PE directors' human capital and add-on strategy

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Abstract

We examine importance of task-specific and general human capital of PE directors for choice of add-on acquisition strategy. Our analysis is based on a hand-collected sample of 588 boards of directors in UK portfolio companies. PE directors' representation on the boards significantly increases likelihood of inorganic value creation strategies (i.e. add-on acquisitions). Task-specific (i.e. financial and operational experience) human capital tends to be more important determinant than general human capital (i.e. educational background). The results are robust to alternative model specifications and various controls for endogeneity.

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Key Words: Private equity, Board of directors, Human captial, Add-on strategy, Buyouts

1. Introduction

Private equity (PE) firms may boost growth of their portfolio companies via add-on acquisitions (i.e. inorganic growth) or via traditional value creation (i.e. buy-and-build) strategy. More recently, traditional strategies have increasingly been giving way to value creation strategies utilizing add-on acquisitions (e.g. Braun et al., 2017; Hammer, et al. 2017). For instance, add-on acquisitions accounted for nearly 30% of PE-backed buyouts globally and around 64% of the European deals. [1]

There is , however, paucity of literature on how exactly the buyouts' add-on acquisitions work and create value. Rare studies report that that buyouts with add-on acquisition strategy tend to outperform their counterparts following other strategies (e.g. Bansraj et al., 2020; Acharya et al., 2013). In a closely related paper to ours, Hammer et al. (2017) focuses on the determinants of decisions to pursue add-on acquisition strategies. Authors identify characteristics of: PE firms, deals, portfolio companies, and industry/economy as the key factors influencing the choice of add-on acquisitions. We take a further step by investigating the determinants from the perspective of buyout governance model. Along with the increasing criticism and pressure on the traditional value creation mechanisms such as high leverage and incentive alignment, PE firms tend to focus more on their step-in strategies (e.g taking seats on boards). For example, PE firms often go beyond the simple provision of finance and invest their specialised human capital in portfolio firms. Reflected in the governance model, PE directors, who are executives of PE firms and sit on the boards of the portfolio companies, execute monitoring role to address agency issues and advisory role to facilitate strategic decision making (Hillman and Dalziel, 2003; Jelic et al., 2019).

[1] Data for the global deals is from Pitchbook (2018), for early 2018. Data for the European deals is from PE insights (2020), for early 2020.

Closely related study, Jelic et al. (2019), report that specialists (i.e. PE directors) on the boards play a core role to improve portfolio companies' growth performance. We extend their analysis by examining the importance of the specialists' human capital in portfolio companies adopting different value creation strategies. Specifically, we examine task-specific human capital, based on previous working experience, and general human capital based on directors' education.

Specifically, we focuse on the advisory role of PE director in add-on acquisitions. First, we examine whether the presence and degree of PE specialists on the boards increase the probability of add-on acquisitions. Second, we investigate which human capital(s) of PE specialists (financial/operational working experience, MBA degree, Science and engineering degree) play important role(s) when advising add-on acquisitions.

The analysis is based on a hand-collected dataset of 588 UK PE-backed buyouts (primary and secondary) during 2004-2012. We track the performance up to 5 years after buyout transactions thus extending our analysis until 2017. In line with global trends, around 25% of sample buyouts experience add-on(s) during the sample period. On average, the add-on acquisitions occurred within 2 years after buyout transactions. The results are consistent with those of Hammer et al (2017). We identify both financial and operational working experience as important factors for the choice of the add-on transactions. Interestingly, we do not find statistically significant effects of university degrees for the likelihood of add-ons. We find overwhelming evidence that the presence and representation of PE director(s) on boards significantly increase the probability of add-on acquisitions, suggesting the importance of add-on acquisitions as one PE strategy and the necessity of PE specialists' expertise for the success

of add-on acquisitions. Our results are robust to a number of robustness tests including using alternative measures, alternative model specifications and controls for endogeneity.

Our paper provides several important contributions. First, we extend the small but growing literature on post-buyout add-on acquisitions (Hammer et al., 2017; Bansraj et al., 2020), by exploring the influence of PE directors on add-ons. Our results suggest a strong engagement of PE directors on add-on acquisitions. Second, we add new evidence to the human capital of private equity and venture capital literature (e.g. Dimov and Sherperd, 2005; Bottazzi et al., 2008; Zarutskie, 2010; Jelic et al., 2019). In doing so, we provide the first evidence of how the human capitals of PE specialists associate with acquisition strategy and confirm the differences in strategy focuses due to different human capitals that PE specialists have. Third, our study in acquisition context echoes the call for investigating the advisory role of PE directors by the literature on board of directors (e.g. Jelic et al., 2019).

The remainder of this paper is structured as follows. Section 2 discusses the theoretical framework. Section 3 descripts the data collection and methodology. Section 4 presents the empirical analysis. Section 5 discusses and concludes.

2. Theories and hypotheses development

2.1 PE and acquisitions

Several recent studies examine impact of PE firms on acquisition transactions. For example, Hammer et al. (2017) find that the probability for add-on acquisitions is high if the buyout is sponsored by experienced or reputable PE firm. Humphery-Jenner et al. (2017) find that the PE-backing of acquirer is viewed as a signal of cross-border takeovers quality and will increase the announcement returns of cross-border takeover. Acharya et al. (2013) document that

financial background of PE firms is associated with outperforming deals with add-on acquisitions. The above studies however utilize only PE firm/fund level data without examining composition of boards in portfolio companies. The results and inferences therefore tend to relate to the effects of the collective human capitals without shading light as how individual PE specialists influence specific acquisitions. The above distinction is very important since PE firms usually allocate a subset of PE specialists to manage a specific buyout. Those specialists take board seats, provide monitoring and advise managers in the portfolio companies. As suggested by Jelic et al. (2019), treating the PE firm as homogeneous overlooks the human capital heterogeneity among PE specialists, because individuals' human capitals are likely to be different from the collective human capitals at a PE firm level. Furthermore, the existent studies do not distinguish the monitoring role and advisory role of PE specialists (e.g. Jelic et al., 2019; Meuleman et al., 2009). We therefore know little about how exactly PE specialists advise and impact their portfolio companies' decision-making. Add-on acquisitions provide an opportunity to examine such influence.

2.2 PE directors and add-on acquisitions

Although overseeing management has always been viewed as the primary responsibility of the board, the literature emphasises the importance of the advisory role of the board of directors on M&A and other corporate decisions (e.g. Adams and Ferreira, 2007). Recent empirical evidence from the acquirer perspective suggests that during the takeover process, the board also add value through its advisory role (Hunag et al., 2014; Field and Mkrtchyan, 2017).

According to strategic entrepreneurship perspective, the advisory role of boards is especially important for buyouts, when buyouts are looking for growth/expansion opportunities. PE directors could be ideal for the advisory role when facilitating exploitation of the growth

opportunities via their complementary resources and capabilities to inside managers (Wright *et al.*, 2000; Meuleman *et al.*, 2009; Jelic *et al*., 2019). Acquisitions as one of the main growth strategies may be affected largely by PE directors and their expertise.

