

# Private Equity and Financial Fragility during the Crisis

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## Abstract

Does private equity (PE) contribute to financial fragility during economic crises? Academics and regulators have worried that the proliferation of poorly structured transactions during booms may increase the vulnerability of the economy to downturns. During the 2008 financial crisis, we find PE-backed companies decreased investments less than their peers, while experiencing greater equity and debt inflows. The effects are stronger among financially constrained companies and those whose PE investors had more resources at the onset of the crisis. PE-backed companies consequentially experienced higher asset growth and increased market share during the crisis. In a large-scale survey, we find that private equity firms were active investors during the crisis, spending more time with their portfolio companies to address operational and financial considerations.

Keywords: Leveraged buyout, debt, operational performance

JEL Classifications: G34, G30, G01

\*Stanford University and National Bureau of Economic Research (NBER); Harvard University and NBER; Northwestern University. We thank the Harvard Business School's Division of Research for financial support. We also thank seminar participants at Columbia, Duke, LBS, MIT, and Northwestern for helpful comments, especially Sabrina Howell, David Robinson, and Morten Sorensen. One of the authors has advised institutional investors in private equity funds, private equity groups, and governments designing policies relevant to private equity. All errors and omissions are our own. Emails: [shaib@stanford.edu](mailto:shaib@stanford.edu), [josh@hbs.edu](mailto:josh@hbs.edu), and [filippo.mezzanotti@northwestern.edu](mailto:filippo.mezzanotti@northwestern.edu)

# 1 Introduction

An extensive literature explores the effects of private equity ownership on firm productivity, product quality, employment, and related dimensions (e.g., Bernstein, et al., 2016; Bernstein and Sheen, 2016; Cohn and Towery, 2013; Davis, et al., 2014; John, Lang, and Netter, 1992; Kaplan, 1989; and Lichtenberg and Siegel, 1990). In general, the picture painted by these papers is one where private equity firms positively and substantially impact the operations of the firms in which they invest. This pattern is not confined to the United States: Boucly, Sraer, and Thesmar (2011) study French transactions and argue that private equity funds create value by relaxing credit constraints, which explains the subsequent increases in profits, growth, and capital expenditures in the firms they backed.

However positive the impact of private equity in normal times, an important concern surrounds its consequences in exacerbating economic downturns. Private equity has been intensely cyclical, with the volume of transactions highly correlated with equity valuations and economic cycles. Moreover, the transactions done during market peaks seem to differ substantially from those in other periods. Kaplan and Stein (1993) document evidence consistent with “overheating” in the buyout market, with higher valuations, transactions in riskier industries, increased leverage, and poorer alignment of the key parties at the peak of the market.

Looking across multiple market cycles and geographies, Axelson and co-authors (2013) explore one of the above considerations. They show that the use of leverage in buyouts has little to do with the underlying characteristics of the companies themselves, but rather are driven by changes in credit conditions in the broader economy. These periods of high leverage are associated with higher transaction prices and lower subsequent returns, suggesting that private equity investors overleverage and overpay when access to credit is readily available. Moreover, the increased level of activity during booms may translate into an inability to effectively monitor and fund their portfolio firms during economic downturns, as witnessed by the lower relative rates of productivity growth by private equity-backed firms during these periods (Davis, et al, 2014).

These cycles in the PE market may have broader economic implications. Private equity firms are important economic actors. In the three years leading up to the financial crisis (between 2006 and 2008), global PE groups raised almost \$2 trillion in equity,<sup>1</sup> with each dollar typically

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<sup>1</sup> <http://www.preqin.com>

leveraged with more than two dollars of debt (Kaplan and Stromberg, 2009). In the United Kingdom (UK, the focus of our study), private equity-owned assets at the time of the crisis represented about 11% of GDP,<sup>2</sup> the largest share in the world. In line with these numbers, the Bank of England estimated that PE-backed companies had issued more than 10% of all non-financial corporate debt in the UK before the crisis and that as many as 20% of British private sector workers were employed by PE-backed firms in 2007 (Goergen, O’Sullivan, and Wood, 2011). In the United States, similar calculations suggest that PE-backed firms represented 7% of GDP in 2008 and that close to 1% of private sector employees were employed by firms bought out in each year during the period leading up to the crisis (Davis, et al., 2014).

This literature suggests that private equity can have systematic economic consequences during economic downturns. These are likely to stem from the poor selection and structuring of transactions during booms that may lead to financial distress during a crisis, exacerbating cutbacks in investment and employment and contributing to the persistence of the downturn (Bernanke and Gertler 1990; and Bernanke, 1983). Put differently, by creating a set of potentially fragile firms in the run-up to an economic crisis, private equity may have a systematic impact in downturns (Giroud and Mueller, 2015).<sup>3</sup>

This concern has manifested itself in policy circles as well. Both the European Central Bank (ECB) and US regulators led by the Federal Reserve Bank have issued guidance to cap the amount of leverage used in PE transactions, citing concerns about systematic risk. As the ECB noted when launching their regulations, “The prolonged period of very low interest rates and the ensuing search for yield strategies have warranted specific monitoring of credit quality by the ECB in general and of leveraged finance exposures in particular... Both the appetite to underwrite a transaction and the propensity to retain parts of the exposure have grown among the significant credit institutions supervised by the ECB.”<sup>4</sup> In a similar vein, the Bank of England has argued that

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<sup>2</sup> These numbers are obtained by dividing the total private equity fundraising between 2004 and 2008, as estimated by the European Venture Capital Association and PEREP Analytics (in the case of the UK) and *Buyouts* magazine (in the case of the US), by GDP in 2008 (as reported by the World Bank). In both cases, we exclude venture capital funds.

<sup>3</sup> Giroud and Mueller (2015) show that more highly levered firms exhibited a significantly larger decline in employment during the crisis, controlling for a broad array of other characteristics, and that these layoffs had important regional consequences.

<sup>4</sup> European Central Bank, Banking Supervision, Guidance on leveraged transactions, May 2017, [https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.leveraged\\_transactions\\_guidance\\_201705.en.pdf](https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.leveraged_transactions_guidance_201705.en.pdf).

buyouts should be monitored for macro-prudential reasons, because “the increased indebtedness of such companies poses risk to the stability of the financial system.”<sup>5</sup>

Note that the concerns expressed by scholars and regulators regarding the potentially deleterious effects of PE differs from anxieties about banks, where the failure of a single bank can ripple through the economy as credit lines are cut off. Rather, the primary concern about PE is the weakness engendered by poor transaction selection and structuring prior to the crisis. Thus, in this analysis, we do not seek to examine the financing of new firms during economic downturns. Put another way, we are not considering whether private equity firms reduce financial fragility by alleviating financing constraints during crisis periods, that is, by acting as a substitute to banks or other financial intermediaries during these periods. Rather, we focus on the fate of companies already financed by PE.

As an alternative to this financial fragility hypothesis, PE-backed companies may be resilient to downturns, and therefore play a stabilizing role during bad times. In particular, these companies may be better positioned to obtain external funding when financial markets are dysfunctional. First, PE groups have strong ties with the banking industry (Ivashina and Kovner, 2011) and may be able to use these relationships to access credit for their firms during periods of crisis. Second, because PE groups raise funds that are drawn down and invested over multiple years—commitments that are rarely abrogated—they may have “deep pockets” during downturns. These capital commitments may allow them to make equity investments in their firms at times when accessing other sources of equity is challenging. Finally, PE groups can redeploy their human capital from undertaking new transactions to assisting with existing firms and generate operational improvements (Bernstein and Sheen, 2016). For instance, Gompers, Mugford, and Kim (2012) report that by December 2008, the private equity fund Bain Capital had redeployed its 175 investment professionals to developing and implementing action plans to allow the firms in its portfolio to survive the downturn.

Motivated by these alternative hypotheses, we study the financial decisions and performance of PE-backed and non-PE backed companies in the wake of the financial crisis. We focus on the financial decisions and performance of these firms during this period, in an attempt to understand whether private equity exacerbates or dampens the sensitivity of the economy to economic downturns.

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<sup>5</sup> *Bank of England Quarterly Bulletin*, 2013Q1

To do so, we focus on the UK, which is a suitable environment to study this question for several reasons. First, the UK had the largest private equity market as a share of GDP before the crisis (Blundell-Wignall, 2007) and one of the largest in absolute value. Second, the UK provides detailed income statement and balance sheet information for almost every active company, whether public or private (Brav, 2009; and Michaely and Roberts, 2012). Similar financial data are not available in the United States. Finally, the UK experienced a severe credit market freeze during the 2008 crisis, with a dramatic decline in private sector investment and lending (Riley, et al., 2014). As illustrated in Figure 1, aggregate investment declined by more than 20% during 2008 in the UK, which simultaneously experienced a sharp credit contraction (Figure 2).

Our main analysis focuses on a final sample of almost five hundred companies that were backed by PE prior to the financial crisis. Using a difference-in-difference approach, we study how the financial decisions and performance of the PE-backed companies were affected by the onset of the crisis relative to a control group. The control group employs companies that were operating in the same industry as the PE-backed companies and had similar size, leverage, and profitability in 2007, following the methodology of Boucly, Sraer, and Thesmar (2011).<sup>6</sup> The matching firms had similar trends in the years leading to the crisis, along dimensions such as investment, revenue, return on assets, equity contributions, and debt issuances. Therefore, this approach allows us to explore differences that stem from organization structure, rather than their balance sheet or investment characteristics.

We start by comparing the PE-backed companies and their peers' behavior during the financial crisis. We find that PE-backed companies decreased investments less than non-PE-backed companies did during the financial crisis, with between five and six percent greater spending, an effect that is strongly statistically significant. Looking at the timing of the effects, the two groups did not differ significantly in the pre-crisis period, but the investment rate of the PE group substantially diverged from the control group beginning in 2008. In fact, the divergence of the PE group occurs exactly when aggregate investments and credit growth in the UK started to decline sharply.

We then show that the higher investments by PE-backed companies reflect the fact that these firms appear to have been less bound by financial constraints. We find that debt issuance

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<sup>6</sup> As we discuss in the paper, the main results are confirmed also when using a similar matching procedure but excluding leverage as a matching variable.

over assets was four percentage points higher for PE-backed companies during the crisis, and similarly, equity issuance over assets increased by two percentage points relative to their peers. At the same time, PE-backed companies experienced a relative decrease in the cost of debt, measured by interest expense over total debt. As before, these effects appeared first in 2008 and continued through the remainder of the period (with varying levels of statistical significance).<sup>7</sup>

The idea that private equity firms can help relax the financial constraints of portfolio companies is also consistent with two additional findings. First, the positive effect on investment is particularly large among companies that were ex-ante more likely to be financially constrained during the crisis. We find this result using various proxies of financial constraints, such as size, industry dependence on external finance (Rajan and Zingales, 1998), and pre-crisis leverage.

Second, the increase in investment is larger when the private equity sponsor had more resources available at the onset of the crisis to help its portfolio companies. To explore this dimension, we exploit the heterogeneity across private equity firms. First, we focus on the amount of dry powder—capital raised but not yet invested – that was available to investors at the time of the financial crisis. Second, we look at whether their most recent fund was at an earlier stage at the time of the financial crisis. These tests are based on the underlying assumption that PE firms that are in the early years of their fund and with more dry powder have more resources—both financial and operational—to invest in their portfolio companies during the crisis. Our results confirm this hypothesis.

Finally, we examine the performance of PE-backed companies during the financial crisis. We find that PE-backed companies experienced greater growth in their stock of assets in the years after the crisis, consistent with the greater investment seen above. Similarly, we find that PE-backed companies increased their market share in the industry during the crisis. At the same time, PE-backed companies did not underperform their peers: that is, they did not become relatively less profitable, whether measured by the ratios of EBITDA to revenue or net income to assets. We also

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<sup>7</sup> The results are robust to a battery of checks. Throughout the analysis, we control for firm fixed effects, and thus remove time-invariant characteristics of the control and treatment firms. We also show that the results are not driven by non-parallel trends in the pre-crisis period and they are not affected by the addition of company controls. Second, our main results do not change when we exclude companies whose private equity deals were management buyouts (MBOs) or public-to-private transactions. Third, it does not appear that the results simply reflect differences in attrition between PE and non-PE companies. Fourth, the results remain unchanged if we control for time-varying industry shocks around the crisis. Lastly, we also confirm that the results are robust to alternative matching estimators. In particular, we find that removing leverage from the variables used to match companies does not affect our results. Neither undertaking the matching approach in 2003, 2004 or 2005 (well before the crisis) nor matching each PE-backed company in the year before the PE buyout significantly changes the results.

find that PE-backed companies were not more likely to go bankrupt relative to their peers, but were more likely to be sold through non-distressed M&A transactions. Overall, these findings are inconsistent with the hypothesis that PE investments increased the financial fragility of the portfolio firms during the crisis.

To explore further the mechanism underlying the results, we conducted a large-scale survey with more than 300 private equity investors. The respondents were experienced investors, almost all of them were at the partner level, with an average of 14 years of experience in the industry. In the survey, we explored whether the operational and financial activities of private equity investors changed during the crisis (relative to normal times) and, if so, how.

The survey evidence reveals that PE investors were significantly more likely to assist portfolio companies with their operating problems during the crisis and provide strategic guidance. Consequently, PE investors were also more likely to interact frequently with portfolio companies during the crisis. In contrast, PE investors were less likely to search for new deals.

Moreover, the survey reveals that during the crisis, PE investors were also more likely to assist portfolio companies with their financial structuring issues. Specifically, they were more likely to interact with bankers and lawyers and renegotiate debt obligations. PE investors were also more likely during the crisis to assist portfolio companies in raising additional debt financing and to inject equity to alleviate financing constraints. Motivated by these findings, we examine the renegotiation of loans to PE-backed and non-PE backed companies using the Dealscan and Standard & Poors databases. Consistent with the survey evidence, we find that in the years immediately after the crisis, loans to PE-backed companies were about 50% more likely to be renegotiated.

In the last part of the survey, we ask investors which unique features of PE investment allowed them to assist portfolio companies during the crisis. PE investors highlight majority control, private ownership (and the lack of scrutiny of public equity markets), and the long-term horizon of PE investors. Moreover, PE investors argue that they can provide better access to banks and restructure debt obligations, and highlight the availability of dry powder (committed but uninvested capital) during the crisis as an important source of liquidity to assist portfolio companies.

Taken together, these results illustrate that PE-backed companies do not appear to be more sensitive to the onset of the financial crisis. Rather, during a period in which capital formation

dropped dramatically, PE-backed companies invested more aggressively than peer companies did. This ability to maintain a high level of investment appears related to the superior access of PE-backed companies to financing, in terms of both equity and debt issuances, and the lower cost of debt. This strategy allowed PE-backed companies to expand and increase market share during the crisis. Moreover, the survey evidence suggests that PE firms were active investors and more likely to engage with portfolio companies during the crisis to mitigate various financial and operational issues.

This paper relates to an extensive body of work examining the behavior of financial institutions during the financial crisis and their consequences for operating firms (e.g., Ivashina and Scharfstein, 2010; and Ben-David, Franzoni, and Rabih, 2012). The conclusions, though, are more benign here than many of the studies examining other financial institutions, including banks, rating agencies, and hedge funds. The role of private equity groups seems more akin to those of the Japanese banks during the 1980s documented by Hoshi, Kashyap, and Scharfstein (1990, 1991), where better information and aligned incentives allowed bank-affiliated firms to overcome the capital constraints that limited investments of their peers without such relationships. During the financial crisis, the greater alignment and relatively longer time horizons of private equity investors may have allowed firms to more successfully respond to the economic dislocations.<sup>8</sup> The paper is also related to an extensive literature that explores the effects of private equity ownership on firm outcomes (e.g., Bernstein, et al., 2016; Bernstein and Sheen, 2016; Boucly, Sraer, and Thesmar, 2011; Cohn and Towery, 2013; Davis, et al., 2014; John, Lang, and Netter, 1992; Kaplan, 1989; and Lichtenberg and Siegel, 1990).

The paper is organized as follows. In Section 2, we present the data used in this study. Section 3 then describes the empirical approach employed in the paper. Sections 4 and 5 present the main results on investment and performance, discussing the possible mechanisms behind our results and presenting a battery of robustness tests. Section 6 discusses the survey results. Finally, Section 7 summarizes our results and conclusions.

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<sup>8</sup> The high-degree of diversification among different types of limited partners (LP) of buyout funds may explain why they were able to support their portfolio companies during the crisis. In contrast, Illig (2012) argues that that venture capital funds had difficulties in raising capital and had to defer capital calls during the crisis because their LPs base was less diversified and more concentrated among endowments.

## 2 Data

### 2.1 Sample Construction

We start our data construction by extracting from Capital IQ all UK companies backed by private equity before the financial crisis. We identified private equity deals in Capital IQ by searching for events such as “going private,” “leveraged buyout,” “management buyout,” and “platform.” In so doing, we excluded “growth buyouts,” “venture capital,” and “expansion capital” investments, where investors generally buy a stake in the company using little or no leverage. Since we are interested in studying the behavior of UK PE-backed companies around the financial crisis, we selected only firms that (i) were headquartered in United Kingdom at the time of the deal; (ii) had received a PE investment by the end of 2007, and (iii) did not experience an exit by the PE group by the end of 2008.<sup>9</sup>

We then further filter our data, keeping only those firms that had balance sheet and income statement information in Amadeus, a Bureau Van Dijk (BvD) data set of European companies. Amadeus collects data from the “Companies House,” the United Kingdom official national registrar office. As already pointed out by other authors (Brav, 2009; and Michaely and Roberts, 2012), the UK is a perfect setting for studies of private companies. According to current regulations, every registered limited company is required to provide financial and income information annually to the public register.

The extent of the requirement to disclose financial information in the UK, however, varies with the size of the company. Small (and some medium-sized) companies are allowed to file abbreviated accounts.<sup>10</sup> Since the amount of information small firms disclose to Companies House (and hence in the Amadeus dataset) is quite limited, we excluded this group from our analysis. The reliability of the source and its coverage of the remaining private firms is a key strength of our study. Most of the companies in our sample consist of middle-sized private enterprises, for which similar financial data are not available in the United States.<sup>11</sup>

We supplement Amadeus data with Orbis, another data product from BvD. While both Amadeus and Orbis collect information from the Companies House, Amadeus generally removes

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<sup>9</sup> During 2008, there were 28 exits of PE firms. The results remain unchanged if we include them in the sample.

<sup>10</sup> Since 2008, a small company is defined as one meeting at least two of the following criteria: total assets less than £3.26 million, annual turnover less than £6.5 million, and an average number of employees fewer than 50. This group usually reports only assets, revenue, and profits.

<sup>11</sup> One limitation of this data set is that balance sheet items are always reported at the book value.

firms from the sample after a few years of inactivity. This is not the case for Orbis. Since the post-financial crisis period was characterized by an increase in firm exit, using only Amadeus would have generated selection concerns that could undermine the reliability of our results.<sup>12</sup>

Therefore, we further restrict the sample to firms meeting the following criteria: (i) matched to Amadeus; (ii) not a small firm, as defined by the Companies House; and (iii) not operating in the financial (SICs 600-699), public (SICs 900-999), or utility sectors (SICs 489-493).<sup>13</sup> This led to an initial sample of 987 unique firms. Once we exclude firms that did not meet minimum data requirements for the matching process described below, the sample includes 722 firms.<sup>14</sup>

## 2.2 Other Data

We supplement the data from Amadeus/Orbis to identify potential acquisitions and bankruptcies during the crisis. We start by constructing two different variables that identify whether a firm went out of business. In particular, we generate a dummy “Out of Business,” which is equal to one if the firms’ information is missing in Amadeus/Orbis by 2011, suggesting that the firm no longer exists.<sup>15</sup> On its own, the interpretation of this variable is unclear, since a firm can exit from the company registry for many different reasons, such as bankruptcy or acquisition.

We thus further refine this measure by generating a dummy—“Bad Exit”—that identifies companies that went out of business unambiguously because of distress. We generate this variable using the firm status history, available through Orbis. The data provider collects information from the Companies House and assigns to each firm a status, such as active, dissolved, dormant, or in liquidation, which may change over time. We define a company status as a “bad exit” if (a) the firm was not active by 2011 and (b) before disappearing from the data, its status implied that the firm was in liquidation or in insolvency proceedings.

Similarly, we use Capital IQ to identify potential profitable exits by looking at firms involved in M&A transactions from 2008 onwards. Since M&A transactions may also arise

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<sup>12</sup> Orbis and Amadeus are essentially the same data product. The main two differences are the deletion of exited firms, as discussed above, and the interface used to distribute the data.

<sup>13</sup> This industry sample selection is common to the private equity literature. Similarly, Michaely and Roberts (2012) apply a similar filter with the same data set.

<sup>14</sup> We require that companies have data on industry, return on assets, capital expenditures, asset, and leverage in 2007.

<sup>15</sup> In particular, we look at the total assets variable to identify company exits. Information on total assets is always required by UK reporting rules, and therefore when this field is missing, the company no longer exists.

because of distress, we provide an alternative measure by excluding companies that were acquired but were also identified in the same period as in distress, as discussed above.

Lastly, we also collect information on the history of the PE investors for each portfolio company, in order to identify when the PE investors raised their last fund before the crisis. The younger the last fund at the onset of the crisis, the more likely that the PE firm had financial and operational resources available, since the PE firm had less time to deploy capital to portfolio companies. In order to compile this information, we manually search the private equity firms in ThomsonOne and Capital IQ and collect information about their fundraising histories.

We also construct a measure of PE firm “dry powder,” a proxy for the dollar amount of financial resources that the PE investors had available by the time of the crisis (committed but undeployed capital). To generate this measure, we collect in ThomsonOne the fundraising and investment history for the PE investors during the 2001 to 2007 period, and calculate aggregate fundraising and investments.<sup>16</sup> The dry powder measure is the difference between the PE firm fundraising and investment.<sup>17</sup> Using this variable, we construct a dummy “high dry powder” that is equal to one if the company’s PE investors are in the top quartile for dry powder.

