

Whom to follow: Individual Manager Performance and Persistence in Private Equity Investments

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Reiner Braun

*Technical University of Munich (TUM), Germany**

Nils Dorau

Technical University of Munich (TUM), Germany

Tim Jenkinson

Saïd Business School, University of Oxford, UK

Daniel Urban

Erasmus University Rotterdam, The Netherlands

ABSTRACT

Using a sample of 3,977 individual buyout managers with more than 10,330 deal involvements in 5,030 unique buyout transactions, we investigate individual manager performance and its persistence. We find evidence for deal-level gross PME performance persistence at this level of analysis. In explaining the cross-section of deal returns, the individual is around four times more important than the PE organization. Interestingly, none of the typical human capital variables (age, PE tenure, MBA, Ivy League attendance) has explanatory power in the cross-section of deal returns. Instead, we document that investment performance increases with a manager's industry expertise. As a consequence, we find that individual persistence only exists for managers who stay within a certain industry, whereas it disappears for manager who invest across different industries.

Contact information: Reiner Braun: reiner.braun@tum.de; Nils Dorau: nils.dorau@tum.de; Tim Jenkinson: tim.jenkinson@sbs.ox.ac.uk; Daniel Urban: urban@ese.eur.nl. We thank Michael Ewens and David Yermack as well as conference participants at the 2018 PERC conference for helpful comments.

1 Introduction

Many scholars doubt that performance persistence by financial intermediaries really exists. However, in absence of alternative sources of information, investors still seem to pay attention to past performance when taking investment decisions. In this respect, private equity investors are unlikely to be an exception. However, these investors might have a point because evidence on performance persistence in private equity, consisting of venture capital and buyouts, remains rather inconclusive.

While earlier papers (e.g. Kaplan and Schoar, 2005) found substantial persistence in private equity in general, more recent studies have documented a considerable decline in buyout persistence (Braun, Jenkinson, and Stoff, 2017, Harris et al., 2014). In contrast, venture capital performance persistence remained stable over time (Harris et al., 2014). Related to this, Ewens and Rhodes-Kropf (2015) show that individual managers at venture capital organizations seem to exhibit repeatable skills and to be much more important than the organization itself in explaining the odds of a successful exit. This body of evidence on venture capital raises the question whether performance persistence in buyout still persists at the individual manager level? Maybe the individual is equally important in explaining buyout returns as well. In fact, private equity fund investors seem to care about the individual. For example, it is not rare that managers leave private equity firms, where they learned their profession, to try their luck with their own firm.¹ Apparently, the investors committing capital to such new funds somehow trust the individual manager's track record although she has left the organization where the track record was built. That is why this paper empirically investigates individual manager persistence and the importance of the individual vs. the organization in the cross-section of deal returns.

¹ For example, in September 2017 the Financial Times published an article titled "Ex-KKR dealmaker Dominic Murphy plans €1bn fund".

If we find individual managers to matter, an obvious next question would be *which individual characteristics* matter. Again, a look into venture capital research reveals that an important source of heterogeneity across individual managers is their human capital (Zarutskie, 2010). Therefore, in this paper we go on and empirically investigate whether individuals' human capital can help explaining variance in deal returns.

To shed some light on these questions, we take advantage of a unique dataset of timed gross cash flows at the buyout deal level that was already used for assessing performance persistence at the level of the private equity organization (see Braun, Jenkinson, and Stoff, 2017). The timed gross cash flows allow us to compute exact measures of buyout deal returns before any fees or profit shares. We still think that such exact gross returns at the deal level, we compute KS PMEs in this paper, are ideal to analyse performance persistence.² This feature sets us apart from all other studies on private equity performance persistence.

Starting with this dataset of buyouts, we screened leading commercial databases (Preqin, Pitchbook, MergerMarkets, and VentureSource) and industry directories to identify which private equity managers were responsible for the buyout deals. This procedure yielded a large sample of 10,330 deal involvements of 3,977 individual managers (from 801 different private equity firms) in 5,030 unique buyout transactions. In other words, for each buyout in this sample we can assign at least one manager representing a private equity firm. Once, these individuals were known we collected timed data on their human capital as of the time of the corresponding investment. Equipped with this large and detailed dataset, we run several sets of tests.