Therefore, we conjecture that PE directors affect a buyout's acquisition decisions and increase the likelihood of acquisition activities. First, add-on acquisition has become an increasingly important value creation strategy appointed by PE firms to their portfolios (Bansraj et al., 2020; Hammer et al., 2017). Incentive-aligned with their home firm, PE directors are highly likely to advise add-on acquisitions, together with other strategies, to largely create value and achieve higher investment returns. Second, PE directors usually have extensive experience on acquisition transactions. Harford and Schonlau (2013) suggest that in the case of acquisitions, prior acquisition experience is more important than ability. Field and Mkrtchyan (2017) also confirm the positive effect of director acquisition experience on the follow-up acquisition activities. In buyout context, the acquisition experience will help PE directors to access a larger deal flow and assist the managers in identifying potential targets (Meuleman et al., 2009; Hammer et al., 2017). PE directors may also contribute to acquire at less transaction costs, negotiate a better acquisition, and integrate add-ons faster (Hammer et al., 2017). Hence,

Hypothesis 1: Having (more) PE director (s) on board will significantly increase the probability of making post-buyout add-on acquisitions than others.

2.3 Human capital of PE directors and add-on acquisitions

Grounded in strategic entrepreneurship perspective, human capital is the cornerstone of seeking growth opportunities. The human capitals of directors shape their advice on strategical decisions (e.g. de Villiers, Naiker and van Staden, 2011). Human capital resources have been

found to be particularly central to acquisition decision due to the importance of knowledge and experience in the taking over process making (Field and Mkrtchyan, 2017; Huang et al., 2014; Cai and Sevilir, 2012; Bazel-Shoham et al., 2020; Basuil and Datta, 2017). In this study, we examine the effect of two types of human capital that PE specialists usually have: task-specific human capital based on previous working experience and general human capital based on education.

Gibbons and Waldman (2004) posit that skills accumulated from individual job or industry should be useful for high-level tasks (e.g. business strategy), regardless of firms that the worker is employed for. Following Archarya et al. (2013), we choose two most common working experience that PE specialists have before joining PE industry: financial (e.g. ex-accountant, ex-financial controller, ex-banker) and operational experience (e.g. management consulting, entrepreneur, operation, marketing).

PE directors with financial working experience can affect the add-on in two ways. First, PE directors' financial background usually link to Big Four and investment banks where M&A is one major activity. They may have learned extensive M&A skills via their banking or accountant firm experience before joining PE industry (e.g. Archarya et al., 2012). These skills in turn help PE specialists to assist the targets identification/valuation and negotiation process. Second, the financial experience is particularly important when the buyouts need additional capital to finance the add-on, since these PE specialists have built up a network with banks/investors through previous financial working.

Different from financial experience, PE directors with operational experience are usually sophisticated participants in specific industry and top management team (Jelic et al., 2019).

First, they are likely to develop deeper knowledge on specific industry dynamics and industry conditions (Kor and Sundaramurthy, 2009; Kor & Misangyi, 2008). Such knowledge will enable them to be in a better position to detect emerging opportunities (Castanias & Helfat, 2001) and evaluate acquisitions decisions more objectively and knowledgably (Le et al., 2013); hence have better advice on potential acquisitions (Basuil and Datta, 2017). As such, the uncertainty of acquiring firms due to insider managers' limited knowledge may be mitigated and the acquisition may be more likely to be successful. Second, the PE directors with operational experience are likely to have a broader strategic concern (Krause et al., 2013) and superior general skills and capabilities of running a business and making suitable strategic decisions (Kang et al., 2018). This may enhance the collaboration between the board and top managers and hence improve the success and efficiency of making acquisition decisions (Kor and Misangyi, 2008). Hence,

Hypothesis 2: Companies having (more) PE director(s) with (a) financial experience and (b) operational experience will be more likely to make post-buyout add-on acquisitions than others.

The education is thought to shape directors' cognition and decision-making process in a more general way (Dimov and Shepherd, 2005), because education is typically an intense and formative experience for individuals' thinking styles and worldview (Schein, 1967; Pascarella et al., 1987). We examine two most distinctive education backgrounds in PE sector: high-level business education (MBA) and science and engineering degree.

PE directors with MBA degree are more responsive to the complexity and uncertainty of the companies and markets and the presence of growth opportunities (Bertrand and Schoar, 2003); and hence may be more likely to make add-on acquisitions. Furthermore, research finds that

MBA graduates closely follow academic theories that they have learned in business schools in their later career (Priem and Rosenstein, 2000). As such, MBA education has significant impact on corporate acquisition (Jung and Shin, 2019). Scherer (2006) also suggests that the incorporation of M&A into MBA curriculums equips students with merger-making theories and fosters an attitude that sustains and encourages vigorous merger activity. In addition, the superior social network from MBA study enable PE directors to be more capable of pursuing acquisitions (Palmer and Barber, 2001). Hence,

Hypothesis 3 (a): Companies having (more) PE directors with MBA degree will be more likely to make post-buyout add-on acquisitions than others.

Education in science and engineering does not directly relate to the add-on acquisition but may still affect the possibility of making it. Having more general knowledge in science and engineering may focus more on the organic growth through improving underlying product and technological advance (Dimov and Shepherd, 2005; Zarutskie, 2010). The PE directors with such degree may tend to advise increases in the expenses on technology or product improvement (e.g. R&D). As a result, financing acquisitions may become less likely. For example, Bloningen and Taylor (2000) documented a significantly negative relation between R&D investments and the probability of engaging in M&A. Furthermore, compared with others, PE directors with science and engineering educational background tend to not have cognition and skills on M&A decision making; hence maybe not focus on acquisition opportunities even though the opportunities are new technological acquisition. For example, Bottazzi et al. (2008) find that venture capital firms with strong science education tend to pursue a strategy of focusing on pre-investment screening rather than post-investment engagement. Thus,

Hypothesis 3 (b): Companies having (more) PE directors with science and engineering degree will be less likely to make post-buyout add-on acquisitions than others.

3. Data and methodology

3.1. Data and sample

Our analysis employs data from different sources. Zephyr and the Centre for Management Buyout Research (CMBOR) database are used to identify all UK primary and secondary buyouts from 2004-2012, respectively. We stop at 2012 to allow us to track the add-on acquisitions up to 5 years after buyout transactions (i.e. until 2017). Data on PE backing and PE firm's entry and exit dates is obtained from Thomson One Banker, Zephyr, and CMBOR. Accounting information is collected from FAME.

We gather information for all completed acquisitions undertaken by buyouts under PE ownership till 2017 from Zephyr.[2] Zephyr is reliable database extensively used in PE (e.g. Hammer et al. 2017; Wang, 2012) and M&A literature (e.g. Erel et al., 2015; Karolyi et al., 2015). As we focus on add-on acquisition strategy, we excluded transactions where two companies are merged to a new entity.

We manually identify the board compositions and biographical information for each PE director from buyout transaction year up to 5 years after transactions. To do so, we combined sources including Fame, Thomson One Banker, Zephyr, deal announcements, Bloomberg professional, PE firms' websites, Linkedin, and Zoominfo. We then match add-on acquisitions with PE director(s) to make sure PE director (s) are on board before the completion date of

[2] In order to rule out the possibility of missing data in Zephyr, we (randomly) cross-checked Zephyr's data with the information in LexisNexis, Google News. We further cross-checked Zephyr' data with data available on websites mentioned in Hammer et al. (2017). After the cross-checks we were satisfied that Zephyr covers all deals mentioned in the above databases.

add-on acquisition[3]. We obtained a final sample of 588 UK PE-backed buyouts (primary and secondary) with 297 add-on acquisitions.

