DID PRIVATE EQUITY-BACKED FIRMS OUTPERFORM OPERATIONALLY DURING COVID-19?

A study on the operational performance of private equity-backed firms during the Covid-19 pandemic.

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Bachelor Thesis

Stockholm School of Economics

Spring 2023

Did private equity-backed firms outperform operationally during Covid-19? A study on the operational performance of private equity-backed firms during the Covid-19 pandemic.

Abstract:

Do private equity (PE) backed companies perform better operationally in a non-financial crisis? By analyzing PE-backed firms in the UK during Covid-19 using fixed effects difference-in-differences, our findings suggest that private equity backed companies' performance decreased significantly more at the onset of the crisis and increased their leverage but recovered faster both with greater magnitude and significance. PE-backed companies thus seem to handle an operationally sided crisis better over time but are more exposed to them initially. In conclusion, private equity adds value operationally, but it is not without tradeoffs in terms of risk.

Keywords:

Private equity, Operational improvements, Covid-19, PE-backed

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Bachelor Thesis
Bachelor Program in Business & Economics
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1. Introduction

1.1 Background

Most of the real economy is private, and PE ownership has over time increased relative to public equity (Popov and Roosenboom, 2009; Meister, 2023) Thus with the number of public companies and IPOs falling in Europe and North America and new public firms increasingly weighted towards the technology sector (Meister, 2023), private equity is increasingly more representative of the economy. As a starting point, this shows why PE is relevant to study and motivates the need to understand the impact of PE ownership on portfolio firms, and whether its impact is similar, positive, or negative with respect to performance.

The PE industry has largely been defined by its use of leverage (Kaplan and Strömberg, 2009). The use of leverage in the 1980s leveraged buyout (LBO) era was largely sufficient to drive returns, with leverage ratios up toward 90% of deal values. This buyout craze peaked with the LBO of RJR Nabisco in 1989 by the industry-defining firm Kohlberg, Kravis, and Roberts (Burrough and Heylar, 1989). These practices came into question following the collapse of the junk bond market and the poor performance of many of these deals done under the relaxed financing conditions of the 1980s (Axelson, Jenkinson, Strömberg, and Weisbach, 2013). Following the crisis of the 1980s, leverage ratios began to drop, and other avenues of value creation came into focus. However, the reliance on leverage remained high, and in the 2000s, a new dawn for the industry seemed to emerge when a main proponent of the use of leverage during the genesis of the industry – Henry Kravis – suggested that the future of PE laid in the value creation initiatives in the firms they bought, declaring that "[...] financial engineering is no longer enough" (The Economist, 2006). This view grew more prevalent with Ljungqvist (2016) finding that 80% of deals up to 2007 focused on operational improvements and 60% on governance engineering. Financial engineering – while important – was not the sole answer anymore; rather, it was the operational value-add that PE firms brought to the table that was supposed to be the central focus. To improve the operations of portfolio companies, PE firms initiated the development of specialized industry teams (Kaplan and Strömberg, 2009), with industry specialists outperforming generalists in every stage of the life cycle (Spaenjers and Steiner, 2020). However, does this translate into superior performance of the portfolio companies?

The value PE firms add to their portfolio companies has been a contentious issue. In this debate, some public figures claim that PE firms focus on short-term initiatives to maximize their exit value at the expense of the long-term performance of the company, being "locusts" that extract value and leave the firm worse off (Private Equity International, 2005). Important PE figures have opposed this view; for example, Blackstone CEO Stephen Schwarzman claimed the opposite in a meeting with the German Chancellor.(Zeisberger, et al, 2017) Arguments in support of the PE ownership

case has been made by Jensen (1989), who claims that PE firms implement financial, governance, and operational engineering in their portfolio companies, and in so doing, improve firm operations and create economic value. Critics argue, on the contrary, that PE firms take advantage of tax breaks, high leverage, and superior information, but do not necessarily create any operational value. To nuance the debate, researchers such as Strömberg, Ljungqvist, and Mezzanotti have showed that there is evidence of the opposite, i.e., of PE firms bringing benefits to their portfolio companies such as greater access to capital, doing more investments, and making them more productive.

In the lead-up to the financial crisis, PE firms raised up towards $2 trillion in equity, with more than twice that amount in debt, a behavior that repeats across credit cycles as shown by Axelson et al. (2013), and that this phenomenon is mainly driven by the state of credit markets rather than idiosyncratic characteristics of investments. In other words, periods of booming credit markets also experience greater fundraising, higher transaction valuations, and consequently, more leverage (Bernstein, Lerner, and Mezzanotti, 2019). The danger eyed by regulators was that PE firms' over-lever when credit markets are booming, and consequently, these firms cut back on employment and investments to a greater extent in economic downturns, exacerbating crises and contributing to their persistence (Bernstein et al., 2019). The discussion evolved in the aftermath of the financial crisis where the potential danger of the high leverage in LBO transactions might have contributed to the fragility of the financial system leading up to the crisis, comparable to a proposal made by Bernanke and Blinder (1988) in the 1980s.

These dangers proved to be smaller in the run-up to the financial crisis compared to the 1980s; debt levels, while high, were not overbearing, and capital structures were less fragile (Kaplan and Strömberg, 2009). Contrary to claims of danger, Bernstein et al. (2019) showed that many PE portfolio companies reaped significant benefits from being owned by PE with PE firms relaxing portfolio companies' financing constraints and experiencing less investment cutbacks. Furthermore, these portfolio companies experienced lower asset contractions and larger market share growth during the financial crisis than pre-crisis comparable firms. The question that arises against this backdrop, and the touting of operational value creation benefits, is whether similar benefits can be seen when the direct impact of an economic crisis lay in operational concerns rather than financial ones, i.e., where the boons of superior access to capital may not be the determining factors of firms' immunity to crises.

Following 2008, the PE industry kept growing, and in the second quarter of 2022 it reached a global level of AUM of $12.8 trillion (Bain Global Private Equity Report, 2023). Furthermore, in parallel with growing AUM, dry powder also grew substantially in the low interest rate environment, potentially adding to the concern of over-levered transactions. One potential consequence of this could be a larger proportion of structurally exposed PE-backed firms should a crisis like Covid-19 hit. This would impact both (i) the financing, and more importantly, (ii) the operational gearing, with firms facing

reductions in revenues resulting in the more levered firms potentially less able to service their debt, which would in turn lead to lower levels of profit or increase number of bankruptcies. Naturally, this begs the question of whether the operational value-add is true: If it truly is the case that PE firms add more value operationally to their portfolio companies, perhaps they are also better at offsetting operational risks and adapting to crisis environments where supply chains are disrupted rather than credit markets – and perhaps the concern that PE firms use too much leverage in booming credit markets is justified if crises hit that are primarily operational rather than financial.

1.2 Research proposal

1.2.1 Research question

In light of the background, the question we attempt to answer in this paper is:

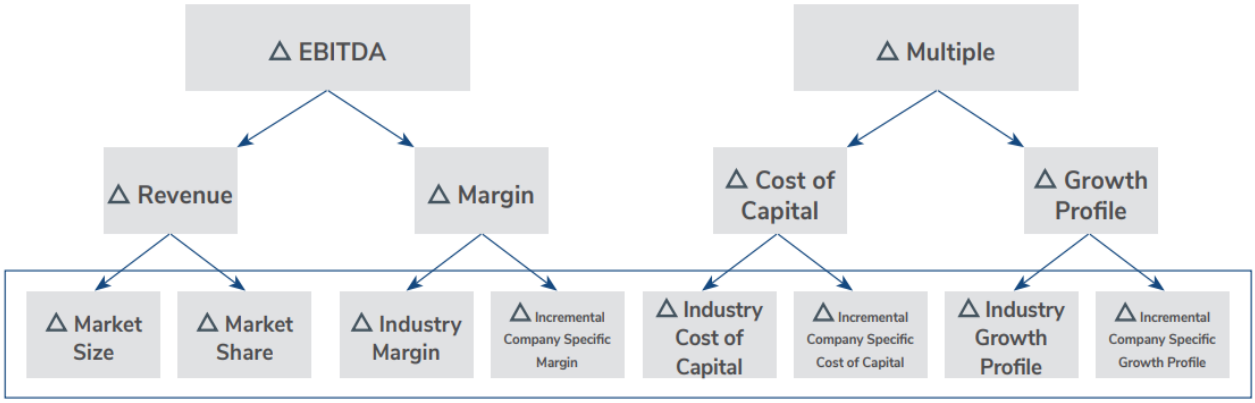
> *How has the performance of PE-backed firms been impacted by the Covid-19 pandemic relative to non-PE-backed firms?*

1.2.2 Performance metrics

To address this research question, it is instrumental that we define how we choose to measure the performance of the firms in our samples. The avenues by which PE firms drive value are usually (1) leverage, (2) EBITDA expansion, and (3) multiple expansion, and it is through these metrics that PE firms maximize their value creation for the exit (Zeisberger, Prahl, and White, 2016). Disentangling the contribution of leverage is necessary for focusing on the operations and evaluating the improvement of the underlying business, as opposed to the financial structure. The financial structure is a key driver of returns, but it is not where the unique operational expertise has effect (Kaplan and Strömberg, 2009).