First, we start our analysis by following traditional approaches of measuring performance persistence, i.e. by analysing the relationship between adjacent investments of individual private equity managers using a Markov transition matrix. By investment year, we sort the

² Please refer to Braun, Jenkinson, and Stoff (2017) for a detailed discussion of the advantages of using such data in investigating performance persistence in private equity.

managers' deal involvements into performance terciles and explore whether a manager's probability to make the top, middle, or bottom tercile is conditional on her performance in the previous investment. As transition probabilities are shown not to be random, we find first evidence of individual manager persistence.

Second, we investigate individual manager persistence in a regression framework. Conceptually, we replicate the private equity firm-level analysis of Braun, Jenkinson, and Stoff (2017) (but at the individual manager level instead) by regressing the current gross deal PME of any given deal by a manager on the same individual's PME performance in her previous investment. This deal-involvement level analysis offers several advantages compared to the initial transition matrix-based approach. First, by adding private equity firm fixed effects to the model, we control for the organizational environment of the individual managers and show that a certain proportion of individual manager persistence can be attributed to the private equity firm they work at. Further, by including deal-related characteristics, we isolate the impact of the manager's investment style, e.g. related to the timing, the region or the industry of an investment, on the individual persistence we find. The results from this analysis provide support for our initial results. Even if we control for the organizational environment and the manager's investment style, we find strong evidence of individual performance persistence. These results remain unchanged if we do not test the managers' persistence by looking at the relationship between adjacent investments, but instead test the relevance of manager fixed effects.

Third, we test the robustness of our results by addressing three potential biases that might affect the results from our main model. In a first step, we remove unrealized deals from our main sample to deal with the concern that the net asset values, which we observe for not yet fully realized investments, are flawed and affect our results. We re-run the main deal-level gross PME regressions using partially and fully realized deals only, but results remain unchanged. In a second step, as most of the data on managers' involvements in buyout transactions is self-

reported by private equity firms and their managers, we focus on potential concerns regarding data validity and survivorship bias. Given that individual manager assignment to a deal in commercial databases is often self-reported, private equity firms may have an incentive, and the possibility, to manipulate information in their own interest. For example, they may delete certain investments from the firm's and the manager's track records in case of disappointing returns. They might even, to support fundraising activities, assign successful deals in the past, managed by individuals that have left the firm, to managers still with the firm. To address such concerns, we form a subsample of deal involvements identified through a series of book directories. These book directories have published information on manager deal involvements on an annual basis and, in most cases, before the corresponding investments have been exited; thereby not providing the possibility to firms to adjust information conditional on investment success. Furthermore, the subsample's contemporaneous nature helps us to mitigate concerns about any potential survivorship bias because most managers, active at that time, should be listed including those who left the firm or the industry in the aftermath. As before, when re-running the regressions, we do not find support neither for a backfill reporting bias nor for a survivorship bias affecting our results.

Our main persistence analysis suggests that both, individual managers and private equity firms, explain at least some variance in investment performance. Hence, our *fourth* set of tests addresses the importance of the person relative to the firm in explaining cross-sectional differences in deal-level gross PME. Following the approach of Ewens and Rhodes-Kropf (2015), who look at successful exits from venture capital managers, we exploit the feature of our dataset that some managers change their employer, i.e. the employing private equity firm, over time. This is a necessary condition since it enables us to measure the variation in performance which can be explained by the individual manager and by the private equity firm, respectively. In detail, we regress the cross-section of deal PME returns on the group of

managers as well as firm fixed effects. Across different model specifications, and even after including control variables related to different investment styles, we find the individual manager being about four times as important as the private equity firm for explaining the cross-section of deal returns.