Table 1 lists the distribution of buyouts entry, exit and post-buyout add-on acquisitions across the years. Out of 588 sample buyouts, 456 buyouts (77.6%) have exited by the end of 2017. 149 (25.3%) have experienced add-on acquisitions during the sample period. The number of add-on acquisitions increases from 2004 to 2008, then decreases in 2009 due to financial crisis, before recovering and receiving the highest number in 2011. Notably, the effect of financial crisis on add-on acquisition activity is less severe than that on buyouts, which is consistent with the finding of Hammer et al. (2017), using a global sample.

Insert Table 1 Here

3.2 Variables

We measure the probability of add-on acquisition activity using a dummy variable (*Add-on dummy*) that equals one if a buyout undertakes at least one acquisition in a given year, and zero otherwise. We construct two variables to capture the incidence and degree of the involvement of PE specialist(s) on board. The dummy variable (*d_PED*), which takes one if a board has at least one PE specialist and zero otherwise, captures the incidence of PE involvement. The percentage of PE directors on the board (*pc_PED*) measures the degree of PE involvement. The *pc_PED* ratio assumes that the greater fraction of PE directors, the greater their influence on corporate decision making.

Our human capital variables are measured based on biographical information. As in Jelic *et al.* (2019), Degeorge, Martin and Phalippou (2016) and Acharya *et al.* (2013), we identify each PE director for whether s/he had worked in finance, accounting, or banking (financial

[3] Buyouts usually do not change PE directors until exits.

experience) or whether s/he had worked in industry or management consulting (operational experience) before joining PE industry. For MBA education, we identify each PE director for whether s/he holds an MBA. For science and engineering degree, we identify each PE director for whether s/he holds a science or engineering degree. Similarly, we investigate the presence and degree of human capitals on board. The presence is measured as a categorical variable equaling one if one or more PE directors poses relevant financial working experience (*d_Finance),* operational working experience *(d_Operation*), MBA degree (*d_MBA*) or Science and engineering degree (*d_Science*), zero otherwise. The degree is measured by calculating the percentage of PE directors with financial experience (*pc_Finance*), operational experience (*pc_Operation*), MBA degree (*pc_MBA*), and Science degree (*pc_Science*) on the board.

We control for a number of known determinants of the probability of acquisitions following the literature (e.g. Huang et al., 2014; Hammer et al., 2017; Asquith, Bruner, and Mullins, 1983; Harford, 1999). First, since corporate governance quality will affect the strategical decisions, we include two board variables to measure the corporate governance quality: board size (*LNBS*) and the percentage of non-executive directors (*pc_NED*). Second, we control for a set of variables regarding the portfolio company's characteristics. We control for sales growth (*Salg*), as fast-growing companies may have more ambitious growth strategies and hence are more likely to engage in acquisitions to expand the businesses. High leverage may constraint the acquisition activities, so we include leverage (gearing). We also include companies' previous acquisition experience (*Prior_ACQ*), as companies with more prior acquisition experience are more likely to continue with acquisitions. Older and larger companies are more likely to acquire other (smaller and younger) companies, therefore, we include company size (*Size*) and age (*Age*).

Third, we control for some buyout characteristics. We include buyout types (*BOTY*) to control for the managerial ownership/management participation. Management buyout may reduce the acquisition probability because of improved governance. One the other hand, the enhanced entrepreneurial management practices of management buyout may increase the acquisition probability. Syndicated deals may be less likely to acquire other business due to high syndication costs during the acquisition process, hence, syndication (*Syndication*) is controlled. We control for PE firm's reputation (*Top10*), as highly reputed PE firms have a broader set of investment opportunities and hence increase the acquisition possibility. Secondary buyout (*SBO*) may have different value creation strategies that may affect the build-and-built strategy. All variables are defined in Appendix 1.

3.4 Baseline model

The panel data we use include both time-series and cross-sectional variations in the presence and fractions of PE directors and their human capitals on the board, add-on acquisitions and some time-variant control variables. However, the main source of variation likely comes from the cross section because our sample consists of 588 buyouts, but only 5 years (or less) post-buyout transactions. The disproportionately large number of buyouts in the cross section compared with the number of years suggests that cross-sectional variation in board composition across firms dominates its variation over time. Moreover, many buyouts in our sample experienced little temporal changes in board composition during the PE ownership. For example, the average percentage of PE directors changes by 0.0035 from year to year. There are 246 sample buyouts (41.84%) whose fraction of PE directors did not change during three years after buyout transactions.[4] Furthermore, there are 489 sample buyouts that did not change

[4]We select 3 years because the majority of add-ons happened within 3 years after buyout transactions.

the (representation) PE directors. The lack of within-firm variation works against finding a significant relation between PE board representation and add-on in firm fixed effects regressions (Zhou, 2001). For these reasons, we estimate pooled Probit regression using *add-on dummy* as dependent variable with year and industry effects fixed and robust standard errors clustered at firm level. [5]

$$Add-on\ dummy_{i,t} = \alpha + \beta_1 d\_PE_{i,t} + \beta_2 LNBS_{i,t} + \beta_3 pc\_NED_{i,t} + \beta_4 Size_{i,t} + \beta_5 Age_{i,t} + \beta_6 salg_{i,t} + \beta_7 BOTY_i + \beta_8 Syndication_i + \beta_9 TOP10_i + \beta_{10}\mathrm{SBO}_i + \beta_{11} Prior\_ACQ_i + \beta_{12} gearing_{i,t} + Year\ dummies_i + Industry\ dummies_i + \varepsilon_{i,t} \quad \text{Eq.(1)}$$

$$Add-on\ dummy_{i,t} = \alpha + \beta_1 d\_Finance_{i,t} + +\beta_2 d\_Operation_{i,t} + \beta_3 d\_MBA_{i,t} + \beta_4 d\_Science_{i,t} + \beta_5 LNBS_{i,t} + \beta_6 pc\_NED_{i,t} + \beta_7 Size_{i,t} + \beta_8 Age_{i,t} + \beta_9 salg_{i,t} + \beta_{10} BOTY_i + \beta_{11} Syndication_i + \beta_{12} TOP10_i + \beta_{13}\mathrm{SBO}_i + \beta_{14} Prior\_ACQ_i + \beta_{15} gearing_{i,t} + Year\ dummies_i + Industry\ dummies_i + \varepsilon_{i,t}$$
Eq. (2)

$$Add-on\ dummy_{i,t} = \alpha + \beta_1 pc\_PE_{i,t} + \beta_2 LNBS_{i,t} + \beta_3 pc\_NED_{i,t} + \beta_4 Size_{i,t} + \beta_5 Age_{i,t} + \beta_6 salg_{i,t} + \beta_7 BOTY_i + \beta_8 Syndication_i + \beta_9 TOP10_i + \beta_{10}\mathrm{SBO}_i + \beta_{11} Prior\_ACQ_i + \beta_{12} gearing_{i,t} + Year\ dummies_i + Industry\ dummies_i + \varepsilon_{i,t} \quad \text{Eq.(3)}$$

$$Add-on\ dummy_{i,t} = \alpha + \beta_1 pc\_Finance_{i,t} + +\beta_2 pc\_Operation_{i,t} + \beta_3 pc\_MBA_{i,t} + \beta_4 pc\_Science_{i,t} + \beta_5 LNBS_{i,t} + \beta_6 pc\_NED_{i,t} + \beta_7 Size_{i,t} + \beta_8 Age_{i,t} + \beta_9 salg_{i,t} + \beta_{10} BOTY_i + \beta_{11} Syndication_i + \beta_{12} TOP10_i + \beta_{13}\mathrm{SBO}_i + \beta_{14} Prior\_ACQ_i + \beta_{15} gearing_{i,t} + Year\ dummies_i + Industry\ dummies_i + \varepsilon_{i,t}$$
Eq. (4)

For robustness tests, we also examine Poisson and Tobit regressions using *Add-on count* as dependent variable. The unreported results are consistent[6].

