PRIVATE EQUITY-OWNED COMPANIES AND COVID-19

A STUDY OF FINANCIAL DECISIONS AND OPERATIONAL PERFORMANCE

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Abstract:

This study aims to investigate the differences in financial decisions and operational performance of PE-backed companies relative to non-PE-backed companies during COVID-19. Our main analysis is conducted with a difference-in-differences model using a sample of 181 PE-owned companies and 850 matched companies headquartered in the United Kingdom. We find indications that PE-backed firms' financial decisions and operational performance during COVID-19 were partly different relative to comparable peers. Consistent with previous studies of the Global Financial Crisis 2008, PE-backed firms experienced an increase in net equity contribution relative to their peers during the pandemic. Our findings also suggest a relative increase in leverage ratio for PE-backed firms. Contrary to the previous body of research, we find a relative decrease in profitability for PE-backed firms relative to non-PE-backed firms. Moreover, our findings suggest that the change in inventory for PE-owned firms increased relative to comparable firms that do not have a PE owner. Working capital management of PE-backed firms during crises have not been appropriately investigated in previous literature, and our findings thus provide an addition to the previous body of research. Furthermore, our study complements previous literature by presenting insights regarding PE-backed firms' performance and financial decisions during the COVID-19 pandemic, which hitherto has not been explored extensively.

Keywords:

Private Equity, COVID-19, Operational Performance, Financial Decisions, Working Capital Management

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Filippa Holmlund and Julia Ingwall Bernander

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1. Introduction

In 2020, COVID-19 was classified as a pandemic and subsequently spread around the world, which caused a negative impact on most economies (Song et al., 2021; WHO, 2020). Government lockdowns affected businesses which resulted in a demand and supply shock (Haarmeyer, 2020). As a result, the world GDP decreased by 3.29% in 2020 compared to 2019 (The World Bank, 2020a). The private equity market was also affected by the pandemic, as private equity fundraising in Europe 2020 declined by 12% compared to 2019 (Invest Europe, 2022).

With over 4 trillion dollars in assets under management in 2020, private equity funds' performance can be considered a key investor concern (Prequin, 2020). Previous research on PE-backed companies' performance has indicated that the PE ownership contributes to enhanced financial capabilities, superior governance and improved operational performance (e.g. Kaplan, 1989a; Hotchkiss et al., 2021), although there are some contradictory findings on the subject (e.g. Axelson et al., 2013; Leslie & Oyer, 2008). Similar to the discussions on the implications of PE ownership in a non-crisis scenario, there have been discussions, albeit less extensive, regarding how the ownership affects the portfolio companies' performance during crises. Scholars find the subject critical to investigate as the volume of PE transactions has been proven to correlate with economic cycles (Bernstein et al., 2019; Davis et al., 2014). Bernstein et al. (2019) studied PE-backed companies' performance during the Global Financial Crisis 2008 (GFC) and found that PE-backed companies decreased investment less and had lower financial constraints relative to their peers. Contradicting these findings, Kaplan and Stein (1993) argued that during the crisis in the 1980s there were signs of overheating in the market with significant declines in the equity contributed by the PE funds.

Although there is evidence regarding private equity resilience during recessions, the COVID-19 effect on PE-backed companies has not been comprehensively examined. The COVID-19 pandemic did, unlike the GFC, not originate from the financial markets and is expected to impose transitory effects on the global economy (Haarmeyer, 2020). Even though the COVID-19 crisis did not originate from inefficiencies in the financial markets, the spill-over effect on PE-backed companies' financing is still relevant to investigate, as the availability of funding has been proven to affect PE-backed firms' resilience during recessions (e.g. Bernstein et al., 2019).

Consequently, a new field for discussion around PE firms' resilience and value creation has evolved as the characteristics of the contemporary crisis might impose other effects on the private equity market compared to previous crises. Therefore, the main purpose of the study is to investigate the differences in financial decisions and operational performance of PE-backed companies relative to non-PE-backed companies during COVID-19. Furthermore, we also intend to discuss why these differences may have

occurred based on existing literature. As the existing studies on PE-backed firms' financial decisions and operational performance mostly investigate financial crises[1] or non-crisis scenarios, we will contribute with an assessment of the generalizability of previous studies. Based on the identified research gaps and findings, we aim to answer the following research question:

- Were PE-backed firms' financial decisions and operational performance different compared to non-PE-backed firms during the COVID-19 pandemic?

To address this question, we will study PE-backed firms headquartered in the United Kingdom, which we find appropriate for four reasons. First, the United Kingdom has undergone three lockdowns between March 2020 and January 2021 (Institute for Government analysis, 2022), which has visibly affected the economy. Hence, this indicates that COVID-19 triggered an external chock in the United Kingdom, which poses a suitable setting where PE-owners' crisis management could be examined. Second, the United Kingdom has one of the largest markets for buyout investment as a share of GDP in 2019 (Invest Europe, 2022), and the performance of the companies thus has a material effect on the economy. Third, previous research regarding PE-backed companies' performance in the United Kingdom during the GFC (e.g. Bernstein et al., 2019) makes it an addition to existing research by investigating the generalizability of previous studies on the subject. Lastly, the United Kingdom has a high supply of financial data since balance sheet and income statement information is available for almost all companies (Brav, 2009).

Our analysis includes 181 companies in the United Kingdom which had a private equity owner during the pandemic and a non-PE-backed peer group that consists of 850 companies headquartered in the United Kingdom. The peer group is matched based on industry, leverage, profitability and asset size using propensity score matching. We use a difference-in-differences model to examine whether PE-backed companies' financial decisions and operational performance were affected differently by the COVID-19 crisis relative to the matched group. In order to capture all aspects of operational performance, the analysis is divided into two sub-areas: (1) profitability and investment and (2) working capital management.

The main results partly indicate that PE-backed firms' financial decisions and operational performance were affected by COVID-19 differently than non-PE-backed firms. We find that net equity contribution and leverage have been significantly higher for PE-backed companies than for non-PE-backed ones. Contrary to previous research, we find that profitability for PE-backed companies decreases relatively more than for non-PE-backed companies. Moreover, our results contribute to the existing literature regarding working capital management. The importance of working capital management to reduce financial problems and enhance companies' profitability has been highlighted during crises in

[1] That is, crises that originated from the financial markets (Haarmeyer, 2020)

previous research (e.g. Salehi et al. 2019). However, it has not been investigated among PE-backed companies in this context. We find that inventory growth for PE-backed companies significantly increased relative to non-PE-backed companies. Moreover, the change in net working capital was not affected significantly differently by COVID-19 for PE-backed compared to non-PE-backed companies.

The paper is structured as follows. We will start by accounting for the background in section 2, entailing the impact of COVID-19 on the United Kingdom's economy and comparisons of the private equity market across geographical areas. Next, in section 3, a review of previous research on PE-backed companies' performance during normal times and during crises is conducted, followed by a development of the proposed hypothesis. In section 4, we will present the data sources, sample selection and the paper's research design. Section 5 presents descriptive statistics and parallel trends followed by our main results. Finally, sections 6 and 7 contain a discussion about the main results connected to previous literature on the area and concluding remarks.

2. Background

The PE market of the United Kingdom during COVID-19 is, as previously described, a suitable setting for analyzing PE-backed firms' ability to manage crises, as it contains an external chock and could be compared to other PE markets. In order to demonstrate this, we will present the impact of COVID-19 on the United Kingdom's economy and a comparison between the United Kingdom's private equity market and other countries' private equity markets in the following sections.

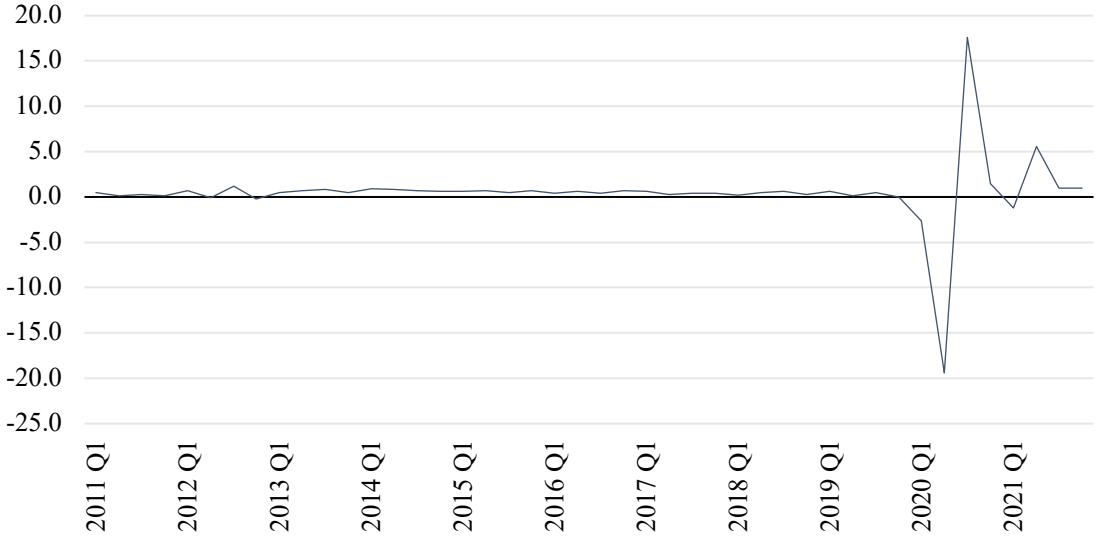
2.1. Impact of COVID-19 on the United Kingdom Economy

In March 2020, COVID-19 was declared as a pandemic (WHO, 2020), which affected the world economy negatively and in 2020 the world GDP decreased by 3.29% compared to 2019 (The World Bank, 2020a). This section contains a description of the impact of COVID-19 on the United Kingdom. Four areas will be discussed: GDP development, business investment activity, unemployment, and corporate bond market performance.

The United Kingdom experienced several government restrictions during 2020. The country had three lockdowns between March 2020 and January 2021 (Institute for Government analysis, 2022). The first lockdown restricted economic activity, which had substantial financial effects (Office for National Statistics, 2022a). As illustrated in Figure 1, the United Kingdom experienced a severe contraction in GDP during Q2 2020, with a 19.8% decrease compared to Q1 (Office for National Statistics, 2022b). The GDP decline was the largest since the government began to account for quarterly data in 1955. However, the GDP recovered in Q3 with an increase of 17.6% compared to Q2. For Q4, the growth was more modest at 1.5% (Office for National Statistics, 2022c).

Business investment in the United Kingdom was also impacted severely by the COVID-19 outbreak (Office for National Statistics, 2022a). Following the first lockdown at the beginning of the year, investments decreased by 26.5%, which is the largest decrease noted in the United Kingdom. The COVID-19 impact on business investment can be compared to the decline during the GFC in 2008 when it decreased by 9.6%, which is a relatively small downturn. Even though business investment recovered somewhat during the end of 2020, the annual decline was 10.3% compared to 2019. One explanation for the decline could be a reluctance to invest given the economic uncertainty (Office for National Statistics, 2022a). From a global perspective, the net inflow of foreign direct

investment for 2020 was somewhat higher in percentage terms with 1.1% of GDP compared to 0.08% in 2019 (The World Bank, 2020b).



Note: This figure illustrates the GDP quarter-on-quarter growth (%) in the United Kingdom. The GDP growth is presented in chained volume series and has been seasonally adjusted. The source of the data is Office for National Statistics (2022c).

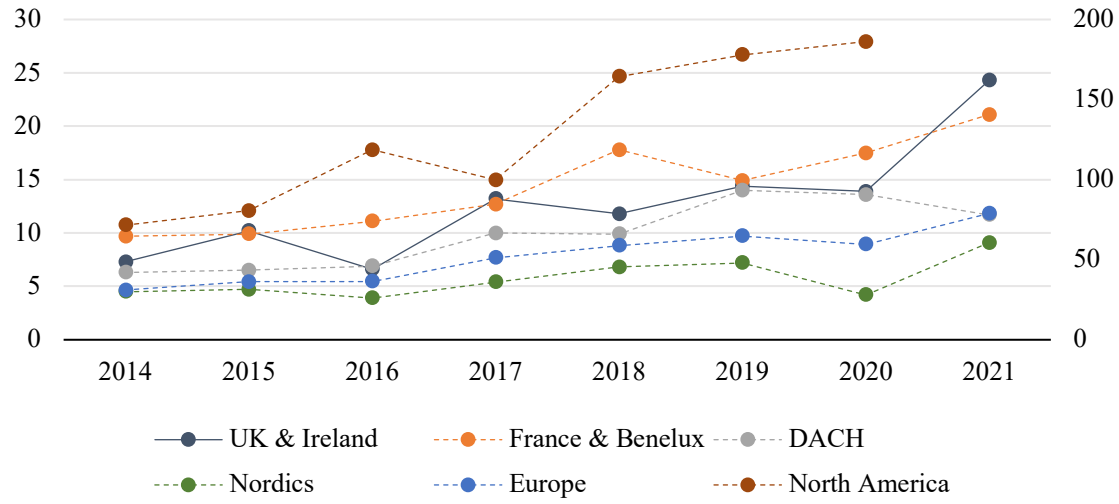
Figure 1. The United Kingdom GDP: quarter-on-quarter growth (%)

The labor market in the United Kingdom was also affected by the lockdowns. In 2020 Q3, the unemployment rate was 4.8%, and in Q4, it was 5.2%. This development can be compared to a rate of 4% before the outbreak of the pandemic (Office for National Statistics, 2022d). However, after peaking at 5.2%, the unemployment rate gradually declined during 2021. The corporate bond market of the United Kingdom was also heavily affected by the outbreak, which caused the spread of investment-grade corporate bonds to increase significantly in March 2020. However, the market recovered during the year and returned to pre-COVID levels at year-end (S&P, 2022).

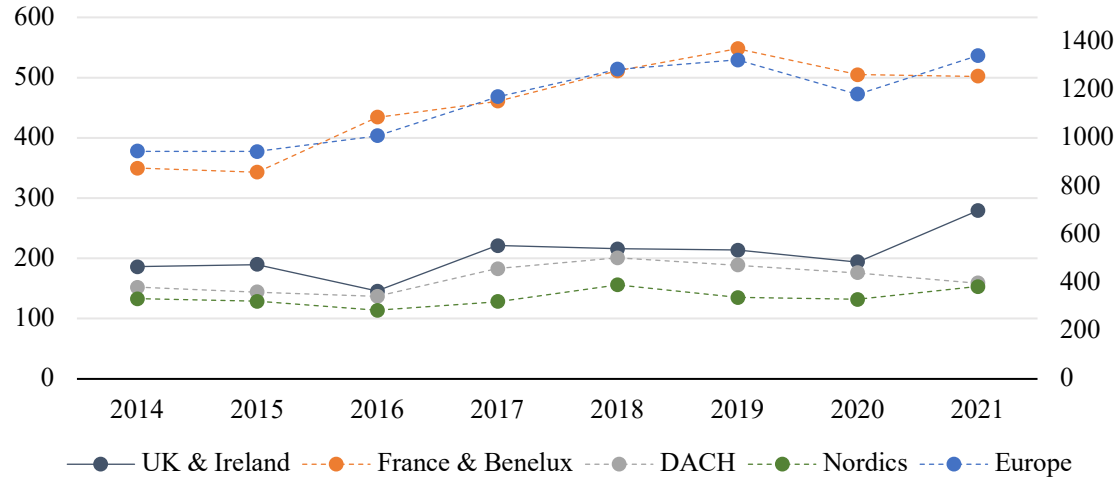
All in all, the United Kingdom experienced an evident economic shock due to the pandemic. Hence, the pandemic creates a setting suitable for a quasi-natural experiment of PE-backed firms' crisis reaction.

2.2. The United Kingdom Private Equity Market

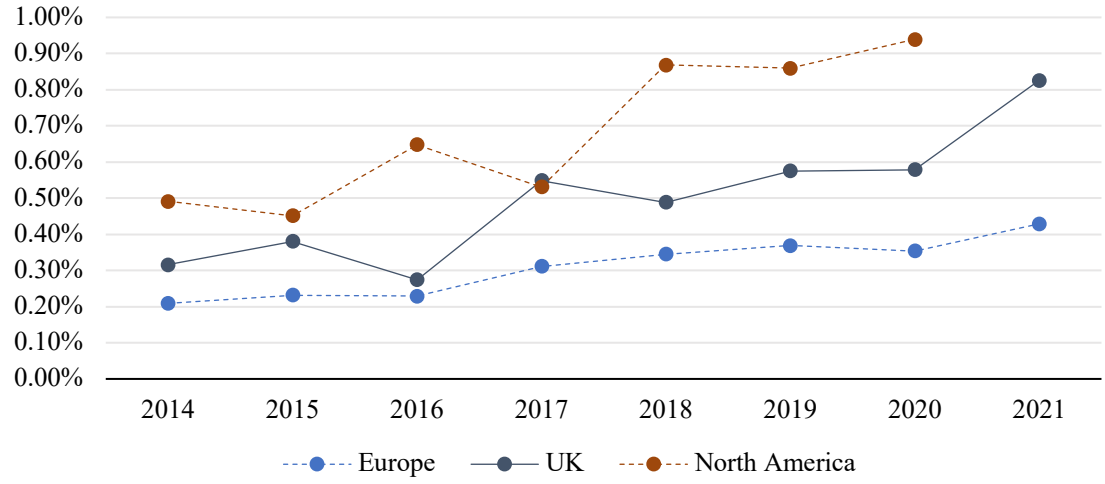
As we previously implied, it is interesting to look into whether the PE investment patterns in the United Kingdom are similar to other countries' or not in order to get an understanding of the papers' external validity. Thus, this section entails comparisons of the private equity market across geographical areas.