Having established the special relevance of the individual manager for explaining returns in private equity, a natural next analysis is to look for individual manager characteristics correlated with investment performance. This is what we do in our *fifth* set of tests. We test whether differences in human capital, measured by the managers' specific investment expertise on the one hand side, and their age at the time of the deal, their general private equity-related experience, their general talent, and educational attainments on the other hand side, explain performance variation across managers' deals. Here, we find that a manager's industry-specific investment expertise increases deal returns, which is in line with prior findings reported by Cressy, Munari, and Malipiero (2007) who document that PE firms' industry specialization portfolio companies' operating performance. Apart from this, we do not find any support of the notion that neither geographic or size-related investment expertise nor age, general private equity-related experience, general talent, or educational attainments matter for investment success.

As managers' industry expertise seems to be an important driver of the cross-section of deal returns, it might also serve as an explanation for the individual performance persistence we documented in the beginning. To test this hypothesis, we split the full sample into adjacent deal involvements according to whether the respective manager switches the target's industry from the previous to the current deal. Interestingly, only if managers stay within a certain industry they show persistence in deal returns. If managers instead drift from one industry to another, there is no evidence of individual performance persistence at all. These findings are robust across different model specification.

When repeating these tests with regard to geographic and size-related investment expertise, we find mixed results.

Overall, the evidence we present suggests that performance persistence persists at the individual buyout manager level. Notwithstanding a decline in persistence at the buyout organization level documented in previous studies, the individual is a relevant determinant in explaining cross-sectional differences in buyout returns. The manager seems to be about four times as important as the organization. Even in the face of increased competition for deals and standardization of processes and terms, some individuals seem to exhibit repeatable investment skill. Indeed, in particular the managers' industry expertise is an important factor not only for explaining differences in the cross-section of deal returns but also for explaining individual persistence.

We structure the remainder of the paper as followed. First, in Section 2, we explain our dataset including a detailed description of how we collected data on managers' deal involvements. Next, in Section 3, we report results from the analyses on manager performance persistence and the robustness tests in Section 3.1 and 3.2, respectively, finally leading to the tests on the relative importance of the manager and the firm in Section 3.3. In Section 4, we question the sources of differences in managers' investment performance and document that managers' investment expertise determines persistence.

2 Data

2.1 Data collection

In order to test for performance persistence of single private equity managers, we need to observe the managers' deal history and the corresponding performance of their investments. For this, we combine a unique proprietary deal database with several commercial databases.

Buyout deal sample

As previous papers (e.g. Braun, Jenkinson and Stoff, 2017, Braun, Jenkinson, and Schemmerl, 2019) we rely on a proprietary deal database of buyout transactions sourced by three large institutional investors. These investors have collected fund- and deal-related data as part of their fund due diligence processes. For all private equity firms in the dataset, we observe their complete investment history across multiple funds.

Apart from fund- and deal-related features, the database provides monthly gross cash flows between funds and their respective portfolio companies from the initial to the final payment. If an investment has not been fully realized at the time of reporting, we observe the latest net asset value. This unique feature of timed cash flow data makes it possible for us to measure gross performance net of fees or transaction costs for every transaction in our database.

Manager deal involvements

To be able to track the investment history of single private equity investment managers, we need to assign individual managers to buyout transactions using information from several public databases.

To construct a comprehensive sample of manager deal involvements in the buyout industry, we combine the data from five major data sources. With data on more than 40,000 total deal involvements of individual managers in buyout transactions between 1970 and 2017, Preqin provides a very extensive starting point for our data collection. In a second step, we enrich the

data by adding manager deal involvements from Pitchbook and MergerMarkets. Similar to Preqin, both databases list leading deal professionals transaction by transaction. Next, we search VentureSource for private equity managers with board memberships at private equity backed firms. Similar to Ewens and Rhodes-Kropf (2015), we interpret a private equity manager having a board seat as being one of the lead investment professional for the corresponding buyout investment. As a final source for expanding our sample of manager deal involvements, we collect data from a series of books called “Who’s Who in private equity”. These industry directories, published annually, list individual investment managers stating their latest deal involvements. In this case, information on deal involvements is collected through an annual survey. Since managers are surveyed frequently, information about deal involvements is usually reported during the holding period and, therefore, in most cases before the corresponding investment has been exited. We will exploit the last source to test the robustness of our results (see section 3.2.2).

