or financial liability ratios have roughly tripled in comparison to the pre-holding period. Meanwhile, this study suggests they have only doubled (Appendix 6). This can have many reasons. First, prior studies included more deals from earlier decades in which leverage levels were slightly higher under a more financial-restructuring or -optimization driven buyout system. Second, leverage levels in Sweden post-2007 seem to have decreased and hover around 0.5 Debt-to-Total Capitalization or 1.0 Debt-to-Equity dependent on the year (Naess-Schmidt et al., 2017). The latter rates are more consistent with this study, suggesting that

slightly lower leverage levels are a feature of the Swedish Private Equity market. Third, not all debt is always held by the operating portfolio company but in some cases by a holding company higher up in the legal structure of the group.

Similar to Kaplan (1989b), it also seems that higher debt levels are rather sticky in the investigated portfolio companies (cf. Figure 6, Table 9). Albeit not proven, high and reasonably stable leverage levels over the range of the holding period are generally consistent with the disciplining function of debt theory (cf. section 2.2). Nonetheless, it remains inconclusive what drives leverage levels in the investigated portfolio companies.

Based on the insignificant difference in industry-adjusted cost of debt in the holding versus the pre-holding period, findings by Ivashina and Kovner (2011), that portfolio companies have better access to cheaper debt through their Private Equity owners, can not be confirmed (cf. Table 9). The slightly significant difference in portfolio companies' cost of debt is thus likely driven by generally decreasing interest rates post the 2007/08 financial crisis. This holds combined with the fact that the firm-year observations from 2007 and later years are more prevalent in holding period event years. Also, it might be that such favourable debt contracts are not held on an operating company level and thus escaped the study's analysis.

The evidence on differing cash management is ambiguous. While liquidity seems to be managed more tightly, indicated by the significant decrease in quick ratio, no difference in working capital components is found (cf. Figure 5, Figure 7, Table 9). Whereas the former suggests some operating or financial use up of cash, the latter is no evidence of any particular trend in portfolio companies. This could be since the presented working capital ratios are traditional components of cash cycles but do not include other accruals and deferrals one may regard as part of working capital.

Lastly, the significant decrease in ROE in the holding period is surprising (cf. Table 9). Prior evidence in the literature on improving ROCE, lower cost of debt, and higher leverage levels should all have suggested that ROEs increase in a DuPont-like breakdown. This is not the case in this study. As established, industry-adjusted cost of debt changes insignificantly and financial leverage levels rise. The slump in ROE is thus likely driven by the drop in ROCE. Even increased leverage does not seem to make up for it. What is more, the same reasoning with a lagging increase in nominator performance (operating income, growth in sales), after the increase in capital employed, applies and seems to be an equally as large issue for equity holders as for total capital providers. Further, this decrease in ROE under PE ownership may partly result from the decomposition of ROE in DuPont terms and not a more condensed Net Income to (Common) Equity definition as in previous studies.

In conclusion, it seems that this study is generally in line with much of the previous literature on capital structure developments in portfolio companies. At the same time,

financial performance in return on equity and cost of debt terms does not seem to improve in portfolio companies as prior literature suggests.

5.3. Increasing Bankruptcy Risk in Portfolio Companies

Based on the findings in section 4.1.2, PE-owned firms end up with higher bankruptcy risk after the buyout than before and seem to face higher probabilities of failure in the holding period compared to the control group (cf. Table 9). Considering this development in light of previous research, Tykvová and Borell (2012) found a similar trend. However, they also discover that bankruptcy risk of PE-owned firms aligns with that of non-PE-owned control firms after three years into the buyout. Even though the probability of failure for PE-owned firms in the data does seem to trend towards the control group from $t + 1$ to $t + 4$, the industry-adjusted ratio still has a positive median in the holding period (cf. Appendix 6). Complementary to comparably higher bankruptcy risk for PE-owned firms, Strömberg et al. (2011) and Wilson and Wright (2013) observed that bankruptcy rates for non-PE-backed firms are slightly lower. Furthermore, the rise in the probability of failure for PE-owned firms is consistent with findings of a significant increase in leverage and a significant drop in liquidity after the buyout, which indicate a rising bankruptcy risk but are as such not part of the 1-year prediction model (cf. Table 5, Table 9). Yet, contradicting expectations, the industry-adjusted cost of debt did not significantly change between the pre-holding and holding period despite the increase in bankruptcy risk (cf. Table 9). This might be explained by Strömberg et al. (2011), who state that portfolio companies are not significantly more likely to default on loans, not even those with comparatively high levels of financial debt.

Furthermore, the probabilities of failure for the study's portfolio company and control sample seem low compared to previous research (cf. section 2.3). This could have several reasons. The two presumably most severe ones are a sample selection bias and the fit of the applied bankruptcy prediction model. In the sample selection process inactive firm years were excluded, and a firm's financial reports had to be available for around 11 years (cf. 3.2). These filters resulted in the exclusion of actual bankruptcies and thus might have lowered the probability of failure. In addition, the applied bankruptcy prediction model was estimated using a data set with differing company characteristics (cf. 3.3.3). These mismatches could have led to lower bankruptcy risks as well.

Although higher bankruptcy risk would usually require higher returns, the industry-adjusted ROCE and ROE actually decrease significantly under PE ownership (cf. Table 9). Similarly, an expected higher cost of debt due to increased bankruptcy risk is not observable in PE-owned firms (cf. Table 9). Hence, the portfolio companies' owners appear not to be compensated for bearing more risk but also do not face higher financing costs in terms of cost of debt. Some explanations can be found in prior studies, which state that PE fund managers are better at handling distress risk and insolvency proceedings

(Strömberg et al., 2011; Wilson & Wright, 2013). Additionally, Strömberg et al.; Wilson and Wright (2011; 2013) conclude that financial distress is less costly for PE-owned firms than their peers. Both findings justify that the impact of bankruptcy risk on returns and financing costs is less severe under PE ownership due to smaller negative effects when becoming distressed.

In general, the development and higher bankruptcy risk of PE-owned firms in this study are mainly aligned with prior research. However, the impact of increased bankruptcy risk on returns and financing costs evolves against expectations.

