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VALUE CREATION IN PRIVATE EQUITY

Abstract

We open up the black box of value creation in private equity with the help of confidential information on value creation plans and their execution. Plans are tailored to each portfolio company's needs and circumstances, have become more hands-on, and vary with deal type, ownership, growth strategy, and geographic focus. Successful execution is subject to resource constraints, economies of specialization, and diminishing returns, and varies systematically across funds. Successful execution is a key driver of investor returns, especially in growth, buyout, and secondary deals. Company operations and profitability improve in ways consistent with successful execution, even beyond PE funds' exit.

JEL Classification: G11, G24, G30, G32, L26

Keywords: private equity, venture capital, Growth investing, secondaries, value creation, financial returns, Machine Learning

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Value Creation in Private Equity [*] [†] [♠]

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Value Creation in Private Equity

Abstract

We open up the black box of value creation in private equity with the help of confidential information on value creation plans and their execution. Plans are tailored to each portfolio company's needs and circumstances, have become more hands-on, and vary with deal type, ownership, growth strategy, and geographic focus. Successful execution is subject to resource constraints, economies of specialization, and diminishing returns, and varies systematically across funds. Successful execution is a key driver of investor returns, especially in growth, buyout, and secondary deals. Company operations and profitability improve in ways consistent with successful execution, even beyond PE funds' exit.

JEL Classification: G11, G24, G30, G32, L26.

Keywords: Private equity, venture capital, growth investing, secondaries, value creation, financial returns, machine learning.

Private equity has grown into a sizeable asset class, deploying USD 1.47 trillion of investors' capital worldwide in 2019.[1] Broadly speaking, academic research has documented that investors do well out of private equity (PE), earning returns after fees that exceed those available in the public equity markets.[2] Academic research has also documented that private equity leads to operational changes at portfolio companies, for example in terms of profitability, employment, productivity, and pricing.[3] Our aim is to explore the links between these operational changes and investor returns and in the process open up the black box of value creation in private equity using unique data.

In their survey of the PE literature, Kaplan and Strömberg (2009) note that PE firms use their industry expertise and operational know-how to identify attractive investments, to develop value creation plans for those investments, and to generate attractive investors returns by implementing their value creation plans. Such plans might focus on cost-cutting and productivity improvements, strategic changes or repositioning, add-on acquisitions, or management changes. Although many studies refer to such value creation plans, there is no systematic evidence on what these plans typically look like or whether they help improve company operations or investor returns.

To answer these questions, we draw on a sample of 1,580 emerging-markets deals by 171 PE funds raised between 1992 and 2017. The unique advantage of our data is that we have access not only to precisely dated cash flows and other quantitative data about the portfolio companies but also to rich textual information in the form of proprietary pre-deal investment memos and investment-

[1] McKinsey Global Private Markets Review 2020, Exhibit 13.

[2] See Ljungqvist and Richardson (2003), Kaplan and Schoar (2005), Kaplan and Strömberg (2009), Robinson and Sensoy (2011), Higson and Stucke (2013), Phalippou (2014), and Harris, Jenkinson, and Kaplan (2014), though whether PE returns beat public-market benchmarks when controlling for differences in risk, liquidity, and leverage remains an open question (Lerner and Schoar 2004, Cochrane 2005, Metrick 2007, Korteweg and Sørensen 2010, Franzoni, Nowak, and Phalippou 2012, Kleymenova, Talmor, and Vasvari 2012, Driessen, Lin, and Phalippou 2012, Axelson, Sørensen, and Strömberg 2013, Axelson et al. 2013, Ewens, Jones, and Rhodes-Kropf 2013, Sørensen, Wang, and Yang 2014, Jegadeesh, Kräussl, and Pollet 2015, Korteweg and Nagel 2016, Robinson and Sensoy 2016, Ang et al. 2018).

[3] Existing work shows that PE improves productivity by increasing capital expenditures (Boucly, Sraer, and Thesmar 2011) and reallocating resources to more productive plants amid net job destruction (Davis et al. 2014), though some studies disagree (Bharat, Dittmar, and Sivadasan 2014). Fracassi, Previtero, and Sheet (2017), who draw on product-level price data, find that U.S. consumer-goods companies acquired by PE firms raise prices only marginally on existing products and that PE ownership benefits customers through new product introductions and increased variety. Acharya et al. (2013) show that the improvements in financial performance of PE deals can be traced to improvements in sales and operating margins, though Guo, Hotchkiss, and Song (2011) find only slight improvements in margins in their sample.

committee presentations and confidential quarterly post-investment reports provided to a fund's limited partners (LPs). We combine the quantitative data with the textual information to document what PE firms' value creation plans look like, what determines whether or not a plan is achieved, and which value-creation strategies are associated with higher returns to investors.

A VCP consists of one or more "action items." We track 23 distinct action items, which we group into five strategies: operational improvements (84% of sample deals), top-line growth (74%), governance engineering (48%), financial engineering (35%), and cash management (14%). A VCP can span more than one strategy. In our data, the average VCP spans 2.5 strategies. With five strategies to choose from, there are 32 ($= 2^5$) possible strategy combinations. The 10 most popular combinations account for 80% of sample VCPs. Eight of the top 10 involve either operational improvements or top-line growth or both. Governance engineering features in six of the top 10, with financial engineering and cash management in three and two of the top 10 combinations, respectively. The three most popular combinations involve both operational improvements and top-line growth, either with no other strategy (18%) or in combination with governance engineering (15%), or with governance and financial engineering (11%).

The average VCP in our sample includes a total of 4.5 action items, with buying/upgrading assets (66%), changing product/service mix (37%), and pursuing M&A deals (33%) the three most popular action items. We see 776 different combinations of action items in our sample, with the 10 most popular accounting for only 11.6% of sample VCPs. This suggests that VCPs are tailored to the needs and circumstances of each individual portfolio company.

We document systematic variation in VCPs over time and by deal type, fund ownership, growth strategy, and geographic focus. All five strategies have become more popular over time, suggesting that PE firms have become more hands-on. For example, three times as many deals pursue governance engineering in 2012-2017 compared to 1992-1997, and twice as many deals pursue growth strategies. The popularity of individual action items varies much more over time. PE firms

are more hands-on in buyouts than in earl-stage deals or turnarounds, when they have majority ownership, when they pursue inorganic growth strategies, and when they invest regionally rather than in a single country. For example, buyouts tend to focus on optimizing capital structure, pursuing inorganic growth, changing the mix of products or services, and replacing senior and middle management, while early-stage and growth deals tend to focus on capital expenditures.

Our data allow us to track the implementation and achievement (or otherwise) of each action item over time. PE firms typically manage to implement the majority of their action items and strategies, though we see variation in achievement rates suggesting that some action items are easier to implement than others. For example, plans to replace management, buy or sell assets, and reduce cost are nearly always implemented, while plans to increase market share, grow through add-on acquisitions, and expand internationally appear more difficult to implement.

We document systematic variation in the achievement of VCPs. Action items belonging to a given strategy are substitutes rather than complements, in the sense that they are less likely to be achieved the more other action items the plan contains for the same strategy. We interpret this finding as consistent with resource constraints: PE firms typically employ highly skilled "operating partners" who help with implementation and whose skills are plausibly in scarce supply in the short term. We find evidence of economies of specialization, in the sense that an action item is more likely to be successfully implemented if the fund's other deals pursue related actions, especially in the case of governance engineering and operational improvements. We also see diminishing returns to making plans ever more detailed. Finally, we find systematic variation in achievement rates across funds. Specifically, funds with focused, homogeneous portfolios of predominantly minority positions are systematically better at implementing their value creation plans than are other funds.

We link investor returns to VCPs to examine whether some strategies are associated with higher returns to investors than others. This analysis reveals a novel finding: it is not the ex ante selection of strategies that matters so much as the successful implementation of the chosen strategies. In other

words, execution is the key to achieving high returns for investors. We base this conclusion on the results of two complementary analyses. The first is a LASSO analysis, a popular machine-learning prediction model which we use to identify the ex ante and the ex post strategy combinations that best predict investor returns out of sample. The LASSO analysis shows that no single strategy is systematically associated with higher or lower returns; instead, returns depend on how strategies are combined. It further shows that ex post (achieved) strategy combinations are better predictors of realized returns than ex ante (planned) combinations, suggesting that execution is key. While the highest returns are predicted (and realized) for strategy combinations that are not particularly popular in our sample, the bulk of our sample deals pursue strategy combinations that outperform the public-market benchmark. (For example, plans to combine top-line growth, governance engineering, and financial engineering are predicted to yield the highest returns but rank only 17th in popularity. The most popular strategy combination is among the top five combinations which, if achieved, predict the highest returns.)

Our second analysis, which focuses on identifying return drivers in-sample rather than on predicting returns out-of-sample, reinforces this conclusion. We find that successful implementation of planned action items is strongly associated with higher investor returns in the cross-section, especially in growth, buyout, and secondary deals. In early-stage deals, execution appears to matter less, perhaps because risk factors are more idiosyncratic and hence more difficult for a PE firm to plan for: optimizing production processes may not matter much if customers turn out not to like a startup's product or the management team is unable to work together effectively.

We take seriously the possibility that PE firms may strategically skew their reporting to their investors in ways that falsely attribute deal success to superior execution and deal failure to external circumstances beyond their control. To this end, we benchmark portfolio companies to observably similar propensity-score-matched control firms in the spirit of Davis et al. (2014) and Bharat, Dittmar, and Sivadasan (2014). Using this matched sample, we show that during the investment

period, portfolio companies experience the kinds of changes in operational metrics, top-line growth, financial metrics, and cash management that would reflect the successful implementation of PE firms' value creation plans. Specifically, portfolio companies significantly improve operations (increasing employment, wages, labor productivity, and capital intensity), boost their top-line (increasing sales and market share while reducing price markups), engage in financial engineering (reducing their effective tax rate as they take advantage of tax shields by increasing leverage, and reducing the interest rate they pay on their debt), and reduce their working capital needs.

A novel finding is that most of these changes turn out not to be temporary: they persist even after the PE firms exit their investments. Compared to before PE investment, portfolio companies continue to employ significantly more people, pay higher wages, and operate more productively in the five years post-exit; their sales and market shares continue to be higher and their markups lower, while their EBITDA profitability increases significantly (but only post-exit). These patterns suggest that PE firms' value creation practices have long-lasting effects, supporting the conjecture by Kaplan and Strömberg (2009) that private equity "has a substantial permanent component."

As further corroborating evidence against strategic reporting, we investigate whether the changes portfolio companies experience during the holding period help explain the cross-section of realized investor returns. This reveals that investors earn higher returns the more a portfolio company increases its sales, EBITDA, employment, and capital intensity during the holding period.

We contribute to the literature on value creation in private equity and venture capital based on evidence collected from surveys and qualitative studies. A survey of 79 PE firms by Gompers, Kaplan, and Mukharlyamov (2016) finds that PE funds focus their value creation activities on increasing growth rather than reducing costs. Their findings support the conceptual framework of Kaplan and Strömberg (2009), who categorize value-enhancing activities that PE firms undertake at their investments under financial, governance, and operational engineering. Most recently, a survey of institutional VC investors by Gompers et al. (2020) shows that while deal sourcing, deal

selection, and post-investment value-added are all believed to contribute to value creation, VC investors view deal selection as the most important driver of returns.

We differ in two main ways from this body of work. First, our findings are based on quantifying textual data reflecting the actual strategies and actions that PE firms plan to undertake in each deal. We document what PE firms set out to achieve (and track implementation) in each of their deals based on confidential information that PE firms typically report to their limited partners. This enables us to sidestep issues related to survey methodology, in particular the worry that PE firms may want to cast themselves in a positive light or respond selectively. Along the way, we identify two value creation strategies – top-line growth and cash management – that are increasingly popular among PE firms but have not featured in academic surveys.

Second, we link initial value creation plans and their achievement to realized investor returns, shedding light on the conditions under which PE firms can create value for investors and the level of risk such value creation entails. Our findings indicate that successful implementation of plans is an important predictor of returns, while no single strategy on its own predicts returns. This has a potentially important implication for LPs: rather than selecting which PE funds to invest in based on their intended strategies, our findings suggest that LPs should base their fund selection on a track record of successful execution of value creation plans.

Finally, we contribute to the literature on the operational performance of PE-backed companies by showing that PE investment has a long-lasting (and positive) effect on portfolio companies.

1. Sample and data

Our data cover a 26-year period in 20 emerging markets. The data come from the European Bank for Reconstruction and Development (EBRD). The EBRD is among the largest investors in PE funds that operate in emerging markets. As part of its mandate, the EBRD seeks to contribute to the development of the PE industry in its region, which spans Central, Eastern, and Southern Europe, the Baltics, the Commonwealth of Independent States (CIS), and the Middle East and North

Africa. Since it started operations in 1991, the EBRD has committed USD 5.165 billion to PE funds targeting its region (as of December 2017). Given the coverage and the obligatory reporting demanded by the EBRD, our data do not suffer a survivor bias resulting from only the best or only the largest fund managers contributing data.

Our dataset extends the sample used in Cornelli, Kominek, and Ljungqvist (2013). Our 171 sample funds were raised between 1992 and 2017 with an average (median) size of USD 168.0 million (USD 93.6 million). Our sample contains 1,580 deals, with an average (median) of 9.2 (9) deals per fund. Table 1, Panel A provides an overview of our sample by country and time period. The top five countries are (in descending order) Russia, Poland, the Czech Republic, Romania, and Turkey, which together account for two-thirds of the sample by number of deals. Deal activity has varied over time, with the busiest periods being 1997-2001 (501 deals) and 2012-2017 (401 deals).

Based on our reading of PE firms' pre-deal investment memos, we group deals into five types: early-stage, growth, buyout, secondaries, and turnarounds. Early-stage deals can be thought of as traditional venture-capital deals, involving startups, pre-revenue companies, and pre-profit companies. Growth deals typically involve external financing (but not outright acquisition) of companies with growing sales and profits. Buyouts usually involve acquisition (or at least majority control) of mature companies with relatively stable cash flows, such as a division of a larger firm or a stock market listed company. In a secondary deal, one PE firm acquires the portfolio company of another PE firm. Secondaries are more common in growth equity or buyouts than in early-stage companies. Turnarounds focus on underperforming or struggling companies.

As Table 1, Panel B shows, growth deals account for more than half of our sample (940 deals, 59%), followed by early-stage investments (303 deals, 19%), buyouts (206 deals, 13%), secondaries (99 deals, 6%), and turnarounds (32 deals, 2%). Average and median deal size, reported in Table 1, Panel C, are USD 13.4 million and USD 5.0 million, respectively. These relatively small deal sizes reflect the sample's tilt towards growth-equity and early-stage investments.

As of December 2017, 1,078 of the 1,580 sample deals have been "exited" or left a PE firm's portfolio. Of these, 681 were sold (mostly to a strategic buyer, management, or another PE firm), 103 were exited through an initial public offering on a stock market, 67 repurchased the fund's securities, and 227 returned less than invested capital or were written off completely. 502 deals are not yet exited, including 46 that have been "partly realized" (typically via a stock market listing in which the PE firm remains an investor post-listing).

To estimate returns to investors, we use precisely dated cash flows between portfolio company and fund (i.e., initial and subsequent investments, dividends, and exit-related proceeds, if any). Cash flows are gross of the fund's management fees and carried interest and thus reflect a portfolio company's underlying performance. We estimate two standard return measures: public market equivalents (PMEs) and multiples on invested capital (MOICs). We construct PME in the spirit of Kaplan and Schoar (2005), using the MSCI Emerging Markets Total Return Index as a public-market benchmark. The average portfolio company outperforms the public-market benchmark with a PME of 1.44 and returns 1.81 times invested capital (see Table 1, Panel D). Not surprisingly, exited deals generate higher investor returns than the average deal (PME of 1.63, MOIC of 2.03). The relatively high level of performance reflects the sample skew towards early-stage and growth-equity deals, which tend to be characterized by a "home-run" return pattern (a few very large wins, many strike-outs). Such deals also tend to be smaller. Returns are accordingly lower on the larger deals in our sample: when weighted by investment cost, the average exited portfolio company outperforms the benchmark with a PME of 1.31 and a MOIC of 1.87.

2. What do PE value creation plans look like?

PE firms typically formulate a value creation plan before agreeing to invest in a company. We have detailed information about these plans for 1,136 of the 1,580 deals in our sample.[4] As Kaplan

[4] In 124 cases, we cannot find pre-deal documentation, even though the EBRD's archive contains post-deal documentation. These 124 investments do not look observably different from our other sample deals, mitigating selection concerns. For the remaining 1,456 sample deals, we code up the salient features of the value creation plans in

and Strömberg (2009) note, PE firms seek to implement their plans during the holding period, making changes to their plans as they see fit. Because we have access to the funds' quarterly reports to their LPs and to the EBRD's internal "monitoring reports" of each fund's activities, we can track both plan implementation and plan changes over time.

To code up the VCPs and their subsequent implementation, we have two of us independently read each VCP, each post-investment quarterly report, and each EBRD monitoring report and extract the salient features according to a template partly based on Gompers et al.'s (2016) survey of PE firms' sources of value creation, suitably expanded to capture the richness we find in our textual data. Areas of disagreement between the two readers are reconciled based on a third reading of the source material. This process takes on average three hours per deal or 3,400 man-hours in total.

In this section, we describe the VCPs in our sample in terms of which strategies funds pursue and which actions they intend to take to implement these strategies. We also highlight trends in VCPs over time and show that VCPs vary systematically with deal type, fund ownership, growth strategy, and geographic focus. In the next section, we study the implementation of the VCPs: what plan features do PE firms manage to achieve, and what explains achievement?

2.1 Value creation strategies

Table 2, Panel A provides an overview of the VCPs in our sample. We distinguish five strategies: operational improvements, top-line growth, governance engineering, financial engineering, and cash management.[5] The two most popular strategies in our sample are operational improvements and top-line growth, which feature in 84% and 74% of sample VCPs, respectively. Governance engineering and financial engineering feature in roughly half (48%) and a third (35%) of plans, respectively. Improvements in cash management feature less often (14%).[6]

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all 959 exited deals and in the 177 unexited deals that have been in a fund's portfolio for at least five years. The latter filter ensures that funds have had a chance to implement their value creation plans.

[5] In their surveys, Kaplan and Strömberg (2009) and Gompers et al. (2016) focus on three of these strategies: financial engineering, operational improvements, and governance engineering. We add top-line growth and cash management based on our reading of the VCPs in our sample.

[6] In 38 deals (3.3%), the PE fund did not formulate a value creation plan at the outset, though it did so post-investment.

It is common for VCPs to span multiple strategies. In our sample, 929 VCPs (or 82%) do so. As Figure 1(a) shows, most plans span two or three strategies; the average is 2.5. With five strategies to choose from, there are 32 ($= 2^5$) possible strategy combinations. In practice, sample PE firms choose from a highly concentrated set of combinations. Figure 1(b) illustrates this high degree of concentration by plotting the cumulative distribution function of observed combinations in descending order of popularity against a uniform cdf. PE firms clearly have favorite combinations.

As Table IA.1 in the Internet Appendix shows, the 10 most popular combinations account for 80% of sample VCPs (twice as many as in a uniform distribution). Eight of the top 10 involve either operational improvements or top-line growth or both. Governance engineering features in six of the top 10, with financial engineering and cash management in three and two of the top 10 combinations, respectively. The three most popular combinations involve both operational improvements and top-line growth, either with no other strategy (18%) or in combination with governance engineering (15%), or with governance and financial engineering (11%).

2.2 Action items

A VCP consists of one or more "action items." We track 23 distinct action items, which Table 2, Panel A groups into our five strategies. (See Appendix A for detailed definitions.) PE firms follow a rich variety of plans to add value to their portfolio companies. As Figure 1(c) shows, sample PE firms typically set out to implement two to five action items; the average is 4.5. The three most popular planned action items are buying new or upgrading existing physical assets (66%), changing the mix of products or services (37%), and pursuing add-on acquisitions (33%). The least frequent action item is improving inventory management (4%).