As lots of the manager-deal-related information from the five sources, Preqin, Pitchbook, MergerMarkets, VentureSource, and the industry directories, overlaps, we are able to cross-check and validate our data. After matching the data on manager deal involvements to the deal-level cash flow data from our proprietary deal database, the initial sample for our analyses includes 10,330 deal involvements of 3,977 individual managers in 5,030 unique buyout transactions. This means that, on average, 2.05 individual lead managers are assigned to one single transaction. The individual managers split into 801 different private equity firms. Some individual managers changed the private equity firm during the observation period. We exploit this feature of our sample when analysing the relative importance of the individual manager and the private equity firm in section 3.3.

Manager characteristics

To complement our dataset, we add biography data such as information on the managers' gender, date of birth, prior work experience, and course of education. Data is primarily collected from BoardEx, and Capital IQ, but is, if necessary and possible, extended by LinkedIn and manual web search.

2.2 Sample summary statistics

When addressing individual manager performance and its persistence in the following, our main outcome variable throughout the analyses is deal-level gross return. We measure deal performance as the public market equivalent (PME) winsorized at the 99th percentile. In order to determine the PME, we use three regional MSCI indices (Asia, Europe, and North America) in local currency as benchmarks. Table 1 provides descriptive statistics for the sample of unique deals. The median deal performance, measured by PME, equals 1.36 with a median equity investment of 31.43 million USD; investments are held for a median period of 3.67 years. The median performance compares very well with the sample statistics for the entire database (including deals for which individual private equity manager involvements could not be identified). For example, the median gross deal-level PME in Braun, Jenkinson, and Stoff (2017), using this comprehensive sample, is 1.3. Although most of the deals are concentrated around the mid-2000s, the sample spans a range between 1983 and 2013. 3,896, or 77%, of the investments are at partially or fully realized (Panel B). Most of the deals are made in North America followed by Continental Europe and the United Kingdom. Less than 10% are done in Asia, Australia, South America, or other regions (Panel C). As Panel D illustrates, the deals are well distributed across different industry categories.

Moving from deal characteristics to individuals, Panel A of Table 2 shows further statistics of the individual private equity managers in our sample with regard to their gender, their date

of birth, their tenure in the private equity industry, and their course of education. Considering all individuals in our dataset, the average manager does 2.61 deals with a median of 2.00. However, 1,955 managers who represent almost half of our sample, only appear with a single deal. Limiting the sample and restricting it to those managers with at least two deals as Ewens and Rhodes-Kropf (2015), a manager is on average assigned to 4.16 deals with a median of 3.00 (not reported). For venture capital managers, Ewens and Rhodes-Kropf (2015) report an average number of deal involvements of six with a median of four. This difference is in line with findings from Metrick and Yasuda (2010) who show that the number of investments per fund in the buyout industry is substantially smaller compared to venture capital. In detail, the average (median) venture capital fund invests in 24.2 (20) portfolio companies whereas a typical buyout fund does 14.8 (12) investments.

Finally, Panel B of Table 2 reports summary statistics on the manager deal involvement level. Mean and median values of the deal performance strongly resemble those of the unique deals reported in Panel A of Table 1.

3 Performance persistence

3.1 Deal-level persistence of buyout managers

The first main empirical question addressed in this paper is, whether a private equity manager's past investment performance has predictive power for the performance of a manager's future deals. To some extent, we replicate parts of the private equity firm persistence analysis of Braun, Jenkinson, and Stoff (2017) at the individual manager level.