Which value creation efforts are made in the operations are often limited to around three to four focus areas. They often take the form of sales growth, margin improvement, EBITDA expansion through cost reductions, or cost synergies, with some revenue synergies as well (Zeisberger, Prahl, and White, 2017). According to Head of KKR Capstone William Corning (2017), the most important focus area is EBITDA growth. The decomposition of EBITDA can be understood from the perspective of the INSEAD (2016) framework (see Figure 1).

Figure 1 – EBITDA & Multiple expansion decomposition



The most important metrics we will examine to evaluate the performance of PE-backed firms will be EBITDA growth, revenue growth, and margin expansion. We also examine other metrics, such as net income, asset growth, profit margins, leverage, among others, as these can give useful additional information. All variables are specified further down.

1.2.3 How private equity value creation is implemented

The means by which the discussed metrics are impacted are highlighted by Ljungqvist, Biesinger, and Bircan (2020) in the examination of value creation plans in private equity. Specifically, they mention contributions of (i) financial engineering, (ii) governance engineering, (iii) revenue growth, and (iv) operational improvements (Ljungqvist et al., 2020) (see Figure 2). For the purposes of this study, points (ii), (iii), and (iv) fall under the umbrella of "operational improvements" as they relate to business improvements rather than optimization of capital structure, leverage changes, or the relaxing of financial constraints through access to PE fund financing as referred to by Bernstein et al. (2019) and Lavery and Wilson (2022). It isolates the contribution of operational improvements to the financial metrics while controlling for previously mentioned capital structure-related variables (as leverage can differ within groups and across time between groups). Optimization of financial structure is, however, something that we do not control for as it is harder to measure correctly for large data sets. Another important note is that since we do not examine the corporate governance changes PE firms implement in their portfolio firms, we cannot single out this effect from more direct operational improvements.

Fig 2. Improvement drivers, according to Ljungqvist et al. (2020).

Operational improvements			Financial engineering
Operational improvements	**Governance engineering**	**Revenue growth**	**Financial engineering**
Asset improvements	Change in CEO	Add-on M&A	Optimization of capital structure
Cost reductions	Change in CFO	Pricing adjustments	Use of leverage
Distribution improvements	Board change	Quality improvements	
IT systems improvements	Improvement of corporate governance	Geographic expansion	
Divestment of unprofitable divisions	Change in management	Market share growth	
Change in organisational structure		Product mix change	

The achievement of a PE firm's objectives with respect to its portfolio companies revolves around execution and support using both its external and internal resources (Zeisberger et al., 2017). Internal resources refer to the use of operating teams directly employed by the PE firm, such as KKR Capstone, Altor Equity Partners Value Creation teams, or employees that implement an operations-focused role in the PE firm's investments. These teams then provide generalist support in helping to execute on operational targets, both short term and long term, set for the company, but may offer specialist support as well (Zeisberger et al., 2017). The external resources refer to consultants hired by the firm. This is important to our study because in the impact made, there is no distinction made by the data with respect to the source of value creation; both internal and external resources are employed under the PE firm umbrella and contribute to the portfolio company performance.

1.2.4 Private equity and Covid-19

Covid-19 had severe impacts on businesses all around the world with supply chain disruptions, lockdowns, and a public health crisis which led many firms to struggle, PE-backed and non-PE-backed alike. What makes the crisis different from the financial crisis is that it put more stress on operational aspects of firms, rather than financial, and consequently makes an ideal event study for evaluating the short-term operational value added by PE firms to portfolio companies in times of crisis; an analysis that can provide short-term perspective on the operational value added by PE firms to their portfolio companies in times when firms need to adapt to a completely new business environment.

1.3 Motivation

1.3.1 Literature review

The research generally supports the hypothesis the private equity indeed provides financial and operational benefits to their portfolio firms. Axelson et al. (2013) found that the ratio of operating income to sales increased by 10% to 20% absolutely and relatively to the industry, and similar benefits were seen by Strömberg and Kaplan (2009), however these studies were based on data from the 1990s up to 2007, where argued by Kaplan, a different private equity paradigm dominated, with less competition that necessitated less

operational focus, and higher leverage levels were utilized, which limited the capacity for growing firms through add-on M&A, and other PE-led growth initiatives beyond asset sales and cost cutting (Kaplan and Strömberg, 2009).

These initiatives that PE firms engage in with their portfolio companies can take time to implement, which motivates both an examination during a shorter time frame, as better governance, focus, and resilience can be tested through the reaction to short term shocks in an event study approach. Long-term initiatives in place naturally take longer to bear fruit, so it is not clear-cut if the value PE brings operationally is significant on a shorter time horizon. A study conducted by Gompers, Kaplan, and Mukharlyamov (2022) on private equity during Covid-19 (where they surveyed large private equity firms) suggests that PE firms engaged in operational, governance, and financial activities of adversely affected portfolio firms more intensely during the pandemic. However, few researchers have studied how operational metrics were affected by the crisis. The lack of research into the operational value-add during crises, and the timing of reviewing it since 2012 allows for research into an era where operational improvements are in focus.

Lavery and Wilson (2022) study how PE-backed firms were affected by the pandemic, but they focus more on the financial support side rather than the operational side, which is what will be our focus, although we do not exclude non-operational metrics such as leverage, because it is still interesting. Our study will thus aim to answer these questions against the implications provided by the research and use the Covid-19 pandemic as the main short-term event study to evaluate the operational skill in the short term in responding to a crisis (Kaplan and Strömberg, 2009).

One difference from the study done by Ljungqvist et al. (2020) is that, instead of surveying on a portfolio level what initiatives were implemented, our study instead relies on INSEAD's breakdown of drivers of financial metrics as proxies for the impact of value creation initiatives implemented in the business during Covid-19 (INSEAD, 2016). This is done to evaluate whether the performance initiatives that PE firms engaged in compared to those of non-PE-backed firms lead to better performance compared to those non-PE-backed firms.

Ours is different from the study by Lavery and Wilson (2022) in that we look at the operations-aspect of PE-backed firms during Covid-19, whereas they mainly analyzed the financial aspect, showing that the benefits of private equity ownership for portfolio companies are in line with the findings of Bernstein et al. (2019). The results of Bernstein et al. (2019), i.e., PE-backed firms experiencing relaxed capital constraints, more investments, and growing market share during the financial crisis seems to be generally applicable, as Lavery and Wilson (2022) had similar findings for Covid-19. This study, however, will examine whether private equity-backed firms perform better operationally than a similar set of non-PE-backed firms in a crisis, both how (i) they handle the crisis with the downturn, and (ii) how quickly they recover.

The risk that some underlying changes, such as boards and incentive structures, could contribute to the performance – as argued by researchers such as Ljungqvist et al. (2020) and Zeisberger et al. (2016) in their respective research paper and book – makes the mechanisms harder to determine since we do not examine changes in the corporate governance structure even though we know that it could be part of the reason why PE firms' performance would potentially differ.

1.3.2 The UK private equity market

Doing research on private firms' financials makes the need for trustworthy data especially large since there are not that many sources where it can be found, and where it is found, selection bias concerns can become an issue. The data required for this study is significant, and this makes the UK an ideal place of study given the high prevalence of private equity ownership in the country, and transparency of private firms' financial data through Amadeus/Orbis Europe, which collects its UK firm data through the Companies House, to which all UK firms that are not considered "Small" (for legal purposes) need to report comprehensive financial information (Bernstein et al., 2019). According to the Companies House, a small firm is a firm that fulfills at least two out of three of the following criteria: (i) total assets are not greater than £5.1m, (ii) revenues are not greater than £10.2m, and (iii) the average number of employees is not greater than 50.

The private equity model is quite uniform across countries, and similar funds are found across regions, such as Blackstone, KKR, Carlyle, and EQT. The use of debt, incentive structures, deal structures, and operational improvements are similar on the macro level given the structure of PE returns and compensation, as the incentives of what the fund focus on is similar in relation to how they are compensated. As for value creation, Harris, Siegel, and Wright (2005) showed that it is indeed prominent in the UK. While heterogeneity does exist, we argue that conclusions the findings of this paper will be are applicable to developed buyout markets other than the UK, such as the rest of Western Europe and the US.

1.3.3 Holding period

PE investments are traditionally long-term investments with typical holding periods ranging between three to five years, with a tendency towards longer ones during periods of economic contractions, such as Covid-19, to maintain company valuations. For example, 72.2% of large PE funds surveyed by Gompers et al. (2022) extended their investment horizon for existing holdings during the pandemic. During this period the GPs focused, as previously mentioned, on increasing the value of the portfolio company. This means that there is a difference in the operational improvement efficacy in relation to the years of ownership, as it takes time for certain initiatives to take effect as documented by Ljungqvist et al. (2020).

Other concerns exist of the pressure of PE funds being more willing to do "worse" deals towards the end of the capital deployment period in order not to lose out on AUM fees as they do not earn it on uninvested capital after 2-3 years (Tykvová, 2022). However, research has not been able to prove this effect significantly, and as such we do not adjust additional for companies bought later in the capital deployment period.