5.4. Unsystematic and Industry-specific Changes in Conservatism

The difference in q-values between the pre-holding and holding period is insignificant. Therefore, the following discussion points have to be treated with caution and are only of indicative value.

Generally, there is some weak indication that conservatism decreases in the sample of portfolio companies (cf. Table 6). Yet, given the insignificant change (Table 11), the aggregated decreases in mean and quartile ranges could equally be associated with firm-specific values skewing the results. Further, the results stand in some contrast to Katz (2009), who found higher conservatism in PE-owned vs non-PE-owned companies. Following the author's logic, one would have expected q-values to increase from pre-holding to holding period.[23] If anything, the drop in q-values is more consistent with a release of hidden reserve from less conservative accounting in portfolio companies.

Going into more granular accounting biases, the bias related to practices of R&D expenses ranges widest and drops the highest in the pre-holding and holding period among the estimated asset and liability biases (cf. Table 6). For companies with such a bias, it is usually the largest component of their total q-values. This is consistent with Runsten (1998), who found R&D biases to be the highest in his sample of Swedish public firms. The overly conservative accounting for R&D, and intangibles generally, could be of particular interest to Private Equity seeking to benefit from releasing hidden reserves. In other words, it still remains open whether owners could benefit from a less conservative and closer to fair value way of accounting, especially in intangibles. This is despite 50% of the sample of portfolio companies stemming from the traditional Industrial and Shopping Goods industries.

The estimated q-values of portfolio companies rank similarly by industry as those of public firms from Runsten (1998) (cf. Appendix 7, Appendix 8). Firms in the Shopping (Consumer) and Industrial (Capital-intensive) Goods industries exhibit the highest total q-value in both studies. More, Runsten's ‚Services' and ‚Consultants and Computers',

[23] Given the scope of this work, q-values were not estimated for the sample of control companies which limits comparability to Katz (2009).

comparable to Corporate Services, rank similarly in the mid-field. Conversely, calculating total q-values as a sum of individual q-value medians suggests that they are highest in Health & Education and IT & Electronics in the pre-holding as well as holding period. Runsten (1998) found the same without considering IT & Electronics in particular. Furthermore, since 1998, conservatism has decreased in Swedish companies which should lead to generally lower estimated biases (cf. 2.4). This is reliably observable for most industries (cf. Appendix 7, Appendix 8, Runsten (1998)). Nevertheless, in the industry breakdown, median total PMBs actually seem to increase for Shopping, Convenience, and Industrial Goods, as well as IT & Electronics comparing pre-holding and holding levels.

In conclusion, there is neither clear evidence that accounting in portfolio companies becomes less conservative nor evidence of a systematic release of hidden reserves in the holding period. Nonetheless, a change in q-values has a considerable impact on RIV values and, consequently, portfolio company-centric IRRs. For example, the mean (median) drop in total q-value by ~0.25 (0.05) has roughly the same effect on estimated RIV values as a 5% (1%) drop in ROE (cf. Table 6 and sensitivity tables in Skogsvik (2002)). The part of q-value pertaining to accounting measurement biases should thus not be disregarded when applying the RIV model in a private firm or PE setting.

5.5. Superior Firm Selection and Performance Reversion

The prior discussions have shown how the companies' operating and financial performance as well as bankruptcy risk developed under PE ownership. However, the analysis revealed a trend concerning portfolio companies even before PE firms acquired them. That is, portfolio companies selected by PE firms seem to perform better than their peers in terms of operating profit margin, asset efficiency, return on capital employed, sales growth, and return on equity (cf. 4.1.1). They also have less levered balance sheets and lower bankruptcy risk before the buyout (cf. 4.1.1, 4.1.2). Even though this trend could result from a sample bias, Tykvová and Borell (2012) detected that PE managers select companies with comparably low bankruptcy risk. Additionally, Wilson and Wright (2013) argue that PE firms select portfolio companies with higher profitability, better ability to generate cash, and lower debt levels than non-PE-owned firms. Furthermore, by comparing RIV-to-Book values of the portfolio company and control sample, it becomes evident that PE firms also seem to select companies with significantly higher equity values in the pre-holding period (cf. Table 7, Appendix 9). In other words, PE owners identify and are willing to pay more for better future business prospects. Therefore, PE fund managers might be very good at selecting superior firms.

However, a second identifiable trend is that certain operating and financial performance measures, such as operating profit margin, return on capital employed, sales growth, and return on equity, actually experience a reduction in superior performance during the

holding period compared to the pre-holding period. In short, they seem to reverse towards the control group. This is supported by negative estimates in the significance tests of operational and financial ratios in Table 9, but mostly positive industry-adjusted ratios in the holding period across PE-owned firms (cf. 4.1.1). Moreover, this trend likely takes effect in the insignificant difference in RIV/BV between PE-owned and non-PE-owned firms in the holding period (Appendix 9), which suggests similar future business prospects. This trend contradicts previous statements on superior performance by PE-owned firms of comparable private firms. In fact, this trend of performance reversion to industry levels is similar to Cohn et al. (2014) argument on high or low pre-buyout operating performance reverting to the industry mean during the initial years in the holding period. Hence, future research could be encouraged to focus on whether PE funds benefit more from increasing a portfolio company's superior performance or rather nurse from their managers' strong ability of superior firm selection. Summing up, superior portfolio companies seem to be selected by PE firms, yet their core performance subsequently reverts to industry levels.

5.6. Lacking Evidence on Excess Value Creation or Destruction

The median IRR of portfolio companies of 11.3% appears at first to be low for a PE setting (cf. Table 8). Yet, this has several explanations. First, the significant decrease in ROE for PE-owned firms, if everything else remained constant, likely leads to proportionally lower predicted residual incomes (nominator) and ultimately lower RIV values in $t + 4$. Second, it is possible that not all of the planned value creation projects are concluded in $t + 4$ which depresses first-year ROEs flowing into the model.[24] Third, median RIV/BV for PE-owned firms remain almost constant between the pre-holding and holding period and are not significantly different from the control groups' RIV/BV in the holding period anymore (Appendix 9). Hence, portfolio companies seem to be entered and exited at similar fair values contributing at best positively to the IRR. Fifth, IRRs are based on portfolio companies and do not account for potential return generated on PE fund level. This originates from multiple arbitrage or skills in company selection and purchase negotiations (cf. section 3.3.7). Hence, the median IRR of 11.3% for PE-owned firms aligns with the findings in ROE and RIV/BV values and is only slightly higher than the control groups'.