Markov transition matrix

To start with, a very common approach to test for performance persistence is to analyse the relationship between adjacent investments using a Markov transition matrix. The matrix provides information about whether the current deal performance is conditional on the

performance of the previous deal or rather a random draw. Therefore, by investment year we sort all deal involvements according to their performance. For each investment year, we build three performance terciles: a top, a middle, and a bottom tercile. We resort to terciles in order to ensure comparability of our results with previous literature on the matter.

As Table 3 shows, individual managers who had a previous top tercile deal have a probability of 39.4% of making the top performance tercile again with their following investment, whereas the probability to move to the middle or bottom tercile is substantially smaller with 32.4% and 28.2%. We observe the same phenomenon for managers from the middle and the bottom tercile. The probabilities of staying in the same performance tercile with their next investments (37.3%, 37.7%) are substantially higher than moving to one of the other terciles (30.5%-31.8%). The Pearson's chi-square of 71.45 ($p\text{-value} = 0.00$) strongly confirms the first impression and rejects the assumption of random transition probabilities. Hence, we find first evidence of performance persistence of individual managers.

Regression models

In a next step, we use a regression specification with the PME performance of a manager's deal involvement ($n=0$) as the dependent variable. The level of analysis are deal involvements. Standard errors are clustered at the individual manager level. Similar to Braun, Jenkinson, and Stoff (2017), we expect the performance of the previous investment ($n=-1$) of the same manager to have a significant positive impact on the current deal performance. Results from several persistence regression specifications are shown in Table 4. When not including any control variables except for the realization status (thereby attributing the performance implications of investment styles to the individual manager), we find a positive and significant impact of the lagged deal performance of a manager on his current deal performance (Model 1). In economic terms, if the previous deal performance increases by 1%, we would expect the current deal performance to rise by 9.03 basis points.

However, this first result does not necessarily indicate that single private equity managers have a unique feature themselves. It might also be true that a group of managers just benefits from the organizational environment they work in which enables them to outperform peers from other private equity firms. Therefore, in a second model specification we include private equity firm fixed effects. When controlling for the organization of the individual managers, the coefficient drops almost by half, to 0.0489, but remains highly statistically significant. To a certain extent, this supports the intuition that parts of the performance persistence we find is driven by the organizational environment of the managers. However, the positive and significant coefficient of the managers' lagged performance also illustrates that even within a given private equity firm some managers seem to be able to consistently outperform others. Thus, the persistence in performance we find cannot just be explained by the fact that groups of managers benefit from their organizational environment resulting in consistent outperformance relative to managers from other private equity firms.

So far, we only consider the organizational environment as a source of performance persistence of single managers. Still, consistent outperformance of certain managers could also be explained by differences in investment styles. Investing at the right time, the right place, or in the right industry, deal by deal can result in repeatedly outperforming other managers even within the same organizational environment. To control for differences in investment styles, we further include control variables related to the industry, the region, and the investment year into our model. As a consequence, the coefficient of the lagged deal performance drops to 0.0398, but still stays positive and significant at the 5% level (Model 3). Finally, when adding further deal-level controls as the manager deal sequence, the size of the equity investment, and the length of the holding period, the economic size of the coefficient remains robust at 0.0365 and statistically significant at a 5% level (Model 4). In our view, these findings are very strong support for performance persistence at the individual manager level, even if we control for the

organizational environment and deal-level characteristics related to a manager's individual investment style.

Finally, in Model 5 and Model 6, instead of interpreting performance persistence as the relationship between subsequent investments, we take a more general approach and include manager fixed effects. In Model 6, we further keep controlling for the above-mentioned deal-related features. As the F-values of the tests on manager fixed effects of 1.178 (Model 5) and 1.186 (Model 6) are both highly statistically significant at the 1% level, our results support the previous findings from Model 1 to Model 4. Individual private equity managers seem to show a relevant level of heterogeneity in their deal gross PME performance³ which cannot be fully explained by their investment styles, with deal-level-related characteristics as the region, the industry, or the timing of their investments.