1.3.4 Short term

In the short term, governance changes and certain operational initiatives have less of an impact, however, revenue-focused ones dominate (Gompers et al., 2022). For this reason, revenue, EBITDA, profit margin, among others are largely examined from a relative change perspective in how they fall and/or recover during Covid-19, as measures of (i) resilience of the portfolio companies, (ii) PE ownership's benefits to responding better to a crisis than a comparable company in being able to use their alleged expertise, and (iii) optimizing supply lines, growth initiatives, and value creation plans to a change in the macro environment and still execute, i.e. their skill as *managers* compared to non-PE-backed firms. In addition, the number of employees, total assets, among others, are metrics that are examined from an operational perspective as to understand how PE-backed firms manage the crisis, with for example firings contrary to whether their employees create more value, as this warrants a longer time analysis (Ljungqvist et al., 2020).

1.3.5 Long term

In the long term, the comparison remains on the change and difference in EBITDA, sales growth, and profit margin, in addition to the level of them, and the other variables, such as leverage, employees, among others, from a value creation perspective. This is examined under "operational improvements" that capture, operational changes (a), governance changes (b), and top-line growth (c) as outlined in (Strömberg and Kaplan, 2009). The rationale is that these items can take longer to take effect, as changes in governance are accretive over time, as supported by Ljungqvist (2016), and as such, a longer evaluation manages to better capture the effect of these changes in how a private equity firm structures a portfolio company, supports it, and helps it execute, contrary to the short term managing of the company during a crisis as in Covid-19.

Profit margin: A change in margin represented around 20% of value creation across the INSEAD (2016) study which, and after controlling for industry, isolates the operational improvement of the PE firm when comparing with a matched comparable firm.

EBITDA growth: EBITDA is the traditional metric in the "three drivers" composition as it captures overall change in the performance of the business beyond the multiple that captures its market attractiveness, and the net debt that captures deleveraging. As industry

is controlled for through a matching procedure, the concern of it capturing the leverage effect through it is elevated, and it thus manages to well capture operational performance to the EBITDA generation of the business, and captures better than profit what PE firms are optimizing for due to their debt level, and as such in combination with the other two main metrics allows for a comprehensive analysis of operational value creation. In addition, EBITDA margin is also compared, which captures a similar effect as the EBITDA growth variable and profit margin.

Detailed analysis of the balance sheet impact and multiple impacts are excluded, as (i) the focus resides on operations and thus multiple impact on exit value and attractiveness of the business in a market sense is not the focus, and (ii) balance sheet items are controlled for through the matching process which leaves operational focuses on the value added to improving the business, rather than the restructuring. This is something that could be an event of further study but warrants a different data sample.

1.3.6 Drawdown and recovery during Covid-19

As this study is inspired by Bernstein et al. (2019), the data extraction and empirical methods will resemble their study to a large degree.

The quantitative analysis will be conducted mainly using Welch's t-tests and more robust fixed effects difference-in-differences models. The t-tests are done for two reasons:

1. To conduct trend analyses and only include those variables from the t-tests that do not show significant trend differences in the pre-crisis period.

2. To give a simple, while comprehensive, overview of the development.

2. Data

2.1 Sample construction

For both the construction of the sample used for the pandemic-related analysis (the research question), the processes we use resemble the one used by Bernstein et al. (2019). We explain the data gathering process for the Covid-19-related analysis in detail. We start off the sample construction process by extracting from Capital IQ all U.K. companies backed by private equity before and during the Covid-19 crisis. We identify private equity transactions done between 1 January 2010 and 1 March 2020 with the features "Leveraged Buyout", "Going Private Transaction", "Management Buyout", and "Platform" where the target firm is headquartered in the U.K. With said keywords, all transactions are identified by Capital IQ as being leveraged buyouts. Since we want to study firms that were backed by PE firms during the pandemic, we filter out PE exits for

the same target firms between 1 Jan 2010 and 1 Jan 2022 such that all firms in our final sample only contains firms that were backed by private equity right before the onset of the crisis and did not experience an exit until at least 2022, which is when we consider the end of the crisis for the purposes of this study. To do this, a column that specifies all related firm transactions is added, and later used for filtering out exits. Note this "exit-data" does not necessarily contain all exits, even when there actually was an exit transaction by the backing PE firm, so we double check this data by gathering data on all current and previous owners of the firm (also from Capital IQ) and exclude firms that were sold off before or during the crisis to a non-PE firm. If a firm appears to have a non-PE parent but no firm transactions are to be found, this firm is excluded.

This dataset was imported into Orbis Europe (also known as Amadeus) for further filtering and financial data extraction. Some firms were not matched to Orbis, and others did not have any financial data for 2020 or 2021, all of which we exclude from the sample. Further, we filter out firms operating in the financial (SICs 600-699), utility (SICs 489-493), or government (SICs 900-999) sectors, since these firms' metrics are not directly comparable to other firms' financial metrics. From Orbis we extract industry codes, total assets, operating revenue, net profit, and solvency ratio (equity divided by assets), since these metrics were the ones decided to use later for the construction of the matched control firms. Firms that do not have data on all these four financial metrics are excluded, since the matched firms would not be as similar otherwise and it did not adversely affect our sample size to an extent where it would become too small. This results in an initial sample of 360 PE-backed firms.

3. Empirical method

To understand the performance differences between PE-backed and non-PE-backed firms across time, an ideal scenario would be to have two identical groups of firms with respect to both observable and unobservable characteristics, the only difference being that the group of firms serving as the control group does not contain any firms backed by private equity. Absent this idealized scenario, we attempt to replicate this as closely as possible by constructing a set of matching control firms. We then develop a difference-in-differences model with time fixed effects and firm fixed effects. We start off by explaining the matching procedure and then we specify the empirical models.

3.1 Constructing a matched control group

We want to construct a control group that is as similar as possible to our sample of PE-backed firms before the onset of the crisis, without sacrificing too much of the sample size. We cannot simply pick a random sample of non-PE-backed firms since this could lead to concerns about selection bias; for instance, PE firms may invest in companies of a particular nature with respect to geographic location, size, leverage, performance, and industry. Thus, we constructed a sample that only had firms that were similar in 2019

with respect to (i) total assets, (ii) operating revenue, (iii) solvency (equity over assets), (iv) net profit, (v) industry code, and (vi) geographic location. Specifically, for each PE-backed firm, we identify all firms falling within a 50% bracket on each of the financial metrics in 2019, having the same two-digit US SIC code, and operating in the UK. If this process identifies more than one matching firm for the PE-backed firm, we select the most similar one based on Euclidean distance on a percentage basis in order to weigh all four financial metrics equally; otherwise, operating revenue and total assets would almost always determine the Euclidean score, and solvency would be a substantial determinant; naturally total assets and operating revenue vary much more in absolute terms than solvency. We decide to only select one matching non-PE-backed firm per PE-backed firm, since we drop all PE-backed firms that do not have any matching firms, and if we decide to have more matched firms for every PE-backed firm, we would drop too many firms from the sample. This results in a final sample of 283 PE-backed firms and 283 non-PE-backed firms.

Next, for all firms, we extract all relevant financial information available in Orbis: total assets, operating revenue, net income, EBITDA, solvency ratio, profit margin, EBITDA margin, cash flow, and number of employees. We use this data set to construct new variables, such as net income over assets, EBITDA over assets, and cash flow over assets. We further augment this data set with the number of years since the buyout occurred (which is later used as a control variable, but we later specify all control variables in detail). This is the final data set that is then used for the tests. Summary statistics on the sample of PE-backed sample and non-PE-backed firms can be found in Panel A of Table 3. An interesting finding from the summary statistics is that PE-backed firms, on average, have half as many employees as non-PE backed firms, which may indicate that PE firms can run as large and successful companies as non-PE-backed firms more efficiently. However, since the medians are relatively similar, this hypothesis may be more significant when comparing larger firms. The size distribution (in both the PE-sample and matched sample) is heavily weighted toward smaller firms, which explains the large difference between the means and the medians.

Table 1. Industry composition of PE exits, 2020 to 2022

Industry composition of PE exits, 2020-2022

Industry	Count	(%)
Construction	1	1.6%
Manufacturing	13	21.3%
Retail trade	5	8.2%
Services	35	57.4%
Transportation, Communications, Electric, Gas and Sanitation	3	4.9%
Wholesale trade	4	6.6%
Total	**61**	**100.0%**

Table 2. Industry composition of the PE Sample in 2019

Industry composition of PE sample, 2019

Industry	Count	(%)
Construction	8	2.8%
Manufacturing	72	25.4%
Retail trade	21	7.4%
Services	141	49.8%
Transportation, Communications, Electric, Gas and Sanitation	18	6.4%
Wholesale trade	23	8.1%
Total	**283**	**100.0%**

One potential concern could be that since we exclude firms that experienced exits before the crisis, this could lead to sample selection issues, one of them being industry, as one can imagine that the Covid-19 pandemic affected firms heterogeneously. From the industry composition of SIC codes (see Tables 1 and 2), no distinct bias towards exiting a particular industry can be seen in the companies exited between 2020 to 2022 compared to the general PE sample. As such, no industry bias towards less-performing industries or such exists in the PE sample, and by extension the control group as PE firms are matched with a corresponding company with the same two-digit US SIC code.