Panel A. Buyout investment (€ billions)



Panel B. Number of buyout transactions



Panel C. Buyout investments as % of GDP

Note: This figure illustrates three different comparisons of private equity activity in North America, Europe, the United Kingdom and Ireland, France and Benelux, DACH and Nordics. In panels A and B, the left y-axis presents the scale for all markets except Europe and the United States, which are presented on the right y-axis. The source of the European data is Invest Europe (2022), and the source for the North American data is Preqin (2022) and the World Bank (2021). North American data for 2021 has not yet been published by Preqin and has therefore been excluded.[2]

Figure 2. Comparison of the private equity market across geographical areas.

Before we elaborate further on differences and similarities, it is important to note that PE activity comparison is not easy. For European data, we have used Invest Europe, which produce its own data. However, for the North American data Preqin was used, which relies on private data from companies. Thus, these different data sources use different methodologies and definitions, which could result in inconsistent estimates.

Figure 2 contains three panels: buyout investment (Panel A), number of buyout transactions (Panel B) and buyout investments as % of GDP (Panel C). The figure illustrates the development during 2014-2021. Overall, the panels in Figure 2 demonstrate that the patterns of PE activity were relatively similar, even though the absolute volume of transactions and amounts are different between countries. Additionally, the United Kingdom and Ireland represent a rather large part of European PE activity. Panel A illustrates the aggregate value of buyout investment per year which overall has been increasing since 2014. As depicted, after the global outbreak of COVID-19 in 2020, the buyout investment in absolute amounts decreased for almost all geographical areas except for North America and France and Benelux. Following the decline, Panel A illustrates a recovery in 2021, apart from in the DACH area where buyout investment declined somewhat. Panel B presents the number of buyout transactions, where the activity pattern is quite similar for all areas during 2014-2021 with a small decline during 2020. Finally, Panel C illustrates the aggregate value of buyout investment per year as % of GDP for Europe, the United Kingdom and North America. All geographical areas exhibited increasing patterns during 2014-2019, even though there were some yearly deviations between the countries. During 2020, the activity for the United Kingdom and Europe stagnated to recover in 2021, while North America's increasing pattern proceeded.

In conclusion, the comparison above discloses similarities across different geographical areas in the PE market. These similarities are important in the discussion of the external validity of the papers' findings. However, the novelty of the COVID-19 outbreak and the lack of future data make this pattern somewhat hard to distinguish.

[2] The distinction of geographical areas is made based on portfolio company hq and include the following countries. DACH: Austria, Germany, Switzerland, Nordics: Denmark, Finland, Norway, Sweden. The measurement of Buyout investments as % of GDP for North America is based on Buyout investment data from Preqin and North American GDP from the World Bank. For Panel A, the Preqin data (USD) was translated to EUR by using ECB (2022) average exchange rate on an annual basis.

3. Previous Literature and Theoretical Development

Private equity managers can implement changes in portfolio companies that have been proven to impose differences in value creation and crisis management between PE-backed and non-PE-backed firms. In the following sections, we will present the existing literature's findings on whether PE-backed firms differ from non-PE-backed firms in a non-crisis scenario and the effect of PE ownership on portfolio companies during crises.

3.1. PE Ownership during Non-Crises Periods

There are three areas through which PE-backed firms have been proven to differ from non-PE-backed firms in previous research: the financial, governance, and operational perspective (Kaplan & Strömberg, 2009). Hence, to understand if PE-backed firms' financial decisions and operational performance might differ from non-PE-backed firms, these three areas are further explained below.

3.1.1. Financial

The vast majority of research have suggested that PE-backed firms differ in financial decisions compared to non-PE-backed firms (Bernstein et al., 2019; Cohn et al., 2022). This section will present the existing literature on how PE-backed firms use financial engineering to create value through two main drivers: capital structure and cost of debt.

First, Kaplan (1989b) has argued that private equity firms aim to preserve tax benefits by keeping capital structure at an optimal level. This reasoning is in line with the trade-off theory, which is based on the concept that leverage generates tax benefits that outweighs the risk of financial distress and contributes to increased equity value (Myers, 2001). Hotchkiss et al. (2021) have suggested that PE-backed firms could have higher optimal leverage because they can restructure at a lower cost. However, Axelson et al. (2013) found that the magnitude of leverage is connected to time-series effects in debt markets rather than firm characteristics. Furthermore, Andrade and Kaplan (1998) claimed that PE transactions are not driven by what is optimal for firms but rather by how much debt PE investors can access and suggested that PE-backed companies tend to be over-leveraged. Nevertheless, Gompers et al. (2016) have claimed that the market timing and trade-off theory are both critical in determining the leverage levels in PE transactions.

Second, there have been some indications in previous studies that volume and loan conditions are two disparities between private equity firms and their peers that could explain differences in the cost of debt. Ivashina and Kovner (2011) stated that private equity firms are more likely to obtain favorable loan spreads than their peers, thus decreasing the firm's cost of debt. Moreover, Ivashina and Kovner (2011) showed that a decrease in the cost of debt has an equity return impact of 4-9% on the private equity

funds. Another characteristic of leveraged buyouts is the link to looser covenants and liberal repayment schedules (Kaplan & Strömberg, 2009). An explanation for this could be that private equity funds have better access to credit as they borrow on a recurring basis, allowing them to build a strong relationship with lenders (Ivashina & Kovner, 2011; Demiroglu & James, 2010). These financing patterns are nevertheless not the same for public firms. For example, Kaplan and Strömberg (2009) have raised the issue that firms with alternative ownership, such as public firms, could be unwilling to take advantage of the debt mispricing by increasing leverage because they do not prefer debt financing or because public market investors dislike high leverage levels.

In conclusion, previous research has indicated that PE-backed firms have a relatively lower cost of debt and are more likely to optimize their capital structure than non-PE-backed firms, which results in lower financial constraints. However, some research supports an alternative view where excessive leverage negatively affects the firms' value creation.

3.1.2. Governance

Several authors have described the governance engineering changes that PE firms can make to enhance operational performance in a portfolio company (e.g. Jensen, 1989; Kaplan, 1989a). In the following section, we will provide evidence on governance engineering in conjunction with two theories: parenting advantage and reduction of agency costs.

Bergström et al. (2007) have described parenting advantage as a concept related to the impact a PE firm has on its portfolio firms concerning value creation because of the PE ownerships' characteristics. First, Bergström et al. (2007) argued that PE ownership has a time horizon that is sufficiently long to execute plans but short enough to motivate managers to implement the strategy. Second, privately-owned companies attract less media attention which could be preferable when implementing changes, and third, the PE firm could contribute with industry expertise and a network of contacts (Berg & Gottschalg, 2005).

Another effect of private equity ownership is the reduction of agency costs without prohibiting risk diversification and liquidity (Jensen, 1989). According to the agency theory, the principal (owner) engages the agent (manager) in a task, which results in a decision-making authority transfer to the agent (Jensen & Meckling, 1976). If both the principal and the agent want to maximize utility, agency costs will arise since the agent might not always act in line with the principal (ibid). We will elaborate further on three areas that can reduce agency costs under PE ownership: increased leverage, strong equity incentives to management teams, and more active boards (e.g. Jensen, 1989; Kaplan, 1989a; Gompers et al., 2016; Cronqvist & Fahlenbrach, 2013; Acharya & Kehoe, 2008; Thompson & Wright, 1991).

First, Kaplan (1989a) has suggested that increased leverage at a leveraged buyout would decrease company cash flows, resulting in decreased waste of resources. Jensen (1986) elaborated that this will decrease the dispersion of cash flows that companies with weak corporate governance in mature industries can experience. Consequently, leverage could increase the risk of bankruptcy, incentivizing management to decrease it by restricting their consumption of perquisites, generating cash flows and making optimal investment decisions (Kaplan, 1989a; Berg & Gottschlag, 2005). However, another way to interpret the increased bankruptcy risk is that it potentially could incentivize risk-averse managers to take decisions to decrease bankruptcy risk even though they might not be the most value-generating (Holthausen & Larcker, 1996).

Second, agency costs can be reduced by increasing the alignment between shareholder and management incentives (Jensen, 1989). During buyouts, it has been common to require or encourage management to increase their equity holdings in the company (Kaplan, 1989a; Easterwood et al., 1989). The large equity stakes increase management's personal costs of inefficiency, and the personal benefit of value creation is therefore expected to be higher (Smith, 1990; Jensen & Meckling, 1976). Hence, management will be more motivated to maximize the firm's value (Easterwood et al., 1989). Furthermore, post-buyout portfolio firms' motivational systems for employees often link pay to performance (Berg & Gottschalg, 2005; Easterwood et al., 1989). In addition, managers' equity investment could be non-diversifiable and hence increase incentives further (Thompson et al., 1992). However, since a large part of management equity is invested in the company, it could also lead to risk aversion among managers (Holthausen & Lacker, 1996).

PE firms tend to be more actively involved in governance than public company boards. The boards tend to meet more frequently and are smaller than peer public company boards (Acharya & Kehoe, 2008; Cornelli & Karakas, 2008). Acharya and Kehoe (2008) found that PE-backed company boards have more informal contacts and twelve formal meetings a year. Furthermore, they found that one-third of CEOs of PE-backed firms tend to be replaced during the first 100 days, and two-thirds are replaced during the first post-buyout year, indicating that PE boards act to replace poor performing management teams.

To summarize, previous research has provided evidence on how PE ownership contributes to a governance model which indirectly explains operational value creation through its parenting advantage and reduction of agency costs. Consequently, the superior governance model among PE firms strengthen the hypothesis that PE-back firms may perform differently than their non-PE-backed peers. In the following section, private equity firms' ability to influence operational performance is further developed through a more direct analysis of PE-backed firms' operational performance.

3.1.3. Operational Performance

Operational engineering implies the expertise in industry and operations that a PE firm applies to create value in their portfolio companies (Kaplan & Strömberg, 2009; Cohn et al., 2022). For example, PE firms tend to organize their operations by industry and use consulting firms in business development processes (Kaplan & Strömberg, 2009). As a result, the comprehensive strategic and industry knowledge can be used to locate more appealing investments, develop value creation plans and implement them (Acharya & Kehoe, 2008).

Previous research on PE firms' ability to add value to portfolio companies has mostly indicated a positive relationship between PE ownership and operational performance (e.g. Harris et al., 2005; Boucly et al., 2011; Bergström et al., 2007; Cohn et al., 2022). Early evidence on PE value creation was presented by Kaplan (1989a) in a study of US public-to-private deals completed in 1980 to 1986. His findings indicate that during a post-buyout period the companies experienced increases in operating income and net cash flow as well as decreases in capital expenditure. Kaplan (1989a) found that the profitability increase is derived by selling off assets and decreasing investments. Furthermore, Boucly et al. (2011) presented evidence that portfolio companies tend to grow faster than their peers, become more profitable, and increase capital expenditure during the first three years following a leveraged buyout. While the finding of increased profitability is in line with Kaplan's (1989a) research, the increase in capital expenditure points to an opposite relationship compared to the one Kaplan (1989a) found. One reason for these conflicting results could be the high incentives to execute cost-cutting policies and restructuring during the 1980s due to the high degree of deregulation in many industries (Jensen, 1993).

In a study of US public-to-private deals, Guo et al. (2011) found no statistically significant positive relationship in operating performance gains between PE-backed firms and peer firms from 1990 to 2006. Similar findings were made by Acharya and Kheoe (2008), who found smaller impacts on profitability during more recent public-to-private deals and Leslie and Oyer (2008), who found weak or no evidence of increases in operating efficiency and profitability. These findings indicate that the relatively larger profitability implications from Kaplan (1989a) in the 1980s might have vanished. However, the results should be interpreted with some caution as Gou et al. (2011) and Leslie and Oyer (2008) conducted the studies on the US market, which could have resulted in selection bias due to a lack of performance data. Moreover, the PE business model might have changed toward new sources of value creation, and one idea is that funds now are buying credit-constrained and underdeveloped firms that can be evolved to grow faster (Cohn et al., 2022; Boucly et al., 2011).

Lastly, Berg and Gottschalg (2005) have suggested that it is usual for PE firms to reduce capital requirements and increase the capital productivity of the portfolio company after a buyout. In a study of public company MBOs during 1977 to 1986, Smith (1990)

presented evidence that post-buyout adjustments in working capital management increase operating returns. Furthermore, the industry-adjusted inventory holding- and receivable collection periods declined significantly. This result aligns with Kaplan's (1989a) earlier findings of increased inventory turnover and Easterwood et al. (1989) findings of lower accounts receivable levels and inventory in the post-buyout period. Furthermore, Singh (1990) presented similar findings of higher inventory turnover and accounts receivables turnover than industry norms and suggested that the findings are an effect of tightened management of inventory, accounts receivable and working capital management.

In conclusion, the evidence from previous research supports a correlation between PE ownership and portfolio company operational performance, even though there are some indications that the relationship has become somewhat weaker over the years. Furthermore, there seems to have been a shift in the PE firm's portfolio strategies, from capital expenditure cutting to an increase in capital expenditure.

3.2. PE Ownership during Crises

While there is research on PE-backed companies' performance during normal times, the concept has not been investigated as comprehensively in a crisis setting (Meles et al., 2014). Furthermore, evidence of PE-backed companies' performance during COVID-19 is even more scarce. In the next section, we present previous research on PE-backed firms' performance during previous financial crises and the implications of COVID-19 on PE-backed companies.

3.2.1. Implications of Previous Crises

The section below entails previous research on PE-backed companies' performance from a crisis perspective, excluding research on the COVID-19 pandemic. We account for the crisis effect on performance in three areas: operational, financial and governance.

From a financial performance perspective, most research have suggested that PE-backed firms have lower financial constraints than peers (e.g. Bernstein et al., 2019; Hotchkiss et al., 2021). Thus, empirics related to financial resilience during recessions are elaborated on below and relate to two main drivers: access to credit markets and access to uninvested funds.

One characteristic of the private equity industry is the magnitude of leverage used in buyouts. Therefore, it is vital that PE-backed firms can manage their leverage levels during economic downturns. According to Bernstein et al. (2019), Ivashina and Kovners' (2011) finding that PE firms have strong bank networks could allow them easier access to credit markets during bad times. Consistent with this finding, Bernstein et al. (2019) discovered that loans from financial sponsors were significantly more likely to be renegotiated during the GFC. Furthermore, Bernstein et al. (2019) found that during the

GFC, PE-backed companies experienced higher levels of debt issuance and lower cost of debt compared to non-PE-backed peers, which appear to have enabled them to proceed with investments during the crisis.

The second characteristic is related to the fact that the capital raised by private equity funds is often drawn down and invested over multiple years with commitments, allowing the funds to make equity investments during recessions when accessing other sources of financing is challenging (Bernstein et al., 2019). Moreover, during the GFC 2008, Bernstein et al. (2019) found net equity issuance over assets to increase by 2 points relative to their peers.

There is research, albeit less extensive, that has presented contradictory views on PE-backed companies' financial resilience during the GFC. The primary concern among PE firms during downturns is the general partners' poor selection tendency and financial structuring before recessions, resulting in financial distress during the crisis, amplifying the declining investment and thus alleviating financial constraints (Bernstein et al., 2019; Bernanke et al., 1988; Bernanke, 1983). Furthermore, Kaplan and Stein (1993) found that during the recession in the 1980s there were signs of overheating in the leveraged buyout market with significant reductions in the equity contributed by financial sponsors.

Furthermore, from a governance perspective, a characteristic among PE-backed companies that could indicate resilience during crises is that PE firms can generate operational improvements. These operational improvements include redeployment of their human capital, e.g. working with existing firms instead of new transactions, as suggested by Bernstein and Sheen (2016). This characteristic is strengthened by Gompers et al. (2012), who found that Bain Capital redeployed investment professionals internally to develop and implement action plans during the GFC. Additionally, in a survey conducted by Bernstein et al. (2019) almost 90% of 300 participating PE investors answered that they were more likely to assist a portfolio company with operational issues during a crisis compared to in a no crisis scenario. Furthermore, the survey revealed that PE firms also were more likely to help portfolio firms with financial structuring issues during a crisis by, inter alia, renegotiating debt obligations interacting with lawyers and bankers, injecting equity and raising additional debt (Bernstein et al., 2019). The survey participants indicated that three of the most crucial factors when supporting a portfolio company were the long-time horizon of a PE investment, the majority control of portfolio companies and the absence of scrutiny from the equity markets due to the private ownership.

In line with the positive impact on operational performance described by scholars investigating PE-backed firms in a non-crisis scenario, Meles et al. (2014) argued that PE-backed companies, with the ability to make strategic acquisitions, train employees, and invest in research should outperform peers during crises. Their study of the GFC presents evidence that PE-backed companies on average were more profitable during the

crisis, even though the crisis had a negative effect on both categories of companies. Consistently, Wilson et al. (2012) found indications of higher profitability of PE-backed firms in the United Kingdom during the GFC. However, these findings are not consistent with Bernstein et al. (2019) who found no indication of a statistically significant difference in profitability for PE-backed companies in the United Kingdom during the same time. Furthermore, Bernstein et al. (2019) found that PE-backed firms decreased investment less than non-PE-backed firms during the GFC and that the PE-backed firms' investments may have been focused on an increase in market share rather than on short-term profitability.

Additionally, one appropriate solution to reduce financial problems during economic downturns is to make appropriate working capital management policy decisions (Salehi et al., 2019). On this topic, Wilson et al. (2012) found that PE-backed firms in the United Kingdom during the GFC experienced better working capital management than non-PE-backed firms. This study was carried out using t-tests and measured working capital as the cash-to-asset ratio. Furthermore, mistakes in working capital management during a crisis can lead to liquidity loss and is therefore especially important (Chang et al., 2019). Thus, in the contemporary economy, working capital management decisions are some of the most critical and challenging tasks for executives since it can function as a critical role in improving the financial situation of companies during crises (Salehi et al., 2019). While there is a vast body of research on working capital management in PE-backed companies during normal times, as detailed in section 3.1.3., research on working capital management in PE-backed companies during a crisis is lacking.

