The Supply Chain Spillovers of Private Equity Buyouts

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March 16, 2025

Abstract

This paper examines the supply chain spillovers of private equity (PE) buyouts using unique data on business-to-business sales for the universe of Belgian firms. We show that, during normal times, suppliers of PE-backed firms outperform their peers due to increased demand for inputs from PE-backed customers, rather than due to alternative mechanisms such as knowledge spillovers. In contrast, during economic downturns, while PE-backed firms outperform their peers even more strongly, their suppliers show no signs of outperformance. This can be explained by PE investors exerting pressure on and reconfiguring their supply chains to achieve cost savings for their portfolio companies during periods of economic distress. Finally, beyond their impact on suppliers, we also show that PE-backed firms can impose negative externalities on competitors that rely on common suppliers. Overall, our findings underscore the role of supply chains in PE investors' ability to create and extract value.

JEL Classification: D22, D24, G32, G34

Keywords: Private equity, Supply chains, Spillover effects, Firm growth, Switching costs

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We thank Gilles Chemla, Claudia Custodio, Hans Degryse, Sebastian Doerr, Emilia Garcia-Appendini, Jiaying Li, Ramana Nanda as well as seminar participants at Imperial College, KU Leuven, and the European Bank for Reconstruction and Development for helpful comments and suggestions. The views expressed in this project are those of the authors and do not necessarily reflect those of the National Bank of Belgium or the Eurosystem. Huylebroek gratefully acknowledges financial support from Research Foundation Flanders (FWO) Grant 11C7923N. All errors are our own. Corresponding author: Cédric Huylebroek.

1. Introduction

The private equity (PE) industry has grown tremendously over the past two decades, reaching more than $4 trillion in assets under management globally by 2023, corresponding to a four-fold increase since 2010. This rapid growth has not gone without criticism; politicians and labor unions increasingly raise concerns about the adverse impact of PE buyouts, prompting legislative responses such as the "Stop Wall Street Looting Act" recently proposed by several U.S. senators. Nevertheless, a growing body of research indicates that PE investors have a positive impact on their portfolio companies. For example, PE buyouts have been documented to improve total factor productivity (Davis et al. 2014), managerial practices (Bloom et al. 2015), and innovation activities (Lerner et al. 2011), among others.

Despite ample empirical evidence on how PE investors affect their portfolio companies, firms are part of complex production networks. Yet, we lack evidence on how buyouts affect PE-backed firms' supply chain partners.[1] Given that PE firms are often criticized for using aggressive short-term value-creation strategies, while the resilience of supply chains rests on long-term investments (Elliott et al. 2022; Khanna et al. 2022), addressing this knowledge gap is of first-order importance. In this paper, we aim to do so using unique data on the universe of buyer-supplier relationships in Belgium combined with Belgian PE buyouts, thereby improving our understanding of whether and how PE investors attempt to create value.

Theoretically, the supply chain spillovers of PE buyouts are ambiguous. On the one hand, assuming that PE buyouts create economic value for target firms, there are various ways through which supply chain partners could benefit from a buyout. For instance, if PE buyouts enable target firms to pursue new growth opportunities and expand their activities, suppliers may benefit from increased demand for inputs (Holmström 1988). Moreover, suppliers may capture some of the efficiency gains from the operational improvements or managerial practices that PE firms bring to their portfolio companies (e.g., through knowledge spillovers). On the other hand, even if PE firms create value for their portfolio companies, they may do so at the expense of target firms' supply chain partners (Shleifer and Summers 1988). PE firms may, for example,

[1] Various industry reports have highlighted the growing influence of PE firms on supply chains. For instance, a report from Alcott Global (2024), entitled "Private Equity's Role in Supply Chain and Value Chain Optimization" highlights that "Private equity firms, with their acute focus on value-creation, are increasingly turning their attention to the supply chain and value chain aspects of their portfolio companies." Similarly, a report from Jabian Consulting (2022), entitled "Private Equity Ate My Customer: Understanding the private equity mindset to build effective partnerships" states that "B2B companies should be familiar with the ways that PE could disrupt their customer base and be prepared to reconsider their customer strategy." In addition, based on a survey of 79 PE investors, Gompers et al. (2016) report that "introducing shared services—where the PE investors help their several portfolio companies aggregate demand for services or supplies to improve their bargaining power with suppliers—is also related to reduced costs and is important in 16% of the deals."

exert pressure on suppliers by renegotiating long-time contracts in order to achieve cost savings for their portfolio companies.

In this paper, we show that both mechanisms contribute to explain the impact of buyouts on the suppliers of PE-backed firms. On the one hand, during normal times, suppliers of PE-backed firms outperform their peers (in terms of sales, employment, and profitability) as they benefit from increased demand for inputs from PE-backed customers pursuing new growth opportunities (not through knowledge spillovers). On the other hand, during economic downturns, suppliers of PE-backed firms show no signs of outperformance and instead reduce their markups. We show that this can be attributed to PE investors exerting pressure on the suppliers of their portfolio companies, as they renegotiate existing contracts or switch to alternative suppliers in order to realize short-term cost savings.[2] In addition, beyond their impact on suppliers, we also find evidence that PE-backed firms impose negative externalities on competitors that rely on common suppliers. Together, these findings offer novel insights into how PE investors create and extract value.

Our empirical analysis relies on three unique data sources from Belgium which, as explained in detail below, is a representative country in terms of PE activity. Our primary data source is firm-to-firm sales data administered by the National Bank of Belgium. For each firm, these data record the universe of firm-to-firm transactions among firms in Belgium, enabling us to construct the network of supply chain relationships for virtually all firms.[3] These data can be linked to detailed firm balance sheet data, which provide information on sales, revenues, and costs of inputs (including capital, labour, and intermediates). Finally, we combine these data with PE deals involving Belgian targets obtained from Orbis M&A and S&P Global. This yields a final dataset that includes approximately 230 thousand firms and nearly 300 PE deals over the period 2002-2022. A key advantage for our study is that the Belgian production network data covers all firms—including small, private ones—which is crucial, as the majority of PE deals, both in Belgium and globally, are private firm buyouts.[4]

Using this dataset, we test for changes in supplier outcomes—such as total sales, profitability,

[2]The fact that PE firms primarily exert pressure on suppliers during periods of economic distress is consistent with survey evidence showing that PE investors engage more actively with their portfolio companies during crisis periods (Bernstein et al. 2019; Gompers et al. 2022). In addition, it aligns with the notion that general partners (in principle) have unlimited liability (Jenkinson et al. 2023); Consequently, when a portfolio company faces financial distress, the general partners have strong incentives to implement cost-cutting measures in order maximize the potential upside of its investment and increase its ability to raise funding in future financing rounds.

[3]In contrast to commonly used datasets like FactSet, an important advantage of our production network data is that it not only records whether a buyer-supplier relationship exists (the extensive margin), but also how much was transacted (the intensive margin)—which is empirically important as we discuss below.

[4]For instance, Cohn et al. (2022) report that private firm buyouts have outnumbered public firm buyouts by more than thirty to one in the US over the past decade.

employment, and markups—after one of its customers is acquired by a PE firm. In this setting, a common identification challenge is that PE targets are not randomly selected, which could lead to endogeneity issues. A key advantage of our study, however, is that we do not focus on PE targets, but on the suppliers of those firms, which reduces many endogeneity concerns.[5] Nevertheless, to mitigate any concerns, we follow prior research and carefully construct a control group of comparable firms for the suppliers of each PE-backed firm.

Specifically, we match the suppliers of PE-backed firms with similar suppliers of non-PE-backed firms at the time of the PE event. The control suppliers are constructed based on a granular match of industry, firm size, leverage, and profitability in the year prior to the PE event (e.g., as in Boucly et al. 2011; Davis et al. 2014). This granular matching procedure ensures that the control suppliers are comparable to the treated suppliers along key firm characteristics, thereby mitigating concerns about confounding factors. Each of the treatment-control groups represents a cohort, which we track for four years prior to the event until five years after the event. We then stack the cohort-level observations and estimate a generalized difference-in-differences model (Baker et al. 2022). Our regression model also controls for unobserved heterogeneity using firm-by-cohort and year-by-cohort fixed effects. Hence, our identification strategy compares within-firm dynamics of firms that deal with PE targets and control firms with similar observables in the same industry and year. Although it may not be possible to completely control for all unobservables, the comparison conditional on matched firm characteristics and granular fixed effects helps mitigate many potentially confounding factors. Moreover, as discussed below, we show that our baseline findings also hold for a battery of robustness checks that further mitigate potential concerns about reverse causality or omitted variable bias.

Before addressing our main research question, we assess the validity of our empirical setup by analyzing the impact of PE buyouts on target firms in our data sample. Prior research has argued that private firm buyouts create value by enhancing targets' access to debt financing, enabling them to pursue new growth opportunities (e.g., Boucly et al. 2011; Cohn et al. 2022).[6] Consistent with this view, our results show that target firms' financial leverage increases significantly following a PE buyout, and these firms grow faster than their matched controls. This finding aligns with earlier studies (Boucly et al. 2011; Cohn et al. 2022; Davis et al. 2021),

[5]Moreover, as discussed below, while we find that PE firms appear to target firms that are relatively larger, more profitable, and more leveraged (consistent with Cohn et al. 2022), we do not find evidence that PE firms appear to target firms with a significantly different supplier base.

[6]Other value-creation mechanisms, such as financial engineering, play a much more limited role in private firm buyouts than in public firm buyouts (also see Cohn et al. 2014; Guo et al. 2011).

supporting the validity of our empirical setup.

We then turn to our main research question and analyze the supply chain spillovers of PE buyouts. We find that, in the years following a buyout, suppliers of PE-backed firms outperform their matched controls in term of sales growth, employment, and profitability. These effects are statistically and economically significant. For instance, in the years following a PE deal, sales growth and employment are around 5% higher at suppliers of PE-backed firms relative to comparable suppliers of non-PE-backed firms.

Interestingly, however, we find that these positive effects disappear during periods of economic distress. In such periods, PE-backed firms outperform their peers even more strongly (consistent with Bernstein et al. 2019), but their suppliers show no performance advantage over the control group, while significantly reducing their markups by around 8%. This suggests that the benefits suppliers derive from PE-backed customers in normal times are muted during periods of economic distress.

To explain the mechanisms behind these results, we exploit heterogeneity in PE target type, customer-supplier relationships, and industry structure. We start by analyzing the mechanism behind the positive effects observed during normal times, and show that this result can be attributed to an increased demand channel. Specifically, as PE-backed firms expand their activities and pursue new growth opportunities, their suppliers seem to benefit from increased demand for inputs.

In line with this view, we first show that the increase in sales by affected suppliers is driven by purchases from PE-backed customers rather than other clients. To do so, we leverage the granularity of our data and transform our sample to the customer-supplier level, which allows us to include supplier-by-year fixed effects, enabling us to isolate demand for inputs from potential supply effects. Consistent with an increased demand channel, this analysis confirms that suppliers significantly increase sales to their PE-backed customers in the post-buyout period relative to other (comparable) customers.

Second, we show that the positive effects are larger for suppliers of PE-backed firms with larger growth opportunities. In particular, the positive spillovers are more pronounced for suppliers of target firms that had lower leverage prior to the buyout, which were arguably better positioned to pursue growth opportunities and drive higher demand after the buyout.

Third, consistent with an increased demand channel, we find that the positive spillovers are larger for suppliers on which target firms are highly dependent for inputs. Specifically, we find

that the positive spillovers are largest for suppliers providing a larger fraction of target' inputs and those that had maintained a longer relationship with the targets pre-buyout.

In addition to this direct demand effect, we find that affected suppliers experience a significant increase in new clients, especially clients from within the network of their PE-backed customer, consistent with a certification effect. That is, PE investors often have a reputation for excellence and a track record of success which, as our results show, can help their suppliers to gain new customers (e.g., by facilitating referrals or building credibility, see Dranove and Jin 2010). Nevertheless, as discussed in detail below, additional analyses indicate that the certification channel is quantitatively minor compared to the direct increase in demand from PE-backed customers.

We also analyze a series of alternative channels through which PE-backed firms might positively affect their suppliers, such as knowledge spillovers. However, as discussed below, we do not find evidence supporting these channels. This suggests that the positive impact of PE-backed customers on their suppliers is largely driven through increased demand for inputs rather than operational changes or technology transfer.

We then proceed by analyzing why the positive spillovers of PE-backed firms on their suppliers are muted during economic downturns. Consistent with survey and anecdotal evidence, we find that PE investors exert pressure on suppliers by negotiating more favorable terms or switching to alternative suppliers in order to achieve cost savings during periods of economic distress. For instance, survey results from Gompers et al. (2016) indicate that increased bargaining with suppliers to reduce costs is important in 16% of PE deals. The New York Times (2012) reports that Blackstone used its purchasing power to reduce the price of overnight FedEx shipments for its portfolio companies, illustrating how PE firms pressure suppliers to achieve cost savings.[7] The fact that this mechanism arises during economic downturns is consistent with the notion that general partners have unlimited liability (in principle), which creates strong incentives to implement cost-cutting measures when a portfolio company is in financial distress, for instance by exerting pressure on suppliers.

To support this conjecture, we first show that the muted spillovers are particularly pronounced when PE-backed firms face lower supplier switching costs. Given that PE-backed firms can more easily switch—or credibly threaten to switch—to alternative suppliers in such cases, we

[7]Similarly, after Bain Capital and Blackstone acquired Michaels Stores, the largest arts and crafts retailer in North America, they implemented a comprehensive cost-cutting strategy that included renegotiating supplier contracts and streamlining the distribution network (VM 2024).

would expect the muted spillover effect during economic downturns to be more pronounced. To explore this, we differentiate between suppliers offering differentiated versus standardized inputs (following the classification by Giannetti et al. 2011), as well as suppliers operating in more versus less competitive industries. Consistent with our hypothesis, we find that suppliers providing standardized inputs and operating in highly competitive industries experience more muted spillovers during economic downturns. Moreover, we observe a significant decrease in the markups of these suppliers during downturns, which aligns with the idea that PE firms actively renegotiate contract terms, as discussed earlier.

Second, we document that, during periods of economic distress, PE-backed firms strategically reconfigure their supply chains to achieve cost savings. In particular, when we transform our data to the customer-supplier level again, we find that, during periods of economic distress, PE-backed customers are significantly more likely to terminate relationships with suppliers that offer standardized goods or operate in highly competitive industries. This supports the notion that PE investors review their existing supply chain relationships in order to realize cost savings for their portfolio companies.

Further supporting this view, we also show that PE-backed firms increase the number of suppliers they rely on and decrease their cost of inputs, particularly during periods of economic distress. Overall, these findings support our conjecture that PE investors exert pressure on suppliers and reconfigure supply chains in order to realize cost savings for their portfolio companies when economic conditions deteriorate. This also reconciles survey evidence from Gompers et al. (2016) that PE investors bargain with suppliers to obtain better prices and realize cost savings for their portfolio companies and survey evidence from Bernstein et al. (2019) that PE firms intensify their engagement with portfolio companies during crisis periods.