With 23 action items to choose from, there is a very large number (2^{23}) of possible combinations. In practice, we observe a total of 776 unique combinations of action items in our sample. A closer look at sample PE firms' choices reveals evidence of both commonality in plans and a great amount of heterogeneity across deals.

Figure 1(d) plots the frequency with which each of the 776 combinations is chosen against its popularity rank. Visual inspection of the figure clearly rejects the null hypothesis that combinations are distributed uniformly. The 10 most popular combinations of action items account for 11.6% of sample VCPs, a vastly greater fraction than if combinations were distributed uniformly, suggesting bunching. Table IA.2 in the Internet Appendix provides a breakdown of the 10 most popular combinations. All 10 include planned purchases/upgrades of physical assets. The most popular combination features in 3.5% of deals. It includes two action items: in addition to asset purchases/upgrades, the plan is to optimize the portfolio company's capital structure.

At the same time as we see evidence of commonality in plans, it is also true that 88.4% of sample VCPs pursue 766 other combinations of action items, suggesting that PE firms are quite heterogeneous in their plans. A plausible interpretation of such heterogeneity is that PE firms tailor each plan to each portfolio company's specific needs and circumstances.

2.3 Time trends in VCPs

PE firms have become more hands-on over time, pursuing top-line growth and governance and financial engineering strategies in increasing fashion. Table 2, Panel B provides a breakdown of strategies (and action items) over time, aggregated into five-year periods starting in 1992. Figure 2(a) illustrates the trends at the strategy level. The popularity of growth strategies has doubled, from 41% of deals in 1992-1996 to 83% in 2012-2017. Governance engineering has become three times more popular, increasing from 24% to 74% of deals, while financial engineering has nearly quadrupled, from 13% to 51% of deals. The popularity of operational improvements – always high – has increased from 76% to 81% of deals. Strategies aimed at cash management have never been particularly popular in our sample, though even they have seen an increase, from 7% to 18% of deals. Each of these time trends is statistically significant at the 5% level or better.

At the action item level, there is much more variation in popularity over time. Notably, purchases/upgrades of physical assets have become relatively less popular (falling from 71% to

58% of deals). Add-on acquisitions were particularly popular during the 2007-2011 period, which coincides with the global financial crisis.

2.4 The cross-section of VCPs

Value creation plans vary systematically with deal type, fund ownership, growth strategy, and geographic focus. We find that PE firms formulate plans that are more hands-on in buyouts than in earl-stage deals or turnarounds, when they have majority ownership, when they pursue inorganic growth strategies, and when they manage a regional rather than country-focused fund.

Strategies differ considerably across deal types. Operational improvements are popular in all deal types, while the popularity of top-line growth, governance engineering, and financial engineering varies significantly. The popularity of top-line growth and governance engineering strategies increases as the maturity of deals increases, with 56% of early-stage, 77% of growth, and 88% of buyout deals planning to boost top-line growth and 39% of early-stage, 47% of growth, and 62% of buyout deals planning governance engineering. Buyouts stand out for their focus on financial engineering, which 54% of deals intend to engage in. Secondaries look similar to buyouts on most dimensions, except with less focus on financial engineering (32%), suggesting diminishing marginal returns to optimizing capital structure and incentive systems as buyout targets are sold on to the next PE owner. Turnaround deals are the least focused on top-line growth (53%) and plan on governance engineering around as rarely as do early-stage deals (41%) but show the greatest focus on financial engineering (59%). Cash management does not vary significantly in popularity across deal types. Figure 2(b) illustrates these patterns graphically.

Which action items PE firms include in their plans depends on the type of deal. Buyouts tend to focus on optimizing capital structure, add-on acquisitions, changing the product or service mix, and replacing senior or middle management. Early-stage and growth deals, on the other hand, tend to focus primarily on capital expenditures and pursue other action items more opportunistically.

Our data allow us to observe each deal's ownership structure. Most deals (71%) are minority

investments (see Table 2, Panel D). PE firms tend to pursue hands-on strategies significantly less often in minority-owned deals. In particular, they plan to pursue growth, governance engineering, and financial engineering in 72%, 45%, and 31% of their minority-owned deals, compared to 79%, 56%, and 43% of their majority-owned deals. Strategies aimed at operational improvements and cash management do not vary significantly with ownership. Figure 2(c) illustrates.

Portfolio companies can grow organically (by increasing the sales and revenues of existing or new products) or inorganically (by acquiring other companies). Around a third of sample deals plan to grow through acquisition (see Table 2, Panel D). Inorganic growth is associated with a significantly greater focus on other action items in the top-line growth bucket, such as "target market share," "change product/services mix," and "pursue international expansion." Inorganic deals also more often plan to implement strategies aimed at governance engineering (59% vs. 43%), financial engineering (42% vs. 31%), and cash management (17% vs. 12%). Figure 2(d) illustrates.

The final breakdown in Table 2 is by geographic focus. A little over half of sample deals (54%) are managed by single-country funds; the remainder involve a "regional" fund investing in more than one country. Regional funds pursue top-line growth and governance engineering strategies significantly more often than single-country funds (see Table 2, Panel D), often because they consolidate companies across countries (say, the Baltics) and can tap into wider networks of managers and board members. Figure 2(e) illustrates.

In sum, we see systematic differences in value creation plans by deal type, ownership, growth strategy, and geographic focus. PE firms are more hands-on in buyouts than in early-stage deals, when they have majority ownership, when they pursue inorganic growth, and when they invest in multiple countries.

3. Implementation of value creation plans

Our data allow us to track the implementation and achievement (or otherwise) of each action item in each deal's value creation plan over time.

3.1 Achievement of plans: Overview

In most deals, PE firms manage to implement the majority of their individual action items and strategies. We illustrate this by plotting the number of planned and achieved strategies in Figure 3(a) and action items in Figure 3(b) using bubble diagrams. The size of each bubble reflects the number of deals. For both strategies and action items, we see that the vast majority of deals lies on the 45-degree line, meaning that most planned strategies and action items are achieved. For example, of the 349 deals intending to pursue a combination of two strategies, 287 achieve both, 50 achieve one, and only 12 achieve neither.

Table 3 tabulates achievement rates at the individual action item level. While achievement rates are generally high, some action items appear to be easier to implement than others. Plans to replace the CEO, CFO, or other members of management are nearly always implemented. (Our reading of the initial investment memoranda indicates that suitable candidates are often identified even before a deal is signed.) Similarly, plans to buy or sell physical assets and to reduce cost are practically always executed. On the other hand, plans to increase market share, to grow inorganically through add-on acquisitions, and to expand internationally appear more difficult to implement. Of the deals including these action items in their VCPs, only 62%, 74%, and 73% achieve them. Similarly, only 71% of deals planning to improve corporate governance manage to do so.

3.2 Achievement of plans: Determinants

What explains whether or not a PE firm manages to implement its value creation plan in a deal? In this section, we study the determinants of plan achievement bottom-up, first at the action-item level, then at the strategy level, followed by the deal level, and finally at the PE fund level. In Section 4, we tie investor returns to the achievement of value creation plans.

3.2.1 Action-item level

We begin at the action-item level: what determines the likelihood that a PE firm successfully implements an action item? To answer this question, we create an action-item-by-deal-level dataset

such that the unit of observation is an action item. In this exercise, we focus on exited deals, to allow for a definitive assessment of whether or not the PE firm achieved the action item in question. We estimate linear-probability models in which the dependent variable is set equal to one if an action item is achieved during the holding period, and zero otherwise. The explanatory variables focus on the characteristics of the value creation plan, the deal, and the fund.

Table 4, columns 1 through 3 report the results. Column 1 shows that holding deal year, deal type, and fund constant, an action item is 1.8 percentage points less likely to be successfully implemented for each additional action item the fund has included in the strategy in question ($p<0.001$). In other words, as far as the likelihood of achievement is concerned, action items belonging to a given strategy are substitutes rather than complements. A plausible interpretation is that the skills required to implement a given strategy (say, operational improvements) are in limited supply, such that focus on a smaller number of action items has a greater chance of success. This finding is consistent with the way most larger PE firms organize their in-house teams: a team of "operating partners" helps portfolio companies with operational improvements and/or top-line growth, a team of experts focus on financial engineering, and so on.

Column 1 includes controls for four deal-level characteristics. Not surprisingly, the more time a deal spends in a PE firm's portfolio, the more likely an action item is achieved ($p<0.001$). Deal size has a positive effect on the likelihood of achievement ($p<0.001$), perhaps because funds focus their limited attention on those deals that, due to their larger size, can generate larger dollar returns to investors. Majority ownership significantly increases the chance that a given action item can be implemented, by an economically large 3.6 percentage points ($p=0.024$). A focus on inorganic growth, on the other hand, significantly reduces the chance that a given action item is successfully implemented, by an economically large 4.8 percentage points ($p<0.001$).

Columns 2 and 3 investigate whether funds benefit from economies of specialization. Suppose that in a given deal, a fund plans to change the board structure (a governance engineering action)

and to improve IT systems (an operational improvement action). Is the IT action more likely to be successfully implemented than the board action if the fund pursues operational improvements in many of its other deals but only rarely engages in governance engineering? To investigate this form of specialization, column 2 includes the share of deals in the fund's portfolio that pursue the strategy which the action item in question belongs to, holding the deal constant (and so dropping the deal-level variables included in column 1). The share of similar deals has a positive effect on the likelihood that an action item is successfully implemented, but this effect is not statistically significant (p=0.345). In column 3, we allow the effect of similarity to vary across the five strategies. This reveals that actions related to governance engineering and operational improvements benefit significantly from specialization. To illustrate, a governance-engineering action would be 13.3 percentage points more likely to be achieved if the fund pursued governance engineering in all its other portfolio companies than in none (p<0.001). For operational-improvement action items, the corresponding increase is 7.4 percentage points (p=0.039).

3.2.2 Strategy level

The findings at the strategy level, shown in columns 4 through 6 of Table 4, are very similar. Here, we use a strategy-by-deal-level dataset and regress the share of planned action items that are achieved in a given strategy and deal on deal characteristics (in column 4) and the similarity of strategies (in columns 5 and 6). Strategies comprising a larger number of action items are significantly less often successfully implemented than more focused ones (p<0.001 in column 4). A longer holding period and a larger deal size are both associated with a significantly larger share of a strategy's planned action items being achieved (p<0.001 and p=0.023, respectively). Pursuing a given strategy in more of the fund's other deals significantly increases the share of governance-engineering actions (p=0.028) and of operational improvement actions (p=0.098) that are successfully implemented per strategy.

3.2.3 Deal level

We next move to the deal level to ask, what determines how many of the planned action items or planned strategies a PE firm manages to implement in a given deal? Table 5 reports the results for the share of action items (in columns 1 and 2) and strategies (in columns 3 and 4) achieved during the holding period. We report two specifications for each outcome variable: one with fund fixed effects (in columns 1 and 3) and one with PE firm fixed effects (in columns 2 and 4). Based on the partial *R*-squared estimates reported in Table 5, the fund fixed effects explain more of the variation in deal-level achievement than any other variable. The PE firm fixed effects explain the largest and second-largest part of the variation in the share of action items and strategies achieved, respectively. These patterns suggest that funds and PE firms differ systematically in their ability to implement their value creation plans. (We investigate this finding further in the next subsection.)

The other variable with large explanatory power is how many action items or strategies a plan includes to begin with. We find an inverse-U shaped relation between how detailed a value creation plan is and its successful implementation: the share of action items and of strategies achieved both increase in the total number of action items and strategies included in the VCP and decrease in their square ($p<0.001$). This suggests that beyond a certain level, adding further detail to a VCP is counterproductive, at least as far as implementation is concerned.

The remaining covariates contribute relatively little to *R*-squared. Mirroring the results in Table 4, a longer holding period increases deal-level achievement, both in terms of action items and strategies ($p<0.001$). Funds achieve a larger share of planned action items in their larger deals ($p=0.034$), though this effect becomes statistically marginal when we include PE firm fixed effects ($p=0.072$). Owning a majority makes no significant difference. Inorganic deals achieve fewer of their action items than organic deals in column 1 ($p=0.046$).

3.2.4 Fund level

The strong explanatory power of the fund fixed effects in Table 5 leads us to ask, what fund-

level characteristics explain a fund's greater or lesser ability to implement its value creation plans? To investigate this question, we follow the methodology proposed by Bertrand and Schoar (2003) who ask how individual managers affect company performance. Specifically, we take the fund fixed effects estimated in Table 5, column 1 as a measure of the (conditional) average share of action items a fund manages to achieve across the companies in its portfolio. We regress these estimated fund fixed effects on measures of fund focus and fund strategy, holding constant fund size, portfolio size, and average deal duration. We use three measures of fund focus: heterogeneity in deal size (as measured by a Herfindahl index of companies' weight in the fund's portfolio), the number of different deal types the fund invests in (ranging from early-stage to turnaround deals), and the number of sectors the fund invests in. We use four measures of fund strategy: indicators for whether the fund's predominant strategy is to take minority ownership positions, to pursue inorganic growth, and to invest regionally, as well as a Herfindahl of strategies the fund employs to capture how specialized its approach to creating value is. We include vintage-year fixed effects to account for changes in macro conditions that affect all funds of a given vintage at the same time. To account for measurement error in the fixed effects, we follow Bertrand and Schoar and weight observations by the inverse of the standard error on the fund fixed effects estimated in Table 5.

The results, reported in column 1 of Table 6, suggest that fund focus matters: funds achieve a larger share of their VCPs on average in their deals if their portfolios are more homogeneous in terms of deal size (p=0.006) and if they focus on a smaller number of deal types (p=0.018). The number of sectors they invest in, on the other hand, appears not to matter. Our measures of fund strategy largely have no significant effect on the successful implementation of VCPs, with one exception: funds are more successful at implementing their plans if they pre-dominantly hold minority ownership stakes (p=0.028). A possible interpretation of this finding could be that minority positions might involve less ambitious plans, which in turn are easier to achieve. The vintage-year fixed effects are statistically significant. To the extent that vintage-year effects capture, in part,

unforeseen macro shocks, they point to the role luck plays in whether or not PE firms are able to implement their value-creation plans.

Column 2 adds the PE firm's age as a joint proxy for its reputation and the collective experience of its partners and replaces the fund-level strategy Herfindahl index with a PE firm-level version thereof. Neither variable is statistically significant, and we continue to find that successful implementation correlates significantly with fund focus and minority ownership.

3.2.5 Summary

The results reported in Tables 4, 5, and 6 point to systematic variation in the achievement of VCPs. We find evidence of resource constraints negatively affecting the likelihood an action item or strategy is successfully implemented; of specialization aiding implementation; of diminishing returns to making plans ever more detailed; and of some funds (those with focused, homogeneous portfolios of predominantly minority positions) being systematically better at implementation.

3.3 Plan revisions

So far, we have considered implementation of a PE firm's initial VCP. We now briefly turn to revisions of VCPs over the holding period. We define a revision as the introduction of a new action item after the holding period's first year. 77.3% of sample deals see revisions, but they tend to be minor, as Figure 4 illustrates. The most common newly added action item is cost reduction, which 31% of deals add at some point during the holding period, perhaps to create additional value, perhaps because the deal has underperformed relative to expectations or has experienced an external shock (such as a recession). New plans to optimize the capital structure (20%) and change the CEO (19%) are also relatively common, presumably for similar reasons. In a companion paper, we investigate what causes deals to fail (see Biesinger, Bircan, and Ljungqvist 2020).

4. Value creation and returns

PE firms pride themselves on being more than just opportunistic investors who buy low and sell high: it is by adding value to their portfolio companies that they generate returns for their investors.

In this section, we investigate to what extent PE firms' value creation plans are associated with higher investor returns in our sample.

4.1 Descriptive statistics

We begin by graphing average returns and return dispersion for the 10 most popular combinations of planned strategies (in Figure 5(a)) as listed in Table IA.1 in the Internet Appendix and for each of the 23 individual action items (in Figure 5(b)). We use two standard return measures: the public market equivalent (PME) and the multiple on invested capital (MOIC).

There is substantial variation across strategy combinations in Figure 5(a) in both average returns and in risk (as measured by 95% confidence intervals). All strategy combinations in the top 10 by popularity generate a MOIC of greater than 1 on average (meaning they return more than invested capital to investors), though this is statistically significant only for strategy combinations #1, #2, #3, and #5 (all of which involve plans to focus on operational improvements and top-line growth). Average MOICs do not increase monotonically in popularity, which gives a first indication that there is no universally optimal strategy that maximizes investor returns in all types of deals and circumstances, a theme that we will return to. In fact, we cannot reliably reject the null hypothesis that the top 10 most popular strategy combinations are associated with the same average return.

PMEs – a more demanding measure, because returns on PE deals are benchmarked against the returns from a contemporaneous public-market investment strategy – show a more nuanced picture. Only seven of the top 10 strategy combinations yields a PME of greater than 1 on average (meaning they outperform the public-market benchmark, not necessarily adjusted for risk), and only one (the most popular) does so statistically significantly.

At the individual action-item level, average MOICs are invariably greater than 1 (statistically so for all but the least popular action items), while average PMEs are mostly greater than 1 (though only in three cases significantly so). The variation in both MOICs and PMEs is too great to single out any single action item as a statistically reliable, superior value driver.

4.2 Predicting investor returns with VCPs out-of-sample

To identify which types of VCPs best predict returns, we turn to LASSO, a popular machine-learning prediction model (Tibshirani 1996). LASSO is a shrinkage method that identifies the set of variables which best predict an outcome (here: investor returns) out-of-sample. This contrasts with OLS, which seeks to provide the best in-sample fit (by minimizing the sum of squared differences between the observed outcomes and the predicted outcomes).[7] In our setting, we use LASSO to identify the combinations of VCP strategies that best predict PMEs and MOICs (controlling for deal size, deal duration, and deal-entry and deal-exit year fixed effects). We model planned strategies ("ex ante") and achieved strategies ("ex post") separately.

Computationally, we run LASSO on all possible combinations of value creation strategies to predict returns. As in all shrinkage methods, LASSO introduces a penalization parameter (lambda), which controls the amount of shrinkage (or in other words, places a constraint on the absolute size of coefficient estimates). A higher degree of penalization reduces the complexity of a model and shrinks coefficients towards zero. This lowers the variance of out-of-sample predictions but increases bias. We select the penalization parameter to optimize out-of-sample prediction, as captured by the mean squared error of predictions, using 10-fold cross-validation whereby the data are repeatedly divided into training and validation data. The output of a LASSO prediction model is one or more specifications (i.e., combinations of variables) that produce the most accurate predictions, in the sense of a lambda that minimizes the mean squared prediction error.

Table 7 reports the LASSO output. Panels A and B model planned strategy combinations for PMEs and MOICs, respectively, while Panels C and D model achieved strategy combinations for PMEs and MOICs, respectively. Panel A shows that there are four ex ante strategy combinations

[7] OLS coefficients optimize in-sample fit. OLS coefficients are unbiased, but OLS tends to produce high residual mean squared errors leading to poor out-of-sample accuracy. In contrast, LASSO coefficients optimize out-of-sample prediction. LASSO coefficients are biased towards 0, but LASSO produces low variance leading to good out-of-sample accuracy. While OLS includes all variables, LASSO tends to choose a subset of variables (i.e., it sets some coefficients to zero). LASSO does so to avoid "overfitting," as including too many variables tends to hurt out-of-sample predictions.

that have predictive power for PMEs (out of a possible 32 combinations): two that predict higher returns and two that predict lower returns than average (as indicated by the sign of the LASSO coefficient in column 6). Planning to combine top-line growth, governance engineering, and financial engineering predicts the highest PMEs, while planning to combine operational improvements and governance engineering predicts the lowest returns. Neither of these strategy combinations is popular in our sample, ranking 17th and 11th, respectively (see column 7). The other two combinations that LASSO selects are ranked 9th and 3rd in popularity. While the ninth most popular ex ante strategy combination predicts higher returns, the third most popular (used in 11.1% of sample deals) is associated with lower predicted returns.