### **2.3 Comparison of the UK to Other Private Equity Markets**

One natural question is the extent to which private equity investment in the UK is anomalous, or rather similar to that in other countries. To address this concern, we undertake some simple comparisons of private equity activity across nations.

One cautionary note is that international comparisons of PE activity are not easy. While the trade association of the European PE industry, Invest Europe (formerly known as the European Venture Capital and Private Equity Association) has produced their own data since the 1980s, other national associations, including in the US, rely on private data companies. Unfortunately, these commercial data sources have often produced inconsistent estimates with quite different methodologies and definitions. In the compilations below, we focus on estimates of the activity by PE funds in general (excluding venture capital firms; that is, including buyout, mezzanine, growth,

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<sup>16</sup> To measure capital investment for PE investors, we sum the total equity investment made over the specified period. Appendix A.1 provides a detailed discussion on how we obtain equity investment from ThomsonONE.

<sup>17</sup> If a portfolio company has more than one PE firm, we select the dry-powder of the investor with the highest level of dry powder to categorize the syndication of investors. The results remain unchanged if instead we classify dry-powder to be equal to the one of the investor that made the largest equity investments before the crisis.

and other private equity funds), organized by the country in which the fund is based.<sup>18</sup> These choices are driven by the desire to present the longest and most consistent time series. Based on the shorter data series using other measures (for instance, focusing on transactions by buyout-focused funds only, or investments by nationality of the firm financed), the results do not change materially.

Figure 3 depicts several international comparisons of PE activity. We focus on the 14-year period around the financial crisis (that is, between 2000 and 2013), and depict in addition to the UK, data for Europe as a whole, France, Germany, and the US.<sup>19</sup> We present four panels in Figure 3: the aggregate equity value invested per year by funds based in a given country,<sup>20</sup> the amount invested as a share of GDP of the nation in that year (as reported by the World Bank), the average amount invested, and the number of investments per year. The source of the private equity data is Invest Europe, except for the US data, which is from Preqin (number of deals) and Cambridge Associates (dollar volume of deals).

The overall themes to emerge from these figures are that while the volume of activity varies across country—with the UK representing a disproportionate share of European activity—the patterns were very similar. More specifically:

- Panel A depicts the aggregate value of investments made per year by funds based in a given country. Virtually all the countries display a run-up in aggregate transaction value up until the inception of the financial crisis, and then a correction afterwards, followed by a recovery in the final years of the sample.
- Similar patterns appear in Panel B, which presents the aggregate value of PE investments per year by funds based in a given country as a share of GDP of the nation in that year. In all countries, private equity investments as a fraction of GDP increased in the run-up to the crisis and declined subsequently. Following the crisis, the share of PE investments recovered, particularly in the US and UK.
- Panel C presents the average deal value of private equity investments by funds based in different countries. Relative to other European countries, average deal size in the UK was

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<sup>18</sup> Thus, an investment by a London-based fund that is part of a US alternative investment group would be included in the UK total.

<sup>19</sup> We also provide data on deal volume and value for each market in Figure A.1 in the Appendix.

<sup>20</sup> To be clear, these are the actual equity injections into these firms, not the enterprise value or the imputed equity capitalization of the portfolio firms.

significantly higher, although it remained much smaller than transaction values in the US. The temporal patterns here were similar to those above. Deal sizes increased in all countries during the run-up period, while during the crisis average deal size declined significantly in all countries.

- Panel D depicts the number of investments made per year by funds based in a given country. In all countries, there was an increase in transaction volume up until the financial crisis, and then a decline in number of investments. The one exception was late-blooming Germany, where private equity had little traction before the financial crisis. While the number of investments increased, total PE transaction value declined in Germany as well, as depicted in previous figures.

Another interesting comparison between different PE markets relates to the type of buyouts. In Panel D of Table 1, we describe the type of investments for our UK sample. We find that roughly 40% of transactions were private to private, 30% divisional buyouts, and 20% are secondary sales. Only 5% of transactions in our sample were public to private. Interestingly, Boucly, et al. (2011) reports a very similar distribution of transaction types in France, and Stromberg (2008) suggests a similar distribution of private equity investments around the world. Specifically, roughly 27% of transactions in France, and 26% in Stromberg's global sample, were divisional buyouts. Secondary sales were slightly less frequent in France (15%) and worldwide (13%). Finally, in both of these samples, the share of public-to-private transactions was around 4.5%, while private-to-private transactions were roughly 50% of the sample.

Overall, this comparison reveals significant similarities across the different markets in which private equity investors operate. In each case, there was an increase in total value of private equity investments and deal sizes in the years leading up to the crisis, and a significant contraction in terms of value and deal size during the crisis. These markets were also quite similar in terms of the types of deals PE investors undertook. Such similarities are important when considering the external validity of the findings below.

### **3 Empirical Strategy**

To understand how the crisis affected the financial and investment policies of PE-backed companies, an ideal experiment would compare two identical firms during the crisis, with the only difference that one is backed by a PE firm and the other is not. Absent such identical firms, we

develop a difference-in-difference design where we compare PE-backed companies to a matched set of control companies around the financial crisis. We first describe how we construct the sample of matched firms and then discuss the empirical specification.

### **3.1 Constructing a Matched Control Group**

Private equity-backed companies are clearly not a random sample of the population: for instance, they are likely to be larger and more leveraged than the average firm. Therefore, the first step in the analysis is to identify a proper control group for the set of PE-backed companies.

Following Boucly, Sraer, and Thesmar (2011), we identify a suitable control group through a matching procedure for each PE-backed company in our sample. We identify a set of control firms that operated in the same industry and had a similar size, leverage, and profitability in 2007. This procedure involved two steps. First, for all private equity-backed companies in our data, we selected every company in the Amadeus/Orbis sample that (a) belonged to the same two-digit SIC; (b) had a return on assets (ROA), defined as net income over total assets, within a 30% bracket around our PE firm; (c) had assets within a 30% bracket around our PE firm; and (d) had leverage within a 30% bracket around our PE firm. Second, if this first step identified more than five firms, we selected the closest five, based on quadratic distance computed based on the variables.<sup>21</sup>

Overall, this procedure is a more conservative version of Boucly, Sraer, and Thesmar (2011), since we add an additional variable to the matching—leverage—and use a narrower matching bandwidth.<sup>22</sup> Using this methodology, we were able to match 434 of the 722 firms, generating a total sample of 1,984 firms. In the robustness section, we present an alternative matching procedure that is closer to Boucly, Sraer and Thesmar (2011), by eliminating leverage in the matching procedure.<sup>23</sup>

For every firm in the final sample, we extract from Amadeus/Orbis the full set of income and financial information available for the period from 2004 to 2011. Using these data, and

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<sup>21</sup> In Table A.1 in the Appendix, we repeat the main results using a similar matching strategy in which we scale the difference in the quadratic measure by the standard deviation of the corresponding variable in the sample (following Abadie and Imbens, 2011). The results remain unchanged.

<sup>22</sup> The other difference is that we measure size in terms of assets and not employment. The reason for this choice is that employment variable in Amadeus is significantly less populated than assets. However, in a robustness test, we added employment as a fourth variable in our matching procedure and show that this does not affect the results.

<sup>23</sup> In a previous version of the paper, we have used wider matching boundaries (50% instead of 30%), which is in line with Boucly, Sraer, and Thesmar (2011). In general, these changes increase the size of our final sample and marginally reduced the quality of the matches, but did not affect the main results.

following Brav (2009) and Michaely and Roberts (2012), we construct several measures of firm activity. In particular, we calculate capital investments as the change in assets plus the reported depreciation. We identify equity injections in the company by measuring the change in equity minus profit. Similarly, debt issuance is computed as the change in total liabilities in the year. All of these variables are normalized by total assets. In addition, we measure firm leverage as total liabilities over total assets, and the cost of debt as the ratio of total interest expenses to total debt. In order to limit the influence of outliers, we winsorize all ratios at 1%. The Data Appendix provides more details about the variables and the sample.

Panel A of Table 1 shows the industry distribution of the PE-backed companies in the sample. We compare these with the universe of the UK firms, after we eliminate small businesses and companies in the financial or regulated sectors. The majority of the sample firms are in either the services (38%) or manufacturing (32%) industries. Other important industries include wholesale trade, construction, and retail. The sample industry distribution is relatively close to the universe of companies: the major difference is that PE-backed companies tend to be more concentrated in manufacturing, and less represented in the construction industry and services. Both the treatment and control samples have the same industry distribution due to the matching procedure.

In Panel B of Table 1, we compare the characteristics of firms in the treatment and the matched control group in 2007. The average firm in the sample is a mid-sized firm with around \$80 million in revenue. Across the two groups, firms have very similar ROA, investment, leverage, and equity and debt issuances. These differences are insignificant, with small economic magnitudes. Similarly, all PE-backed companies and control firms are under private ownership (with few exceptions among the control group), and are not in default or in insolvency proceedings at the onset of the financial crisis. The only notable difference is that PE-backed companies are slightly larger than the control group in terms of revenue. Overall, this matching procedure suggests that differences across the treated and control groups mostly disappear when we compare firms with similar sizes, leverage ratios, and profitability within the same industry.

Since this paper relies on a difference-in-difference analysis, it is important to explore the assumption of pre-crisis parallel trends. We explore whether this assumption holds in the observables in Panel C. In particular, we compare one and two-year growth rates ending in 2007 for the main firm characteristics considered so far. We find that the differences in the growth rates

between the two groups are not significantly different from zero across all observables. Similar patterns can be seen graphically in Figures 4, 5, and 6, in which both treatment and control firms follow similar trends in the years leading up to the crisis.

Overall, these analyses suggest that PE-backed companies were similar in 2007 to the control group. Later in the paper, we further show that our results are also stable when we augment our model with a set of controls for firm characteristics in 2007, which should absorb any residual differences in observables across the two groups. Moreover, the two groups present similar growth paths before the crisis, which alleviates concerns that PE-backed companies were outperforming the control group before the crisis. As we discuss below, our estimates are consistent with the assumption of parallel trends between treated and control groups during the period leading to the crisis, the main identification assumption in our difference-in-difference design. A more formal and direct test of the parallel trend assumption will be discussed in Section 4.

### 3.2 Identification Strategy

We estimate this model using a panel data set from 2004 to 2011, a symmetric window around the 2008 shock.<sup>24</sup> The choice of 2008 as the first year of the crisis is in line with a large body of empirical evidence on the crisis (e.g., Duchin, Ozabas, and Sensoy, 2010; and Kahle and Stulz, 2013), as well as official statistics on the UK provided by the Bank of England. As we show in Figure 1, aggregate investment in the UK declined by more than 20% between the beginning of 2008 and mid-2009. At the same time, credit availability experienced a sharp contraction, starting in the first quarter of 2008 (Figure 2).<sup>25</sup> We estimate the following equation:

$$y_{it} = \alpha_t + \alpha_i + \beta_1(PE\ firm_i * Post) + \theta X_{it} + \varepsilon_{it} \quad (1)$$

where  $y_{it}$  is an outcome variable measured for company  $i$  at time  $t$ ,  $(\alpha_i, \alpha_t)$  are a set of company and year fixed effects,  $PE\ firm_i$  is a dummy for the companies that are backed by PE investors, and  $Post$  is a dummy for the period from 2008 to 2011. Furthermore, we augment our specification with a set of firm covariates  $X_{it}$ . Lastly, we cluster standard errors at the firm level (Bertrand, Duflo, and Mullainathan, 2004).

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<sup>24</sup> For consistency, each PE-backed company and its corresponding control group enter in the sample at the same time, which is 2004 or the year of the PE deal if after 2004.

<sup>25</sup> Statistics are taken from the Bank of England's "Trends in Lending - April 2009," <https://www.bankofengland.co.uk/-/media/boe/files/news/2009/april/trends-in-lending-april-2009>, 2009.

The inclusion of firm fixed effects removes time-invariant differences between treatment and control firms. However, the causal interpretation of the results crucially depends on the parallel trend assumption. In particular, we need to assume that PE-backed companies would have experienced the same change in behavior as non PE-backed companies in the absence of the financial crisis. We explore the existence of this assumption by examining pre-shock trends.

First, it is important to recognize that our treatment and control groups are similar, at least in terms of observable characteristics. By construction, both groups have the same industry distribution and, as we discussed before, profitability, investment, and leverage are similar across these groups. Even more importantly for the parallel trend assumption, the PE and non-PE companies have similar growth rates in the years leading up to the crisis, as illustrated in Panel C of Table 1. Pushing this argument one step further, we can formally examine the time-varying behavior of the treatment effects for the main outcomes in our analysis by estimating:

$$y_{it} = \alpha_t + \alpha_i + \sum \beta_k (PE\ firm_i) + \theta X_{it} + \varepsilon_{it} \quad (2)$$

where we estimate a different  $\beta_k$  for every year between 2004 and 2011, using the last year before the crisis, 2007, as the reference year. If our parameter  $\beta_k$  in the standard equation is correctly capturing the causal effect of the crisis on private equity firms—rather than a differential trend between the two groups—then we expect the effect of private equity to appear only at the onset of the crisis. In the next section, we will show evidence consistent with this argument.

In the paper, we take two additional steps to strengthen the analysis further. First, we augment our specifications with controls that capture the heterogeneity across firms in important characteristics before the crisis. In particular, we control for firm size (log of revenue), growth of revenue, normalized cash flow (cash flow over assets), profitability (ROA), and leverage. To avoid concerns regarding the endogeneity of controls (Angrist and Pischke, 2008; and Gormley and Matsa, 2014), these variables are measured in the pre-crisis period (2007) and then interacted with the crisis dummy to allow them to have a differential impact around the shock. These controls further alleviate concerns regarding the presence of some unbalanced observable characteristics across treatment and control groups before 2008.

Second, as a robustness test for our main results, we also add a full set of time-varying industry fixed effects, which can account for changes in industry demand and other industry considerations around the financial crisis. In particular, we interact two-digit industry fixed effects with the post dummy. We discuss this, as well as additional robustness tests, in Section 4.2.

## 4 Investment and Funding

### 4.1 Main Results

We start by examining whether companies backed by PE investors were more or less affected by the financial crisis. While overall investments dropped significantly in the UK during the crisis period, it is important to understand whether PE-backed companies experienced even a more severe decline during the crisis.

We start our analysis by studying the change in investment policies in PE- and non PE-backed companies. In column (1) of Table 2, we find that PE-backed companies decreased investments less than non-PE backed companies around the financial crisis. This effect is not only statistically significant, but also large in economic magnitude. Normalized by assets, the PE firms saw their investments increase by almost 6% relative to the non-PE companies in the post-crisis period. In column (2), we find that the results are unchanged—in terms of both size and statistical significance—when we add the standard set of firm-level controls.<sup>26</sup>

In Figure 4, we plot the year effects estimates around the crisis—and the corresponding standard errors—separately for the PE-backed companies and matched companies. As illustrated in the figure, both treated and control firms followed similar paths before the crisis: the estimates are not statistically different from one another. Hence, the estimates seem to satisfy the parallel trends assumption. Once the crisis ensued, both the PE-backed companies and the matched companies decreased investments dramatically during 2008 and 2009. However, the PE-backed companies decreased their investments significantly less during the crisis years, consistent with the evidence in Table 2. This higher level of investment persisted in the years after the crisis.

Similar conclusions arise from Column (1) of Table 3, where we estimate equation (2) to capture year-by-year PE effects (we add company controls in column (2)). This analysis formally estimates the significance of the differences between the two groups, confirming the lack of statistically significant patterns before the crisis. In contrast, note that investments by PE-backed companies substantially diverged from the control group at the same time as the sharp decline in aggregate investments and credit in the UK, as illustrated in Figures 1 and 2. This positive

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<sup>26</sup> Since we focus on the PE treatment effects around the crisis and therefore after the PE investments, our results do not account for the potentially positive impact of the initial PE investment on operations and financing. Since the effects of the initial investment has been generally found to be positive (e.g., Kaplan, 1989), our estimates may underestimate the overall effect of PE on the portfolio companies.

difference persists in the next few years. We plot the estimates in column (2) graphically in Panel A of Figure A.2 in the Appendix.<sup>27</sup>

Overall, the results so far suggest that companies backed by private equity firms were more resilient in the face of the financial crisis than a similar set of non-PE backed companies, therefore contradicting the claim that PE firms increased financial fragility. Next, we move to explore the mechanism behind this finding. One hypothesis is that PE firms help their portfolio companies to maintain high investment levels by relaxing their financial constraints, particularly during periods of financial upheaval. This can happen in two ways. First, private equity firms have fund commitments that are rarely abrogated and may therefore be in a better position to inject equity into the companies if access to financial markets is limited. Second, private equity firms have strong ties with banks (Ivashina and Kovner, 2011) and should therefore find it easier to access credit markets during periods of turmoil. We find evidence that is generally consistent with both these channels in Table 2.

We find that net equity contributions increased more for PE-backed companies than for the control group around the crisis (Table 2, Columns 3 and 4).<sup>28</sup> Normalized by assets, equity contributions during the financial crisis were 2% higher for PE-backed companies relative to non-PE firms. As illustrated in Figure 5, equity contributions for both classes of firms dropped significantly during the crisis. However, the decline was smaller for PE-backed companies. This suggests that PE funds were willing to support the operations of their portfolio companies by injecting equity into the firms. As illustrated in Columns (3) and (4) of Table 3, there are no divergent trends before the crisis. This divergence in financial policy appeared mostly in 2008. We plot these estimates in the Appendix, in Panel B of Figure A.2.

At the same time, Column (5) of Table 2 illustrates that PE-backed companies also experienced a relative increase in debt issuance.<sup>29</sup> While on average debt issuance over assets

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<sup>27</sup> One could attempt to quantify the size of the gap in investment between PE-backed companies and control firms using our micro estimates. Given that PE-backed companies' assets were approximately \$30 billion at the onset of the crisis, the 6% gap between PE-backed companies and control firms translates into a \$1.8 billion increase in investment per year during the crisis years. When we compare this relative to the annual aggregate investment made in the UK at that time period (as reported quarterly in Figure 1), it implies that PE-backed companies in our sample increased aggregate annual investment by about 0.8% in that time period.

<sup>28</sup> Notice that we define equity contribution by looking at the changes in equity that were not explained by profit (see Data Appendix). Therefore, we cannot distinguish whether positive effects were due to raising more capital or paying out fewer dividends.

<sup>29</sup> As discussed in the data section and in the Appendix, this is measured as the change in total debt, scaled by assets.

declined during the financial crisis, this decline was 4% smaller for PE-backed companies. The result is similar when adding controls, as illustrated in Column (6). These patterns can be observed in Figure 6. In the years leading to the crisis, the PE-backed companies and matched companies followed similar, parallel trends. Both the treated and control companies experienced a significant decline in debt issuances during the crisis. PE-backed companies, however, experienced a relative increase in debt issuance in 2008, exactly when lending conditions and aggregate investment started to decline in the UK. We find similar results when estimating debt issuances on a yearly basis in Columns (5) and (6) of Table 3. Again, we plot these estimates graphically in the Appendix, in Panel C of Figure A.2.

While overall debt issuance was greater, PE companies did not materially increase their leverage, as is evident from columns 7 and 8 in Table 2. The PE coefficient in this regression is positive, but it is non-significant and small in magnitude. This null result reflects the joint increase in equity and debt. However, in columns (9) and (10) of Table 2, we find that the relative cost of debt, measured by the ratio of interest expense of total debt, declined for the PE-backed companies. This is also illustrated over time in Columns (7) and (8) of Table 3, confirming that the relative decline in cost of debt appears first in 2008, at the onset of the financial crisis.

One concern regarding the interpretation of the results is that by matching on leverage (in addition to other variables), we may have captured firms that are somewhat unrepresentative due to their high leverage. For this reason, we repeat the main analyses using an alternative matching that does not rely on leverage, but only on size, ROA, and industry. This matching estimator allows the two groups to have different leverage ratios in the pre-crisis period. This approach has two additional advantages. First, this matching is closer to the approach of Boucly, Sraer, and Thesmar (2011). Second, using fewer matching variables allow us to match a larger number of observations.

In Table 4, we repeat the analysis with the alternative matching methodology. We find that all results remain unchanged. In Columns (1) and (2), we find as well that PE-backed companies experienced a smaller decline in investment during the crisis, a highly statistically significant effect. We find similar results with respect to equity contribution (Columns 3 and 4) and debt issuances (Columns 5 and 6). The only difference with our main results is a positive increase in the relative leverage ratio for PE-backed companies (Columns 7 and 8), but the effect is small in

magnitude and only of borderline significance. As in the main results, we find a decline in interest expense during the crisis for PE-backed companies.<sup>30</sup>

Overall, these analyses suggest that private equity groups alleviated financing constraints of portfolio companies during the financial crisis, allowing them to invest more when credit markets were frozen and economic uncertainty high. In particular, private equity groups appear to have taken advantage of their fund structures and bank relationships to provide both equity and debt financing to their portfolio companies, with the latter at a lower cost.<sup>31</sup>

Why PE-backed companies were able to raise more external financing? There are several potential explanations. Since private equity firms typically own a majority stake in portfolio companies and control the board, information asymmetries are likely to be smaller. Moreover, given their full control, managers in portfolio companies are less entrenched and therefore less likely to be able to generate private benefits. These considerations may reduce frictions that prevent equity investments in companies. Moreover, repeated interactions of PE firms with banks may reduce information asymmetries, establish trust, and provide additional cross-selling activities, than is the case with other firms (Kovner and Ivashina, 2011; and Fang, Ivashina and Lerner, 2013). These considerations may have eased debt financing during the crisis for PE-backed companies.

## **4.2 Robustness**

In this section, we undertake a set of robustness analyses. First, we drop management buyouts from the main sample. At least historically in the UK, MBOs were characterized by lower engagement by PE firms. If their inclusion completely drove the results, the interpretation and generalization of the analysis might be subtler. To explore whether this is the case, we eliminate MBOs from the sample and repeat the main analysis. As we show in Table A.2 in the Appendix, we find similar results. In columns (1) and (2), we find that when MBOs are dropped, the effect on investment is even larger than in our baseline model. Similarly, we confirm the expansion in equity contribution and debt issuance, the relative stability in the leverage ratio, and the decline in interest expense. Therefore, the exclusion of MBOs does not affect the results.