The Fama-French model implied required returns are higher in median than the median IRRs for PE-backed firms and their peers, as the negative median IRR-COE indicates for both samples (cf. Table 8). There are some possible explanations for this. First, the firm-specific costs of equity are bankruptcy-adjusted, thus increase the COE (cf. 3.3.5). At the same time, the robustness test of not adjusting for bankruptcy risk generated the same results (cf. 4.4, Appendix 14). Second, since the cost of equity is derived from public firm

[24] Please refer to section 3.1 as to why t+4 is chosen to measure RIV values and calculate IRRs.

returns, the liquidity premium is added and naturally increases the COE by 2.5 percentage points (cf. 3.3.5). Since the liquidity premium applies to control and PE-owned firms and is not large enough to turn the median IRR-COE positive, no different result should be expected. Third, the estimation horizon of the Fama-French model is comparatively short, with most indices starting from the year 2000, potentially leading to higher COEs given the predominantly bullish equity markets. Still, the comparatively high costs of equity fit this set of small- to mid-cap private companies. This is because investors in those require not only a private firm premium but also a size premium.

Admittedly, the summary statistics with predominantly negative IRR-COEs look odd at first, as the long-term perseverance of the PE industry and previous research would suggest significant equity value creation on portfolio company level (cf. section 2). Generally, the mean IRR-COE for control firms is statistically insignificantly different from zero (cf. Appendix 10), meaning the expected excess return in an equally balanced portfolio of the control companies is zero. This makes the control group a comparable private market portfolio. Fulfilling this expectation supports the construction of the control sample and validates the applicability of RIV and Fama-French implied COE in a PE setting. Furthermore, the mean and median IRR-COE for PE-owned firms are significantly negative but not significantly different from those of the control group (cf. Appendix 10, Table 12).

This negative drift is also expected when analysing the winner-loser segmentation. Two-thirds of the total sample generate lower IRRs than the required return (cf. Table 8), while one third generates excess returns. This means that most Swedish firms, whether PE-held or not, did not generate excess shareholder value over a six-year time horizon during the past two decades. Additionally, the data includes many firm-year observations during the financial crisis and its aftermath, which could explain the low gross IRRs. Nonetheless, the impact of the financial crisis years does not distort the IRR-COE interpretation because of the difference test between portfolio companies and their non-PE-owned peers. Therefore, the statement of no excess value creation in Swedish PE-owned companies versus non-PE-owned ones holds.

In short, the presented results and discussions imply that there is not more or less equity value created or destroyed in Swedish portfolio companies post 2000 than in a comparable Swedish market portfolio. This does not mean that PE firms generate an inferior return to investors in the fund. It merely implies that other levers, such as buying good firms at a discount or selling them at a premium to fair value or benefitting from different forms of multiple arbitrage, could be more important than previously believed.

6. Conclusion

6.1. Contributions

Using a sample of 95 Swedish PE-owned companies and 393 matched control firms, this study investigated the performance and value creation in portfolio companies acquired between 2001 and 2015, based purely on publicly available accounting data. Thereby, valuable insights on the development of Swedish portfolio company characteristics in the holding versus pre-holding period have been generated.

Contrary to a large body of research, operating profit margins and returns decrease significantly from pre-holding to holding period. At the same time, sales growth matures and operating leverage declines under PE ownership driving operating risk down. Both operating returns and risk are impacted by the decrease in asset turnover from a sudden increase in capital employed as part of the buyout. This does not seem to be matched by a proportional increase in operating income even some years into the holding period.

Financial leverage doubled from pre-holding to holding period and remains sticky over the holding period. Yet, this increase is smaller than in previous studies, likely due to the lower leverage levels in Sweden and since the 1990s as well as not all financial debt being reported on an operating portfolio company's balance sheet. This financial debt also does not carry significantly lower cost of debt than faced by non-PE-owned firms, as suggested by prior research. Return on equity decreases significantly under PE ownership which primarily originates from the decrease in operating returns not compensated by a large enough decrease in cost of debt or increase in financial leverage.

What is more, portfolio companies' probability of failure increases significantly after the buyout but remains low. Furthermore, the analysis of q-values provided no clear evidence of a systematic shift in accounting conservatism or release of hidden reserves under PE ownership. However, in certain industries and companies with large intangibles, such as R&D, accounting conservatism changes more drastically from pre-holding to holding period and should thus not be omitted when estimating equity values in a PE context.

The findings are also consistent with the idea that PE firms select superior companies. This is expressed by better operating business prospects, more leeway in the capital structure and lower bankruptcy risk in portfolio companies in the years before the buyout. Even so, this prior superior performance in terms of operating profit margins, operating returns, growth in sales, and return on equity seems to regress towards industry levels over the holding period.

On portfolio company level, there is not more or less equity value created or destroyed in Swedish PE-owned companies post-2000 than in a comparable Swedish market portfolio.

This does not mean that PE firms generate inferior returns to investors in the fund.[25] Furthermore, this study adds to the methodology in private firm research. The RIV model allowed for clean fair value estimates at different points in the event-period while considering accounting conservatism. Additionally, valuation is not influenced by market-sided value effects in the PE context. Practitioners in Sweden could use Serrano and the outlined methodology to identify outstanding prospective portfolio company performance and valuation.

6.2. Limitations

Similar to most studies in which the sampled data requires prior filtering and cleaning, there is a risk of selection bias in the sample of portfolio companies and comparable non-PE-owned firms. In this context, the exclusion of complex transactions, for example, different companies were merged or the filing with the tax authority changed radically, creates a considerable bias. This might also have led to the exclusion of particularly large transactions assuming they are more complex or PE funds reorganise them more drastically. Further, requiring comprehensive and successive accounting data over many years is somewhat restrictive. This is especially the case for PE transactions in which large scale reorganisations occur. Also, the study's design does not cover secondary PE deals, venture capital investments, minority equity investments or distressed situations. Hence, inferences about portfolio companies in such situations are not possible.