In the final part of our paper, we extend our analysis beyond the first-order effects of PE buyouts on suppliers of target firms, and document that buyouts have significant second-order effects effects on the rivals of PE-backed firms that rely on common suppliers. Specifically, we find that suppliers are significantly more likely to terminate existing relationships with the rivals of their PE-backed customers (identified as firms operating within the same 4-digit NACE industry). This could be a result of capacity constraints from suppliers—which may prioritize their faster-growing PE-backed customers—or anti-competitive practices by PE-backed firms—which may engage in exclusive dealing agreements with suppliers. Rivals that lose a critical supplier suffer adverse consequences, including reduced sales, employment, and profitability,

highlighting the potential network-induced anti-competitive effects of PE buyouts.

Our findings hold for a battery of robustness checks. First, we estimate dynamic difference-in-differences models and show that there are no pre-trends, supporting the parallel trends assumption underlying our empirical framework. Second, we provide two falsification tests which mitigate that our results are driven by unobservable differences between suppliers of PE-backed and suppliers of non-PE-backed firms. In principle, if suppliers of PE-backed firms and suppliers of non-PE-backed firms were on different growth trajectories, one would expect to see divergent outcomes even for (1) canceled PE deals and (2) suppliers whose relationship with the PE-backed firm ended right before the buyout.[8] In contrast, we do not find differences in suppliers outcomes in either of these cases, suggesting that our results are unlikely to be driven by inherent supplier differences alone.

Third, we rule out alternative mechanisms. One could for instance think that our results may be driven by knowledge spillovers, as suppliers may learn from the operational and technological improvements of their PE-backed customers (Amiti et al. 2024; Isaksson et al. 2016). Although we do find increased hiring of highly educated employees and innovation activities at PE-backed firms, we do not find that this is the case for their suppliers, and we also do not find larger spillovers for suppliers of technology-intensive PE-backed firms, which is inconsistent with a knowledge spillover channel. Another potential mechanism is that PE buyouts may affect the trade credit terms between PE-backed firms and their suppliers (Billett et al. 2024). Inconsistent with this, we find no evidence that the accounts payable of PE-backed firms change post-buyout and only limited evidence of changes in the accounts receivable of their suppliers. Finally, we examine whether the reduction in markups during downturns is driven by pressure from PE investors or by the increased leverage of target firms which may serve as a bargaining tool. Contrary to the hypothesis that leverage or bankruptcy risk explain this effect, we find that the reduction in markups is not confined to suppliers of highly leveraged or financially distressed PE-backed firms, suggesting that PE investors directly exert pressure on suppliers.

Fourth, we show that our results hold using alternative measurement choices and matching models. In our baseline results, the identification assumption is that two suppliers with matching characteristics, before a PE buyout, would have had otherwise similar outcomes had the PE buyout never taken place. In robustness, we apply a stricter matching strategy which is based on

[8]The latter falsification test is similar to the one applied by Agrawal and Tambe (2016). They study the impact of PE investments on workers' career paths and argue that, if PE-backed firms produce workers with different levels of ex-post employability than non-PE-backed firms, one would expect to see divergent career paths even for workers who exit PE-backed firms before the PE buyout. In contrast, they do not find differences in the long-run careers of these workers.

matching suppliers on their own characteristics as well as the characteristics of their customers. In this setting, the identification assumption is that two suppliers with matching characteristics who have customers that, on average, have similar characteristics, before a PE buyout, would have had otherwise similar outcomes had the PE buyout never taken place. We show that our results hold even using this stricter matching model.

Fifth, one could wonder whether, ex-ante, PE investors take into account firms' supply chain structure in their investment decisions. For example, PE funds might target firms that, on average, face lower switching costs vis-à-vis their suppliers. Inconsistent with this, we do not find evidence that a firm's supply chain structure affects its probability of being acquired by a PE fund.

In sum, while there is a growing academic and policy interest in the real effects of PE buyouts, there is no evidence on the network effects of PE buyouts. We address this research gap using unique data on buyer-supplier relationships and PE buyouts from Belgium. Our findings reveal that, in normal times, PE-backed firms have positive spillovers on their suppliers, primarily through increased demand for inputs. However, during economic downturns, these positive effects disappear as PE investors exert pressure on suppliers to achieve cost savings. Moreover, beyond the direct effect of PE-backed firms on their suppliers, we document that there can be externalities on competitor firms through common supplier networks. Overall, our study thus highlights the role of PE investors in shaping production networks and deepens our understanding of how they create and extract value.

Our paper contributes to several strands of research. First, our paper contributes to a large strand of literature that studies the real effects of PE buyouts. Most studies in this literature have focused on how PE buyouts affect target firms and, in general, have documented positive effects on firm growth (Acharya et al. 2013; Boucly et al. 2011; Bansraj et al. 2024; Cohn et al. 2022; Davis et al. 2014; Fracassi et al. 2022; Kaplan 1989; Lichtenberg and Siegel 1990) managerial practices (Bernstein and Sheen 2016; Bloom et al. 2015), innovation activities (Lerner et al. 2011), and firm resilience during crisis periods (Bernstein et al. 2019).[9]

In recent years, a growing strand of research has focused on how PE buyouts affect stakeholders, including the employees, consumers, and rivals of PE-backed firms. The empirical evidence on the effect on employees and consumers is rather mixed,[10] while the effect on rivals seems positive

[9]For a more extensive overview on the real effects of PE buyouts, see Kaplan and Strömberg (2009), Bernstein (2022), or Ljungqvist (2024). For an overview of the literature on PE fund performance, see Kaplan and Sensoy (2015) or Korteweg (2019).

[10]Using US firm-establishment data, Davis et al. (2014) find moderate declines in employment and income after PE buyouts. In Germany, Antoni et al. (2019) report reduced employment, higher turnover, and lower wages post-buyout. Agrawal and Tambe

(e.g., Aldatmaz and Brown 2020; Bernstein et al. 2017; Chevalier 1995a, 1995b). For instance, Bernstein et al. (2017) find that firms operating in industries with more PE investments grow more rapidly than other firms. Our paper extends the literature by analyzing the effect of PE buyouts on firms' supply chain partners, an important group of stakeholders that has so far been neglected.[11]

Second, our paper contributes to a growing body of research that studies the effects of shocks to production networks (Acemoglu et al. 2012). Previous papers in this field have for instance studied how natural disasters (Barrot and Sauvagnat 2016; Boehm et al. 2019; Carvalho et al. 2021; Ersahin et al. 2024; Giroud and Mueller 2019; Pankratz and Schiller 2024), credit and liquidity shocks (Alfaro et al. 2021; Boissay and Gropp 2013; Costello 2020; Giannetti et al. 2021), bankruptcy (Hertzel et al. 2008; Jacobson and Von Schedvin 2015), cyberattacks (Crosignani et al. 2023), common ownership (Fee et al. 2006; Freeman 2023), or horizontal and vertical mergers (Bhattacharyya and Nain 2011; Fee and Thomas 2004; Luco and Marshall 2020; Shahrur 2005) propagate through the supply chain. Our paper contributes to this literature by documenting the network effects of the PE buyouts. Given that PE firms are often criticized for using aggressive short-term value-creation strategies,[12] while the resilience of supply chains rests on long-term investments (Elliott et al. 2022; Khanna et al. 2022), our findings offer valuable policy-relevant insights into how PE investors influence production networks.

The remainder of the paper is organized as follows. In Section 2, we describe our data sources and position the PE industry in Belgium compared to the rest of the world. Section 3 then explains the empirical methodology used in our analysis. Section 4 presents our main results, the possible mechanisms behind our results, and a battery of robustness tests. Finally, Section 5 summarizes our findings and conclusions.

(2016), using US individual level data, show that PE buyouts boost IT investments, which in turn enhances employees' human capital and wages. Other studies find positive effects on workplace safety (Cohn et al. 2021), insignificant effects on health (Garcia-Gomez et al. 2024), and negative effects on job satisfaction (Gornall et al. 2024; Lambert et al. 2021). Evidence on the impact of PE buyouts on consumers is mixed and often focused on specific industries, such as retail (Chevalier 1995b, 1995a; Fracassi et al. 2022; Pursiainen and Tykvova 2022), healthcare (Aghamolla et al. 2023; Duggan et al. 2023; Gao et al. 2021; Gupta et al. 2024; Liu 2022), life insurance (Kirti and Sarin 2024), firearms (Hüther 2023), banking (Johnston-Ross et al. 2024), newspapers (Ewens et al. 2022), education (Eaton et al. 2020), airports (Howell et al. 2022), fracking (Bellon 2020), and energy (Andonov and Rauh 2022; Bai and Wu 2023).

[11] In a related paper, Brown et al. (2009) study how suppliers' stock prices react to customers' leveraged buyout (LBO). Four key differences distinguish our analysis from theirs: First, while they mainly rely on stock price reactions to infer the impact of LBOs on suppliers, we leverage firm-to-firm sales and detailed financial statement data to provide a more granular analysis of how PE buyouts affect supplier outcomes. Second, while they focus on public firm buyouts, we study private firm buyouts. This distinction is crucial, as private firm buyouts constitute the majority of PE deals globally and often differ substantially from PE deals involving public firms. Third, while they emphasize a bargaining power effect, arguing that LBOs enhance firms' leverage to extract supplier concessions, we show that the effects of PE buyouts on suppliers depend on economic conditions. Specifically, PE-backed firms drive supplier growth in normal times through increased input demand but impose cost-saving pressures during downturns. Fourth, while they only study the effect on suppliers, we also analyze indirect spillovers on rivals of PE-backed firms with common suppliers.

[12] PE firms have distinct incentives to rapidly and substantially increase the value of their portfolio firms as they employ large amounts of leverage, aim to liquidate investments within a short time frame, compensate fund managers through a call option-like share of the profits, and do not have existing relationships with target firm stakeholders (Kaplan and Strömberg 2009).

2. Data

Our primary data source is the business-to-business (B2B) transactions database administered by the National Bank of Belgium. This dataset records the universe of firm-to-firm transactions among all VAT-liable firms in Belgium on an annual basis (for details, see Duprez et al. 2023), which enables us to identify firms' buyers and suppliers (the extensive margin) as well as the sales amount between each buyer-supplier pair (the intensive margin)—as discussed below, the latter is essential for analyzing the mechanisms driving our results.[13] Our second data source is the annual accounts database from the National Bank of Belgium. This dataset contains detailed information from firms' balance sheets on sales, revenues, costs of inputs (such as capital, labour, and intermediates), as well as firms' 4-digit (NACE) industry code and zip code.[14]

We apply the following filters to our data sample (as in Bernard et al. 2022; Dhyne et al. 2022). First, we select private Belgian firms operating in the non-financial sector that report positive sales and labor cost, and at least one full-time equivalent employee (to avoid potential issues with shell or management companies). Second, we further select firms that report tangible assets of more than 100 euro and positive total assets for at least one year throughout our sample period. Finally, we keep only the set of firms that are active in the production network. This results in a final data sample that yields 231,772 unique firms over the period 2002–2022. Descriptive statistics of the data sample are reported in Panel A of Table 2.

We merge these data with data on PE transactions involving Belgian target firms obtained from Orbis M&A (formerly Zephyr), one of the most comprehensive databases on PE transactions in Europe. Following prior literature, we restrict our focus to transactions for which the deal type is equal to "Private equity" or "Institutional buy-out" as well as all transactions for which the deal type is equal to "Acquisition" and the deal financing is equal to either "Leveraged buyout" or "Private equity." This ensures that we focus on later-stage buyout transactions and exclude venture capital investments, which differ in important ways (Davis et al. 2014; Lambert et al. 2021). Further, we require for all transactions that the acquirer is an institutional investor, the initial stake in the firm is less than 50% and the final stake is larger than 75%. To mitigate

[13] By law, all Belgian firms are required to report yearly sales values of at least 250 euro. The Belgian tax authorities impose pecuniary sanctions for late or erroneous reporting, which ensures a very high quality of the data.

[14] Note that the unit of observation in these datasets are VAT-IDs, and one firm can potentially have multiple VAT-IDs. Following Dhyne et al. (2021), we aggregate VAT-IDs up to the firm level using ownership filings in the annual accounts and foreign ownership filings in the Balance of Payments survey. The Balance of Payments survey reports for each VAT-ID, the name of foreign parent firms that own at least 10% share, along with the associated ownership share. We group all VAT-IDs into firms if they are linked with more than or equal to 50% of ownership or if they share the same foreign parent firm that holds more than or equal to 50% of their shares.

potential concerns that Orbis M&A may not cover all PE deals, we further complement this data with PE deals obtained from S&P Global (Capital IQ). Ultimately, this results in 294 PE buyouts of Belgian firms between 2002 and 2021. The Bureau van Dijk (BvD) identifier in Orbis M&A corresponds to the VAT number for Belgian firms, allowing us to directly link the PE transactions data to the firm B2B and financial statement data explained above. We manage to match approximately 70% of the transactions to the VAT number of a firm in our data sample (after applying the filters mentioned above).[15] For each firm, we record the year of the first PE transaction that we observe as the buyout year.

2.1. PE activity in Belgium

In general, the Belgian PE buyouts in our data sample are relatively comparable to PE buyouts in the rest of the world. First, Figure 1 shows the number of PE buyouts per year in our sample. Overall, the number of buyouts gradually increases from 2002 until 2007 when it peaks, followed by a severe drop in the aftermath of the global financial crisis. The number of deals then slowly recovers followed by a decrease in the years 2011-2013, after which it strongly increases in the years 2014-2015. In 2018 there is a small dip, after which the number of deals increases again until the end of our sample period. These patterns are similar to the evolution recorded by Aldatmaz and Brown (2020) for their global sample of PE deals. In terms of the total number of deals, our sample obviously includes less deals than the sample of US deals from Davis et al. (2014) and French deals from Boucly et al. (2011), but this is primarily due to the fact that these economies are several times larger than the Belgian economy. Accounting for differences in size of the economy, Belgian PE activity seems comparable to that of the US or France, for instance (with the average ratio of PE buyout capital over GDP being equal to 0.172%, 0.053%, 0.049% in the US, France, and Belgium over the period 1990–2017, respectively, as reported by Aldatmaz and Brown 2020).

The types of sellers involved in our sample of Belgian transactions does not differ much from the typical transactions in the rest of the world. Three points are worth highlighting. First, only 4% of the deals in our sample are public-to-private transactions, a number close to the 7% found in the sample of global PE deals documented by Strömberg (2008). In Belgium, as in the world, about 55% of PE transactions are pure private-to-private transactions. Second, divisional buyouts comprise 23% in our sample, compared to 26% in Strömberg's sample. Finally,

[15] This match rate is comparable to the one obtained by Davis et al. (2014) with US data and Boucly et al. (2011) with French data, for instance.

secondary buyouts (i.e., transactions involving a financial vendor) comprise 19% in our sample compared to 13% in Strömberg's sample.