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<sup>30</sup> The results from Table 2 also remain similar economically and statistically also if we estimate it using weighted least squares, where we weight firms based on their revenue at the onset of the financial crisis.

<sup>31</sup> It is important to note that we are not making any claims about whether PE firms allocated capital more or less efficiently than banks. It is an interesting question, which poses challenging measurement issues. Hence, while fascinating, this question is outside the scope of our paper.

We also explore whether our results are driven by public-to-private PE transactions. In Table A.3 in the Appendix, we repeat the main analysis while excluding such transactions. We find that the results remain unchanged. This result is expected, given that such deals compromise only 5% of the transactions in our sample, as illustrated in Panel D of Table 1.

Next, we address concerns that our estimates may be biased by attrition. As usual with panel data, endogenous exit through acquisition or bankruptcy may bias the results. First, we note that, as illustrated in Table 3, the shift in investment and financing policies occurred already in 2008 (at the peak of the financial crisis), while firm exit only took place later. We can also illustrate this pattern more directly by estimating our standard model using data from 2007 and 2008 only (Table A.4 in the Appendix), in which we find similar results. In other words, much of the shift in corporate policy happened soon after the onset of the crisis.

An alternative robustness test to address attrition bias concerns is to focus only on firms that did not exit the sample. In Table A.5 in the Appendix, we take this conservative approach and drop every firm that exited the database before 2011. This approach leads to approximately 15% fewer observations in the sample.<sup>32</sup> Even with this reduced sample, the main results remain unchanged. PE-backed companies experienced a smaller decline in investment and a relative increase in equity contributions and debt issuance. At the same time, the leverage ratio stayed constant, and interest expense declined.

Our results are robust also to changes in industry dynamics. One concern is that PE-backed companies may be more or less sensitive than the control group to any changes in demand that were contemporaneous with the crisis. In principle, this should not be a problem, because the treatment and control groups are matched within industries. Nonetheless, we augment our analysis with a full set of (two-digit) industry fixed effects interacted with the post dummy. This set of fixed effects can control non-parametrically for changes in demand and other time-varying industry characteristics. As we show in Table A.6 in the Appendix, despite the large number of fixed effects that the model introduces, the main results remain unchanged. The estimates are still close in magnitude and statistical power to the one presented in the text.

Finally, we further explore the robustness of our matching procedure. As discussed earlier, in the analysis we undertake the matching at the time of the onset of the financial crisis, to construct proper counterfactuals for the PE-backed companies during the crisis. An alternative approach

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<sup>32</sup> In our sample, about 310 firms exit before 2011.

would be to match PE-backed companies in an earlier year or just before the private equity buyout. While these matching approaches will not construct the most appropriate counterfactual *at the onset of the crisis*, it will provide a treatment effect that combines the joint effect of the buyout and the crisis. In Table A.7 in the Appendix, we explore constructing alternative control groups by conducting the matching at various points in time. Specifically, we conduct the matching in pre-crisis years (that is, in 2003, 2004, or 2005), as well as in the year before the buyout. Across all these different approaches, we find that main results of the paper remain similar and relatively unchanged, as reported in Panels A, B, and C.

### 4.3 The Heterogeneity of PE-Backed Companies

The results so far are consistent with the idea that private equity can play an important role during financial turmoil by relaxing the financial constraints faced by their portfolio companies. In this section, we provide more evidence consistent with this hypothesis by focusing on financially constrained firms.

We use several measures as proxies for financing constraints. First, we study how the effect of PE backing on investment differs between large and small firms (Table 5, Panel A). Consistent with the idea that small companies are more likely to be financially constrained, small businesses have been shown to be more sensitive to credit market shocks (Petersen and Rajan, 1994; Chodorow-Reich, 2014; and Bottero, Lenzu, and Mezzanotti, 2015). In our sample, we identify large firms by looking at the top quartile of employment at 2007, the last year in our pre-shock period, and classify remaining firms as small. Using this measure, we show in Columns (1) and (2) that the positive effect on investment is stronger for small companies.

Second, we find similar results when we look across companies that operate in industries that are more likely to depend on external finance, identified using the standard Rajan-Zingales (RZ) index (Rajan and Zingales, 1998). In particular, we define more financially dependent firms as companies operating in two-digit SIC industries whose share of capital expenditure that are externally financed was in the top quartile.<sup>33</sup> In principle, firms that were more dependent on external finance should have been more affected by the financial crisis, given the dramatic decline

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<sup>33</sup> In line with the literature, this measure is computed using data from US corporations between 1980 and 2008, available through Compustat. In particular, for each two-digit SIC industry, we measure the RZ index as the median of CAPEX minus cash flows from operations, scaled by CAPEX.

in credit availability. Therefore, if PE provides some relief to financial stresses, companies in industries characterized by larger RZ indices should benefit more from PE. Consistent with this idea, in Columns (3) and (4) of Panel A of Table 5, we find that the positive effect of being backed by PE is larger for firms in more financially dependent industries.

Third, we find similar results when comparing firms that were more leveraged entering into the crisis. In general, firms with higher leverage are characterized by lower financial flexibility and higher interest payment burdens. Therefore, they face more risks when credit markets dry up. Comparing companies based on their 2007 leverage levels, we define high-leverage firms if they are in the top quartile of the leverage distribution at the onset of the crisis. We find that companies with high pre-crisis leverage experienced lower investment post-crisis. But high leverage companies backed by PE investors decreased investments significantly less than their non-PE counterparts (Table 5, Panel A, Columns 5 and 6). The presence of a PE investor counter-balanced the negative effect of high leverage on investments.<sup>34</sup>

Similarly, we find that the effect of PE on debt issuance seem to be stronger among financially constrained companies (Table 5, Panel B). This is true when using firm size (Columns 1 and 2), dependence on external finance (Columns 3 and 4), and leverage (Columns 5 and 6). In Panel C of Table 5, we explore equity issuances. While the coefficients are generally in the expected direction, they are not statistically significant. This suggest that financially constrained firms particularly benefited from debt issuances to alleviate financing constraints. By way of contrast, equity contributions benefited all PE-backed companies similarly.

As another test, in Table A.8 in the Appendix, we explore whether the benefits of PE to financially constrained firms were more significant during the 2008-2009 period, relative to 2010-2011. During 2008-2009, credit markets froze, and finance was scarce and costly. Consistent with this hypothesis, we find that indeed financially constrained firms that were backed by PE firms were more likely to invest more, and especially to raise more debt, during the 2008-2009 period.

Overall, these results suggest that the positive effect of PE on investments was stronger among firms that were more likely to be financially constrained. Differences in funding strategies in response to the financial crisis—particularly with regard to debt—seem to explain this result.

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<sup>34</sup> Clearly, leverage in 2007 was endogenous to many firm characteristics, in particular debt capacity. If anything, firms that expect to respond more successfully to a negative credit shock should ex-ante employ more debt. Therefore, it is reasonable to think that the results are downward biased.

#### 4.4 The Heterogeneity of PE Groups

To further explore the underlying channel of the findings, we exploit heterogeneity across the private equity groups themselves. We focus on the differences across PE firms in their financial and operational resources that were available in 2007, at the onset of the financial crisis.

First, we compare PE groups based on the amount of “dry powder” that they had available at the onset of the crisis. As we discuss in the data section, we collect information from ThomsonOne about the amount of capital that PE firms raised, but not invested, in the pre-crisis period. Firms with more capital available may have been better positioned to provide liquidity to their portfolio companies and been able to commit more time and attention to portfolio companies, since they had deployed less capital. We divided the PE-backed companies into two groups, depending on whether their PE investors had dry powder at the top quartile in 2007.

In Table 6, we present the results. We naturally restrict the sample to PE-backed companies, since the variation at investor level is only relevant for PE-backed companies. In Columns (1) and (2), we find that companies whose PE investors had a considerable amount of dry powder at the beginning of the crisis increased their investment level relatively more. The result is both statistically and economically significant: a high dry powder company experienced a 10% increase in investment over assets relative to the control group. Consistent with this result, we find that this group of PE firms were also more active in financing their portfolio companies. Companies financed by high dry powder groups had 5% greater debt issuances (Columns 5 and 6) and, importantly, 7% larger equity injections (Columns 9 and 10), consistent with a greater availability of capital.

Second, we test this hypothesis using an alternative measure, which is whether the PE group’s most recent fund was of a relatively recent vintage in 2008. This analysis is based on the underlying assumption that PE firms with younger funds have more resources available—both financial and operational—to provide to their portfolio companies. Over the course of the first three to five years of the fund, PE firms deploy capital and commit their time and attention to portfolio companies. Therefore, PE funds that are younger at the onset of the crisis could direct more financial and operational resources to portfolio firms. We identify the year in which these investors raised their last fund before the financial crisis. We use a dummy that equals to one if the fund was formed in the years between 2002 and 2007.<sup>35</sup>

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<sup>35</sup> The result is also robust to using a continuous measure, the year of the last fund raised before 2007.

In Table 6, we also find a larger increase in investment when PE investors had raised a fund more recently (Columns 3 and 4), suggesting the importance of the availability of resources for the PE group. We find similarly strong patterns with respect to debt issuances, which have increased much more for companies where the investors had raised a fund more recently (Columns 7 and 8). The effects are both economically and statistically significant. The results for equity contributions are similarly positive and statistically significant in Column 11. When adding firm controls in Column 12, however, while coefficients remain similar, they are no longer statistically significant.<sup>36</sup>

Overall, the results in this section are consistent with the hypothesis that portfolio companies with PE investors that had more resources at the onset of the crisis, financial and operational, increased investments during the crisis. We further explore the mechanisms through which PE firms contributed to their portfolio companies during the crisis in a large-scale survey that we describe in Section 6.

## **5 Performance and Company Outcomes Analysis**

### **5.1 Company Performance**

In this section, we attempt to understand the long-term prospects of PE-backed companies. We examine this question by looking at various measures of company performance. Were the investment by PE-backed companies imprudent or wasteful, we would expect that these decisions would have detrimental effects on their performance.

In Columns (1) and (2) of Panel A in Table 7, we find that PE-backed firms' assets grew faster than those of the matched firms. This pattern is consistent with prior findings that PE-backed companies decreased their investment relatively less during the crisis.

Next, we explore accounting measures of firm performance around the crisis period. In Columns (3) and (4), we explore EBITDA scaled by revenue, and in Columns (5) and (6), ROA, defined as net income over assets. In both cases, we do not find that PE-backed companies experienced worse performance than the matched firms during the crisis.

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<sup>36</sup> In Table A.9 in the Appendix, we explore heterogeneity across portfolio companies that were backed by a single PE investor, versus portfolio companies backed by a syndicate of PE investors. A syndicate of PE investors may on the one hand benefit portfolio companies by enabling access to “deeper pockets”, but on the other may generate “free riding” and coordination problems within the syndicate. We find no statistically significant differences between the two types of portfolio companies.

This analysis suggests that the average performance of PE-backed companies was not differentially affected by the financial shock. However, given the long-term nature of the returns in many corporate capital expenditures, these accounting measures of performance may fail to fully capture the underlying changes in asset quality and company value around the crisis captured by their expansion strategy. For example, Gilchrist, et al. (2017) show that during the 2008 crisis, less financially constrained firms lowered their prices as an investment to build market share. In contrast, financially constrained firms could not pursue such a strategy since they needed the liquidity in the short run to meet their financial obligations. Therefore, the next two sections explore two dimensions of firms' performance. First, to capture the potential benefits of increased investment, we explore how firms' market shares evolved around the crisis. Second, we examine the patterns of firm exit—both positive (non-distressed M&A acquisitions) and negative (bankruptcy)—in the post-crisis period.

## 5.2 Market Share

The increase in investment may yield long-term profitability (and valuation) benefits if it allows the firm to capture a larger share of its market. We explore this hypothesis in Panel B of Table 7. For each firm in our sample, we measure its market share as the firm's sales relative to the total operating revenue in its industry (using the three-digit SIC codes).<sup>37</sup> Then, using a log-specification, we explore the change in market share of PE-backed companies relative to their peers during the crisis.

In Columns (1) and (2), we explore this question focusing on market share outcomes in the first two years of the crisis (2008 and 2009), where we found the largest divergence in investment and funding policies. In other words, using market share as a dependent variable, we repeat the standard difference-in-difference model using the 2004-2009 period. We find that during the crisis period, PE-backed companies experienced an 8% increase in market share relative to the control group. In Columns (3) and (4), we show that results are also similar when we use the full sample period (2004-2011), albeit smaller and less precisely estimated.<sup>38</sup>

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<sup>37</sup> The total operating revenue of the industry is constructed using only medium and large firms in the Orbis/Amedeus data, as previously discussed. Results are also similar using the SIC two-digit industry classification.

<sup>38</sup> In Appendix Table A.10, we show that these results are robust to an alternative specification. In particular, rather than using the full panel, we employ only cross-sectional variation. In particular, in Columns (1) and (2), we show that PE-backed companies were more likely to have larger market share in 2009 relative to 2007 (using a conditional

In order to explore what may drive these slight differences in the results, in Columns (5) and (6), we employ a fully interacted model where we examine the effect of being a PE-backed company in every year of our panel. Consistent with our previous results, we find that PE-backed companies experience a larger increase in market share in 2008 and 2009, but this effect becomes smaller and statistically insignificant in 2010 and 2011. This result is consistent with the fact that the change in investment and funding policy were mostly concentrated in the 2008 and 2009, a period during which the financial turmoil was most severe. Furthermore, this timing is consistent with the findings of Gilchrist, et al. (2017), which identified changes in pricing strategies of financially less constrained firms concentrated in the 2008 and 2009 crisis years.

Overall, our results suggest that PE-backed companies may have channeled their investment towards an increase in market share rather than increasing their short-term profitability. In the next section, we look at exit patterns as another relevant dimension to understand firms' performance.

### 5.3 Exit Analysis

In this section, we examine exit patterns in the post-crisis period. In particular, we compare the relative likelihood that PE-backed companies entered distress, went bankrupt, or were acquired. This provides an additional perspective on the performance of PE-backed companies during the crisis, potentially capturing dimensions not easily assessed using accounting measures or market share.

As we discussed in the Section 2, we define “bad exits” as when a firm exits the sample after a status of financial distress or bankruptcy. We identify “potentially profitable exits” as company acquisitions without prior corporate distress. Thus, we examine how post-crisis exit patterns differed across PE-backed and non-PE companies. The variation under study is only cross-sectional, as we explore the status of the sample firms in 2011: our matching methodology requires that both PE-backed companies and control firms did not exit before the matching period at the onset of the financial crisis. We also control for industry fixed effects and firm characteristics. In particular, we estimate the following equation:

$$Exit_i = \alpha_{ind(i)} + \beta(PE\ firm_i) + \gamma X_i^{PRE} + \varepsilon_{it}$$

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logit model). Similarly, in Columns (5) and (6), we look at the growth in market share over the same period and find that the growth in market share was 6%.

where  $Exit_i$  is a firm-level dummy that identifies the type of exit activity (“bad” or “potentially profitable”),  $\alpha_{ind(i)}$  are industry-level fixed effects at two digit SIC level,  $PE\ firm_i$  is a dummy variable identifying PE-backed companies, and  $X_i^{PRE}$  are the firm-level characteristics measured before the crisis. We estimate this model using a conditional logit model. To facilitate interpretation, all the results are presented as marginal effects at the mean.

In Panel C of Table 7, we show the main results. We find that PE-backed companies were not more likely to go out of business or enter into distress in the post-crisis period (Columns 1-4). The results are not only insignificant, but also small in magnitude. Moreover, we find that PE-backed companies were more likely to experience a potentially profitable exit (Columns 5-8). The results are similar with and without controls, but the magnitude is a bit smaller with controls. However, it is worth noting that “potentially positive exit” is a very crude measure of a successful exit, and therefore the results should be interpreted cautiously.<sup>39</sup>

Overall, in the post-crisis period, PE-backed companies were not more likely to go out of business and were more likely to be targeted in potentially profitable M&A transactions. The results are again inconsistent with the hypothesis that PE financing increased the financial fragility of the PE-backed companies.<sup>40</sup>

## 6 Survey Evidence

Our main findings thus far illustrate that PE-backed companies decreased investments relatively less than the control group during the financial crisis, a result that can be explained by the greater ability of PE-backed companies to raise equity and debt financing during the crisis. However, the particular channels through which private equity investors interacted with their portfolio companies during the crisis are not easily observable. To provide further evidence on the underlying mechanisms driving these findings, we conduct a large-scale survey of private equity investors.

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<sup>39</sup> One important limitation of the exit analysis is that due to the timing of the matching estimator, we do not have pre-crisis benchmark exit rates. To address this, we repeat the analysis with an alternative matching approach, in which we construct the matched sample in 2004 before the crisis. The concern with this approach is that it does not construct appropriate counterfactuals at the onset of the crisis. Nevertheless, the results are reported in Table A.11 in the Appendix. The analysis reaffirms the results on the bankruptcy exits, but suggests that the increased tendency to exit through M&A is not unique for PE-backed companies to the crisis period.

<sup>40</sup> In Table A.12 in the Appendix, we explore the correlation between equity injections and various firm outcomes, such as investment, ROA, and firm exit. We find suggestive evidence that PE-backed companies that received equity financing were less likely to go bankrupt during the crisis, invested more, and had a higher ROA.

## 6.1 Survey Design

Surveying PE investors is difficult because these investors are time constrained and typically reluctant to share proprietary details about their operations. In order to increase the likelihood of participation in the survey, we limited our survey population to alumni from our respective business schools (Harvard, Northwestern, and Stanford). In total, we identified roughly 3,100 alumni with current or past private equity experience, through both alumni offices and the Pitchbook database. We distributed the survey electronically to these alumni and obtained 319 responses (corresponding to a response rate of 10.3%).<sup>41</sup>

As is typically the case with surveys, our sample is unlikely to be perfectly representative of the PE universe. Nonetheless, we see no reason to believe that the sample, and the willingness to participate in the survey, should bias our results toward particular types of activities that the investors undertook during the crisis. As illustrated in Table 8, Panel A, the vast majority of the survey participants were private equity partners (80%), with an average number of 14 years of experience as PE investors. Their roles in the PE groups are quite diverse and include deal making (80% of survey participants), deal sourcing (72%), financial structuring (64%), and improving portfolio companies' operations (61%). To a slightly lower degree, they are also involved with the fundraising process at their private equity groups (43% of survey participants). There is a wide variation in the size of assets under management of survey participants. Panel B shows that roughly 40% of participants' funds have less than \$1 billion of assets under management, while more than 20% of the participants' funds have more than \$10 billion in assets under management.

A common issue in survey design is the possibility of social desirability bias (SDB). This refers to the tendency of research participants to present themselves in a positive or socially acceptable way (Maccoby and Maccoby, 1954). We apply several commonly used approaches in survey design to alleviate this concern. First, we administered the survey in an anonymous manner and informed the participants that their identities could not be linked with their responses. In addition to anonymization, we also used the well-known technique of "indirect questioning," an approach that has been shown to effectively mitigate SDB (Haire, 1950; Calder and Burnkrant, 1977; and Anderson, 1978). Specifically, rather than asking research participants about their own

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<sup>41</sup> By way of comparison, Gorman and Sahlman (1989) obtained responses from 49 venture capitalists. Gompers, et al. (2016) obtained responses from 79 buyout investors. Our response rate is quite similar to other large-scale surveys. Graham and Harvey (2001) obtain a response rate of 8.9% from CFOs while Da Rin and Phalippou (2014) obtain a response rate of 13.8% from PE limited partners.

behavior directly, we asked about their beliefs about PE behavior in general. Finally, according to survey design conventions, questions were generally asked in a variety of different but closely related ways. Among other things, this approach helps ensure that participants misunderstanding a single question is not driving the results.

## **6.2 Private Equity Activism during the Crisis**

In the first part of the survey, we presented participants a list of operational and financial activities that are common to private equity investors. Examples of such activities include assisting portfolio company operations, restructuring debt obligations, and injecting equity to alleviate financing constraints. We asked participants to state the degree in which they believed that private equity investors were more or less likely to engage in such activities during the financial crisis of 2008 (relative to normal times). We used a standard 5-point Likert scale, commonly used by psychologists, where potential responses ranged from significantly more likely (= 1), more likely (=2), same (=3), less likely (=4), and significantly less likely (=5). For example, an average response below 3 suggests that participants believed that a given strategy was more likely to take place during the crisis.

Panel C of Table 9 summarizes the responses with respect to operational activities. The precise wording of the questions is shown in Figure A.3 of the Appendix. The most striking result is that almost 90% of participants indicated that PE investors were more likely to assist portfolio companies with their operating problems during the crisis. The mean response was 1.58, statistically different from the neutral mid-point response of 3 at the one-percent significance level. Similarly, roughly 85% of the respondents reported that investors were more likely to interact frequently with portfolio companies during the crisis, and 77% argued that investors provided more strategic guidance during that time period. There was less consensus on the particular manners through which such operational guidance was provided, which included hiring managers, connecting to investors, and finding strategic partners. The distribution of responses is presented graphically in Figure 8. In all cases but one, the mean response was significantly more likely during the crisis at the one-percent level. Overall, the results illustrate that PE investors were more involved and engaged with firm operations during the crisis. This evidence sheds more light on the underlying mechanisms that led to the increased investment and market share of portfolio companies during the crisis.