4. Empirical analysis

4.1 Descriptive statistics

[5] Celikyurt et al. (2014) also adopted a pooled Probit regression.
[6] Unreported results are available from the authors unpon request.

Table 2 presents the summary statistics of our add-on characteristics. 22.8% (25.3%) of sample buyouts have at least one add-on acquisition within 3 (5) years after buyout transactions. There is an average of 0.412(0.505) add-ons per buyout within 3(5) years after buyout transactions. In terms of timing, buyouts tend to make first add-on acquisitions after about 1.63 years. On average, buyouts with only one add-on make their acquisitions after 1.98 years (about 2 years), while buyouts with multiple add-ons make their first acquisitions quicker, after 1.12 years. These results are again consistent with those of Hammer et al. (2017).

Insert Table 2 Here

Table 3 presents the descriptive statistics of all other variables (Panel A) and correlation matrix (Panel B). Majority of sample companies (71.8 % of firm-year observations) have at least one PE director on board. PE directors with financial experience are present on boards of 57.2% of sample companies. The percentage for directors with operational experience is 24.8%. The percentages for directors with MBA and science degrees are similar (22.6% and23.1%, respectively). We also find that 56% sample buyouts are management buyins whilst 27.2% are secondary buyouts. Only 12% of sample buyouts are syndicated deals.About 10% of sample buyouts are backed by reputable PE firms. 12.8% sample companies have acquired other businesses before buyouts. The correlation matrix of Panel B does not suggest any major multicollinearity issues.

Insert Table 3 Here

4.2 Regression results

Table 4 presents our baseline Probit regression results. Model 1 and 2 are results of the effect of the incidence of PE directors and their human capitals using *d_PE* for Model 1 and *d_Finance, d_Operation, d_MBA, d_Science* for Model 2*;* whereas Model 3 and 4 are results of the effect of the degree of PE directors and their human capitals, using *pc_PE* for Model 3 and *pc_Finance, pc_Operation, pc_MBA, pc_Science* for Model 4.

Regarding the effect of PE directors on add-on acquisition, the coefficient on *d_PE* (Model 1) is 0.286 and statistically significant at 5% level. Drawing on the marginal effects, buyouts with PE directors on the board are 3.8% more likely to make at least one acquisition than other buyouts.[7] This magnitude is substantial because add-on acquisitions constitute of about 7.8% firm-year observations in the regression.[8] Furthermore, Model 3 shows a positive and significant coefficient on *pc_PE* (coefficient=0.412; z-stat= 0.200). Using marginal effect, one unit increase in the percentage of PE directors will increase the likelihood of add-on transaction by 5.5%. In line with hypothesis 1, the presence of PE directors improves the likelihood of post-buyout add-on transactions.

Insert Table 4 Here

Considering the impact of the previous working experience of PE directors on add-on acquisitions, Model 2 shows that coefficients for *d_Finance* (coefficient=0.281; z-stat=0.101) and *d_Operation* (coefficient=0.204; z-stat=0.103) are positive and statistically significant at 1% and 5% level, respectively. Using marginal effects, buyouts with PE directors who have previous financial (operational) working experience are 3.8% (2.8%) more likely to have at least one acquisition than others. The positive and significant coefficients on *pc_Finance* and *pc_Operation* confirm these findings. Hence, Hypothesis 2 is supported.

Regarding the education, our results on Model 3 and 4 do not show significant effect of MBA degree on add-on acquisitions; hence does not support Hypothesis 3 (a). We also find little

[7] All marginal effects are excluded owing to brevity concerns but are available from the authors upon request.
[8] Unreported results show that when using the number of add-ons (*Add-on count*) as dependent variable, buyouts with PE directors have 1.54 more add-ons than those without PE directors.

evidence to support Hypothesis 3 (b). For instance, Model 4 show that the coefficient of *pc_Science* (coefficient=-.0850; z-stat=0.391) is negative and statistically significant at 5% level, implying the more PE directors with science and engineering degree on the board will reduce the probability of acquiring other businesses.

As to control variables, syndication is significantly and negatively associated with add-on probability, suggesting that potential increase in syndication costs will impede add-on activity. This result is consistent with that found by Hammer et al. (2017). We also find that previous acquisition and company size are significantly and positively associated with add-on probability.

5. Other robustness tests

5.1 Heckman model

PE directors may be not randomly appointed to the board. Rather, the involvement of PE directors may be related to the pre-determined buyout add-on strategy on buyout transaction. In this case, the link between PE directors and add-on probability may not be a casual effect. To address this issue, we employ Heckman two-stage model (Heckman, 1979). In the first step, we estimate a probit regression with cluster variance estimate for the probability of having PE specialists on the board, using *d_PE* as dependent variable. Following Jelic et al. (2019) and Chahine et al. (2012), we include the following variables that are identified as determinants of a buyout having PE director (s): the location of buyout's headquarter (*London*), Board size (LNBS), percentage of non-executive directors (pc_NED), firm size (Size), firm age (Age), buyout types (BOTY), syndication (Syndication), PE reputation (Top10), Secondary buyout (SBO), leverage (Gearing). The estimated probability of having PE director(s) (*Lambda*) is then included in the second step probit regression to correct for potential sample selection bias.

The results are presented in Table 5. Although the instrumental variable (*Lambda*) is statistically insignificant in Models 1 to 4, the coefficient on *TOP10* in all models turn to be significant, providing some evidence on the existence of selection bias. However, the coefficients for all variables of interest are remain economically and statistically consistent with our main results in Table 4, except for that on *pc_PE* in Model 3.

Insert Table 5 Here

5.2 Propensity score matching (PSM)

To further address potential endogeneity issues, we also employ PSM. PSM allows us to identify a control sample of buyouts without PE directors and that exhibit no observable differences in characteristics pertaining to buyouts with PE directors. Thus, each pair of matched buyouts is almost indistinguishable from one another except for PE directors.

To do this, we first use a probit model and estimate the probability (i.e. the propensity score) that a buyout has at least one PE director as a function of all control variables in the baseline regression. The probit regression results are reported in Model_1 of Table 6 Panel A. Buyouts with PE directors (i.e., the treatment group) are then matched with those without PE directors (i.e., the control group) based on the nearest neighbour technique. If a buyout without PE directors is matched to more than one buyout with PE directors, we use only the pair for which the difference between the propensity scores of the two firms is the smallest.[9] To ensure

[9] We perform 1-to-1 matching without replacement, because most of buyouts (72.6%) in our sample have at least one PE director. If we allow for replacement, then over half of the buyouts in the control group (61.0%) are matched to more than one buyout in the treatment group.

sufficient matching, the maximum difference in the propensity scores between each pair is required not exceeding 0.1% in absolute value.