Methodologically, there are some limitations to the applicability of the RIV model. We standardized the holding period from $t-2$ to $t+4$ based on the specified reasons in section 3.1, 3.3.6, and 3.3.7. This fits most transactions in the sample but may not depict the full reality for portfolio companies held for a longer period of time. Moreover, the estimated RIV values rest on a set of assumptions, which nonetheless are feasible and have been partly tested for robustness. Additionally, one might have preferred to choose a public twin to estimate the firm-specific cost of equity rather than industry returns. Still, this is overly cumbersome for such a large sample, and there may not even exist one for a large portion of companies. Further, since q-values were only estimated for the portfolio company sample, some effects could have spilled over to the control sample. Nevertheless, the control sample, based on Propensity Score Matching, likely fulfils similar firm characteristics to the portfolio company sample. Lastly, by design, this study cannot capture performance parameters and characteristics or value effects that are not observable through accounting numbers in the investigated event period. For instance, this pertains to governance-related performance and value drivers.

[25] Cf. discussion on market-sided effects in section 3.3.7 and 5.6

6.3. Suggestions for Future Research

This study's contributions open new fields for discussion in PE research, which could be investigated in future research. First, researchers should consider the different forms of performance and characteristics of portfolio companies over longer event horizons around the transaction event date to examine the trend of performance regression and maturation under PE ownership. Second, notwithstanding its benefits, the RIV model's accuracy in pricing past PE transaction values has not been tested. Yet, making this direct connection would further contribute to the applicability of the RIV model in the PE setting. Third, only a limited number of papers about the change in accounting conservatism under PE ownership is available. Fourth, the same applies to value appreciation due to changes in accounting practices. Not least, this study shows that accounting conservatism is a relevant characteristic to be further investigated in the PE context. Fifth, future research could be encouraged to focus more on whether PE funds benefit more from increasing portfolio company superior performance or rather nurse from their managers' strong ability of superior firm selection.

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8. Appendix

Appendix 1. List of 95 acquired portfolio companies in the portfolio sample

Target	Acquirer	Effective date	Years held
Callenberg AB(Expanda AB)	Segulah Advisor AB	May-01	6.7
Industri-Matemetik Intl Corp	Symphony Technology Group LLC	Dec-02	5.1
Serco Sverige AB	CapMan Oyj	Oct-03	3.6
Semper AB	Triton Advisers(Nordic)AB	Dec-03	2.1
Previa AB	Segulah Advisor AB	Mar-04	3.6
Blomsterlandet AB	Stena Adactum AB	Mar-04	n/a
Wernersson Ost AB	Accent Equity Partners AB	May-04	3.2
Akzo Nobel Inks A/S	CVC Capital Partners BV	Sep-04	9.5
Myresjohus	Industri Kapital AB	Mar-05	2.2
Atos Medical AB	Nordic Capital Advisory AB	Apr-05	6.3
Boxer TV Access AB	3i Group PLC	May-05	3.5
PAX Electro Products AB	Litorina Kapital 1998 KB	Jun-05	7.5
Inflight Service Europe AB	CapMan Oyj	Sep-05	4.2
Nils Hansson Logistics AB	Nordstjernan AB	Oct-05	5.7
Skanska Modul AB	3i Group PLC	Dec-05	1.1
JetPak AB	Polaris Management A/S	Feb-06	13.8
Saddler Scandinavia AB	Credelity Capital AB	Jul-06	n/a
Dustin AB	Altor Equity Partners AB	Aug-06	10.2
ScandBook AB	Accent Equity Partners AB	Oct-06	3.5
Ellipse Kliniken	Reiten & Co AS	Nov-06	5.4
Bygg Partner i Dalarna AB	Priveq Investment AB	Nov-06	10
Isaberg Rapid AB	Segulah Advisor AB	Dec-06	3.2
Etac Sverige AB	Nordstjernan AB	Dec-06	n/a
ELFA AB	Industri Kapital AB	Dec-06	1.3
RH Form AB	Ratos AB	Jan-07	7.5
Resta	Litorina Capital Advisors AB	Jan-07	3
AVT Industriteknik AB	Investment AB Latour	Feb-07	n/a
Inredningsglas Skandinavien	Accent Equity Partners AB	Feb-07	2.8
Fiskarhedenvillan AB	Polaris Management A/S	Mar-07	4.9
Liber AB	Bridgepoint Advisers Ltd	Mar-07	8.9
Corroventa Avfuktning AB	Volati AB	Mar-07	n/a
EFG European Furniture Group	Ferd Private Equity Fund II	Apr-07	11.1
Securia Systems AB	Litorina Capital Advisors AB	Jun-07	n/a
Heatex AB	Odin Equity Partners A/S	Jun-07	13.5
Pahlens Fabriker AB	Litorina Capital Advisors AB	Jul-07	5.3
Nautilus (Actic Sverige AB)	FSN Capital LP II	Nov-07	4.7
Ikivo AB	Verdane Capital Advisors AS	Nov-07	n/a
Frösunda LSS AB	Polaris Management A/S	Dec-07	2.4