3.2 Robustness

Our findings on performance persistence at the individual private equity manager level are very strong. However, the nature of our dataset might come with some weaknesses relevant for this analysis. Therefore, in the following we test the robustness of our results by re-doing the regression analysis, using deal-level gross PME as dependent variable again, but using different subsamples aiming to address concerns arising from (1) different realization status of deals, (2) potential backfill reporting biases and survivorship biases.

3.2.1 Realization status

Many of the deals in the dataset are not exited when the institutional investors perform their due diligence. In this case, we observe the latest net asset value (NAV) at this point in time. However, NAVs in private equity were shown to be flawed (e.g. Barber and Yasuda, 2017, Jenkinson, Sousa, and Stucke, 2013, Brown, Gredil, and Kaplan, 2017). Hence, in Table 5, we

³ We run unreported tests using $\ln(1+\text{PME})$ as dependent variable. The results remain robust.

provide further evidence regarding the robustness of our results by limiting the sample to deals that are at partially or fully realized. First, in Model 1 we only include lagged deal PME performance and realization status as right-hand side variables. The coefficient on lagged PME equals 0.101 which is even slightly higher than in the main sample. It also remains highly statistically significant at the 1% level. If we further add private equity firm fixed effects and control variables as the investment's industry, region, and year, as well as the manager's deal sequence, the size of the equity investment, and the length of the holding period, the persistence coefficient drops to 0.0376. Again, this is similar to the drop in the main sample from 0.0903 to 0.0365 reported in Table 4. The coefficient remains significant at the 10% level. Finally, we test the general persistence specification by looking at manager fixed effects. The corresponding F-value of 1.197 deviates only marginally from the main model (Table 4, Model 6) showing strong statistical significance. Overall, the results from all three model specifications suggest that the results from our main sample are not driven by any structural biases arising from reported net asset values.

3.2.2 Backfill reporting and survivorship bias

As described in section 3.1, our data collection relies on self-reported data by private equity firms. Even public databases such as Preqin or Pitchbook rely on information shared by private equity firms. In this context, concerns about the validity of self-reported data can be twofold. First, private equity firms might try to only report successful deals to public data providers and delete unsuccessful investments from the firms' and their managers' track records. Second, in order to signal team quality to potential investors, firms might have an incentive to retrospectively assign managers still with the firm to prior investments whose managers have left the firm in the meantime.

In both cases, our results could be biased by backfill reporting bias. To address this concern, we build a subsample of deal involvements taken from directory books called "Who's Who in

private equity”. These books collect their data surveying managers on an annual basis, which forces managers to report their current deal involvements before knowing the final deal performance. Such a subsample of deal involvements, assigned to individual private equity managers using ‘contemporaneous’ information, should be practically free of ex-post manipulation, e.g. if an exit has not been successful, and effectively deal with backfill reporting bias.

Further, as in all other studies on performance persistence survivorship can be a major concern to our analysis. If survival of the managers in our dataset depends on their early performance, worse performing managers would drop out quickly. Only relying on lately reported data on manager deal involvements, and thus potentially observing only well-performing, ‘surviving’ managers could lead to survivorship issues in our persistence analysis. As introduced above, again, we can exploit the contemporaneous feature of the data taken from the industry directories “Who’s Who in private equity”. Private equity firms and their managers had to report on their deal involvements not knowing the final outcome of their investments and the managers’ future career paths. As a consequence, whereas poor-performing managers, who might have already left the business, and their investments would potentially not be considered by private equity firms in current publications, they should have been considered in the contemporaneous industry directories of “Who’s Who in private equity”. Therefore, restricting the sample to only those involvements which have been identified using the books will help mitigating concerns not only about potential backfill reporting bias but also about survivorship issues in our sample of managers.