Third, average deal size is also very similar to international data. Looking at enterprise value, Strömberg (2008) documents that the mean deal size is $389 million in the US and $280 million in the UK over the period 2001-2007, while Boucly et al. (2011) reports a mean deal size of $395 million in France over the period 1994–2004. These figures are comparable to the median deal size of $280 million in our sample of Belgian deals. The PE firms in our sample are also representative of the universe of PE firms around the world. Among the 147 sponsors backing the deals in our sample, there are both very large sponsors (such as CVC Capital Partners, The Carlyle Group, and Goldman Sachs Capital Partners) as well as small ones (such as Bencis Capital Partners). The majority (50%) of PE firms in our sample are Belgian firms which are, on average, small (with $1.1 billion of assets under management). US, UK, and Dutch funds are common (10%, 10% and 16%, respectively, of the deals in our sample) and, on average, larger (with $4.5 billion of assets under management). In sum, domestic funds are prevalent but an important fraction of deals are backed by larger US or UK based funds.

One difference compared to US buyouts is that the target firms in our sample are slightly older than the typical US targets, but this accords with the idea that PE buyouts involve more mature firms in continental Europe than in the US or the UK (Boucly et al. 2011). For instance, in the sample of Davis et al. (2014), about 50% of targets are more than 10 years old and 25% are less than 5 years old. In our sample, 78% of targets are more than 10 years old, and only 6% are younger than 5 years old. Nevertheless, it should be stressed that the treated firms in our sample do not systematically differ from their matched control firms on the age dimension (even though age was not a criterion in the matching procedure), which mitigates potential concerns that our results would be driven by the effect of firm age on firm performance for instance.

3. Methodology

The main objective of our study is to analyze the spillover effects of PE buyouts on the suppliers of PE targets. In this respect, a common identification challenge is that PE buyouts are non-random, which could lead to endogeneity issues. However, unlike other studies, we do not focus on target firms but on the suppliers of those firms, which addresses many endogeneity concerns; In support of this argument, additional analyses presented in Section 4.4.5 indicate that PE investors do not take into account firms' supply chain structure in their investment

decisions. Nevertheless, to mitigate any remaining concerns, we use the granularity of our data to construct a control group of comparable firms (as in Davis et al. 2014; Boucly et al. 2011; Cohn et al. 2021), and run stacked difference-in-differences regressions to analyze the supply chain spillovers of PE buyouts.[16]

To do so, for each PE event, we first identify the suppliers of each target firm and match those with a group of control firms. Following previous papers, we apply nearest neighbor propensity score matching (PSM) with replacement, where we require the potential matches to have similar size (total assets), leverage, and profitability (EBITDA) as the supply chain partners of the acquired firms in the year before the event. Further, we require potential matches to be in the same 4-digit NACE industry as the treated supply chain partners and to have data available at least in year $t-1$ and $t+1$. In robustness checks, discussed below, we show that our results are insensitive to the matching procedure or matching variables used. After the matching procedure, we retain the five closest control firms of each treated firm. The resulting control-treatment groups are called cohorts. The implicit assumption is that firms in the same cohort would follow a similar trend in the absence of the treatment, in which case the control firms are an appropriate counterfactual for the treated firms.

We restrict our analysis to cohorts in which the PE-backed customer accounted for at least 5% of the treated supplier's total sales prior to the PE deal, to ensure that the treatment effect is economically meaningful. Then, we track the firms in each cohort for four years prior to the event until five years after the event (as the typical holding period for target firms is three to five years, see Kaplan and Strömberg 2009). Finally, we stack all cohorts together and compare the outcomes of treated firms (relative to their control group) after (versus before) a customer of the treated firms was acquired by a PE firm. Specifically, we estimate the following regression:

$$y_{i,t,c} = \beta \cdot Post\ PE_{i(j),t,c} + \gamma \cdot X_{i,t-1} + \lambda_{i,c} + \lambda_{t,c} + \epsilon_{i,t,c} \tag{1}$$

where i, j, t, and c correspond to supplier, customer, time, and cohort, respectively. $y_{i,t,c}$ represent various firm level outcomes, including total sales, profitability, employment, and markups. The latter are computed following De Loecker and Warzynski (2012), by estimating

[16] Recent studies in econometrics have shown that the use of standard two-way fixed effects models generates biased estimates in settings with staggered timing of treatment assignment or treatment effect heterogeneity. Baker et al. (2022) review the alternative estimators proposed in the literature and find that a stacked difference-in-differences estimator allows to identify the true treatment effects. Gardner et al. (2024) further show that a stacked design is equivalent to estimating an average treatment effect in each cohort and then taking the average of the cohort-specific estimators, weighted by the relative sizes of the cohorts. Therefore, the stacked difference-in-differences estimator is similar to the idea proposed by Sun and Abraham (2021) and Callaway and Sant'Anna (2021) to estimate separate average treatment effects in different groups and then aggregate these estimators to form an overall estimate of the treatment effect.

industry level revenue production functions using the Ackerberg et al. (2015) control function estimator (see Appendix O.B for more details on the estimation procedure).[17,18]

Our independent variable of interest is $Post\ PE_{i(j),t,c}$ which is an indicator variable equal to one in the years after customer j of supplier i in cohort c was acquired by a PE firm. $X_{i,t-1}$ is a vector of lagged control variables. In principle, the strict matching procedure used to construct cohorts of treated and control firms reduces the need for additional control variables. However, in robustness checks, we demonstrate that our results remain consistent when we include additional controls. $\lambda_{i,c}$ and $\lambda_{t,c}$ are firm-by-cohort and year-by-cohort fixed effect, respectively. The former ensure that we exploit within-firm variation and that our estimates are not affected by unobservable differences between the treated and control firms (as long as the unobservable differences are time-invariant within a cohort). The latter account for any time-specific unobserved heterogeneity. We cluster standard errors at the firm-cohort level.

In essence, our identification strategy compares within-firm dynamics of firms that supply inputs to PE-backed firms and control firms with similar observables in the same industry and year. The key identification assumption is that two suppliers with matching characteristics before a PE buyout would have had similar outcomes had the PE buyout never taken place. First, to confirm the validity of our matching approach, panels (a) and (b) of Figure 2 presents balance diagnostics for suppliers of PE-backed firms and suppliers of non-PE-backed firms before and after applying our matching strategy explained above. We can observe that, after matching, the average size, leverage, and profitability are remarkably similar for treated and control groups. This can be derived from the fact that the standardized mean differences are generally between -20% and 20% after matching, indicating that the variables are well-balanced. We also observe that, after matching, the treated and control firms are similar in terms of employment, tangible assets, age, and markups, among others, even though these variables are not used in our matching procedure. Importantly, as we discuss below, the treated and control suppliers in our matched sample also follow similar trends prior to PE events, which is what ultimately matters for the validity of our empirical methodology.

[17]We assume capital, labor, and materials as variable inputs in the markup estimation procedure. As the data do not record the physical output of Belgian firms, we rely on revenue data in estimating firm level markups. A potential concern is that this may lead to mis-measurement in the output elasticity and, hence, markups. However, De Ridder et al. (2022) show that the markups that are based on revenue data for firms under oligopolistic competition are estimated well in terms of dispersion, while they may be biased in levels.

[18]As is common in the literature, we restrict our sample for estimating markups to firms in the manufacturing sector as firms in the services sector differ substantially in terms of their input-output conversion processes and their higher ratio of intangible assets, among others.

4. Results

4.1. The effect of PE buyouts on target firms

Before turning to our main analysis on the supply chain spillovers of PE buyouts, we validate our empirical setting by analyzing the effect of PE buyouts on target firms. Prior research has argued that, in the case of private firm buyouts, PE firms improve targets' access to debt financing, allowing them to take advantage of new growth opportunities (e.g., Boucly et al. 2011; Cohn et al. 2022). To test this hypothesis, we analyze how PE buyouts affect target firms' financial leverage and growth. To do so, we employ the matching strategy explained earlier and compare the outcomes of PE targets with (matched) control firms using stacked difference-in-differences regressions.

The results are reported in Table 3. First, column (1) shows that, relative to control firms, target firms' financial leverage ratio significantly increases in the years after the transaction.[19] Columns (2)–(4) further show that, after a PE transaction, target firms also grow faster than control firms. For instance, columns (2) and (3) imply that, relative to control firms, target firms' total sales and employment increases by around 22% and 16%, respectively, in the five years following the PE transaction. Table O.A2 in the Appendix shows that these effects are more pronounced for target firms that were more financially constrained pre-buyout, which further supports the idea that PE firms increase targets' access to debt financing, allowing them to take advantage of new growth opportunities (consistent with, e.g., Boucly et al. 2011; Davis et al. 2021).

4.2. The supply chain spillovers of PE buyouts

We now turn to the findings from our main analysis, which studies the spillover effects of PE buyouts on suppliers of PE-backed firms.

We start by estimating Equation (1) to assess the spillovers of PE buyouts on the suppliers of PE-backed firms. Table 4 reports the results, with the natural logarithm of sales, employment, EBITDA, and markups as outcome variables across the different columns. In general, we find that PE buyouts seem to have a positive impact on the suppliers of PE-backed firms. Columns (1)–(3) for instance indicate that, after a PE transaction, suppliers of PE-backed firms report an

[19] The debt raised for a PE buyout is typically borne by a holding company and therefore does not appear in the unconsolidated accounts reported to the tax authorities (Boucly et al. 2011). Thus, the positive effect on target firms' leverage indicates that the PE buyout allows firms to raise debt beyond what has been raised by the PE firm to finance the buyout.

increase in sales growth, employment, and EBITDA of 6%, 4%, and 6%, respectively, compared to similar suppliers of non-PE-backed firms. Column (4) further shows that there is no significant change in treated suppliers' markups, suggesting that PE firms do not necessarily exert pressure on suppliers for lower input prices.

Next, an important question is how PE investors affect the economic resilience of their portfolio companies and their supply chain partners. If PE firms employ aggressive short-term value-creation strategies, they may attempt to improve the financial performance of their portfolio companies by cutting costs, renegotiating existing contracts with suppliers, or shifting to alternative suppliers that offer short-term cost advantages.[20] Following prior literature (e.g., Bernstein et al. 2019; Khanna et al. 2022), we test this hypothesis by examining how PE ownership impacts both target firms and their supply chain partners' ability to withstand economic shocks. Specifically, we adapt Equation (1) by interacting our main independent variable of interest (*Post PE*) with a dummy variable (*Economic Downturn*) which takes the value of one during economic downturns, as identified by the OECD recession indicators for Belgium.

The results are reported in Tables 5 and 6, which show how economic downturns impact PE-backed firms and their suppliers, respectively. Consistent with Bernstein et al. (2019), Table 5 shows that PE-backed firms outperform their peers even more strongly during economic downturns. For instance, Column (2) show that the sales of PE-backed firms is 32% higher during economic downturns compared to 15% higher during normal times (relative to their matched controls). Based on survey evidence, Bernstein et al. (2019) report that a potential explanation for this finding may be that PE firms are more active investors and spend more time working with their portfolio companies during crisis periods.

In contrast, Table 6 shows that suppliers of PE-backed firms do not outperform suppliers of non-PE-backed firms during economic downturns. The negative interaction terms in columns (1)–(3) suggest that the positive effects observed for suppliers of PE-backed firms during normal times disappear during economic downturns. In addition, column (4) indicates that, during periods of economic distress, suppliers of PE-backed firm reduce markups by around 8% compared to their matched controls.

[20] PE investors have significant incentives to reduce costs during periods of financial distress. This arises from the fact that (in theory) general partners have unlimited liability for the PE fund's losses. Consequently, when a firm is in financial distress, the general partners have a strong incentive to implement cost-cutting measures to retain control and maximize the potential upside of the investment. Consistent with this, survey evidence from Bernstein et al. (2019) reports that PE investors significantly increase their engagement with portfolio companies during crisis periods.

Robustness tests discussed in Section 4.4 show that our findings are very robust. For one, dynamic difference-in-differences models support the parallel trends assumption underlying our estimates, and falsification tests confirm that our results are not driven by other, inherent differences between suppliers of PE-backed firms and suppliers of non-PE-backed firms. Before discussing these robustness tests in more detail, we study the mechanism behind our findings in Section 4.3 below.

4.3. Mechanism

We first analyze the mechanism behind the results reported in Table 4, which indicate that, on average, suppliers of PE-backed firms outperform their peers. In this section, we focus on two potential mechanisms; (1) increased demand and (2) certification (other potential mechanisms are discussed in Section 4.4.3). To do so, we exploit heterogeneity in supplier characteristics, target firm characteristics, and customer-supplier relationships.

First, if the positive spillovers stem from increased orders by PE-backed customers, we would expect these effects to be stronger for target firms with greater growth potential. Panel A of Table 7 confirms this conjecture, showing that the effects are more pronounced for suppliers of target firms that had lower leverage prior to the buyout, which were arguably better positioned to pursue growth opportunities and drive higher demand after the buyout.

Second, in line with an increased demand channel, Panels B and C of Table 7 show that the positive spillovers are largest for suppliers on which target firms are highly dependent for inputs. Specifically, in Panel B, we classify suppliers based on whether they represent a below- or above-average share of their customers' inputs, and find that the positive spillovers are largest for suppliers providing a larger fraction of target firms' inputs. In Panel C, we split our sample based on the duration of the supplier's relationship with the PE-backed customer. As long relationships typically indicate greater dependence for inputs, an increased demand channel would predict stronger effects for such cases. Consistent with this, we find that our results are more pronounced for suppliers that had a long relationship with the PE-backed customer.

Third, we exploit the granularity of our dataset and transform the data to the customer-supplier level in order to analyze whether, consistent with an increased demand channel, treated suppliers benefit from a significant increase in purchases from PE-backed customers compared to other (comparable) customers. In particular, for each treated supplier, we identify its PE-backed and non-PE-backed customers. Then, we apply our matching approach in order to match PE-

backed customers with comparable non-PE-backed customers from the same supplier (similar to the approach of Benincasa et al. 2024). For each matched pair, we track customer-supplier relationships for four years prior to and five years following the event and estimate the following regression:

$$y_{i,j,t} = \beta \cdot Post\ PE_{j,t} + \lambda_{i,t} + \lambda_j + \lambda_{i,j} + \epsilon_{i,j,t} \tag{2}$$

where $y_{i,j,t}$ corresponds to the purchases from customer j at supplier i in year t. The independent variable is a dummy variable equal to one in the years after customer j was acquired by a PE firm. An important advantage over our baseline regression model is that the regression is at the customer-supplier level (rather than the supplier level), which allows us to include supplier-by-year, customer, and customer-by-supplier fixed effects, represented by $\lambda_{i,t}$, λ_j, and $\lambda_{i,j}$, respectively. The supplier-by-year fixed effects capture unobserved time-varying supplier-specific heterogeneity (such as changes in productivity) and enable us to isolate changes in PE-backed firms' demand from potential supply effects. The customer fixed effects control for time-invariant customer-specific characteristics (such as inherent differences between PE-backed and non-PE-backed firms), and the customer-by-supplier fixed effects control for time-invariant supplier-customer relationship characteristics (such as geographic proximity). The error term is clustered at the customer level.