Next, we explore whether private equity investors were likely to behave differently during the crisis on dimensions that relate to financial activities. We present the results in Panel D of Table 8, and the distribution of responses in Figure 7. The first finding that emerges is that PE investors were more likely to assist portfolio companies with financial structure issues during the crisis. Specifically, 90% of survey participants indicated that this was the case: the mean response was 1.8, statistically different from the neutral case at the one-percent significance level. Naturally, this raises the question of how exactly such assistance took place. We find that close to 90% of participants highlighted the renegotiation of debt obligations and more than 80% emphasized increased interactions with bankers and lawyers regarding the financial structure of the portfolio companies. Interestingly, almost 80% reported that during the crisis, they were more likely to inject equity to portfolio companies to alleviate financing constraints, and 60% assisted in raising debt financing. In all cases but one, the mean response was significantly more likely during crisis at the one-percent level. Hence, the evidence is very consistent with our empirical findings. PE investors were more likely during the crisis to provide equity funding, and to assist in raising and renegotiating debt financing.

Meanwhile, survey respondents reported that PE investors were less likely to search and evaluate new investments during this period. These responses were consistent with the evidence in Figure 3 that show a significant decline in number and value of new PE investments during the crisis. Hence, it seems that most of the focus of PE investors during the crisis was diverted towards the management of existing portfolio companies.<sup>42</sup>

The survey evidence illustrates that private equity investors were active investors during the crisis. They spent more time with their portfolio companies and addressed various operational and financial issues, in an attempt to assist the companies in weathering the crisis. This evidence is inconsistent with the interpretation that PE-backed companies did better during the crisis only because the PE firms picked targets that were more resilient to negative shocks without intervention of the PE investors.

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<sup>42</sup> Table A.13 in the Appendix explores whether survey participants of large funds (above \$5B in assets under management) behaved differently during the crisis relative to smaller funds. We find no differences across almost all dimensions. The only two exceptions were that investors in larger funds were more likely to increase the frequency of board meetings and buy back public debt. Both differences may arise because these investors were more likely to acquire larger companies, in which communication was more formal (through board meetings) and more likely to have issued public debt. We similarly repeat the exercise by dividing investors by experience. We do not find significant or economically meaningful differences in their responses.

In light of this survey evidence on the financial activities of private equity investors during the crisis, we explore empirically whether indeed private equity investors were more likely to assist their portfolio companies in renegotiating debt obligations. To do so, we obtain data on renegotiations of leveraged loans from Standard & Poors (S&P). Like the commonly used DealScan data on loan origination, this data set is constructed by S&P from public sources and information supplied by its clients. Overall, the data covers loan amendments affecting any material features of a loan contract. Examples of such amendments include waiver agreements to avoid default, loan extensions, changes in the collateral package, and modifications that allow the issuer to stretch out its payments.

Figure A.4 in the Appendix plots the loan amendments for the years 2006 to 2013. Consistent with the importance of loan renegotiations in time of financial distress, the data show a large spike in amendments during the crisis. In particular, in the two years of the crisis (2008-2009), the number of amendments was almost ten times larger than the pre-crisis period (2006-2007). Renegotiations peaked in 2009, and then slowed down in subsequent years.

To compare the renegotiation rate of loans issued by private equity firms, we obtain background information on the loans from DealScan. We identify loans issued in relationship with a PE deal following the methodology of Ivashina and Kovner (2011). We focus on leveraged loans that were issued in the pre-crisis period (2003-2007) with minimum deal size of \$30 million.<sup>43</sup> We find that during the financial crisis, loans with private equity sponsors were significantly more likely to be renegotiated. In particular, Figure 9 plots the renegotiation rates year-by-year for both PE and non-PE loans in our sample. In almost every year, we find that PE group loans were characterized by a higher renegotiation rate than the non-PE group. In particular, if we focus on the three years since the crisis (2008-2010), we find that in aggregate, PE loans were about 50% more likely to be renegotiated relative to the other group.<sup>44</sup>

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<sup>43</sup> In the Data Appendix, we provide detailed information on the matching procedure and data selection.

<sup>44</sup> The previous literature focusing on loan renegotiation has generally found higher renegotiation rates. We believe that the difference with our sample is explained by fact that the other papers have focused on larger firms. For instance, Denis and Wang (2014) uses a sample of large, public US firms and find that renegotiation rate in this group is about 60%. This is consistent with our sample. When focusing on larger deals in our sample, we obtain significantly larger renegotiation rates. For instance, if we focus on deals larger than one billion dollars, the renegotiation rate is about 26%. Even within this more restricted sample, we find a similar difference between PE and non-PE loans. Specifically, using the \$1 billion threshold, PE loans had a 31% probability of being renegotiated, versus a 22% for the non-PE ones.

These stylized facts on loan amendments provide suggestive evidence that is consistent with the evidence provided by the survey, highlighting the active role of private equity investors in assisting portfolio companies with financial structuring issues. These results are also consistent with the regression analyses showing that PE-backed companies had better access to external financing, which allowed them to expand during the crisis, particularly the more financially constrained companies.

### **6.3 What was the Private Equity Advantage during the Crisis?**

In the last part of the survey, we asked PE investors which factors they believe were most instrumental in assisting portfolio companies during the crisis. These results are presented in Figure 8. Participants argued that having a majority control and private ownership that does not require scrutiny from public equity markets were both important factors. This is consistent with the ability of PE investors to engage in operational engineering and to assist the portfolio companies during the crisis. Similarly, investors argued that the long investment horizon of PE investors was equally important, enabling PE investors to make significant changes.

Survey participants also argued that another important factor was the access of private equity investors to banks, which facilitated the restructuring of debt obligations. This response is consistent with Ivashina and Kovner (2011), which highlighted the importance of repeated interaction of banks and PE investors in mitigating information asymmetries. They also provide additional cross-selling opportunities for banks, which, in turn, enhances the incentives of banks to provide liquidity to PE-backed companies during the crisis and renegotiate debt obligations.

Moreover, private equity firms' dry powder during the crisis was also considered an important factor in assisting portfolio companies during the crisis. Considerations such as the high leverage of portfolio companies (which can potentially ensure portfolio companies remain efficient) and the strong financial incentives of managers were not considered by investors to be important factors.

To summarize, the survey results indicate that PE investors were active investors and more likely to engage in both operational and financial activities during the crisis. Specifically, the evidence suggests that PE investors were likely to spend more time with portfolio companies and assist with their operational problems. They were more likely to engage in financial restructuring by renegotiating debt obligations, assisting in raising additional debt, and injecting additional equity. PE investors argued that these activities during the crisis were possible due to the particular

characteristics of private equity investments: majority control, private ownership, deep connections to banks, and the availability of un-invested funds. These results are consistent with our empirical evidence.

## 7 **Conclusion**

In this paper, we examined how PE-backed companies responded to the turmoil caused by the 2008 financial crisis by exploring their investments, financing, and performance. One of the main objectives of this analysis was to explore whether PE-backed companies increased the fragility of the economy during this period, as articulated in both academic studies and by regulators. Furthermore, this analysis can improve our understanding about the relationship between economic cycles and financial intermediaries more generally.

We find that PE-backed companies decreased investments relatively less than the control group during the financial crisis. This result can be explained by the ability of PE-backed companies to utilize the resources and relationships of their private equity sponsors to raise equity and debt funding in this difficult period, and to lower their cost of capital, as captured by the interest expense. Furthermore, the positive investment effect of PE was particularly large in companies more likely to be financially constrained at the time of the crisis and when the PE firms had more resources. The increase in investment during the crisis led to increased asset growth and higher market shares. We find consistent evidence in a survey of over 300 PE practitioners, as well as in an analysis of renegotiation of loans. Altogether, these results are inconsistent with the hypothesis that private equity contributed to the fragility of the economy during the recent financial crisis.

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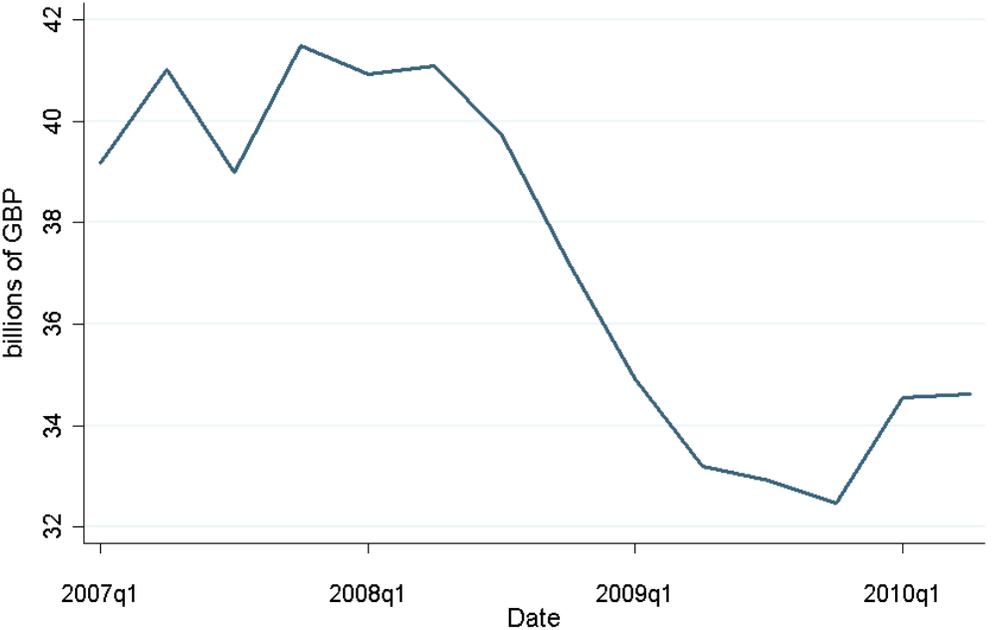
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**Figure 1: Investment in United Kingdom around the financial crisis**

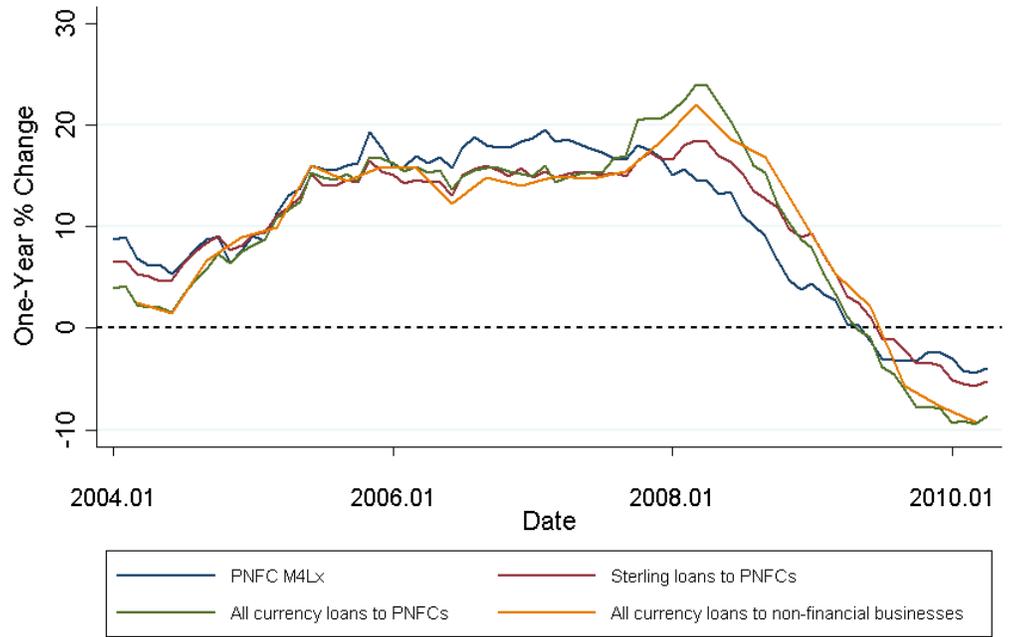
This figure shows the quarterly business investment volume in the United Kingdom (seasonally adjusted). Currency values are as of 2013. The measure does not include expenditure on dwellings, land and existing buildings and costs of ownership transfer of non-produced assets. The data is available at the “Office of National Statistics” in the UK. (<https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/businessinvestment/quarter3julytosept2016revisedresults>).



Source: UK Office for National Statistics

**Figure 2: Lending growth in UK around the financial crisis**

This figure shows the growth rate in the stock of lending by UK monetary financial institutions to private non-financial corporations (PNCF) or non-financial businesses. The stock of lending is the total amount of outstanding net lending. Series included are PNFC M4Lx (seasonally adjusted), sterling loans to PNFCs (seasonally adjusted), all currency loans to PNFCs (seasonally adjusted), all currency loans to non-financial businesses (non-seasonally adjusted). PNFC M4Lx is the lending to PNFCs, which includes loans, securities, reverse repos, overdrafts, and commercial paper. The other three measures each includes loans, reverse repos and overdrafts. The data is available at the official statistics of the Bank of England and are reported in “Trends in Lending (2014).” <http://www.bankofengland.co.uk/publications/Pages/other/monetary/trendsinlending2014.aspx>.



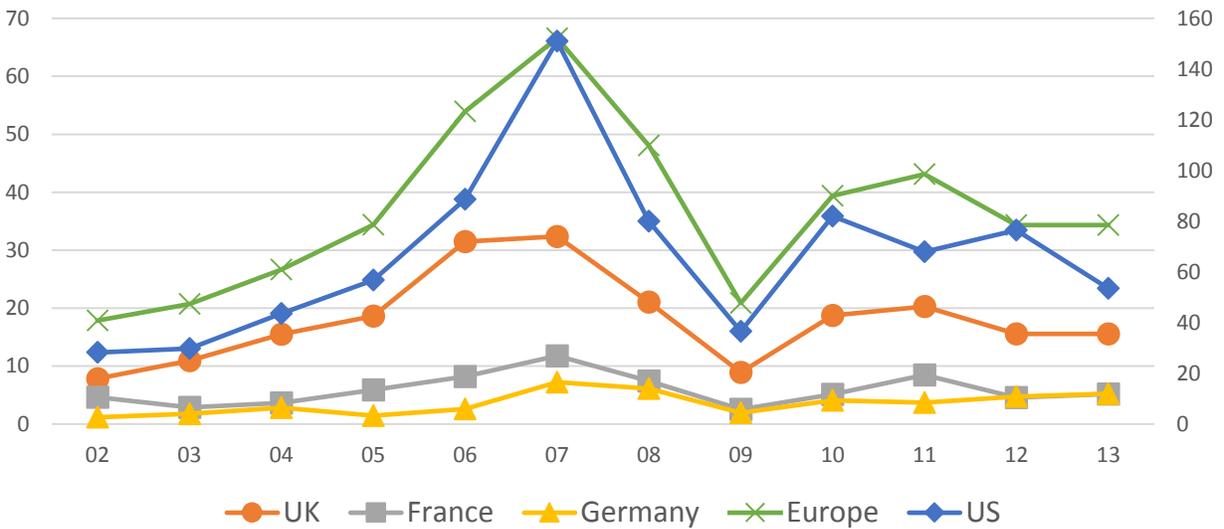
Source: Bank of England - Trends in lending

### Figure 3: Comparison of Private Equity Activity across different Markets

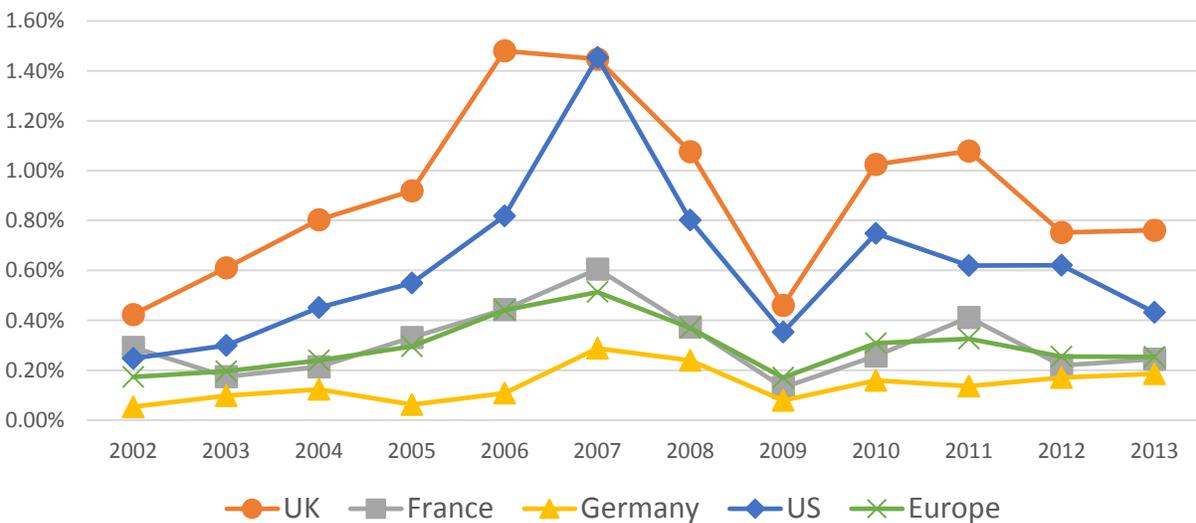
This figure depicts several international comparisons of private equity activity in the UK, France, Germany, Europe as a whole, and the US. Panel A describes the aggregate equity value invested per year by funds based in a given country, Panel B describes the amount invested as a share of GDP of the nation in that year, Panel C reports the average amount invested in a given year, and Panel D illustrates the number of investments. The source of the private equity data is Invest Europe, except for the US data, which is from Prequin (number of deals) and Cambridge Associates (dollar volume of deals).

#### Panel A: Aggregate Equity Value (€ billions)

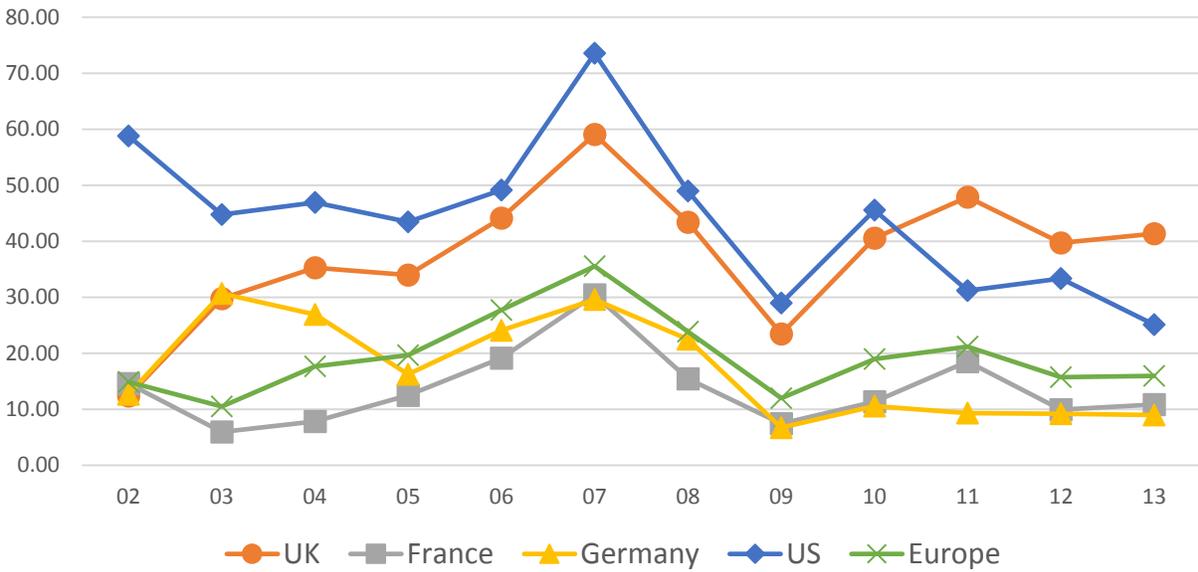
Left Y-axis present the scale for all markets, except the US (right Y-axis).