In conclusion, there has been a consensus in previous research for the claim that private equity funds are capable of providing their portfolio companies with sufficient funding during crises and are thus less bound by financial constraints relative to their peers. Additionally, the PE firms' ability to reallocate employees has indicated that PE-backed companies can get additional assistance during crises. However, there is an ongoing discussion on whether the excess leverage among PE-backed firms might cause deadweight costs on firms, where some argue that the excessive leverage leads to the opposite relationship.

3.2.2. Implications of COVID-19

Although some evidence has been presented regarding private equity resilience during previous recessions, the COVID-19 outbreak has no historical precedent and might have other implications on firm performance than suggested in previous research. Unlike the GFC 2008, the pandemic did not originate from the financial system and is expected to impose temporary effects on the global economy (Haarmeyer, 2020). Furthermore, it is different from past financial crises in terms of scope and severity (Song et al., 2021). In this section, we present the outlooks of the private equity market during the COVID-19 crisis, as well as previous research on COVID-19 and firm performance.

According to Haarmeyer (2020), the contemporary private equity market is more evolved than the pre-GFC market, as the private equity industry was larger, more diversified, had more dry powder and had more access to longer-term capital in comparison to the previous downturn. The PE capital raised but not used has increased by approximately $1.3 trillion from 2007 up until the pandemic. Moreover, as the private equity market has matured, general partners have started to raise permanent and perpetual capital, which is utilized for long-term capital growth and enables the funds to ride out short-term volatility when liquidity is in short supply (ibid).

The behaviors among PE managers during the COVID-19 pandemic have been studied by Gompers et al. (2022), who questioned PE managers about their decision-making, activities, and portfolio performance during COVID-19. The authors concluded that the private equity managers were actively engaged in their portfolio companies' governance, financing, and operations. In terms of performance, the authors showed that the PE managers believed that 50% of the portfolio companies were negatively affected by the pandemic. For the most severely affected companies, the most common activities for PE managers were reducing headcount and reducing costs. These activities were not as common for portfolio companies that had not experienced any material decline in performance during the crisis. However, providing operational and strategic guidance and recruiting new board members were common activities linked to all portfolio companies. Furthermore, some managers also desired to refinance the debt and extend maturities. In terms of equity investments, most PE managers who desired to raise equity capital in the portfolio companies would source the equity from the existing fund that was initially invested in the company. Moreover, the authors found that target debt-to-capital fell significantly during the crisis, which indicate an increased risk in the market and a desire to finance the portfolio companies more conservatively. Lastly, the authors found that most PE managers believed that the industry would perform better than the public market over the next ten years.

Research on whether PE-backed companies have been affected by COVID-19 is relatively scarce as the crisis lacks precedent. We found no published paper covering PE-backed companies' operational performance and financial decisions during the pandemic using a difference-in-differences method, even though some papers have covered the topic during the previous downturns (e.g. Bernstein et al., 2019). However, Zang (2021) conducted a non-published paper where the author investigated the reaction of PE-backed and non-PE-backed firms during the pandemic. The author focused on Swedish firms' financial fragility in the first year of the pandemic and explored how private equity influenced target firms during the economic downturn. The analyzes focused on Swedish firms that have undergone a leveraged buyout before 2020 using a difference-in-differences approach. The results showed that PE-backed firms experienced a relative increase in investments and had access to more equity and debt capital in 2020 relative to their peers. These findings are thus in line with Bernstein et al. (2019) findings on the

GFC, as the impact of private equity ownership was more significant among companies with higher financial constraints. However, these results should be interpreted with caution, as Zang's (2021) paper is not peer-reviewed.

According to Pujawan and Bah (2022), COVID-19 caused vast global supply chain disruptions and, consequently, economic slowdown. Thus, it is interesting to investigate the impact of COVID-19 on working capital management. However, the impact of working capital management during the pandemic is lacking in previous research. Zimon and Tarighi (2021) investigated the COVID-19 pandemic's effect on working capital management among small and medium-sized enterprises in Poland and found that companies with high financial security[3] tried to attract new customers by increasing the due date of accounts receivables and reduce liabilities turnover to be able to work with more suppliers in the market. Furthermore, in a study of 2,542 publicly traded firms in the US during Q1 2019 to Q2 2021, Tarkom (2021) showed evidence that firms exposed to COVID-19 had higher levels of cash conversion cycle.

To summarize, previous research on the impact of COVID-19 on the private equity market has been relatively scarce, especially related to portfolio companies' operational performance and financial decisions. However, there are some early indications of a more mature private equity market. Furthermore, PE managers seem to be actively engaged in the operational, financial and governance areas in all their portfolio companies. Lastly, there have been some indications of similar implications of private equity ownership on financial decisions and operational performance during the pandemic as in previous research on the GFC 2008.

3.3. Hypothesis Development

As previously discussed, the consensus in previous research has been that PE-backed companies tend to make different financial decisions and differentiate in operational performance during crises compared to non-PE-backed companies. Regarding the direction of the relationship, although the majority of research has demonstrated a positive relationship between PE ownership and operational performance and financial capabilities during crises, previous research has also found that there is some contradicting evidence on the subject.

Furthermore, most of the existing literature on differences between PE-backed and non-PE-backed firms' financial decisions and operational performance is based on the GFC or a non-crisis period. Section 3.2.2. provided potential reasons behind a changed direction and statistical power in the relationship during COVID-19. First, the economic crisis generated by the pandemic, unlike the GFC, was not driven by deficiencies in the financial markets. The treatment effect might thus introduce different effects on the

[3] Financial security is measured as a high ratio of cash conversion cycle, liquidity, and current assets scaled by current liabilities (excluding inventory and prepaid expenses)

portfolio companies compared to crises driven by inefficiencies in the financial markets. Furthermore, the differences in financial decisions and operational performance of PE-backed and non-PE-backed companies during COVID-19 might differ from the precedent crisis since the pre-pandemic private equity market has been considered more mature compared to pre-GFC. Hence, based on the findings presented in section 3, we aim to answer the research question by addressing the following hypothesis:

H1: PE-backed firms' financial decisions and operational performance were significantly different compared to non-PE-backed firms during the COVID-19 pandemic.

4. Methodology

The following section presents the methodological choices in the study. Using a difference-in-differences approach, we investigate how the operational performance and financial decisions of 181 PE-backed companies were affected by the COVID-19 pandemic compared to a set of 850 non-PE-backed control firms.

4.1. Data Source and Sample Selection

Following the methodology of Bernstein et al. (2019), we matched the peer group to the PE-backed company sample based on industry, size, leverage, and profitability in 2019. The following section presents how the sample selection is composed and the methodological choices made.

4.1.1. PE-Backed Companies

The secondary unbalanced panel data for the study's portfolio company sample originates from two sources, Thomson Reuter's SDC Platinum database and Orbis. As illustrated in Table 1, we started our data collection by extracting data from the SDC Platinum database, which provide 570 transactions with the following characteristics: (i) were headquartered in the United Kingdom at the time of the deal, (ii) had received a private equity investment before the end of 2019 and (iii) had not experienced an exit by the private equity firm by the end of 2020[4]. Next, we excluded venture capital, expansion capital investments and growth buyouts as well as undisclosed investor groups from the data set. These transactions were excluded because investors generally buy a stake in these companies using little to no leverage. We then manually checked that each company meet these required characteristics.

The observed transactions are then matched with the Orbis database that provides annualized financial data for 2016-2020. We only include the firms with income statement and balance sheet information available in Orbis. Orbis collects data from the United Kingdom's official national registrar office. Therefore, we further limit the sample to firms meeting the following requirements: (1) does not operate in the financial (SICs 600-699), public (SICs 900-999) or utility sector (SICs 489-493) and (2) has available financial information in Orbis. Consequently, one restraint connected to the data set is that the items are reported at the book value, and any inferences concerning market values are therefore hard to make. This is especially relevant for leverage since capital structure theory often uses market values (Brav, 2009). However, previous studies have proposed that the usage of book values for leverage is not a severe limitation (e.g. Fama and French, 2002; Marsh, 1982).

[4] Exit strategies include trade sales, secondary buyouts and initial public offerings (IPOs)

All in all, the sample meet the mentioned requirements and consists of 181 unique PE-backed companies, corresponding to 842 firm-year observations. Although the loss of data could be considered relatively large, it was not perceived to be systematic.

Some actions were taken to avoid skewness and kurtosis to ensure that the study data meet the requirements for assuming a normal distribution. Based on a residual analysis, we thus winsorized all growth rates and ratios included in the models on a 5% level to mitigate concerns about outliers and data errors. Winsorizing was chosen instead of trimming to avoid loss of data and bias in case an industry would have been overrepresented among these extreme values.

Table 1. Data loss matrix

PE transactions in the UK between 2012 and 2019	**570**
Venture and growth capital transactions	110
Operating in financial, public or utility sectors	111
Lack of financial data	168
Total number of PE-backed companies	**181**
Firm-year observations	**842**

Note: Table 1 presents the original sample, the observations that were excluded and the final number of observations

4.1.2.Non-PE-Backed Companies Matching Procedure

As the sample of private equity-backed companies is not constructed based on random assignment, there is a need to identify a suitable matched group of non-PE-backed firms to avoid selection bias. The selection bias refers to the concern in our quasi-experiment approach where the effect of the treatment might be confounded with the pre-existing differences between the PE-backed firms and the matched sample (Campbell & Stanley, 1963). Therefore, in line with Bernstein et al. (2019), we identified comparable non-PE-backed firms for all private equity portfolio companies in the sample based on the PE-backed companies' two-digit SIC-code, return on assets (ROA), leverage and asset size in 2019. These characteristics are used because PE-owned companies tend to be larger and have more leverage than the average firm (Bernstein et al., 2019). Moreover, PE-backed companies tend to have higher ROA than non-PE-backed firms (Boucly et al., 2011). We match on industry distribution to avoid biases connected to differences in industry dynamics between the samples. Lastly, the year 2019 was chosen to construct proper counterfactuals for the PE-backed companies at the onset of the crisis. A matching

procedure based on earlier years would potentially combine the effect of the leveraged buyout and the crisis[5].

However, our matching procedure differs somewhat from Bernstein et al. (2019) method. The authors chose the closest five non-PE-backed companies based on quadratic distance conditioned on 30% brackets around each matching criteria. Instead, we use propensity score matching (PSM) 1:5 nearest neighbour matching with a caliper (<0.001)[6], resulting in a total matched sample of 850 companies and 3892 firm-year observations. For each observation in the comparable sample, we extracted financial data from Orbis from 2016 to 2020. The PSM procedure introduces another version of matching procedure compared to Bernstein et al. (2019) and is used in this study as the method has been proven to be effective in reducing confounding bias (Austin, 2011; Rosenbaum & Rubin, 1983). However, even though PSM has been commonly used in research due to its tendency to reduce confounding bias, King and Nielsen (2019) argue that PSM might increase statistical biases. Therefore, we explore the robustness of our matching procedure and additional robustness tests in section 5.3.

4.2. Research Design

To test whether PE-backed firms' financial decisions and operational performance were different compared to non-PE-backed firms during the COVID-19 pandemic, we use a difference-in-differences method. A difference-in-differences method is a quasi-experimental approach that compares the changes in outcomes over time between the treatment population and the population that is not treated. In this case, the difference-in-differences approach differs from the traditional setting, which generally contains a pre-treatment and a post-treatment period. Instead, as the COVID-19 pandemic affected all firms at the same time in 2020, this setting is different. Thus, we introduce another dimension to the difference, where the treatment is referred to the difference between PE-backed firms' and non-PE-backed firms' reactions to COVID-19. The following section presents how the main model is constructed and how the validation of key assumptions is assessed.

4.2.1. Main Model

Using a panel data set from 2016 to 2020, we estimate a model inspired by Bernstein et al. (2019) method. Consequently, the following equation is estimated for the main model:

$$y_{it} = \alpha_t + \alpha_i + \beta_1(PE_i \times COVID) + \theta X_{it} + \varepsilon_{it} \quad (1)$$

[5] We also try an alternative approach in an earlier year as a robustness test in section 5.3

[6] We use a narrow caliper as this can improve the performance of propensity score matching, which is recommended by Lunt (2014)

Where y_{it} is a dependent variable of the company i at the time t, and α_i and α_t are a set of firm and year fixed effects. The y_{it} variables are based on the discussion in section 3 and aim to measure financial decisions and operational performance. Furthermore, the operational performance measure is divided into two parts: (1) profitability and investment and (2) working capital management. PE_i is a dummy for the PE-backed companies and $COVID$ is a dummy for the year 2020. Moreover, we have identified a set of control variables (X) that includes return on assets, firm leverage, size, normalized cash flow and one-year net sales growth. Furthermore, we exclude control variables if they are equivalent to the dependent variable in the respective model. In section 4.2.2, a more detailed description of the chosen independent, dependent and control variables is disclosed. Standard errors are clustered at firm level. The empirical design control for time-invariant variances between the PE-backed firms and their peers by including firm fixed effects.

4.2.2. Variables

This section contains a detailed description and motivation of the dependent variables, interaction variables and control variables used in the study. As mentioned in section 4.2.1, for the assessment of financial decisions and operational performance, we have identified dependent variables in three sub-areas, which are specified in Table 2 and further described in the below section: (1) financing decisions, (2) profitability and investment, and (3) working capital management.

The dependent variables for the financing decisions area are consistent with Bernstein et al. (2019) and aim to investigate the financing activities of PE-backed companies. The variables are detailed in Table 2: net equity contribution, debt issuance, leverage and cost of debt. As described in the table, all variables are normalized by assets and cost of debt is calculated in relation to total debt. We use these variables since they represent vital parts of a firms' financing activities and similar variables have been used by Michaely and Roberts (2012) and Brav (2009). Furthermore, leverage could impact the firm's ability to raise debt and could thus understate leverage from the deal point of view. Our measurement of leverage has also been used by Guo et al. (2011), Boucly et al. (2011) and Brav (2009). Since these measures do not distinguish interest-bearing debt from non-interest-bearing liabilities, this might pose a potential measurement error for leverage, debt issuance and cost of debt. However, we follow Bernstein et al. (2019) measurements for two reasons; increased comparability and lack of disclosure of interest-bearing liabilities in Orbis. Moreover, even though most theories regarding capital structure are based on market values, we have following Brav (2009) and Bernstein et al. (2019) chosen to use book values since market values for private companies cannot be observed.

Multiple variables potentially could be applicable to investigate PE-backed companies' operational performance. Thus, we have chosen four measurements to illustrate the performance regarding profitability and investment, as detailed in Table 2: Return on

assets (ROA), EBITDA margin, asset growth and investment. These variables have been used in the existing body of research. First, our measurement of profitability as EBITDA margin, asset growth and ROA has been used by multiple authors. EBITDA margin has been used by Guo et al. (2011), Boucly et al. (2011), Bernstein et al. (2019) and Kaplan (1989a). Furthermore, Bergström et al. (2007) argue that EBITDA is specifically relevant for PE-backed firms since it often is used in the buyout market. Additionally, we find EBITDA appropriate for our study since it disregards financial activities related to the firm's capital structure, as we intend to measure operational performance.

ROA has been widely used in previous research (e.g. Boucly et al., 2011; Bergström et al., 2007; Bernstein et al., 2019). We calculate ROA as net income scaled by assets, which we find suitable since it approximates the utilization of assets in a firm. The choice of net income in the numerator is consistent with Bernstein et al. (2019) measurement of ROA, and our choice is motivated by the intention that our results should be comparable. However, EBITDA or EBIT might have been more consistent with the denominator. Therefore, to test the robustness of this measure, we have conducted two alternative measures of ROA, which are further described in section 5.3. Finally, our measurement of asset growth and investment has previously been used by Bernstein et al. (2019).

The dependent variables on the working capital management area contains the annual change in accounts payables, accounts receivables, inventory and net working capital. All variables are normalized by assets. Previous research on working capital management in PE-backed companies has used various variables for working capital management. For instance, Le (2019) has used working capital over total assets and Tarighi and Zimon (2021) used accounts payables, accounts receivables, inventory and net working capital normalized by current assets.

We focus our main model on the effect brought the interaction term $PE_i \times COVID$. The dummy variable PE equals 1 if the firm is PE-owned and 0 if the firm does not have a PE owner. The second dummy variable is COVID which equals 1 in 2020 and 0 in 2016-2019, based on the contractions in credit markets and investment markets shown in section 2. and 3.

We have chosen a set of control variables following Bernstein et al. (2019), as presented in Table 2. To mitigate bias the variables are lagged by one year, which is an approach to this problem commonly used across a wide range of disciplines in economics and finance (Reed, 2015). Furthermore, we exclude control variables if they are equivalent to the dependent variable in the respective model, as the strategy of lagging variables has been proven to only be effective if the lagged variables themselves do not equal the dependent variable (ibid). The control variables are size (net sales), leverage, ROA, normalized cash flow and revenue growth. The measurement of size and leverage is consistent with Guo et al. (2011) estimations, and Boucly et al. (2011) have also used revenue growth. Moreover, the ROA measure has been used by multiple studies such as Boucley et al.

(2011), Bergström et al. (2007) and Smith (1990). Furthermore, as mentioned in section 3.1.2, cash flow has previously been discussed as a proxy for agency costs.