Table 3. Summary statistics of firm's characteristics pre-crisis and their trends

A. Firms' characteristics in 2019

	PE-backed sample				Matched sample			
Summary statistics, 2019	**N**	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**
Operating Revenue (M£)	278	54.59	24.45	99.22	282	59.87	24.77	126.12
Total Assets (M£)	278	55.96	24.77	114.01	282	53.95	23.35	121.23
EBITDA (M£)	274	6.17	2.54	14.95	262	5.77	2.38	13.24
EBITDA margin (%)	272	11.06	8.75	15.43	260	11.18	9.36	16.49
Net Income (M£)	278	3.52	1.12	12.63	282	2.84	1.09	9.33
Solvency ratio (%)	278	45.6	48.86	28.58	282	44.27	45.59	29.25
Profit Margin (%)	275	6.52	5.58	16.89	279	6.93	6.11	17.37
Cash Flow (M£)	274	5.58	2.05	14.32	262	4.87	2.02	11.50
Number of Employees	274	333.9	143.5	520.3	260	670.3	128.5	4876.5

B. Firms' trends, 2017-2019

	PE-backed sample				Matched sample					
Trend analysis, 2017-2019	**N**	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**	**Mean diff.**	**Significance**
Operating Revenue (log)	245	0.053	0.052	0.109	247	0.052	0.049	0.102	0.001	0.901
Total Assets (log)	264	0.113	0.105	0.136	264	0.081	0.073	0.122	0.031	0.006
EBITDA (log)	242	0.018	0.052	0.363	227	0.054	0.055	0.343	-0.036	0.269
Net Income (log)	244	-0.060	0.009	0.532	247	0.025	0.035	0.461	-0.085	0.061
EBITDA/Assets	243	-2.807	-2.639	9.123	228	-1.134	-1.266	8.539	-1.673	0.040
Net Income/Assets	245	-2.543	-2.390	8.754	248	-0.857	-0.911	7.840	-1.687	0.025
Cash Flow/Assets	242	-2.400	-2.174	8.815	228	-0.712	-0.838	7.477	-1.688	0.025
Solvency ratio	264	0.564	0.343	13.325	264	0.217	0.931	11.146	0.346	0.746
EBITDA margin	241	-0.481	-0.108	6.612	227	-0.167	-0.155	5.440	-0.314	0.574
Profit Margin	239	-1.207	-0.918	7.161	246	-0.352	-0.323	5.821	-0.855	0.150
Number of employees (log)	258	0.050	0.045	0.091	239	0.026	0.023	0.076	0.024	0.002

C. Firms' trends, 2018-2019

	PE-backed sample				Matched sample					
Trend analysis, 2018-2019	**N**	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**	**Mean diff.**	**Significance**
Operating revenue (log)	259	0.031	0.031	0.068	260	0.023	0.021	0.061	0.008	0.168
Assets (log)	274	0.048	0.043	0.078	273	0.036	0.028	0.075	0.012	0.066
EBITDA (log)	256	0.018	0.026	0.262	241	0.030	0.029	0.231	-0.012	0.578
Net income (log)	258	0.000	0.007	0.445	259	0.003	0.009	0.331	-0.003	0.921
EBITDA/Assets	257	-1.164	-1.155	7.184	242	-0.144	-0.241	6.478	-1.020	0.096
Net income/Assets	259	-1.150	-1.045	7.037	260	-0.351	-0.497	5.699	-0.799	0.156
Cash flow/Assets	256	-0.966	-1.101	6.867	241	-0.150	-0.438	6.053	-0.816	0.160
Solvency ratio	274	-0.063	0.194	8.290	274	0.376	0.961	7.624	-0.439	0.519
EBITDA margin	255	-0.219	-0.341	5.316	241	-0.004	-0.062	3.948	-0.215	0.609
Profit Margin	255	-0.437	-0.294	6.384	258	-0.311	-0.260	4.456	-0.126	0.796
Number of employees (log)	268	0.024	0.020	0.050	250	0.010	0.007	0.045	0.015	0.001

Panel A shows the summary statistics of PE-backed and non-PE-backed firms operating in the UK in 2019, with firms within the financial, utilities, and government sectors excluded. Panels B and C show the trends of these samples of firms from 2017 to 2019 and 2018 to 2019 respectively. Note that growth in operating revenue, total assets, EBITDA, net income, and number of employees are reported in log changes, whereas all other metrics are reported as percentage point changes since these variables are already measured as percentages, rather than absolute levels. The examination of trends resembles the approach used by Bernstein et al. (2019), since they also compare the two-year trend and the one-year trend. Those variables that are insignificant at the 10%-level are included in the difference-in-difference models (which are: operating revenue, EBITDA, solvency ratio, EBITDA margin, and profit margin). The significance is based on Welch's t-tests for the differences between each group for each variable. Winsorization at the 1-percent level has been done to reduce concerns of outliers severely affecting the results.

3.2 Empirical strategy

We estimate this model using a panel data set from 2017 to 2021, a symmetric window around 2019, the year before 2020, which is widely regarded as the year when the pandemic started. For the main model, we estimate the following equations:

$$y_{it} = \alpha_i + \alpha_t + \beta(PE\ firm_i * 2020) + \theta X_{it} + \varepsilon_{it} \quad (1)$$

$$y_{it} = \alpha_i + \alpha_t + \beta(PE\ firm_i * 2021) + \theta X_{it} + \varepsilon_{it}, \quad (2)$$

where y_{it} is an outcome variable measured for firm i at time t, (α_i, α_t) are a set of firm and year fixed effects, PE_i is a dummy variable which takes on the value 1 for those firms that are backed by a private equity investor and 0 otherwise, and the time variables 2020 and 2021 are dummy variables which take on the value 1 if that observation is from that year and 0 otherwise. X_{it} represents a set of control variables that we use to isolate the effects of the difference-in-differences estimator. Contrary to what Bernstein et al. (2019) did in their study, we do not define both post-crisis years as one dummy variable, rather we separate them to see the independent effects. The reason why we choose to separate 2020 and 2021 is because those years are very different with respect to the performance of the firms. Therefore, we deem it more interesting to observe the changes that happened for these years in isolation, rather than in combination. Standard errors are clustered at the firm level. Since a difference-in-differences model relies on the parallel trend assumption, we only test those variables examined through Welch's t-tests (see Panel B and C from Table 3) where the mean difference between the changes from 2017 to 2019 and 2018 to 2019 are not significant, which includes log of operating revenue, log of EBITDA, profit margin, EBITDA margin, and solvency. The reason why we take the logarithm of operating revenue is because the outcomes would otherwise be skewed toward the development of larger firms, whereas we intend to observe the relative changes, weighing all firms more equally. Another reason is that it could be the case that randomness in the matching process matched larger firms that naturally vary more in absolute terms, which subsequently could result in control firms at the larger end of the size spectrum that destroys the statistically beneficial effects of having a large sample. By taking the logs of variables like operating revenue, this noise is reduced quite a bit.

In addition to the fixed effects difference-in-differences models, we run Welch's t-tests on all metrics observed in Panel B and C from Table 3 for the changes in the variables from 2019 to 2020, and 2020 to 2021 to give the reader a comprehensive and simple overview of the development. Variables that exhibit large heterogeneity within groups, such as total assets, operating revenue, EBITDA, net income, and number of employees are scaled down by logarithms, for the same reason explained above with regards to operating revenue in the fixed effects difference-in-differences model.

This is not an issue for other variables, which are ratios, such as EBITDA over assets, net income over assets (ROA), cash flow over assets, solvency ratio (which is a measure for leverage, specifically, it is equity over assets), profit margin, and EBITDA margin since these variables are already scaled and somewhat independent of firm size.

The change in log values should have a similar interpretation as the percentage change, but for EBITDA and net income, taking the percentage change is inappropriate as they could be negative in base years, resulting in spurious signs and, consequently, misleading results. In contrast, Bernstein et al. (2019) observe percentage changes instead of log differences. However, they did not examine variables such as EBITDA and net income which in many cases take on negative values in base years, which makes them problematic if analyzed on a percentage change basis. In their analysis, the only variable that was not a ratio to begin with in their pre-crisis trend analysis was revenue, which proved to have significant trend differences between the control and treatment groups, so they did not test it in their fixed effects difference-in-differences regression. For consistency however, we use log differences on all such variables, but the interpretation should quite similar.

Further, as a robustness test, we augment this model with difference-in-differences models with time and firm fixed effects for the changes in relevant outcome variables from 2019 to 2020 and 2020 to 2021 to see if there is any significant difference in the results.

3.3 Control variables

The following variables are used as control variables in the main analyses:

Years since buyout. This is controlled for to check for the impacts of varying priorities across the holding period of a fund. Early on, the focus can be on value creation plans, and benefits to this may accrue more towards the end of the holding period (Valkama, Maula, Nikoskelainen, and Wright, 2013). In addition, it controls for the equity capital markets' implications of market environments, as the grooming of a portfolio company for an exit can change what the private equity firm focuses on in preparing it for the exit (Strömberg et al, 2009).