The results are reported in Table 8. Across the different columns, we gradually saturate the regression with fixed effects to assess the stability of the coefficient estimates. The results consistently show a significantly positive coefficient, which supports the notion that PE suppliers benefit from increased input demand from PE-backed customers, and indicates that the firm level increase in suppliers' sales documented in Table 4 is primarily driven by purchases from PE-backed customers rather than other clients. Taking into account that the average sales share of treated suppliers to their PE-backed customers is around 25% in the sample used for the estimations in Table 8, the economic magnitudes across the two specifications are also highly comparable, confirming that the observed firm level sales growth is attributable to supplying inputs to PE-backed firms post-buyout.[21]

Alternatively, PE-backed firms could indirectly affect their suppliers through a certification channel; A company is often known by the customers it keeps (Simonin and Ruth 1998), and it is common to see firms being referred to by their famous customers.[22] This mechanism is

[21]The coefficient estimate of 0.06 in column (1) of Table 4 is close to the coefficient estimate of 0.18 in column (3) of Table 8 multiplied by 0.25.

[22]For example, Foxconn, a Taiwanese electronics manufacturer with approximately 2.5 billion USD market capitalization, is often

particularly relevant in our context, as PE investors typically have a reputation for excellence and an extensive network, which can benefit the suppliers of PE-backed firms by facilitating referrals, signaling quality, or reducing search costs for potential customers (Cai et al. 2024; Dranove and Jin 2010).

To investigate this channel, we first examine whether suppliers of PE-backed firms experience an increase in their customer base post-buyout. Indeed, column (1) of Table 9 show that, following a PE buyout, suppliers of PE-backed firms gain on average 3 new customers. Based on the certification channel, we would expect that affected suppliers gain customers that are within the PE-backed firms' network. To test this, we use the production network data to distinguish between customers within and outside of a PE-backed firm's network that the treated and control suppliers of a given cohort sell to (similar to Amiti et al. 2024). The results are reported in columns (2) and (3), which show that, consistent with our prediction, affected suppliers increasingly deal with customers that are in the PE-backed firms' network, providing further support for a certification channel.

Consequently, one may wonder about the quantitative importance of the direct demand channel versus the certification channel. We address this question in the Appendix O.C, where our detailed analysis indicates that the direct demand channel is the primary driver of the positive effect observed for suppliers of PE-backed firms during normal periods. Furthermore, as discussed in Section 4.4.3 below, we explore several alternative channels through which PE-backed firms might benefit their suppliers, such as knowledge spillovers, but we find no evidence supporting these mechanisms. This suggests that the positive impact of PE-backed customers on their suppliers during normal times is largely "passive"—through increased demand rather than technology transfer or operational changes.

We then turn to the performance of suppliers of PE-backed firms during economic downturns. As shown in Table 6 earlier, while treated supplier outperform their peers during normal times, this does not hold during economic downturns. At the same time, Table 6 shows that during such periods, suppliers of PE-backed firms significantly reduce markups compared to their peers. As explained below, we find that these results are driven by cases where the PE-backed firm faces lower switching costs, consistent with the idea that PE investors renegotiate contracts with existing suppliers or shift to alternative suppliers that offer short-term cost advantages to realize cost savings for their portfolio companies.

referred to as Apple supplier Foxconn. Similarly, Lamb Weston, one of the world's largest producers and processors of frozen french fries, is often introduced as a key supplier of McDonald's.

To provide empirical evidence in line with this conjecture, we first design two tests that compare the spillovers of PE buyouts on suppliers for which the PE-backed firms face low versus high switching costs. First, we differentiate between suppliers offering differentiated versus standardized inputs (following the classification by Giannetti et al. 2011). Suppliers of services and differentiated products are generally more difficult to replace as they provide unique or highly customized inputs (Cunat 2007). Panel A of Table 10 shows that the negative interaction term observed during economic downturns is more pronounced for suppliers that offer standardized inputs. Moreover, these suppliers significantly reduce their markups during such periods. This is consistent with the idea that PE firms exert pressure on suppliers to negotiate lower prices and realize cost savings for their portfolio companies, as reported by some PE firms in the survey by Gompers et al. (2016) and highlighted in media sources (e.g., The New York Times 2012).[23]

Second, we compare the outcomes of suppliers that operate in industries with high versus low competition. Assuming that firms face lower switching costs for suppliers in industries with more competitors (as there are more alternative suppliers from which the firm could obtain inputs), we would expect the negative interaction effect observed during economic downturns to be more pronounced for those suppliers. Consistent with this view, Panel B of Table 10 show that the negative interaction effect is more pronounced for suppliers in more competitive industries, and that these suppliers also reduce their markups during such periods.

Third, we transform our data back to the customer-supplier level and extend Equation (2) to study whether PE-backed customers reconfigure their supply chain during economic downturns. Specifically, we analyze the probability of PE-backed customers terminating existing customer-supplier relationships and the role of switching costs in this decision (based on the two proxies of switching costs introduced earlier). Given our identification strategy, we essentially assess the probability that a PE-backed customer versus a control customer terminates its relationship with the same supplier within the same year.

The results reported in Table 11 show that, on average, PE-backed customers are 10 percentage points less likely to terminate existing customer-supplier relationships compared to control customers. However, Panels A and B of Table 12 reveal that PE-backed customers become significantly more likely to terminate relationships with suppliers during economic downturns if switching costs are low. This finding suggests that, during economic downturns, PE-backed

[23]For example, an article by The New York Times (2012) highlights how Blackstone used its purchasing power to reduce the price of overnight FedEx shipments for its portfolio companies, illustrating how PE firms pressure suppliers to achieve cost savings.

customers reconfigure their supply chains at least as aggressively as their non-PE-backed peers.

Finally, in Table 13 we turn our attention to the target firms, and provide additional evidence consistent with our conjecture that they adjust their supplier networks during economic downturns, allowing them to realize cost savings. Column (1) and (2) first show that PE-backed firms significantly increase the number of suppliers they rely on, particularly during periods of economic distress, suggesting that they actively diversify their procurement sources. Furthermore, column (3) shows that targets' cost of inputs to total sales decreases on average, while column (4) shows that this reduction is primarily observed in periods of economic distress. The coefficient estimate in column (4) implies a reduction of 2 percentage points in the cost of inputs to total sales, which is not only statistically but also economically significant. Overall, our findings imply that PE firms help their portfolio companies achieve cost savings during periods of economic distress by renegotiating contracts with existing suppliers and reconfiguring their supply chain (consistent with survey evidence from Gompers et al. 2016). More broadly, these findings align with the notion that PE firms intensify their engagement with portfolio companies during crisis periods, as documented by Bernstein et al. (2019).

4.4. Extensions

4.4.1. Parallel trends assumption

Our research design is a generalized difference-in-differences model, using granular fixed effects and comparable suppliers of non-PE-backed firms as controls. A potential concern could be that PE buyouts are non-random, which could lead to endogeneity issues. For instance, PE firms may target firms that have higher growth potential, which could bias the estimated effect of PE buyouts on target firms' outcomes. As mentioned earlier, a key advantage of our paper is that we do not focus on target firms but on the suppliers of those firms, which addresses many endogeneity concerns. Nevertheless, we estimate dynamic difference-in-differences event studies to see whether target firms and their suppliers appear to be on different growth trajectories than their controls before the buyout. Specifically, we estimate the following regression model:

$$y_{i,t,c} = \sum_{\tau=-4,\tau\neq-1}^{\tau=+5} \beta_\tau \cdot (Post\ PE_{i(j),t,c} \times I_{\tau=t}) + \lambda_{i,c} + \lambda_{t,c} + \epsilon_{i,t,c} \tag{3}$$

where $I_{\tau=t}$ are leads and lags in event time, with $\tau = -1$ being the reference category.

Figures O.A2a–O.A2d present the estimates for target firms, and Figures 3a–3d present

the results for suppliers of PE-backed firms. The figures generally support the parallel trends assumption underlying our difference-in-differences regressions, as the the coefficients are close to zero and statistically insignificant in the periods prior to a PE buyout. This suggests that target firms and their suppliers were not on different growth trajectories compared to their controls before the PE buyout took place, supporting the validity of our empirical methodology.

4.4.2. Falsification tests

One alternative explanation for our findings could be that PE-backed firms and non-PE-backed firms historically have relationships with different types of suppliers. These differences may result from the ex-ante sorting process by which customers and suppliers match before a PE buyout. If the matching variables do not sufficiently capture such differences, this could explain the observed differences in supplier outcomes post-buyout.

To rule out this alternative explanation, we conduct two falsification tests. First, we repeat our baseline analysis, but focus on suppliers whose relationship with a PE-backed firm ended right before the PE buyout took place, and analyze their outcomes relative to matched control suppliers. If PE-backed firms and non-PE-backed firms historically have relationships with suppliers that have different levels of ex-post growth potential—even in the absence of the PE event—then one might expect to see divergent outcomes for suppliers whose relationship with the PE-backed firm ended before the PE buyout.

In contrast, however, Panels A and B of Table O.A3 in the Appendix illustrates that there are no significant differences in our estimates for suppliers whose relationship with the PE-backed firm ended right before the PE event. Across all columns of both panels, the treatment estimates for this sample are economically small and statistically insignificant. The findings suggest that the differences in outcomes of suppliers of PE-backed firms are not explained by systematic differences in the types of suppliers who have relationships with PE targets versus non-PE targets.

Second, we repeat our baseline analysis using canceled PE deals (e.g., Agrawal and Tambe 2016; Faccio and Hsu 2017). If PE firms target companies with suppliers that have above-average growth opportunities, then one might expect to see divergent outcomes for suppliers of PE targets and non-PE targets, even if the PE deal was not completed in the end (e.g., because the deal was withdrawn). Panels A and B of Table O.A4 in the Appendix shows that this is not the case. Across all columns of both panels, we do not find statistically significant treatment effects

for canceled deals, which further supports that our baseline findings are not driven by systematic differences in suppliers who have relationships with PE targets versus non-PE targets.

4.4.3. Alternative channels

We examine several alternative channels through which PE-backed firms could influence their suppliers. First, we assess the potential role of knowledge spillovers. Various studies have shown that the technological and operational advancements of one company can spill over to others within the same industry or across the supply chain (Aghion and Jaravel 2015; Alfaro-Urena et al. 2022; Amiti et al. 2024; Grossman and Helpman 1991). As prior research has found that PE investors improve the managerial practices and innovation activities of their portfolio companies (Bloom et al. 2015; Lerner et al. 2011), the suppliers of these firms could benefit by learning about innovative technologies or operational practices adopted by their PE-backed customers.

To explore this channel, we study whether the technological and operational investments of PE-backed firms and their suppliers change post-buyout, proxied by their R&D expenses and high-skilled employees. The results for target firms are reported in Table O.A5 in the Appendix. Consistent with previous papers, we find a significant increase in the share of high-skilled employees and R&D expenses of target firms, suggesting that PE investors enhance the technological and operational advancements of their portfolio companies. In Table O.A6 in the Appendix, we focus on the suppliers of PE-backed firms, but we do not find any evidence that treated suppliers increase their share of high-skilled employees or R&D expenses, inconsistent with the idea that our findings are driven by knowledge spillovers from PE-backed firms to their suppliers.

Finally, to further address the possibility that knowledge spillovers might be confined to a subset of suppliers, we focus on highly innovative sectors, identified as those with above-average patenting activity (using patent data for Belgian firms obtained from PATSTAT).[24] Panels A, B, and C of Table O.A7 in the Appendix present analyses restricted to three distinct subsamples: suppliers of target firms operating in highly innovative sectors, suppliers operating in highly innovative sectors, and buyer-supplier pairs within highly innovative sectors, respectively. Across all three subsamples, we find no evidence that suppliers increase their share of high-skilled employees or R&D expenses, which further rules out that our results can be explained by

[24]Unreported results confirm that our findings are consistent if we instead use the OECD's technology intensity classification, which is based on the average R&D intensity of manufacturing industries (Hatzichronoglou 1997; Isaksson et al. 2016).

knowledge spillovers. Overall, these findings imply that the positive impact of PE-backed customers on their suppliers is driven by an increased demand mechanism, rather than active engagement mechanisms such as technological transfer.

Second, we study the potential role of trade credit. Prior studies have highlighted the importance of trade credit in customer-supplier relationships and the transmission of shocks across supply chains (e.g., Billett et al. 2024; Cunat 2007; Costello 2020; Giannetti et al. 2021; Garcia-Appendini and Montoriol-Garriga 2013). For instance, one might expect that, if PE-backed firms have increased bargaining power relative to their suppliers, they may negotiate more favorable trade credit terms (Billett et al. 2024; Petersen and Rajan 1997). Alternatively, PE-backed firms' increased access to external debt may reduce their demand for trade credit.

To explore this, we analyze how trade credit usage and provision change for both PE-backed firms and their suppliers following a PE buyout. The results are presented in Table O.A8 in the Appendix. Panel A focuses on the accounts payable of PE-backed firms, while Panel B addresses the accounts receivable of the suppliers of PE-backed firms. The outcome variables in Panels A and B, respectively, include the amount of accounts payable and receivable in columns (1)–(2) and the average days payables and receivables are outstanding in columns (3)–(4).[25] We find no significant changes in the accounts payable of PE-backed firms or the accounts receivable of their suppliers, whether during normal or crisis periods. The only notable evidence of a change in trade credit is observed in columns (3)–(4) of Panel B, indicating that treated suppliers report an increase in the number of days receivables remain outstanding. Overall, the lack of significant effects across all panels and columns suggests that changes in trade credit policies likely play a limited role.

Third, we investigate whether the observed reduction in markups during periods of economic distress stems from pressure exerted by PE investors or from the increased leverage of target firms, which may function as a bargaining tool. High leverage is a defining feature of PE buyouts LBOs, setting them apart from other transaction types, such as mergers and acquisitions and growth equity, by amplifying both returns and the risk of financial distress (Kaplan and Strömberg 2009; Guo et al. 2011). Theoretical models suggest that increased leverage can serve as a commitment device, enabling firms to limit stakeholders' claims by credibly threatening to forgo investments that would otherwise benefit the stakeholders unless more favorable terms are negotiated (Bronars and Deere 1991; Perotti and Spier 1993). Suppliers, concerned that higher

[25]The average days payables is proxied as 365 multiplied by the ratio of accounts receivable over cost of goods sold. The average days receivables are outstanding is proxied as 365 multiplied by the ratio of accounts receivable by net credit sales.

leverage could increase PE-backed customers' bankruptcy risk, may offer price concessions to mitigate the risk of customer default.[26]

To assess this potential mechanism, we examine whether the markups of treated suppliers are significantly lower if their PE-backed customer is highly leveraged or has a low Altman Z-score (the latter serves as a direct proxy of financial distress).The results, presented in Table O.A9 in the Appendix, indicate that the reduction in markups among treated suppliers during periods of economic distress is not limited to those associated with PE-backed firms characterized by high leverage or low Altman Z-scores. This finding challenges the hypothesis that the bargaining power of PE-backed firms is solely attributable to increased leverage or bankruptcy risk.