Insert Table 6 Here

We employ two diagnostic checks. First, we re-estimate the probit model with the matched sample. The result reported in Model_2 of Panel A shows that none of the coefficients is significant. The coefficients and the pseudo R-square of Model_2 are much lower than those of Model_1 in magnitude. Second, we examine the difference in means for each observable characteristic between the two groups. The results in Panel B show that none of the differences is significant. Taken together, the two diagnostic tests suggest that the PSM removes all other observable differences and the treatment and control groups in our matched sample are indistinguishable. Therefore, the difference in the probability of add-on acquisitions between the treatment and control groups is only due to the presence of PE directors on boards.

Finally, the impacts of the presence of PE directors and their human capitals on the probability of add-on acquisitions using the matched sample are reported in Models 3-4 of Panel A of Table 6.[10] Consistent with our previous results, the coefficients on *d_PE*, *d_Finance* and *d_Operation* are positive and statistically significant. Interestingly, the coefficients on *d_MBA* is significantly and negatively associated with *Add-on dummy*. Overall, our main results that the presence of PE directors and PE directors with financial and operational experience increase the probability of making post-buyout add-on acquisitions remain.[11]

5.3 Cross-sectional regression

[10] The number of observations in Models 3-4 of Panel A are less than that in Model 2, because a few observations are not used due to collinearity when industry fixed effects are included in the regressions.
[11] We also use median of *pc_PE* to run PSM test for the effect of the fractions of PE directors and human capitals. The unreported results are generally consistent.

As described in Section 3.4, the incidence of PE directors and their human capitals tend to not change during the first three years after buyout transactions. Furthermore, the majority add-on transactions are made during the first three years. Therefore, we also examine the hypotheses during the first three years after buyout transactions. In doing so, we also solved the concern that same PE directors are on the board for 3 or more years but only take add-on in one year and no add-on in the other years.

The dependent variable is a dummy variable that takes 1 if the buyout has at least one add-on acquisition within three years after buyout transaction and 0 otherwise. As to the independent variables, we use the values in the first year after buyout transaction. Notably, the independent variables of interest are *d_PE, d_Finance, d_Operation, d_MBA, and d_Science*. The results, presented in Table 7, show consistent results as our baseline results. Since the percentage of buyouts with add-on increases to 22.8%, the marginal effects of PE director variables also increase. For example, the marginal effect of *d_PE* is 10%, suggesting that buyouts with PE directors on board are 10% more likely to take add-on that buyouts without PE directors.

Insert Table 7 Here

6. Conclusion

This is, to the best of our knowledge, the first paper examining the role of PE directors in M&A transactions in a UK buyout sample. We make several contributions to the literature.

First, we add to the literature on the post-buyout add-on acquisitions (Hammer et al., 2017; Bansraj et al., 2020) by examining the effects of PE directors' human capital. Contrary to other related studies, we utilize portfolio company level data. We find strong evidence that both the

incidence and degree of representation of PE directors on boards significantly increase the probability (and number) of add-on acquisitions during the PE holding period. This implies the importance of PE firms' activism (e.g. taking seats on board) for post-buyout strategies (e.g. add-on). Our findings on the heterogeneity of PE specialists highlight importance of utilizing portfolio company level rather than (aggregate) PE firm level data in this context.

Second, we shed more light on on the importance of human capitals of PE firms/specialists by providing novel evidence on their influence on the choice of PE firms' portfolio specific strategic decisions. Our findings suggest different focuses/capabilities of PE directors based on their human capitals. For example, we find that both previous financial and operational working experience increase the probability of post-buyout add-on acquisitions. The insignificant result on MBA education background is surprising. One explanation could be that PE specialists with MBA degree mainly focus on organic growth (e.g. Jelic et al., 2019). It could also be that the shifting from diversification strategy advocate to agency-theoretical-logic in MBA education after 1970s causes that MBA graduates in recent decades are less likely to support diversifying acquisitions (Jung and Shin, 2019). The weak evidence of the negative effect of science and engineer degree is in line with evidence that venture capital firms with strong science education tend not to be active after investment (Bottazzi et al., 2008). This evidence further highlights the importance of appointing suitable expertise to the portfolios (Jelic, et al., 2019). Finally, we provide new evidence to board literature by exploring the advisory role of PE directors on the strategic decision-making of portfolio companies.

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Table 1 Sample distribution

This table presents the distribution of buyouts and add-on acquisitions by year. Numbers (in parentheses) represent the number of buyout entries (exits) in the respective year or the number of add-on acquisitions.

Year	All deals		Deals with add-on		Deals w/o add-on		Add-acquisitions	
	N	%	N	%	N	%	N	%
2004	72(-)	12.24(-)	13(-)	8.72(-)	59(-)	13.44(-)	3	1.01
2005	64(-)	23.13(-)	10(-)	6.71(-)	54(-)	12.3(-)	12	4.04
2006	93(8)	38.95(1.75)	24()	16.11()	69(8)	15.72(2.33)	17	5.72
2007	102(29)	56.29(6.36)	21(5)	14.09(4.46)	81(24)	18.45(6.98)	22	7.41
2008	58(22)	66.16(4.82)	16(2)	10.74(1.79)	42(20)	9.57(5.81)	32	10.77
2009	27(22)	70.75(4.82)	4(6)	2.68(5.36)	23(16)	5.24(4.65)	22	7.41
2010	60(34)	80.95(7.46)	21(5)	14.09(4.46)	39(29)	8.88(8.43)	30	10.10
2011	53(35)	89.97(7.68)	16(6)	10.74(5.36)	37(29)	8.43(8.43)	49	16.50
2012	59(51)	-(11.18)	24(13)	16.11(11.61)	35(38)	7.97(11.05)	37	12.46
2013	-(53)	-(11.62)	-(13)	-(11.61)	-(40)	-(11.63)	35	11.78
2014	-(75)	-(16.45)	-(17)	-(15.18)	-(58)	-(16.86)	20	6.73
2015	-(60)	-(13.16)	-(20)	-(17.86)	-(40)	-(11.63)	10	3.37
2016	-(38)	-(8.33)	-(15)	-(13.39)	-(23)	-(6.69)	5	1.68
2017	-(29)	-(6.36)	-(10)	-(8.93)	-(19)	-(5.52)	3	1.01
Total	588(456)	100(100)	149(112)	100(100)	439(344)	100(100)	297	100

Table 2 Summary statistics of add-on characteristics

This table presents the summary statistics of add-on characteristics. *Add-on dummy* indicates whether the buyout has at least one add-on acquisition within 3 years or 5 years or in a given year after buyout transaction. *Add-on count* is the number of add-on acquisitions within 3 years or 5 years or in a given year after buyout transaction. *Time to add-on acquisitions* shows the number of years from buyout date to add-on acquisition date. Single add-on only means there is only has on add-on acquisition during PE holding period; whereas multiple add-ons means there are more than one add-ons during PE holding period.