Solvency Ratio. Capital availability through solvency ratio, to limit the impact of the relaxed financial constraints Bernstein et al. (2019) showed for private equity-backed firms. That is to ensure that operational improvements and investments come not from the financing benefits of a PE-backed companies that non-PE backed firms may not have (in line with Bernstein et al. (2019) and Lavery and Wilson (2022).

Log of Assets. Assets essentially control for firm size, which we need to do since there is within-group size heterogeneity.

4. Results

We evaluate whether firms backed by private equity investors performed better or worse during the pandemic, i.e., during 2020 and 2021. Since the pandemic affected essentially all firms in the United Kingdom, it is important to assess if PE-backed firms were more or less affected than comparable, non-PE-backed, firms. We begin the results analysis with outcomes from running Welch's t-tests on the relative change in the same variables observed previously, i.e., not only those outcome variables that exhibited insignificant differences in the pre-crisis period. Then, we continue the analysis by observing the results from the fixed effects difference-in-differences models for 2017 to 2021, i.e., we evaluate equations (1) and (2). To augment the primary fixed effects difference-in-differences model, we specify and estimate two similar difference-in-differences models without including the years 2017 and 2018; one models differences between 2019 and 2020 and the other models the differences between 2020 and 2021. This is done to see if there are any deviations in the results compared to the regular difference-in-differences estimations.

4.1 Welch's t-tests

Generally speaking, the t-tests presented in Panel A of Table 4 tell us that, during 2020, PE-backed firms experienced a greater drawdown on almost every performance metric than did comparable non-PE-backed firms. The change in total assets and number of employees are the only significant metrics where PE-backed on average grew more. The significant difference in growth of total assets and solvency may indicate that the growth in assets was mainly driven by a significantly greater increase in debt among the PE-backed firms compared to non-PE firms, which would support the notion that PE-backed firms have better access to capital (debt) in times of distress. In addition, since total assets on average grew more for PE-backed firms than it did for the matched group, it may be the case that the significant differences we observe for variables that are scaled by assets are partly due to the greater increase in assets for PE-backed firms in addition to the changes in EBITDA, net income, and cash flow.

From Panel B we see that, as a rule, the magnitudes of the mean difference estimates are much smaller than in Panel A and they are never significant. Subsequently we do not gain much information from this table as regards the change in outcomes from 2020 to 2021.

Table 4. Welch's t-tests

A.	PE-backed sample				Matched sample					
Trend analysis, 2019-2020	**N**	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**	**Mean diff.**	**Significance**
Operating revenue (log)	268	-0.038	-0.027	0.113	272	-0.041	-0.028	0.104	0.003	0.729
Total assets (log)	272	0.028	0.025	0.090	276	0.015	0.009	0.072	0.014	0.049
EBITDA (log)	262	-0.185	-0.110	0.487	254	-0.058	-0.023	0.343	-0.127	0.001
Net income (log)	268	-0.288	-0.155	0.735	272	-0.126	-0.063	0.566	-0.162	0.004
EBITDA/Assets	263	-5.302	-4.155	10.800	255	-2.023	-1.442	7.848	-3.279	0.000
Net income/Assets	269	-4.845	-3.702	9.962	273	-2.191	-1.631	7.920	-2.654	0.001
Cash flow/Assets	263	-4.572	-3.462	9.647	255	-2.083	-1.485	7.407	-2.489	0.001
Solvency ratio	270	-2.687	-2.030	10.246	275	0.189	0.307	7.480	-2.876	0.000
EBITDA margin	256	-2.411	-1.726	7.980	252	-0.603	-0.122	5.666	-1.807	0.003
Profit margin	256	-3.112	-1.961	8.577	266	-1.381	-0.511	6.785	-1.730	0.011
Number of employees (log)	265	0.001	0.000	0.057	255	-0.008	0.000	0.050	0.009	0.051
B.	PE-backed sample				Matched sample					
Trend analysis, 2020-2021	**N**	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**	**Mean diff.**	**Significance**
Operating revenue (log)	250	0.052	0.060	0.098	249	0.060	0.052	0.100	-0.007	0.408
Total assets (log)	254	0.049	0.046	0.086	255	0.038	0.036	0.072	0.011	0.123
EBITDA (log)	244	0.150	0.128	0.365	237	0.120	0.085	0.301	0.030	0.328
Net income (log)	250	0.234	0.161	0.576	249	0.185	0.117	0.506	0.048	0.322
EBITDA/Assets	245	1.693	1.495	9.194	237	2.075	1.590	7.032	-0.383	0.607
Net income/Assets	251	2.025	1.673	8.595	249	2.208	1.514	7.306	-0.182	0.798
Cash flow/Assets	245	1.858	1.646	8.683	237	2.143	1.272	7.098	-0.286	0.692
Solvency ratio	252	-0.396	0.009	8.708	252	-0.048	0.008	7.977	-0.347	0.641
EBITDA margin	236	1.999	1.511	7.958	236	1.404	0.882	6.496	0.595	0.374
Profit margin	239	2.347	1.513	9.023	244	2.161	1.186	7.194	0.186	0.802
Number of employees (log)	247	0.004	0.003	0.061	237	0.002	0.001	0.059	0.003	0.612

This table reports the mean change in each variable, from the years 2019 to 2020 and 2020 to 2021. The mean difference is based on Welch's t-tests, where the difference in the changes is the estimation of interest, along with the associated p-value. Note that operating revenue, total assets, EBITDA, net income, and number of employees are scaled by logarithms to reduce the effect of within-group heterogeneity. Panel A shows trends from 2019 to 2020 and Panel B shows trends from 2020 to 2021.

4.2 Difference-in-differences with fixed effects

Next, we evaluate the results from the main analysis, i.e., equations (1) and (2). Only metrics that did not have significantly different trends leading up to the crisis are used as outcome variables, due to the assumption of parallel trends that a difference-in-differences regression requires.

Similar to the t-tests, the general impression is that PE-backed firms' performance dropped more than the matched control group during 2020 (see Panel A of Table 5). For each outcome variable in the following models, we show the estimated variable of interest with and without controls, similar to Bernstein et al. (2019). However, we should trust the results more when including the controls, as the estimator otherwise could suffer from omitted variable bias. Also, due to the nature of the outcome variables and the control variables, we do not deem concerns of endogeneity of controls or reverse causality to cause problems in our regressions.

When including control variables, all difference-in-differences coefficients drop considerably, and two out of five coefficients become insignificant, even though they still point in the same direction. Specifically, the β-coefficient is only negative and significant for EBITDA, EBITDA margin, and solvency when control variables are included. This

points in the direction that PE-backed firms performed worse and took on more debt during 2020 than the matched control group. However, during 2021 (see Panel B of Table 5), PE-backed firms seem to have experienced a much larger recovery than the matched group, with β-coefficients being positive, exhibiting several times larger magnitude, and being significant at the 1-percent level for EBITDA, profit margin, and EBITDA margin. This could indicate that PE-backed firms are better at adapting to operational crises than firms that are similar, but not backed by private equity.

In the difference-in-differences models where we exclude the years prior to the crisis (see Table 6), some of the effects seem to disappear. In fact, when control variables are included, only for operating revenue and EBITDA in 2020 is the interaction term (PE firm * 2020) significant, but it still points in the same direction in both cases as it does when years prior to the crisis are included in the model. With controls, the estimator points in the same direction as in the models with pre-crisis years for the most part, but is never significant except for the outcome variables mentioned, which we think still tells us that the first model is more robust, and we can trust those results to a greater extent.

Without controls, however, the difference-in-differences variable changes sign for EBITDA during 2021 and is significant as well, which may seem confusing, but it shows that controls are absolutely necessary for this type of analysis.

We find it interesting that PE-backed firms seem to have assumed significantly more leverage during the first year of the pandemic. This is in agreement with the notion that PE-backed firms have better access to capital in times of distress (Bernstein et al., 2019).

Visual plots of these changes are presented in the appendix, where we look development of each outcome variable from the fixed effects model with the value at 2019 indexed to zero. Here, the story is quite similar except that the change from 2020 to 2021 does not seem to be significantly greater for PE-backed firms as is the case in the fixed effects model with pre-crisis years.