#### Panel B: Annual Aggregate Deal Value / GDP

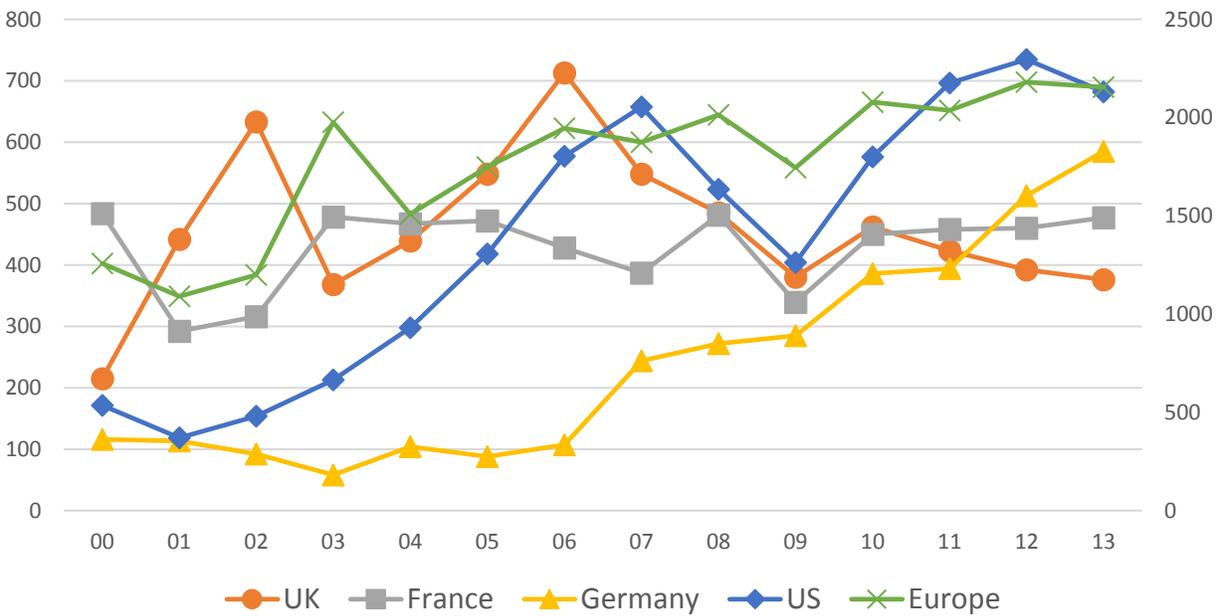


**Panel C: Average Deal Value (€ millions)**



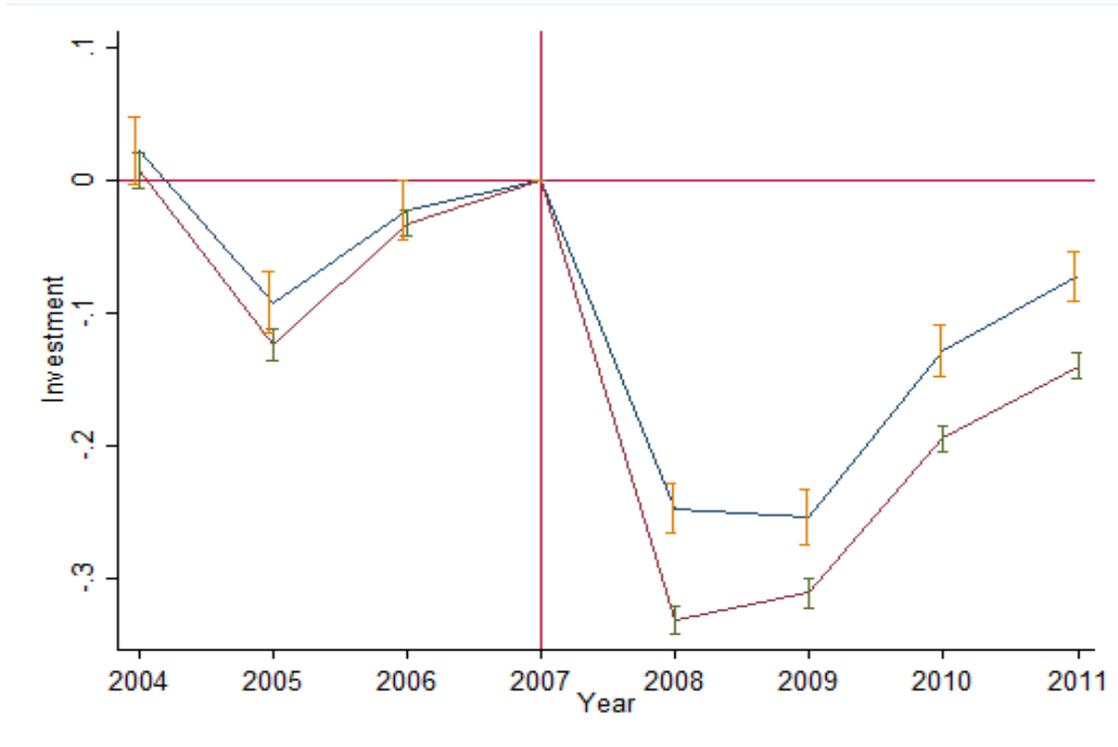
**Panel D: Number of Transactions**

Left Y-axis describe all markets, except the US that is described in the right Y-axis.



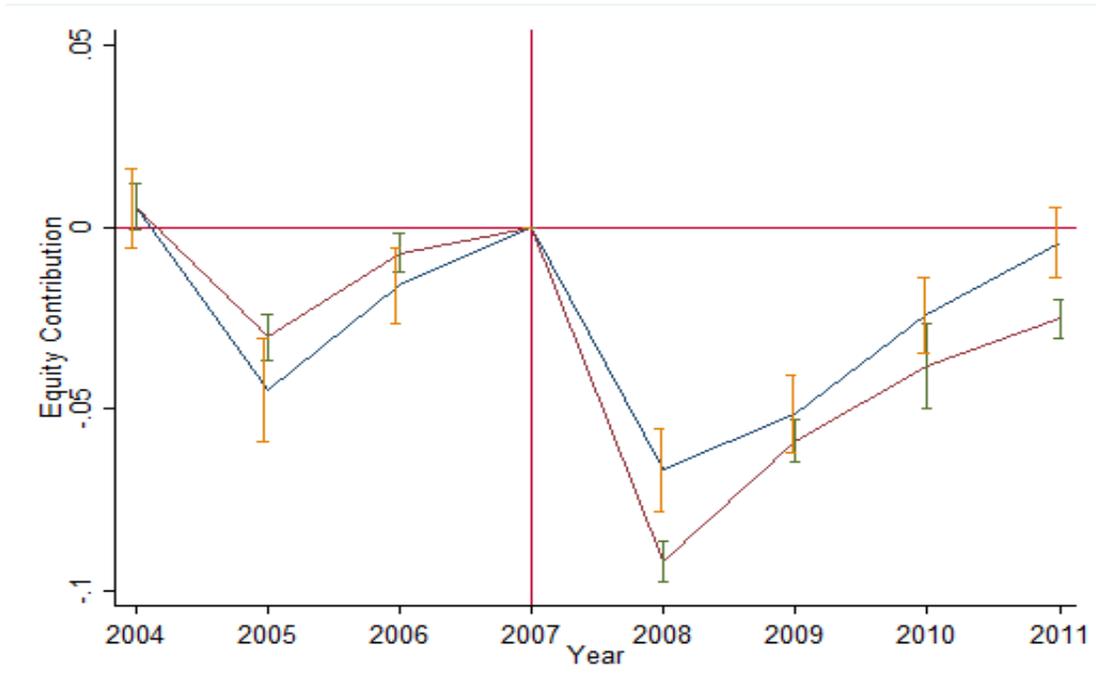
**Figure 4: Effect of PE-backed companies on investment over time**

This figure illustrates the change in investment separately for both PE and non-PE companies in our sample. Specifically, the figure reports  $\alpha_t$  of the following equation:  $y_{it} = \alpha_t + \alpha_i + \varepsilon_{it}$ , estimated separately for PE and non-PE companies, where  $\alpha_t$  capture year fixed effects, and  $\alpha_i$  firm fixed effects. The year 2007 is used as the base period and therefore the corresponding coefficient is normalized to zero. The estimates are plotted with standard errors above and below the point estimates. Standard errors are clustered at firm level.



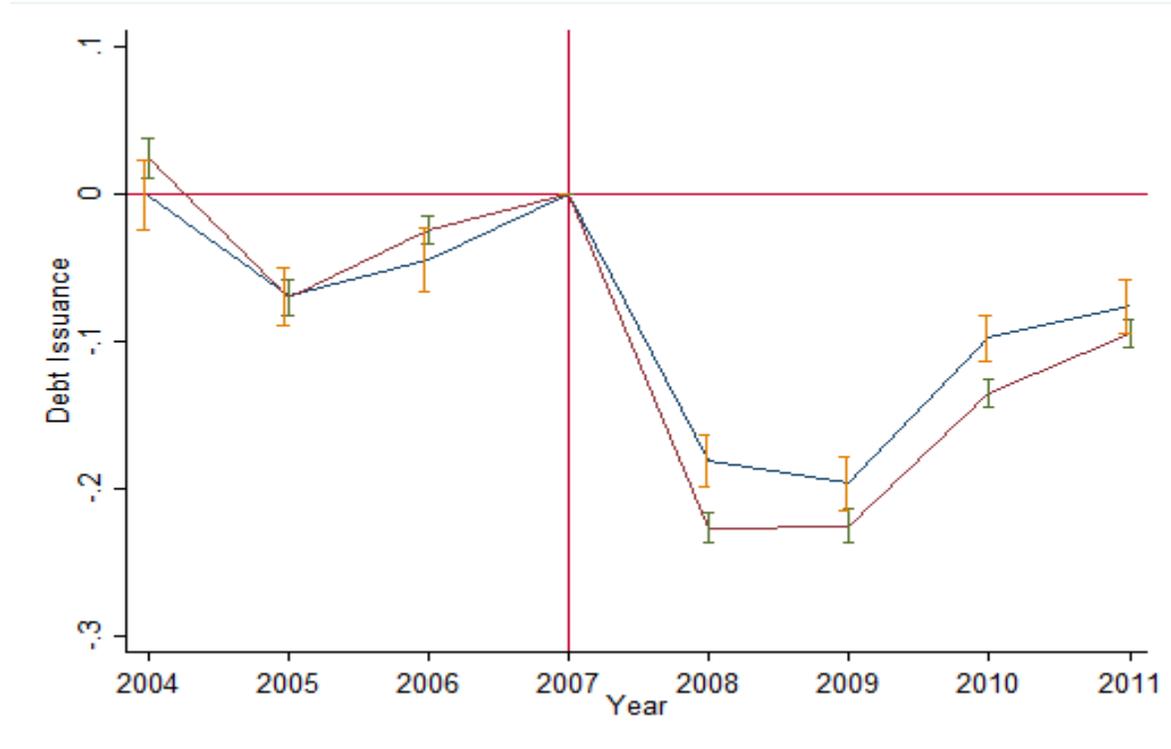
**Figure 5: Effect of PE-backed companies on equity contributions over time**

This figure illustrates the change in equity contributions separately for both PE and non-PE companies in our sample. Specifically, the figure reports  $\alpha_t$  of the following equation:  $y_{it} = \alpha_t + \alpha_i + \varepsilon_{it}$ , estimated separately for PE and non-PE companies, where  $\alpha_t$  capture year fixed effects, and  $\alpha_i$  firm fixed effects. The year 2007 is used as base period and therefore the corresponding coefficient is normalized to zero. The estimates are plotted with standard errors above and below the point estimates. Standard errors are clustered at firm level.



**Figure 6: Effect of PE-backed companies on debt issuances over time**

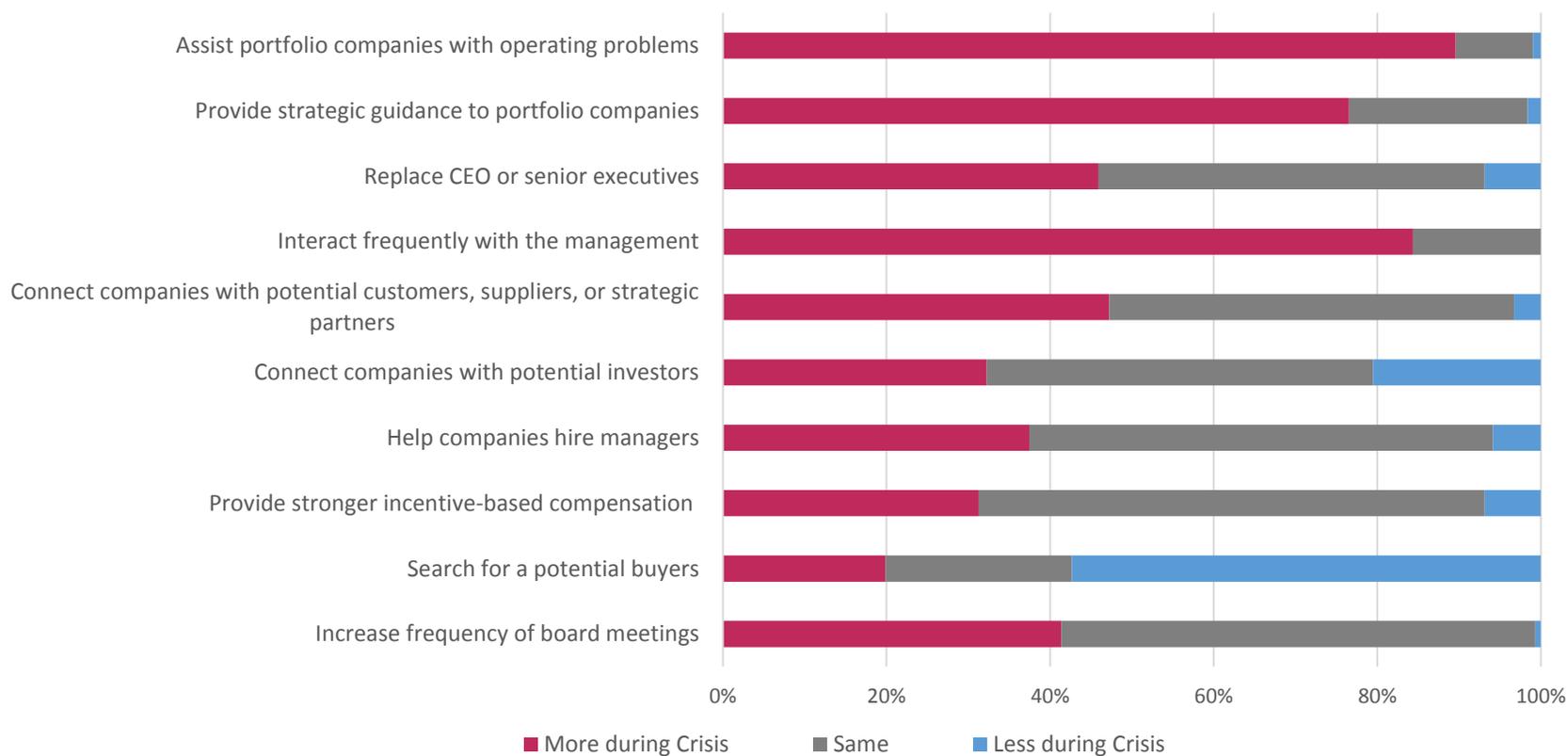
This figure illustrates the change in debt issuances separately for both PE and non-PE companies in our sample. Specifically, the figure reports  $\alpha_t$  of the following equation:  $y_{it} = \alpha_t + \alpha_i + \varepsilon_{it}$ , estimated separately for PE and non-PE companies, where  $\alpha_t$  capture year fixed effects, and  $\alpha_i$  firm fixed effects. The year 2007 is used as base period and therefore the corresponding coefficient is normalized to zero. The estimates are plotted with standard errors above and below the point estimates. Standard errors are clustered at firm level.



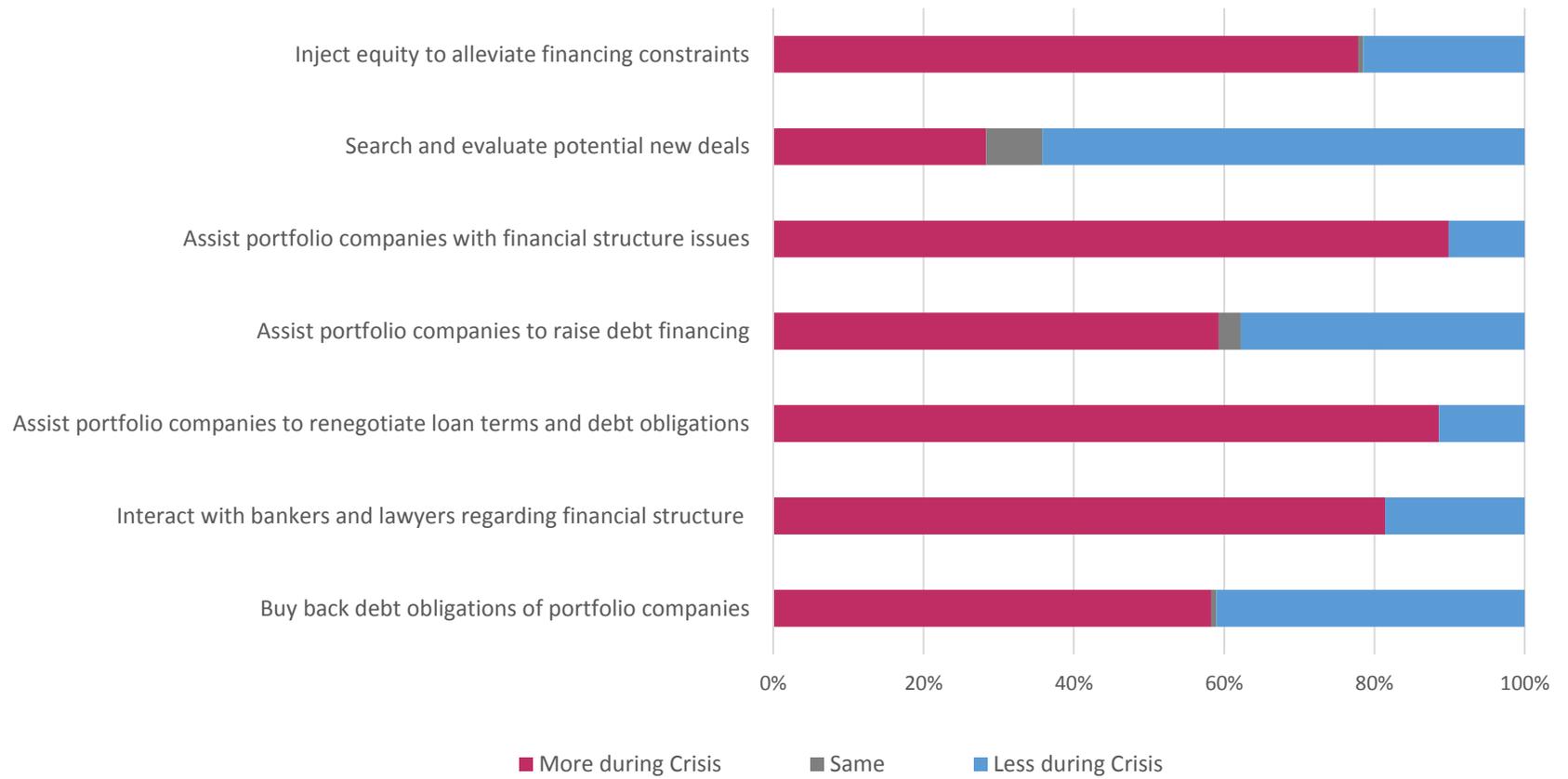
## Figure 7: Survey Responses – Comparing Crisis and Normal Times

This figure reports the survey answers of 319 participants. Survey participants were presented with a list of common private equity activities related to firm operations (Panel A) and firm financials (Panel B). For each activity, participants answered whether this activity is more or less likely to take place during the 2008 financial crisis, when compared to normal times. Participants answers ranged from significantly more likely (= 1), more likely (=2), same (=3), less likely (=4), and significantly less likely (=5). Both figures illustrate the fraction of survey participants with answer less than 3 (more likely during the crisis), answer that equals to 3 (same during the crisis), and answer that is larger than 3 (less during the crisis). The survey questions are presented in Figure A.3 of the Appendix.

### Panel A: Operational Activities

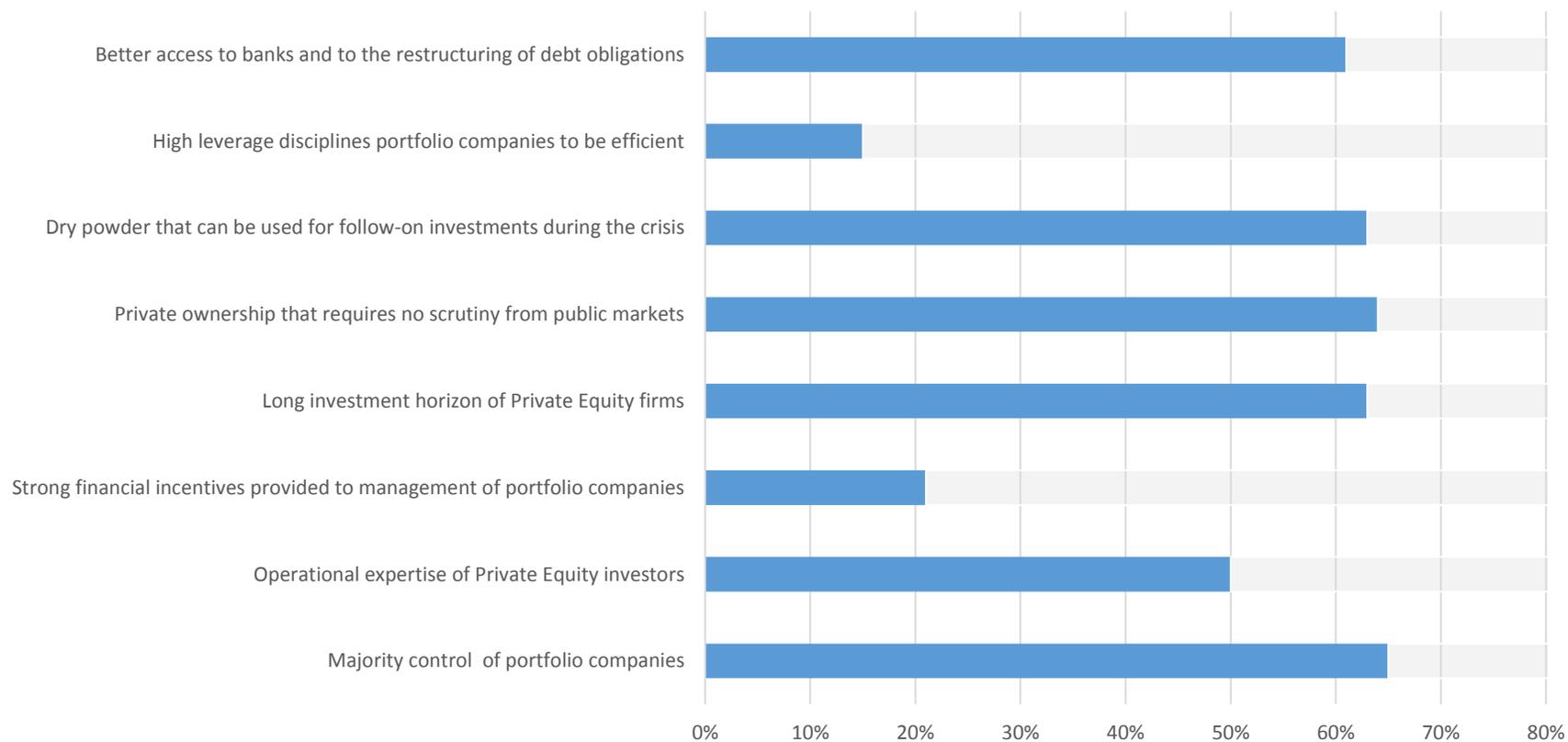


**Panel B: Financial Activities**



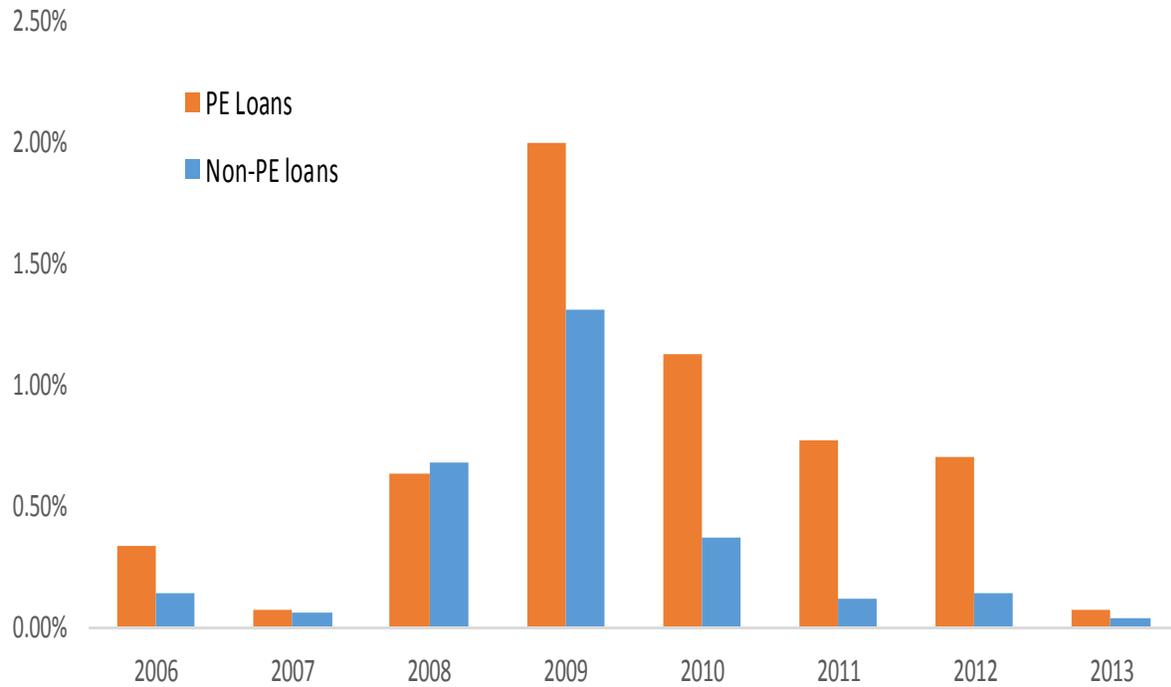
### Figure 8: Survey Responses – Explanations for Behavior during Crisis

This figure reports the survey answers of 319 participants. Survey participants were presented with a list of various aspects of private equity firms’ structure and investments, and were asked to answer which aspects were most useful for portfolio companies to weather the crisis. The distribution of the responses is provided in the figure. The survey questions are presented in Figure A.2 of the Appendix.