4.4.4. Matching strategy

In our baseline analysis, we match suppliers of PE-backed firms with suppliers of non-PE-backed firms based on observable firm level characteristics one year before the buyout. The key underlying assumption is that two suppliers with matching characteristics, before a PE buyout, would have had otherwise similar outcomes had the PE buyout never taken place. To strengthen the robustness of our findings, we exploit the granularity of our data to apply a stricter matching strategy by matching suppliers on their own characteristics as well as the characteristics of their customers. In particular, in line with our baseline matching approach, we match suppliers based on size, leverage, profitability, and industry. However, we now additionally match on the average size, leverage, and profitability of their customer base. In this setting, the identification assumption is that two suppliers with matching characteristics who have customers that, on average, have similar characteristics, before a PE buyout, would have had otherwise similar outcomes had the PE buyout never taken place.

The results of this stricter matching strategy are presented in Panels A and B of Table O.A10 in the Appendix. The number of observations slightly decreases, but our findings remain robust. On average, we continue to observe that suppliers of PE-backed firms exhibit faster growth than their matched controls, except during periods of economic distress.

4.4.5. The determinants of PE buyouts

One could wonder whether, ex-ante, PE investors take into account firms' supply chain structure in their investment decisions. For example, PE funds might target firms that, on average, face

[26] Prior research confirms that customer bankruptcies impose significant adverse effects on suppliers (e.g., Hertzel et al. 2008).

lower switching costs vis-à-vis their suppliers (i.e., firms with suppliers that are easier to squeeze or replace during economic downturns). While this would not invalidate the empirical strategy used in our baseline analysis, we formally test this hypothesis by building on the approach of Cohn et al. (2022). Specifically, we estimate linear probability regression models to predict which firms are targeted by PE investors:

$$PE\ target_{f,t} = \beta \cdot X_{f,t} + \gamma \cdot Z_{f(i),t} + \lambda_f + \lambda_t + \epsilon_{f,t} \tag{4}$$

where the dependent variable is an indicator variable equal to one if firm f is acquired by a PE fund in year t, and zero otherwise. $X_{f,t}$ is a vector of firm characteristics (such as firm size, profitability, and leverage), while $Z_{f(i),t}$ is a vector of average supplier characteristics (such as the average size, leverage, and profitability of a firm's suppliers, or the share of a firm's suppliers operating in highly competitive industries). λ_f and λ_t represent firm and time fixed effects, respectively, and $\epsilon_{f,t}$ are robust standard errors clustered at the firm level.

The results are presented in Table O.A11 in the Appendix. We report estimates based on two specifications: one with only the vector of firm controls and another with both firm and supplier controls. Additionally, we present separate regression results in which we control for the average markups of the firm and its suppliers, which reduces the sample size.

First, focusing on firm characteristics, the results consistently show that PE investors appear to target firms that are relatively larger, more profitable, and more leveraged. These results accord with findings from Cohn et al. (2022), and could be interpreted as PE acquirers targeting firms with greater growth potential (also see Biesinger et al. 2023).[27] Next, in terms of average supplier characteristics, we do not find any statistically significant coefficient estimates, suggesting that PE investors do not actively take into account firms' supply chain structure in their investment decisions.

4.4.6. Externalities through common suppliers

Our main results show that, on average, suppliers of PE-backed firms outperform their peers as they benefit from increased demand for inputs from their PE-backed customers. This finding suggests that, in general, the affected suppliers can effectively fulfill the increased demand. However, capacity constraints may lead suppliers to prioritize their (faster-growing) PE-backed

[27] Using confidential textual data contained in pre-deal investment memos and value-creation plans, Biesinger et al. (2023) recently show that PE funds create value for their investors both by selecting firms that are more likely to outperform their peers over the next years and by helping their portfolio companies improve production processes through capital expenditures and acquisitions (but not by financial engineering).

customers. Alternatively, PE-backed firms may engage in anti-competitive practices, such as exclusive dealing agreements with their suppliers. In such cases, significant externalities could arise for other customers dependent on these suppliers, particularly competitors of the PE-backed firms (Bolton and Whinston 1993).

To formally analyze this, we start by examining whether affected suppliers are significantly more likely to terminate relationships with rivals of their PE-backed customers. To do so, we apply a similar customer-supplier level framework as before, where we first identify the non-PE-backed customers of each affected supplier, and then find comparable non-affected suppliers of those customer using the matching approach described earlier. This allows us to compare whether affected suppliers are significantly more likely to terminate relationships with a certain customer relative to (comparable) non-affected suppliers of that same customer.

The results are presented in Table 14. To investigate potential anti-competitive effects, we include an interaction term between our main independent variable of interest and a dummy equal to one if the customer is a direct competitor of the affected suppliers' PE-backed customer (which we proxy based on whether firms operate in the same 4-digit NACE industry). Across the different columns, we find that affected suppliers are 4–6 percentage points more likely to end an existing relationship with a certain customer if that firm is a direct competitor of their PE-backed customer. This result holds after including customer-year fixed effects, and is economically significant, corresponding to around 20% of the average probability of relationship termination in the estimation sample.

To quantify the economic implications of this result, we compare the economic trajectories of competitors whose supplier relationships were terminated within the first year of the buyout event versus those of other comparable firms, employing the same matching strategy as before. The results are presented in Table O.A12 in the Appendix. Panel A shows that the average firm does not experience adverse effect from the relationship termination. However, Panel B reveals that, when focusing on firms that lose a supplier accounting for at least 2.5% of their inputs, there is a decline in sales, profitability, and employment (although the negative effect on employment is not statistically significant). The results in Table O.A12 should be interpreted with caution due to the limited number of observations, but provide suggestive evidence that, by terminating relationships, affected suppliers can harm the rivals of their PE-backed customers.

To summarize, suppliers of PE-backed firms seem significantly more likely to terminate relationships with the rivals of their PE-backed customers. This can have negative effects on the

performance of these rival firms, particularly when the terminated supplier relationship involves a critical input. Together, these findings highlight that PE-backed firms can impose indirect competitive pressures on their rivals via common supplier networks.

5. Conclusion

Despite the long-time interest of academics and policymakers in the economic implications of PE buyouts, there is no evidence on the network effects of PE buyouts. This paper fills this gap in the literature by combining granular data on customer-supplier relationships and PE buyouts from Belgium.

Using a difference-in-differences methodology, we show that, in normal times, suppliers of PE-backed firms perform significantly better than comparable suppliers of non-PE-backed firms. This positive effect seems to be driven by increased demand for inputs from target firms that pursue new growth opportunities. Consistent with this view, we find that the positive effects are larger for suppliers of PE-backed firms that have greater growth opportunities and suppliers on which PE-backed firms are more dependent for inputs. Moreover, customer-supplier level regressions (which allow us to separate demand from supply effects) confirm that the increase in sales of affected suppliers is driven by increased purchases of inputs from PE-backed customers rather than other (comparable) clients.

However, suppliers of PE-backed firms do not outperform their peers during economic downturns, when PE investors seem to exert pressure on suppliers to realize cost savings. In line with this, we show that the muted effects observed during economic downturns are more pronounced when PE-backed customers face lower switching costs vis-à-vis their suppliers, that these suppliers experience a significant decline in markups, and that PE-backed firms are more likely to terminate existing relationships with these types of suppliers. This implies that PE investors negotiate better contract terms or reconfigure their supply chains to achieve cost savings for their portfolio companies. This finding broadly aligns with survey evidence from Gompers et al. (2016) that PE investors may bargain with suppliers to obtain better prices and realize cost savings for their portfolio companies, and with the argument from Bernstein et al. (2019) that PE firms intensify their engagement with portfolio companies during crisis periods.

Finally, we show that buyouts can adversely affect competitors of PE-backed firms that rely on common suppliers. Specifically, suppliers are significantly more likely to terminate relationships

with the rivals of their PE-backed customers. For rivals that lose a critical supplier, this has adverse consequences for their economic activities, highlighting the potential network-induced anti-competitive effects of PE buyouts.

Overall, our paper provides novel evidence on how PE buyouts affect the supply chain partners of PE targets—an important but neglected stakeholder group—and, more broadly, our findings improve our understanding of how PE investors create and extract economic value.

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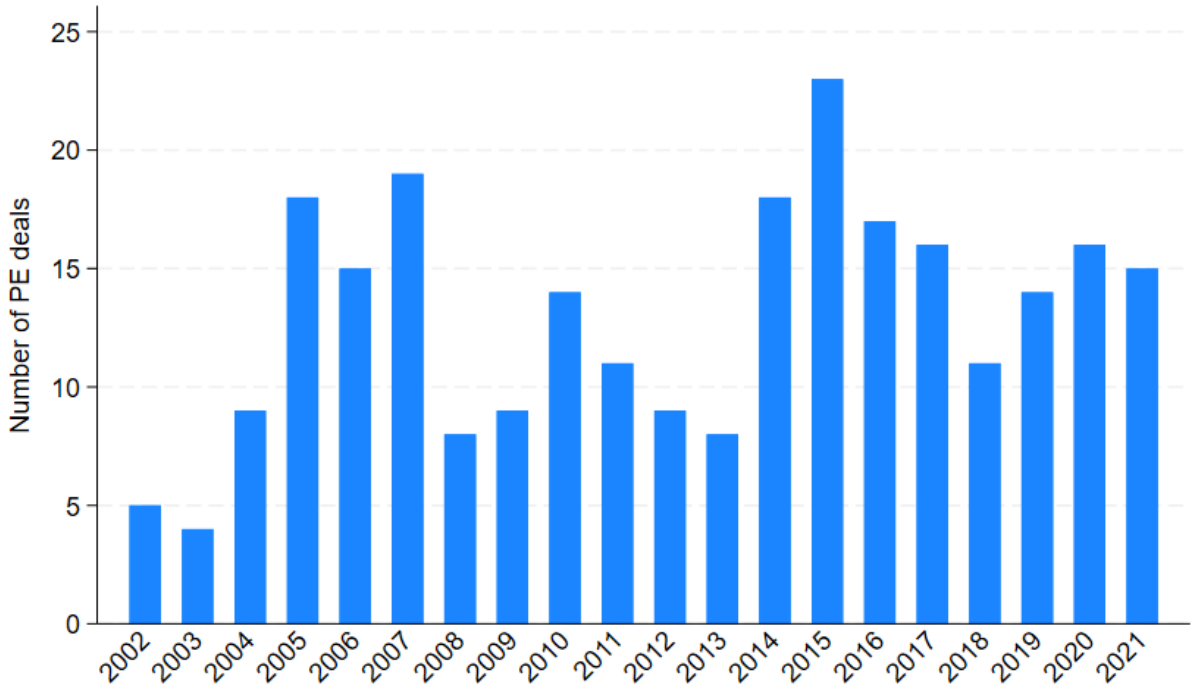
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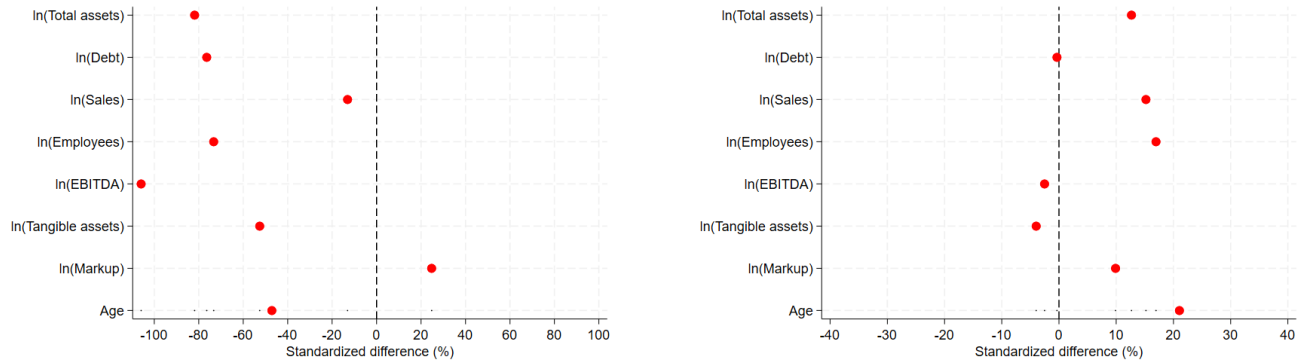
Figures

Figure 1. Number of PE deals per year



This histogram presents the number of PE deals per year in Belgium over the period 2002-2021.

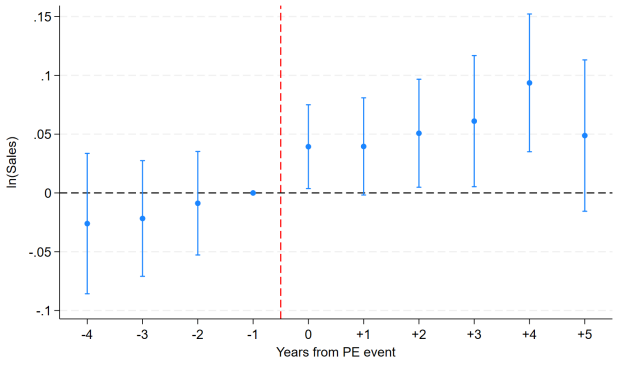
Figure 2. Balance tests: suppliers of target firms



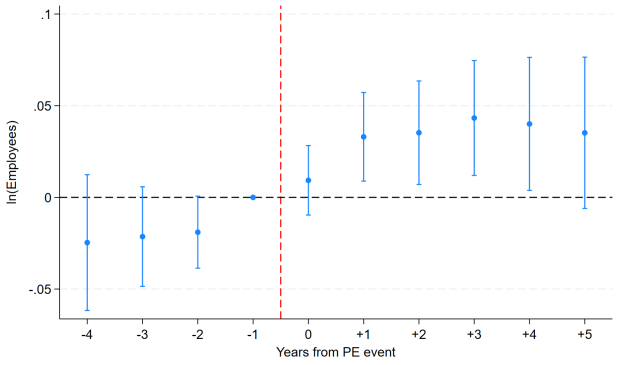
(a) Unmatched (b) Matched

This figure presents the balance test statistics for the sample of treated suppliers and control suppliers, before and after applying the matching strategy explained in Section 3.