There are more ex ante strategy combinations that accurately predict MOICs than PMEs. As Panel B shows, LASSO selects 11 combinations: four that predict higher returns (ranked 17th, 14th, 9th, and 2nd in popularity), and seven that predict lower returns than average. The third most popular combination continues to predict lower returns.

Predicting returns based on combinations of achieved (rather than planned) strategies changes the picture somewhat. The most interesting change is that the most popular strategy combination, if achieved, predicts both higher PMEs and higher MOICs. It is not predicted to generate the *highest* returns (which are still associated with the 17th and 9th most popular strategy combinations), but it is reassuring, given its popularity, to see it at least associated with higher investor returns.

Looking across the four panels in Table 7, we see that every strategy features both in combinations that predict higher returns and those that predict lower returns. In other words, no single strategy stands out as being "good" or "bad" for returns; instead, realized returns depend on how strategies are combined (presumably in a way tailored to each deal). We also see that the number of strategies that are combined into a value creation plan does not predict returns: both very broad combinations and very focused ones feature among those combinations that predict higher returns and those that predict lower returns.

Figure 6 visualizes the predictive performance of the four LASSO models reported in Table 7. The figure plots realized average returns against the predicted return ranking of the 28 VCP strategy combinations observed in our sample.[8] Specifically, we use the LASSO model to predict the return (PME or MOIC) of each deal, average predicted returns by strategy combination, sort combinations from high (rank 1) to low (rank 28), and plot average realized returns for deals in a given combination against the predicted return rank. The size of each bubble reflects the number of deals using the strategy combination in question. If the LASSO model does a good job predicting performance, strategy combinations predicted to yield high returns should be associated with higher realized returns on average. In Figure 6, this would correspond to the bubbles lying along a negatively sloped line. We find strong evidence that combinations of strategies predicted to do well actually do well on average, in terms of both realized PME and realized MOIC.

The line along which the bubbles lie is steeper (more negatively sloped) for ex post achieved combinations than for ex ante planned combinations. In other words, achieved strategies are a better predictor of performance than planned strategies. A key take-away from our LASSO model is therefore that it is not the ex ante selection of strategies that matters so much as the implementation of the chosen strategies. In other words, execution is key to achieving high returns for investors.

Figure 6 also highlights that PE firms in our sample do not necessarily follow the strategy combinations predicted to yield the best performance. The highest returns are associated with strategy combinations that are not very popular. Still, as the size and distribution of the bubbles show, the bulk of sample deals pursue strategy combinations that outperform the public-market benchmark and that return more than invested capital to investors.

4.3 Explaining the cross-section of investor returns with VCPs in-sample

We complement our out-of-sample prediction model with a traditional in-sample analysis of the cross-section of investor returns. Specifically, we regress PMEs and MOICs on the share of action

[8] Four of the 32 possible combinations are not chosen in our sample.

items a fund manages to achieve before exiting a portfolio company, holding constant the number of planned action items. As Table 8 shows, achieving a greater share of planned action items is strongly associated with higher returns in the cross-section. Economically, a one-standard-deviation increase in the share of achieved action items is associated with an 9.8% increase in PME (p<0.001, column 1) and a 10.2% increase in MOIC (p<0.001, column 3), relative to the sample mean. This result reinforces the key take-away from the previous section, that execution appears to be key to achieving high returns for investors.

The specifications in columns 2 and 4 show that the importance of execution varies across deal types. Successful execution is associated with significantly higher returns only in growth, buyout, and secondary deals. In early-stage deals, achievement of planned action items does not correlate significantly with returns, suggesting that risk factors in early-stage ventures are more idiosyncratic and hence more difficult for a PE firm to influence: will customers like the product? will the team be able to execute the business plan? how will incumbents respond? Turnarounds often involve tricky negotiations with lenders over covenant waivers, loan refinancing, asset sales, and collateral impairment, activities that may be central to returns but are not explicitly mentioned in our VCPs.

5. Do PE firms actually create value?

Before we can conclude that execution drives returns, we need to consider the possibility that PE firms' reports to their investors are strategic. Perhaps PE firms only *claim* to have successfully executed on their plans in their ex post successful deals, in order to *appear* to be adding value, and blame failure in ex post unsuccessful deals on external events that interfered with their ability to put plans into action even when plans were in fact implemented (just not with the hoped-for returns).

There are two (in our mind good) reasons to doubt that strategic reporting of this kind can account for our findings. First, strategic reporting is difficult to square with the timing of our data: funds report each portfolio company's progress on a quarterly basis rather than providing a (possibly strategic) narrative after write-off or successful exit. It is thus impossible for a fund to

pretend not to have been able to execute its plan in an ex post unsuccessful deal, though we recognize that a fund *might* begin to report strategically once it deems the chances a deal will succeed to have worsened. Second, Cornelli, Kominek, and Ljungqvist (2013) discuss the EBRD's monitoring processes of the quarterly fund reports from which we extract implementation information, concluding that "reports are unbiased" and that "it is highly unlikely that a fund manager would deliberately withhold or distort information," for both legal and reputation reasons.

Still, we offer two types of corroborating evidence as a check on funds' self-reported plan achievements. The first is in the form of a company-level analysis of changes in operational metrics, top-line growth, governance, financial metrics, and cash management, each measured before, during, and after the PE holding period. Any such analysis requires a benchmark against which to judge whether observed changes are plausibly associated with PE investment or would have happened anyway. We follow prior literature and compare sample portfolio companies to a set of control companies matched on country, industry, year of investment, and observable financials.[9] Our control companies come from narrowly defined cells in which they are likely to experience the same macro and industry shocks or expectations about future profitability as our portfolio companies. Constructing such tight control groups based on observables is similar to the strategy followed by Davis et al. (2014) and Bharat, Dittmar, and Sivadasan (2014) to tackle concerns of unobservable company attributes that may correlate with these control groups.

The second type of corroborating evidence relates investor returns to changes in operational metrics, top-line growth, governance, financial metrics, and cash management, as well as profitability. This complements the evidence in Section 4 relating returns to value creation plans.

[9] Specifically, we estimate the propensity of receiving PE investment by estimating a probit regression on total assets in the investment year t, revenue in years $t-1$ and t, employment in year t, and fixed effects for two-digit NACE industry and investment year. We then select up to five companies from the same country-industry-year cell as the portfolio company, chosen to have the closest propensity to be acquired as the corresponding portfolio company. We also ensure that control companies have not received PE investment before.

5.1 Sample, data, and measures

We manually search for sample companies in Orbis, a global provider of harmonized financial data for public and private companies. We are able to link 1,373 of the 1,580 sample companies to Orbis by name (including historical ones where names have changed). Table IA.3 in the Internet Appendix confirms that the Orbis sample is representative of our full sample of 1,580 deals in terms of investor returns, so that data gaps in Orbis are random at least in this sense.

Using Orbis data, we construct a number of measures related to our five VCP strategies. To track PE firms' operational activities, we measure changes in a company's employment, wages, labor productivity, net investment, capital intensity, and total factor productivity (TFP).[10] To track top-line growth activities, we measure changes in sales, market share, and price-cost markups.[11] To track governance activities, we measure changes in the number of shareholders and ownership concentration.[12] To track financial engineering activities, we measure changes in leverage, net debt to EBITDA, the (implicit) interest rate the company pays on its outstanding debt, its tax payments, and its effective tax rate. To track cash management activities, we measure changes in working capital, credit period, collection period, and stock turnover. In addition, we measure changes in profitability as captured by changes in EBITDA, EBITDA profit margins, and return on assets (ROA). In total, we track 23 outcome variables. See Appendix A for detailed definitions.

Table IA.5 in the Internet Appendix reports summary statistics in the form of pre-investment levels and pre-investment trends in our 23 outcome variables, separately for portfolio companies and their matched controls, along with *t*-tests of differences in means. The two groups are generally well balanced on observables and exhibit no significant differences in pre-trends.

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[10] TFP captures the efficiency with which labor, materials, and capital are used. We follow the production-function approach to TFP estimation pioneered by Olley and Pakes (1996), Levinsohn and Petrin (2003), and Ackerberg et al. (2006). This approach deals with the challenge that input choices are likely correlated with the error term, given that companies choose inputs based on unobserved future productivity. Details of the approach can be found in Appendix B.

[11] We follow De Loecker and Warzynski (2012) in deriving company-level markups from a production-function framework. Details of the approach can be found in Appendix C.

[12] We have attempted to locate reliable data on other governance measures such as board composition, but unfortunately Orbis does not retain historic governance data.

5.2 Econometric specification

To estimate how portfolio companies change during the PE holding period, we estimate regressions of the following form:

$$y_{it} = \beta_0 + \beta_1 PE_i * postPE_{it} + \beta_2 postPE_{it} + \beta_3 PE_i * postPE_{it} * Exit_{it} \quad (1)$$
$$+ \beta_4 postPE_{it} * Exit_{it} + \gamma_i + \delta_t + \varepsilon_{it}$$

where y_{it} is an outcome for company i in year t, and PE_i is set equal to 1 for companies receiving a PE investment and 0 for companies in the control group. For portfolio companies, $postPE_{it}$ equals 1 for years following the first PE funding round and 0 before. For control companies, $postPE_{it}$ equals 1 for years after their matched target first received PE funding and 0 before. Our main coefficient of interest is β_1, which is identified from the interaction of PE_i and $postPE_{it}$.

We track portfolio companies that are fully realized for up to five years post-exit. This allows us to isolate changes that manifest themselves during the PE holding period and test whether these changes persist or abate post-exit. To this end, equation (1) includes the interaction term $PE_i * postPE_{it} * Exit_{it}$, where $Exit_{it}$ equals 1 post-exit and 0 otherwise.[13] The β_3 coefficient on this additional interaction term captures any incremental post-exit effects, over and above the average impact of PE investment captured by the β_1 coefficient (and relative to control companies). If the sign of β_3 disagrees with the sign of β_1, the effect realized during the PE holding does not persist and reverts toward the pre-PE investment level. To estimate the long-term effect of PE investment, we report the linear combination $\beta_1 + \beta_3$, which compares the sum of the holding-period effect and the post-exit effect to the pre-investment level of the outcome variable in question.

We estimate model (1) with a full set of company (γ_i) and deal year (δ_t) fixed effects and cluster standard errors at the company level, as disturbances to a company's operations and performance are potentially correlated over time.

[13] Our data identify the buyers when deals are exited. We code as exits only strategic sales, IPOs, or write-offs. In secondaries involving PE buyers, we define $postPE_{it}$ to equal 0 only after the last PE fund has exited the company.

5.3 How do portfolio companies change during the PE holding period?

The results of estimating equation (1) for each of our 23 outcome variables are summarized in Table 9 and visualized in Figure 7. To conserve space, Table 9 reports one regression per row, focusing on the coefficients of interest β_1 (capturing average changes during the PE holding period), β_3 (capturing persistence effects), and the linear combination $\beta_1 + \beta_3$ (capturing long-run effects). Full regression results can be found in Tables IA.6 through IA.11 in the Internet Appendix.

Consistent with the hypothesis that PE firms effect changes in their portfolio companies during the holding period, Table 9, columns 2 and 3 show that a majority of the 23 outcome variables we consider change significantly, over and above contemporaneous changes at control companies. On the operational side, portfolio companies significantly increase employment, average wages, labor productivity, and capital intensity. On the top-line side, they significantly increase sales and market share while reducing markups on their products. On the governance side, they marginally increase ownership concentration. On the financial engineering side, they significantly reduce their effective tax rate as they take advantage of tax shields by increasing leverage; they also reduce the interest rate they pay on their debt. On the cash management side, they significantly reduce their working capital needs. Plotting standardized coefficients, Figure 7 shows that the largest changes are the increases in sales, capital intensity, and employment and the reduction in working capital.

Figure 8 complements the estimates of average PE holding effects shown in Table 9 and Figure 7 with estimates for the cross-section of selected outcome variables obtained from quantile regressions. This reveals that the scope for holding-period changes varies in the cross-section with each company's starting position in ways that sit well with economic intuition. While all companies increase employment significantly, employment increases are larger at smaller companies. Labor productivity too increases significantly across companies, but it is the least productive companies that see the largest improvements. Increases in sales, uniformly statistically significant throughout the distribution, are largest among the smallest companies. Reductions in markups, also significant

throughout the distribution, are largest among companies with the largest initial markups. The increase in leverage does not vary with initial leverage, but it is the companies paying the highest interest rates before that see the largest reductions in interest rates during the holding period. Finally, while all companies improve their use of working capital significantly, it is the most working-capital intensive companies that see the largest improvements.

Most of the changes in average outcomes in Table 9 persist beyond the PE firm's exit from the company (in the sense that $\beta_3 = 0$ for most outcome variables; see columns 4 and 5). TFP exhibits an interesting delayed effect: while we see no significant change in TFP during the holding period, TFP increases by a highly significant 3.9% post-exit on average ($\beta_3 = 0.067$ in column 4 divided by the pre-investment mean of 1.7 in column 1). A plausible interpretation of the delayed effect is that the significant operational improvements PE firms help catalyze during the holding period take longer to yield material productivity gains.

The long-run effects $\beta_1 + \beta_3$ shown in column 6 confirm that a stint in a PE firm's portfolio fundamentally changes our sample companies: compared to the period before they received PE investment (and relative to matched controls), in the five years post-exit they employ significantly more people, pay higher wages, and operate with greater labor productivity, capital intensity, and TFP. They also sell more, both in absolute terms and relative to their competitors, with the increase in sales and market share accompanied by lower price-cost markups. Financial engineering, on the other hand, proves temporary, with increases in leverage (averaging three percentage points of total assets) only marginally statistically significant. The reduction in effective tax rates during the holding period is reversed post-exit, likely because EBITDA profitability (though not profit margins or ROA) increases sharply post-exit, moving companies into higher tax bands.

5.4 Company-level changes and investor returns

We interpret the evidence summarized in Table 9 and Figures 7 and 8 as portfolio companies experiencing the kinds of fundamental changes during the PE holding period that would reflect the

successful implementation of PE firms' value creation plans. We conclude our empirical analysis by asking whether these fundamental changes help explain the cross-section of investor returns.

To this end, we estimate cross-sectional company-level regressions of the form:

$$y_{it} = \alpha_0 + \alpha_1\left[x_{i,exit} - x_{i,entry-1}\right] + \alpha_2 X_i + \delta_t^{entry} + \delta_t^{exit} + \varepsilon_{it} \quad (2)$$

where $\left[x_{i,exit} - x_{i,entry-1}\right]$ is a vector of company-level changes in the outcome variables considered in Table 9 measured over the PE holding period,[14] X_i is a vector of controls such as deal size and deal duration, and δ_t^{entry} and δ_t^{exit} are time dummies for the years of PE investment and PE exit which we include to capture macro factors that affect all investments and all exits at the same time. The sample includes all exited deals plus unexited deals that have been held in a PE fund's portfolio for at least four years.[15]

Table 10 reports results separately for PMEs and MOICs, considering each outcome variable one at a time. The number of observations included in each regression varies depending on data availability in Orbis. Figure 9 visualizes the regression results using standardized coefficients that can easily be compared in terms of their power to explain investor returns.

Whether we measure investor returns using PMEs or MOICs, we find that four company-level changes correlate significantly with returns: the more a portfolio company manages to increase its sales, EBITDA, employment, and capital intensity during the holding period, the higher investors' returns on the deal.[16] As Figure 3 shows, increases in sales, EBITDA, and employment yield the largest effects. Changes in outcomes associated with governance engineering, financial engineering, or cash management do not correlate significantly with investor returns in the cross-section.

[14] To guard against fluctuations in company-level changes driven by entry and exit years (and to increase the number of observations), we average entry and exit values over a three-year period. That is, $x_{i,entry}$ is measured as the mean of $x_{i,t-1}, x_{i,t}$, and $x_{i,t+1}$, where t is the investment year, and analogously for $x_{i,exit}$. Results are qualitatively unaffected if we use only outcomes observed in entry and exit years.

[15] Excluding unexited deals does not change our results qualitatively, but reduces our sample size.

[16] For PMEs but not for MOICs, increases in ROA also have a significant and positive effect on returns.

6. Conclusion

We open up the black box of value creation in private equity with the help of confidential textual information on value creation plans and their implementation. We combine this information with high-quality quantitative data on cash flows and investor returns and detailed financial data on company operations and performance. Value creation plans appear highly differentiated, suggesting that they are tailored to the needs and circumstances of each individual portfolio company. They have become more hands-on over the course of our 1992-2017 sample period and vary systematically with deal type, fund ownership, growth strategy, and geographic focus. Successful execution of value creation plans is subject to resource constraints, economies of specialization, and diminishing returns, and varies systematically across funds and PE firms. Successful execution (rather than ex ante selection of strategies) appears to be a key driver of investor returns, especially in growth, buyout, and secondary deals. Much like combination therapies in the treatment of certain diseases, investor returns depend on how strategies are combined. Company operations and profitability improve in ways consistent with the successful implementation of value creation plans, and these improvements persist beyond PE funds' exit.

Our focus in this paper is on value creation conditional on a PE fund having selected a company for investment. Surveys of PE firms and VC investors (Gompers, Kaplan, and Mukharlyamov 2016, Gompers et al. 2020) highlight the importance of deal selection, especially in the context of startups. How PE funds select their investments is a promising avenue for future research.

References

Acharya, V.V., O.F. Gottschalg, M. Hahn, and C. Kehoe (2013). "Corporate governance and value creation: Evidence from private equity." *Review of Financial Studies* 26, 368-402.

Ackerberg, D., K. Caves, and G. Frazer (2006). "Structural identification of production functions." Working paper, University of California, Los Angeles.

Ang, A., B. Chen, W.N. Goetzmann, and L. Phalippou (2018). "Estimating private equity returns from limited partner cash flows." *Journal of Finance* 73, 1751-1783.

Axelson, U., T. Jenkinson, M.S. Weisbach, and P. Strömberg (2013). "Borrow cheap, buy high? The determinants of leverage and pricing in buyouts." *Journal of Finance* 68, 2223-2267.

Axelson, U., M. Sørensen, and P. Strömberg (2013). "The alpha and beta of buyout deals." Working paper, Stockholm School of Economics.

Bertrand, M., and A. Schoar (2003). "Managing with style: The effect of managers on firm policies." *Quarterly Journal of Economics* 118, 1169-1208.

Bharath, S., A. Dittmar, and J. Sivadasan (2014). "Do going-private transactions affect plant efficiency and investment?" *Review of Financial Studies* 27, 1929-1976.

Biesinger, M., C. Bircan, and A. Ljungqvist (2020). "Why do private equity deals fail?" Working paper, Stockholm School of Economics.

Boucly, Q., D. Sraer, and D. Thesmar (2011). "Growth LBOs." *Journal of Financial Economics* 102, 432-453.

Cochrane, J.H. (2005). "The risk and return of venture capital." *Journal of Financial Economics* 75, 3-52.

Cornelli, F., Z. Kominek, and A. Ljungqvist (2013). "Monitoring managers: Does it matter?" *Journal of Finance* 68, 431-481.

Davis, S.J., J. Haltiwanger, K. Handley, R. Jarmin, J. Lerner, and J. Miranda (2014). "Private equity, jobs, and productivity." *American Economic Review* 104, 3956-3990.

De Loecker, J., and F. Warzynski (2012). "Markups and firm-level export status." *American Economic Review* 102, 2437-2471.

De Loecker, J., and J. Eeckhout (2017). "The rise of market power and the macroeconomic implications." NBER Working Paper No. 23687.

Driessen, J., T.-C. Lin, and L. Phalippou (2012). "A new method to estimate risk and return of non-traded assets from cash flows: The case of private equity funds." *Journal of Financial and Quantitative Analysis* 47, 511-535.

Ewens, M., C.M. Jones, and M. Rhodes-Kropf (2013). "The price of diversifiable risk in venture

capital and private equity." *Review of Financial Studies* 26, 1854-1889.

Fracassi, C., A. Previtero, and A. Sheet (2017). "Is private equity good for consumers?" Working Paper, University of Texas, Austin.