Models 4 to 6 of Table 5 report the results when limiting the sample to such manager deal involvements. In Model 4, the persistence coefficient of lagged performance equals 0.0918. This is statistically significant at the 5% level and just marginally different from the persistent coefficient in our main sample (0.0903). If we add private equity firm fixed effects and deal-

level control variables to the model, the coefficient drops to 0.0312. Although the persistent coefficient in this specification becomes insignificant (t-value: 0.80), the model shows that, in economic terms, it does not differ substantially from the one of the main sample (0.0365). Finally, Model 6 supports the findings of our main sample with the group of manager fixed effects being highly statistically significant at the 1% level (F-value: 1.265). Altogether, these regressions suggest that backfill reporting bias does not drive our results. Again, this also makes us confident that survivorship bias is not a relevant concern in our analysis.

3.3 Relative importance of managers and private equity firms

In our main performance persistence regressions in section 3.1 the coefficient on lagged PME drops substantially, is almost halved, when we add private equity firm fixed effects to our model. However, it still remains statistically significant. This result indicates that both, the individual manager and the private equity firm, contribute to deal performance, resulting in cross-sectional performance differences between managers and firms.

In order to quantify the relative importance of managers and firms in explaining deal performance, we follow the methodological approach initially proposed by Abowd, Kramarz, and Margolis (1999) and redefined by Abowd, Creedy, and Kramarz (2002). Making use of individuals who move between firms, this so called AKM method has been applied to separate individual and firm effects, e.g. with regard to corporate policies, corporate performance, or executive compensation (Bertrand and Schoar, 2003, Graham, Li, and Qiu, 2012). In the investment context, Ewens and Rhodes-Kropf (2015) use the AKM method to disentangle the relative importance of individual venture capital managers from the importance of the corresponding investment firms in explaining venture capital investment outcomes.

Following this AKM methodology, we estimate a model which includes individual manager and private equity firm fixed effects. The fact that some managers from our sample have worked

for different private equity firms throughout their careers and thus have represented different firms in buyout transactions over time enables us to disentangle the individual manager effect from the organizational effect. Similar to Ewens and Rhodes-Kropf (2015), we restrict our estimation sample to those managers with at least four deal involvements in order to accurately identify the fixed effects. Moreover, our estimation sample only includes managers from those firms which have employed at least one moving manager, thereby being connected to each other. In our model specifications, the fraction of movers from the overall group of managers varies between 10% and 12%.

Table 5 reports the results of our AKM estimation with manager and private equity firm fixed effects. As before, the dependent variable is the deal gross performance measured by the PME. Model 1 does not include any control variables except for the realization status of the investment. Both, the manager and the firm fixed effects are statistically significant at the 5% and 10% significance level. At the top, we report the covariance of the deal performance with the manager fixed effect and the firm fixed effect. Whereas 14.7% of variation in the dependent variable is attributable to the group of manager fixed effects, only 4.0% is attributable to the firm fixed effects. Thus, the manager fixed effects explains 3.7 times as much variation in the cross-section of performance relative to the firm fixed effects.

In Model 2, we further include industry, region, and investment year fixed effects as well as the manager deal sequence, the size of the equity investment, and the length of the holding period. Individual manager fixed effects remain statistically significant at the 5% level, whereas the private equity firm fixed effects become statistically insignificant. However, the degree to which both groups can explain the variation in the cross-section of returns remains economically unchanged at 14.5% and 3.7%, respectively. This leads to a ratio of 3.9, which supports the results from Model 1.

Finally, we restrict our sample to deals that are partially or fully realized. The results in Model 3 are comparable to those in Models 1 and 2. The F-tests show that both, the group of manager fixed effects and the group of firm fixed effects, are statistically significant with F-values being similar to those in Models 1 and 2. While the explanatory power of manager fixed effects increases to 20.0% of the variation in deal performance, the variation explained by the group of firm fixed effects remains stable at 4.4%. Therefore, the relative explanatory power of the two increases to 4.5.

All three model specifications point towards two things. First, both, the individual and the organization, contribute significantly to the performance of a buyout investment in our dataset. Second, when comparing the relative contribution of the two, managers are considerably more important than private equity firms in terms of explanatory power by a factor of about 4.