Variable	N	Mean	SD	Q1	Median	Q3
Add-on dummy						
within 3 years after buyout	588	0.228	0.42	0	0	0
within 5 years after buyout	588	0.253	0.435	0	0	1
in a given year	2781	0.081	0.272	0	0	0
Add-on count						
within 3 years after buyout	588	0.412	1.044	0	0	0
within 5 years after buyout	588	0.505	1.298	0	0	1
in a given year	2781	0.105	0.408	0	0	0
Time to add-on acquisitions (in years)						
Single and multiple add-ons	149	1.626	1.222	0.616	1.304	2.307
Single add-on only	88	1.98	1.273	1.105	1.755	3.021
Multiple add-ons only	61	1.117	0.941	0.479	0.756	1.573

Table 3 Summary statistics of other variables

This table presents the summary statistics of all independent variables (Panel A) and correlations (Panel B). The definitions are presented in Appendix 1.

Panel A Summary statistics

	N	Mean	SD	Q1	Median	Q3
Time variant variables						
d_PE	2781	0.718	0.45	0	1	1
pc_PE	2781	0.244	0.215	0	0.222	0.375
d_Finance	2629	0.572	0.495	0	1	1
d_Operation	2629	0.248	0.432	0	0	0
d_MBA	2629	0.226	0.418	0	0	0
d_Science	2629	0.231	0.421	0	0	0
pc_Finance	2629	0.162	0.192	0	0.143	0.25
pc_Operation	2629	0.057	0.118	0	0	0
pc_MBA	2629	0.054	0.124	0	0	0
pc_Science	2629	0.051	0.111	0	0	0
LNBS	2781	1.53	0.46	1.386	1.609	1.792
pc_NED	2781	0.125	0.149	0	0.111	0.2
Age	2781	2.874	0.692	2.398	2.833	3.332
Size	2762	9.993	1.62	8.952	9.914	11
Gearing	2566	1.551	10.056	0.097	0.434	1.434
Salg	2481	0.034	0.387	-0.035	0.069	0.168
Time invariant variables						
BOTY	588	0.560	0.497	0	1	1
Syndication	588	0.119	0.324	0	0	0
TOP10	588	0.099	0.298	0	0	0
SBO	588	0.272	0.445	0	0	1
Prior_ACQ	588	0.128	0.445	0	0	0

Panel B Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
(1) Add-on dummy	1.000																					
(2) Add-on count	0.873***	1.000																				
(3) d_PE	0.021	0.019	1.000																			
(4) pc_PE	0.022	0.018	0.712***	1.000																		
(5) d_Finance	0.057***	0.054***	0.705***	0.577***	1.000																	
(6) d_Operation	0.031	0.018	0.345***	0.367***	0.117***	1.000																
(7) d_MBA	0.028	0.028	0.337***	0.386***	0.236***	0.305***	1.000															
(8) d_Science	0.021	0.023	0.341***	0.337***	0.234***	0.350***	0.281***	1.000														
(9) pc_Finance	0.046**	0.048**	0.496***	0.687***	0.729***	0.094***	0.217***	0.170***	1.000													
(10) pc_Operation	0.014	0.002	0.283***	0.445***	0.076***	0.837***	0.237***	0.298***	0.168***	1.000												
(11) pc_MBA	0.006	0.004	0.270***	0.466***	0.186***	0.268***	0.805***	0.223***	0.281***	0.344***	1.000											
(12) pc_Science	-0.003	-0.001	0.272***	0.358***	0.178***	0.310***	0.237***	0.845***	0.229***	0.407***	0.271***	1.000										
(13)LNBS	0.016	0.012	0.476***	0.102***	0.404***	0.168***	0.196***	0.187***	0.050***	-0.044**	-0.009	0.018	1.000									
(14) pc_NED	0.015	0.025	-0.059***	-0.177***	-0.024	-0.111***	-0.044**	-0.016	-0.057***	-0.142***	-0.063***	-0.044**	0.097***	1.000								
(15) Age	0.013	0.017	-0.077***	-0.026	-0.019	0.043**	-0.020	0.023	0.026	0.055***	-0.024	0.004	-0.036*	-0.010	1.000							
(16) BOTY	-0.076***	-0.090***	-0.034*	-0.179***	-0.085***	-0.032*	-0.196***	-0.103***	-0.159***	-0.066***	-0.186***	-0.088***	-0.014	0.064***	-0.091***	1.000						
(17) Syndication	-0.036*	-0.030	0.059***	0.100***	0.062***	0.038**	0.113***	-0.013	0.051***	0.086***	0.093***	-0.017	0.057***	0.011	0.003	-0.113***	1.000					
(18) TOP10	0.082***	0.085***	-0.101***	-0.039**	-0.074***	-0.015	0.000	-0.023	-0.038**	-0.034*	0.004	-0.011	-0.059***	0.001	0.020	-0.113***	0.036*	1.000				
(19) SBO	0.023	0.028	0.082***	-0.008	0.106***	0.097***	0.050**	0.015	0.030	0.036*	-0.028	0.011	0.213***	-0.047**	-0.065***	0.052***	-0.010	0.012	1.000			
(20) Prior_ACQ	0.298***	0.306***	-0.026	0.034*	0.015	-0.004	0.049**	0.078***	0.053***	-0.023	0.029	0.073***	-0.009	-0.039**	0.001	-0.216***	0.025	0.184***	0.060***	1.000		
(21) Size	0.134***	0.127***	0.053***	0.101***	0.100***	0.057***	0.126***	0.071***	0.073***	0.018	0.055***	0.056***	0.186***	-0.060***	0.180***	-0.343***	0.176***	0.221***	0.169***	0.280***	1.000	
(22) Gearing	-0.008	-0.009	0.000	-0.013	-0.049**	-0.013	0.015	0.017	-0.033*	0.009	0.031	0.031	0.010	-0.002	-0.010	0.003	0.025	0.041**	0.044**	0.002	0.010	1.000
(23) Salg	0.033*	0.032	0.015	-0.001	0.031	-0.006	-0.014	-0.010	0.018	0.000	-0.032	-0.002	0.053***	-0.002	-0.017	0.030	-0.005	0.007	0.037*	-0.006	0.042***	-0.002

Table 4 The effect of PE directors and their human capitals

This table presents the baseline results of the effect of PE directors and their human capital on the probability of add-on acquisitions (*Add-on dummy*). Model_1 and 2 are results using the incidence of PE directors and their human capitals (*d_PE, d_Finance, d_Operation, d_MBA, and d_Science*); whereas Model_3 and 4 are results of using the fractions of PE directors and their human capitals (*pc_PE, pc_Finance, pc_Operation, pc_MBA, and pc_Science*). N reports the number of firm year observations. All regressions are estimated with robust standard errors clustered by firm. Robust standard errors are in parentheses. All variables are defined in Appendix 1. Reported results are based on 99% winsorized data. *** p<0.01, ** p<0.05, * p<0.1