### Figure 9: Loan Renegotiation Rates

This figure reports year-by-year probability of renegotiation of leveraged loans issued between 2003 and 2007 with a size of at least \$30 million. The figure reports separately renegotiation probability of loans granted to PE-backed companies and non-PE backed companies. The sample considered is the one of US, non-financial corporations. Data on renegotiation comes from S&P and the background loan information comes from DealScan. The Data Appendix provides detailed information on the data sets used, the matching, and the way we have defined leveraged loans in the data.



## Table 1: Summary Statistics

Panel A reports the industry distribution at the broad industry level (1-digit SIC) for the PE sample and the whole universe of medium and large UK firms, but excluding financial, insurance, regulated or public administration. In Panel B reports the summary statistics of sample firms in 2007 across treated (PE-backed companies) and non-treated firms (non-PE companies). The last column reports the mean difference across the two groups. Level variables are in millions of dollars. Panel C reports the one-year and two-year growth in percentage increase in the characteristics in 2007. The last column reports the mean difference across the two groups. Panel D reports the split in terms of deal type for the final sample of PE deals. More information on variable definition is available in the Appendix. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

### Panel A: Industry distribution

Industry Distribution	PE Sample	Full Sample
Mining	1%	2%
Construction	6%	15%
Manufacturing	32%	17%
Wholesale Trade	12%	11%
Retail Trade	7%	6%
Transportation	4%	6%
Services	38%	44%

### Panel B: Firms' characteristics in 2007

	PE Sample				Matched Sample				Mean Diff.
	N	Mean	Median	SD	N	Mean	Median	SD	
Revenue (M\$)	432	98.05	35.30	240.81	1527	77.64	29.86	184.49	20.41*
ROA	434	0.09	0.09	0.23	1550	0.09	0.09	0.22	0.01
Investment/Asset	434	0.19	0.20	0.18	1550	0.20	0.20	0.18	-0.01
Equity Contr/Asset	415	-0.02	0.01	0.13	1513	-0.01	0.01	0.13	-0.01
Net Debt Iss. /Asset	415	0.09	0.10	0.23	1513	0.11	0.08	0.24	-0.01
Debt/Asset	434	0.71	0.70	0.39	1550	0.69	0.67	0.39	0.02
Private Ownership	434	1.00	1.00	0.00	1550	0.99	1.00	0.01	0.01

**Panel C: Firms' trends in 2007**

	PE Sample				Matched Sample				Mean Diff.
	N	Mean	Median	SD	N	Mean	Median	SD	
<i>One Year Growth</i>									
Revenue	423	0.37	0.18	1.34	1456	0.35	0.17	1.17	0.02
ROA	427	0.71	-0.03	5.21	1483	0.79	0.07	4.48	-0.07
Investment/Asset	386	1.54	0.10	5.86	1434	1.37	0.05	5.20	0.17
Equity Contr/Asset	372	-0.59	0.39	15.96	1376	-0.93	0.09	13.73	0.34
Net Debt Iss. /Asset	376	2.95	0.32	15.09	1428	2.25	0.20	12.86	0.70
Debt/Asset	418	0.02	-0.03	0.34	1516	0.02	-0.02	0.31	0.01
<i>Two Year Growth</i>									
Revenue	393	0.56	0.33	2.08	1362	0.71	0.34	2.33	-0.15
ROA	400	1.10	0.05	8.33	1388	1.40	0.11	6.97	-0.29
Investment/Asset	339	1.85	0.61	6.22	1333	2.39	0.94	6.06	-0.54
Equity Contr/Asset	330	0.43	1.09	23.44	1274	0.70	1.05	18.95	-0.28
Net Debt Iss. /Asset	343	3.45	0.65	18.73	1359	2.94	0.76	13.99	0.51
Debt/Asset	382	0.01	-0.04	0.46	1442	0.04	-0.04	0.60	-0.03

**Panel D: Buyout Type**

Buyout Type	Percentage
Public to Private Buyouts	5.3%
Private to Private Buyouts	42.8%
Divisional Sales	29.9%
Secondary Sales	20.0%
Distressed Buyouts	2.0%

**Table 2: Investment and funding policies**

This table reports the estimates of a difference-in-difference fixed effect model on the investment and funding variables. All specifications include firm and year fixed effects. The main parameter of interest is the interaction between the post dummy and PE-backed company dummy variable. Odd columns contain the baseline regression and even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables include firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by assets; in Columns (3) and (4) is net equity contribution over assets; in Columns (5) and (6) is the net debt issuance scaled by assets; in Columns (7) and (8) is the total leverage; in Columns (9) and (10) on average interest rate. More information on the variables are available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Post	0.059*** (0.013)	0.056*** (0.013)	0.022*** (0.007)	0.021*** (0.007)	0.042*** (0.011)	0.039*** (0.011)	0.013 (0.015)	0.012 (0.014)	-0.003** (0.001)	-0.003** (0.001)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	12456	11910	12469	12003	12903	12274	13205	12553	10222	9831
Clusters	1984	1878	1981	1876	1982	1876	1984	1878	1841	1743
R-squared	0.160	0.161	0.040	0.059	0.090	0.104	0.011	0.029	0.016	0.022

**Table 3: Investment and funding policies over time**

This table reports the estimates from a time-varying fixed effects model. All specifications include firm and year fixed effects. Specifically, the table reports  $\beta_t$  of the following equation:  $y_{it} = \alpha_t + \alpha_i + \beta_t(PE\ firm_i) + \varepsilon_{it}$  where  $\alpha_t$  capture year fixed effects, and  $\alpha_i$  firm fixed effects. E columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by assets; in Columns (3) and (4) the outcome is net equity contribution over assets; in Columns (5) and (6) is the net debt issuance over assets; in Columns (7) and (8) is average interest rate. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Interest Rate	
PE firm x y2004	0.015 (0.029)	0.018 (0.029)	-0.000 (0.013)	0.002 (0.013)	-0.026 (0.027)	-0.028 (0.028)	0.001 (0.003)	-0.000 (0.003)
PE firm x y2005	0.032 (0.026)	0.032 (0.026)	-0.015 (0.015)	-0.013 (0.016)	0.001 (0.023)	0.000 (0.023)	-0.002 (0.002)	-0.002 (0.002)
PE firm x y2006	0.010 (0.024)	0.009 (0.025)	-0.009 (0.012)	-0.010 (0.012)	-0.020 (0.024)	-0.024 (0.024)	0.002 (0.002)	0.002 (0.002)
PE firm x y2008	0.084*** (0.022)	0.087*** (0.022)	0.025** (0.013)	0.025** (0.012)	0.046** (0.021)	0.043** (0.020)	-0.003** (0.001)	-0.003** (0.001)
PE firm x y2009	0.057** (0.024)	0.050** (0.024)	0.008 (0.012)	0.006 (0.012)	0.029 (0.021)	0.022 (0.021)	-0.002 (0.002)	-0.002 (0.002)
PE firm x y2010	0.067*** (0.021)	0.064*** (0.021)	0.014 (0.012)	0.013 (0.012)	0.037** (0.018)	0.032* (0.018)	-0.003* (0.002)	-0.004** (0.002)
PE firm x y2011	0.068*** (0.021)	0.064*** (0.021)	0.021* (0.011)	0.018* (0.011)	0.019 (0.020)	0.019 (0.020)	-0.002 (0.002)	-0.003 (0.002)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes
Observations	12456	11910	12469	12003	12903	12274	10222	9831
Clusters	1984	1878	1981	1876	1982	1876	1841	1743
R-squared	0.160	0.161	0.040	0.059	0.090	0.104	0.016	0.021

**Table 4: Main results with alternative matching sample**

This table reports the estimates of a difference-in-difference fixed effect model on the investment and funding variables using an alternative matching estimator based only on ROA, industry and size. All specifications include firm and year fixed effects. The main parameter of interest is the interaction between the post dummy and PE-backed company dummy variable. Odd columns contain the baseline regression and even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables include firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by assets; in Columns (3) and (4) is net equity contribution over assets; in Columns (5) and (6) is the net debt issuance scaled by assets; in Columns (7) and (8) is the total leverage; in Columns (9) and (10) on average interest rate. More information on the variables are available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Post	0.057*** (0.012)	0.053*** (0.012)	0.025*** (0.007)	0.022*** (0.007)	0.040*** (0.011)	0.037*** (0.011)	0.026* (0.015)	0.024* (0.015)	-0.003*** (0.001)	-0.004*** (0.001)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	16318	15672	16347	15790	16872	16150	17259	16512	12808	12369
Clusters	2598	2477	2596	2475	2596	2475	2598	2477	2356	2251
R-squared	0.153	0.153	0.040	0.076	0.075	0.103	0.009	0.026	0.011	0.015

**Table 5: Heterogeneity across firms' financial constraints**

These tables estimate standard difference-in-difference fixed effect model and repeat the specification of Table 2 while exploring various proxies of financing constraints in 2007. All specifications include firm and year fixed effects. In each table, the interaction term in Columns 1 and 2 is based on firm size, and equal one if the firm is at the top quartile of firm employment versus the rest of the sample. The interaction in Columns 3 and 4 is based on dependency on external finance, measured by RZ index (Rajan and Zingales, 1998). The interaction equals one if dependence on external finance is in the top quartile, and zero otherwise. In Columns 5 and 6, the interaction is based on firm leverage. The interaction equals one if firm leverage is at the top quartile, and zero otherwise. Panel A reports the results using investment as an outcome, Panel B uses instead debt issuance over assets as dependent variable and lastly Panel C reports the results with net equity contributions over assets. Even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. More information on the variables are available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

**Panel A - Investment / Asset**

	(1)	(2)	(3)	(4)	(5)	(6)
PE firm x Post	0.014 (0.020)	0.011 (0.020)	0.039*** (0.014)	0.032** (0.014)	0.032** (0.013)	0.031** (0.013)
Interaction. x Post	-0.025* (0.013)	-0.016 (0.015)	-0.049*** (0.013)	-0.040*** (0.013)	-0.072*** (0.016)	-0.050*** (0.018)
Interaction x Post x PE	0.053** (0.026)	0.051** (0.026)	0.056* (0.029)	0.068** (0.029)	0.108*** (0.033)	0.101*** (0.032)
Interaction Variable	Small		External Dependence		High Leverage	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	11539	11105	12456	11910	12456	11910
Clusters	1824	1742	1984	1878	1984	1878
Adjusted R-squared	0.160	0.162	0.161	0.162	0.162	0.162

**Panel B - New Debt Issuances / Assets**

	(1)	(2)	(3)	(4)	(5)	(6)
PE firm x Post	-0.004 (0.019)	0.003 (0.019)	0.021* (0.012)	0.019 (0.012)	0.028** (0.011)	0.026** (0.011)
Interaction. x Post	-0.015 (0.014)	-0.030** (0.014)	-0.055*** (0.014)	-0.037*** (0.012)	-0.183*** (0.017)	-0.110*** (0.017)
Interaction x Post x PE	0.055** (0.024)	0.046* (0.024)	0.055** (0.026)	0.058** (0.026)	0.072** (0.029)	0.065** (0.029)
Interaction Variable		Small	External Dependence		High Leverage	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	11891	11400	12903	12274	12903	12274
Clusters	1823	1741	1982	1876	1982	1876
Adjusted R-squared	0.089	0.101	0.091	0.105	0.105	0.108

**Panel C - Net Equity Contr./Asset**

	(1)	(2)	(3)	(4)	(5)	(6)
PE firm x Post	0.035*** (0.012)	0.026** (0.012)	0.018** (0.009)	0.015* (0.008)	0.016* (0.008)	0.016** (0.008)
Interaction. x Post	-0.006 (0.007)	0.014 (0.008)	0.001 (0.007)	-0.003 (0.007)	0.073*** (0.008)	0.043*** (0.007)
Interaction x Post x PE	-0.016 (0.016)	-0.008 (0.015)	0.013 (0.016)	0.014 (0.015)	0.011 (0.016)	0.011 (0.016)
Interaction Variable		Small	External Dependence		High Leverage	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	11564	11193	12469	12003	12469	12003
Clusters	1823	1741	1981	1876	1981	1876
Adjusted R-squared	0.045	0.063	0.040	0.059	0.051	0.062

**Table 6: Heterogeneity across funds**

This table reports the estimates from a difference-in-difference fixed effect model, while exploring heterogeneity across resource availability of PE firms backing the company. The analysis is a cross-section estimated using only the set of PE-backed companies. High Dry Powder is a dummy variable equals to one if PE investors are at the top quartile for amount of dry powder at 2007, defined based on the amount of capital raised but not invested. Note that if a portfolio company has more than one PE firm, we select the dry-powder of the investor with the highest level of dry powder to categorize the syndication of investors. The variable 1(Fund 02-07) is a dummy variable equals to one if the PE firm raised its latest fund between 2002 and 2007. All specifications contain firm and year fixed effects. Even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. More information on the variables are available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Investment/Assets				Net Debt Iss./Assets				Net Equity Contr./Assets			
Post*High Dry Powder	0.105** (0.048)	0.086** (0.041)			0.053* (0.031)	0.062** (0.03)			0.070*** (0.025)	0.055** (0.022)		
Post*1(Fund 02-07)			0.075* (0.039)	0.090** (0.036)			0.064** (0.026)	0.073*** (0.026)			0.036* (0.021)	0.030 (0.021)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1582	1539	1582	1539	1589	1546	1589	1546	1565	1527	1565	1527
Adjusted R-squared	0.108	0.117	0.106	0.117	0.064	0.068	0.064	0.068	0.028	0.048	0.023	0.044

## Table 7: Performance Analysis

This Table reports several analyses that aim to explore the performance of PE deals. Panel A reports a standard difference-in-difference fixed effect model exploring various performance measures. All specifications include firm and year fixed effects. In Columns (1) and (2) the outcome is one year assets growth; in Columns (3) and (4) is total EBITDA scaled by revenue; in Columns (5) and (6) is ROA. Standard errors are clustered at firm level. In Panel B, the dependent variable is firm market share, measured as the log of share of firms' revenue scaled by total revenue at the level of three-digit SIC industry. Columns (1) and (2) estimate the standard model, but using only data from 2004-2009. Columns (3) and (4) instead uses the full sample period of 2004-2011. Lastly, Columns (5) and (6) report the coefficient from the time-varying regression. Standard errors are clustered at firm-level. In Panel C, we report the marginal value (at the mean) of a conditional logit model where we study the effect of being a PE-backed company on various exit outcomes. Even columns have firm level controls at 2007. In Columns (1) and (2) the outcome is a dummy equal to one if the company was the target of an M&A activity in the post-crisis period; in Columns (3) and (4) the outcome is instead a dummy equal to one if the company was a target of an M&A activity and the company does not exit from the data in the same time frame; in Columns (5) and (6) the outcome is the dummy equal to one if the company exit the data set in the post period; lastly in Columns (7) and (8) the outcome is a dummy if the company exit the data and it reported some financial difficulties before the exit. Standard errors are clustered by two-digit industry. In the first two panels, even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. In the last panel, control variables are not interacted. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. See the Appendix and the paper for more info on the variables. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

<b>Panel A- Accounting Performance</b>						
	(1)	(2)	(3)	(4)	(5)	(6)
	Assets Growth		EBITDA/REV		ROA	
PE firm x Post	0.148*** (0.040)	0.124*** (0.038)	-0.009 (0.013)	-0.010 (0.014)	-0.003 (0.009)	-0.004 (0.008)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	13180	12528	12507	12137	12865	12364
Clusters	1984	1878	1960	1878	1984	1878
R-squared	0.026	0.042	0.001	0.015	0.005	0.041

**Panel B: Market Share**

	(1)	(2)	(3)	(4)	(5)	(6)
PE firm x Crisis	0.081** (0.035)	0.079** (0.034)	0.050 (0.034)	0.055* (0.033)		
PE firm x y2004					0.039 (0.057)	0.048 (0.059)
PE firm x y2005					0.035 (0.050)	0.047 (0.049)
PE firm x y2006					-0.035 (0.036)	-0.020 (0.035)
PE firm x y2008					0.094*** (0.031)	0.106*** (0.034)
PE firm x y2009					0.072** (0.031)	0.088*** (0.033)
PE firm x y2010					0.039 (0.037)	0.052 (0.039)
PE firm x y2011					-0.007 (0.053)	0.005 (0.055)
Sample	2004-2009		Whole Sample		Whole Sample	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	9090	8847	12697	12326	12697	12326
Clusters	1960	1878	1960	1878	1960	1878
R-squared	0.035	0.087	0.021	0.064	0.021	0.064

**Panel C - Exit Outcomes**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Marginal Eff.	1{Exit}		1{Bankruptcy}		1{M&A}		1{M&A, no distress}	
PE Firm	0.058 (0.085)	0.039 (0.087)	0.058 (0.085)	0.039 (0.087)	0.351*** (0.023)	0.325*** (0.101)	0.351*** (0.024)	0.318*** (0.100)
Industry (2-digit) F.E.	Y	Y	Y	Y	Y	Y	Y	Y
Firm Controls 2007		Y		Y		Y		Y
Observations	1368	1368	1368	1368	1635	1635	1635	1635

## Table 8: Survey Results

This table reports the survey answers of 319 participants. Panel A describes survey participants' characteristics, and Panel B reports the size of assets under management of the funds of survey participants. Panels C and D summarize survey results. Survey participants were presented with a list of common private equity activities related to firm operations (Panel C) and firm financials (Panel D). For each activity, participants answered whether this activity is more or less likely to take place during the 2008 financial crisis, when compared to normal times. Participants answers ranged from significantly more likely (= 1), more likely (=2), same (=3), less likely (=4), and significantly less likely (=5). Column (2) of Panels C and D report the average response and the significance level in which the average response is different from the neutral answer (Same=3). \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%. Column (4) reports the fraction of survey participants with answer less than 3 (more likely during the crisis), column (5) reports the fraction of participant responding precisely 3 (same during the crisis), and column (6) reports the fraction of participants reporting more than 3 (less during the crisis). The survey questions are shown in Figure A.3 of the Appendix.

### Panel A: Participants Characteristics

	mean	median	SD
Partner	0.793	1	0.46
Years of Experience (as PE investor)	14.09	13	7.5
<i>Tasks within the Fund</i>			
Deal Making	0.807	1	0.395
Deal Sourcing	0.729	1	0.44
Improving Portfolio Company Operations	0.609	1	0.488
Financial Structuring of Deals	0.644	1	0.479
Fund Raising	0.429	0	0.495

### Panel B: Fund Size (Assets Under Management)

Less than US\$1b	43.24%
US\$1b - US\$5b	28.38%
US\$5b - US\$10b	8.78%
US\$10b - US\$50b	15.54%
More than US\$50b	4.05%

**Panel C – Operational Activities**

Question	Observations	Avg. response	St. Dev.	More during Crisis (%)	Same (%)	Less during Crisis (%)
1 Assist portfolio companies with their operating problems	319	1.586***	0.715	89.58%	9.45%	0.98%
2 Provide strategic guidance to portfolio companies	319	1.918***	0.806	76.55%	21.82%	1.63%
3 Replace CEO or senior executives of portfolio companies	319	2.495***	0.810	45.93%	47.23%	6.84%
4 Interact frequently with the management of the portfolio company	319	1.778***	0.698	84.36%	15.64%	0.00%
5 Connect companies with potential customers, suppliers, or strategic partners	319	2.456***	0.737	47.23%	49.51%	3.26%
6 Connect companies with potential investors	319	2.830***	0.924	32.25%	47.23%	20.52%
7 Help companies hire managers	319	2.615***	0.702	37.46%	56.68%	5.86%
8 Provide stronger incentive-based compensation to management in portfolio company	319	2.690***	0.708	31.27%	61.89%	6.84%
9 Search for a potential buyer	319	3.508	1.101	19.87%	22.80%	57.33%
10 Increase frequency of board meetings per year	319	2.521***	0.653	41.37%	57.98%	0.65%

**Panel D – Financial Activities**

Question	Observations	Avg. response	St. Dev.	More during Crisis (%)	Same (%)	Less during Crisis (%)
1 Inject equity to alleviate financing constraints	319	2.254***	1.132	77.85%	0.65%	21.50%
2 Search and evaluate new deals	319	3.592	1.331	28.34%	7.49%	64.17%
3 Assist portfolio companies with financial structure issues	319	1.801***	0.887	89.90%	0.00%	10.10%
4 Assist portfolio companies to raise debt financing	319	2.726***	1.320	59.28%	2.93%	37.79%
5 Assist portfolio companies to renegotiate loan terms and debt obligations	319	1.827***	0.922	88.60%	0.00%	11.40%
6 Interact with bankers and lawyers regarding the financial structure of companies	319	2.042***	1.055	81.43%	0.00%	18.57%
7 Buy back debt obligations of portfolio companies	319	2.664***	1.387	58.31%	0.65%	41.04%

## Appendix

### A.1 Data and variable construction

The income and balance-sheet information used in the paper come from the Amadeus/Orbis database, produced by Bureau Van Dijk. To minimize concerns about outliers and data errors, we winsorize at 1% every ratio and growth rate used in the analysis. The winsorization was undertaken over the full sample of Amadeus/Orbis companies.