Table 2. Variables

Dependent Variables	
Financial Decisions	
Net equity contribution	$\frac{\text{Total equity}_t - \text{Total equity}_{t-1} - \text{Net income}_t}{\text{Total assets}_{t-1}}$
Debt issuance	$\frac{\text{Total liabilities}_t - \text{Total liablities}_{t-1}}{\text{Total assets}_{t-1}}$
Leverage	$\frac{\text{Total debt}_t}{\text{Total assets}_{t-1}}$
Cost of debt	$\frac{\text{Interest expense}_t}{\text{Total assets}_{t-1}}$
Profitability and Investment	
Asset growth	$\frac{\text{Total assets}_t - \text{Total assets}_{t-1}}{\text{Total assets}_{t-1}}$
EBITDA margin	$\frac{\text{EBITDA}_t}{\text{Sales}_t}$
ROA	$\frac{\text{Net income}_t}{\text{Total assets}_{t-1}}$
Investment	$\frac{\text{Total assets}_t - \text{Total assets}_{t-1} + \text{Depreciation and Amorization}}{\text{Total assets}_{t-1}}$
Working Capital Management	
ΔAccounts payable	$\frac{\text{Accounts payable}_t - \text{Accounts payable}_{t-1}}{\text{Total assets}_{t-1}}$
ΔAccounts receivable	$\frac{\text{Accounts recievable}_t - \text{Accounts recievable}_{t-1}}{\text{Total assets}_{t-1}}$
ΔInventory	$\frac{\text{Inventory}_t - \text{Inventory}_{t-1}}{\text{Total assets}_{t-1}}$
ΔNet working capital	$\frac{\text{NWC}_t - \text{NWC}_{t-1}}{\text{Total assets}_{t-1}}$
Independent variable (Interaction variables)	
PE	Dummy that describes if the firm is PE-owned (1) or not (0)
COVID	Dummy that describes if the observation was in 2020 (1) or not (0)
Control variables	
Size (Net sales)	$\ln(\text{Net sales}_t)$
Growth in revenue	$\frac{\text{Net sales}_t - \text{Net sales}_{t-1}}{\text{Sales}_{t-1}}$
Normalized cash flow	$\frac{\text{Cash flow}_t}{\text{Total assets}_t}$
ROA	$\frac{\text{Net income}_t}{\text{Total assets}_{t-1}}$
Leverage	$\frac{\text{Total debt}_t}{\text{Total assets}_t}$

Note: Table 2 depicts the variables that were calculated for each firm-year observation.

4.2.3. Validation of the Parallel Trend Assumption

To formally investigate whether the parallel trend assumption holds, in line with the methodology presented by Bernstein et al. (2019), we study whether both groups had similar financial and operational characteristics during the pre-pandemic period (2016-2019) by examining the year effects estimates. The test is estimated through the following equation for PE-backed firms and non-PE-backed firms respectively:

$$y_{it} = \alpha_t + \alpha_i + \varepsilon_{it} \quad (2)$$

Where α_i captures firm fixed effects and α_t captures year fixed effects. In this model, we focus on the effect brought by the year fixed effects α_t. We use the year 2019 as the benchmark and the corresponding coefficient is normalized to zero. Hence, the α_t will capture the yearly changes in the dependent variable, y_{it}, compared to 2019. If there are no significant differences between the groups' estimates during the non-crisis years, it is an indication that the parallel trend assumption holds. Standard errors are clustered at the firm level.

Second, in line with Bernstein et al. (2019), the PE-backed and the non-PE-backed companies' time-varying behaviour is tested during the pre-pandemic period through the following equation:

$$y_{it} = \alpha_t + \alpha_i + \sum \beta_k (PE_i) + \theta X_{it} + \varepsilon_{it} \quad (3)$$

where β_k is estimated for every year between 2016 and 2020[7], using 2019 as the base year with a corresponding coefficient normalized to zero. The parameter β_k can be interpreted as follows. Suppose the parameter β_k captures the significant effect of the crisis on PE-backed companies rather than a differential trend between the groups. In that case, we can expect the effect of private equity ownership to appear because of the crisis. Next, the same set of control variables as in the main model, X, is included; see section 4.2.2 for operationalization of the variables. The control variables include lagged one year ROA, lagged one year firm leverage, lagged one year normalized cash flow, lagged one-year log of net sales, and relative one-year net sales growth. Furthermore, we exclude control variables if they are equivalent to the dependent variable in the respective model. Standard errors are clustered at the firm level.

[7] Note that the parallel trend assumption assessment is only during 2016-2019 since COVID-19 started in 2020

5. Results

5.1. Descriptive Statistics and Parallel Trends

5.1.1. Descriptive Statistics

The panel data of 1031 unique companies and 4734 firm-year observations are distributed between 7 industries, excluding the finance, real estate and utility sector. As illustrated in Panel A of Table 3, the majority of the observations are in the service sector (45.08%) and manufacturing sector (26.70%), which could imply a bias towards these industries. The PE sample industry distribution is relatively similar to the matched group sample.

As a difference-in-differences analysis relies on the assumption of parallel trends in the pre-crisis years, we start by briefly exploring the assumption in Table 3. In Panel B of Table 3, the matching characteristics of 2019 for PE-backed companies and their non-PE-backed peers are presented, as the groups were matched based on the financials in 2019. As previously discussed in section 4.1.2, 2019 was chosen as the base year because it provides proper counterfactuals on the onset of the crisis. As shown in Panel B, both groups follow the same distribution with except for ROA, as the ratio indicates a significant difference between the samples. Regarding the growth rates presented in Panel C of Table 3, the PE-backed companies and their peers seem relatively similar. The only significant difference in growth rates before the crisis is the 2-year growth rate for leverage, indicating a tendency for PE-backed companies to increase their leverage to a higher rate over the period compared to non-PE-backed firms. The different distribution between the samples might introduce limitations in comparing the firms on leverage. However, the suggested differences between the groups disappear when looking at the 1-year growth rates, indicating similar trends between the samples in the year before the crisis. Overall, these analyzes suggest that PE-backed companies have similar characteristics for most ratios and growth rates in the pre-crisis years.

Table 3. Distribution of PE-backed and non-PE-backed companies

A. Industry distribution

Industry	PE-Backed (N=842)	Non-PE-backed (N=3892)	Total (N=4734)
Mining	15 (1.78%)	62 (1.59%)	77 (1.63%)
Construction	28 (3.33%)	108 (2.77%)	136 (2.87%)
Manufacturing	203 (24.11%)	1061 (27.26%)	1264 (26.70%)
Transportation	106 (12.59%)	430 (11.05%)	536 (11.32%)
Wholesale	54 (6.41%)	262 (6.73%)	316 (6.68%)
Retail Trade	49 (5.82%)	222 (5.70%)	271 (5.72%)
Service	387 (45.96%)	1747 (44.89%)	2134 (45.08%)
Finance, real estate utility	0 (0.0%)	0 (0.0%)	0 (0.0%)

B. Matching variables 2019

	PE-Backed		Non-PE-backed			
	Mean	SD	Mean	SD	Diff	N
Leverage	0.739	0.028	0.720	0.015	-0.019	1044
ROA	0.039	0.009	0.063	0.006	0.024*	987
Asset	88958.440	10449.200	111419.400	8073.642	22460.950	1044

C. Growth in firm trends 2019

	PE-Backed		Non-PE-backed			
	Mean	SD	Mean	SD	Diff	N
1-year growth						
Leverage	0.095	0.027	0.078	0.027	-0.016	987
ROA	-0.485	0.191	-0.731	0.678	-0.245	900
Revenue (log)	0.103	0.018	0.113	0.014	0.010	904
Investment	0.091	0.620	-1.630	1.172	-1.721	750
Net equity contr.	0.000	0.001	0.000	0.001	0.000	704
Debt issuance	-0.250	3.833	0.663	6.961	0.912	895
2-year growth						
Leverage	0.213	0.046	0.097	0.031	-0.116*	845
ROA	0.705	1.200	0.557	0.908	-0.148	847
Revenue (log)	0.189	0.050	0.272	0.045	0.083	762
Investment	-9.625	10.900	-1.656	1.482	7.969	708
Net equity contr.	-0.640	0.203	-0.619	0.042	-0.622	731
Debt issuance	19.334	13.020	-17.146	14.332	36.481	842

Note: Panel A illustrates the industry distribution from 2016-2020 across PE-backed firms and matched firms. Panel B reports the matching variables characteristic during 2019. Column ” Diff” reports the mean difference across the two groups. Panel C reports the 1- and 2-year growth by the end of 2019. Column ”Diff” reports the mean difference across the two groups. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

Table 4 summarizes the descriptive statistics for our dependent variables for PE-backed and non-PE-backed sample firms. The table illustrates that the distributions of PE-and non-PE-backed companies have relatively similar characteristics in terms of direction and

magnitude for financing decisions, profitability and investment, as well as working capital management. Moreover, the differences between both groups might be influenced by the inclusion of the crisis year 2020. Nevertheless, looking at the variable's quartiles, the distributions for both groups seem to be fairly similar.

Table 4. Descriptive statistics for PE-backed and non-PE-backed firms

	Mean	SD	P25	P50	P75	Mean	SD	P25	P50	P75	N
	PE-Backed					**Non-PE-Backed**					
Debt issuance	0.103	0.208	-0.012	0.054	0.184	0.097	0.290	-0.050	0.021	0.161	4,477
Net equity contr.	-0.021	0.098	-0.007	0.000	0.000	-0.032	0.096	-0.037	0.000	0.000	4,477
Leverage	0.717	0.360	0.462	0.658	0.913	0.715	0.445	0.397	0.667	0.930	4,733
Cost of Debt	0.026	0.027	0.003	0.015	0.041	0.018	0.019	0.003	0.012	0.026	3,246
ΔAsset	-0.126	0.249	-0.238	-0.091	0.022	-0.126	0.317	-0.208	-0.049	0.047	4,477
EBITDA margin	0.102	0.167	0.037	0.097	0.192	0.087	0.159	0.018	0.070	0.150	3,959
ROA	0.046	0.146	-0.029	0.046	0.131	0.056	0.161	-0.009	0.039	0.116	4,477
Investments	0.182	0.242	0.025	0.151	0.298	0.162	0.308	-0.013	0.089	0.251	3,805
ΔAR	0.007	0.056	-0.013	0.000	0.022	0.011	0.055	-0.013	0.000	0.024	4,406
ΔAP	0.010	0.047	-0.007	0.003	0.024	0.007	0.055	-0.011	0.000	0.015	4,381
ΔInventory	0.006	0.000	0.000	0.000	0.024	0.004	0.026	0.000	0.000	0.002	4,378
ΔNWC	0.001	0.156	-0.046	0.014	0.089	0.008	0.156	-0.041	0.012	0.076	4,444

Note: Table 4 illustrates the descriptive statistics for our dependent variables for PE-backed and Non-PE-backed firms for 2016-2020. Debt issuance is the change in total debt scaled by total asset; Net equity contribution is the change in total equity minus profit scaled by total asset; Leverage is the ratio of total debt scaled by total assets; Cost of debt is the interest expense scaled by total debt; ΔAsset is the change in total assets scaled by total assets; EBITDA margin is the earnings before interest and taxes, depreciation and amortization divided by revenue; ROA is the net income scaled by total assets; Investments is change in total assets plus depreciation and amortization scaled by total assets; ΔAR is the change in accounts receivables scaled by total assets; ΔAP is the change in accounts receivables scaled by total assets; ΔInventory is the change in inventory scaled by total assets; ΔNWC is the change in net working capital scaled by total assets.

5.1.2. Parallel Trends

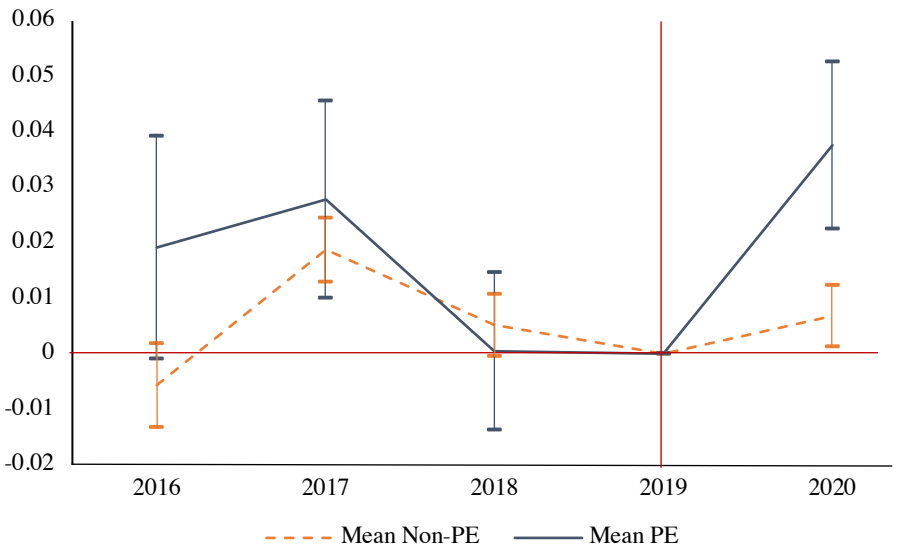
As presented in section 5.1.1., the PE-backed firms and the matched sample are relatively similar in terms of observable characteristics. In the following section, we investigate the parallel trend assumption through more formal and direct models as described in section 4.2.3. Since our intention with these tests is to investigate if the parallel trend assumption holds, we will discuss the results for the pre-pandemic period 2016-2019 through Equation 2. For brevity, we will only present the variables that indicate a significant difference between the groups during COVID-19 when we apply our main model. The variables which have not indicated a significant relationship with the treatment variable for our main model are instead illustrated in Figures A.1-A.6 in the appendix. We have

also performed tests on the parallel trend assumption using a time-varying fixed effects model, i.e. Equation 3, presented in Tables A.1-A.3 in appendix.

Financing decisions

In Figure 3, the net equity contribution patterns for PE- and non-PE-backed companies are illustrated separately by year fixed effects estimates and corresponding confidence intervals. As described in section 4.2.3., we use 2019 as the base year. Thus, the estimates can be interpreted as the yearly changes in net equity contribution compared to 2019. The figure demonstrates that net equity contributions for PE-backed and non-PE-backed companies were not statistically different before the crisis, as confidence intervals for PE-backed and non-PE-backed firms are overlapping. This development indicates consistency with the parallel trend assumption.

In Table A.1. column 1 in the appendix, we describe the yearly trends of the two samples by estimating the significance of the differences in net equity contribution between PE- and non-PE-backed companies on a yearly basis. In column 2, we conduct the same analysis but introduce a standard set of control variables. As illustrated in columns 1 and 2, the estimate for 2017-2019 is insignificant. However, the estimate for 2016 is positively statistically significant, which indicates that the parallel trend assumption is not fulfilled during the entire pre-crisis period from 2016 to 2019. Thus, the result illustrated in Figure 3 does not seem to be robust in 2016, as this additional parallel-trend test illustrates a significant difference between the groups during the year.

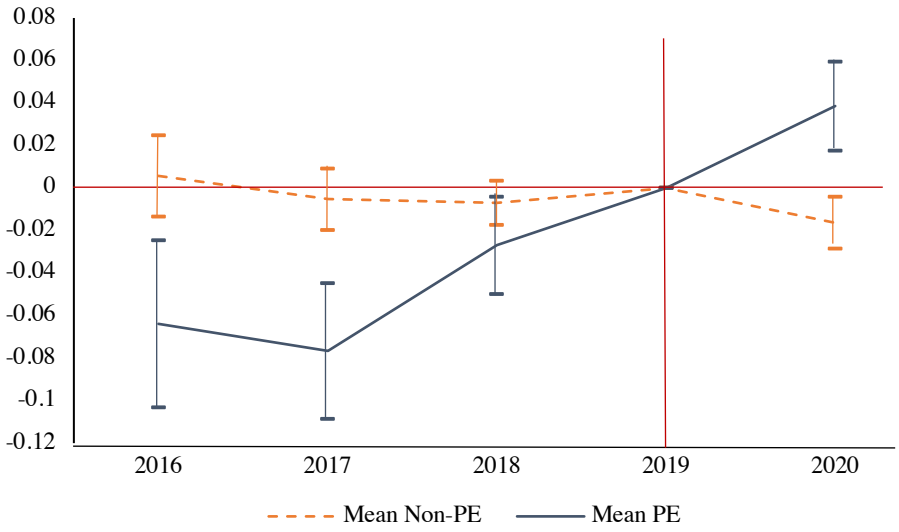


Note: Figure 3 shows the change in net equity contribution of PE-backed firms and non-PE-backed firms due to the year fixed effect. The estimates are based on the following equation: $y_{it} = \alpha_i + \alpha_t + \varepsilon_{it}$. α_t captures year fixed effect and α_i captures firm fixed effect. The coefficients are illustrated with a corresponding 90%

confidence interval. Standard errors are clustered at the firm level. 2019 is used as the base year and its coefficient is therefore normalized to zero.

Figure 3. Year fixed effects on net equity contribution

The pre-crisis trends for PE- and non-PE-backed firms in terms of leverage can be examined in Figure 4. The figure illustrates that estimates for PE- and non-PE-backed companies were statistically significant in 2016-2017, which indicates that the parallel trend assumption does not hold. However, the figure exhibit that the significant differences between the groups disappear during 2018. This finding is consistent with the results presented in Table A.1 columns 5 and 6, where significant year-by-year PE effects were recorded for 2016-2017.