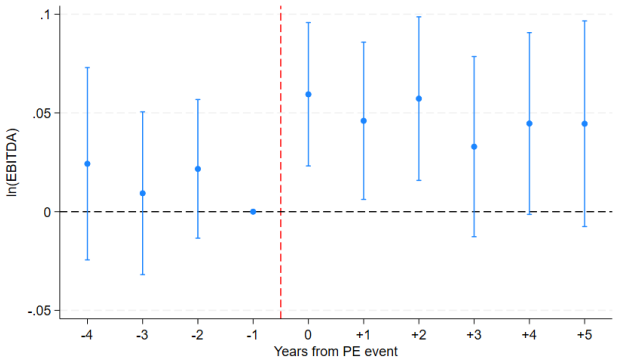
Figure 3. Dynamic difference-in-differences estimates for the effect of PE buyouts on suppliers of target firms



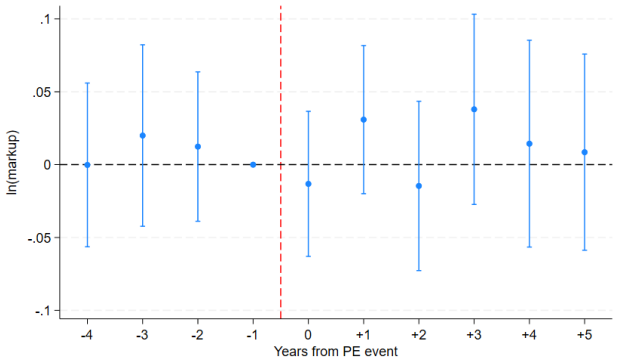
(a) ln(Sales)



(b) ln(Employees)



(c) ln(EBITDA)



(d) ln(Markup)

This figure presents the dynamic difference-in-differences estimates of the effect of PE buyouts on the suppliers of target firms. The y-axis corresponds to the coefficient estimates of β from Equation (1). The x-axis corresponds to years relative to the year in which the target firm was acquired. The dependent variables are the natural logarithm of sales, employees, EBITDA, and markups. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the firm-cohort level. The vertical bars represent confidence intervals at the 95% level.

Tables

Table 1. Number of treated firms

PE-backed firms	204
Suppliers of PE-backed firms	36,222
Suppliers of PE-backed firms with sales share $> 5\%$	2,457

This table reports the number of PE target that could be linked to the firms included in the firm financial statement data from the National Bank of Belgium (after applying the data filters explained in Section 2). The table also reports the number of suppliers that had a relationship with a PE-backed customer over the sample period, as well as the number of suppliers that had a relationship with a PE-backed customer that made up at least 5% of the supplier's total sales.

Table 2. Summary statistics

	N	Mean	Median	SD	P10	P90
			Panel A: Full sample			
ln(Total assets)	1,638,918	13.579	13.422	1.501	11.817	15.539
ln(Employees)	1,638,918	1.603	1.386	1.245	0.000	3.277
Age	1,638,918	17.716	15.000	13.092	4.000	35.000
Debt/TA	1,638,918	0.663	0.675	0.335	0.253	0.961
ln(Debt)	1,638,918	13.015	12.909	1.555	11.131	15.024
EBITDA/Sales	1,364,769	0.948	0.905	0.181	0.790	1.166
ln(EBITDA)	1,638,918	11.549	11.453	1.542	9.736	13.515
Tangible assets/TA	1,638,918	0.290	0.225	0.249	0.017	0.675
ln(Tangible assets)	1,638,918	11.511	11.823	2.549	9.117	13.999
ln(R&D expenses)	1,638,918	0.125	0.000	1.199	0.000	7.888
ln(Sales)	1,638,918	12.460	12.675	2.246	9.306	15.209
ln(Markup)	336,959	0.932	0.736	0.806	0.230	1.777
Number of suppliers	1,638,918	63.487	47.000	51.805	16.000	139.000
Number of customers	1,638,918	65.810	21.000	104.835	2.000	191.000
			Panel B: Matched sample			
ln(Total assets)	45,349	14.331	14.049	2.119	11.674	17.369
ln(Employees)	45,349	2.277	1.917	1.692	0.336	4.734
Age	45,349	21.790	19.000	15.018	6.000	41.000
Debt/TA	45,349	0.580	0.550	0.432	0.109	0.957
ln(Debt)	45,349	13.461	13.168	2.268	10.631	16.778
EBITDA/Sales	45,349	0.886	0.907	0.274	0.743	1.107
ln(EBITDA)	45,349	12.335	12.198	2.072	9.715	15.256
Tangible assets/TA	45,349	0.234	0.162	0.225	0.010	0.583
ln(Tangible assets)	45,349	11.941	12.081	2.966	8.987	15.469
ln(R&D expenses)	45,349	0.393	0.000	2.155	0.000	12.906
ln(Sales)	45,349	13.274	13.392	2.373	10.065	16.536
ln(Markup)	15,821	0.746	0.571	0.697	0.132	1.524
Number of suppliers	45,349	84.834	55.000	72.350	15.000	216.000
Number of customers	45,349	81.389	26.000	124.707	2.000	266.000

This table reports the number of observations, mean, median, standard deviation, 10^{th} percentile, and 90^{th} percentile for the main variables of interest. Panel A contains statistics for the entire sample of firm-year observations. Panel B contains statistics for the sample of treated and control suppliers used in our baseline analysis. The sample period is from 2002 to 2022. Table O.A1 in the Appendix provides more information about the variable definitions.

Table 3. The effect of PE buyouts on target firms

	(1) ln(Debt)	(2) ln(Sales)	(3) ln(Employees)	(4) ln(EBITDA)
Post PE	0.50***	0.22***	0.16***	0.22***
	(0.06)	(0.06)	(0.03)	(0.06)
Observations	6,662	6,662	6,662	6,662
Adjusted R-squared	0.92	0.86	0.98	0.80
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on target firms. Across the different columns, the outcome variables are the natural logarithm of total debt, sales, employees, and EBITDA. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 4. The spillover effect of PE buyouts on suppliers of target firms

	(1) ln(Sales)	(2) ln(Employees)	(3) ln(EBITDA)	(4) ln(Markup)
Post PE	0.06***	0.04***	0.06**	-0.00
	(0.02)	(0.01)	(0.02)	(0.02)
Observations	45349	45349	45349	15821
Adjusted R-squared	0.93	0.97	0.90	0.73
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on the suppliers of target firms. Across the different columns, the outcome variables are the natural logarithm of total sales, employees, EBITDA, and markups. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 5. The effect of PE buyouts on the economic resilience of target firms

	(1) ln(Debt)	(2) ln(Sales)	(3) ln(Employees)	(4) ln(EBITDA)
Post PE	0.47***	0.15**	0.12***	0.20***
	(0.06)	(0.07)	(0.04)	(0.07)
Post PE × Economic downturn	0.09	0.17*	0.12***	0.06**
	(0.08)	(0.10)	(0.04)	(0.03)
Observations	6,662	6,662	6,662	6,662
Adjusted R-squared	0.92	0.86	0.98	0.80
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on the economic resilience of target firms. Across the different columns, the outcome variables are the natural logarithm of total debt, sales, employees, and EBITDA. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 6. The effect of PE buyouts on the economic resilience of suppliers of target firms

	(1) ln(Sales)	(2) ln(Employees)	(3) ln(EBITDA)	(4) ln(Markup)
Post PE	0.08***	0.05***	0.07**	0.01
	(0.03)	(0.01)	(0.03)	(0.02)
Post PE × Economic downturn	-0.06*	-0.04**	-0.04*	-0.08*
	(0.03)	(0.02)	(0.02)	(0.05)
Observations	45349	45349	45349	15821
Adjusted R-squared	0.93	0.97	0.90	0.73
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on the economic resilience of suppliers of target firms. Across the different columns, the outcome variables are the natural logarithm of total debt, sales, employees, and EBITDA. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 7. The spillover effect of PE buyouts on suppliers of target firms: Heterogeneity

	ln(Sales)		ln(Employees)	
	(1)	(2)	(3)	(4)
Panel A:	Low leverage	High leverage	Low leverage	High leverage
Post PE	0.07***	0.06	0.04**	0.03
	(0.03)	(0.04)	(0.02)	(0.02)
Observations	28432	16099	28432	16099
Adjusted R-squared	0.94	0.93	0.97	0.97
Panel B:	High input dependence	Low input dependence	High input dependence	Low input dependence
Post PE	0.07**	0.06	0.05***	0.02
	(0.03)	(0.04)	(0.02)	(0.02)
Observations	27309	18040	27309	18040
Adjusted R-squared	0.92	0.93	0.97	0.97
Panel C:	Long relationships	Short relationships	Long relationships	Short relationships
Post PE	0.10***	0.04	0.07***	0.01
	(0.04)	(0.03)	(0.02)	(0.02)
Observations	17845	22827	17845	22827
Adjusted R-squared	0.93	0.93	0.97	0.97
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on the suppliers of target firms across different subsamples. The outcome variables are the natural logarithm of total sales in columns (1) and (2), employees in columns (3) and (4), EBITDA in columns (5) and (6), and markups in columns (7) and (8). All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 7 (continued)

	ln(EBITDA)		ln(Markup)	
	(5)	(6)	(7)	(8)
Panel A:	Low leverage	High leverage	Low leverage	High leverage
Post PE	0.07**	0.05	0.00	-0.01
	(0.03)	(0.04)	(0.03)	(0.03)
Observations	28432	16099	9940	5632
Adjusted R-squared	0.90	0.89	0.73	0.74
Panel B:	High input dependence	Low input dependence	High input dependence	Low input dependence
Post PE	0.08**	0.02	0.00	-0.01
	(0.03)	(0.03)	(0.02)	(0.04)
Observations	27309	18040	11785	4036
Adjusted R-squared	0.89	0.88	0.75	0.67
Panel C:	Long relationships	Short relationships	Long relationships	Short relationships
Post PE	0.08**	0.04	0.02	-0.01
	(0.04)	(0.03)	(0.03)	(0.03)
Observations	17845	22827	5253	8975
Adjusted R-squared	0.89	0.90	0.70	0.77
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on the suppliers of target firms across different subsamples. The outcome variables are the natural logarithm of total sales in columns (1) and (2), employees in columns (3) and (4), EBITDA in columns (5) and (6), and markups in columns (7) and (8). All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 8. PE buyouts and PE-backed customers' demand for inputs from suppliers

	(1) ln(Purchases)	(2) ln(Purchases)	(3) ln(Purchases)
Post PE	0.15**	0.16**	0.18**
	(0.06)	(0.07)	(0.07)
Observations	9951	9238	9197
Adjusted R-squared	0.78	0.78	0.82
Supplier FE	Yes	No	No
Customer FE	Yes	Yes	No
Year FE	Yes	No	No
Supplier × Year FE	No	Yes	Yes
Supplier × Customer FE	No	No	Yes

This table reports the estimated impact of PE buyouts on target firms' demand for inputs from suppliers. Across the different columns, the outcome variable is the natural logarithm of total purchases from customer j at supplier i in year t. Across the different columns, the regressions are saturated with supplier fixed effects, customer fixed effects, year fixed effects, supplier-by-year fixed effects, and supplier-by-customer fixed effects, as indicated at the bottom of the table. For each treated supplier, the sample contains PE-backed customers and non-PE-backed customers, which are selected using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 4.3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the customer level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 9. PE buyouts and the certification effect of PE-backed customers

	ln(Number of customers)	ln(Number of within-network customers)	ln(Number of outside-network customers)
	(1)	(2)	(3)
Post PE	0.04**	0.05***	-0.01
	(0.02)	(0.01)	(0.02)
Observations	45349	45349	45349
Adjusted R-squared	0.95	0.87	0.95
Firm × Cohort FE	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on target firms. Across the different columns, the outcome variables are the natural logarithm of the total number of customers, the number of customers within the PE-backed firms' network, and the number of customers outside of the PE-backed firms' network. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 10. The spillover effect of PE buyouts on the economic resilience of suppliers of target firms: Heterogeneity

	ln(Sales)		ln(Employees)	
	(1)	(2)	(3)	(4)
Panel A:	Differentiated inputs	Standardized inputs	Differentiated inputs	Standardized inputs
Post PE	0.11***	0.06*	0.04**	0.04**
	(0.04)	(0.03)	(0.02)	(0.02)
Post PE × Economic downturn	-0.04	-0.09**	-0.03	-0.04*
	(0.05)	(0.04)	(0.03)	(0.02)
Observations	18845	26194	18845	26194
Adjusted R-squared	0.94	0.92	0.97	0.97
Panel B:	Low competition	High competition	Low competition	High competition
Post PE	0.08*	0.08***	0.04*	0.05***
	(0.04)	(0.03)	(0.02)	(0.02)
Post PE × Economic downturn	-0.05	-0.07*	-0.02	-0.04*
	(0.06)	(0.04)	(0.03)	(0.02)
Observations	15929	29420	15929	29420
Adjusted R-squared	0.93	0.93	0.96	0.97
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on the economic resilience of suppliers of target firms across different subsamples. The outcome variables are the natural logarithm of total sales in columns (1) and (2) employees in columns (3) and (4), EBITDA in columns (5) and (6), and markups in columns (7) and (8). All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 10 (continued)

	ln(EBITDA)		ln(Markup)	
	(5)	(6)	(7)	(8)
Panel A:	Differentiated inputs	Standardized inputs	Differentiated inputs	Standardized inputs
Post PE	0.04	0.09**	0.07	-0.02
	(0.04)	(0.04)	(0.05)	(0.02)
Post PE × Economic downturn	0.07	-0.09*	-0.09	-0.09*
	(0.06)	(0.05)	(0.08)	(0.05)
Observations	18845	26194	5832	9922
Adjusted R-squared	0.89	0.90	0.73	0.74
Panel B:	Low competition	High competition	Low competition	High competition
Post PE	0.04	0.08**	-0.04	0.02
	(0.04)	(0.03)	(0.07)	(0.02)
Post PE × Economic downturn	0.03	-0.05	-0.02	-0.08*
	(0.06)	(0.05)	(0.14)	(0.05)
Observations	15929	29420	2685	13136
Adjusted R-squared	0.88	0.90	0.62	0.75
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on the economic resilience of suppliers of target firms across different subsamples. Across the different columns, the outcome variables are the natural logarithm of total sales in columns (1) and (2) employees in columns (3) and (4), EBITDA in columns (5) and (6), and markups in columns (7) and (8). All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 11. PE buyouts and customer-supplier relationship termination during economic downturns

	(1) Relationship terminated	(2) Relationship terminated	(3) Relationship terminated
Post PE	-0.10***	-0.10***	-0.10***
	(0.02)	(0.02)	(0.02)
Observations	9951	9238	9197
Adjusted R-squared	0.27	0.60	0.59
Supplier FE	Yes	No	No
Customer FE	Yes	Yes	No
Year FE	Yes	No	No
Supplier × Year FE	No	Yes	Yes
Supplier × Customer FE	No	No	Yes

This table reports the estimated impact of PE buyouts on the probability that customer-supplier relationships are terminated. Across the different columns, the outcome variable is a dummy variable equal to one if the relationship between supplier i and customer j is terminated in year $t+1$. Across the different columns, the regressions are saturated with supplier fixed effects, customer fixed effects, year fixed effects, supplier-by-year fixed effects, and supplier-by-customer fixed effects, as indicated at the bottom of the table. For each treated supplier, the sample contains PE-backed customers and non-PE-backed customers, which are selected using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 4.3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the customer level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 12. PE buyouts and customer-supplier relationship termination during economic downturns: Heterogeneity