The main variables we used in the analysis are the following: (a) Investment/Assets, where investment is constructed as the change in assets over the past year, plus depreciation; (b) (Net) Equity Contribution/Assets, where the equity contribution is measured as the difference in total equity (shareholder value) over the past year, minus profit; (c) (Net) Debt Issuance/Assets, where the debt issuance is measured as the overall change in debt; (d) Leverage, which is simply total debt (including both short- and long-term) divided by assets; (e) ROA, which is net income over assets; (f) EBITDA/Assets, where EBITDA is the earnings before interest, taxes, depreciation, and amortization; (g) the Logarithm of Market Share, where market share is the ratio of the firm revenue in a specific year and the total revenue of all medium and large firms in the same SIC two-digit industry.

In the paper, we use different methodologies to determine companies that are more or less likely to be financial constrained at the time of the financial crisis. First, we rely on firm size, measured as top quartile of revenue in 2007 across the sample. Second, we identify firms that are in the top quartile of leverage in 2007. Third, we identify companies operating in the top quartile industries in terms of dependency on external finance. The underlying index is constructed using all firms in Compustat between 1980 and 2007: we construct a score for every two digit SIC code, which is the median of CAPEX minus operating cash flow, scaled by CAPEX.

We also construct two measures of dry-powder for PE investors. The first measure relies on fund level capital investment and fundraising. While measuring fundraising is straightforward, the construction of capital investment may require a short clarification. Capital investments is defined as the sum of the total equity investment made over the specified period. Equity investment in each case is estimated in the following manner. If available, we use the estimated equity investment as reported by ThomsonONE. Otherwise, we estimate the equity investment by the fund as the total amount of equity invested in the firm divided by the total number of funds

investing in the round. When ThomsonONE does not report the total equity invested, we use the value of the deal minus the debt (we assume debt to be zero when missing). If the fund used for investment is not reported, we use the total investment made by the PE group over the period.

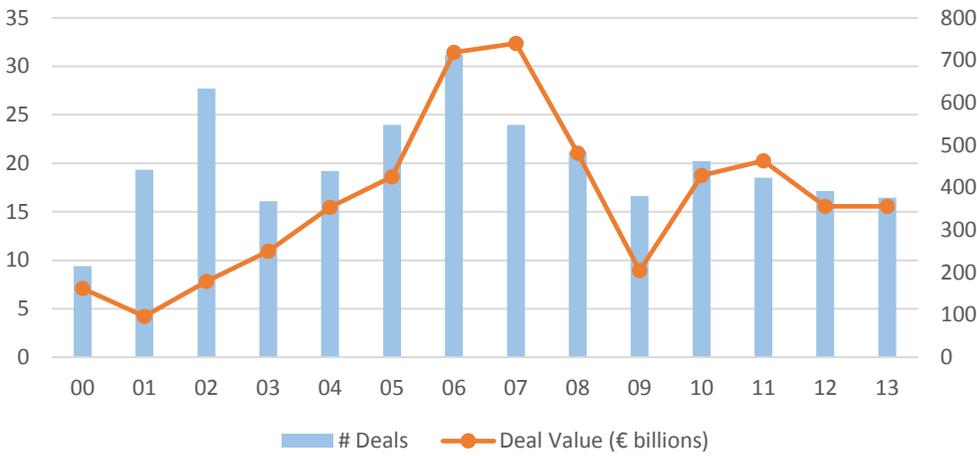
In the paper we explore renegotiation rates in the US leveraged loan market. Data on loan amendments are obtained from Standard & Poor's, which contains the universe of leveraged loans renegotiations with material changes to the contracts between 2005 and 2017. This data on contract amendments is matched with information on the original loan, which is collected from DealScan. In particular, we consider all the loans in DealScan issued after 1995 in the US. These two data sources are matched based on the year of the original loan and the name of the borrower or of its parent firm. In very few cases (less than one hundred amendments), a firm has issued more than one loan in a year and - even using the exact date of the issuance - we cannot determine to which loan is the renegotiation referring to. In these cases, we assume that both loans were renegotiated. Overall, we are able to match to DealScan more than 80% of the unique loan amendments in the S&P sample.

In line with the previous literature, we use the presence of a financial sponsor for the loan as evidence that the loan is linked to private equity transactions (Ivashina and Kovner, 2011). To make loans issued for private equity transactions more comparable to the rest of the sample, we undertake two steps. First, we focus only on the sample of leveraged loan, as defined by DealScan. In particular, we define a loan to be leveraged if any facility in the loan is defined as either leveraged or highly leveraged. Second, we focus only on loans larger than \$30M.

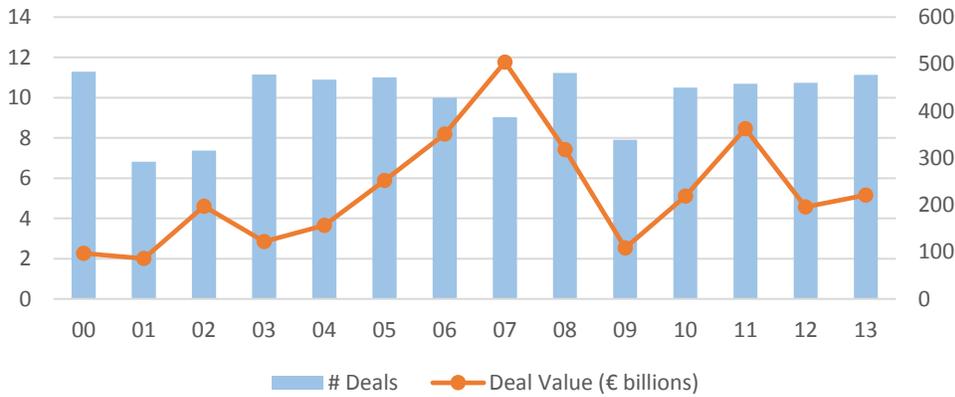
### Figure A.1: Private Equity activity country by country around the crisis

This figure depicts separately the aggregate equity value invested per year by funds based in a given country and number of investments. Panels A-E describe this for the UK, France, Germany, Europe as a whole, and the US. The source of the private equity data is Invest Europe, except for the US data, which is from Preqin (number of deals) and Cambridge Associates (dollar volume of deals).

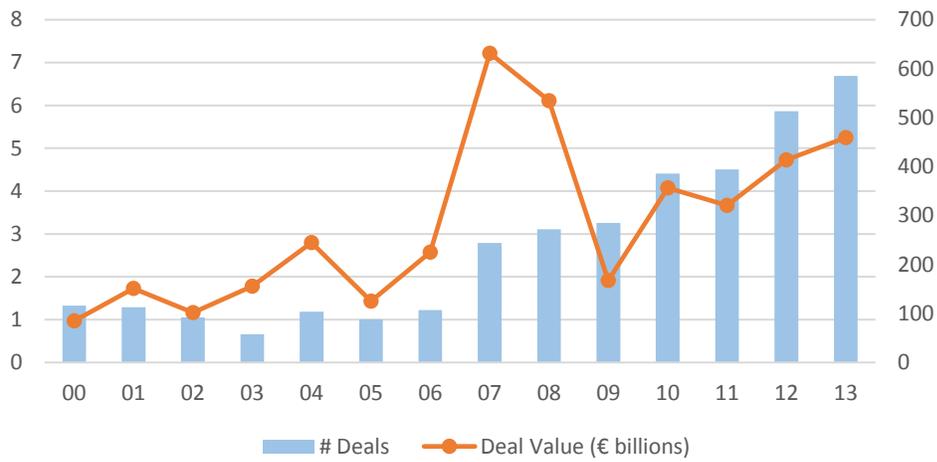
#### Panel A: Private Equity in the UK



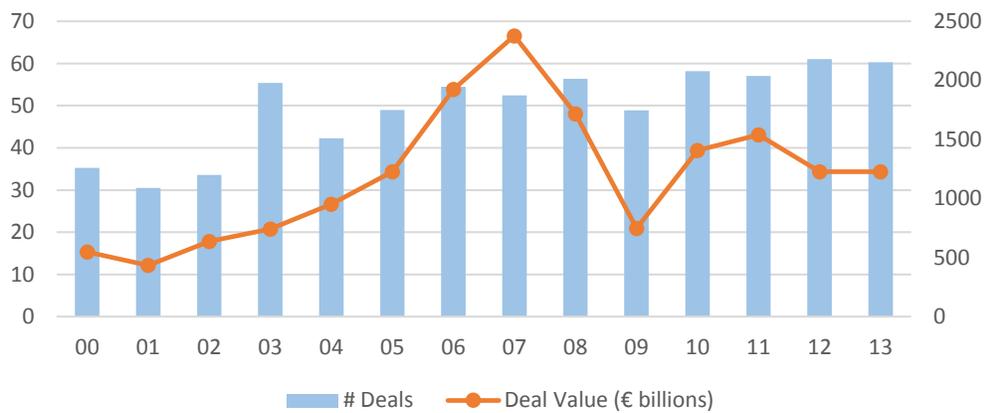
#### Panel B: Private Equity in France



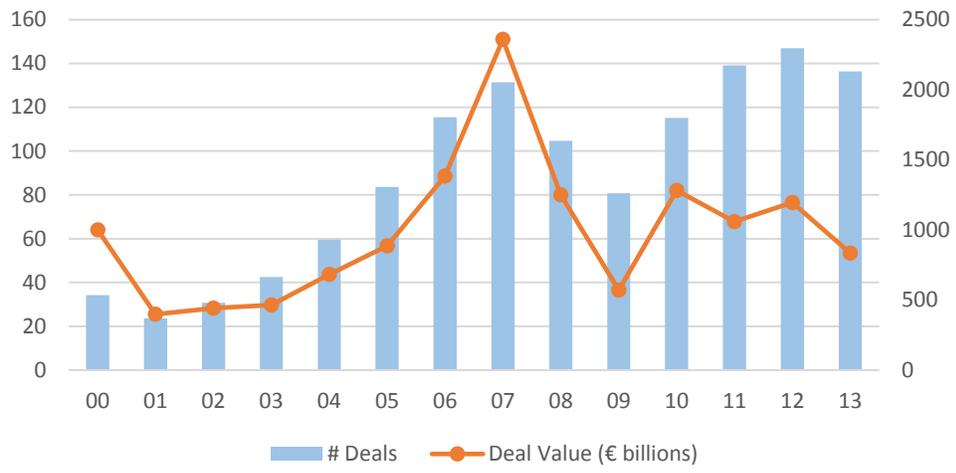
**Panel C: Private Equity in Germany**



**Panel D: Private Equity in Europe**



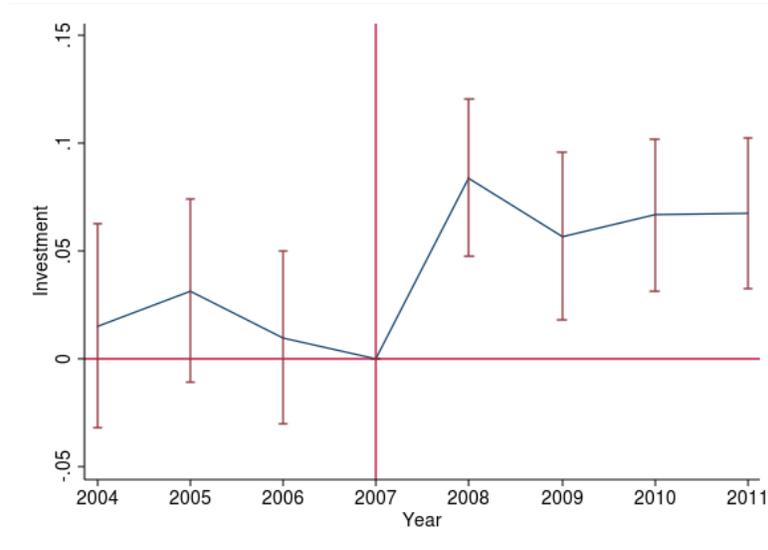
**Panel E: Private Equity in the United States**



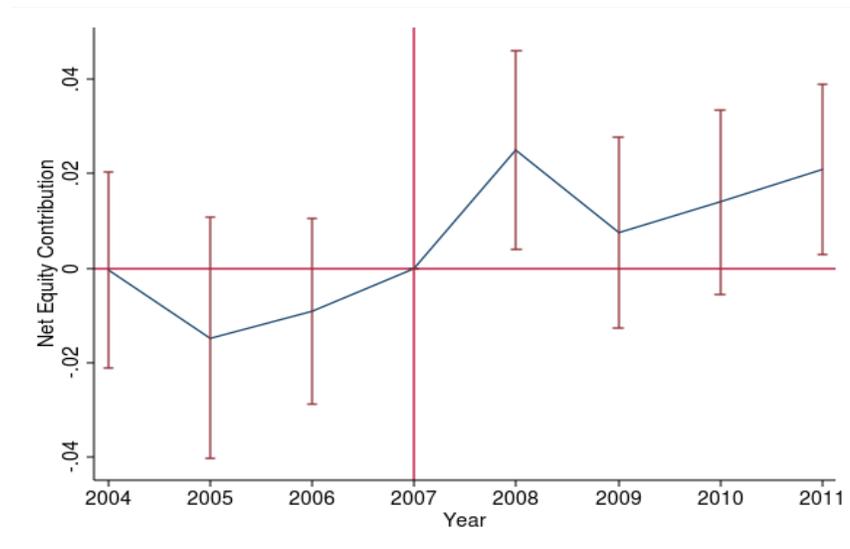
## Figure A.2: Effect of PE-backed companies over time

This figure reports the time-varying effect of being a PE-backed company on the main outcomes. Panel A reports the effect on investment, Panel B on debt issuance and Panel C on equity contribution. Specifically, this Figure reports the  $\beta_t$  of the following equation:  $y_{it} = \alpha_t + \alpha_i + \beta_t(PE\ firm_i) + \varepsilon_{it}$ . As explained in the paper, the year 2007 is used as base period and therefore the corresponding coefficient is normalized to zero. The central dot reports the point estimate while the straight vertical lines report the 90% confidence interval. The confidence interval is constructed using standard errors clustered at firm level. More info on this measure is available in the paper and in the Appendix.

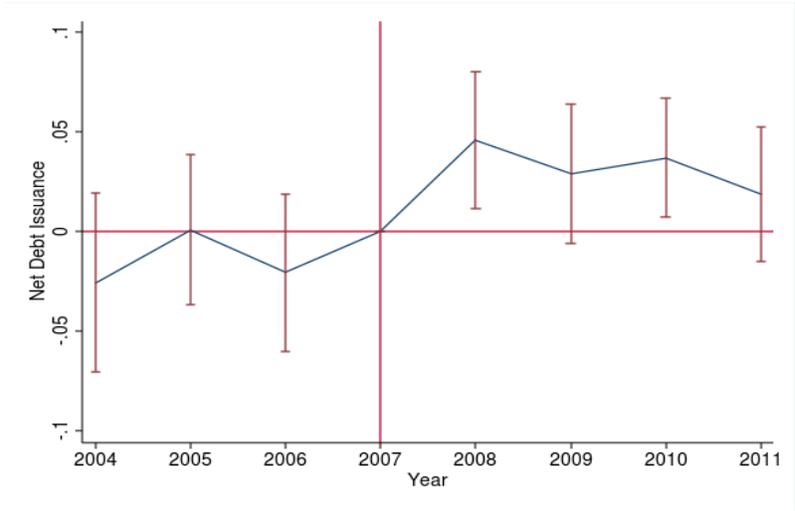
### Panel A - Investment



### Panel B - Equity Contributions



**Panel C – Debt Issuance.**



## Figure A.3: Survey Questions

In this table we provide the questionnaire that was presented to survey participants.

### Panel A – Operational Activities

Based on your experience, were private equity investors more or less likely to engage in the following activities during the financial crisis?

	2	1	0	-1	-2
	Significantly More During Crisis	More During Crisis	Same	Less During Crisis	Significantly Less During Crisis
Assist portfolio companies with their operating problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provide strategic guidance to portfolio companies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Replace CEO or senior executives of portfolio companies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interact frequently with the management of the portfolio company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Connect companies with potential customers, suppliers, or strategic partners	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Connect companies with potential investors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Help companies hire managers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provide stronger incentive-based compensation to management in portfolio company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search for a potential buyer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increase frequency of board meetings per year	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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**Panel B – Financial Activities**

Based on your experience, were private equity investors more or less likely to engage in the following activities during the financial crisis?

	2	1	0	-1	-2
	Significantly More During Crisis	More During Crisis	Same	Less During Crisis	Significantly Less During Crisis
Inject equity to alleviate financing constraints	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Search and evaluate potential new deals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assist portfolio companies with financial structure issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assist portfolio companies to raise debt financing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assist portfolio companies to renegotiate loan terms and debt obligations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interact with bankers and lawyers regarding the financial structure of portfolio companies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buy back debt obligations of portfolio companies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## Panel C – Potential Explanations

In your opinion, which aspects of private equity firms' structure and investments were most useful for the portfolio companies to weather the financial crisis?

- Private Equity has majority control of portfolio companies
- Operational expertise of Private Equity investors
- Strong financial incentives provided to management of portfolio companies
- Long investment horizon of Private Equity firms
- Private ownership that requires no scrutiny from public markets
- Dry powder that can be used for follow-on investments during the crisis
- High leverage disciplines and force portfolio companies to be efficient
- Private equity firms provide better access to banks and are more able to restructure and negotiate existing debt obligations of portfolio companies

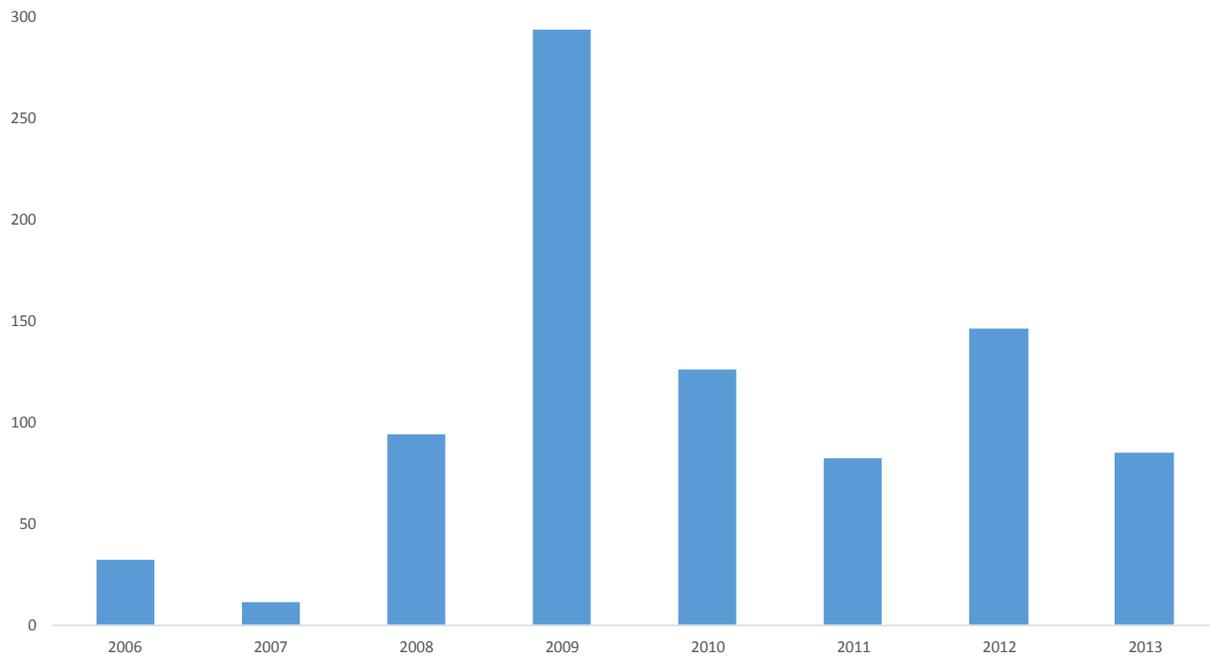
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### Figure A.4: Number of Loan Amendments

This figure reports the count of amendment events per year constructed using the data on debt amendments collected by S&P. The data should contain the universe of renegotiations that cover a material feature of the contract involving leveraged loans between 2006 and 2013. Unique amendment events are defined using the name of the company, the date of the amendment and the name of the original deal that is amended. The year in the horizontal axis refers to the year in which the amendment has been undertaken. More information on the data is available in the Data Appendix.