Table 5. Diff-in-diff, 2017-2021

A. DiD 2020

Fixed effects DiD, 2017-2021	**Revenue**		**EBITDA**		**Profit margin**		**EBITDA margin**		**Solvency ratio**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PE firm x 2020	-0.037	-0.054*	-0.56***	-1.107***	-0.250	-2.362**	-1.530**	-3.387***	-1.925***	-2.497***
	(0.028)	(0.032)	(0.217)	(0.299)	(0.802)	(1.167)	(0.613)	(0.872)	(0.383)	(0.705)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Observations	2611	2625	2517	2531	2566	2579	2497	2511	2692	2692
R-squared	0.056	0.012	0.073	0.022	0.1000	0.015	0.075	0.012	0.011	0.002

B. DiD 2021

Fixed effects DiD, 2017-2021	**Revenue**		**EBITDA**		**Profit margin**		**EBITDA margin**		**Solvency ratio**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PE firm x 2021	0.066	-0.025	1.178***	-0.707*	3.263***	-3.100***	3.180***	-1.517	-0.707	-1.608
	(0.046)	(0.167)	(0.404)	(0.353)	(0.803)	(0.987)	(0.758)	(1.123)	(1.559)	(1.097)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Observations	2611	2625	2517	2531	2566	2579	2497	2511	2692	2692
R-squared	0.046	0.002	0.065	0.002	0.094	0.003	0.072	0.001	0.010	0.003

This table reports the estimated difference-in-differences coefficients for each outcome variable for two fixed effects models from 2017 to 2021. All specifications include firm and year fixed effects. Specifically, Panel A estimates the β-parameter (PE firm x 2020) from equation (1). Panel B estimates the β-parameter (PE firm x 2021) from equation (2). Standard errors of the β-coefficient are show right below the coefficient of said coefficient. Even-numbered columns show the estimated parameter of interest without control variables, whereas odd-numbered columns show the estimated parameter of interest with control variables, which include log of assets, solvency ratio, and the number of years since the buyout occurred (which is always 0 for matching firms). In Columns (1) and (2), the dependent variable is operating revenue; in Columns (3) and (4) the dependent variable is EBITDA; in Columns (5) and (6), the dependent variable is profit margin; in Columns (7) and (8), the dependent variable is EBITDA margin; and finally, in Columns (9) and (10), the dependent variable is solvency ratio (equity over assets). All standard errors are clustered at the firm-specific level. The significance levels are denoted by * at the 10-percent level, ** at the 5-percent level, and *** at the 1-percent level.

Table 6. Diff-in-diff, 2019-2020 & 2020-2021

A. DiD 2020

Fixed effects DiD, 2019-2020	**Revenue**		**EBITDA**		**Profit margin**		**EBITDA margin**		**Solvency ratio**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PE firm x 2020	-0.064**	-0.060*	-3.373*	-1.414***	-5.099	-3.650***	-4.790	-3.355***	-1.668	-3.396***
	(0.027)	(0.036)	(1.758)	(0.313)	(7.860)	(1.169)	(8.119)	(1.125)	(5.761)	(0.853)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Observations	1093	1098	1050	1055	1070	1075	1038	1043	1101	1101
R-squared	0.076	0.027	0.154	0.056	0.214	0.041	0.164	0.028	0.028	0.028

B. DiD 2021

Fixed effects DiD, 2020-2021	**Revenue**		**EBITDA**		**Profit margin**		**EBITDA margin**		**Solvency ratio**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PE firm x 2021	0.023	0.027	0.359	-1.107***	-0.664	-0.734	0.949	1.662	0.491	0.418
	(0.038)	(0.037)	(0.307)	(0.299)	(1.175)	(1.206)	(0.949)	(1.060)	(0.995)	(0.995)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Observations	1040	1053	1004	1004	1011	1023	991	1004	1059	1059
R-squared	0.039	0.015	0.069	0.022	0.077	0.015	0.057	0.007	0.015	0.004

This table reports the estimated difference-in-differences coefficients for each outcome variable for two fixed effects models, one from 2019 to 2020 and one from 2020 to 2021. All specifications include firm and year fixed effects. Specifically, Panel A estimates the β-parameter (PE firm x 2020) from equation (1). Panel B estimates the β-parameter (PE firm x 2021) from equation (2). Standard errors of the β-coefficient are show right below the coefficient of said coefficient. Even-numbered columns show the estimated parameter of interest without control variables, whereas odd-numbered columns show the estimated parameter of interest with control variables, which include log of assets, solvency ratio, and the number of years since the buyout occurred (which is always 0 for matching firms). In Columns (1) and (2), the dependent variable is operating revenue; in Columns (3) and (4) the dependent variable is EBITDA; in Columns (5) and (6), the dependent variable is profit margin; in Columns (7) and (8), the dependent variable is EBITDA margin; and finally, in Columns (9) and (10), the dependent variable is solvency ratio (equity over assets). All standard errors are clustered at the firm-specific level. The significance levels are denoted by * at the 10-percent level, ** at the 5-percent level, and *** at the 1-percent level.

4.3 Limitations

Compared to Bernstein et al. (2019) and Lavery and Wilson (2022), our samples may be considered small. We hypothesize that this is the case because we have been very conservative in the sample selection process; for example, we use four financial metrics in the matching process instead of three, and if a firm has all but one of these financial data points available, this firm is excluded from the sample in order to create a similar control group as possible. In addition, unlike Lavery and Wilson (2022), we exclude firms operating in the financial, utility, and public sectors, which further reduces the sample size. Lavery and Wilson (2022) extracted buyout data from both Capital IQ and Pitchbook, whereas we only extracted buyout data from Capital IQ. Furthermore, if we do not find very evident data on every criterion (including that it is indeed owned by a PE-firm during the period of study), i.e., that it probably fulfills the criterion, but we cannot be sure of it, this firm is excluded.

Another limitation of the study is the issue of unobservable characteristics among the firms that are backed by private equity, which makes the allocation of private equity ownership non-random, even when creating a matched sample. Naturally, we can only create a matched control group based on observable characteristics such as geographic location, financial metrics, and industry. However, these aspects are not the only aspects of firms, and certainly not the only aspects private equity investors assess when deciding if they should invest in a company or not. This may make the interpretation of the results somewhat ambiguous, because we cannot be a hundred percent certain that the differences, we observe are attributable to the private equity investor or some inherent characteristics among the firms they choose to invest in that we cannot observe – and consequently – not measure. Some aspects of this concern are alleviated by means of controlling for trend differences in years leading up to the pandemic and by including firm and year fixed effects in the main analysis.

Furthermore, the variables we examine do not fully capture the operational aspect. Perhaps a more robust test is needed to bypass the parallel trend assumption so that more comprehensive tests can be done with regards to performance.

5. Discussion

5.1 The drawdown in 2020

The results show that private equity backed firms decreased significantly more during the initial onset of Covid-19 in 2020 but recovered significantly more quickly in 2021. There are several potential explanations for this. One story is that of overextension. An explanation for this could be that akin to how Axelson et al. (2013) illustrate that private equity firms use more debt, and take on risks when the economy is booming, and that during a financial boom they also take additional operational risks in the form of (1) add-on M&A, (2) geographic expansions, and (3) other strategies to boost topline growth.

The drop-and-increase relationship is indicative of private equity firms likely taking on more operational risks, as noted by Axelson (2013); rather than using their expertise to de-risk a comparable business, they take on more operational risk, but show greater skill which their quicker recovery in Covid-19 point to. Thus, from this perspective, the quicker recovery could (a) be a result of a more volatile business and not skill, or (b) more skillful management that can turn around a riskier business more quickly. We argue that the latter seems more likely given the matched sampling process.

Thus, there seems to be validity to the hypothesis of better operational improvement capabilities of PE-backed companies stemming from value added by their private equity owners, and that it can lead to better operating capabilities as shown by the larger significant positive change to EBITDA, EBITDA margin and profit margin post-crisis. The larger drop then can be the result of increased risk-taking, which, given the private equity incentive structure, is likely (Strömberg and Kaplan, 2009). The recovery can, on the other hand, be a sign of skill in operational execution. Consequently, this is something that could then show the value of the operational improvement activities carried out during Covid-19 as documented by Ljungqvist et al. (2020) and Gompers et al. (2022). In addition, it shows the value of value creation teams: it allows private equity to operate riskier firms but operate them better and use that to drive value and returns as argued by Zeisberger et al. (2017).

Furthermore, the result of private equity outperformance in the recovery is supported by Lavery and Wilson (2022). Different from our study is that they find more significant support for financial resilience during the pandemic, i.e., superior access to capital. While existent in our study, it prevails to a lesser extent and more on the debt side. The higher levels could potentially be understood from the lens of Axelson et al. (2013), in that the easier credit cycle leading up to the crisis contributed to higher prices being paid, and leading to more M&A and LBOs, all be it financed using debt of various sorts as leverage (Strömberg and Kaplan, 2009).

5.2 The Recovery in 2021

That PE-backed firms recovered more quickly could be a potential result of the more active boards, private equity fund operations teams, and greater execution operational as avenues of value creation that can foster a more agile and quickly adapting firm (Ljungqvist et al., 2020). Another explanation is that the operational change plans Ljungqvist et al. (2020) recorded mirror the value creation plans that Zeisberger et al. (2017) detail as key short term effective drivers of change and could thus imply that private equity-backed companies have the ability to more quickly adapt and implement changes given their ownership model relative to non-PE-backed firms. This can explain why private equity adds value, and how the operational improvements contribute to likely making these firms "better" (Zeisberger et al., 2017).