Target	Acquirer	Effective date	Years held
Nilssons Gott AB	Segulah Advisor AB	Dec-07	3.3
Mont Blanc Industri AB	Accent Equity Partners AB	Dec-07	8
Coromatic Datasakerhet	Litorina Capital Advisors AB	Jan-08	3.4
CTEK Sweden AB	FSN Capital LP II	May-08	3.1
Bendiro AB	Altor Equity Partners AB	Aug-08	11.2
Gunnebo Industrier AB	Segulah Stellata Holding AB	Aug-08	10.8
Unisport Scandinavia AB	Priveq Investment AB	Aug-08	6.6
Sandberg & Soner Mekanisk	Volati AB	Sep-08	n/a
Pocketstallet AB	Scope Capital Advisory AB	Nov-08	5.2
San Sac AB	PRIVEQ Capital Funds	Dec-08	5.8
Tactel AB	FSN Capital Partners AS	Jul-09	5.7
Hemtex AB	Hakon Invest AB	Jul-09	9.8
Pysslingen Forskolor	Polaris Management A/S	Aug-09	1.9
Baluba AB	CapMan Oyj	Sep-09	4.1
Motala Train AB	Qeep Ventures AB	Jan-10	8.7
Scanacon AB	Capilon AB	Feb-10	8.7
Team Ortopedteknik Scandinavia	Volati AB	Feb-10	3.7
World Class Seagull Intl AB	Norgesinvestor AS	Apr-10	8.1
G-TEK Gummeson Teknik AB	Starcup Private Equity Fund 1	Jun-10	n/a
PP7 Affarssystem AB	ALMI Invest AB	Nov-10	7.4
Gunnebo Troax AB	Accent Equity Partners AB	Nov-10	2.2
Kellfri Holding AB	Volati AB	Nov-10	n/a
Miroi AB	Via Venture Partners A/S	Nov-10	n/a
Björnklader AB	Litorina Capital Advisors AB	Dec-10	5.4
Tengbomgruppen AB	Sobro AB	Feb-11	n/a
Hööks Hästsport AB	Accent Equity Partners AB	Feb-11	3.9
Maskinflisning i Laxa AB	PEQ AB	Apr-11	n/a
Thomson Reuters-Legal,Tax	Gmt Commun Partners Llp	Apr-11	4.2
Jarnforsen Energi System AB	Alder AB	May-11	7
Flexpay AB	Vitruvian Partners LLP	Jun-11	n/a
Silva Sweden AB	Karnell	Jul-11	n/a
Scandinavian Track Group AB	Polaris Management A/S	Sep-11	7.3
Sveba-Dahlen Group AB	Litorina Capital Advisors AB	Nov-11	5.6
Skanska Byggvaror AB	Polaris Management A/S	Jan-12	3.8
Noas Snickeri AB	Kattegatt Partners AB	Mar-12	n/a
Prenax Global AB	AB2 SAS	Apr-12	5.7
Llentab AB	Nordstjernan AB	Jun-12	n/a
Royal Design Group AB	eEquity AB	Dec-12	8
Netel AB	Axcel Industriinvestor A/S	Mar-13	3.2
Byredo AB	Manzanita Capital Ltd	May-13	n/a
AB CJ Bjornberg	Evolver Investment Group Ab	May-13	3.1
Klattermusen AB	Scope Capital Advisory AB	Sep-13	n/a
Mälar Sprinkler AB	Evolver Investment Group Ab	Dec-13	3.3

Target	Acquirer	Effective date	Years held
Didriksons Regnklader AB	Herkules Capital AS	Jan-14	4.4
Breas Medical AB	Pbm Capital Group LLC	Feb-14	3.1
Bygg Dialog AB	Sobro AB	Feb-14	n/a
STARK Corporate Communication	More Ventures Nordic AB	Mar-14	n/a
Kjell & Co Elektronik AB	FSN Capital Partners AS	May-14	n/a
NaturaMed-Pharma AB	Volati AB	Jun-14	6.6
Bygghemma Sverige AB	Nordstjernan AB	Nov-14	1.9
Grade AB	Monterro 1 AB	Jan-15	n/a
Happy Socks AB	Scope Capital Advisory AB	Jan-15	2
Pierce AB	Procuritas Partners AB	May-15	n/a
INTERSPORT Sverige AB	Adelis Equity Partners AB	Jun-15	n/a
Roplan Holding AB	FSN Capital IV	Aug-15	3.9
TFS	Ratos AB	Sep-15	n/a
Creovent AB	Evolver Investment Group Ab	Sep-15	3.3

Appendix 1 lists the 95 portfolio companies in the sample and the respective PE acquirer, effective acquisition date, and the years under primary private equity ownership. Years held is n/a for which firms an exit date was not found or had not been exited in February 2021. Target and acquirer name are as in SDC Platinum.

Appendix 2. Association of Serrano Industries to Swedish Production Price Indices

Serrano Industry	Serrano / SNI07 Code	SCB Statistics Sweden PPI	PPI Type
Energy & Environment	10	ERVE energy related goods, including D	Industrial
Materials	15	INS intermediate goods industry	Industrial
Industrial goods	20	C manufacturing industry	Industrial
Construction industry	22	INV capital goods industry	Industrial
Shopping goods	25	VKON durable consumer goods industry	Industrial
Convenience goods	30	IVKON non-durable consumer goods industry	Industrial
Health & Education	35	Custom health index	Industrial / Service
IT & Electronics	45	Custom tech index	Industrial / Service
Telecom & Media	50	Art. Entertainment	Service
Corporate services	60	Administrative and support service	Service
Other	98	Average of selected indices	Industrial / Service

Appendix 2 shows the Production Price Indices from Statistiska centralbyrån (SCB, 2021) associated with the respective industries in Serrano. Industrial and Service PPIs were available on a monthly basis from the year 2000 to 2020 (rebased to the year 2000) and annualized. For earlier years up to 1990, the same Industrial PPIs were available on a yearly basis and consequently matched. The Service PPIs, as a simplification, were held constant from the year 2000 backwards. For some Serrano Industries, a custom index of available industrial and service production price indices was constructed. The custom health index consists of the indices 'Education. human health and social work' and '21 industry for basic pharmaceutical products and pharmaceutical preparations'. The custom tech index consists of the indices '26 industry for computer, electronic and optical products', '27 industry for electrical equipment' and 'IT real-estate businesses'. Both custom indices are equally weighted. Not depicted is the Financial & Real Estate industry, as no such firms are in our sample.