**Table A.1: Robustness using an alternative matching procedure**

This table reports the estimates of a difference-in-difference fixed effect model on the investment and funding variables using an alternative matching procedure. This alternative matching is identical to the one used to construct the main sample, but for the fact that we scale quadratic distance by the standard deviation of the variable. All specifications include firm and year fixed effects. The main parameter of interest is the interaction between the crisis dummy and PE-backed company dummy variable. Odd columns contain the baseline regression and even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables include firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by assets; in Columns (3) and (4) is net equity contribution over assets; in Columns (5) and (6) is the net debt issuance scaled by assets; in Columns (7) and (8) is the total leverage; in Columns (9) and (10) on average interest rate. More information on the variables are available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Asset		Net Equity Contr./Asset		Net Debt Issu./Asset		Leverage		Interest Rate	
PE firm x Post	0.065*** (0.013)	0.061*** (0.013)	0.021*** (0.007)	0.020*** (0.007)	0.048*** (0.012)	0.046*** (0.011)	-0.003 (0.015)	-0.002 (0.015)	-0.003** (0.001)	-0.003** (0.001)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	12481	11962	12477	12034	12933	12329	13230	12606	10162	9785
Clusters	1985	1884	1983	1882	1983	1882	1985	1884	1825	1728
Adjusted R-squared	0.161	0.162	0.037	0.050	0.089	0.106	0.004	0.029	0.018	0.022

**Table A.2: Robustness excluding MBO**

This Table reports a robustness test, where we estimate the standard difference-in-difference fixed effect model on the main outcome variables dropping the PE-backed companies whose deal is identified as a management buyout (MBO) and the corresponding matched companies. Every specification contains a set of firm and year fixed effects. The main parameter of interest is the interaction between the crisis dummy and a dummy identifying PE-backed companies. Odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by assets; in Columns (3) and (4) is net equity contribution; in Columns (5) and (6) is the net debt issuance; in Columns (7) and (8) is leverage; in Columns (9) and (10) is ROA. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Post	0.068*** (0.017)	0.072*** (0.017)	0.022** (0.010)	0.018** (0.009)	0.047*** (0.015)	0.053*** (0.015)	0.022 (0.020)	0.022 (0.020)	-0.003 (0.002)	-0.003* (0.002)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	8295	7965	8316	8028	8557	8181	8764	8376	6711	6483
Adjusted R-squared	0.157	0.159	0.039	0.064	0.085	0.103	0.009	0.029	0.016	0.021

**Table A.3: Robustness excluding public-to-private transactions**

This table reports a robustness test, where we estimate the standard difference-in-difference fixed effect model on various outcomes excluding the set of deals undertaking a public-to-private transactions. Every specification contains a set of firm and year fixed effects. The main parameter of interest is the interaction between the post dummy and a dummy identifying PE-backed companies. Odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by asset; in Columns (3) and (4) is net equity contribution; in Columns (5) and (6) is the net debt issuance; in Columns (7) and (8) is leverage; and in Columns (9) and (10) is ROA. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Asset		Net Equity Contr./Asset		Net Debt Issu./Asset		Leverage		Interest Rate	
PE firm x Crisis	0.064*** (0.013)	0.060*** (0.013)	0.023*** (0.008)	0.021*** (0.007)	0.041*** (0.012)	0.039*** (0.012)	0.007 (0.015)	0.006 (0.015)	-0.003** (0.001)	-0.003** (0.001)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	11829	11304	11834	11388	12256	11649	12539	11910	9715	9343
Clusters	1893	1791	1890	1789	1891	1789	1893	1791	1753	1659
Adjusted R-squared	0.160	0.160	0.040	0.058	0.090	0.105	0.011	0.029	0.016	0.021

**Table A.4: Robustness using only 2007-2008**

This table reports a robustness test, where we estimate the standard difference-in-difference fixed effect model on various outcomes using only data from 2007 and 2008. This corresponds to the last year before the crisis and the first one in the crisis. Every specification contains a set of firm and year fixed effects. The main parameter of interest is the interaction between the post dummy and a dummy identifying PE-backed companies. Odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by assets; in Columns (3) and (4) is net equity contribution; in Columns (5) and (6) is the net debt issuance; in Columns (7) and (8) is leverage; and in Columns (9) and (10) is ROA. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Post	0.083*** (0.022)	0.085*** (0.022)	0.027** (0.013)	0.029** (0.012)	0.047** (0.021)	0.039* (0.021)	0.004 (0.010)	0.001 (0.010)	-0.003** (0.001)	-0.003** (0.001)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	3924	3715	3860	3672	3892	3696	3948	3737	3183	3019
Adjusted R-squared	0.385	0.399	0.139	0.262	0.234	0.296	0.002	0.020	0.009	0.020

**Table A.5: Robustness using only companies not experiencing exit**

This table reports a robustness test, where we estimate the standard difference-in-difference fixed effect model on various outcomes using only data only for groups of matched firms where no company is identified as leaving the data by 2011 (survivorship bias free). Every specification contains a set of firm and year fixed effects. The main parameter of interest is the interaction between the post dummy and a dummy identifying PE-backed companies. Odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is Investment scaled by asset; in Columns (3) and (4) is net Equity Contribution; in Columns (5) and (6) is the net Debt Issuance; in Columns (7) and (8) is leverage; in Columns (9) and (10) is ROA. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Post	0.044*** (0.014)	0.040*** (0.014)	0.017** (0.008)	0.016** (0.008)	0.030** (0.013)	0.025** (0.012)	0.003 (0.014)	0.000 (0.014)	-0.002 (0.001)	-0.003* (0.001)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	9658	9271	9700	9367	10020	9567	10242	9776	7963	7683
Adjusted R-squared	0.160	0.160	0.046	0.061	0.090	0.102	0.029	0.040	0.020	0.026

**Table A.6: Robustness adding time-varying industry fixed effects**

This table reports a robustness test, where we estimate the standard difference-in-difference fixed effect model on various outcomes adding set of fixed effects generated as the product of industry (two digit SIC) and the post dummy. Every specification contains a set of firm and year fixed effects. The main parameter of interest is the interaction between the post dummy and a dummy identifying PE-backed companies. Odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by asset; in Columns (3) and (4) is net equity contribution; in Columns (5) and (6) is the net debt issuance; in Columns (7) and (8) is leverage; and in Columns (9) and (10) is ROA. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Post	0.055*** (0.013)	0.053*** (0.013)	0.022*** (0.007)	0.021*** (0.007)	0.039*** (0.011)	0.037*** (0.011)	0.012 (0.015)	0.013 (0.014)	-0.002* (0.001)	-0.003** (0.001)
Industry X Post FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	12456	11910	12469	12003	12903	12274	13205	12553	10222	9831
R-squared	0.163	0.163	0.042	0.060	0.093	0.105	0.019	0.040	0.021	0.026

**Table A.7: Robustness using alternative timing of the matching**

This Table reports a robustness test, where we estimate the standard difference-in-difference fixed effect model on the main outcome variables using alternative matching procedure. In particular, we experiment in matching our set of PE firms in periods different than 2007. Across all the three panels, the matching is undertaken: (a) at 2003 in column (1); (b) at 2004 in column (2); (c) at 2005 in column (3); and (d) in the year before the last buyout in column (4). For clarity, we organized the results in three panels: (1) Panel A looks at investment; (2) Panel B explores the effect on equity contribution; (3) Panel C looks at debt issuance. Every specification contains a set of firm and year fixed effects as well as firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

**Panel A: Investments**

	(1)	(2)	(3)	(4)
	Investment/Asset			
PE firm x Crisis	0.036*** (0.013)	0.045*** (0.012)	0.040*** (0.012)	0.038*** (0.014)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Firm Control	Yes	Yes	Yes	Yes
Year Matching	2003	2004	2005	pre-buyout
Observations	16426	15395	16509	9529
Clusters	2761	2508	2728	1558
Adjusted R-squared	0.036	0.134	0.127	0.137

**Panel B: Equity Contributions**

	(1)	(2)	(3)	(4)
	Net Equity Contributions /Asset			
PE firm x Crisis	0.021*** (0.008)	0.022*** (0.007)	0.024*** (0.007)	0.020** (0.009)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Firm Control	Yes	Yes	Yes	Yes
Year Matching	2003	2004	2005	pre-buyout
Observations	14737	15734	16772	9677
Clusters	2382	2543	2761	1565
Adjusted R-squared	0.064	0.061	0.062	0.057

**Panel C: Debt Issuances**

	(1)	(2)	(3)	(4)
	Net Debt Issuances /Asset			
PE firm x Crisis	0.024* (0.013)	0.028** (0.012)	0.031*** (0.012)	0.027** (0.013)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Firm Control	Yes	Yes	Yes	Yes
Year Matching	2003	2004	2005	pre-buyout
Observations	15222	16296	17439	10052
Clusters	2394	2564	2778	1571
Adjusted R-squared	0.067	0.075	0.065	0.091

**Table A.8: Heterogeneity across firms - comparing 2008-2009 with 2010-2011.**

These tables further explore how our results differ across various proxies of financial constraints in 2007. Relative to Table 5, the only difference is that in these tables we estimate the effects separately for the crisis period (2008-2009) and the post-crisis one (2010-2011). In this way, we can explore when financial constraint played a bigger role. All specifications include firm and year fixed effects. In each table, the interaction term in Columns 1 and 2 is based on firm size, and equal one if the firm is at the top quartile of firm employment versus the rest of the sample. The interaction in Columns 3 and 4 is based on dependency on external finance, measured by RZ index (Rajan and Zingales, 1998). The interaction equals one if dependence on external finance is on the top quartile, and zero otherwise. In Columns 5 and 6, the interaction is based on firm leverage. The interaction equals one if firm leverage is on the top quartile, and zero otherwise. Panel A reports the results using investment as an outcome, Panel B uses instead debt issuance over assets as dependent variable and lastly Panel C reports the results with net equity contributions over assets. Even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. More information on the variables are available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

**Panel A: Investment heterogeneity**

Investment / Asset	(1)	(2)	(3)	(4)	(5)	(6)
Interaction x 1{08-09} x PE	0.056* (0.031)	0.053* (0.031)	0.091*** (0.031)	0.102*** (0.031)	0.117*** (0.037)	0.117*** (0.037)
Interaction x 1{10-11} x PE	0.050 (0.031)	0.049 (0.031)	0.064** (0.031)	0.069** (0.031)	0.097** (0.039)	0.084** (0.037)
Interaction Variable	Small		External Dependence		High Leverage	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	11539	11105	12456	11910	12456	11910
Clusters	1824	1742	1984	1878	1984	1878
Adjusted R-squared	0.160	0.162	0.162	0.162	0.162	0.162

**Panel B: Debt issuance heterogeneity**

Debt Issuances / Assets	(1)	(2)	(3)	(4)	(5)	(6)
Interaction x 1{08-09} x PE	0.075** (0.030)	0.065** (0.029)	0.071** (0.030)	0.075** (0.030)	0.103*** (0.035)	0.098*** (0.035)
Interaction x 1{10-11} x PE	0.034 (0.029)	0.026 (0.029)	0.067** (0.028)	0.067** (0.028)	0.040 (0.038)	0.031 (0.039)
Interaction Variable	Small		External Dependence		High Leverage	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	11891	11400	12903	12274	12903	12274
Clusters	1823	1741	1982	1876	1982	1876
Adjusted R-squared	0.089	0.101	0.091	0.105	0.106	0.109

**Panel C: Equity injection heterogeneity**

Net Equity Contr./Asset	(1)	(2)	(3)	(4)	(5)	(6)
Interaction x 1{08-09} x PE	-0.015 (0.019)	-0.005 (0.018)	0.021 (0.019)	0.023 (0.017)	0.011 (0.019)	0.013 (0.019)
Interaction x 1{10-11} x PE	-0.018 (0.017)	-0.010 (0.017)	-0.001 (0.016)	0.001 (0.016)	0.012 (0.018)	0.009 (0.019)
Interaction Variable	Small		External Dependence		High Leverage	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	11564	11193	12469	12003	12469	12003
Clusters	1823	1741	1981	1876	1981	1876
Adjusted R-squared	0.045	0.062	0.041	0.059	0.057	0.067

**Table A.9: Heterogeneity across multiple vs. single investor**

This table reports the estimates from a difference-in-difference fixed effect model, while exploring heterogeneity across PE-backed companies with one or more investors in the last deal. The analysis is estimated using only the set of PE-backed companies. Multiple is a dummy variable equals to one if there is only one investor listed in the deal description. All specifications contain firm and year fixed effects. Even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. More information on the variables are available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)
	Investment/Asset		Net Debt Issu./Asset		Net Equity Contr./Asset	
Post*Multiple	-0.012 (0.048)	0.006 (0.036)	0.025 (0.037)	0.035 (0.036)	0.011 (0.028)	0.019 (0.023)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	1582	1539	1565	1527	1589	1546
Adjusted R-squared	0.103	0.113	0.021	0.043	0.062	0.066

**Table A.10: Robustness of Market Share Results**

This table reports a robustness test on the market share results. All regressions are cross-sectional regressions, where we compare firms across PE and non-PE backed companies. In Columns (1)–(4), we estimate a conditional logit model, where the outcome is a dummy equal to one if the market share of the firm increased over 2009 and 2007 (Columns 1 and 2) or over 2011 and 2007 (Columns 3 and 4). The reported beta are marginal effect at the average and the model is estimated with SIC two-digit fixed effects. In Columns (5)–(8), we estimate an OLS model where the outcome is the growth rate in market share between 2009 and 2007 (Columns 5 and 6) or 2011 and 2007 (Columns 7 and 8). The market share growth is winsorized at 1% to reduce the influence of outliers. Odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<u>Market Share Increase - Dummy</u>				<u>Market Share Growth</u>			
	2007-2009		2007-2011		2007-2009		2007-2011	
PE Firm	0.054**	0.032*	0.042	0.017	0.046*	0.063**	0.027	0.054
	(0.024)	(0.018)	(0.027)	(0.012)	(0.027)	(0.031)	(0.049)	(0.050)
Industry (2-digit)								
F.E.	Y	Y	Y	Y	Y	Y	Y	Y
Firm Controls 2007		Y		Y		Y		Y
Observations	1639	1639	1564	1564	1655	1655	1565	1565

**Table A.11: Exit Analysis Before and After the Crisis**

This Table reports a panel regression where we compare the likelihood of undertaking a certain exit strategy between the pre-crisis and post-crisis period. The sample is a repeated cross-section of PE-backed firm matched to the corresponding set of non-PE firm. For the pre-crisis sample, we consider a set of PE-backed deals completed by 2004, allowing to have in the sample also that exited before the crisis. This sample is then matched using the usual methodology to non-PE firms at 2004, and the outcomes for this sample are measured between 2005 and the financial crisis. For the post-crisis sample, we consider exactly the same sample we use in the main analyses, which is reported in Panel C of Table 7. In the Table, we report the marginal value (at the mean) of a conditional logit model where we study the effect of being a PE-backed company in the pre- vs. post sample on various exit outcomes. Even columns have firm level controls at 2007. In Columns (1) and (2) the outcome is a dummy equal to one if the company was the target of an M&A activity in the post-crisis period; in Columns (3) and (4) the outcome is the dummy equal to one if the company exit the data set in the post period. Standard errors are clustered by two-digit industry. The control variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. See the Appendix and the paper for more info on the variables. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

	(1)	(2)	(3)	(4)
	1{M&A}		1{Exit}	
PE Firm	0.312*** (0.017)	0.206*** (0.072)	0.056 (0.090)	0.037 (0.117)
Post	0.144*** (0.034)	0.114** (0.045)	0.126** (0.058)	0.125* (0.069)
Post*PE Firm	-0.019 (0.078)	-0.025 (0.076)	-0.012 (0.117)	0.022 (0.142)
Industry (2-digit) F.E.	Y	Y	Y	Y
Firm Controls 2007		Y		Y
Observations	3184	2667	3053	2547

**Table A.12: Equity injections and Performance**

This table reports a set of robustness test, where we look at the effect of PE activism across firms that received equity injection. Across both panels, these firms are defined as those that on average received positive equity injection. In Panel A, we examine how PE-backed companies reacted to the crisis depending on whether they received equity injections, as defined earlier. In particular, in columns (1) and (2), the outcome is investment, while in (3) and (4) the outcome is ROA. Every specification contains a set of firm and year fixed effects. In Panel B, we repeat our examination of exit behavior looking at the differential effect depending on whether the firm received equity injections. In Columns (1) and (2) the outcome is a dummy equal to one if the company was the target of an M&A activity in the post-crisis period; in Columns (3) and (4) the outcome is instead a dummy equal to one if the company was a target of an M&A activity and the company does not exit from the data in the same time frame; in Columns (5) and (6) the outcome is the dummy equal to one if the company exit the data set in the post period; lastly in Columns (7) and (8) the outcome is a dummy if the company exit the data and it reported some financial difficulties before the exit. In both panels, odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis. In panel A, these controls are also interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by asset; in Columns (3) and (4) is net equity contribution; in Columns (5) and (6) is the net debt issuance; in Columns (7) and (8) is leverage; and in Columns (9) and (10) is ROA. More information on the variables is available in the Appendix. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%.

**Panel A: Equity injections and performance**

	(1)	(2)	(3)	(4)
	Investment/Asset		ROA	
PE firm x Crisis	0.039*** (0.012)	0.040*** (0.013)	-0.010 (0.008)	-0.010 (0.008)
1{Equity Injection}*Post	-0.079*** (0.027)	-0.032 (0.027)	0.063** (0.028)	-0.011 (0.022)
PE Firm * 1{Equity Injection}*Post	0.183*** (0.056)	0.152*** (0.055)	0.072* (0.042)	0.065 (0.040)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes
Observations	12291	11782	12707	12228
Clusters	1944	1847	1944	1847
Adjusted R-squared	0.163	0.164	0.013	0.042

**Panel B: Equity injections and exits**

	(1) 1{M&A}	(2) 1{M&A, No Distress}	(3) 1{Exit}	(4) 1{Bankruptcy}
PE Firm	0.320*** (0.106)	0.320*** (0.106)	0.065 (0.123)	0.112 (0.100)
1{Equity Injection}	0.091 (0.082)	0.091 (0.082)	0.121 (0.157)	0.082 (0.070)
PE Firm * 1{Equity Injection}	-0.149 (0.208)	-0.149 (0.208)	-0.226 (0.312)	-0.496** (0.225)
Industry (2-digit) F.E.	Y	Y	Y	Y
Firm Controls 2007	Y	Y	Y	Y
Observations	1607	1607	1270	1263

**Table A.13: Survey Evidence – Heterogeneity of Fund Size and Investor Experience**

This table reports the survey answers of 319 participants. Panels A and B summarize survey results, split based on fund size and investor experience. Survey participants were presented with a list of common private equity activities related to firm operations (Panel A) and firm financials (Panel B). For each activity, participants answered whether this activity is more or less likely to take place during the 2008 financial crisis, when compared to normal times. Participants answers ranged from significantly more likely (= 1), more likely (=2), same (=3), less likely (=4), and significantly less likely (=5). In columns (1) and (2) we split the sample of survey participants to Small funds (with assets under management of less than \$5B) and large funds (with assets greater than \$5B) and report the fraction of participants in each group that provided a response that is lower than 3 (activity is more likely during the crisis). The difference in response across groups is reported in column (3) which also denotes whether the difference is statistically significant. \*\*\* denotes significance at the 1% level, \*\* at the 5%, and \* at the 10%. Columns (5) and (6) split the survey participants sample by on years of experience. Experienced investors have more than 14 years of experience (sample median) and inexperienced investors have less than 14 years of experience and report the fraction of investors report that a given activity is more likely during the crisis. Column (6) reports the difference in responses and statistical significance. The survey questions are shown in Figure A.3 of the Appendix.

**Panel A – Operational Activities**

		Small fund	Large fund	difference	Inexperienced Investor	Experienced Investor	difference
1	Assist portfolio companies with their operating problems	89.15%	90.53%	-1.38%	92.76%	86.45%	0.06
2	Provide strategic guidance to portfolio companies	77.36%	74.74%	2.62%	77.63%	75.48%	2.15%
3	Replace CEO or senior executives of portfolio companies	44.34%	49.47%	-5.13%	46.05%	45.81%	0.25%
4	Interact frequently with the management of the portfolio company	83.02%	87.37%	-4.35%	82.24%	86.45%	-4.21%
5	Connect companies with potential customers, suppliers, or strategic partners	47.17%	47.37%	-0.20%	50.00%	44.52%	5.48%
6	Connect companies with potential investors	30.66%	35.79%	-5.13%	32.24%	32.26%	-0.02%
7	Help companies hire managers	37.26%	37.89%	-0.63%	45.39%	29.68%	0.15***
8	Provide stronger incentive-based compensation to management in portfolio company	31.60%	30.53%	1.08%	30.26%	32.26%	-1.99%
9	Search for a potential buyer	21.70%	15.79%	5.91%	17.76%	21.94%	-4.17%
10	Increase frequency of board meetings per year	37.74%	49.47%	-0.11**	36.18%	46.45%	-0.10*

**Panel B – Financial Activities**

Question	Small fund	Large fund	difference	Inexperienced Investors	Experience	
					Investors	difference
1 Inject equity to alleviate financing constraints	78.30%	76.84%	1.46%	73.68%	81.94%	-0.08*
2 Search and evaluate potential new deals	26.89%	31.58%	-4.69%	28.95%	27.74%	1.21%
3 Assist portfolio companies with financial structure issues	89.15%	91.58%	-2.43%	88.16%	91.61%	-3.46%
4 Assist portfolio companies to raise debt financing	58.49%	61.05%	-2.56%	56.58%	61.94%	-5.36%
5 Assist portfolio companies to renegotiate loan terms and debt obligations	88.21%	89.47%	-1.27%	88.16%	89.03%	-0.87%
6 Interact with bankers and lawyers regarding the financial structure of portfolio companies	80.19%	84.21%	-4.02%	82.24%	80.65%	1.59%
7 Buy back debt obligations of portfolio companies	50.47%	75.79%	-0.25***	57.24%	59.35%	-2.12%