Franzoni, F., E. Nowak, and L. Phalippou (2012). "Private equity performance and liquidity risk." *Journal of Finance* 67, 2341-2373.

Gompers, P., S.N. Kaplan, and V. Mukharlyamov (2016). "What do private equity firms say they do?" *Journal of Financial Economics* 121, 449-476.

Gompers, P., W. Gornall, S.N. Kaplan, and I.A. Strebulaev (2020). "How do venture capitalists make decisions?" *Journal of Financial Economics* 135, 169-190.

Guo, S., E.S. Hotchkiss, and W. Song (2011), "Do buyouts (still) create value?" *Journal of Finance* 66, 479-517.

Harris, R.S., T. Jenkinson, and S.N. Kaplan (2014). "Private equity performance: What do we know?" *Journal of Finance* 69, 1851-1882.

Higson, C., and R. Stucke (2013). "The performance of private equity." Working paper, University of Oxford.

Jegadeesh, N., R. Kräussl, and J. Pollet (2015). "Risk and expected returns of private equity investments: Evidence based on market prices." *Review of Financial Studies* 28, 3269-3302.

Kaplan, S.N., and A. Schoar (2005). "Private equity performance: Returns, persistence and capital flows." *Journal of Finance* 60, 1791-1823.

Kaplan, S.N., and Strömberg, P. (2009). "Leveraged buyouts and private equity." *Journal of Economic Perspectives*, 23(1), 121-146.

Kleymenova, A., E. Talmor, and F. P. Vasvari (2012). "Liquidity in the secondaries private equity market." Working paper, London Business School.

Korteweg, A., and S. Nagel (2016). "Risk-adjusting the returns to venture capital." *Journal of Finance* 71, 1437-1470.

Korteweg, A., and M. Sorensen (2010). "Risk and return characteristics of venture capital-backed entrepreneurial companies." *Review of Financial Studies* 23, 3738-3772.

Lerner, J. and A. Schoar (2004). "The illiquidity puzzle: Theory and evidence from private equity." *Journal of Financial Economics* 72, 3-40.

Levinsohn, J.A., and A.K. Petrin (2003). "Estimating production functions using inputs to control for unobservables." *Review of Economic Studies* 70, 317-341.

Ljungqvist, A., and M. Richardson (2003). "The cash flow, return, and risk characteristics of private equity." NBER Working Paper No. 9454.

Marschak, J., and W.H. Andrews (1944). "Random simultaneous equations and the theory of production." *Econometrica* 12, 143-205.

Metrick, A. (2007). Venture Capital and the Finance of Innovation. Wiley & Sons.

Olley, G.S., and A. Pakes (1996). "The dynamics of productivity in the telecommunications equipment industry." *Econometrica* 64, 1263-1297.

Phalippou, L. (2014), "Performance of buyout funds revisited." *Review of Finance* 18, 189-218.

Robinson, D.T., and B.A. Sensoy (2011). "Private equity in the 21st century: Liquidity, cash flows, and performance from 1984-2010." Working paper, Duke University.

Robinson, D.T., and B.A. Sensoy (2016). "Cyclicality, performance measurement, and cash flow liquidity in private equity." *Journal of Financial Economics* 122, 521-543.

Sørensen, M., N. Wang, and J. Yang (2014). "Valuing private equity." *Review of Financial Studies* 27, 1977-2021.

Tibshirani, R. (1996). "Regression shrinkage and selection via the Lasso." *Journal of the Royal Statistical Society, Series B (Methodological)* 58, 267-288.

Appendix A. Variable definitions.

Action-item level covariates

Operational improvements

Buy/upgrade assets refers to plans to buy or upgrade fixed assets and capital expenditures.

Sell existing assets refers to plans to sell fixed assets.

Divest/spin off companies refers to plans to sell or spin off parts of the company's business.

Reduce costs refers to plans to reduce the cost of goods sold (e.g., direct labor, materials, and overhead) and/or operational expenses (e.g., selling, general, and administrative).

Improve IT systems refers to plans to improve information technology (IT) systems (e.g., management information system).

Improve distribution or logistics refers to plans to improve the movement of raw materials into an organization and/or the movement of finished goods out of the organization to the end-customer.

Improve organizational structure refers to plans to reorganize business functions and/or business units.

Top-line growth

Target market share refers to plans to increase market share or reach a certain scale.

Pursue add-on acquisitions refers to plans to merge with or acquire another business.

Change product/services mix refers to plans to introduce, upgrade, or eliminate products and/or services from a company's offering.

Pursue international expansion refers to plans to enter new geographies or leave existing geographies.

Change pricing strategy refers to plans to increase or reduce prices.

Improve marketing/promotion refers to plans to improve marketing communications and/or the company's promotion and communication strategy.

Improve quality refers to plans to improve the quality of products and/or services.

Governance engineering

Change CEO refers to plans to replace the company's chief executive officer (CEO).

Change CFO refers to plans to replace the company's chief financial officer (CFO).

Change other management refers to plans to change members of the senior management team other than the CEO or CFO (e.g., the chief operating officer or chief information officer) and/or middle management (e.g., heads of departments).

Improve corporate governance refers to plans to improve the system of rules, practices, and processes by which a company is directed and controlled (e.g., internal controls, disclosure, and transparency).

Change board/shareholder structure refers to plans to change the size and/or composition of the board of directors or the ownership structure and/or to resolve shareholder conflicts.

Financial engineering

Optimize capital structure refers to plans to borrow additional debt to finance projects or to refinance existing debt.

Improve incentive systems refers to plans to introduce performance-based incentive systems for management and/or employees (e.g., through equity ownership or bonus programs).

Cash management

Improve receivables/payables refers to plans to reduce payment terms to customers and/or to extend suppliers' payment terms.

Improve inventory management refers to plans to improve the process of ordering, storing, and using a company's inventory.

Strategy-level covariates

 # action items per strategy is defined as the number of action items a fund plans to pursue in a value creation strategy.

Share of action items in strategy achieved is defined as the number of action items per strategy achieved divided by the number of planned action items per strategy.

Share of deals following strategy is defined as the number of deals in which a fund plans to pursue a specific value creation strategy divided by the total number of deals in the fund's portfolio.

Deal-level covariates

Deal characteristics

Deal size is defined as the total cost of investment in a portfolio company by a fund; if there are multiple funds investing in a portfolio company, we sum each fund's investment cost.

Deal duration is defined as the number of years that a deal spends in a fund's portfolio, rounded up to the nearest integer.

Majority ownership is an indicator variable set equal to one if a fund's largest equity ownership stake in the portfolio company is equal to or greater than 50% over the deal's holding period, and zero otherwise.

Inorganic growth is an indicator variable set equal to one if a fund plans to pursue add-on acquisitions as an action item, and zero otherwise.

Total # action items per deal is defined as the number of action items a fund plans to pursue in a deal.

Share of action items achieved in a deal is defined as the number of planned action items a fund achieves during the deal's holding period divided by the number of action items the fund planned to pursue in the deal.

Total # strategies per deal is defined as the number of strategies a fund plans to pursue in a deal.

Share of strategies achieved in a deal is defined as the number of planned strategies a fund achieves during the deal's holding period divided by the number of strategies the fund planned to pursue in the deal.

Performance measures

Fully realized is defined as a deal that been fully exited by a fund either through an initial public offering (IPO), a trade sale, or a secondary sale, or has been written off.

Unrealized is defined as a deal that has not been fully exited as of the end of our sample period (December 2017).

Multiple on invested capital (MOIC) is defined as the sum of investment proceeds received and current fair value divided by total investment cost based on gross-of-fees cash flows between a fund and a portfolio company.

Public market equivalent (PME) is defined as the present value of gross-of-fees cash flows between a fund and a portfolio company relative to the present value of cash flows from a hypothetical contemporaneous investment in a public market index. The computation follows Kaplan and Schoar (2005) and uses the MSCI Emerging Markets Total Return Index as a public-market benchmark. PMEs greater than one indicate PE investments that yield higher gross-of-fees returns than contemporaneous public-market investments, not holding risk, liquidity, or leverage constant.

Operational improvements measures

Employment is defined as the natural log of the total number of full-time employees.

Average wage is defined as the natural log of the ratio of total staffing costs to employment.

Labor productivity is defined as the natural log of revenue per employee.

Net investment in fixed assets is the annual change in fixed assets net of depreciation and scaled by beginning-of-year nominal total assets.

Capital intensity is defined as the natural log of the ratio of fixed assets to employment.

Total factor productivity (TFP) captures the efficiency with which all inputs into production (labor, materials, and capital) are used. For details of its construction, see Appendix B.

Top-line growth measures

Sales is defined as the natural log of annual operating revenue measured in USD.

Markup is defined as the natural log of the estimated ratio of price to marginal cost. For details of its construction, see Appendix C.

Market share is defined as the ratio of annual company sales to the total of annual sales by all companies in the same four-digit NACE industry and country.

Governance engineering measures

Number of shareholders is defined as the number of all individuals or entities that legally own one or more shares of stock in a company.

Ownership concentration is the Herfindahl index of individual shareholdings in a company, calculated as the sum of the squares of each individual shareholding.

Financial engineering measures

Leverage is defined as the ratio of short-term bank loans plus long-term debt (= total debt) to total assets.

Net debt to EBITDA is defined as the ratio of total debt minus cash to EBITDA.

Implicit interest rate is imputed as the ratio of interest expense to total debt.

Taxes paid is defined as the natural log of the total taxes paid by the company.

Tax rate is imputed from $(1 - earnings\ after\ tax\ /\ earnings\ before\ tax)$ and winsorized such that all tax rates above 1 are set equal to 1 (roughly, the top 98th percentile).

Cash management measures

Working capital is defined as the ratio of working capital to the sum of working capital and fixed assets.

Credit period is defined as the ratio of creditors' accounts to operating revenue, multiplied by 360.

Collection period is defined as the ratio of debtors' accounts to operating revenue, multiplied by 360.

Stock turnover is defined as the ratio of operating revenue to inventories.

Profitability measures

Operating cash flows is defined as the natural log of a company's earnings before interest, taxes, depreciation, and amortization (EBITDA) if EBITDA is positive, and minus the natural log of minus EBITDA if EBITDA is negative. Note that we replace EBITDA with EBIT whenever the former is missing.

EBITDA margin is defined as the ratio of EBITDA to sales.

Return on assets (*ROA*) is defined as the ratio of a company's net income to its total assets.

Fund-level covariates

Fund size is defined as the total value of commitments, in millions of U.S. dollars, from all limited and general partners in a private equity fund as of the final closing date.

Portfolio size (number of deals) is defined as the number of deals the fund invests in over its lifetime (allocating add-on acquisitions to the initial platform investment).

Number of deal types is defined as the total number of deal types the fund invests in over its lifetime, where deal types are early-stage, growth, buyout, secondary, and turnaround.

Number of sectors is defined as the total number of sectors the fund invests in over its lifetime, where sectors are agriculture & forestry, construction, consumer, ICT, manufacturing, pharma & medical, primary & energy, services, wholesale & retail, and other.

Deal size Herfindahl is defined as the sum of the squared portfolio weights of all deals in a fund, using investment cost to construct weights.

Dominant ownership: minority is an indicator variable set equal to one if more than 50% of fund investment cost is in deals in which the fund holds a minority stake, and zero otherwise.

Dominant growth strategy: inorganic is an indicator variable set equal to one if more than 50% of fund investment cost is in deals in which the fund follows an inorganic growth strategy, and zero otherwise.

Single-country fund is an indicator variable set equal to one if the fund invests in a single country rather than multiple countries, and zero otherwise.

Regional fund is an indicator variable set equal to one if the fund invests in multiple countries rather than a single country, and zero otherwise.

Strategy Herfindahl is defined as the sum of the squared weights of planned strategies, using the number of deals in which a fund plans to pursue a specific strategy as weights.

Average deal duration is defined as the simple average of deal duration across all deals in a fund.

PE-level covariates

PE firm age is defined as the number of years between the PE firm's founding year and the vintage year of the fund it raises, rounded up to the nearest integer.

Strategy Herfindahl is defined as the sum of the squared weights of planned strategies, using the number of deals in which a PE firm plans to pursue a specific strategy as weights.

Appendix B. Estimating productivity

Assume production is given by $Y = L^{\beta_l} K^{\beta_k} M^{\beta_m} * \Omega$, where Ω is an unobserved technology parameter and *L*, *K*, and *M* are labor, capital, and materials, respectively. TFP is typically calculated as the residual in a Cobb-Douglas production function in logs:

$$y_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \omega_{it} \quad \text{(A.1)}$$

where y_{it} denotes output, l_{it} denotes labor inputs, k_{it} denotes the capital stock, m_{it} denotes material inputs, and ω_{it} denotes unobserved productivity for company i at time t. The residual from a regression of output on the three inputs should therefore give us TFP. However, it is well known since Marschak and Andrews (1944) that such a regression suffers from endogeneity: input choices are correlated with the error term since companies are likely to choose their inputs based on their productivity, which is observed to the company but not to the econometrician. OLS estimates of the coefficients in equation (A.1) and the error term are then biased.

To address this endogeneity, researchers either follow the dynamic panel literature (as in Bharat, Dittmar, and Sivadasan 2014) or use the more structural methods pioneered by Olley and Pakes (1996) and Levinsohn and Petrin (2003).[17] The latter use observed input decisions to control for unobserved productivity shocks. The two methods essentially differ in their assumptions about how unobserved productivity evolves to identify the coefficients in equation (A.1). In structural models, unobserved productivity follows an arbitrary first-order Markov process,

$$\omega_{i,t+1} = g(\omega_{it}) + \xi_{i,t+1}, \quad \text{(A.2)}$$

where $g(.)$ is any non-parametric function and $\xi_{i,t+1}$ is a shock to productivity. In contrast, dynamic panel models have to make the more restrictive assumption that the Markov process is parametric and linear.

[17] See Ackerberg et al. (2006) for a detailed discussion of problems encountered in the identification of production functions and how structural methods differ from the use of dynamic panel estimators.

Given their ability to accommodate arbitrary productivity processes, we estimate TFP using structural methods. We implement the methodology with a Cobb-Douglas production function as in equation (A.1), subject to the productivity process in equation (A.2). As companies may differ across countries or industries in the intensity with which they use each input, we estimate the production function separately for each country and industry pair.[18] This allows for differences in technology across industry-country pairs. We measure capital stock as the reported book value of fixed assets and labor inputs as total staffing costs.[19] We deflate all values by the appropriate country and industry level deflator, which transforms them into real values, stripped of the effect of price changes.[20]

We closely follow Ackerberg et al. (2006) and De Loecker and Warzynski (2012) in obtaining estimates of the production function. Estimation proceeds in two stages. In a first stage, we obtain predicted output by estimating equation (A.1) via OLS and using the universe of companies available in the Orbis database. In a second stage, we compute the company's unobserved productivity ω_{it} using predicted output and regress it on a third-order polynomial approximation of past productivity (i.e., we approximate function $g(.)$ in equation (A.2) non-parametrically) to recover the productivity shocks $\xi_{i,t+1}$. The production-function coefficients are then identified by using standard GMM techniques on the following moment conditions:

$$E\left[\xi_{it} | l_{i,t-1}, k_{it}, m_{i,t-1}\right] = 0. \qquad \text{(A.3)}$$

Once we obtain a consistent set of production-function coefficients, we calculate a company's

[18] We use Rev. 2 of NACE as our industry grouping.
[19] We prefer using total staffing costs instead of number of employees. Staffing costs better capture the skill composition of a company's workforce assuming that more skilled employees get higher wages. Our TFP estimates are then less affected by the skill composition of a company's labor force.
[20] Deflators for capital goods and output are separately available for most of the countries in our sample at the 2-digit NACE Rev. 2 industry level either through Eurostat or the OECD. At its most detailed level, this corresponds to 64 industries, although deflators for capital goods are typically provided at a more aggregate level. Where Eurostat or the OECD does not provide deflators for sample countries, we rely on local sources such as national central banks and statistical institutes or the World Bank's World Development Indicators to obtain this information.

time-varying (log) TFP as follows:

$$\widehat{\omega}_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it} - \hat{\beta}_m m_{it}. \quad \text{(A.4)}$$

We note that company-level expenditures on materials and staff costs are not always available in Orbis. In particular, some countries (Greece, Kazakhstan, Latvia, Lithuania, Russia, Turkey, and Ukraine) provide better coverage for total cost of goods sold than for materials and staff costs separately. In these cases, we follow De Loecker and Eeckhout (2017) and estimate a production function with two (rather than three) inputs. Specifically, for these subset of countries, we estimate the following production function by industry for this subset of countries:

$$y_{it} = \beta_k k_{it} + \beta_v v_{it} + \omega_{it} \quad \text{(A.5)}$$

where v_{it} denotes total cost of goods sold, subject to the productivity process in equation (A.2). The two-step estimation procedure that uses the moment conditions in equation (A.3) and described above then yields consistent estimates of the coefficients on cost of goods sold alongside capital. We then calculate (log) TFP as:

$$\widehat{\omega}_{it} = y_{it} - \hat{\beta}_k k_{it} - \hat{\beta}_v v_{it}. \quad \text{(A.6)}$$

Appendix C. Estimating price-cost markups

We follow De Loecker and Warzynski (2012) in deriving company-level markups from a production-function framework. De Loecker and Warzynski's approach assumes cost-minimizing producers who have access to a variable input of production (e.g., materials or labor) and relies on the insight that the output elasticity of this variable input equals its expenditure share in total revenue when price equals marginal production cost (i.e., when markup = price/marginal cost = 1). Under imperfect competition, companies can charge a price above marginal cost, thereby introducing a wedge between the input's revenue share and its output elasticity. The ratio of any input's output elasticity to the input's revenue share then provides a consistent estimate of a company's markup.

We obtain estimates of output elasticities for variable inputs from our production-function estimation as described in Appendix B. We choose materials as the variable input of production to calculate markups, since materials are more likely to respond to productivity shocks than labor, which is subject to potentially large hiring and firing costs. Using materials, we recover markups from:

$$\mu_{it} = \hat{\beta}_m / \alpha_{it}^M \tag{A.7}$$

where $\hat{\beta}_m$ is the estimated output elasticity of materials from equation (A.1) and α_{it}^M is the share of expenditures on materials in total company revenue. Following De Loecker and Warzynski (2012), we correct markup estimates for the presence of measurement error in revenues. That is, we calculate α_{it}^M as the ratio of reported expenditures on materials to predicted company revenues from equation (A.1).

As mentioned in Appendix B, countries vary in terms of their reporting of materials and staffing costs in the Orbis database. The methodology by De Loecker and Warzynski (2012) allows one to estimate markups consistently using the cost of goods sold alongside capital when a more detailed

breakdown of variable input use – i.e., labor costs and material costs – is not available. We therefore follow De Loecker and Eeckhout (2017) in calculating markups based on estimates from a production function with two inputs for the set of countries listed in Appendix B. In particular, the price-cost markup in these countries is given by:

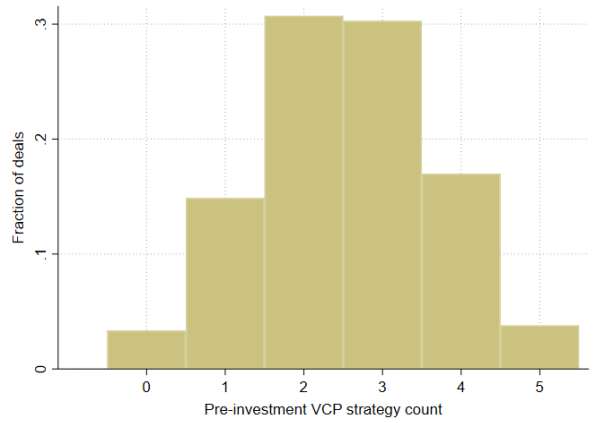
$$\mu_{it} = \hat{\beta}_v / \alpha_{it}^V$$

where $\hat{\beta}_v$ is the estimated output elasticity of cost of goods sold from equation (A.5) and α_{it}^V is the share of cost of goods sold in total company revenues. We again correct markup estimates for the presence of measurement error as in De Loecker and Eeckhout (2017).