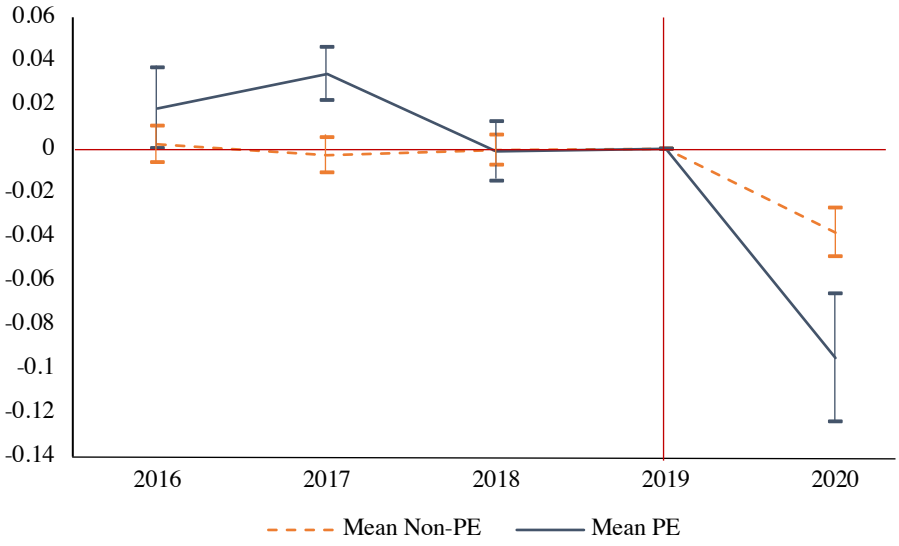


Note: Figure 4 shows the change in leverage of PE-backed firms and non-PE-backed firms due to the year fixed effect. The estimates are based on the following equation: yit = αi + αt + ε_{it}. αt is the year fixed effect an αi is the firm fixed effect. The coefficients are illustrated with a corresponding 90% confidence interval. Standard errors are clustered at the firm level. 2019 is used as the base year and its coefficient is therefore normalized to zero.

Figure 4. Year fixed effects on leverage

Profitability Analysis

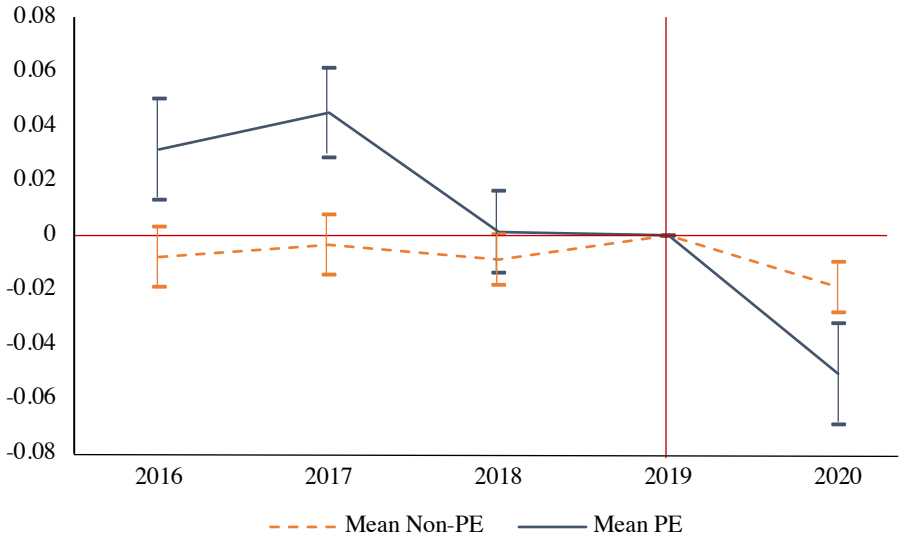
The EBITDA margin development for non-PE and PE-backed companies around the COVID-19 outbreak is illustrated in Figure 5. As shown in the figure, estimates for PE-backed and non-PE-backed companies were not statistically significant in 2016 and 2018 but significant in 2017. Hence, the parallel trends assumption does not seem to be fulfilled during the entire pre-crisis window. To further explore the robustness of these results, Table A.2 columns 3 and 4 illustrate our estimation of the differences between PE- and non-PE-backed companies on a yearly basis. Inconsistent with Figure 5, the table illustrates that the yearly estimates are significantly different for the years 2016-2017 and not significant in 2018. Hence, the figure estimate for 2016 does not seem to be robust.



Note: Figure 5 shows the change in EBITDA margin of PE-backed firms and non-PE-backed firms due to the year fixed effect. The estimates are based on the following equation: yit = αi + αt + ε_{it}. αt is the year fixed effect an αi is the firm fixed effect. The coefficients are illustrated with a corresponding 90% confidence interval. Standard errors are clustered at the firm level. 2019 is used as the base year and its coefficient is therefore normalized to zero.

Figure 5. Year fixed effects on EBITDA margin

As Figure 6 shows, the ROA estimates for PE-backed and non-PE-backed companies in 2016-2017 are significantly different, which implies that the parallel trend assumption does not seem to be fulfilled during the entire pre-crisis period. Nonetheless, the differences in 2018 are not significant, indicating a similar pattern between the groups. Furthermore, this result is consistent with the findings in Table A.2, column 5 and column 6.

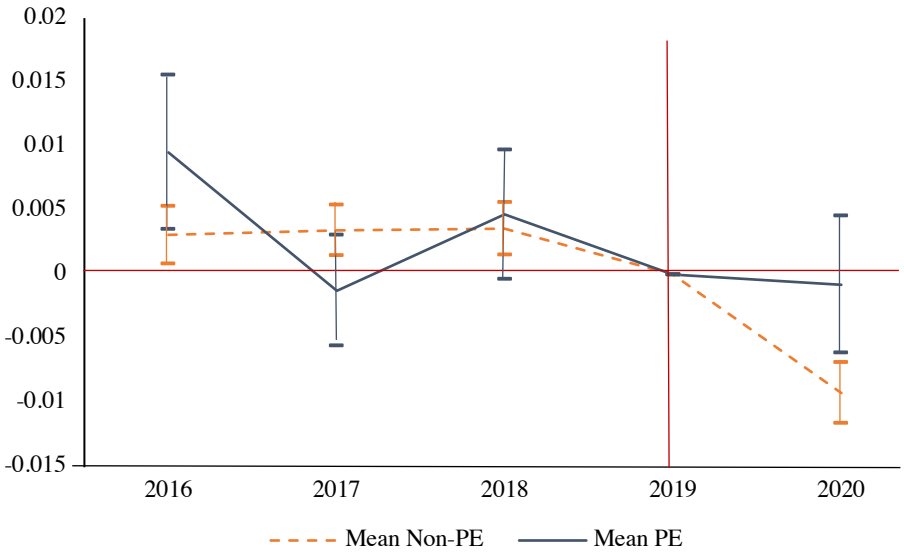


Note; Figure 6 shows the change in ROA of PE-backed firms and non-PE-backed firms due to the year fixed effect. The estimates are based on the following equation: yit = αi + αt + ε_{it}. αt is the year fixed effect an αi is the firm fixed effect. The estimates are plotted with 1.65 standard errors above and below the point estimates. Standard errors are clustered at the firm level. 2019 is used as the base year and its coefficient is therefore normalized to zero.

Figure 6. Year fixed effects on ROA

Working Capital Management

In Figure 7, where the change in inventory growth development of PE-backed and non-PE-backed companies is plotted separately, we can observe that the estimates for the samples are not statistically different before the crisis and do thus seem to be consistent with the parallel trend assumption. In Table A.3, columns 5 and 6 illustrate that the difference in inventory growth is statistically significant during 2016 and 2017 at a 10% level and insignificant in 2018. Hence, the findings in Figure 7 do not seem to be robust, which implies that the parallel trend assumption is not fulfilled during the entire pre-crisis period.



Note: Figure 7 shows the change of change in inventory of PE-backed firms and non-PE-backed firms to the year fixed effect. The estimates are based on the following equation: $y_{it} = \alpha_i + \alpha_t + \varepsilon_{it}$. αt is the year fixed effect an αi is the firm fixed effect. The coefficients are illustrated with a corresponding 90% confidence interval. Standard errors are clustered at the firm level. 2019 is used as the base year and its coefficient is therefore normalized to zero.

Figure 7. Year fixed effects on change in Inventory.

5.2. Main Results

In the following section, the outcomes of the main model are presented. As previously discussed in section 4.2.1., the main result is structured as follows. First, the differences in financing decisions between PE-backed firms and their peers are presented, followed by the differences in operational performance. When analyzing operational performance, our result is divided into the following two parts: profitability and investments, and working capital management.

5.2.1. Financial Decisions

In order to investigate whether PE firms relax financial constraints in their portfolio companies, the differences between PE-backed firms and the matched sample in net equity contribution, debt issuance, leverage and cost of debt were studied in Table 5. First, we find that PE-backed companies experienced a significant increase in net equity contribution relative to their peers during the crisis in columns 1 and 2. As shown in column 1, PE-backed companies experienced a relative increase in net equity contribution of 2.5% relative to non-PE-backed firms during the COVID-19 pandemic, statistically significant at a 1% level. Furthermore, in column 2, we find that the results are similar in regard to statistical significance and size, with a 2.0% relative increase for PE-backed

firms compared to non-PE-backed companies when a standard set of firm controls were added to the model.

Another way through which financial constraints can be relaxed is debt issuance, which is presented in Table 5 columns 3 and 4. According to column 4, debt issuance for PE-backed firms increased relative to non-PE-backed firms by 4.6%, statistically significant on a 5% level. However, this result is not consistent with Table 5 column 3, where the increase in debt issuance is not statistically significant. The fact that the significance of debt issuance disappears when we remove the standard set of control variables indicates that the controls are driving the statistical significance for debt issuance in column 4.

While the groups' differences in net equity issuance increased significantly, PE-backed companies also increased their leverage significantly relative to non-PE-backed firms, as evident in Table 5 columns 5 and 6. Column 5 illustrates that PE-backed companies leverage increased by 7.7% relative to non-PE-backed companies with a significance at the 1% level. This is similar to the results displayed in column 6, where we add the standard set of control variables and find an increase in leverage for the PE-backed firms relative to the matched companies of 6.8%, which also is statistically significant on a 1% level.

Lastly, we examine whether PE-backed companies were affected differently by the COVID-19 pandemic than non-PE-backed companies in terms of cost of debt. As illustrated in Table 5, columns 7 and 8, we find no significant indication that these variables have been affected differently by the interaction term.

Table 5. Main results: Financial Decisions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Net equity contr.		Debt issuance		Leverage		Cost of debt	
PExCOVID	0.025***	0.020***	0.034	0.046**	0.077***	0.068***	0.001	0.001
	(0.008)	(0.007)	(0.023)	(0.023)	(0.021)	(0.021)	(0.002)	(0.002)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	767	767	767	767	767	767	590	590
n	3432	3432	3432	3432	3432	3432	2415	2415
Adj. R^2	0.375	0.418	0.117	0.198	0.853	0.861	0.690	0.693

Note: Table 5 shows the estimates of the difference-in-differences model. All models include year and firm fixed effects. The interaction between the COVID and PE dummy is the effect focused on. Odd-numbered columns shows regression without controls, while the even-numbered columns shows regression with a set of control variables. These control variables include lagged one year of ROA, lagged one year of leverage[8], lagged one year of log of net sales, lagged one year normalized cash flow, and relative one-year sales growth. Columns 1 and 2 report the effect on net equity contribution; Columns 3 and 4 report the effect on

[8] Leverage is disregarded as a control in table 5 column 6

debt issuance; Columns 5 and 6 report the effect on leverage; Columns 7 and 8 report the effect on the cost of debt. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represent significance at the 1% level, ** at the 5% level, * at the 10% level.

5.2.2. Profitability and Investment

In this section, we investigate if the operational performance of PE-backed companies and non-PE-backed companies were affected differently by the COVID-19 pandemic with regard to profitability and investment. The profitability and investment are evaluated based on the companies' asset growth, EBITDA margin, ROA and investment.

First, Table 6, columns 1 and 2, examine whether PE-backed companies were affected differently by the COVID-19 pandemic than non-PE-backed companies in terms of asset growth. As illustrated in Table 6, we find no significant indication that asset growth has been affected differently.

Second, we study the effect on the EBITDA margin, which is illustrated in Table 6 columns 3 and 4. In column 3, we can see that margins for PE companies decreased by 7.2% relative to non-PE-backed companies during the COVID-19 pandemic, statistically significant at a 1% level. In column 4, where the standard set of control variables is added, we retrieve a relative decrease of 7.5%, which is statistically significant at a 1% level.

In line with the results for EBITDA margin, we find that ROA for PE-backed companies is decreasing relative to non-PE-backed companies after the outbreak of COVID-19, which is illustrated in Table 6 in columns 5 and 6. ROA is decreasing by 5.3% for PE-backed companies relative to non-PE-backed companies, statistically significant on a 1% level (column 5). When adding the standard set of control variables, we get a decrease of 6.1%, which is statistically significant at a 1% level.

Finally, we investigate the effect on investment in Table 6, columns 7 and 8. As described in Table 6, we find no indication that PE-backed companies were affected differently by COVID-19 than non-PE-backed companies.

Table 6. Main results: Profitability and Investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Asset growth		EBITDA margin		ROA		Investment	
PExCOVID	0.008	0.011	-0.072***	-0.075***	-0.053***	-0.061***	0.000	-0.004
	(0.026)	(0.024)	(0.021)	(0.020)	(0.010)	(0.012)	(0.026)	(0.024)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	767	767	756	756	835	835	756	756
n	3432	3432	3391	3391	3645	3645	3391	3391
Adj. R^2	0.096	0.191	0.556	0.573	0.510	0.554	0.117	0.212

Note: Table 6 shows the estimates of the difference-in-differences model. All models include year and firm fixed effects. The interaction between the COVID and PE dummy is the effect focused on. Odd-numbered columns shows regression without controls, while the even-numbered columns shows regression with a set of control variables. These control variables include lagged one year of ROA[9], lagged one year of leverage, lagged one year normalized cash flow, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on Asset growth; Columns 3 and 4 report the effect on EBITDA margin; Columns 5 and 6 report the effect on ROA; Columns 5 and 6 report the effect on Investment. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represent significance at the 1% level, ** at the 5% level, * at the 10% level.

5.2.3. Working Capital Management

Next, operational performance was further reviewed by investigating working capital management. In order to investigate working capital management we examine the differences between PE-backed and non-PE-backed companies in change in accounts payable, accounts receivable, inventory and net working capital, as illustrated in Table 7.

First, the treatment effect on change in accounts payable is presented in Table 7, columns 1 and 2. The results for this variable were not significant, indicating that the non-PE- and PE-backed firms were not affected differently by the COVID-19 pandemic in terms of change in accounts payable. As illustrated in column 3, change in account receivables increased by 1% for PE-backed companies relative to non-PE-backed companies, statistically significant on a 10% level. However, when we add the specific set of control variables in column 4, we do not receive significant results. This indicates that the controls are driving the result in column 3.

Furthermore, in Figure 7 in section 5.1.2. we can comprehend that change in inventory for non-PE-backed firms decreased during COVID-19 while PE-backed firms had similar levels of change in inventory in comparison to 2019. Consistently, columns 5 and 6 in Table 7 illustrate that change in inventory for PE-backed companies increased relative to

[9] Lagged ROA is ignored in Table 6 Column 6

non-PE-backed companies during 2020. The relative increase corresponds to 0.7% without the specific set of controls and 0.8% with controls, both statistically significant at a 5% level. Lastly, we find that PE-backed and non-PE-backed companies were not affected differently by COVID-19 with regards to change in net working capital, as described in columns 7 and 8 in Table 7.

Table 7. Main results: Working Capital Management

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔAccounts payable		ΔAccounts receivable		ΔInventory		ΔNet working capital	
PExCOVID	0.004	0.005	0.010*	0.008	0.007**	0.008**	-0.005	-0.015
	(0.006)	(0.006)	(0.006)	(0.006)	(0.003)	(0.003)	0.015	0.016
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	765	765	766	766	761	761	767	767
n	3414	3414	3425	3425	3399	3399	3432	3432
Adj. R^2	0.000	0.023	0.000	0.028	0.063	0.086	0.056	0.106

Note: Table 7 shows the estimates of the difference-in-differences model. All models include year and firm fixed effects. The interaction between the COVID and PE dummy is the effect focused on. Odd-numbered columns shows regression without controls, while the even-numbered columns shows regression with a set of control variables. These control variables include lagged one year of ROA, lagged one year normalized cash flow, lagged one year of firm leverage, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on change in accounts payable; Columns 3 and 4 report the effect on change in accounts receivable; Columns 5 and 6 report the effect on change in inventory; Columns 7 and 8 report the effect on change in net working capital. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

5.3. Robustness Tests

This section presents four types of tests that were performed in order to examine the robustness of the results that have previously been accounted for in section 5.2. First, we control for changes in industry dynamics, as one issue with the original approach might be that the differences between the PE- and non-PE-backed firms can be driven by industry-specific changes in demand or supply that were coexistent with the pandemic. However, as the groups were matched based on industry classification, this should in principle not bias the result. Nevertheless, industry fixed effects were added to the model through an interaction with the time fixed effects[10]. Hence, by including the interaction of fixed effects, the industry effects will not be absorbed by the firm fixed effects since they have within variation for the set of firm observations. Tables B.1-B.3 in the appendix

[10] The model is formulated as follows, $y_{it} = \alpha_t \times \alpha_t + \alpha_i + \beta_1(PE_t \times COVID) + \theta X + \varepsilon_{it}$.

illustrate that the main results remain approximately the same considering the statistical significance and magnitude of the difference between the groups, apart from a slightly lower statistical power on the net equity contribution estimate in Table B.1, column 5.

Second, we will explore the robustness of our matching method, propensity score matching, by testing what outcome a coarsened exact matching (CEM) method would produce. Even though PSM has been commonly used in research due to its tendency to reduce confounding bias (Rosenbaum & Rubin, 1983; Austin, 2011), King and Nielsen (2019) argue that PSM might increase imbalance, inefficiency, model dependence and statistical biases. For data with continuous, discrete, or mixed variables, King and Nielsen (2019) argue that coarsened exact matching is the most natural one. However, the difference-in-differences regression results are still similar to the main results, as illustrated in Tables B.4-B-6 for the majority of the variables. However, the method produces insignificant results for change in inventory (Table B.6, columns 5 and 6), which is inconsistent with the main result. Furthermore, the differences in changes in account receivable are positively significant on a 1% level (Table B.6, columns 3 and 4), which also contradicts the main results. Hence, the findings related to working capital management thus seem to be less robust for changes in the matching method.