	Model_1	Model_2	Model_3	Model_4
d_PE (pc_PE)	0.286**		0.412**	
	(0.115)		(0.200)	
d_Finance (pc_Finance)		0.281***		0.484**
		(0.101)		(0.204)
d_Operation (pc_Operation)		0.204**		0.898**
		(0.103)		(0.371)
d_MBA (pc_MBA)		0.016		-0.094
		(0.118)		(0.348)
d_Science (pc_Science)		-0.116		-0.850**
		(0.109)		(0.391)
LNBS	-0.050	-0.032	0.066	0.134
	(0.107)	(0.105)	(0.100)	(0.106)
pc_NED	0.117	0.068	0.164	-0.003
	(0.299)	(0.301)	(0.295)	(0.304)
Age	-0.008	-0.010	-0.014	-0.016
	(0.069)	(0.071)	(0.069)	(0.071)
BOTY	0.074	0.098	0.092	0.116
	(0.099)	(0.104)	(0.100)	(0.104)
Syndication	-0.360**	-0.358**	-0.380***	-0.382***
	(0.146)	(0.148)	(0.147)	(0.143)
TOP10	0.180	0.193	0.174	0.179
	(0.140)	(0.143)	(0.140)	(0.142)
SBO	-0.011	0.003	-0.003	0.017
	(0.096)	(0.106)	(0.096)	(0.106)
Prior_ACQ	0.666***	0.633***	0.663***	0.634***
	(0.102)	(0.099)	(0.102)	(0.099)
Size	0.116***	0.115***	0.109***	0.117***
	(0.035)	(0.036)	(0.035)	(0.035)
Gearing	-0.023	-0.018	-0.023	-0.020
	(0.026)	(0.026)	(0.026)	(0.026)
Salg	0.155	0.153	0.156	0.146
	(0.127)	(0.131)	(0.127)	(0.132)
Constant	-3.104***	-2.919***	-3.109***	-2.997***
	(0.578)	(0.584)	(0.581)	(0.592)
Year FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Pseudo R^2	0.162	0.163	0.161	0.163
Wald chi2	217.9***	230.7***	208.0***	227.3***
N	2,349	2,213	2,349	2,213

Table 5 Heckman Model

This table presents the results of Heckman model. In Panel A, the first-stage probit model is a probit regression for the probability of having PE director (s) on board in a given year (*d_PE).* In Panel B, we represent the results of the second stage baseline models. Dependent variable is *Add-on dummy*. Model_1 and 2 are results using the incidence of PE directors and their human capitals (*d_PE, d_Finance, d_Operation, d_MBA, and d_Science*); whereas Model_3 and 4 are results of using the fractions of PE directors and their human capitals (*pc_PE, pc_Finance, pc_Operation, pc_MBA, and pc_Science*). *Lambda* is the fitted probability of having PE director (s) on board, estimated from stage 1. N reports the number of firm year observations. All regressions are estimated with robust standard errors clustered by firm. Robust standard errors are in parentheses. All variables are defined in Appendix 1. Reported results are based on 99% winsorized data. *** p<0.01, ** p<0.05, * p<0.1

Panel A: Stage 1		Panel B: Stage 2				
d_PE		Baseline models	Model_1	Model_2	Model_3	Model_4
London	0.034	d_PE (pc_PE)	0.273**		0.385*	
	(0.134)		(0.113)		(0.204)	
LNBS	1.600***	d_Finance(pc_Finance)		0.286***		0.510**
	(0.139)			(0.099)		(0.209)
pc_NED	-0.991**	d_Operation (pc_Operation)		0.206**		0.919**
	(0.391)			(0.104)		(0.375)
Age	-0.125	d_MBA (pc_MBA)		0.019		-0.129
	(0.091)			(0.118)		(0.356)
BOTY	-0.067	d_Science (pc_Science)		-0.116		-0.865**
	(0.126)			(0.109)		(0.402)
Syndication	0.240	LNBS	-0.550	-0.584	-0.432	-0.441
	(0.189)		(0.356)	(0.361)	(0.361)	(0.364)
Gearing	0.022	pc_NED	0.417	0.400	0.459	0.337
	(0.017)		(0.368)	(0.379)	(0.364)	(0.388)
TOP10	-0.323*	Age	0.022	0.022	0.016	0.018
	(0.167)		(0.071)	(0.074)	(0.071)	(0.073)
SBO	-0.045	BOTY	0.087	0.113	0.104	0.131
	(0.144)		(0.099)	(0.103)	(0.099)	(0.103)
Constant	-1.237***	Syndication	-0.399***	-0.402***	-0.416***	-0.428***
	(0.354)		(0.149)	(0.151)	(0.149)	(0.146)
		TOP10	0.281*	0.302*	0.274*	0.293*
			(0.160)	(0.163)	(0.160)	(0.164)
		SBO	0.007	0.021	0.015	0.035
			(0.097)	(0.106)	(0.097)	(0.106)
		Prior_ACQ	0.667***	0.634***	0.664***	0.635***
			(0.102)	(0.099)	(0.103)	(0.099)
		Size	0.121***	0.121***	0.114***	0.124***
			(0.035)	(0.036)	(0.035)	(0.035)
		Gearing	-0.026	-0.022	-0.027	-0.024
			(0.025)	(0.025)	(0.025)	(0.025)
		Salg	0.147	0.145	0.149	0.136
			(0.126)	(0.130)	(0.126)	(0.131)
		Lambda	-0.605	-0.653	-0.598	-0.691
			(0.433)	(0.437)	(0.440)	(0.448)
		Constant	-2.227**	-1.981**	-2.243**	-2.017**
			(0.874)	(0.885)	(0.881)	(0.904)
		Year FE	YES	YES	YES	YES
		Industry FE	YES	YES	YES	YES
Pseudo R^2	0.216	Pseudo R^2	0.164	0.165	0.162	0.164
Wald chi2	152.5***	Wald chi2	217.5***	227.8***	207.8	219.4
N	2,357	N	2,349	2,213	2,349	2,213

Table 6 Propensity score matching

This table presents the propensity score matching results. Panel A shows the matched sample regression results. Model_1 reports the pre-match propensity score regression and Model_2 reports the post-match diagnostic regression. Model_3 and Model_4 are the results of the effect of incidence of PE directors and their human capitals (*d_PE, d_Finance, d_Operation, d_MBA, and d_Science*) using the matched sample. The dependent variable in Model_1 and Model_2 is the incidence of PE directors (*d_PE*). The dependent variable in Models_3-4 is the probability of add-on acquisitions (*Add-on dummy*). Panel B shows the univariate comparisons of firm characteristics between firms with and without PE directors. The reported values are group means and reported t-statistics is for equality of means in the two groups. All regressions are estimated with robust standard errors clustered by firm. Robust standard errors are in parentheses. All variables are defined in Appendix 1. Reported results are based on 99% winsorized data. *** p<0.01, ** p<0.05, * p<0.1