5.3 Operational risk

The data show that PE ownership tends to lead to higher operational performance on average, but it might be that it is used to take more operational risks. This is noted by Strömberg and Kaplan (2009) that rather than using their expertise to de-risk a business, they increase it by seeking growth and expansion. The quicker recovery, however, does show that there seems to be greater operational skill when they focus on adapting to a crisis, as the quick recovery in Covid-19 points to. Thus, in tandem, there seems to be validity to the better operational improvement capabilities of PE-backed companies as a value added from their private equity owners, and that it can manifest in higher levels of revenue, EBITDA, margins, etc. While one may claim that this is a result of them using their operational skills to take more risks, the recovery in Covid-19 suggests that they may use their operational expertise to take more risk, but when not doing so, they manage it well, and thus showing that likely they have an operational improvement edge above the non-PE-backed firms, and shows the value of the PE firms' growing focus on value creation teams.

5.4 Long-term & Covid-19 implications

That PE adds value long term is quite well documented; however, that often includes turnarounds and scenarios in which traditional firms do not engage to the same degree (Strömberg and Kaplan, 2009). Thus, taking the long-term perspective in this study serves to the examination of how PE value creation relates to comparable companies. Extrapolating the Covid-19 results into the long run supports the notion brought forward by KKR in that they add more value than just financial, and showcases that they improve the performance of businesses contrary to the claim of PE firms being "locusts", as no significant difference in employment change is seen directionally rather that the PE firms do not fire as many as they are more stable through the crisis given the relaxed financial constraints (Zeisberger et al., 2017; Lavery and Wilson, 2022). This is seen in that PE-backed firms do outperform the non-PE-backed sample, and builds on the results found

by Gompers et al. (2022), i.e., that PE firms implement operational initiatives, and confirms that these are in fact significant positive improvements and are persistent over time, and especially in times of distress; a result which is shown from the higher levels reached as shown in the fixed effects difference-in-differences model for 2017 to 2021, which confirms the story of operational improvement. However, there is a question to be had on whether this comes at a higher risk, that this is PE taking increased operational and financial risk, which is a question that has yet to be fully answered, but our results seem to suggest that this is the case.

5.5 Private equity vs public equity

The findings in our study hold for private equity against public equity, in that there are significant benefits to being owned by a private equity firm. In looking at the sample of public firms in both the long term, and Covid-19 sample, there exists an operational performance difference between the private and public group in EBITDA and EBITDA margin. In looking at the drivers of the difference, the governance, value creation plans, and other aspects highlighted by Ljungqvist et al. (2020) appear to be plausible explanations and are supported by the notion of the long-term focus as argued by Moon (2006). In conclusion, our study's takeaways are held for public companies in addition to private equity.

5.6 Practitioner perspectives

The results agree with the practitioner perspectives. Interviewed Investment professionals from Mutares SE & Co. KGaA, Norvestor A/S, and Altor Equity Partners were spoken to with regards to how private equity responds in a crisis. The answers agreed well with what is laid out by Zeisberger et al. (2017), Lavery and Wilson (2022), and Ljungqvist et al. (2020), namely value creation plans and short-term execution plans. This is evident in the quicker recovery and response to the crisis, as illustrated by changing their SG&A and COGS composition as seen in the statistically significant growth in the EBITDA margin relative to the non-PE-backed firms. The SG&A was the likely driver as revenue was not significantly enhanced, and consequently it could not be the main driver of the observed significant increase in EBITDA, rather they optimized their cost structure. (INSEAD, 2020).

5.7 Turnaround situations

This shows the operational improvement ability of private equity firms in their portfolio companies, and especially handling them in a crisis. Of note is that this sample controlled for turnarounds as equally performing companies were matched, and as such, it better captures the operational improvement ability that is not a result of private equity firms' inherent benefits and overrepresentation in turnaround investing (Cuny and Talmor, 2007). A limitation to the method of separating operational improvements in the Covid-

19 test is that while the capital structure is controlled for from the start, some revenue, EBITDA, and profit increases could be the result of inorganic acquisitions that have driven the growth through for example (i) a cash deal using external committed capital or (ii) exchange deal where the capital structure is largely unaffected.

5.8 Extensions

There are two extensions that would be especially interesting to conduct, which would be a similar analysis but on (a) industry size, and industry splits (b) to evaluate how it holds across both mature to less mature industries, and in which type of industries it performs better. The industry split is interesting because the Covid-19 pandemic had adverse effects heterogeneously across industries, and therefore looking at this view could provide some useful insights into PE-backed firms' performance during crises. Perhaps PE firms are better at providing industry expertise in certain industries, and other industries not. Also, since we saw a very large difference in the average number of employees while the medians were quite similar, this could indicate that larger PE-backed firms are run more efficiently than equally large non-PE-backed firms. Examining this in detail is something worth looking into.

As we mentioned previously, the variables we examine do not fully capture the operational aspect. Perhaps a more robust test is needed in order to bypass the parallel trend assumption so that more comprehensive tests can be done with regards to performance on many more operational outcome variables.

Furthermore, another extension that could be done is on ESG. Evaluating whether PE-backed firms perform better on ESG metrics and implement more ESG focused changes in their companies could be of interest to review. In addition to see how this impacts valuation of these firms in an exit, and the operational performance of them.

Another extension that could be pursued is if one can see a similar benefit to private credit, that is if PE firms that lend or use mezzanine solutions provide the same benefits through the advisory channel as done in leveraged buyouts, and what the value drivers are in those transactions.

6. Conclusion

To summarize, private equity backed companies experienced a significantly larger drawdown in 2020 than non-PE-backed companies but recovered more quickly during 2021. In the long run private equity backed firms may reach a higher level of operational performance due to operational improvements from governance to M&A compared to a comparable non-PE backed company.

Our findings suggest that private equity owners seem to add value to their companies and show an operational edge in recovering quicker than non-PE-backed firms and do so

significantly and with larger magnitude in a positive direction. It is possible that they take on more operational risk given the at times higher volatility and slightly greater drawdown at the initiation of the crisis, but on average they trend to a higher level of operational performance than non-PE-backed companies. This result is promising for the increasing PE ownership of the real economy and shows the positive operational effects of PE ownership on portfolio firms.

In conclusion, contrary to the benefits of relaxed financial constraints through PE ownership as demonstrated by Bernstein et al. (2019) in a crisis by reducing volatility, PE instead increased it operationally in the beginning of Covid-19 in the UK compared to non-PE-backed comparable firms. However, after the initial shock, private equity backed companies recovered faster. This shows that PE-backed firms may be more exposed to operational risks in a crisis initially; however, through a crisis PE ownership benefits the portfolio firm. Combining this finding with the proven operational value added over time, and the financial benefit demonstrated in previous studies, such as Lavery and Wilson (2022), private equity appears to be a positive force in the operational performance of firms in an operationally sided crisis, but it comes at a risk tradeoff with slightly higher short-term volatility at the onset of a crisis. We cannot, however, prove that the differences are certainly attributable to PE firms' operational expertise and support since unobserved characteristics in the portfolio companies could account for the difference. That said, we still argue that private equity firms' active ownership of firms seems to add value operationally in the short and long run, but not without its tradeoffs in risk.

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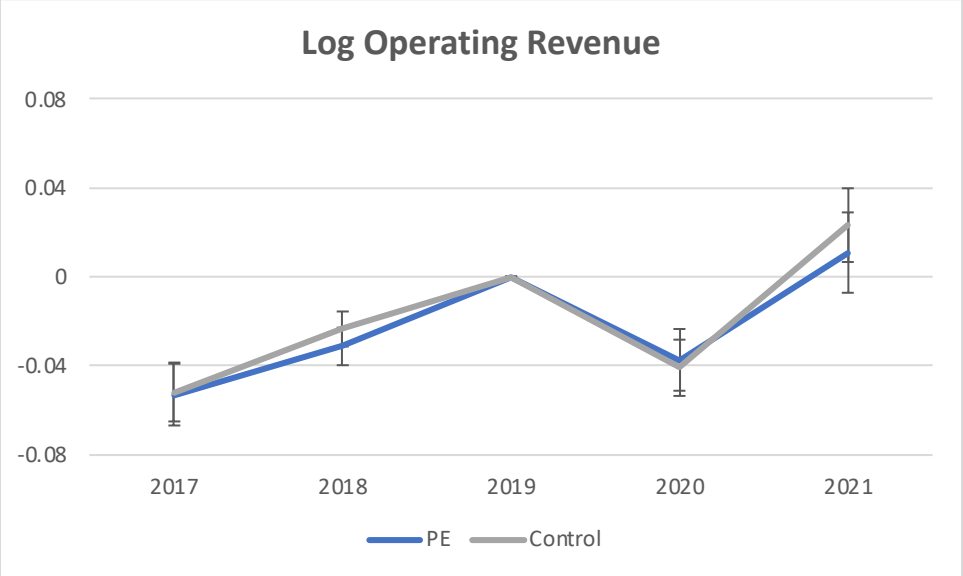
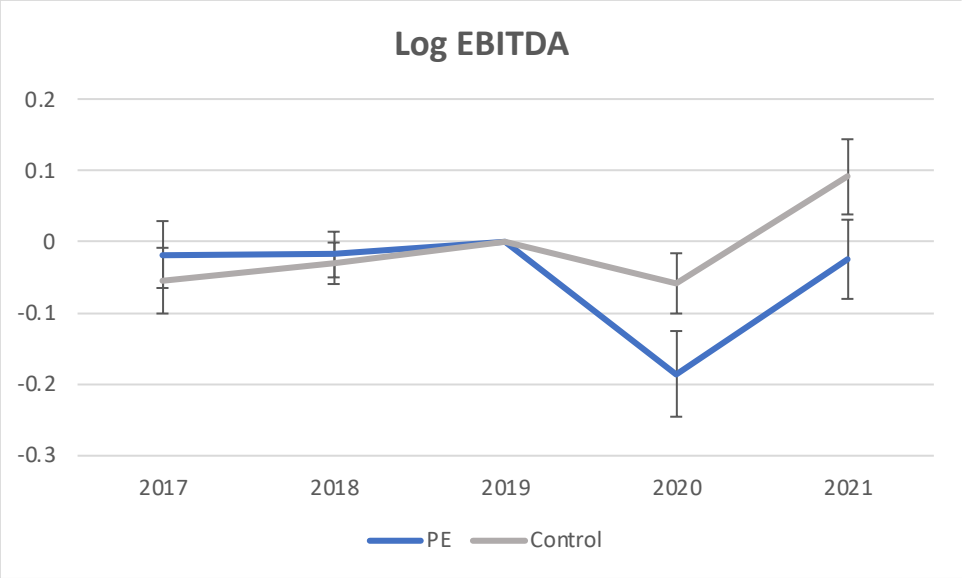
8. Appendix