Appendix 3. Association of Serrano Industries to NASDAQ Stockholm Industry Indices for industry-specific Fama-French 3-factor model estimation

Serrano Industry	**Serrano / SNI07 Code**	**NASDAQ Public Equities Industry Index**
Energy & Environment	10	SX60GI, OMX Stockholm Energy GI, (SE0004382588)
Materials	15	SX55GI, OMX Stockholm Basic Materials GI, (SE0004382646)
Industrial goods	20	SX50GI, OMX Stockholm Industrials GI, (SE0004382711)
Construction industry	22	SX5010GI, OMX Stockholm Construction and Materials GI, (SE0004382729)
Shopping goods	25	SX4020GI, OMX Stockholm Consumer Products and Services GI, (SE0004382877)
Convenience goods	30	SX4510GI, OMX Stockholm Food, Beverage and Tobacco GI, (SE0004382844)
Health & Education	35	SX20GI, OMX Stockholm Health Care GI, (SE0004382927)
IT & Electronics	45	SX10GI, OMX Stockholm Technology GI, (SE0004383222)
Telecom & Media	50	SX15GI, OMX Stockholm Telecommunications GI, (SE0004383032)
Corporate services	60	SX502050GI, OMX Stockholm Industrial Support Services GI, (SE0004382802)
Other	98	OMXS30, OMX Stockholm 30 Index, (SE0000337842)

Appendix 3 shows the NASDAQ Stockholm Public Equity Industry Indices (Nasdaq Stockholm, 2021) associated with the respective industries in Serrano. All indices are Gross Indices (GI) and were matched to the Serrano industries based on similar types, product offering and business models. Not depicted is the Financial & Real Estate industry, as no such firms are in our sample.

Appendix 4. Estimated Swedish Fama-French 3-factor industry models

	Dependent variable:						
	Ri - rf						
	Energy & Environment	Materials	Industrial Goods	Construction Industry	Shopping Goods	Convenience Goods	Health & Education
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
rm_rf	1.214***	0.869***	0.938***	0.894***	0.624***	0.470***	0.512***
	(0.041)	(0.013)	(0.008)	(0.012)	(0.010)	(0.014)	(0.012)
smb_vw	0.603***	0.164***	-0.012	0.054***	-0.009	0.242***	-0.069***
	(0.057)	(0.019)	(0.012)	(0.018)	(0.015)	(0.021)	(0.018)
hml_vw	0.207***	0.382***	0.234***	0.176***	0.242***	0.082***	-0.020
	(0.061)	(0.018)	(0.012)	(0.017)	(0.015)	(0.021)	(0.017)
Constant	0.0002	0.00003	0.0001	0.0001	0.0001	0.0003**	0.0002
	(0.0003)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Observations	4,159	4,885	4,885	4,885	4,885	4,885	4,885
R^2	0.304	0.591	0.805	0.616	0.550	0.197	0.345
Adjusted R^2	0.304	0.590	0.805	0.616	0.550	0.196	0.345
RSE	0.020	0.010	0.007	0.010	0.008	0.012	0.010
F Statistic	606.105***	2,347.353***	6,706.896***	2,613.084***	1,988.237***	398.222***	857.998***

	Dependent variable:				
	Ri - rf				
	Finance & Real estate	IT & Electronics	Telecom & Media	Corporate Services	Other
	(8)	(9)	(10)	(11)	(12)
rm_rf	0.975***	1.409***	0.977***	0.770***	1.062***
	(0.008)	(0.020)	(0.016)	(0.014)	(0.002)
smb_vw	0.032***	-0.010	0.095***	0.152***	-0.095***
	(0.011)	(0.029)	(0.024)	(0.021)	(0.003)
hml_vw	0.346***	-0.393***	-0.105***	0.159***	-0.033***
	(0.011)	(0.028)	(0.023)	(0.020)	(0.003)
Constant	-0.00003	-0.0002	-0.0001	-0.00002	-0.0001***
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.00002)
Observations	4,885	4,885	4,885	4,885	8,167
R^2	0.838	0.570	0.476	0.449	0.976
Adjusted R^2	0.838	0.570	0.476	0.448	0.976
RSE	0.006	0.016	0.013	0.011	0.002
F Statistic	8,423.564***	2,156.319***	1,478.735***	1,324.364***	109,509.200***

*Appendix 4 shows the industry-specific estimated Fama-French 3 factor models. The majority of linear models with 4,885 observations were estimated based on daily industry index and factor observations from the first available trading date in 2000 until the end of 2019. Industry-index values (Ri) originate from the defined NASDAQ indices. Since daily factor returns and index values for the OMXS30 are available from 01/10/1986, the Fama-French models for the Other (Serrano code 98) are estimated based on a higher number of daily observations (8,167). No firms in our sample were not associable. The corresponding index for the Energy & Environment industry was only available from 02/01//2003 onwards. Factor returns for the Swedish stock market are available at the Swedish House of Finance. Please see their companion documentation on the composition of the Fama-French factors (Aytug et al., 2020). Significance levels are p<0.1; **p<0.05; ***p<0.01*

Appendix 5. Fama-French 3-Factor implied yearly industry-specific cost of equity for the Swedish Stock Market, including 2.5 % gross liquidity premium

Year/ Industry	**10**	**15**	**20**	**22**	**25**	**30**	**35**	**45**	**50**	**60**	**98**
2000	26.9%	23.7%	22.5%	21.5%	18.7%	15.5%	14.2%	21.3%	19.4%	19.9%	20.9%
2001	24.4%	22.6%	21.2%	20.0%	17.9%	14.4%	13.1%	17.5%	17.0%	18.5%	18.7%
2002	21.4%	20.2%	18.6%	17.5%	16.1%	13.1%	11.6%	14.0%	14.5%	16.4%	15.8%
2003	23.7%	21.7%	19.8%	18.7%	16.9%	13.9%	12.0%	15.3%	15.6%	17.5%	16.9%
2004	24.5%	22.2%	20.1%	19.1%	17.1%	14.1%	12.0%	15.6%	15.9%	17.9%	17.2%
2005	25.9%	22.8%	20.9%	19.9%	17.5%	14.5%	12.4%	17.5%	17.0%	18.6%	18.3%
2006	26.4%	23.2%	21.4%	20.3%	17.8%	14.7%	12.7%	18.3%	17.5%	18.9%	18.9%
2007	24.7%	21.9%	20.3%	19.3%	16.9%	13.9%	12.3%	17.7%	16.8%	17.9%	18.1%
2008	20.8%	19.0%	17.8%	16.8%	15.1%	12.4%	11.2%	15.1%	14.6%	15.7%	15.8%
2009	23.5%	21.0%	19.6%	18.6%	16.3%	13.3%	11.8%	16.9%	16.1%	17.2%	17.4%
2010	24.0%	21.4%	20.0%	18.9%	16.6%	13.4%	12.0%	17.7%	16.5%	17.5%	18.0%
2011	22.0%	20.0%	18.8%	17.8%	15.7%	12.6%	11.5%	16.4%	15.4%	16.4%	16.9%
2012	22.0%	20.0%	18.9%	17.8%	15.7%	12.5%	11.5%	16.6%	15.5%	16.4%	17.0%
2013	23.1%	20.6%	19.4%	18.3%	16.0%	12.8%	11.6%	17.3%	16.0%	16.9%	17.5%
2014	22.9%	20.5%	19.3%	18.3%	15.9%	12.7%	11.6%	17.4%	16.0%	16.8%	17.5%
2015	23.2%	20.3%	19.1%	18.1%	15.7%	12.7%	11.4%	17.4%	16.0%	16.7%	17.3%
2016	23.2%	20.2%	18.9%	17.9%	15.5%	12.7%	11.2%	17.1%	15.8%	16.6%	17.0%
2017	22.9%	19.9%	18.6%	17.7%	15.3%	12.5%	11.0%	17.0%	15.6%	16.3%	16.9%
2018	22.4%	19.4%	18.1%	17.2%	14.8%	12.2%	10.7%	16.2%	15.0%	15.9%	16.2%
2019	22.8%	19.8%	18.6%	17.6%	15.2%	12.3%	10.9%	17.0%	15.6%	16.3%	16.9%