	(1) Relationship terminated	(2) Relationship terminated	(3) Relationship terminated	(4) Relationship terminated	(5) Relationship terminated	(6) Relationship terminated
Panel A:	Standardized inputs	Differentiated inputs	Standardized inputs	Differentiated inputs	Standardized inputs	Differentiated inputs
Post PE	-0.11***	-0.08***	-0.12***	-0.08***	-0.12***	-0.08***
	(0.04)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)
Post PE × Economic Downturn	0.02	-0.01	0.08**	-0.03	0.08**	-0.03
	(0.07)	(0.04)	(0.04)	(0.03)	(0.04)	(0.03)
Observations	2060	6966	1935	6511	1934	6490
Adjusted R-squared	0.26	0.28	0.66	0.59	0.66	0.57
Panel B:	High competition	Low competition	High competition	Low competition	High competition	Low competition
Post PE	-0.08**	-0.09***	-0.09***	-0.09***	-0.10***	-0.09***
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)
Post PE × Economic Downturn	0.02	-0.03	0.07*	-0.04	0.07*	-0.03
	(0.07)	(0.05)	(0.04)	(0.03)	(0.04)	(0.03)
Observations	2766	6262	2604	5844	2603	5827
Adjusted R-squared	0.24	0.29	0.62	0.59	0.63	0.58
Supplier FE	Yes	Yes	No	No	No	No
Customer FE	Yes	Yes	Yes	Yes	No	No
Year FE	Yes	Yes	No	No	No	No
Supplier × Year FE	No	No	Yes	Yes	Yes	Yes
Supplier × Customer FE	No	No	No	No	Yes	Yes

This table reports the estimated impact of PE buyouts on the probability that customer-supplier relationships are terminated across different subsamples. Across the different columns, the outcome variable is a dummy variable equal to one if the relationship between supplier i and customer j is terminated in year $t+1$. Across the different columns, the regressions are saturated with supplier fixed effects, customer fixed effects, year fixed effects, supplier-by-year fixed effects, and supplier-by-customer fixed effects, as indicated at the bottom of the table. For each treated supplier, the sample contains PE-backed customers and non-PE-backed customers, which are selected using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 4.3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the customer level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 13. The effect of PE buyouts on target firms:
The number of suppliers and cost of inputs

	ln(Number of suppliers)		Cost of inputs/Sales	
	(1)	(2)	(3)	(4)
Post PE	0.04*	0.02	-0.02**	-0.01
	(0.02)	(0.02)	(0.01)	(0.01)
Post PE × Economic downturn		0.04*		-0.02**
		(0.02)		(0.01)
Observations	6106	6106	6584	6584
Adjusted R-squared	0.95	0.95	0.70	0.70
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on target firms. The outcome variables are the natural logarithm of the firm's total number of suppliers in columns (1) and (2), and the ratio of the cost of inputs over total sales in columns (3) and (4). All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 14. PE buyouts and customer-supplier relationship terminations with rivals of PE-backed customers

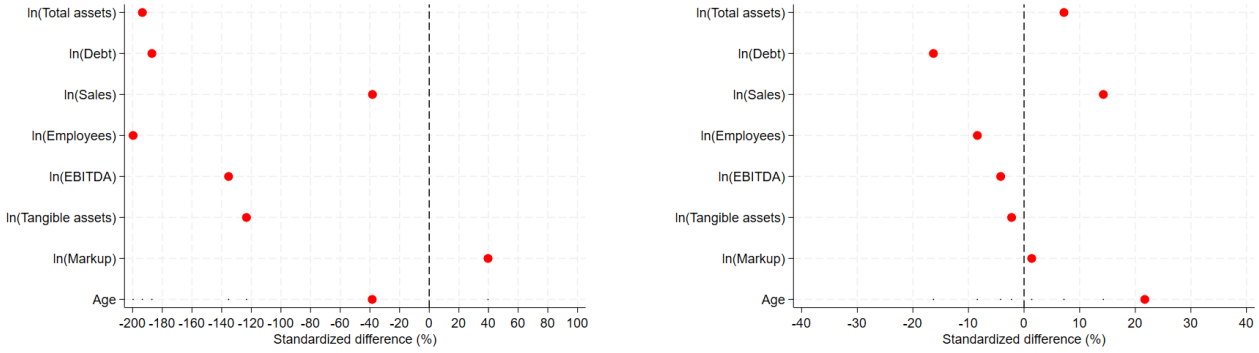
	(1) Relationship terminated	(2) Relationship terminated	(3) Relationship terminated
Post PE	-0.03	0.00	-0.01
	(0.02)	(0.02)	(0.02)
Post PE × Competitor	0.01	0.04**	0.06**
	(0.02)	(0.02)	(0.03)
Observations	78812	78083	68990
Adjusted R-squared	0.18	0.33	0.45
Supplier FE	Yes	No	No
Customer FE	Yes	Yes	No
Year FE	Yes	No	No
Customer × Year FE	No	Yes	Yes
Supplier × Customer FE	No	No	Yes

This table reports the estimated impact of PE buyouts on the probability that treated suppliers terminate customer-supplier relationships with competitors of their PE-backed customers. Across the different columns, the outcome variable is a dummy variable equal to one if the relationship between supplier i and customer j is terminated in year $t+1$. Across the different columns, the regressions are saturated with supplier fixed effects, customer fixed effects, year fixed effects, customer-by-year fixed effects, and supplier-by-customer fixed effects, as indicated at the bottom of the table. For each treated supplier, the sample contains suppliers of PE-backed customers and suppliers of non-PE-backed customers, which are selected using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 4.3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the supplier level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

APPENDIX

Appendix O.A

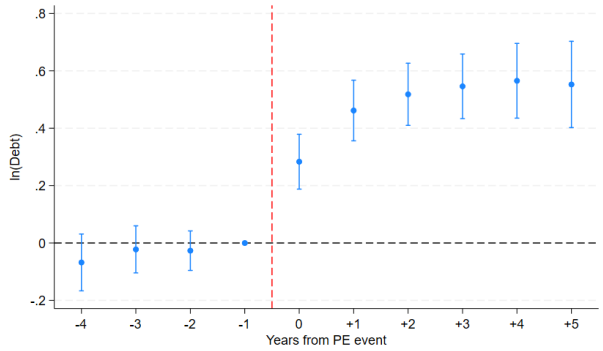
Figure O.A1. Balance tests: target firms



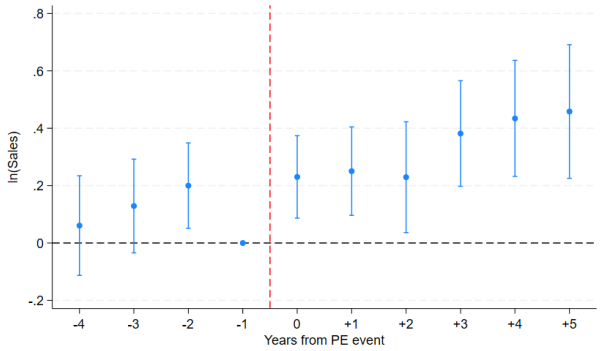
(a) Unmatched (b) Matched

Note: This figure presents the balance test statistics for the sample of target firms and control firms, before and after applying the matching strategy explained in Section 3.

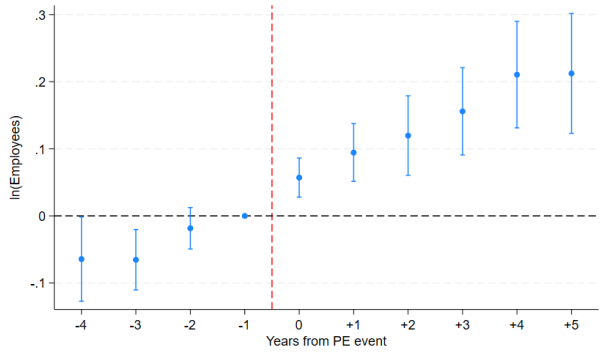
Figure O.A2. Dynamic difference-in-differences estimates for the effect of PE buyouts on target firms



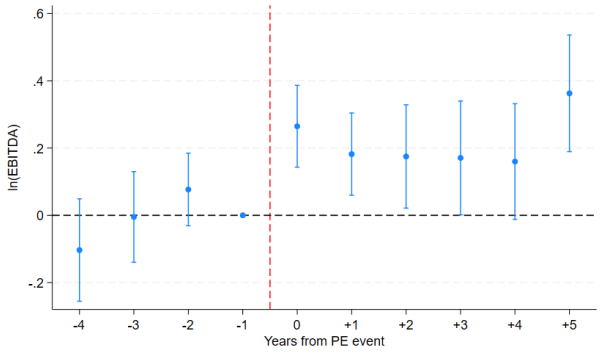
(a) ln(Debt)



(b) ln(Sales)



(c) ln(Employees)



(d) ln(EBITDA)

This figure presents the dynamic difference-in-differences estimates of the effect of PE buyouts on target firms. The y-axis corresponds to the coefficient estimates of β from Equation (3). The x-axis corresponds to years relative to the the year in which the target firm was acquired. Across the different panels, the outcomes variables are the natural logarithm of debt, sales, employees, EBITDA. A constant is included in all regressions but not reported. Standard errors are clustered at the firm-cohort level. The vertical bars represent confidence intervals at the 95% level.

Table O.A1. Variable definitions

Variable	Description
ln(Total assets)	The natural logarithm of total assets.
ln(Employees)	The natural logarithm of the number of employees.
Age	The number of years since the firm was founded.
Debt/TA	The ratio of debt to total assets.
ln(Debt)	The natural logarithm of the total debt.
EBITDA/Sales	The ratio of earnings before interest, taxes, depreciation, and amortization to sales.
ln(EBITDA)	The natural logarithm of earnings before interest, taxes, depreciation, and amortization (EBITDA).
Tangible assets/TA	The ratio of tangible assets to total assets.
ln(Tangible assets)	The natural logarithm of tangible assets.
ln(R&D expenses)	The natural logarithm of research and development expenses.
ln(Sales)	The natural logarithm of total sales.
ln(Markup)	The natural logarithm of firm-level markups, estimated following the procedure from De Loecker and Warzynski (2012).
ln(Skilled labor)	The natural logarithm of employees with a higher education degree.
Accounts payable	The ratio of accounts payable over total purchases.
Accounts receivable	The ratio of accounts receivable over total sales.
Number of suppliers	The total number of suppliers that the firm has a relationship with.
Number of customers	The total number of customers that the firm has a relationship with.

This table provides the variable definitions of our main variables of interest.

Table O.A2. The effect of PE buyouts on target firms: Heterogeneity

	(1) ln(Debt)	(2) ln(Sales)	(3) ln(Employees)	(4) ln(EBITDA)
Post PE	0.42***	0.17**	0.11***	0.17**
	(0.07)	(0.07)	(0.04)	(0.07)
Post PE × Low leverage$_{pre}$	0.38**	0.21*	0.28***	0.23*
	(0.15)	(0.12)	(0.08)	(0.13)
Observations	6,662	6,662	6,662	6,662
Adjusted R-squared	0.92	0.86	0.98	0.80
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on target firms, depending on the targets' pre-buyout leverage. Across the different columns, the outcome variables are the natural logarithm of total debt, sales, employees, and EBITDA. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table O.A3. The effect of PE buyouts on suppliers of target firms: Falsification test based on supplier-customer relationships that ended pre-buyout

	(1) ln(Sales)	(2) ln(Employees)	(3) ln(EBITDA)	(4) ln(Markup)
Panel A:				
Post $PE_{placebo}$	-0.01	-0.01	0.21	-0.07
	(0.05)	(0.02)	(0.18)	(0.05)
Observations	19399	19399	19399	3529
Adjusted R-squared	0.90	0.94	0.50	0.64
Panel B:				
Post $PE_{placebo}$	0.02	-0.01	0.09	-0.08
	(0.06)	(0.02)	(0.24)	(0.07)
Post $PE_{placebo}$ × Economic Downturn	-0.07	-0.01	0.31	0.01
	(0.10)	(0.04)	(0.39)	(0.12)
Observations	19399	19399	19399	3529
Adjusted R-squared	0.90	0.94	0.49	0.64
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports placebo results for the estimated impact of PE buyouts on the suppliers of target firms, based on suppliers whose relationships with the target firm ended pre-buyout. Across the different columns, the outcome variables are the natural logarithm of total sales, employees, EBITDA, and markups. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table O.A4. The effect of PE buyouts on suppliers of target firms: Falsification test based on canceled deals

	(1) ln(Sales)	(2) ln(Employees)	(3) ln(EBITDA)	(4) ln(Markup)
Panel A:				
Post $PE_{canceled}$	0.04	0.00	0.02	-0.02
	(0.04)	(0.03)	(0.04)	(0.05)
Observations	14959	14959	14959	5458
Adjusted R-squared	0.95	0.97	0.91	0.69
Panel B:				
Post $PE_{canceled}$	0.03	0.00	-0.02	-0.01
	(0.05)	(0.03)	(0.05)	(0.06)
Post $PE_{canceled}$ × Economic Downturn	0.03	-0.00	0.09	-0.03
	(0.05)	(0.03)	(0.06)	(0.07)
Observations	14959	14959	14959	5458
Adjusted R-squared	0.95	0.97	0.91	0.69
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports placebo results for the estimated impact of PE buyouts on the suppliers of target firms, based on canceled PE deals. Across the different columns, the outcome variables are the natural logarithm of total sales, employees, EBITDA, and markups. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table O.A5. The effect of PE buyouts on target firms:
Alternative channel: Knowledge spillovers

	ln(Skilled labor)		ln(R&D expenses)	
	(1)	(2)	(3)	(4)
Post PE	0.25***	0.23**	0.72**	0.48*
	(0.09)	(0.11)	(0.30)	(0.27)
Post PE × Economic downturn		0.04		0.72
		(0.14)		(0.45)
Observations	5163	5163	6662	6662
Adjusted R-squared	0.83	0.83	0.73	0.73
Firm×Cohort FE	Yes	Yes	Yes	Yes
Year×Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on target firms. The outcome variables are the natural logarithm of highly skilled employees in columns (1) and (2), and the natural logarithm of R&D expenses in columns (3) and (4). All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table O.A6. The effect of PE buyouts on suppliers of target firms: Alternative channel: Knowledge spillovers

	ln(Skilled labor)		ln(R&D expenses)	
	(1)	(2)	(3)	(4)
Post PE	-0.01	-0.01	0.04	0.04
	(0.03)	(0.03)	(0.05)	(0.05)
Post PE × Economic downturn		-0.00		0.02
		(0.03)		(0.06)
Observations	30622	30622	45349	45349
Adjusted R-squared	0.87	0.87	0.70	0.70
Firm×Cohort FE	Yes	Yes	Yes	Yes
Year×Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on the suppliers of target firms. The outcome variables are the natural logarithm of highly skilled employees in columns (1) and (2), and the natural logarithm of R&D expenses in columns (3) and (4). All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table O.A7. The effect of PE buyouts on suppliers of target firms: Alternative channel: Knowledge spillovers

	ln(Skilled labor)		ln(R&D expenses)	
	(1)	(2)	(3)	(4)
Panel A:	Innovative sectors (targets)			
Post PE	-0.04	-0.03	0.02	0.02
	(0.03)	(0.04)	(0.05)	(0.05)
Post PE × Economic downturn		-0.01		0.01
		(0.04)		(0.09)
Observations	19067	19067	30922	30922
Adjusted R-squared	0.87	0.87	0.72	0.72
Panel B:	Innovative sectors (suppliers)			
Post PE	0.02	-0.00	0.03	0.01
	(0.05)	(0.06)	(0.08)	(0.07)
Post PE × Economic downturn		0.05		0.07
		(0.05)		(0.12)
Observations	12552	12552	19145	19145
Adjusted R-squared	0.86	0.86	0.74	0.74
Panel C:	Innovative sectors (targets & suppliers)			
Post PE	-0.03	-0.04	0.04	0.03
	(0.05)	(0.06)	(0.09)	(0.08)
Post PE × Economic downturn		0.02		0.06
		(0.06)		(0.16)
Observations	8600	8600	14207	14207
Adjusted R-squared	0.86	0.86	0.74	0.74
Firm×Cohort FE	Yes	Yes	Yes	Yes
Year×Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on the suppliers of target firms across different subsamples. The outcome variables are the natural logarithm of highly skilled employees in columns (1) and (2), and the natural logarithm of R&D expenses in columns (3) and (4). All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table O.A8. The effect of PE buyouts on target firms:
Alternative channel: Trade credit