Exhibit 1. Log of Revenue



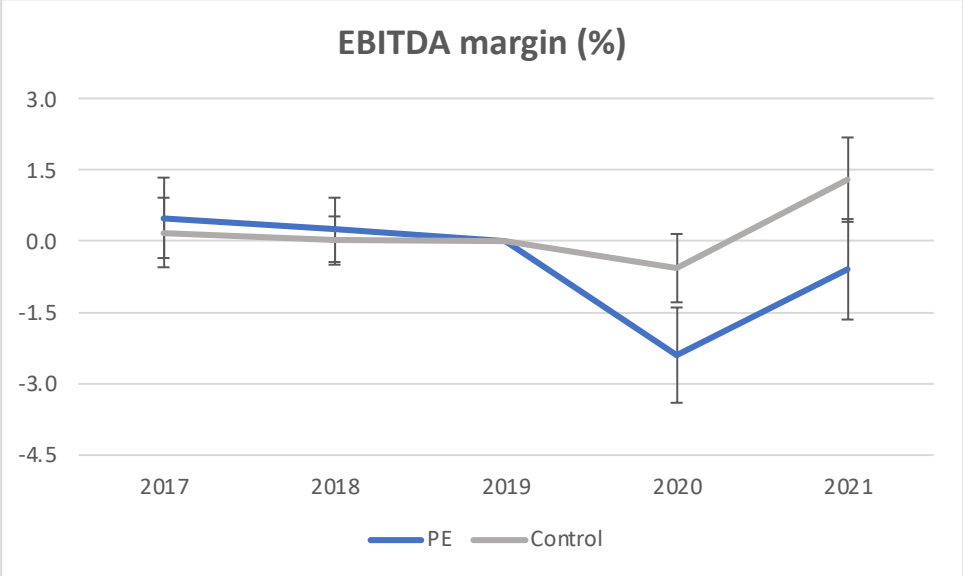
This plot reports the change in mean log revenue across time, indexed to 2019, such that the value for each year is the difference compared with the value it had in 2019. We winsorize at the 1-percent level to reduce the concern of outliers severly affecting the overall picture of the development. The plot is intended to give the reader a visual overview of what happened, but should not be taken at face value since it is not as robust as the fixed effects difference-in-differences models which also control for other variables. The error bars show the 95% confidence interval.

Exhibit 2: Log EBITDA



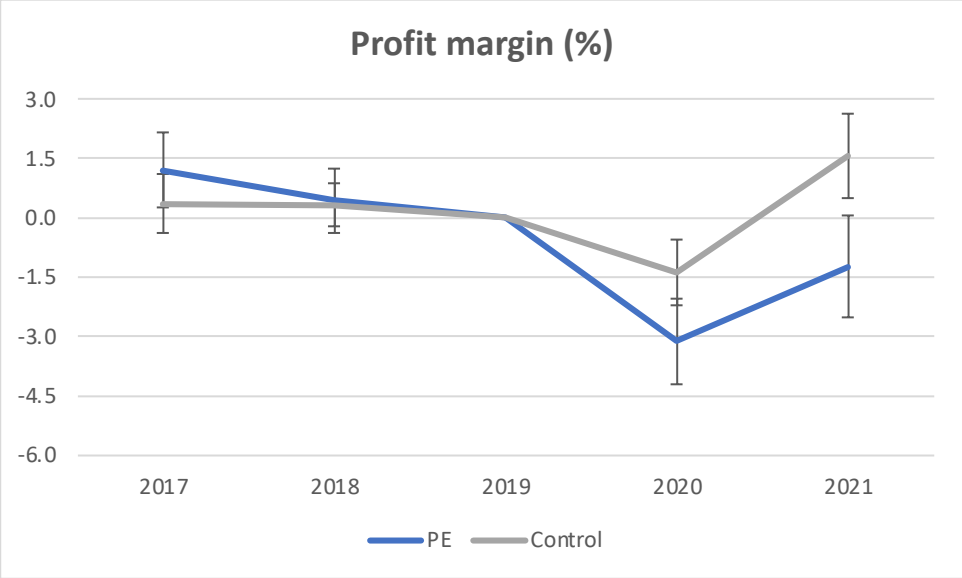
This plot reports the change in mean log EBITDA across time, indexed to 2019, such that the value for each year is the difference compared with the value it had in 2019. We winsorize at the 1-percent level to reduce the concern of outliers severly affecting the overall picture of the development. The plot is intended to give the reader a visual overview of what happened, but should not be taken at face value since it is not as robust as the fixed effects difference-in-differences models which also controls for other variables. The error bars show the 95% confidence interval.

Exhibit 3: EBITDA margin



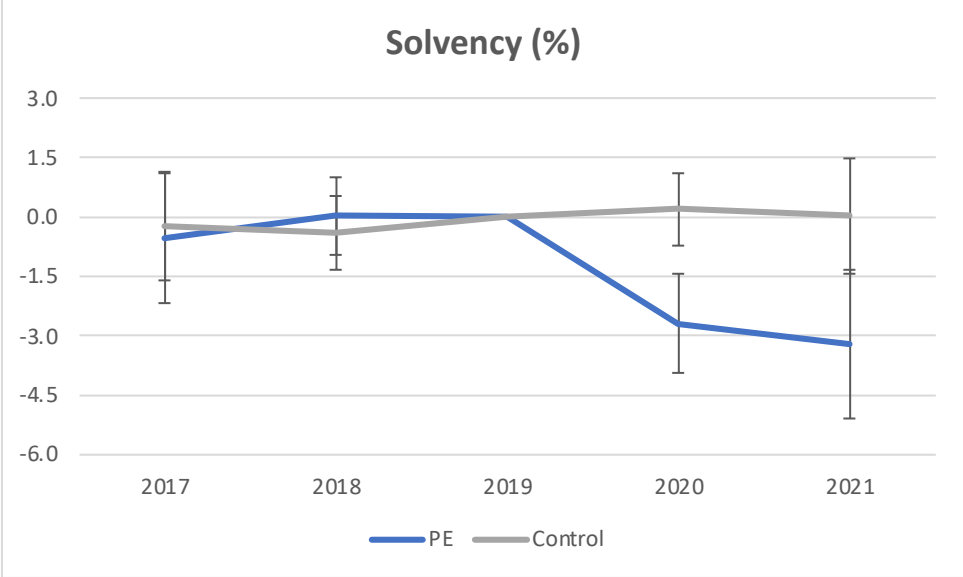
This plot reports the change in mean EBITDA margin across time, indexed to 2019, such that the value for each year is the difference compared with the value it had in 2019. We winsorize at the 1-percent level to reduce the concern of outliers severly affecting the overall picture of the development. The plot is intended to give the reader a visual overview of what happened, but should not be taken at face value since it is not as robust as the fixed effects difference-in-differences models which also controls for other variables. The error bars show the 95% confidence interval.

Exhibit 4: Profit margin



This plot reports the change in mean profit margin across time, indexed to 2019, such that the value for each year is the difference compared with the value it had in 2019. We winsorize at the 1-percent level to reduce the concern of outliers severly affecting the overall picture of the development. The plot is intended to give the reader a visual overview of what happened, but should not be taken at face value since it is not as robust as the fixed effects difference-in-differences models which also control for other variables. The error bars show the 95% confidence interval.

Exhibit 5: Solvency ratio



This plot reports the change in mean solvency (equity over assets) across time, indexed to 2019, such that the value for each year is the difference compared with the value it had in 2019. We winsorize at the 1-percent level to reduce the concern of outliers severly affecting the overall picture of the development. The plot is intended to give the reader a visual overview of what happened, but should not be taken at face value since it is not as robust as the fixed effects difference-in-differences models which also controls for other variables. The error bars show the 95% confidence interval.