Appendix 5 depicts the yearly Fama-French model implied industry cost of equity for the different industry codes available in Serrano. Notably, the depicted costs of equity all include a gross liquidity premium of 2.5%. In other words, if one wanted to get the raw estimated Fama-French model implied industry cost of equity, deduct 2.5% off of every percentage in the table. Please refer to the previous tables for the industry names. The table omits values for the Finance & Real Estate (40) as no such firms are present in the sample.

Appendix 6. Median values of pre-holding and holding period for portfolio company and industry-adjusted ratios

	Portfolio Company Ratios		**Industry-adjusted Ratios**	
Variables	**Pre-Holding**	**Holding**	**Pre-Holding**	**Holding**
OPM	0.0779	0.0628	0.0191	0.0089
ATO	4.2296	3.0793	1.6077	0.8002
ROCE	0.3374	0.1856	0.2077	0.0767
AR_WC	0.1392	0.1401	−0.0114	−0.0019
INV_WC	0.0646	0.0754	0.0000	0.0000
AP_WC	0.2638	0.2424	0.0063	0.0026
CH_SALES	0.1237	0.0473	0.0709	0.0153
CMR	0.3251	0.3112	0.0042	−0.0208
OLE_II	1.3145	0.9598	0.6512	0.3452
FIN_LEV	0.3728	0.7739	−0.3425	0.2541
EQ_RATIO	0.7261	0.5623	0.1684	−0.1009
FIN_LIAB_RATIO	0.2739	0.4377	−0.1684	0.1009
FIN_LIAB_PCT	0.1724	0.3771	−0.1824	0.0329
TAX_COST	0.2812	0.2667	−0.0021	−0.0012
COD	0.0626	0.0518	0.0128	0.0172
QUICK_RATIO	1.1057	1.0973	−0.1460	−0.2505
ROE	0.5371	0.3183	0.3061	0.1379
PROB_FAIL1	0.0018	0.0039	−0.0017	0.0019

Appendix 6 presents the median values for the portfolio companies' and industry-adjusted ratios clustered by pre-holding and holding period. The median values present the median of all observations in event years t-5 to t-1 for the pre-holding and t+1 to t+5 for the holding period specification in this table. The abbreviations for the ratios can be found in Table 3 and Table 4.

Appendix 7. Swedish portfolio companies' median q-values per industry in the pre-holding period

Industry	Total q-value	Depreciable Assets	R&D	Inventory	Def. Income Tax Liab.
Shopping goods	0.49	0.33	0.29	0.14	0.02
Industrial goods	0.48	0.11	1.87	0.11	0.01
Construction industry	0.45	0.44		0.00	0.01
Corporate services	0.44	0.07	0.61	0.02	0.01
Health & Education	0.37	0.11	4.63	0.00	0.06
Energy & Environment	0.31	0.25		0.07	0.00
Convenience goods	0.31	0.03	0.30	0.13	0.01
IT & Electronics	0.26	0.04	2.45	0.00	0.00
Other	0.23	0.00			0.01
Telecom & Media	0.23	0.01		0.11	0.00
Materials					

Appendix 7 depicts median q-values for the pre-holding period, proxied by event year $t-2$ per industry and bias type in descending order by Total PMB. For some industries, no individual asset biases were available. The Total q-value is not the sum of the median asset and liability q-values. Instead, it is the median of the Total q-values in the respective industries.

Appendix 8. Swedish portfolio companies' median q-values per industry in the holding period

Industry	Total q-value	Depreciable Assets	R&D	Inventory	Def. Income Tax Liab.
Shopping goods	1.04	0.44	0.18	0.16	0.00
Industrial goods	0.60	0.39	0.27	0.06	0.03
IT & Electronics	0.44	0.06	1.25		0.00
Convenience goods	0.40	0.13	0.20	0.04	0.08
Health & Education	0.12	0.02	2.53	0.00	0.00
Construction industry	0.07	0.00		0.00	0.03
Corporate services	0.05	0.01		0.00	0.00
Telecom & Media	0.03	0.01		0.00	0.00
Other	0.00	0.00		0.32	0.00
Energy & Environment		0.00			0.00
Materials					

Appendix 8 depicts median q-values for the holding period, proxied by event year $t+3$ or $t+4$ per industry and bias type in descending order by Total PMB. For some industries, no individual asset biases were available. The Total q-value is not the sum of the median asset and liability q-values. Instead, it is the median of the Total q-values in the respective industries.