Third, we further examine the robustness of our matching method. In the original method, we match the non-PE-backed companies based on 2019 financial data in proximity to the COVID-19 pandemic breakout to construct appropriate counterfactuals for PE-backed companies during 2020. However, an alternative approach would be to match PE-backed companies based on an earlier year. This approach would not result in the most appropriate counterfactuals for the crisis, as the results might be affected by the buyout effect. In Tables B.7-B.9 we illustrate the results when using 2018 as the basis for matching. We can observe that the results are similar to the main results in terms of direction, magnitude and statistical power. However, the difference in net equity contribution is no longer significant when adding the set of controls (Table B.7, columns 1 and 2). Furthermore, in Table B.9 columns 3 and 4, we receive a significant difference between PE-backed firms and non-PE-backed firms in terms of change in account receivable, which contradicts the main results.

Lastly, we explore two alternative measures of ROA in Table B.10 in the appendix. The choice of net income in the numerator is in line with Bernstein et al. (2019) measure. However, EBITDA or EBIT might have been more appropriate with regard to the consistency with the denominator total assets. Therefore, to test the robustness of this measure, we have conducted an alternative measure of ROA with EBITDA and EBIT in the numerator. Table B.10 in the appendix illustrate that the main results remain approximately the same considering statistical significance and magnitude of the difference between the groups, thus implying that our measure ROA is robust for change of measurement technique.

All in all, the main results seem quite unchanged and robust considering industry dynamics, choice of matching method and change of measurement technique of ROA. However, the result for net equity contribution and change in inventory is sensitive to the choice of matching method.

5.4. Summary of Findings

The findings can be summarized as follows. In terms of financial decisions, there is a significant positive difference between PE-owned companies and their peers for net equity contribution and leverage level, which is in line with our hypothesis. This holds after adjusting for industry fixed effect. However, net equity contribution is sensitive to the choice of matching method (CEM). The outcomes connected to profitability and investment indicated a significant relative decline in ROA for PE-owned companies, consistent with a negative difference in EBITDA margin. This result is robust for industry changes, matching method, as well as changes of matching year. Moreover, ROA was also robust for changes in measurement technique. Finally, PE firms experienced a significant increase in change in inventory relative to their peers, which remains robust when adjusting for industry effects but not for changes in the matching procedures.

Furthermore, the parallel trend assumption is not fulfilled during the entire pre-crisis period for any of our variables, which is especially applicable for the leverage estimates. Consequently, these results have to be interpreted with care.

All in all, the outcome indicates significant differences between PE- and non-PE-backed firms for some financial decisions and operational performance measures, thus partly supporting our initial hypothesis. Furthermore, even though the parallel trend assumption is not fulfilled for most variables during the entire pre-crisis period, the differential trends generally become weaker or insignificant closer to the pandemic.

6. Discussion

This section entails a discussion of the results presented in section 5 with regards to previous research formerly presented in section 3. The discussion is based on three areas: financial decisions, profitability and investment, and working capital management.

6.1. Financial Decisions

As mentioned in section 3.1.1, PE firms can relax financial constraints for their portfolio companies through net equity contributions and debt issuance. Consistent with Bernstein et al. (2019) findings during the GFC, we find an increase in net equity contribution for PE-backed companies relative to non-PE-backed companies during COVID-19 (Table 5). The finding is similar to the evidence presented by Bernstein et al. (2019) in terms of the magnitude, statistical significance and direction. Thus, our findings indicate that PE firms took action to relax portfolio companies' financial constraints by injecting equity into their portfolio companies during COVID-19. Furthermore, this is in line with the idea that the capital raised by PE funds often is drawn down over multiple years and thus gives PE firms the ability to relax financial constraints even during a crisis when access to other types of financing can be scarce. It also confirms Gompers et al. (2022) findings that PE managers seemed to have a desire to use the funds' dry powder during the pandemic.

There are numerous potential explanations for this result given that the relative increase in net equity contribution is connected to lower agency costs among PE-backed firms, as a reduction of agency cost might decrease the frictions that can inhibit equity investments. First, the magnitude of leverage used in private equity transactions tends to reduce cash flows which decreases management waste and thus reduces agency costs. Furthermore, high leverage levels could increase the bankruptcy risk, incentivizing managers to make decisions that decrease bankruptcy probability, such as more optimal investment decisions, which would also further align management and the PE firm's interest. Second, another potential explanation could be that the alignment between shareholder and management incentives is higher in PE-backed companies than in non-PE-backed companies due to the incentive structure with a high share of management equity, which increases management's personal costs of inefficiency. Finally, reduced agency costs could be due to the high involvement of PE firms on portfolio firm boards, which previous research has shown entails more frequent formal and informal meetings and a higher CEO turnover.

Second, PE firms' access to credit markets can relax the financial constraints of their portfolio companies through the injection of debt and lower cost of debt. However, we find no indication that PE-backed companies had different levels of debt issuance or cost of debt than non-PE-backed companies during the COVID-19 pandemic (Table 5). This finding is inconsistent with Bernstein et al. (2019) findings from the GFC that PE-backed

firms experienced higher levels of debt issuance and lower cost of debt than non-PE-backed peers. Furthermore, previous research implies that frequent contact between financial sponsors and PE firms could alleviate debt funding during a crisis. However, according to our findings, this seems not to have been applicable during the financial crisis.

As this result contradicts most existing research, the question arises regarding why private equity companies did not receive more debt inflow than their peers. Our results' deviation from Bernstein et al. (2019) findings imply different reactions among PE-backed firms in the United Kingdom during the pandemic compared to during the GFC. However, as our result also differs compared to Zang (2021), there are indications that the responses also differ on a country level, as the author's scope was to investigate PE-backed firms' financial decisions in the Swedish market during COVID-19[11]. These findings are thus, unlike Bernstein et al. (2019), comparable to this study in terms of the time period but not on the country level. Hence, the outcomes could be dependent on differences in PE-market dynamics of the countries, how affected the country was by COVID-19, as well as the banks' ability to lend out funds. The contradictory results also highlight generalization limitations among studies which investigate PE-backed firms' financial decisions on a country level such as ours and Bernstein et al. (2019).

Related to the finding that PE-backed companies did not issue more debt, we suggest two potential drivers that might affect the outcome and thus the PE-backed firms' behavior: either PE firms were not allowed to issue more debt or they did not want to issue more debt. PE-backed firms might not be allowed to issue more debt because the banking industry has implemented a set of regulatory changes after the GFC to reduce the financial sector's tendency to reinforce economic cycles. Therefore, the credit market might be more restrictive at the time of the COVID-19 outbreak than during the GFC. However, as previously mentioned, the reason that we found no significant result for debt issuance could be that PE-backed firms did not want to issue more debt. One explanation for this could be the increasing leverage levels, which might have increased the fear of breaching covenants and could potentially also explain why PE-backed preferred to issue equity. Furthermore, the economic crisis resulting from the COVID-19 pandemic was, as previously mentioned, not originated from the financial system and could imply that PE-backed companies might not have taken the same actions to decrease financial fragility. Moreover, the proposition that the COVID-19 pandemic was regarded as transitory in the PE market might have led managers to not search for this kind of external capital. This should be especially applicable in PE-backed companies, as these companies have, in line with Haarmeyers' (2020) article, uninvested funds that enable them access to equity which is aimed to ride out short-term volatility when liquidity is in short supply.

[11] As mentioned in section 3.2.2, reflections connected to Zang (2021) study should be made with caution as it has not been published or peer-reviewed.

Our results indicate that leverage increased for PE-backed companies relative to non-PE-backed companies during COVID-19 (Table 5), which is inconsistent with Bernstein et al. (2019) result, who found no significant difference between PE- and non-PE-backed companies for leverage. Nevertheless, our findings indicate a relative increase in leverage for PE-backed companies even though net equity contribution increased and no significant difference in debt issuance was detected. Hence, equity seems to have decreased in PE-backed companies even though we have recorded a significant increase in equity issuance. This is consistent with our finding of decreasing profitability for PE-backed companies relative to non-PE-backed companies. Thus, the increased net equity contribution for PE-backed companies might be aimed to compensate for the decrease in profitability. One explanation for the need for this compensation through equity issuance could be the importance of PE-backed firms monitoring their leverage ratios not to breach covenants.

Consistent with Hotchkiss et al. (2021) reasoning, another explanation behind the statistically significant differences in leverage between PE-backed firms and their peers could be a distinction between the different owner's perceptions of the companies' optimal leverage levels. This reasoning is thus based on the trade-off theory, indicating that private equity firms aim to keep their capital structure at a higher optimal level where the leverage generates more tax benefits compared to the risk of financial distress. This also indicates that, in line with Kaplan and Strömberg's (2009) reasoning, non-PE-backed firms could be unwilling to take advantage of debt financing. These interpretations should be made with care, as our measures are accounting based. However, previous studies have proposed that the usage of book values for leverage may not be a severe limitation (e.g. Fama and French, 2002; Marsh, 1982).

On the other hand, if the relative increase in leverage among PE-backed firms compared to their peers is not driven by what is optimal for firms but rather by market timing and how much debt PE investors can access, there is a risk that the higher debt levels among PE-backed firms are a sign of over-leveraging. However, since there are no significant differences in cost of debt, there is no evident sign that financial institutions have perceived PE-backed firms' relatively higher leverage levels as a risk needed to be compensated for. Instead, in line with Ivashina and Kovner (2011), this finding might indicate that PE-backed firms obtain more favorable loan spreads than their peers, as we find no significant difference in cost of debt even though the leverage levels are significantly different.

In conclusion, the results illustrated in section 5.2.1. confirm that PE-backed firms partly made different financial decisions compared to their peers during COVID-19. However, there seems to be a dissonance between the presented previous research in section 3 and our results in terms of PE-backed firms' decisions related to debt issuance during a crisis.

6.2. Profitability and Investment

In this section, we will discuss our findings regarding how the profitability and investments of PE-backed companies were affected during COVID-19.

First, we do not find a statistically significant difference in investment for PE- and non-PE-backed companies during COVID-19 (Table 6). Thus, inconsistent with Bernstein et al. (2019), PE-backed firms did not seem to have more financial capabilities for investment as a result of their financing decisions during the pandemic relative to non-PE-backed companies. The absence of statistically significant results for investment indicates that the increased net equity contribution for PE-backed companies relative to non-PE-backed companies was not intended for asset growth. Moreover, we find indications that ROA for PE-backed companies decreased relative to non-PE-backed companies, simultaneously with a relative decrease in EBITDA margin (Table 6). These findings were unexpected since previous research on the GFC indicates relatively higher profitability for PE-backed firms (Meles et al., 2014; Wilson et al., 2012) or no significant difference in profitability (Bernstein et al., 2019; Zang, 2021).

Although previous crisis research on PE-backed companies is somewhat scarce, most of the PE-backed research during normal times has drawn similar conclusions regarding the crisis research of PE-backed companies' profitability. However, as this result oppose most previous research, the question arises regarding why our findings are different. In comparison to the scope of Bernstein et al. (2019) study of PE-backed companies in the United Kingdom during the GFC, our study investigates the COVID-19 pandemic. Hence, there might be a difference between PE-backed firms' profitability during the COVID-19 pandemic and the GFC. Furthermore, Zang (2021) studies Swedish PE-backed firms during the COVID-19 pandemic, and the dissimilarities from our result might also be a difference in the COVID-19 effect on the profitability at a country level. Hence, our findings regarding profitability highlight the limitations of generalizing studies which only investigate PE-backed firms' operational performance in a single country.

We suggest that there can be two potential explanations for the profitability development among PE-backed firms in the United Kingdom, either PE-backed firms tried to reduce the COVID-19 impact on operational performance and failed compared to non-PE-backed companies, or they did not intend to reduce the COVID-19 impact to the same extent. Most previous research contradicts these explanations since it is inconsistent with the idea that PE ownership generates a parenting advantage. Also, PE firms have the ability to redeploy employees during crises to assist with operational issues, which might facilitate increased profitability. However, previous literature has suggested that increased bankruptcy risk might incentivize risk-averse managers to take non-optimal decisions from a value generation perspective. Thus, since our results indicate a relative increase in leverage for PE-backed firms, which could signal an increased bankruptcy

risk, this could be one explanation for the relative decreasing profitability if PE-backed firms tried to reduce the pandemics' impact but failed relative to non-PE-backed companies.

One reason for the absence of PE-backed firms measures to reduce impact could be that the pandemic was only expected to impose transitory effects on the global economy, as Haarmeyer (2020) discussed. Moreover, given the idea of a transitory crisis and PE-backed companies' relaxed financial constraints, as indicated by the relative increase in equity issuance, it might not be necessary to make operational changes, e.g. cost-cutting. On the contrary, non-PE-backed firms might feel a more substantial need to make operational changes to survive since they do not have access to uninvested funds. Furthermore, Gompers et al. (2022) find that PE managers believe that the PE industry will perform better than the public market over the next ten years, which also implies that the different profitability patterns might be due to a belief in positive future operational performance. Likewise, Gompers et al. (2022) suggest that activities such as reducing headcount and cost were not as common for portfolio companies that had not experienced a material decline in performance during the crisis. Thus, the PE owners' might not have perceived that operational performance among the portfolio companies had deteriorated materially. However, since we lack insight into the non-PE owners' perception of the companies' operational performance, this reflection should be made with caution. Furthermore, since we only study one year of the pandemic, we are not able to investigate whether PE-backed firms perform better or worse in the long term.

We find no significant difference in asset growth for PE-backed relative to non-PE-backed companies during COVID-19 (Table 6). This is not in line with Bernstein et al. (2019) results, which illustrate a significant relative increase in asset growth for PE-backed companies during the GFC. Furthermore, our finding for asset growth is not significant, but the EBITDA margin is, indicating that the margin drives the negative ROA estimate.

Thus, in contrast to previous research, it appears that profitability for PE-backed companies decreased relative to non-PE-backed companies during the COVID-19 pandemic. Consequently, the findings support the hypothesis that PE-backed companies' operational performance was different from their peers during the pandemic. We find no indication of a statistically significant effect on investment or asset growth.

6.3. Working Capital Management

As explained in section 3.2.1., an important aspect to consider during a crisis is to reduce financial constraints by making suitable decisions regarding working capital management. However, while previous research has presented evidence on working capital management for PE-backed firms during normal times and non-PE-backed firms during the COVID-19 crisis, research exploring working capital management for PE-

backed firms during crises is lacking, even though it has been described as an essential tool to navigate a crisis. Working capital management during the COVID-19 pandemic is especially interesting since the crisis did not erupt from the financial system. Also, the United Kingdom government issued three lockdowns during 2020, which might have impacted the working capital management since critical facilities such as warehouses and stores were closed. Thus, in this section, we will discuss our findings regarding the effect that COVID-19 had on operational performance in terms of working capital management.

As mentioned in section 5.1.2., non-PE-backed companies experienced a decrease in the change in inventory during COVID-19, while PE-backed firms' change in inventory remained similar compared to 2019. Furthermore, the findings from our main model in Table 7 indicate that the difference in change in inventory for PE-backed companies increased relative to non-PE-backed companies. This finding is unanticipated based on previous research, which indicates that PE-backed firms experienced more strict working capital management than non-PE-backed firms during the GFC. Furthermore, in a non-crisis setting, Smith (1990) presents that more strict inventory management, such as shorter holding periods for inventory, contributed to an increase in operating profit for MBOs. Our result indicates a relative decrease in profitability for PE-backed firms in combination with a relative increase in inventory growth. Thus, the relative increase in inventory growth for PE-backed firms during the COVID-19 crisis might have contributed to the relative decrease in profitability for PE-backed firms compared to non-PE-backed firms. Hence, even though previous research indicates that private equity firms have more strict working capital management than non-PE-backed firms, our results contribute to existing research with a crisis perspective on working capital management in PE-backed firms.

There could be multiple reasons behind the relative increase in change in inventory for PE-backed firms compared to non-PE-backed firms. One suggestion is that PE-backed firms consciously chose not to take action to decrease inventory growth. This tendency might be more substantial for PE-backed firms since their relaxed financial constraints might enable them to have higher inventory growth levels during uncertain times without endangering liquidity. Another explanation could be that PE firms underestimated the effect or length of the crisis. This might have resulted in larger decreases in sales during the period than expected or that inventory input (e.g. raw materials) became more expensive than expected. Consistent with Haarmeyer (2020) reasoning, this could be an implication of the belief that the crisis was transitory. Moreover, firms usually aim to reduce capital requirements and increase capital productivity. A relative increase in change inventory for PE-backed companies would thus be considered a sign of inefficiency.

On the contrary, too low inventory levels might be regarded as undesirable since companies strive to satisfy customer demand as sufficiently as possible. Thus, another explanation for our results might be that PE-backed companies did predict that there

would be a shortage in supply due to supply chain disruptions following COVID-19 and hence actively took measures to increase inventory growth in order to avoid a shortage in the future. There are indications in previous research that this potentially could be easier for PE-backed firms to execute due to the parenting advantage in terms of the PE-owners' strong network and industry experience, which might enable them to have a closer relationship with their suppliers than non-PE-backed firms.

As the differences in change in accounts payable and accounts receivable were not found significant, we did not find any indication that these variables were affected differently by COVID-19 for PE-backed companies (Table 7). This is not in line with previous research which suggests that PE-backed firms have different accounts payable and accounts receivable developments than non-PE-backed companies during the post-buyout period.

Thus, while it seems that inventory growth increased for PE-backed companies relative to non-PE-backed companies, working capital management as a whole was quite unaffected by COVID-19 for PE-backed relative to non-PE-backed companies. This is consistent with the insignificant difference in change in net working capital between PE-backed and non-PE-backed firms presented in Table 7. Since previous research regarding the crisis effect on PE-backed companies working capital management is scarce, this is an addition to the current body of literature.