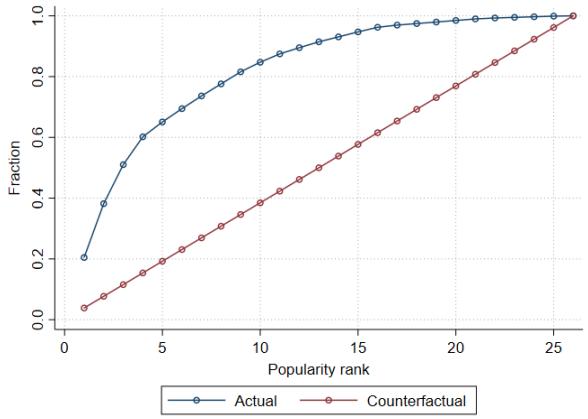
Ideally, we would like to have quantity data on output and inputs so that price differences across companies (e.g., due to variation in quality or transfer pricing) do not distort estimation. De Loecker and Warzynski (2012) show that when relying on company revenue data, only the level of the markup is potentially affected by lack of data on physical output, but not the estimate of the correlation between markups and company-level characteristics or how markups change within a company over time. This means that we are fortunate: while we do not observe measures of physical output, our focus is on understanding how a portfolio company's markups change over time and how this change correlates with other company-level characteristics.

Figure 1. Value creation plans: Strategies and action items.

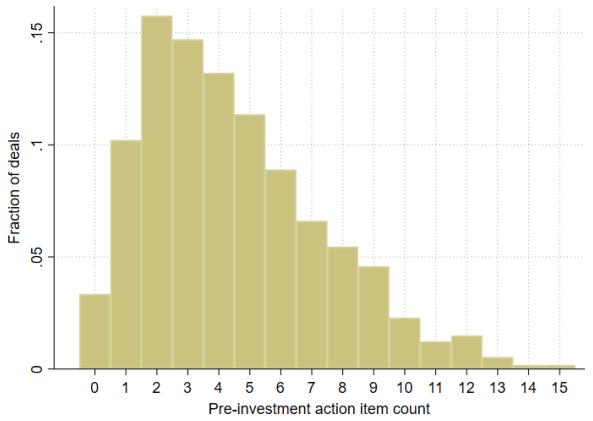
The two graphs on the left show the distribution of the total number of initial strategies (a) and action items (c) per VCP. The two graphs on the right show the distribution of unique combinations of strategies (b) and action items (d) against their popularity rank, conditional on a VCP including at least two strategies or two action items, respectively. "Actual" in (b) and (d) shows the observed empirical distribution of combinations, while "counterfactual" shows the hypothetical distribution that would obtain if each combination were observed equally often.



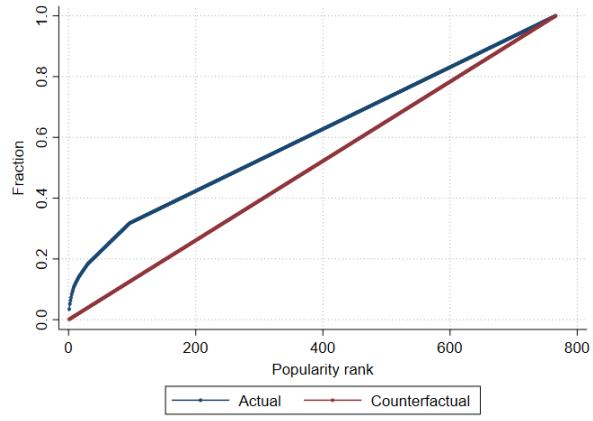
(a) Distribution of VCP strategies



(b) Distribution of VCP strategy combinations

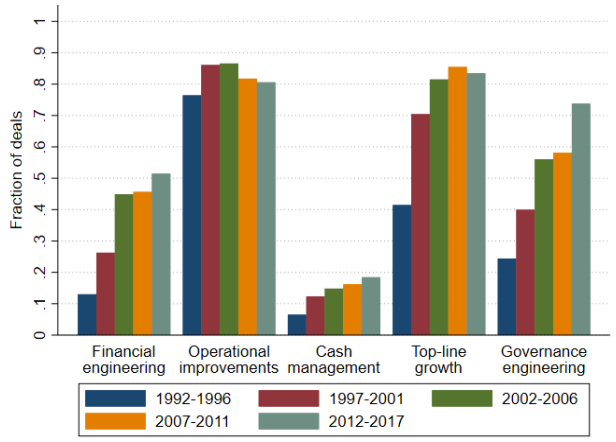


(c) Distribution of action items

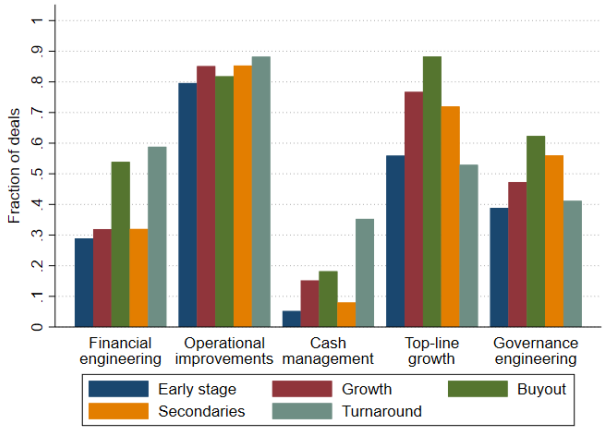


(d) Distribution of action item combinations

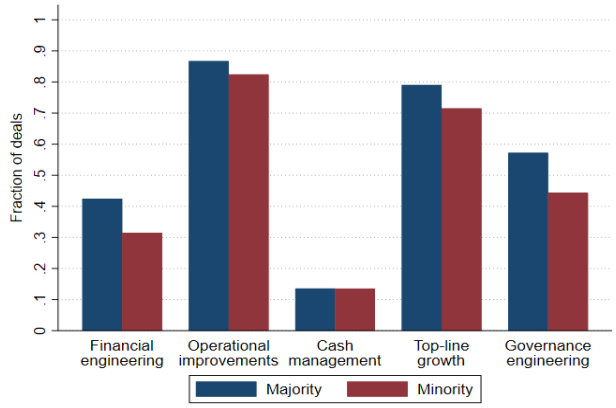
Figure 2. Breakdown of VCP strategies.
The figure shows the share of deals pursuing each value creation strategy by deal vintage, deal type, fund ownership, growth strategy, and geographic focus. The sample size is 1,136 deals. See Table 2, Panels B through D for the full set of statistics.



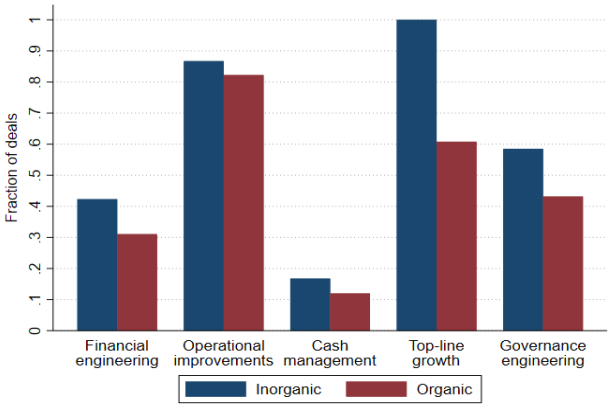
(a) VCP strategies by vintage year



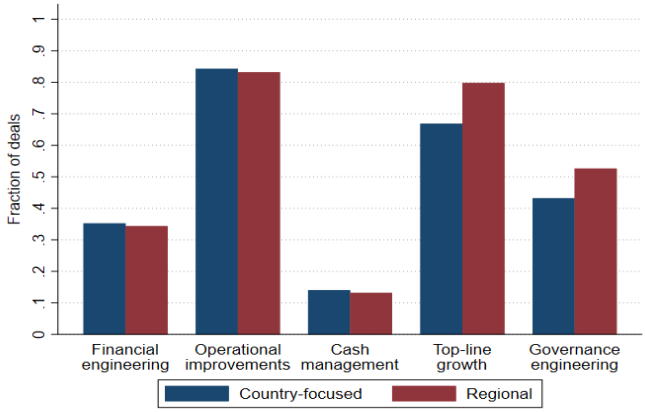
(b) VCP strategies by deal type



(c) VCP strategies by fund ownership

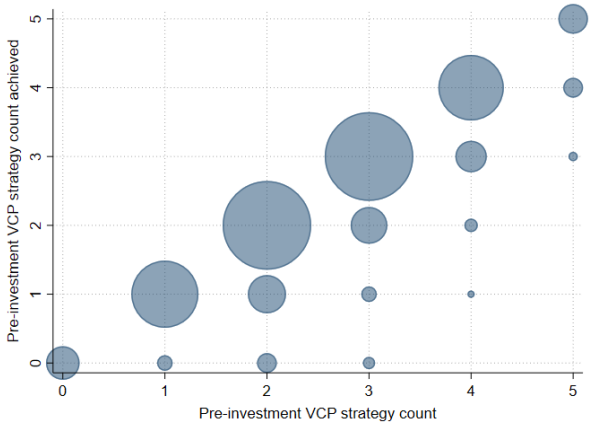


(d) VCP strategies by growth strategy

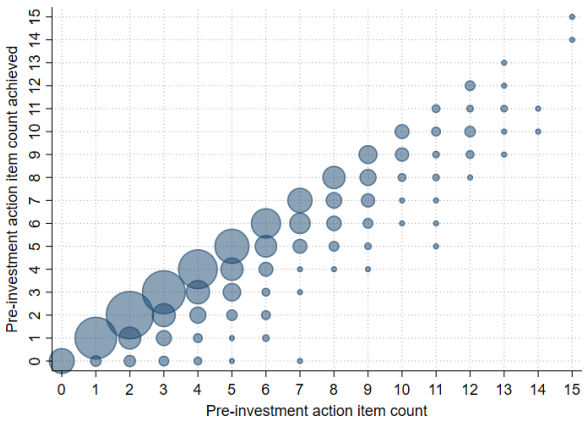


(e) VCP strategies by fund geographic focus

Figure 3. Achievement of value creation plans during the holding period.
The figure shows a scatterplot of how many of the value creation strategies (a) and action items (b) are eventually achieved in a given deal. We code the composition of VCPs using information available at the time of investment in a portfolio company and use all subsequent information to track achievement. The sample size is 1,136 deals. Bubble size represents the number of deals.



(a) Achievement of VCP strategies



(b) Achievement of action items

Figure 4. Revisions of initial VCPs.

The figure shows the share of deals pursuing individual action items in the initial value creation plan and in a revised plan. We define a revision as the introduction of a new action item after the first year of the holding period. The sample size is 1,136 deals. For variable definitions and details of their construction see Appendix A. See Table IA.4 in the Internet Appendix for a full set of statistics.

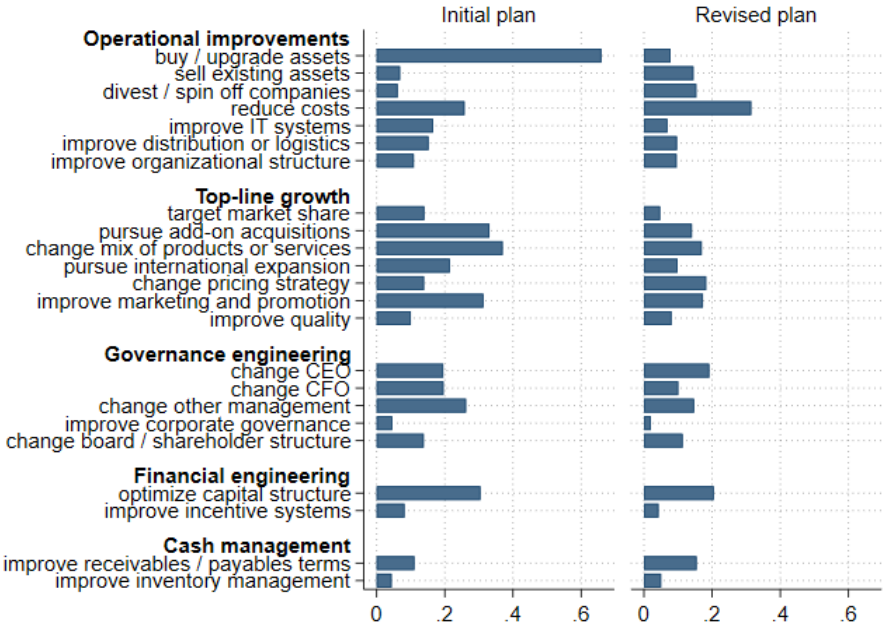
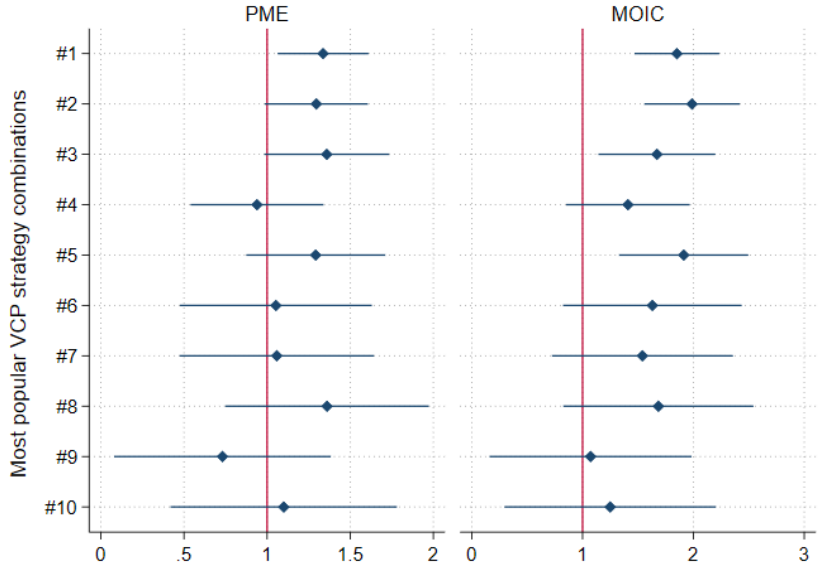
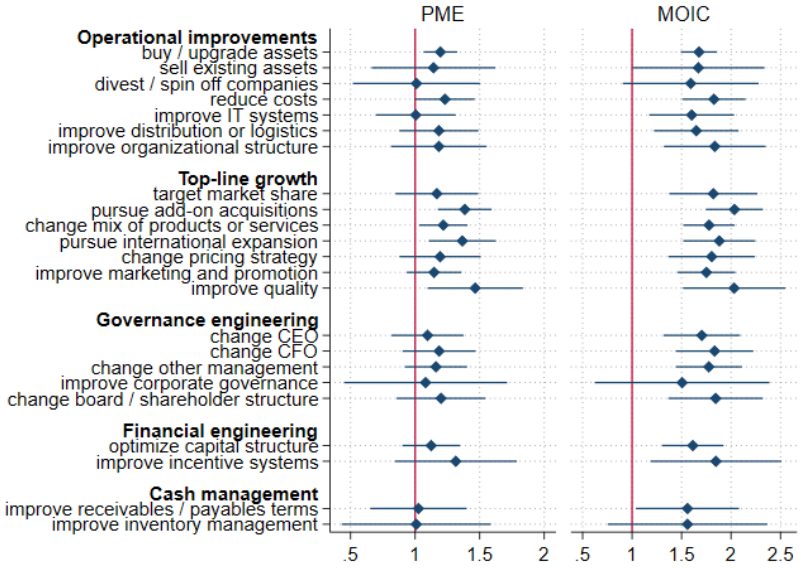


Figure 5. Value creation plans and distribution of returns.

The figure shows average returns and dispersion of returns by combination of VCP strategies (a) and individual action items (b). For variable definitions and details of their construction see Appendix A. The numbering of strategy combinations in (a) follows Table IA.1 in the Internet Appendix. Averages and dispersion are obtained from a univariate regression, without a constant, of PME or MOIC on an indicator set equal to one if the strategy combination or action item in question is included in the value creation plan. Error bands indicate 95% confidence intervals.



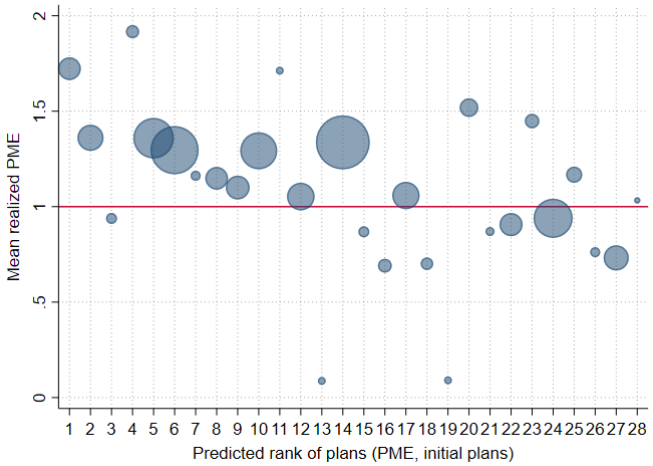
(a) Return distribution by strategy combination



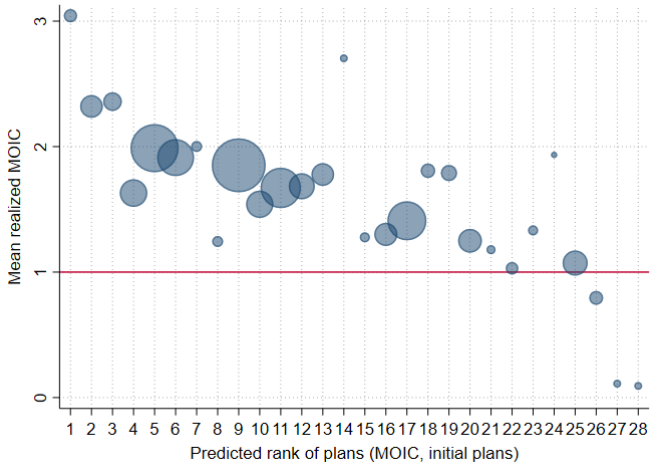
(b) Return distribution by action item

Figure 6. Realized returns versus LASSO-predicted returns by VCP strategy combination.

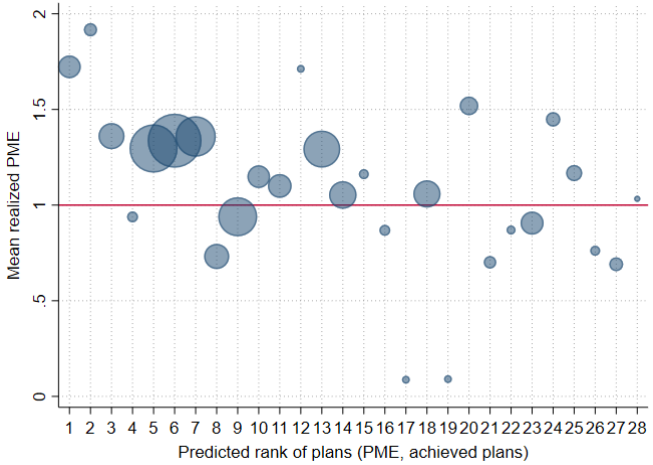
The figure plots realized average returns against the predicted return ranking of the 28 VCP strategy combinations observed in our sample (out of 32 possible). The predicted return ranking of each strategy combination is based on the LASSO selection model shown in Table 7. We use the LASSO model to predict the return (PME or MOIC) of each deal, average predicted returns by strategy combination, sort combinations from high (rank 1) to low (rank 28), and plot average realized returns for deals in a given combination against the predicted return rank. The size of each bubble reflects the number of deals using the strategy combination in question.