Appendix 9. Difference in RIV-to-BV ratio between portfolio and control group

RIV/BV	Estimate	p-value	Significance
Pre-Holding	−0.9960	0.0009	***
Holding	−0.5955	0.0658	ns

*Appendix 9: The two-sided Wilcoxon test was applied to test the median difference in RIV-to-Book Value for portfolio vs control group in the pre-holding ($t-2$) and holding ($t+4$) period. The number of company observations (N) in the pre-holding period is 291 in the control sample and 95 in the portfolio company sample of portfolio companies and in the holding period 291 and 89, respectively. The estimates display the difference of the medians between a sample of the control and portfolio group in the respective pre-holding and holding period. This is not the exact difference in medians in both samples, wherefore a focus in interpretation is put on the sign and magnitude of the estimate. The significance levels are determined as: 'ns' $p \geq 0.05$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, and **** $p < 0.0001$.*

Appendix 10. Mean and median difference of IRR-COE from zero for portfolio company and control sample

	T-Test			Wilcoxon Test		
	Estimate	p-value	Significance	Estimate	p-value	Significance
IRR-COE						
Control	−0.0316	0.2350	ns	−0.0843	0.0000	****
Portfolio company	−0.0812	0.0102	*	−0.0853	0.0068	**

*Appendix 10 presents the results of independent sample tests of difference of mean and median IRR-COE to zero for the control and portfolio company sample. The Two-sided t-test has been applied to test the mean difference to zero, whereas the two-sided Wilcoxon test to test the median difference to zero in the respective samples. The number of company observations (N) is 291 in the control sample and 89 in the portfolio company sample of portfolio companies. The estimates display the difference of the medians between a sample of the pre-holding and holding period. This is not the exact difference in medians in both samples, wherefore a focus in interpretation is put on the sign and magnitude of the estimate. The significance levels are determined as: 'ns' $p \geq 0.05$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, and **** $p < 0.0001$.*

Appendix 11. Robustness test 10NN matched control sample - Significant difference ratios between pre-holding and holding period

	Portfolio company Ratios			Industry-adjusted Ratios		
Ratio	**Estimate**	**p-value**	**Significance**	**Estimate**	**p-value**	**Significance**
OPM	−0.0201	0.0040	**	−0.0178	0.0140	*
ATO	−0.9061	0.0001	****	−0.6696	0.0020	**
ROCE	−0.1590	0.0000	****	−0.1431	0.0000	****
CH_SALES	−0.0959	0.0000	****	−0.0694	0.0000	****
CMR	−0.0185	0.2170	ns	−0.0205	0.1310	ns
OLE_II	−0.2796	0.0001	***	−0.2597	0.0006	***
AR_WC	0.0016	0.7570	ns	0.0068	0.2360	ns
INV_WC	0.0000	0.5650	ns	0.0008	0.5300	ns
AP_WC	−0.0114	0.2700	ns	−0.0112	0.3180	ns
FIN_LEV	0.2695	0.0000	****	0.4724	0.0000	****

EQ_RATIO	−0.1085	0.0000	****	−0.1739	0.0000	****
FIN_LIAB_RATIO	0.1085	0.0000	****	0.1739	0.0000	****
FIN_LIAB_PCT	0.1156	0.0000	****	0.1294	0.0000	****
TAX_COST	−0.0136	0.0006	***	0.0029	0.1950	ns
QUICK_RATIO	−0.0850	0.0390	*	−0.1246	0.0030	**
COD	−0.0085	0.0320	*	0.0028	0.5210	ns
ROE	−0.2096	0.0001	***	−0.1753	0.0010	**

*Appendix 11 presents the results of the same tests as in Table 9 but with the control sample based on 10NN propensity score matching. The explanation of the ratio names can be found in Table 3 and Table 4. N for variables in the pre-holding and holding period are 468 and 400 firm-year observations, respectively. The estimates display the difference of the medians between a sample of the pre-holding and holding period. This is not the exact difference in medians in both samples, wherefore a focus in interpretation is put on the sign and magnitude of the estimate. The significance levels are determined as: 'ns' $p \geq 0.05$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, and **** $p < 0.0001$.*

Appendix 12. Robustness test 10NN matched control sample – T-test and Wilcoxon test results for difference in IRR-COE between portfolio companies and control group

	T-Test			**Wilcoxon Test**		
Ratio	**Estimate**	**p-value**	**Significance**	**Estimate**	**p-value**	**Significance**
IRR-COE	0.0413	0.2520	ns	−0.0031	0.9280	ns

*Appendix 12 depicts the results of the same tests as in Table 12 but with the control sample based on 10NN propensity score matching. The number of company observations (N) is 553 in the control sample and 89 in the portfolio company sample. The estimates display the difference of the medians between a sample of the pre-holding and holding period. This is not the exact difference in medians in both samples, wherefore a focus in interpretation is put on the sign and magnitude of the estimate. The significance levels are determined as:: 'ns' $p \geq 0.05$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, and **** $p < 0.0001$.*

Appendix 13. Robustness test 7-year RIV horizon – T-test and Wilcoxon test results for difference in IRR-COE between portfolio companies and control group

	T-Test			**Wilcoxon Test**		
Ratio	**Estimate**	**p-value**	**Significance**	**Estimate**	**p-value**	**Significance**
IRR-COE	0.0842	0.0957	ns	0.0104	0.8160	ns

*Appendix 13 shows the results of the two-sided t-test and two-sided Wilcoxon test for the IRR-COE spread between PE-backed firms and control firms. The number of observations N for the control group are 291 and 89 for the PE-owned companies. The estimates display the difference of the medians between a sample of the pre-holding and holding period. This is not the exact difference in medians in both samples, wherefore a focus in interpretation is put on the sign and magnitude of the estimate. The significance levels are determined as: 'ns' $p \geq 0.05$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, and **** $p < 0.0001$.*

Appendix 14. Robustness test CoE without bankruptcy adjustment – T-test and Wilcoxon test results for difference in IRR-COE between portfolio companies and control group

	T-Test			Wilcoxon Test		
Ratio	**Estimate**	**p-value**	**Significance**	**Estimate**	**p-value**	**Significance**
IRR-COE	0.0495	0.2170	ns	−0.0006	0.9750	ns

*Appendix 14 shows the results of the two-sided t-test and two-sided Wilcoxon test for the IRR-COE spread between PE-backed firms and control firms. The number of observations N for the control group are 300 and 89 for the PE-owned companies. The estimates display the difference of the medians between a sample of the pre-holding and holding period. This is not the exact difference in medians in both samples, wherefore a focus in interpretation is put on the sign and magnitude of the estimate. The significance levels are determined as: 'ns' $p \geq 0.05$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, and **** $p < 0.0001$.*