7. Concluding Remarks

7.1. Contributions

This study aimed to investigate if the financial decisions and operational performance were affected differently by the COVID-19 crisis depending on whether a company was PE-owned or not. The study was based on publicly available accounting data, through which insights on the development of PE-backed companies in the United Kingdom during COVID-19 have been formed. Overall, our study adds to existing research by examining PE-backed firms' financial decisions and operational performance in a COVID-19 setting, as previous research primarily investigates financial crises[12] or non-crises scenarios. Furthermore, we have contributed to existing research on three major areas: (1) different empirical findings compared to previous research, (2) the introduction of working capital management to the analysis of PE-backed firms' operational performance during crises, and (3) methodological improvements.

We found indications that the hypothesis that PE-backed firms' financial decisions and operational performance were significantly different from their peers during the COVID-19 pandemic, is partly true. However, since we do not find a significant difference for all models and across robustness tests, it should be interpreted with caution. However, in conflict with most previous research on the subject, such as the parenting advantage of a PE ownership and reduced agency costs, we find that profitability measures such as ROA and EBITDA margin deteriorated for PE-backed firms compared to non-PE-backed firms during the pandemic. Simultaneously, PE-owned companies' net equity contribution and leverage were significantly higher than non-PE-backed firms during the pandemic. The lack of significant differences between the estimates for investment and cost of debt between the groups is also considered contradictory to the most previous research. The consequence of the insignificant difference for these estimates consequently leads to other interpretations of the relative increase in net equity contribution and leverage compared to previous research, where the main suggestion has been that PE funds issue more debt and equity in order to increase financial capabilities and invest in asset growth.

Furthermore, the study contributes to existing research by suggesting reasons why the results presented in our study are different from previous research. First, there might be a potential connection between PE-backed firms' relative decline in profitability and relative increase in net equity contribution and leverage ratio. We propose that PE-backed companies might use their access to uninvested funds to ride out operational volatility and to attempt to control the increased leveraged ratio. The relative increase in leverage ratio might in turn have been caused by a decrease in equity as a result of decreasing net

[12] That is, crises that originated from the financial markets (Haarmeyer, 2020)

income. Second, we suggest that the relative increase in leverage ratio might be due to differences in the perceived optimal leverage ratio between PE-backed and non-PE-backed firms, which is in line with the trade-off theory[13]. Moreover, the relative increase in net equity contribution might be explained by the agency theory, as PE-backed firms might have lower agency costs which could decrease frictions that inhibit equity investments. Furthermore, we argue that there can be two potential explanations for the reduction in profitability among PE-backed firms compared to their peers. First, PE-backed firms may have tried to reduce the COVID-19 impact on operational performance and failed relative to non-PE-backed companies, or they did not try to reduce the COVID-19 impact to the same extent.

In addition, the paper contributes to the existing literature on working capital management. Even though working capital management has been studied during crises before, research incorporating the PE ownership component is lacking. Furthermore, it is interesting to study working capital management during COVID-19 due to the grave supply chain disruptions following lockdowns. We found that inventory growth increased for PE-backed companies relative to non-PE-backed companies, but that change in net working capital was not affected differently by COVID-19 for PE-backed relative to non-PE-backed companies. We suggest that this could be the result of a conscious choice among PE-backed firms, as too low levels of inventory could be regarded as undesirable if it does not meet the customer demand. Furthermore, PE firms' ability to relax financial constraints could also affect their risk appetite related to working capital management. On the other hand, another explanation for the relative increase in change in inventory could be that PE firms had a different perception of the effect or length of the crisis compared to their peers.

Lastly, the study adds to the methodology that has previously been used when examining how PE-backed firms are affected by COVID-19. First, the sample of PE-backed firms is different compared to Zang (2021), as we exclude growth and venture capital firms. These types of transactions were ignored because investors generally buy a stake in these companies using little or no leverage. Second, we introduce an alternative measure of ROA compared to Bernstein et al. (2019) by using EBITDA and EBIT in the numerator instead of net income, as these measurements capture operational cash flows more sufficiently.

[13] The interpretation of leverage with regards to the trade-off theory should be made with care, as our measure for leverage is accounting based. Nevertheless, previous studies have proposed that the usage of book values for leverage is not a severe limitation (e.g. Fama and French, 2002; Marsh, 1982).

7.2. Limitations

First, gathering accounting data over multiple years might introduce an unbalanced distribution of firm-year observations, especially for smaller firms. The requirement to disclose financial information in the United Kingdom differs depending on the firm's size, as these companies are allowed to publish condensed accounts. This could also introduce a selection bias towards larger portfolio companies in the sample. Furthermore, as the data selection included manual filtering and cleaning, there is an additional risk of selection bias related to the sample of PE-backed companies. Another potential bias is the samples' industry distribution, as the sample mostly consists of companies in the service and manufacturing industry, which indicates a bias towards these industries.

Furthermore, the significant effect of private equity ownership in the main model must be interpreted with caution, as the assumption of parallel trends was not fulfilled during the entire pre-crisis period. However, the differences between the groups tended to be less significant or not significant in the years closer to the crisis. One explanation of the significant differences in the earlier years might be that PE-backed firms tend to be more profitable, have more rapid growth, and have higher debt issuance compared to non-PE-backed companies during the initial three years after a buyout (Boucly et al.,2011). As the matching procedure is based on characteristics in 2019, the PSM matching criteria might thus capture characteristics which are common among PE firms at a certain stage of the holding period. Consequently, this might indicate a bias towards PE-backed firms that are in a particular stage of the holding period.

Third, since the results for net equity contribution and change in inventory were not robust for the change of matching year and the change to CEM matching method, the significant outcomes from our main model may be biased, and any interpretation related to the suggested relationships might be inaccurate.

In terms of generalizability, it might be difficult to compare this result to previous and future crises, as the characteristics of the COVID-19 pandemic might be unique. Furthermore, as mentioned in section 3.2.2., the maturity of the private equity market during the pre-pandemic seems to be different compared to the GFC. Any comparisons to research on PE ownership during the GFC should therefore be made with caution as it is difficult to distinguish whether the different outcomes during the financial crisis compared to a pandemic are due to other factors, such as the PE market development. Another issue related to generalizability is that this study only focuses on the market in the United Kingdom, which has been proven to be approximate to other PE markets during previous crises according to Bernstein et al. (2019). Since there have been signs of changes in industry dynamics for the PE market, this might no longer be the case. However, our findings in section 2.2. shows that the trends in different geographical areas are still rather similar during recent years.

Finally, as it was not possible to obtain financial data from more than one crisis year, the results may be influenced by the asymmetric time window before and after the shock. It is thus not possible to assess whether there are any cyclical elements in the relationship after the first year of the crisis nor if the changes are transitory or not.

7.3. Suggestions for Future Research

This study has contributed to new discussion fields in PE-backed firms' operational performance and financial decisions, which could be further examined in future research. First, as financial data were only available one year following the COVID-19 pandemic when our study was conducted, a suggestion for future research would be to gather financial information for a symmetric window around the shock. This would be especially interesting in order to draw more general conclusions about whether there are cyclical elements in the relationship or not. Second, future researchers may investigate PE-backed firms' performance in a cross-country study to further understand the disparities in country dynamics. Fourth, as previously mentioned, a bias towards private firm buyouts might underestimate the effect of financial engineering on operational performance. As a result, a suggestion for future research might be to control for the buyout type. Lastly, as there might be limitations in the theoretical framework on which the study is based, future research could explore the relationships in more detail using a qualitative research method. This would contribute to this study as it is difficult to isolate the impact of the COVID-19 crisis and the reasons why PE managers make certain decisions, and a supplemented qualitative research method would increase the capacity to explain the findings.

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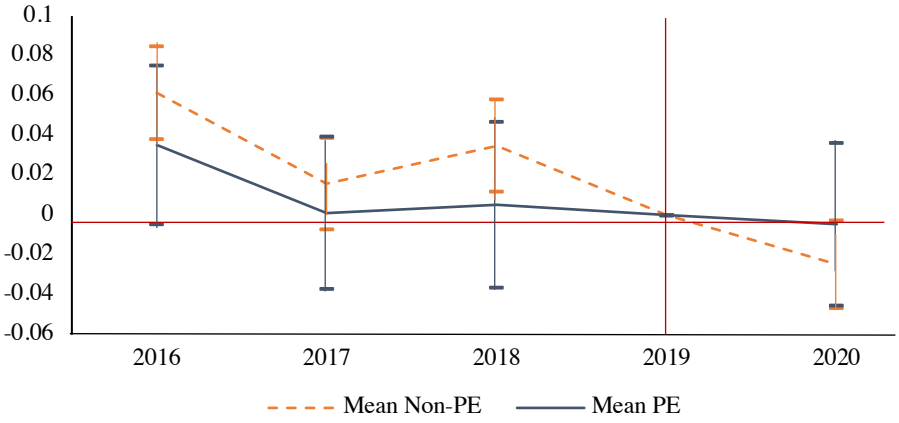
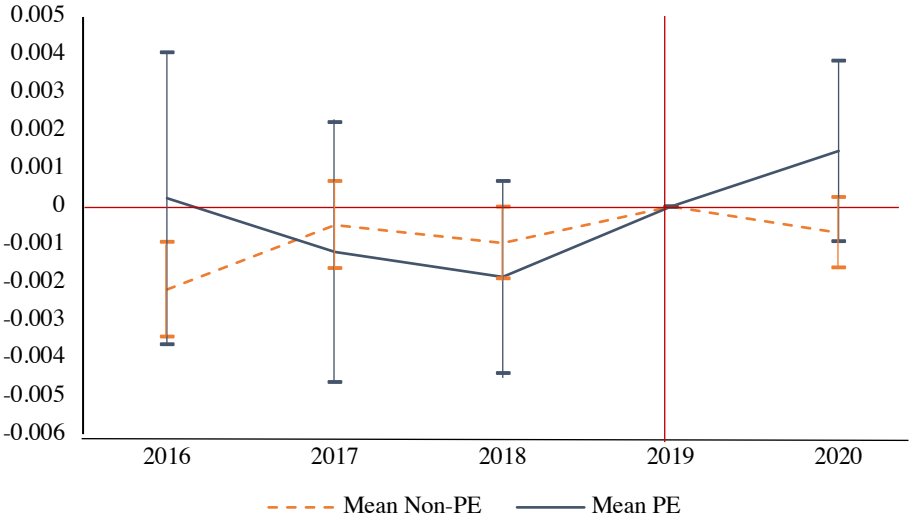
9. Appendix

Appendix A. Parallel Trends



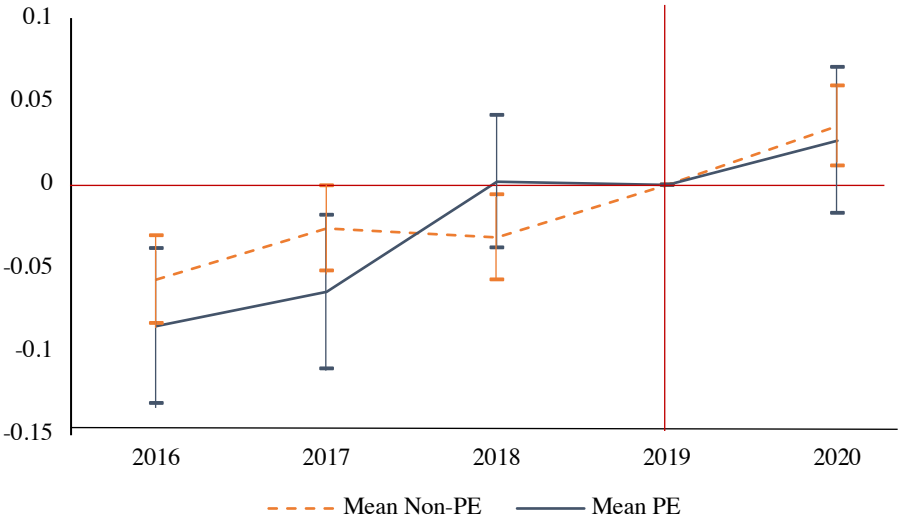
Note: Figure A.1 shows the change of debt contribution of PE-backed firms and non-PE-backed firms due to the year fixed effect. The estimates are based on the following equation: yit = αi + αt + ε_{it}. αt is the year fixed effect an αi is the firm fixed effect. The coefficients are illustrated with a corresponding 90% confidence interval. Standard errors are clustered at the firm level. 2019 is used as the base year and its coefficient is therefore normalized to zero.

Figure A.1. Year fixed effects on debt contribution



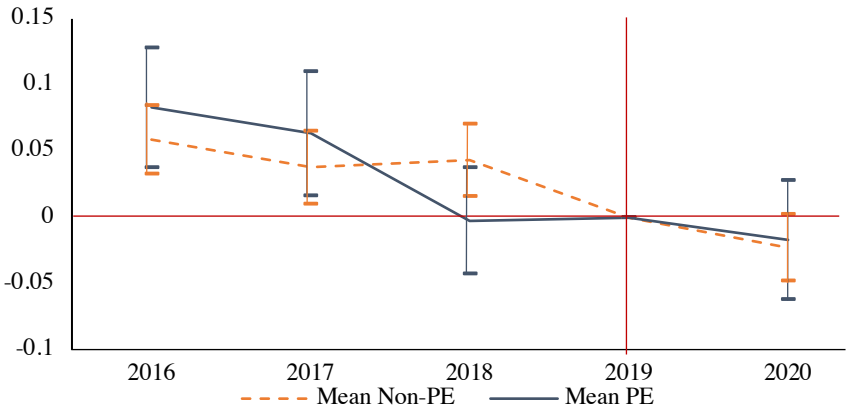
Note: Figure A.2 shows the change of cost of debt of PE-backed firms and non-PE-backed firms due to the year fixed effect. The estimates are based on the following equation: $y_{it} = \alpha_i + \alpha_t + \varepsilon_{it}$. αt is the year fixed effect an αi is the firm fixed effect. The coefficients are illustrated with a corresponding 90% confidence interval. Standard errors are clustered at the firm level. 2019 is used as the base year and its coefficient is therefore normalized to zero.

Figure A.2. Year fixed effects on cost of debt



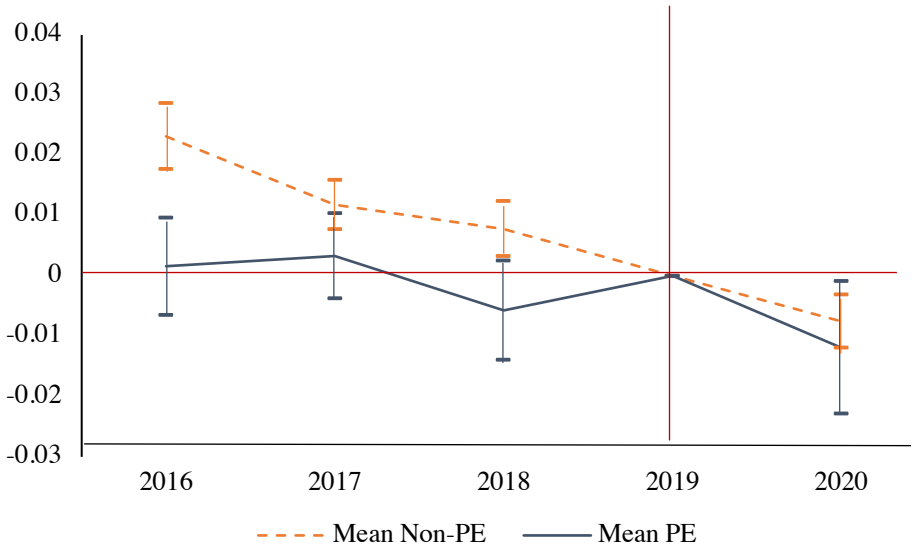
Note: Figure A.3 shows the change of asset growth of PE-backed firms and non-PE-backed firms due to the year fixed effect. The estimates are based on the following equation: $y_{it} = \alpha_i + \alpha_t + \epsilon_{it}$. αt is the year fixed effect an αi is the firm fixed effect. The coefficients are illustrated with a corresponding 90% confidence interval. Standard errors are clustered at the firm level. 2019 is used as the base year and its coefficient is therefore normalized to zero.

Figure A.3. Year fixed effects on asset growth



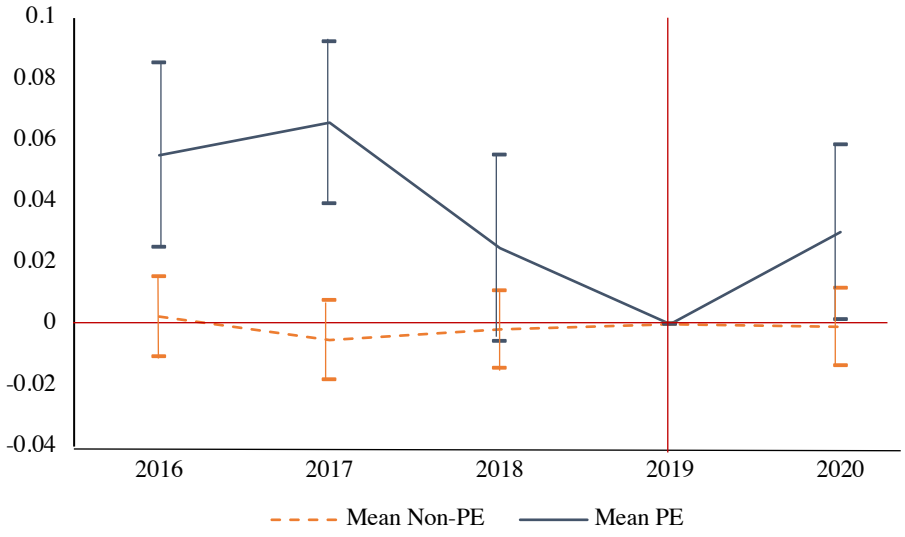
Note: Figure A.4 shows the change of investment of PE-backed firms and non-PE-backed firms due to the year fixed effect. The estimates are based on the following equation: yit = αi + αt + ε_{it}. αt is the year fixed effect an αi is the firm fixed effect. The coefficients are illustrated with a corresponding 90% confidence interval. Standard errors are clustered at the firm level. 2019 is used as the base year and the coefficient is therefore normalized to zero.