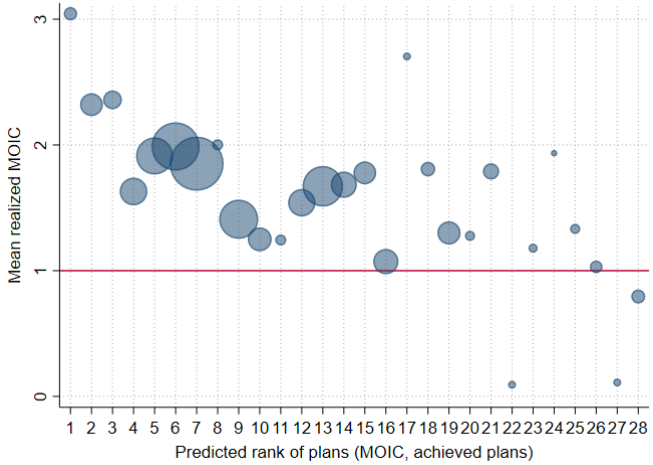
(a) Planned strategy combinations, PME



(b) Planned strategy combinations, MOIC



(c) Achieved strategy combinations, PME



(d) Achieved strategy combinations, MOIC

Figure 7. Company-level changes during and after the PE holding period.

The figure graphs estimates of company-level changes in 23 outcome variables during and after the PE holding period, as specified in equation (1). The estimation sample includes both realized and unrealized deals as well as matched controls. For variable definitions and details of their construction see Appendix A. Full regression results are reported in Tables IA.6 through IA.11 in the Internet Appendix and summarized in Table 8. Coefficient estimates are standardized to have mean 0 and standard deviation 1 to make them comparable across the 23 outcome variables. Error bands indicate 95% confidence intervals.

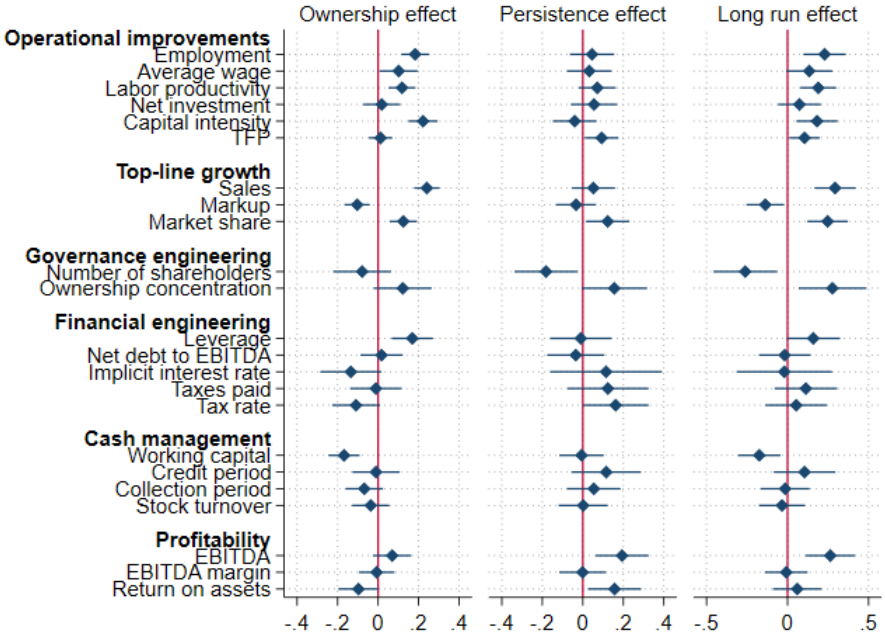


Figure 8. Quantile regression estimates for the PE holding-period effect.
The figure graphs quantile-regression estimates of the PE holding-period effect for selected variables. We estimate decile-level quantile regressions of equation (1) and report the PE ownership effect β_1. The horizontal red line indicates the corresponding OLS estimate from Table 9. The dashed lines indicate 95% bootstrapped confidence intervals.

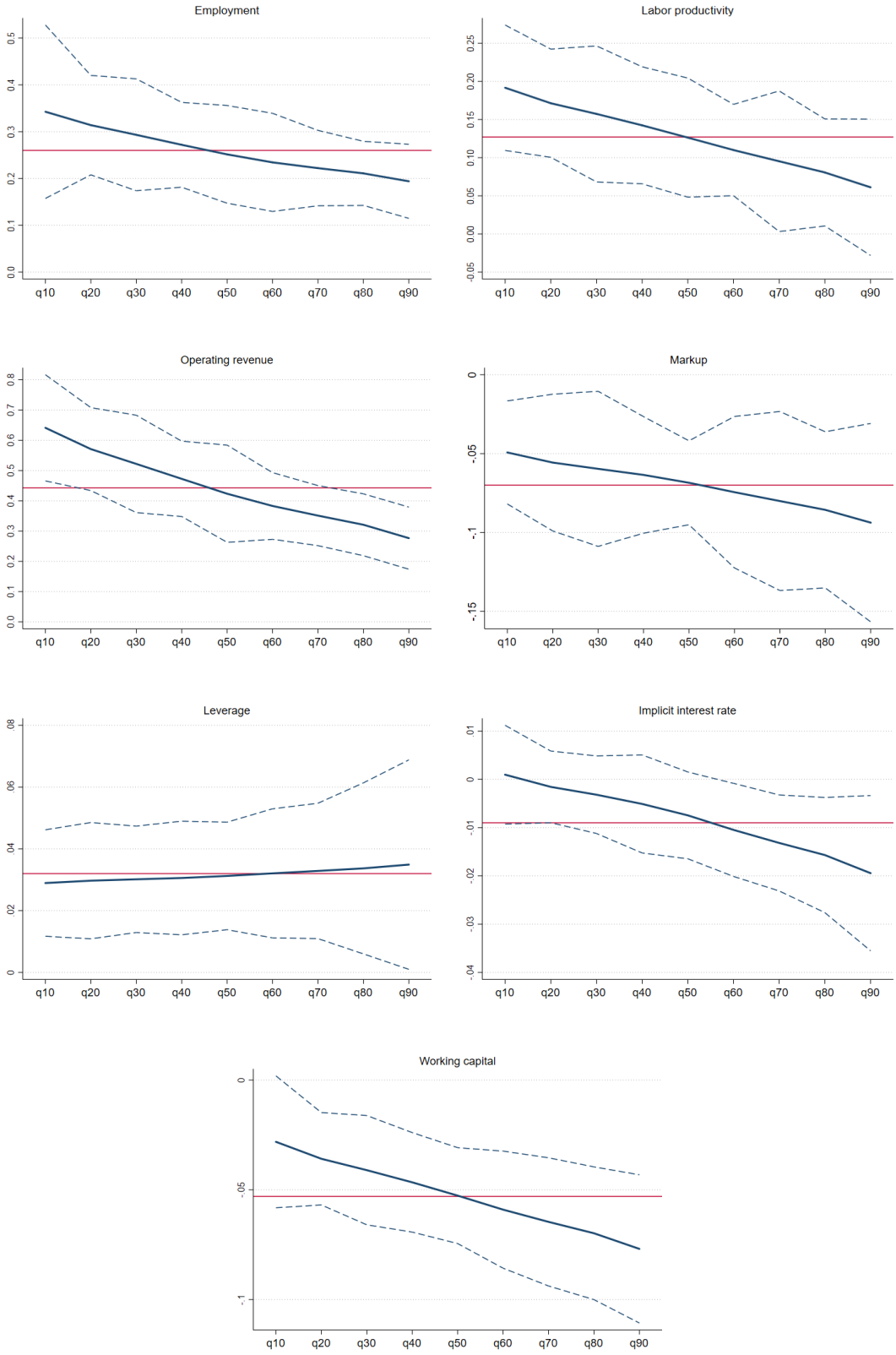


Figure 9. Value creation outcomes and investor returns.

The figure shows the effect of company-level changes in each of the 23 outcome variables considered in Table 9 measured over the PE holding period on investor returns as measured by PME or MOIC. For variable definitions and details of their construction see Appendix A. Both outcomes and returns are standardized to have mean 0 and standard deviation 1. Error bands indicate 95% confidence intervals. See Table 10 for the non-standardized regression coefficients and standard errors.

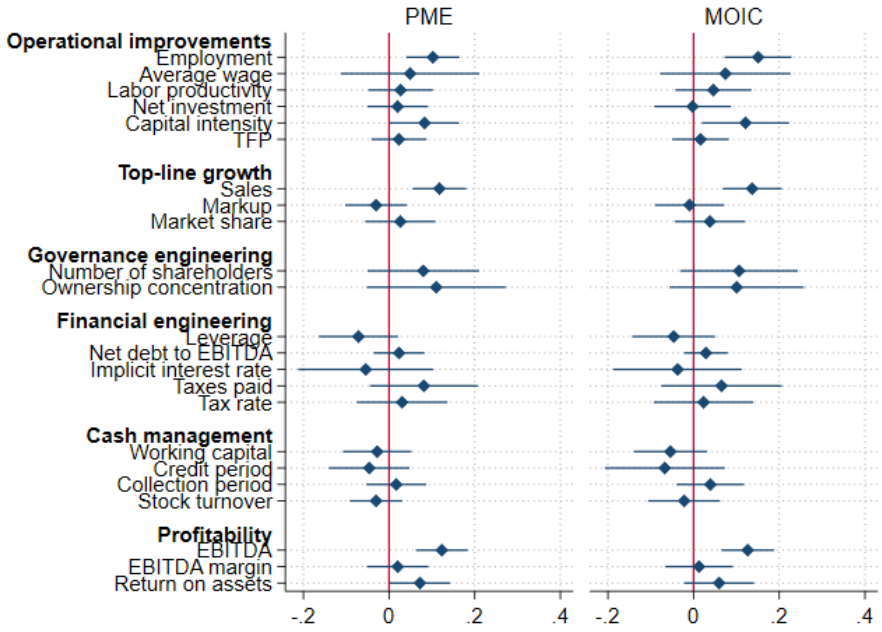


Table 1. Sample overview.

The sample consists of 1,580 deals by 171 private equity funds investing in Central, Eastern, and Southern Europe, the Baltics, the Commonwealth of Independent States (CIS), and the Middle East and North Africa. The private equity funds were raised and closed between 1992 and 2017 and made investments between 1992 and 2017. We track each investment through the earlier of the final outcome or December 2017, and record whether it has been "fully realized" (through an IPO or a trade sale, or written off) or "unrealized" as of December 2017. Tracking each deal over time gives us an unbalanced panel.

Country	1992-1996	1997-2001	2002-2006	2007-2011	2012-2017	Fully realized	Unreal-ized	All deals
A. Number of deals								
Bosnia & Herzegovina		4	5	1	2	10	2	12
Bulgaria	1	13	20	25	7	54	12	66
Croatia		11	6	4	6	18	9	27
Czech Republic	16	39	19	26	13	96	17	113
Estonia	2	24	17	6	15	47	17	64
FYR Macedonia		12	3		4	16	3	19
Greece			2	3	12	3	14	17
Hungary	12	39	14	11	5	76	5	81
Kazakhstan		12	2	5	16	19	16	35
Latvia		6	11	4	6	18	9	27
Lithuania	1	21	5	5	4	30	6	36
Morocco					18	1	17	18
Poland	54	113	40	57	56	245	75	320
Romania	6	40	16	27	22	80	31	111
Russia	38	121	52	74	96	238	143	381
Serbia			2	4	12	6	12	18
Slovak Republic		20	5	3	5	28	5	33
Slovenia	7	15	1	2	4	23	6	29
Turkey			3	12	76	15	76	91
Ukraine	26	11	9	14	22	55	27	82
All countries	163	501	232	283	401	1,078	502	1,580
B. Deal type								
Early Stage	69	117	27	22	68	229	74	303
Growth	71	330	129	155	255	623	317	940
Buyout	1	9	52	84	60	122	84	206
Secondaries	17	33	22	14	13	78	21	99
Turnaround	5	12	2	8	5	26	6	32
C. Deal size (USD millions)								
Mean	3.4	4.0	13.1	24.3	17.7	8.2	21.3	12.4
Median	2.0	2.3	5.9	13.2	9.6	3.4	10.9	5.0
D. Investor returns								
PME								
mean	1.50	2.06	1.21	0.92	1.14	1.63	1.04	1.44
weighted mean	2.02	1.41	1.23	0.84	1.14	1.31	0.93	1.10
MOIC								
mean	1.43	2.36	2.47	1.11	1.41	2.03	1.34	1.81
weighted mean	1.88	2.38	2.26	1.00	1.42	1.87	1.21	1.51

Table 2. Value creation plans.

The table describes the 1,136 value creation plans in our sample. We code a strategy equal to 1 if at least one action item belonging to that strategy is pursued, and 0 otherwise. Fractions are reported with respect to the total deal count of 1,136 reported in the top row. Panel A provides an overview of the prevalence of VCP strategies and individual action items. Panel B provides a breakdown by deal vintage, grouped into five quinquennia starting in 1992. Panel C provides a breakdown by deal type. Panel D provides breakdowns by fund ownership, growth strategy (whether intended growth is organic or inorganic), and geographic focus. Inorganic deals are those in which the PE fund includes a buy-and-build (M&A) action item in its initial VCP. For variable definitions and details of their construction see Appendix A. The Pearson's χ^2 tests in Panels B through D test for equal fractions across vintages, deal type, fund ownership, growth strategy, and geographic focus.

Panel A. Prevalence of strategies and action items.

	Value creation plans	
	Deal count	Fraction
Total deal count	1,136	
Operational improvements	951	0.84
…buy/upgrade assets	749	0.66
…sell existing assets	78	0.07
…divest/spin off companies	70	0.06
…reduce costs	293	0.26
…improve IT systems	188	0.17
…improve distribution or logistics	173	0.15
…improve organizational structure	124	0.11
Top-line growth	838	0.74
…target market share	159	0.14
…pursue add-on acquisitions	376	0.33
…change product/services mix	420	0.37
…pursue international expansion	244	0.21
…change pricing strategy	158	0.14
…improve marketing/promotion	356	0.31
…improve quality	114	0.10
Governance engineering	548	0.48
…change CEO	222	0.20
…change CFO	223	0.20
…change other management	298	0.26
…improve corporate governance	52	0.05
…change board/shareholder structure	157	0.14
Financial engineering	395	0.35
…optimize capital structure	346	0.30
…improve incentive systems	93	0.08
Cash management	154	0.14
…improve receivables/payables	126	0.11
…improve inventory management	50	0.04

Panel B. Breakdown by deal vintage.

	Fractions by deal vintage					Pearson χ^2 test (p-value)
	1992-1996	1997-2001	2002-2006	2007-2011	2012-2017	
Total deal count	123	453	216	241	103	
Operational improvements	0.76	0.86	0.87	0.82	0.81	0.05
…buy/upgrade assets	0.71	0.74	0.62	0.56	0.58	0.00
…sell existing assets	0.02	0.04	0.10	0.11	0.10	0.00
…divest/spin off companies	0.01	0.06	0.10	0.05	0.08	0.02
…reduce costs	0.11	0.25	0.30	0.31	0.26	0.00
…improve IT systems	0.07	0.13	0.24	0.19	0.26	0.00
…improve distribution or logistics	0.12	0.15	0.17	0.15	0.17	0.80
…improve organizational structure	0.03	0.08	0.15	0.14	0.18	0.00
Top-line growth	0.41	0.70	0.81	0.85	0.83	0.00
…target market share	0.06	0.12	0.16	0.18	0.19	0.00
…pursue add-on acquisitions	0.11	0.23	0.42	0.54	0.37	0.00
…change product/services mix	0.20	0.33	0.43	0.44	0.45	0.00
…pursue international expansion	0.13	0.17	0.25	0.24	0.39	0.00
…change pricing strategy	0.07	0.12	0.17	0.19	0.13	0.01
…improve marketing/promotion	0.14	0.32	0.32	0.35	0.39	0.00
…improve quality	0.09	0.12	0.09	0.08	0.08	0.33
Governance engineering	0.24	0.40	0.56	0.58	0.74	0.00
…change CEO	0.07	0.17	0.25	0.22	0.28	0.00
…change CFO	0.07	0.12	0.26	0.27	0.39	0.00
…change other management	0.09	0.17	0.35	0.36	0.47	0.00
…improve corporate governance	0.00	0.02	0.05	0.08	0.10	0.00
…change board/shareholder structure	0.07	0.14	0.11	0.16	0.22	0.01
Financial engineering	0.13	0.26	0.45	0.46	0.51	0.00
…optimize capital structure	0.12	0.25	0.38	0.37	0.46	0.00
…improve incentive systems	0.01	0.02	0.13	0.13	0.20	0.00
Cash management	0.07	0.12	0.15	0.16	0.18	0.05
…improve receivables/payables	0.02	0.10	0.12	0.15	0.16	0.00
…improve inventory management	0.04	0.04	0.06	0.04	0.07	0.59

Panel C. Breakdown by deal type.

	Fractions by deal type					Pearson
	Early stage	Growth	Buyout	Second-aries	Turn-around	χ^2 test (*p*-value)
Total deal count	211	679	154	75	17	
Operational improvements	0.80	0.85	0.82	0.85	0.88	0.26
…buy/upgrade assets	0.69	0.70	0.48	0.59	0.71	0.00
…sell existing assets	0.01	0.07	0.12	0.11	0.12	0.00
…divest/spin off companies	0.02	0.06	0.11	0.07	0.18	0.00
…reduce costs	0.13	0.25	0.40	0.33	0.47	0.00
…improve IT systems	0.11	0.18	0.18	0.15	0.18	0.16
…improve distribution or logistics	0.11	0.16	0.15	0.20	0.12	0.28
…improve organizational structure	0.05	0.10	0.18	0.20	0.18	0.00
Top-line growth	0.56	0.77	0.88	0.72	0.53	0.00
…target market share	0.05	0.15	0.25	0.12	0.12	0.00
…pursue add-on acquisitions	0.14	0.34	0.58	0.35	0.12	0.00
…change product/services mix	0.31	0.34	0.55	0.45	0.18	0.00
…pursue international expansion	0.15	0.21	0.34	0.21	0.24	0.00
…change pricing strategy	0.08	0.14	0.19	0.17	0.12	0.02
…improve marketing/promotion	0.32	0.31	0.36	0.28	0.12	0.26
…improve quality	0.05	0.12	0.06	0.09	0.24	0.00
Governance engineering	0.39	0.47	0.62	0.56	0.41	0.00
…change CEO	0.13	0.19	0.29	0.24	0.18	0.00
…change CFO	0.09	0.19	0.34	0.25	0.18	0.00
…change other management	0.19	0.25	0.43	0.24	0.35	0.00
…improve corporate governance	0.02	0.05	0.05	0.07	0.00	0.36
…change board/shareholder structure	0.13	0.14	0.12	0.16	0.18	0.90
Financial engineering	0.29	0.32	0.54	0.32	0.59	0.00
…optimize capital structure	0.28	0.28	0.44	0.24	0.59	0.00
…improve incentive systems	0.02	0.07	0.20	0.12	0.06	0.00
Cash management	0.05	0.15	0.18	0.13	0.14	0.99
…improve receivables/payables	0.04	0.12	0.16	0.11	0.12	0.36
…improve inventory management	0.02	0.05	0.03	0.03	0.03	0.22

Panel D. Breakdown by fund ownership, growth strategy, and geographic focus.