Panel A

	Pre-match sample	Post-match sample	Matched sample	
	Model_1	Model_2	Model_3	Model_4
	d_PE		*Add-on dummy*	
d_PE			0.396**	
			(0.18)	
d_Finance				0.445**
				(0.19)
d_Operation				0.736***
				(0.21)
d_MBA				-0.432*
				(0.24)
d_Science				-0.312
				(0.23)
lnbs	1.685***	-0.022	0.268	0.311
	(0.082)	(0.19)	(0.22)	(0.24)
pc_NED	-1.099***	0.368	-0.986	-0.773
	(0.215)	(0.49)	(0.61)	(0.61)
age	-0.139***	-0.014	-0.108	-0.134
	(0.049)	(0.12)	(0.13)	(0.15)
BOTY	-0.095	-0.051	0.092	0.064
	(0.072)	(0.17)	(0.17)	(0.19)
Syndication	0.421***	0.062	0.059	0.049
	(0.113)	(0.25)	(0.28)	(0.29)
TOP10	-0.122	0.042	-0.008	0.090
	(0.113)	(0.24)	(0.26)	(0.26)
SBO	-0.0156	-0.017	-0.168	-0.204
	(0.076)	(0.19)	(0.18)	(0.21)
Prior_ACQ	-0.159**	-0.002	0.715***	0.657***
	(0.078)	(0.20)	(0.22)	(0.20)
size	-0.060**	-0.003	0.192**	0.214***
	(0.025)	(0.06)	(0.08)	(0.08)
gearing	0.025*	-0.043	-0.007	-0.018
	(0.014)	(0.04)	(0.06)	(0.06)
salg	-0.042	-0.035	0.106	0.150
	(0.082)	(0.13)	(0.23)	(0.26)
Constant	-1.411	0.487	-2.832***	-3.137***
	(0.387)	(0.82)	(0.84)	(0.88)
Year FE	YES	YES	YES	YES

Industry FE	YES	YES	YES	YES
Pseudo R2	0.251	0.015	0.233	0.256
N	2,349	738	638	599

Panel B: Differences between treatment and control group				
	Treatment group (N=369)	Control group (N=369)	Difference	t-statistics
lnbs	1.424	1.410	0.013	0.455
pc_NED	0.139	0.124	0.015	1.320
age	2.911	2.932	-0.021	-0.402
BOTY	0.539	0.556	-0.016	-0.443
Syndication	0.098	0.087	0.011	0.509
TOP10	0.106	0.095	0.011	0.490
SBO	0.247	0.255	0.008	-0.255
Prior_ACQ	0.098	0.104	0.007	-0.231
size	10.007	10.016	-0.008	-0.077
gearing	1.038	1.219	-0.181	-1.437
salg	0.040	0.045	-0.005	-0.179

Table 7 Cross-sectional regression

This table presents the results using cross-sectional probit model. Model_1 and 2 are results using the incidence of PE directors and their human capitals (*d_PE, d_Finance, d_Operation, d_MBA, and d_Science*); whereas Model_3 and 4 are results of using the fractions of PE directors and their human capitals (*pc_PE, pc_Finance, pc_Operation, pc_MBA, and pc_Science*). Dependent variable is *Add-on dummy*. N reports the number of observations. All regressions are estimated with robust standard errors. Robust standard errors are in parentheses. All variables are defined in Appendix 1. Reported results are based on 99% winsorized data. *** p<0.01, ** p<0.05, * p<0.1

	Model_1	Model_2	Model_3	Model_4
	Add-on dummy			
d_PE (pc_PE)	0.462**		0.976***	
	(0.211)		(0.353)	
d_Finance(pc_Finance)		0.302*		0.382
		(0.161)		(0.414)
d_Operation (pc_Operation)		0.390**		1.191**
		(0.158)		(0.607)
d_MBA (pc_MBA)		0.205		0.601
		(0.162)		(0.630)
d_Science (pc_Science)		-0.232		-0.918
		(0.168)		(0.810)
LNBS	-0.188	-0.193	-0.003	0.045
	(0.202)	(0.192)	(0.179)	(0.180)
pc_NED	-0.057	0.187	0.074	0.090
	(0.484)	(0.479)	(0.491)	(0.486)
Age	-0.030	-0.049	-0.034	-0.059
	(0.100)	(0.101)	(0.100)	(0.100)
BOTY	0.157	0.155	0.207	0.186
	(0.150)	(0.155)	(0.153)	(0.155)
Syndication	-0.562**	-0.644**	-0.626**	-0.650**
	(0.245)	(0.254)	(0.248)	(0.254)
TOP10	0.252	0.242	0.243	0.242
	(0.252)	(0.256)	(0.251)	(0.250)
SBO	-0.047	-0.109	-0.050	-0.077
	(0.164)	(0.161)	(0.164)	(0.162)
Prior_ACQ	2.029***	2.043***	2.039***	2.033***
	(0.386)	(0.396)	(0.381)	(0.387)
Size	0.067	0.059	0.057	0.062
	(0.054)	(0.054)	(0.053)	(0.053)
Gearing	0.020	0.016	0.022	0.009
	(0.036)	(0.036)	(0.036)	(0.036)
Salg	0.013	0.007	0.011	-0.002
	(0.142)	(0.141)	(0.143)	(0.140)
Constant	-1.453**	-1.230*	-1.514**	-1.425**
	(0.715)	(0.718)	(0.712)	(0.713)
Year FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Pseudo R^2	0.297	0.307	0.299	0.299
Wald chi2	94.02	97.51	99.80	99.16
N	537	537	537	537

Appendix 1 Variable definitions

Variable	Definition
Add-on dummy	A dummy variable taking the value of one if a buyout undertakes at least one acquisition in year *t*, and zero otherwise
Add-on count	The total number of acquisitions completed by a buyout in year *t*
Time to add-on acquisitions	The number of days between the buyout date and the first acquisition date divided by 365 days
pc_PED	The number of PE directors divided by the total number of directors on the board in year *t*
d_PED	A dummy variable taking the value of one if a board has at least one PE in year *t*, and zero otherwise
d_Finance	A dummy variable taking the value of one if at least one PE director in year *t* worked in finance, accounting or banking related job before joining PE industry, and zero otherwise
pc_Finance	The number of PE directors worked in finance, accounting or banking related job before joining PE industry, divided by the total number of directors on the board in year *t.*
d_Operation	A dummy variable taking the value of one if at least one PE director in year *t* worked in an industry job that was not finance, accounting or banking related before joining PE industry, and zero otherwise
pc _Operation	The number of PE directors worked in an industry job that was not finance, accounting or banking related before joining PE industry, divided by the total number of directors on the board in year *t.*
d_MBA	A dummy variable taking the value of one if at least one PE director in year *t* holds an MBA degree, and zero otherwise
pc _MBA	The number of PE directors who hold an MBA degree, divided by the total number of directors on the board in year *t.*
d_Science	A dummy variable taking the value of one if at least one PE director in year *t* holds a science or engineering degree, and zero otherwise
pc _Science	The number of PE directors who hold a science or engineering degree, divided by the total number of directors on the board in year *t.*
LNBS	The natural logarithm of the number of directors on board in year *t.*
pc_NED	The number of non-executive directors divided by the total number of directors on board in year *t*
Size	The natural logarithm of total assets in £000 in year *t*
Age	The natural logarithm of one plus the number of years since the firm was incorporated
Gearing	The sum of long-term and short-term debt divided by the total equity in year *t*
SALG	The difference between the firm's sales in year *t* and *t*-1, scaled by the average of sales in years *t* and *t*-1
BOTY	A dummy variable taking the value of one for management buyouts (MBOs), management buy-ins (MBIs) and buy-in management buyouts (BIMBOs), and zero otherwise

Syndication	A dummy variable taking the value of one if the buyout is backed by more than one PE sponsor, and zero otherwise
TOP10	A dummy variable taking the value of one if the lead PE sponsor is in the top 10 list, and zero otherwise
SBO	A dummy variable taking the value of one for secondary buyout, and zero otherwise
Prior_ACQ	The natural logarithm of one plus the number of acquisitions that the firm has made before the buyout event