	(1)	(2)	(3)	(4)
Panel A: PE-backed firms	Accounts payable		Days payable outstanding	
Post PE	0.00	-0.00	3.42	2.39
	(0.00)	(0.00)	(3.15)	(3.23)
Post PE × Economic downturn		0.01		1.58
		(0.01)		(4.40)
Observations	6296	6296	5247	5247
Adjusted R-squared	0.77	0.77	0.70	0.70
Panel B: Suppliers of PE-backed firms	Accounts receivable		Days sales outstanding	
Post PE	0.00	0.00	3.79*	4.43**
	(0.00)	(0.00)	(2.11)	(2.23)
Post PE × Economic downturn		-0.00		-3.08
		(0.00)		(3.44)
Observations	41454	41454	16967	16967
Adjusted R-squared	0.67	0.67	0.71	0.71
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on target firms and their suppliers. The outcome variables in columns (1) and (2) are the ratio of accounts payable to total purchases in Panel A, and the ratio of accounts receivable to total sales for the sample in Panel B. The outcome variables in columns (13) and (4) are the average days payables are outstanding in Panel A, and the the average days receivables are outstanding in Panel B. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table O.A9. The effect of PE buyouts on suppliers of target firms: Alternative channel: Financial distress

Financial distress measure	PE-backed firms with high leverage		PE-backed firms with low Altman Z	
	ln(Markup)	ln(Markup)	ln(Markup)	ln(Markup)
	(1)	(2)	(3)	(4)
Post PE	-0.00	0.02	0.00	0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Post PE × Financial distress	0.00	0.00	-0.00	-0.02
	(0.08)	(0.06)	(0.04)	(0.05)
Post PE × Economic downturn		-0.08*		-0.09*
		(0.05)		(0.05)
Post PE × Economic downturn × Financial distress		0.08		0.06
		(0.24)		(0.10)
Observations	15821	15821	15821	15821
Adjusted R-squared	0.73	0.73	0.73	0.73
Firm×Cohort FE	Yes	Yes	Yes	Yes
Year×Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on suppliers of target firms, depending on the targets' financial distress. Across the different columns, the outcome variables is the natural logarithm of the supplier's markups. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table O.A10. The effect of PE buyouts on suppliers of target firms: Stricter matching procedure

	(1) ln(Sales)	(2) ln(Employees)	(3) ln(EBITDA)	(4) ln(Markup)
Panel A:				
Post PE	0.06**	0.03**	0.05*	-0.00
	(0.02)	(0.01)	(0.02)	(0.02)
Observations	43773	43773	43773	14229
Adjusted R-squared	0.93	0.97	0.89	0.72
Panel B:				
Post PE	0.08***	0.04***	0.05*	0.00
	(0.03)	(0.01)	(0.03)	(0.02)
Post PE × Economic downturn	-0.07**	-0.03*	0.01	-0.04*
	(0.03)	(0.02)	(0.04)	(0.02)
Observations	43773	43773	43773	14229
Adjusted R-squared	0.93	0.97	0.89	0.72
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on the suppliers of target firms using a stricter matching strategy. Across the different columns, the outcome variables are the natural logarithm of total sales, employees, EBITDA, and markups. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, industry, and average customer base characteristics as explained in Section 4.4.4. Table O.A1 in Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table O.A11. The determinants of PE buyouts

	(1) PE target	(2) PE target	(3) PE target	(4) PE target
ln(Total assets)	0.0006***	0.0007***	0.0010***	0.0011***
	(0.0001)	(0.0001)	(0.0004)	(0.0004)
ln(Employees)	-0.0000	0.0000	-0.0003*	-0.0002
	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Debt/TA	0.0008***	0.0008***	0.0018***	0.0018***
	(0.0002)	(0.0002)	(0.0006)	(0.0007)
Accounts receivable	0.0002	0.0004	-0.0009	-0.0007
	(0.0007)	(0.0007)	(0.0022)	(0.0022)
EBITDA/TA	0.0023***	0.0023***	0.0057***	0.0058***
	(0.0005)	(0.0005)	(0.0016)	(0.0016)
ln(Markup)			-0.0006*	-0.0006**
			(0.0003)	(0.0003)
$\text{Age}_{\text{average supplier}}$		-0.0000		-0.0000
		(0.0000)		(0.0000)
$\ln(\text{Total assets})_{\text{average supplier}}$		0.0003		0.0004
		(0.0003)		(0.0007)
$\ln(\text{Employees})_{\text{average supplier}}$		-0.0001		0.0001
		(0.0002)		(0.0006)
$\text{Debt/TA}_{\text{average supplier}}$		0.0002		0.0008
		(0.0005)		(0.0018)
$\text{Accounts payable}_{\text{average supplier}}$		0.0022		-0.0104
		(0.0029)		(0.0078)
$\text{EBITDA/TA}_{\text{average supplier}}$		0.0002		0.0039
		(0.0011)		(0.0037)
Number of suppliers		-0.0002		-0.0004
		(0.0001)		(0.0004)
Share of suppliers offering standardized inputs		0.0004		0.0003
		(0.0007)		(0.0015)
Share of suppliers in low competition sectors		-0.0004		0.0000
		(0.0005)		(0.0012)
$\ln(\text{Markup})_{\text{average supplier}}$				0.0002
				(0.0003)
Observations	400106	400106	117946	117404
Adjusted R-squared	0.09	0.09	0.12	0.12
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

This table reports the determinants of PE buyouts. Across the different columns, the outcome variable is a dummy variable equal to one if firm f is a PE target in year t, and zero otherwise. All specifications include firm and year fixed effects. Table O.A1 in Appendix provides more information about the variable definitions. Standard errors are clustered at the firm level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table O.A12. The effect of customer-supplier relationship terminations for rivals of PE-backed customers

	(1) ln(Sales)	(2) ln(Employees)	(3) ln(EBITDA)	(4) ln(Markup)
Panel A:				
Post PE	0.10	0.05	0.03	0.09
	(0.08)	(0.04)	(0.09)	(0.05)
Observations	3701	3701	3701	1634
Adjusted R-squared	0.94	0.94	0.80	0.69
Panel B:				
Post PE	-0.19*	-0.07	-0.37***	0.11
	(0.11)	(0.09)	(0.13)	(0.09)
Observations	1307	1307	1307	650
Adjusted R-squared	0.96	0.94	0.82	0.65
Firm × Cohort FE	Yes	Yes	Yes	Yes
Year × Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of customer-supplier relationship terminations for competitors of PE-backed firms with a shared supplier. Across the different columns, the outcome variables are the natural logarithm of total sales, employees, EBITDA, and markups. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, industry, and average customer base characteristics as explained in Section 4.4.4. Table O.A1 in Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Appendix O.B

Estimating markups requires the input share of revenue and the output elasticity of that input. The former can simply be computed as costs for input X divided by total firm revenue. However, the latter need to be recovered from estimating production functions. Below, we describe how De Loecker and Warzynski (2012), and other papers using the production approach, address this estimation challenge using a control function approach that assumes productivity is Hicks neutral.

O.B1. Production functions

For the translog production function with capital (k_{it}), labour (l_{it}), and materials (m_{it}), the (logged) production function excluding the Hicks neutral productivity term is:[a]

$$f_{it} = \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \beta_{kk} k_{it}^2 + \beta_{ll} l_{it}^2 + \beta_{mm} m_{it}^2 + \beta_{kl} k_{it} l_{it} + \beta_{km} k_{it} m_{it} + \beta_{lm} l_{it} m_{it}, \tag{5}$$

and the output elasticity for each input will depend on the level of all inputs. The production function coefficients are not time-varying, but the output elasticities can vary over time due to changes in factors.

O.B2. Control function estimation

We follow prior literature and use the Ackerberg et al. (2015) (ACF) estimator. The two key assumptions of the ACF estimator are that productivity is (1) Hicks neutral and (2) evolves following a Markov process.

The control function approach assumes that observed revenue includes additive measurement error ϵ_{it}. Thus, given log productivity ω_{it}, measured log revenue y_{it} is:

$$y_{it} = f(k_{it}, l_{it}, m_{it}) + \omega_{it} + \epsilon_{it}. \tag{B1}$$

Let materials be the flexible input decided at the time the firm learns its productivity shock. If so, materials is a function of the observed inputs and productivity $m_{it} = g(k_{it}, l_{it}, \omega_{it})$, and can be inverted for productivity so that $\omega_{it} = g^{-1}(k_{it}, l_{it}, m_{it})$.

The first stage of the ACF estimator controls for a flexible form of the inputs to recover the additive measurement error ϵ_{it}. Formally, y_{it} is:

$$y_{it} = f(k_{it}, l_{it}, m_{it}) + g^{-1}(k_{it}, l_{it}, m_{it}) + \epsilon_{it} = h(k_{it}, l_{it}, m_{it}) + \epsilon_{it}, \tag{B2}$$

Since both the production function and productivity are functions of the inputs, they cannot be separated in the first stage. Instead, the nonparametric function h includes both productivity ω_{it} and measurement error ϵ_{it} and the production function f. The measurement error in sales ϵ_{it} is a residual in the first stage equation after controlling for h.

The second major assumption of the ACF approach is that productivity follows a first-order Markov process. Further, we also assume an AR(1) process. Formally,

[a] For notation purposes, all lower case variables are in logged form.

$$\omega_{it} = \rho\omega_{it-1} + \nu_{it} \tag{6}$$

with AR(1) coefficient ρ and productivity innovation ν_{it}. In that case, based on the production function coefficients β, one can recover the innovation in productivity ν_{it} as:

$$\nu_{it}(\beta) = \omega_{it} - \rho\omega_{it-1} \tag{7}$$

The innovation in productivity is a function of production coefficients β because $\omega_{it} = y_{it} - \epsilon_{it} - f_{it}(\beta)$, and ϵ_{it} was recovered in the first stage.

Because the innovation in productivity is, by construction, independent of inputs chosen before time t, moments of the innovations multiplied by inputs chosen before the productivity innovation, such as $E(\nu_{it}h_{it-1})$, identify the production function coefficients.

For the translog, we use capital and the first lag of materials and labour, as well as their interactions, as instruments.

Finally, we follow De Loecker and Warzynski (2012) and correct the value of sales in the input share of revenue for the measurement error estimated in the first stage. Hence, for input X, the estimate of the markup is:

$$\hat{\mu}_{it} = \frac{\hat{\beta}^X}{s_{it}^X \exp(\epsilon_{it})} \tag{8}$$

Appendix O.C

Our main results show that, on average, PE-backed firms have a positive impact on the performance of their suppliers. This effect operates through two main channels. On the one hand, suppliers benefit from increased demand for inputs as PE-backed firms pursue new growth opportunities and expand their activities following the buyout. On the other hand, PE-backed firms appear to have a certification effect, helping their suppliers to gain new customers from within the PE-backed firms' network.

To assess the relative economic importance of these two mechanisms, we perform two additional analyses. First, we augment our baseline regression model by including a variable (*Post-buyout within-network customers*) that measures the number of new customers a treated supplier gains within the PE-backed firms' network post-buyout. This variable isolates the effect of new customer acquisition on suppliers' post-buyout performance, while the post treatment indicator would capture the impact of increased demand from PE-backed firms.

Table O.C1 presents the results. Across the different columns, the post-treatment indicator remains statistically significant and positive, with coefficient estimates of a magnitude comparable to those in our baseline results. In contrast, the estimated effect of new within-PE-network customers is statistically insignificant across all columns. These findings suggest that the observed improvement in affect suppliers' performance, as documented in our baseline results, cannot be attributed to the certification effect; instead, this it is more likely driven by increased demand from the PE-backed firm.

Moreover, as mentioned earlier, our results from Table 8 provide further support that the direct increase in demand from PE-backed customers is the primary driver of the positive impact on suppliers' performance. This table reports the changes in sales of treated suppliers to PE-backed customers versus (comparable) non-PE-backed customers, before versus after the buyout event. The results confirm that treated suppliers experience a significant increase in purchases from PE-backed customers relative to other (comparable) customers. Furthermore, the coefficient estimates suggest that the firm-level increase in suppliers' sales is predominantly driven by purchases from PE-backed customers rather than other clients. Specifically, multiplying the estimated coefficient of 0.18 in column (3) of Table 8 by the average sales share of treated suppliers to their PE-backed customers in the sample (approximately 25%) yields a value close to the estimated firm-level sales increase (with coefficient estimate of 0.06) in column (1) of Table 4.

Table O.C1. The effect of PE buyouts on suppliers of target firms: Disentangling the direct demand and certification channel

	(1) ln(Sales)	(2) ln(Employees)	(3) ln(EBITDA)	(4) ln(Markup)
Post PE	0.07***	0.04***	0.06**	-0.00
	(0.02)	(0.01)	(0.02)	(0.02)
Post-buyout within-network customers	0.01	0.01	0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Observations	45349	45349	45349	15821
Adjusted R-squared	0.93	0.97	0.90	0.73
Controls	No	No	No	No
Firm×Cohort FE	Yes	Yes	Yes	Yes
Year×Cohort FE	Yes	Yes	Yes	Yes

This table reports the estimated impact of PE buyouts on the suppliers of target firms. Across the different columns, the outcome variables are the natural logarithm of total sales, employees, EBITDA, and markups. All specifications include firm-by-cohort and year-by-cohort fixed effects. The sample of treated and control firms is constructed using a granular matching approach based on firm size, leverage, profitability, and industry, as explained in Section 3. Table O.A1 in the Appendix provides more information about the variable definitions. Standard errors are clustered at the firm-cohort level. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

References

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