	Fractions by fund ownership			Fractions by growth strategy			Fractions by geographic focus		
	Majority	Minority	Pearson χ^2 test (*p*-value)	Organic	Inorganic	Pearson χ^2 test (*p*-value)	Single country	Regional	Pearson χ^2 test (*p*-value)
Total deal count	333	803		760	376		528	608	
Operational improvements	0.86	0.83	0.10	0.82	0.87	0.06	0.84	0.83	0.63
…buy/upgrade assets	0.68	0.65	0.31	0.68	0.61	0.01	0.72	0.61	0.00
…sell existing assets	0.09	0.06	0.11	0.06	0.08	0.30	0.05	0.09	0.02
…divest/spin off companies	0.07	0.06	0.50	0.04	0.11	0.00	0.04	0.08	0.02
…reduce costs	0.25	0.26	0.67	0.23	0.31	0.00	0.23	0.28	0.10
…improve IT systems	0.22	0.14	0.00	0.14	0.22	0.00	0.15	0.18	0.31
…improve distribution or logistics	0.17	0.14	0.25	0.14	0.18	0.09	0.14	0.16	0.22
…improve organizational structure	0.13	0.10	0.16	0.09	0.15	0.00	0.08	0.13	0.00
Top-line growth	0.79	0.72	0.02	0.61	1.00	0.00	0.67	0.80	0.00
…target market share	0.13	0.15	0.39	0.09	0.24	0.00	0.08	0.19	0.00
…pursue add-on acquisitions	0.40	0.30	0.00	0.00	1.00	0.00	0.26	0.39	0.00
…change product/services mix	0.40	0.36	0.14	0.34	0.43	0.00	0.34	0.39	0.10
…pursue international expansion	0.29	0.19	0.00	0.17	0.30	0.00	0.13	0.29	0.00
…change pricing strategy	0.16	0.13	0.15	0.13	0.16	0.22	0.14	0.14	0.94
…improve marketing/promotion	0.36	0.29	0.03	0.30	0.35	0.10	0.30	0.33	0.22
…improve quality	0.10	0.10	0.90	0.11	0.09	0.32	0.10	0.10	1.00
Governance engineering	0.56	0.45	0.00	0.43	0.59	0.00	0.43	0.53	0.00
…change CEO	0.23	0.18	0.03	0.17	0.25	0.00	0.16	0.22	0.02
…change CFO	0.27	0.16	0.00	0.15	0.29	0.00	0.15	0.24	0.00
…change other management	0.36	0.22	0.00	0.23	0.32	0.00	0.23	0.29	0.01
…improve corporate governance	0.05	0.04	0.39	0.03	0.07	0.00	0.04	0.05	0.37
…change board/shareholder structure	0.14	0.14	0.85	0.13	0.15	0.36	0.14	0.13	0.60
Financial engineering	0.43	0.31	0.00	0.31	0.42	0.00	0.35	0.34	0.76
…optimize capital structure	0.37	0.28	0.00	0.28	0.35	0.02	0.32	0.29	0.35
…improve incentive systems	0.15	0.05	0.00	0.06	0.12	0.00	0.06	0.10	0.05
Cash management	0.13	0.14	0.68	0.12	0.17	0.03	0.14	0.13	0.67
…improve receivables/payables	0.12	0.11	0.67	0.10	0.14	0.06	0.11	0.11	0.77
…improve inventory management	0.03	0.05	0.14	0.04	0.05	0.29	0.05	0.04	0.28

Table 3. Implementation of value creation plans over the life of a deal.

The table reports the number and fraction of deals in which an initial strategy or action item is achieved or revised. Share achieved in column 4 is the fraction of deals including a particular action item in its initial VCP from Table 2, Panel A that successfully implement it. We code a strategy as having been achieved if at least one action item belonging to that strategy is achieved, and 0 otherwise. We code the introduction of new strategies and action items after the first year as revisions. For variable definitions and details of their construction see Appendix A.

	Number of deals planning action	Fund achieves initial VCP			Fund revises initial VCP	
		Number of deals	Fraction of sample	Share achieved	Number of deals	Fraction of sample
	(1)	(2)	(3)	(4)	(5)	(6)
Operational improvements	951	904	0.80	0.95	588	0.55
…buy/upgrade assets	749	698	0.61	0.93	84	0.08
…sell existing assets	78	75	0.07	0.96	156	0.15
…divest/spin off companies	70	56	0.05	0.80	165	0.15
…reduce costs	293	275	0.24	0.94	338	0.31
…improve IT systems	188	154	0.14	0.82	74	0.07
…improve distribution or logistics	173	147	0.13	0.85	104	0.10
…improve organizational structure	124	106	0.09	0.85	103	0.10
Top-line growth	838	762	0.67	0.91	529	0.49
…target market share	159	98	0.09	0.62	51	0.05
…pursue add-on acquisitions	376	280	0.25	0.74	151	0.14
…change product/services mix	420	376	0.33	0.90	182	0.17
…pursue international expansion	244	178	0.16	0.73	106	0.10
…change pricing strategy	158	138	0.12	0.87	196	0.18
…improve marketing/promotion	356	310	0.27	0.87	186	0.17
…improve quality	114	89	0.08	0.78	87	0.08
Governance engineering	548	519	0.46	0.95	420	0.39
…change CEO	222	207	0.18	0.93	206	0.19
…change CFO	223	211	0.19	0.95	108	0.10
…change other management	298	287	0.25	0.96	158	0.15
…improve corporate governance	52	37	0.03	0.71	22	0.02
…change board/shareholder structure	157	139	0.12	0.89	122	0.11
Financial engineering	395	349	0.31	0.88	252	0.23
…optimize capital structure	346	303	0.27	0.88	220	0.20
…improve incentive systems	93	84	0.07	0.90	46	0.04
Cash management	154	137	0.12	0.89	191	0.18
…improve receivables/payables	126	113	0.10	0.90	166	0.15
…improve inventory management	50	41	0.04	0.82	54	0.05

Table 4. Explaining achievement of VCPs at the action item and strategy levels.

The table reports regression results of VCP achievement on various covariates and fixed effects at the deal-by-action-item level in columns 1-3 and at the deal-by-strategy level in columns 4-6. For variable definitions and details of their construction see Appendix A. The estimation sample includes only fully realized deals. The unit of observation in columns (1) through (3) is action item i pursued in deal k. The unit of observation in columns (4) through (6) is strategy j pursued in deal k. Standard errors, shown in italics below the coefficient estimates, are clustered at the fund level in columns 1 and 4 and at the deal level in all other columns. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	Planned action item achieved?			Share of action items in strategy achieved		
	(1)	(2)	(3)	(4)	(5)	(6)
# action items per strategy	-0.015***	-0.024***	-0.007	-0.016***	-0.023***	-0.009
	0.005	*0.008*	*0.008*	*0.005*	*0.009*	*0.009*
Log deal duration	0.069***			0.064***		
	0.023			*0.024*		
Log deal size	0.028***			0.025**		
	0.009			*0.011*		
Majority ownership	0.036**			0.031**		
	0.016			*0.015*		
Inorganic growth	-0.048***			-0.049**		
	0.018			*0.019*		
Share of deals following strategy		0.032			0.035	
		0.034			*0.038*	
x operational improvements			0.074**			0.069*
			0.036			*0.042*
x top-line growth			-0.032			-0.034
			0.040			*0.049*
x governance engineering			0.133***			0.125**
			0.049			*0.057*
x financial engineering			0.079			0.066
			0.061			*0.075*
x cash management			0.135			0.100
			0.119			*0.150*
Deal year FE	Yes	-	-	Yes	-	-
Deal type FE	Yes	-	-	Yes	-	-
Fund FE	Yes	-	-	Yes	-	-
Deal FE	-	Yes	Yes	-	Yes	Yes
R-squared	0.122	0.338	0.352	0.180	0.517	0.534
Number of obs.	4,088	4,088	4,088	2,326	2,326	2,326

Table 5. Explaining deal-level achievement of VCPs.

The table reports deal-level regression results of the share of planned action items that were achieved (columns 1 and 2) and the share of planned strategies that were achieved (columns 3 and 4) on various covariates and fixed effects. For variable definitions and details of their construction see Appendix A. The estimation sample includes only fully realized deals, for a sample size of 946. (We lack cash flow data for 13 of the 959 fully realized deals.) Standard errors, shown in italics below the coefficient estimates, are clustered at the fund level in columns 1 and 3 and at the PE firm level in columns 2 and 4. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	Share of action items achieved in a deal		Share of strategies achieved in a deal	
	(1)	(2)	(3)	(4)
Total # action items per deal	0.079***	0.076***		
	0.019	*0.019*		
Total # strategies per deal			0.368***	0.357***
			0.044	*0.042*
… squared	-0.006***	-0.005***	-0.062***	-0.060***
	0.001	*0.001*	*0.008*	*0.008*
Log deal duration	0.086***	0.092***	0.077***	0.083***
	0.026	*0.021*	*0.026*	*0.024*
Log deal size	0.034**	0.027*	0.022	0.019*
	0.016	*0.015*	*0.014*	*0.011*
Majority ownership	0.025	0.015	0.020	0.008
	0.021	*0.023*	*0.018*	*0.020*
Inorganic growth	-0.050**	-0.041	-0.016	-0.009
	0.025	*0.029*	*0.019*	*0.022*
Deal year FE	Yes	Yes	Yes	Yes
Deal type FE	Yes	Yes	Yes	Yes
Fund FE	Yes	-	Yes	-
PE firm FE	-	Yes	-	Yes
R-squared	0.337	0.278	0.444	0.389
Partial *R*-squared:				
Total # action items/strategies per deal	0.058	0.055	0.196	0.186
… squared	0.043	0.041	0.155	0.146
Log deal duration	0.022	0.024	0.023	0.025
Log deal size	0.010	0.008	0.006	0.005
Majority ownership	0.001	0.001	0.001	0.000
Inorganic growth	0.006	0.004	0.001	0.000
Deal year FE	0.004	0.004	0.008	0.009
Deal type FE	0.045	0.046	0.049	0.051
Fund FE	0.213		0.214	
PE firm FE		0.144		0.137
Number of obs.	946	946	946	946

Table 6. Explaining fund-level achievement of VCPs.

The table reports regression results of the fund fixed effects estimated in column 1 of Table 5 on a set of fund characteristics. For variable definitions and details of their construction see Appendix A. Observations are weighted by the inverse of the standard error on the fund fixed effects estimated in Table 5 to account for measurement error in the fixed effects. The unit of observation is a fund. Heteroskedasticity-consistent standard errors are shown in italics underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	(1)	(2)
Fund focus		
Deal size Herfindahl index	-0.564***	-0.545***
	0.205	*0.178*
Number of deal types	-0.045**	-0.049***
	0.019	*0.019*
Number of sectors	-0.006	-0.012
	0.014	*0.014*
Fund strategy		
Dominant ownership: minority	0.088**	0.088**
	0.040	*0.040*
Dominant growth strategy: inorganic	-0.019	-0.022
	0.037	*0.037*
Regional fund	0.018	0.029
	0.033	*0.036*
Strategy Herfindahl index	0.183	
	0.400	
Fund characteristics		
Fund size (log USD million)	-0.016	-0.021
	0.020	*0.020*
Portfolio size (number of deals)	-0.005	-0.004
	0.004	*0.004*
Log average deal duration	0.022	0.005
	0.073	*0.101*
PE firm characteristics		
Log PE firm age		0.002
		0.017
Strategy Herfindahl index		-0.291
		0.326
Vintage year FE	Yes	Yes
R-squared	0.342	0.339
Joint *F*-test of vintage year FE	3.4***	2.6***
Number of obs.	132	132

Table 7. Predicting investor returns with value creation plans: LASSO model selection.

The table reports results from a LASSO model-selection estimation of value creation plans. Panels A and B focus on ex ante planned strategies; Panels C and D focus on ex post achieved strategies. We use two alternative measures of investor returns: PME (in Panels A and C) and MOIC (in Panels B and D). The estimation sample includes only fully realized deals, for a sample size of 946. (We lack cash flow data for 13 of the 959 fully realized deals.) Each row represents one specification the LASSO model has selected from among the set of possible strategy combinations. The initial specification includes all 32 possible combinations of the five strategies shown in columns 1 through 5, as well as log deal size, log deal duration, and entry and exit year fixed effects (not shown) for a total of 82 variables. The penalization parameter lambda used to select prediction specifications is chosen with 10-fold cross-validation and minimizes the mean-squared prediction error. LASSO retains the strategy combinations reported below, as well as log deal size, a subset of entry and exit year fixed effects, and (in Panels B and D only) log deal duration (not shown), for a total of 19, 37, 18, and 39 variables in Panels A through D. Columns 7 and 8 show how popular the strategy combinations chosen by LASSO were as of the time of investment. (See Table IA.1 in the Internet Appendix for details of the 10 most popular strategy combinations.)

Fund plans to focus on						Ex ante popularity	
Operational improvements (1)	Top-line growth (2)	Governance engineering (3)	Financial engineering (4)	Cash management (5)	LASSO coef. (6)	Rank (7)	% of deals (8)
Panel A. Ex ante plans, dependent variable PME.							
-	Yes	Yes	Yes	-	0.023	17	1.3
-	Yes	Yes	-	-	0.132	9	3.6
Yes	Yes	Yes	Yes	-	-0.107	3	11.1
Yes	-	Yes	-	-	-0.223	11	3.4
Panel B. Ex ante plans, dependent variable MOIC.							
-	Yes	Yes	Yes	-	0.737	17	1.3
Yes	Yes	-	-	Yes	0.193	14	1.8
-	Yes	Yes	-	-	0.237	9	3.6
Yes	Yes	Yes	-	-	0.018	2	15.3
Yes	Yes	Yes	-	Yes	-0.049	6	4.2
Yes	Yes	Yes	Yes	-	-0.252	3	11.1
Yes	-	-	Yes	-	-0.326	10	3.4
Yes	-	Yes	-	-	-0.381	11	3.4
-	-	Yes	-	-	-0.161	18	1.2
-	Yes	-	-	Yes	-0.026	26	0.2
-	-	-	-	Yes	-0.243	25	0.2

Table 7. Continued.

Fund plans to focus on						Ex ante popularity	
Operational improvements (1)	Top-line growth (2)	Governance engineering (3)	Financial engineering (4)	Cash management (5)	LASSO coef. (6)	Rank (7)	% of deals (8)
Panel C. Achieved plans, dependent variable PME.							
-	Yes	Yes	-	-	0.595	9	3.6
-	Yes	Yes	Yes	-	0.166	17	1.3
Yes	Yes	-	-	-	0.043	1	17.7
Yes	-	Yes	-	-	-0.019	11	3.4
-	-	Yes	-	-	-0.118	18	1.2
Panel D. Achieved plans, dependent variable MOIC.							
-	Yes	Yes	Yes	-	0.899	17	1.3
-	Yes	Yes	-	-	0.890	9	3.6
-	Yes	-	Yes	-	0.141	15	1.4
Yes	Yes	-	-	Yes	0.350	14	1.8
Yes	Yes	-	-	-	0.109	1	17.7
Yes	Yes	-	Yes	-	0.057	5	7.9
Yes	Yes	Yes	Yes	-	-0.044	3	11.1
Yes	-	Yes	-	-	-0.081	11	3.4
Yes	-	-	Yes	-	-0.161	10	3.4
Yes	-	Yes	-	Yes	-0.172	19	0.6
-	Yes	-	-	Yes	-0.015	26	0.2
-	-	Yes	-	-	-0.476	18	1.2

Table 8. VCP achievement and the cross-section of investor returns.

The table reports regression results of investor returns on VCP achievement. The unit of observation is a deal. The dependent variable (PME or MOIC) is winsorized at the top 1%. All regressions include log deal size, log deal duration, and entry and exit year fixed effects (not shown to conserve space). For variable definitions and details of their construction see Appendix A. The estimation sample includes only fully realized deals, for a sample size of 946. (We lack cash flow data for 13 of the 959 fully realized deals.) Heteroskedasticity-consistent standard errors clustered at the fund level are shown in italics underneath the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	PME		MOIC	
	(1)	(2)	(3)	(4)
Share of action items achieved	0.425***		0.625***	
	0.161		*0.230*	
x early stage		-0.263		-0.210
		0.179		*0.260*
x growth		0.580***		0.813***
		0.176		*0.241*
x buyout		0.958***		1.352***
		0.224		*0.319*
x secondaries		0.947***		1.130***
		0.283		*0.306*
x turnaround		0.250		0.430
		0.407		*0.569*
Number of planned action items	-0.012	-0.023	-0.020	-0.033
	0.021	*0.021*	*0.030*	*0.031*
Deal size and duration	Yes	Yes	Yes	Yes
Entry and exit year FE	Yes	Yes	Yes	Yes
R-squared	0.093	0.132	0.139	0.169
Number of obs.	946	946	946	946

Table 9. Company-level changes during and after the PE holding period.

The table summarizes estimates of company-level changes in 23 outcome variables during and after the PE holding period, as specified in equation (1). Full regression results are reported in Tables IA.6 through IA.11 in the Internet Appendix. The estimation sample in each regression includes both realized and unrealized deals as well as matched controls. The number of observations varies depending on the availability of individual data items in Orbis. For variable definitions and details of their construction see Appendix A. All regressions include company and year fixed effects. Heteroskedasticity-consistent standard errors clustered at the company level are shown in italics next to the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	pre-PE	Ownership effect β_1: *PE* x *postPE*		Persistence effect β_3: *PE x postPE x exit*		Long run effect $\beta_1 + \beta_3$			
	mean	coef.	s.e.	coef.	s.e.	coef.	s.e.	*R*-sq.	N
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Operational improvements									
employment	335	0.260***	*0.050*	0.065	*0.079*	0.325***	*0.095*	0.045	20,925
average wage	15.01	0.080**	*0.037*	0.025	*0.044*	0.105*	*0.057*	0.343	12,393
labor productivity	175.72	0.127***	*0.036*	0.077	*0.050*	0.203***	*0.061*	0.152	20,132
net investment	0.11	0.002	*0.004*	0.005	*0.005*	0.007	*0.006*	0.133	20,406
capital intensity	127.55	0.325***	*0.054*	-0.059	*0.080*	0.266***	*0.095*	0.119	19,450
TFP	1.7	0.009	*0.021*	0.067**	*0.030*	0.076**	*0.035*	0.010	19,059
Top-line growth									
sales	42,372	0.443***	*0.059*	0.096	*0.100*	0.539***	*0.119*	0.116	22,685
markup	2.42	-0.070***	*0.022*	-0.022	*0.034*	-0.093**	*0.040*	0.029	19,058
market share	0.14	0.014***	*0.004*	0.014**	*0.006*	0.028***	*0.007*	0.117	22,683
Governance engineering									
Number of shareholders	2.15	-0.170	*0.156*	-0.389**	*0.170*	-0.559***	*0.215*	0.016	13,834
Ownership concentration	0.68	0.040*	*0.024*	0.051*	*0.027*	0.091***	*0.035*	0.023	13,834
Financial engineering									
leverage	0.23	0.032***	*0.010*	-0.002	*0.014*	0.030*	*0.016*	0.013	19,607
net debt to EBITDA	0.6	0.066	*0.203*	-0.134	*0.274*	-0.068	*0.309*	0.002	17,995
implicit interest rate	0.11	-0.009*	*0.005*	0.007	*0.009*	-0.001	*0.010*	0.027	6,555
taxes paid	517.96	-0.028	*0.164*	0.314	*0.259*	0.286	*0.249*	0.035	13,059
tax rate	0.16	-0.014*	*0.007*	0.020*	*0.010*	0.007	*0.012*	0.028	16,649
Cash management									
working capital	0.33	-0.053***	*0.012*	-0.002	*0.018*	-0.055***	*0.021*	0.008	20,201
credit period	50.81	-0.413	*2.348*	4.568	*3.457*	4.155	*3.835*	0.023	16,703
collection period	62.25	-3.241	*2.235*	2.559	*3.201*	-0.682	*3.639*	0.022	17,486
stock turnover	55.78	-1.401	*1.804*	0.075	*2.389*	-1.326	*2.786*	0.007	14,734
Profitability measures									
EBITDA	3,922	0.336	*0.231*	0.933***	*0.321*	1.269***	*0.376*	0.025	21,720
EBITDA margin	0.09	-0.001	*0.005*	-0.000	*0.006*	-0.001	*0.007*	0.028	20,494
Return on assets	0.04	-0.009*	*0.004*	0.014**	*0.006*	0.005	*0.007*	0.022	21,357

Table 10. Value creation outcomes and investor returns.