Figure A.4. Year fixed effects on investment



Note: Figure A.5 illustrates the change of change in accounts payable of PE-backed firms and matched firms due to the year fixed effect. The estimates are based on the following equation: $y_{it} = \alpha_i + \alpha_t + \epsilon_{it}$. αt is the year fixed effect an αi is the firm fixed effect. The coefficients are illustrated with a corresponding 90% confidence interval. Standard errors are clustered at the firm level. 2019 is used as the base year and its coefficient is therefore normalized to zero.

Figure A.5. Year fixed effects on change in Accounts payable



Note: Figure A.6 shows the change of change in net working capital of PE-backed firms and matched firms due to the year fixed effect. The estimates are based on the following equation: $y_{it} = \alpha_i + \alpha_t + \epsilon_{it}$. αt is the year fixed effect an αi is the firm fixed effect. The coefficients are illustrated with a corresponding 90% confidence interval. Standard errors are clustered at the firm level. 2019 is used as the benchmark year and its coefficient is therefore normalized to zero.

Figure A.6. Year fixed effects on change in Net working Capital

Table A.1. Parallel trend: Financing decisions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Net equity contr.		Debt issuance		Leverage		Cost of debt	
PEx2016	0.031**	0.034**	-0.021	-0.041	-0.053*	-0.045*	0.003	0.004
	(0.014)	(0.014)	(0.030)	(0.030)	(0.028)	(0.027)	(0.003)	(0.003)
PEx2017	0.014	0.020	-0.024	-0.030	-0.054**	-0.045*	-0.000	0.000
	(0.013)	(0.013)	(0.030)	(0.029)	(0.024)	(0.023)	(0.002)	(0.002)
PEx2018	-0.005	0.002	-0.041	-0.044	-0.013	0.002	0.001	0.001
	(0.011)	(0.010)	(0.031)	(0.029)	(0.019)	(0.019)	(0.002)	(0.002)
PEx2020	0.033***	0.031***	0.014	0.020	0.051***	0.050***	-0.000	0.002
	(0.010)	(0.010)	(0.030)	(0.028)	(0.017)	(0.016)	(0.001)	(0.002)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	767	767	767	767	767	767	590	590
n	3432	3432	3432	3432	3432	3432	2415	2415
Adj. R^2	0.378	0.421	0.117	0.198	0.853	0.861	0.690	0.770

Note: Table A.1 illustrates the estimates for equation (3), a time varying fixed effects model. The estimates are based on the following equation: yit = αt + αi + ∑βk(PEi) +θX it + ε_{it}. αi captures firm fixed effect, αt captures the fixed effect of year. Year 2019 is ignored in the table as the year is used as base year. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA, lagged one year normalized cash flow, lagged one year of leverage[14], lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report net equity contribution; Columns 3 and 4 report debt issuance; Columns 5 and 6 report leverage; Columns 7 and 8 cost of debt. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

[14] Lagged leverage are ignored in Table A.1 Column 6

Table A.2. Parallel trend: Profitability and Investments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Asset growth		EBITDA margin		ROA		Investment	
PEx2016	-0.027	-0.014	0.022*	0.025**	0.031**	0.040***	0.031	0.020
	(0.033)	(0.032)	(0.013)	(0.013)	(0.014)	(0.014)	(0.032)	(0.031)
PEx2017	-0.020	-0.024	0.033***	0.031***	0.041***	0.050***	0.022	0.029
	(0.034)	(0.033)	(0.011)	(0.011)	(0.012)	(0.011)	(0.034)	(0.033)
PEx2018	0.057*	0.050)	0.001	-0.003	0.006	0.010	-0.060*	-0.051*
	(0.032)	(0.031)	(0.010)	(0.012)	(0.011)	(0.010)	(0.031)	(0.029)
PEx2020	0.013	0.017	-0.060***	-0.064***	-0.036***	-0.040***	-0.004	-0.051
	(0.033)	(0.031)	(0.021)	(0.020)	(0.013)	(0.012)	(0.032)	(0.016)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	767	767	756	756	835	835	756	756
n	3432	3432	3391	3391	3645	3645	3391	3391
Adj. R2	0.098	0.192	0.556	0.574	0.512	0.557	0.118	0.213

Notes: Table A.2 illustrates the estimates for equation (3), a time varying fixed effects model. The estimates are based on the following equation: $y_{it} = \alpha_t + \alpha_i + \sum\beta k(PEi) + \theta X$ it + ε_{it}. αi captures firm fixed effect, αt captures the fixed effect of year. Year 2019 is ignored in the table as the year is used as base year. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA[15], lagged one year normalized cash flow, lagged one year of leverage, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on asset growth; Columns 3 and 4 report the effect on EBITDA margin; Columns 5 and 6 report the effect on ROA. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

[15] Lagged ROA are ignored in Table A.2 Column 6

Table A.3. Parallel trend: Working Capital Management

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔAccounts payable		ΔAccounts receivable		ΔInventory		ΔNet working capital	
PEx2016	-0.014**	-0.016**	0.004	0.002	0.008*	0.008*	0.048**	0.055***
	(0.006)	(0.006)	(0.010)	(0.010)	(0.004)	(0.004)	(0.021)	(0.021)
PEx2017	-0.009	-0.009***	0.001	0.001	-0.006*	-0.006*	0.054***	0.060***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.003)	(0.003)	(0.020)	(0.019)
PEx2018	-0.017	-0.017*	-0.010	-0.008	0.002	0.001	0.012	0.018
	(0.007)	(0.007)	(0.008)	(0.008)	(0.004)	(0.004)	(0.026)	(0.022)
PEx2020	-0.005	-0.005	0.009	0.007	0.009**	0.009**	0.020	0.013
	(0.008)	(0.008)	(0.007)	(0.007)	(0.004)	(0.004)	(0.021)	(0.020)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	765	765	766	766	761	761	767	767
n	3414	3414	3425	3425	3399	3399	3432	3432
Adj. R2	0.000	0.025	0.000	0.027	0.068	0.090	0.060	0.110

Notes: Table A.3 illustrates the estimates for equation (3), a time varying fixed effects model. The estimates are based on the following equation: yit = αt + αi + ∑βk(PEi) +θX it + ε_{it}. αi captures firm fixed effect, αt captures the fixed effect of year. Year 2019 is ignored in the table as the year is used as base year. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA, lagged one year normalized cash flow, lagged one year of firm leverage, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on change in accounts payable; Columns 3 and 4 report the effect on change in accounts receivable; Columns 5 and 6 report the effect on change in inventory; Columns 7 and 8 the effect on change in net working capital. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** denotes significance at the 1% level, ** at the 5% level, * at the 10% level.

Appendix B. Robustness Tests

Table B.1. Robustness test industry fixed effects: Financial decisions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Net equity contr.		Debt issuance		Leverage		Cost of debt	
PExCOVID	0.022***	0.017**	0.037	0.049**	0.076***	0.068***	0.002	0.002
	(0.008)	(0.007)	(0.023)	(0.023)	(0.021)	(0.020)	(0.002)	(0.002)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	766	766	766	766	766	766	589	589
n	3426	3426	3426	3426	3426	3426	2403	2403
Adj. R^2	0.374	0.415	0.103	0.185	0.852	0.861	0.693	0.695

Notes: Table B.1 reports the estimates of a difference-in-differences model. The estimates are based on the following equation: $y_{it} = \alpha_t \times \alpha_t + \alpha_i + \beta_1(PE_t \times COVID) + \theta X + \varepsilon_{it}$. All models incorporate firm, industry and year fixed effect. We focus on the interaction term between the COVID dummy and PE dummy. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA, lagged one year normalized cash flow, lagged one year of firm leverage[16], lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on net equity contribution; Columns 3 and 4 report the effect on debt issuance; Columns 5 and 6 report the effect on leverage; Columns 7 and 8 report the effect on leverage; Columns 9 and 10 report the effect on the cost of debt. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

[16] Lagged firm leverage are ignored in Table B.1 Column 6

Table B.2. Robustness test industry fixed effects: Profitability and Investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Asset growth		EBITDA margin		ROA		Investment	
PExCOVID	0.003	0.008	-0.059***	-0.061***	-0.050***	-0.058***	0.004	-0.001
	(0.027)	(0.025)	(0.019)	(0.019)	(0.012)	(0.011)	(0.027)	(0.025)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	766	766	755	755	834	834	755	755
n	3426	3426	3385	3385	3649	3649	3385	3385
Adj. R^2	0.074	0.168	0.576	0.590	0.518	0.559	0.093	0.188

Note: Table B.2 reports the estimates of a difference-in-differences model. The estimates are based on the following equation: $y_{it} = \alpha_t \times \alpha_t + \alpha_i + \beta_1(PE_t \times COVID) + \theta X + \varepsilon_{it}$. All models incorporate firm, industry and year fixed effect. We focus on the interaction term between the COVID dummy and PE dummy. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA[17], lagged one year of firm leverage, lagged one year normalized cash flow, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on asset growth; Columns 3 and 4 report the effect on EBITDA margin; Columns 5 and 6 report the effect on ROA; Columns 7 and 8 report the effect on Investment. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

[17] Lagged ROA are ignored in Table B.2 Column 6

Table B.3. Robustness test industry fixed effects: Working capital management

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔAccounts payable		ΔAccounts receivable		ΔInventory		ΔNet working capital	
PExCOVID	0.007	0.008	0.009	0.007	0.006**	0.007**	-0.005	-0.015
	(0.006)	(0.006)	(0.006)	(0.006)	(0.004)	(0.003)	(0.016)	(0.016)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	764	764	765	765	760	760	766	766
n	3408	3408	3419	3419	3393	3393	3426	3426
Adj. R^2	0.000	0.010	0.000	0.007	0.114	0.131	0.068	0.112

Note: Table B.3 reports the estimates of a difference-in-differences model. The estimates are based on the following equation: $y_{it} = \alpha_t \times \alpha_t + \alpha_i + \beta_1(PE_t \times COVID) + \theta X + \varepsilon_{it}$. All models incorporate firm, industry and year fixed effect. We focus on the interaction term between the COVID dummy and PE dummy. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA, lagged one year normalized cash flow, lagged one year of leverage, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on change in accounts payable; Columns 3 and 4 report the effect on change in accounts receivable; Columns 5 and 6 report the effect on change in inventory; Columns 7 and 8 report the effect on change in net working capital. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

Table B.4. Robustness test CEM Matching: Financing decisions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Net equity contr.		Debt issuance		Leverage		Cost of debt	
PExCOVID	0.027***	0.020***	0.020	0.052**	0.068***	0.063***	0.002	0.001
	(0.007)	(0.007)	(0.021)	(0.022)	(0.019)	(0.019)	(0.002)	(0.002)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	1095	1095	1095	1095	1095	1095	763	763
n	4621	4621	4622	4622	4622	4622	2937	2937
Adj. R^2	0.267	0.311	0.058	0.210	0.823	0.827	0.746	0.750

Notes: Table B.4 shows the estimates of a difference-in-differences model. All models incorporate firm and year fixed effect. We focus on the interaction term between the COVID dummy and PE dummy. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA, lagged one year normalized cash flow, lagged one year of leverage[18], lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on net equity contribution; Columns 2 and 3 report the effect on debt issuance; Columns 4 and 5 report the effect on leverage; Columns 7 and 8 report the effect on cost of debt; Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

[18] Lagged leverage are ignored in Table B.4 Column 6

Table B.5. Robustness test CEM Matching: Profitability and Investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Asset growth		EBITDA margin		ROA		Investment	
PExCOVID	0.005	0.013	-0.085***	-0.090***	-0.042***	-0.052***	0.013	0.019
	(0.023)	(0.021)	(0.016)	(0.026)	(0.011)	(0.011)	(0.023)	(0.021)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	1095	1095	1084	1084	1159	1159	1084	1084
n	4622	4622	4565	4565	5025	5025	4565	4565
Adj. R^2	0.084	0.230	0.609	0.623	0.454	0.521	0.097	0.237

Note: Table B.5 shows the estimates of a difference-in-differences model. All models incorporate firm and year fixed effect. We focus on the interaction term between the COVID dummy and PE dummy. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA[19], lagged one year normalized cash flow, lagged one year of firm leverage, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on asset growth; Columns 3 and 4 report the effect on EBITDA margin; Columns 5 and 6 report the effect on ROA; Columns 7 and 8 report the effect on investment. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

[19] Lagged ROA are ignored in Table B.5 Column 6

Table B.6. Robustness test CEM Matching: Working capital management

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔAccounts payable		ΔAccounts receivable		ΔInventory		ΔNet working capital	
PExCOVID	0.002	0.005	0.019***	0.022***	0.002	0.002	-0.004	-0.023
	(0.005)	(0.005)	(0.006)	(0.006)	(0.003)	(0.003)	(0.015)	(0.014)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	1092	1092	1092	1092	1085	1085	1095	1095
n	4608	4608	4602	4602	4579	4579	4622	4622
Adj. R^2	0.000	0.000	0.000	0.074	0.037	0.051	0.083	0.158

Note: Table B.6 shows the estimates of a difference-in-differences model. All models incorporate firm and year fixed effect. We focus on the interaction term between the COVID dummy and PE dummy. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA, lagged one year normalized cash flow, lagged one year of leverage, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on change accounts payable; Columns 3 and 4 report the effect on change account receivable; Columns 5 and 6 report the effect on change in inventory; Columns 7 and 8 report the effect on change in net working capital. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level

Table B.7. Robustness test alternative year: Financing Decisions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Net equity contr.		Debt issuance		Leverage		Cost of debt	
PExCOVID	0.014*	0.020	0.029	0.043*	0.067***	0.065***	0.004*	0.003
	(0.007)	(0.007)	(0.024)	(0.024)	(0.023)	(0.022)	(0.002)	(0.002)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	732	732	733	733	733	733	567	567
n	3136	3136	3138	3138	3138	3138	2219	2219
Adj. R^2	0.365	0.398	0.104	0.213	0.845	0.850	0.658	0.663

Note: Table B.7 shows the estimates of a difference-in-differences model. All models incorporate firm and year fixed effect. We focus on the interaction term between the COVID dummy and PE dummy. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA, lagged one year of leverage[20], lagged one year normalized cash flow, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on net equity contribution; Columns 3 and 4 report the effect on debt contribution; Columns 5 and 6 report the effect on leverage; Columns 7 and 8 report the effect on cost of debt. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

[20] Lagged firm leverage are ignored as control in Table B.7 Column 6

Table B.8. Robustness test alternative year: Profitability and Investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Asset growth		EBITDA margin		ROA		Investment	
PExCOVID	-0.011	-0.010	-0.100***	-0.102***	-0.065***	-0.070***	-0.008	-0.006
	(0.026)	(0.024)	(0.020)	(0.020)	(0.013)	(0.012)	(0.027)	(0.024)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	733	733	725	725	749	749	725	725
n	3138	3138	3093	3093	3267	3267	3094	3094
Adj. R^2	0.108	0.214	0.662	0.672	0.547	0.585	0.138	0.237

Notes: Table B.8 shows the estimates of a difference-in-differences model. All models incorporate firm and year fixed effect. We focus on the interaction term between the COVID dummy and PE dummy. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA[21], lagged one year of firm leverage, lagged one year normalized cash flow, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on asset growth; Columns 3 and 4 report the effect on EBITDA margin; Columns 5 and 6 report the effect on ROA; Columns 7 and 8 reports effect on Investment. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

[21] Lagged ROA are ignored as control in Table B.8 Column 6

Table B.9. Robustness test alternative year: Working capital management

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔAccounts payable		ΔAccounts receivable		ΔInventory		ΔNet working capital	
PExCOVID	0.000	0.002	0.013*	0.012*	0.006*	0.006*	-0.005	-0.071
	(0.006)	(0.006)	(0.007)	(0.007)	(0.004)	(0.003)	(0.110)	(0.110)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Clusters	733	733	729	729	726	726	733	733
n	3134	3134	3119	3119	3106	3106	3138	3138
Adj. R^2	0.000	0.000	0.000	0.062	0.025	0.038	0.000	0.000

Note: Table B.9 shows the estimates of a difference-in-differences model. All models incorporate firm and year fixed effect. We focus on the interaction term between the COVID dummy and PE dummy. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of ROA, lagged one year normalized cash flow, lagged one year of firm leverage, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on change accounts payable; Columns 3 and 4 report the effect on change account receivable; Columns 5 and 6 report the effect on change in inventory; Columns 7 and 8 report the effect on change in net working capital. Details about the related variables are reported in section 4.2.2. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.

Table B.10. Robustness test: Different measurement of ROA

	(1)	(2)	(3)	(4)
	EBITDA/Assets		EBIT/Assets	
PExCOVID	-0.038***	-0.046***	-0.047***	-0.053***
	(0.011)	(0.010)	(0.011)	(0.010)
Year	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes
Clusters	835	835	835	835
n	3644	3644	3644	3644
Adj. R^2	0.520	0.561	0.539	0.584

Notes: Table B.10 reports the estimates of the difference-in-differences model. All models incorporate firm and year fixed effect. We focus on the interaction term between the COVID dummy and PE dummy. Odd-numbered columns shows regression without controls, and the even-numbered columns shows regression with a set of control variables. The control variables included are lagged one year of leverage, lagged one year normalized cash flow, lagged one year of log of net sales, and relative one-year net sales growth. Columns 1 and 2 report the effect on ROA measured by $EBITDA/Assets_{t-1}$. Columns 3 and 4 report the effect on ROA measured by $EBIT/Assets_{t-1}$. Standard errors are clustered at the firm level. *** represents significance at the 1% level, ** at the 5% level, * at the 10% level.