The table summarizes regression results of equation (2) estimated on the cross-section of portfolio companies. Each row represents two regressions, one with PME and the other with MOIC as the dependent variable. PME and MOIC are winsorized at the top 1%. The variable of interest in each regression is the company-level change in one of the 23 outcome variables considered in Table 9 measured over the PE holding period and winsorized at the 1% level. Log deal size, log deal duration, and entry and exit year fixed effects are included but not shown to conserve space. For variable definitions and details of their construction see Appendix A. The estimation sample includes exited deals and unexited deals that are held in a fund's portfolio for at least four years. The number of observations included in each regression varies depending on data availability in Orbis. Heteroskedasticity-consistent standard errors are shown in italics next to the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	PME			MOIC			
	coeff.	s.e.	*R*-sq.	coeff.	s.e.	*R*-sq.	N
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Operational improvements							
employment	0.121***	*0.038*	0.144	0.248***	*0.065*	0.184	523
average wage	0.097	*0.162*	0.210	0.203	*0.211*	0.199	270
labor productivity	0.026	*0.036*	0.135	0.061	*0.059*	0.172	473
net investment	0.001	*0.002*	0.114	-0.000	*0.004*	0.157	545
capital intensity	0.072**	*0.036*	0.142	0.147**	*0.063*	0.191	468
TFP	0.051	*0.073*	0.113	0.050	*0.103*	0.160	483
Top-line growth							
sales	0.094***	*0.025*	0.132	0.151***	*0.039*	0.173	603
markup	-0.086	*0.103*	0.113	-0.036	*0.161*	0.159	483
market share	0.101	*0.160*	0.116	0.202	*0.222*	0.154	599
Governance engineering							
Number of shareholders	0.072	*0.058*	0.456	0.132	*0.086*	0.494	118
Ownership concentration	0.489	*0.362*	0.461	0.618	*0.485*	0.493	118
Financial engineering							
leverage	-0.484	*0.318*	0.123	-0.437	*0.462*	0.171	522
net debt to EBITDA	0.001	*0.001*	0.118	0.001	*0.001*	0.169	515
implicit interest rate	-0.882	*1.289*	0.215	-0.836	*1.699*	0.312	229
taxes paid	0.036	*0.028*	0.193	0.040	*0.043*	0.262	227
tax rate	0.267	*0.469*	0.168	0.284	*0.715*	0.192	312
Cash management							
working capital	-0.102	*0.150*	0.128	-0.277	*0.222*	0.164	552
credit period	-0.001	*0.001*	0.163	-0.001	*0.001*	0.187	298
collection period	0.000	*0.001*	0.162	0.001	*0.001*	0.199	309
stock turnover	-0.000	*0.000*	0.164	-0.000	*0.000*	0.197	281
Profitability measures							
EBITDA	0.032***	*0.008*	0.130	0.046***	*0.011*	0.168	595
EBITDA margin	0.157	*0.286*	0.116	0.138	*0.435*	0.152	553
Return on assets	0.553**	*0.274*	0.123	0.634	*0.440*	0.160	594

INTERNET APPENDIX
for
Value Creation in Private Equity

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(NOT INTENDED FOR PUBLICATION)

Table IA.1. Top 10 most popular combinations of value creation strategies.

The table reports the most popular combinations of value creation strategies. Fractions in the last column are reported with respect to total deal count. Combinations are ordered from high to low in terms of frequency.

	Strategy						
Rank	Operational improvements	Top-line growth	Governance engineering	Financial engineering	Cash management	Freq.	Fraction
1	Yes	Yes	-	-	-	201	17.7
2	Yes	Yes	Yes	-	-	174	15.3
3	Yes	Yes	Yes	Yes	-	126	11.1
4	Yes	-	-	-	-	104	9.2
5	Yes	Yes	-	Yes	-	90	7.9
6	Yes	Yes	Yes	-	Yes	48	4.2
7	-	Yes	-	-	-	44	3.9
8	Yes	Yes	Yes	Yes	Yes	43	3.8
9	-	Yes	Yes	-	-	41	3.6
10	Yes	-	Yes	-	-	39	3.4

Table IA.2. Most popular combinations of value creation action items.

The table reports the 10 most popular combinations of action items, conditional on a value creation plan including at least two action items. Fractions are reported with respect to total deal count (N=982). Combinations are ordered from high to low in terms of frequency.

Combination #	1	2	3	4	5	6	7	8	9	10
Frequency	34	17	11	10	10	8	7	7	5	5
Percentage	3.46	1.73	1.12	1.02	1.02	0.81	0.71	0.71	0.51	0.51
Operational improvements										
…buy / upgrade assets	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
…sell existing assets	-	-	-	-	-	-	-	-	-	-
…divest / spin off companies	-	-	-	-	-	-	-	-	-	-
…reduce costs	-	-	-	-	Yes	-	-	-	-	-
…improve IT systems	-	-	-	-	-	-	-	-	-	-
…improve distribution or logistics	-	-	-	-	-	Yes	-	-	-	Yes
…improve organizational structure	-	-	-	-	-	-	-	-	-	-
Top-line growth										
…target market share	-	-	-	-	-	-	-	-	-	-
…pursue add-on acquisitions	-	Yes	-	-	-	-	-	-	Yes	-
…change product/services mix	-	-	Yes	-	-	-	-	-	Yes	-
…pursue international expansion	-	-	-	Yes	-	-	-	-	-	-
…change pricing strategy	-	-	-	-	-	-	-	-	-	-
…improve marketing/promotion	-	-	-	-	-	-	-	Yes	-	Yes
…improve quality	-	-	-	-	-	-	-	-	-	-
Governance engineering										
…change CEO	-	-	-	-	-	-	-	-	-	-
…change CFO	-	-	-	-	-	-	-	-	-	-
…change other management	-	-	-	-	-	-	-	-	-	-
…improve corporate governance	-	-	-	-	-	-	-	-	-	-
…change board / shareholder structure	-	-	-	-	-	-	Yes	Yes	-	-
Financial engineering										
…optimize capital structure	Yes	-	-	-	-	-	-	-	-	-
…improve incentive systems	-	-	-	-	-	-	-	-	-	-
Cash management										
…improve receivables/payables	-	-	-	-	-	-	-	-	-	-
…improve inventory management	-	-	-	-	-	-	-	-	-	-

Table IA.3. Investor returns across the samples used in the analysis.

The table reports summary statistics on deal-level investor returns for the full sample, the VCP sample, and the Orbis sample of companies. PME stands for public market equivalent and MOIC stands for money on invested capital. Weighted means report returns weighted by investment cost. We lack cash flow data for 19 of the 1,580 sample deals in Panel A and for 16 of 1,136 sample deals in Panel B.

		PME		MOIC	
	N	Mean	Weighted mean	Mean	Weighted mean
Panel A. Full sample					
Fully realized	1,062	1.63	1.31	2.03	1.87
Unrealized	499	1.04	0.93	1.34	1.21
All	1,561	1.44	1.10	1.81	1.51
Panel B. VCP sample					
Fully realized	946	1.72	1.33	2.15	1.91
Unrealized	174	0.91	0.70	1.19	0.92
All	1,120	1.59	1.11	2.00	1.56
Panel C. Orbis sample					
Fully realized	922	1.75	1.33	2.20	1.93
Unrealized	436	1.04	0.95	1.35	1.23
All	1,358	1.52	1.12	1.93	1.55

Panel D. Two-sample *t*-tests of equality of means (full sample less VCP sample)

	t-stat	*p*-value	*t*-stat	*p*-value
Fully realized	-0.14	0.89	-0.26	0.79
Unrealized	1.41	0.16	1.28	0.20
All	-0.32	0.75	-0.54	0.59

Panel E. Two-sample *t*-tests of equality of means (full sample less Orbis sample)

	t-stat	*p*-value	*t*-stat	*p*-value
Fully realized	-0.19	0.85	-0.36	0.72
Unrealized	-0.02	0.99	-0.06	0.96
All	-0.19	0.85	-0.36	0.72

Table IA.4. Revisions of initial VCPs.

The table reports the number and fraction of deals in which a strategy or action item is added after the first year.

	Fund revises initial VCP	
	Deal count (1)	Fraction of sample (2)
Operational improvements	588	0.55
…buy/upgrade assets	84	0.08
…sell existing assets	156	0.15
…divest/spin off companies	165	0.15
…reduce costs	338	0.31
…improve IT systems	74	0.07
…improve distribution or logistics	104	0.10
…improve organizational structure	103	0.10
Top-line growth	529	0.49
…target market share	51	0.05
…pursue add-on acquisitions	151	0.14
…change product/services mix	182	0.17
…pursue international expansion	106	0.10
…change pricing strategy	196	0.18
…improve marketing/promotion	186	0.17
…improve quality	87	0.08
Governance engineering	420	0.39
…change CEO	206	0.19
…change CFO	108	0.10
…change other management	158	0.15
…improve corporate governance	22	0.02
…change board/shareholder structure	122	0.11
Financial engineering	252	0.23
…optimize capital structure	220	0.20
…improve incentive systems	46	0.04
Cash management	191	0.18
…improve receivables/payables	166	0.15
…improve inventory management	54	0.05

Table IA.5. Pre-investment characteristics of portfolio and control companies.

The table reports summary statistics for company-level outcome variables grouped by VCP strategy, separately for portfolio companies and matched control companies. For pre-investment levels, each variable is averaged over the three years preceding the first year of PE funding. For pre-investment trends, we calculate the change from the previous year to the first year of PE funding for each variable. All dollar amounts are reported in thousands. Difference in means reports the results of regressing each variable on a dummy equal to 1 for portfolio companies and 0 for control companies. *P*-values are derived from heteroskedasticity-consistent standard errors.

	Pre-investment levels					**Pre-investment trends**				
	Portfolio companies	Control companies	Difference in means			Portfolio companies	Control companies	Difference in means		
			Diff.	*t*-stat	*p*-value			Diff.	*t*-stat	*p*-value
Operational improvements										
Employment	335	298	37	1.19	0.23	21	7	14.24	0.99	0.32
Average wages (USD)	15.01	13.77	1.24	1.39	0.16	1.09	-0.04	1.13	1.76	0.08
Labor productivity (USD)	175.72	175.01	0.71	0.04	0.97	-1.24	0.95	-2.19	-0.15	0.88
Net investment (%)	0.11	0.07	0.04	3.02	0.00	0.00	-0.02	0.03	1.21	0.23
Capital intensity (USD)	127.55	165.40	-37.86	-1.65	0.10	9.97	1.83	8.14	0.57	0.57
TFP (log)	1.70	1.60	0.10	1.84	0.07	-0.05	-0.01	-0.04	-1.57	0.12
Top-line growth										
Sales (USD)	42,372	40,251	2,121	0.35	0.73	3,606	462	3,144	1.42	0.16
Markup	2.42	2.46	-0.04	-0.18	0.85	-0.06	0.10	-0.16	-1.49	0.14
Market share (%)	0.14	0.09	0.05	4.00	0.00	0.00	0.00	0.00	0.28	0.78
Governance engineering										
Number of shareholders	2.15	1.94	0.21	1.83	0.07	0.02	0.03	-0.01	-0.16	0.88
Ownership concentration	0.68	0.74	-0.05	-2.83	0.02	-0.00	0.00	-0.00	-0.24	0.81
Financial engineering										
Leverage (%)	0.23	0.17	0.05	4.53	0.00	0.00	0.00	0.00	-0.39	0.69
Net debt to EBITDA	0.60	0.44	0.15	0.34	0.74	-1.04	0.05	-1.09	-1.46	0.15
Implicit interest rate (%)	0.11	0.10	0.01	1.02	0.31	-0.00	0.00	-0.00	-0.43	0.67
Taxes paid (USD)	517.96	617.97	-100.01	-1.19	0.24	36.39	1.10	35.29	0.48	0.63
Tax rate (%)	0.16	0.16	0.00	-0.15	0.88	-0.02	0.00	-0.02	-2.04	0.04
Cash management										
Working capital (%)	0.33	0.35	-0.02	-0.85	0.39	-0.02	0.00	-0.02	-0.88	0.38
Credit period (days)	50.81	55.99	-5.18	-1.59	0.11	-3.82	1.02	-4.83	-1.12	0.26
Collection period (days)	62.25	75.39	-13.14	-3.53	0.00	2.96	4.45	-1.49	-0.40	0.69
Stock turnover	55.78	46.88	8.90	1.38	0.17	-6.27	1.35	-7.62	-1.54	0.12
Profitability measures										
EBITDA (USD)	3,922	3,589	333	0.54	0.59	-284	82	-366	-0.86	0.39
EBITDA margin	0.09	0.09	0.00	0.02	0.99	-0.03	-0.01	-0.02	-2.96	0.00
Return on assets (%)	0.04	0.04	0.00	-0.13	0.90	-0.02	0.00	-0.02	-2.75	0.01

Table IA.6. Operational improvements.

The table reports estimates of company-level changes in outcome variables associated with operational improvement activities during and after the PE holding period, as specified in equation (1). The estimation sample includes both realized and unrealized deals as well as matched controls. For variable definitions and details of their construction see Appendix A. All regressions include company and year fixed effects. Heteroskedasticity-consistent standard errors clustered at the company level are shown in italics next to the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	Employ-ment (1)	Average wage (2)	Labor productivity (3)	Net investment (4)	Capital intensity (5)	TFP (6)
β_1: *PE* x *postPE*	0.260***	0.080**	0.127***	0.002	0.325***	0.009
	0.050	*0.037*	*0.036*	*0.004*	*0.054*	*0.021*
β_2: *postPE*	0.041*	0.011	0.021	-0.012***	-0.036	-0.006
	0.021	*0.017*	*0.020*	*0.002*	*0.027*	*0.010*
β_3: *PE* x *postPE* x *exit*	0.065	0.025	0.077	0.005	-0.059	0.067**
	0.079	*0.044*	*0.050*	*0.005*	*0.080*	*0.030*
β_4: *postPE* x *exit*	-0.201***	-0.051**	-0.012	0.001	-0.039	-0.018
	0.034	*0.023*	*0.027*	*0.003*	*0.039*	*0.014*
$\beta_1 + \beta_3$	0.325***	0.105*	0.203***	0.007	0.266***	0.076**
	0.095	*0.057*	*0.061*	*0.006*	*0.095*	*0.035*
R-squared	0.045	0.343	0.152	0.133	0.119	0.010
Number of obs.	20,925	12,393	20,132	20,406	19,450	19,059

Table IA.7. Top-line growth.

The table reports estimates of company-level changes in outcome variables associated with top-line growth activities during and after the PE holding period, as specified in equation (1). The estimation sample includes both realized and unrealized deals as well as matched controls. For variable definitions and details of their construction see Appendix A. All regressions include company and year fixed effects. Heteroskedasticity-consistent standard errors clustered at the company level are shown in italics next to the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	Sales (1)	Markup (2)	Market share (3)
β_1: *PE* x *postPE*	0.443***	-0.070***	0.014***
	0.059	*0.022*	*0.004*
β_2: *postPE*	0.026	0.031***	-0.002
	0.029	*0.011*	*0.002*
β_3: *PE* x *postPE* x *exit*	0.096	-0.022	0.014**
	0.100	*0.034*	*0.006*
β_4: *postPE* x *exit*	-0.297***	0.021	-0.009***
	0.047	*0.017*	*0.002*
$\beta_1 + \beta_3$	0.539***	-0.093**	0.028***
	0.119	*0.040*	*0.007*
R-squared	0.116	0.029	0.117
Number of obs.	22,685	19,058	22,683

Table IA.8. Governance engineering.

The table reports estimates of company-level changes in outcome variables associated with governance engineering activities during and after the PE holding period, as specified in equation (1). The estimation sample includes both realized and unrealized deals as well as matched controls. For variable definitions and details of their construction see Appendix A. All regressions include company and year fixed effects. Heteroskedasticity-consistent standard errors clustered at the company level are shown in italics next to the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	Number of shareholders (1)	Ownership concentration (2)
β_1: *PE* x *postPE*	-0.170	0.040*
	0.156	*0.024*
β_2: *postPE*	-0.078*	-0.002
	0.046	*0.008*
β_3: *PE* x *postPE* x *exit*	-0.389**	0.051*
	0.170	*0.027*
β_4: *postPE* x *exit*	-0.116*	0.008
	0.064	*0.010*
$\beta_1 + \beta_3$	-0.559***	0.091***
	0.215	*0.035*
R-squared	0.016	0.023
Number of obs.	13,834	13,834

Table IA.9. Financial engineering.

The table reports estimates of company-level changes in outcome variables associated with financial engineering activities during and after the PE holding period, as specified in equation (1). The estimation sample includes both realized and unrealized deals as well as matched controls. For variable definitions and details of their construction see Appendix A. All regressions include company and year fixed effects. Heteroskedasticity-consistent standard errors clustered at the company level are shown in italics next to the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	Leverage	Net debt to EBITDA	Implicit interest rate	Taxes paid	Tax rate
	(1)	(2)	(3)	(4)	(5)
β_1: *PE* x *postPE*	0.032***	0.066	-0.009*	-0.028	-0.014*
	0.010	*0.203*	*0.005*	*0.164*	*0.007*
β_2: *postPE*	0.008*	0.146	0.002	-0.129*	-0.006*
	0.004	*0.110*	*0.003*	*0.072*	*0.003*
β_3: *PE* x *postPE* x *exit*	-0.002	-0.134	0.007	0.314	0.020*
	0.014	*0.274*	*0.009*	*0.259*	*0.010*
β_4: *postPE* x *exit*	-0.010	-0.131	-0.006	-0.405***	-0.012**
	0.006	*0.142*	*0.004*	*0.094*	*0.005*
$\beta_1 + \beta_3$	0.030*	-0.068	-0.001	0.286	0.007
	0.016	*0.309*	*0.010*	*0.249*	*0.012*
R-squared	0.013	0.002	0.027	0.035	0.028
Number of obs.	19,607	17,995	6,555	13,059	16,649

Table IA.10. Cash management.

The table reports estimates of company-level changes in outcome variables associated with cash management activities during and after the PE holding period, as specified in equation (1). The estimation sample includes both realized and unrealized deals as well as matched controls. For variable definitions and details of their construction see Appendix A. All regressions include company and year fixed effects. Heteroskedasticity-consistent standard errors clustered at the company level are shown in italics next to the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	Working capital	Credit period	Collection period	Stock turnover
	(1)	(2)	(3)	(4)
β_1: *PE* x *postPE*	-0.053***	-0.413	-3.241	-1.401
	0.012	*2.348*	*2.235*	*1.804*
β_2: *postPE*	-0.009	0.747	0.993	1.620*
	0.006	*1.105*	*1.169*	*0.872*
β_3: *PE* x *postPE* x *exit*	-0.002	4.568	2.559	0.075
	0.018	*3.457*	*3.201*	*2.389*
β_4: *postPE* x *exit*	0.007	-0.921	-2.168	0.158
	0.009	*1.599*	*1.574*	*1.140*
$\beta_1 + \beta_3$	-0.055***	4.155	-0.682	-1.326
	0.021	*3.835*	*3.639*	*2.786*
R-squared	0.008	0.023	0.022	0.007
Number of obs.	20,201	16,703	17,486	14,734

Table IA.11. Profitability.

The table reports estimates of company-level changes in profitability during and after the PE holding period, as specified in equation (1). The estimation sample includes both realized and unrealized deals as well as matched controls. For variable definitions and details of their construction see Appendix A. All regressions include company and year fixed effects. Heteroskedasticity-consistent standard errors clustered at the company level are shown in italics next to the coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	EBITDA (1)	EBITDA margin (2)	Return on assets (3)
β_1: *PE* x *postPE*	0.336	-0.001	-0.009*
	0.231	*0.005*	*0.004*
β_2: *postPE*	0.086	-0.002	-0.002
	0.119	*0.003*	*0.002*
β_3: *PE* x *postPE* x *exit*	0.933***	-0.000	0.014**
	0.321	*0.006*	*0.006*
β_4: *postPE* x *exit*	-0.510***	-0.005	-0.005*
	0.159	*0.003*	*0.003*
$\beta_1 + \beta_3$	1.269***	-0.001	0.005
	0.376	*0.007*	*0.007*
R-squared	0.025	0.028	0.022
Number of obs.	21,720	20,494	21,357