4 Sources of performance persistence

Sections 3.1 and 3.2 suggest performance persistence at the manager-level. Further, Section 3.3 documents that an individual manager is about four times as important as the private equity firm in explaining cross-sectional differences in investment performance. In this section, we investigate the sources of managerial performance persistence. For this, we first look at the determinants of gross deal performance. We then proceed to examine whether the same determinants help to explain cross-sectional difference in managerial performance persistence.

4.1 Manager investment expertise and absolute deal performance

There are many potential reasons that could explain managerial performance persistence. In this paper, we mostly find evidence that is consistent with managerial expertise being important. At this point, it is important to note that it is virtually impossible to measure all potential types of human skills. We therefore stick to skills that have been shown to be important by the prior literature. Given the endogenous matching of private equity managers to firms as well as

unobserved heterogeneity as a result of a wide array of potentially important skills, we cannot rule out that the skills we find to be important are truly the ones that matter. Nevertheless, our results at least suggest that the measures we find are at least correlated to the truly relevant skills.

Ex ante, prior literature suggests that we can distinguish specific managerial expertise that stems from prior deal experience in a certain industry, country, or size segment from general managerial expertise as a result of working in the private equity industry for an extended period. In addition, we also look at education as another source of expertise.

Empirically, we measure three types of specific managerial expertise. First, we define Industry Expertise as the fraction of manager's previous deals in the same industry category, according to the Industry Classification Benchmark, as the current deal. Similarly, Geographic Expertise is the fraction of manager's previous deals in the same country as the current deal, while Investment Size Expertise is the fraction of a manager's previous deals in the same investment size quartile as the current deal. We build investment size quartiles by sorting deal involvements according to the private equity firm's equity investment, grouped by the investment year. To measure general managerial expertise, we employ age and private equity tenure (e.g. Acharya et al, 2013, Chevalier and Ellison, 1999). In terms of managerial education, we observe whether a manager has obtained a degree from an Ivy League university and whether a manager has an MBA degree (e.g. Fuchs, 2017, Zarutskie, 2010).

Descriptive statistics for all the variables can be found in Panels B of Table 2. On average, about 24% of a manager's prior deals are in the same industry as the deal at present. In contrast, it appears that PE managers are less likely to perform deals in different countries as about 45% of their prior deals have taken place in the same country. Finally, PE managers are also likely to engage in deals that are of similar size: about 29% of previous deals are in the same size quartile as the current deal. For managers with at least two deal involvements on average 29%

of prior deals are in the same industry category, 55% in the same country, and 36% in the same size quartile.

Regression results of deal-level gross PME on our measures for managerial expertise can be found in Table 7. In Model 1, we specifically look at industry expertise. The model includes a set of PE firm, deal industry, deal country, investment size quartile, and investment year fixed effects. Standard errors are clustered at the manager-level. Overall, we observe a strong positive relation between prior same-industry experience and deal performance. Economically, a one standard deviation increase in the managers' industry expertise translates into a 0.206 higher PME. The result is statistically significant at the 5% level.

Model 2 of Table 7 additionally includes interactions of PE firm and deal industry fixed effects. The intuition behind this test is to separate prior industry experience by an individual manager from PE firm-specific industry knowledge. The results in Model 2 suggest that adding PE firm-investment industry fixed effects leaves the coefficient for prior industry experience almost unchanged, both economically and statistically.

In Model 3, we examine the relation between deal country experience and gross PME. Even though the regression coefficient for Geographic Experience exhibits a positive sign, it is far from being statistically significant. Again, adding PE firm-investment country fixed effects barely changes the results (Model 4). Similarly, we do not detect that prior size experience matters for current deal performance (Models 5 and 6). Model 7 that looks at all three types of specific managerial deal experience confirms previous results.

Interestingly, none of the measures for general managerial expertise and education exhibit a significant relation with deal performance. If anything, there is weak evidence that tenure is negatively associated with deal performance, albeit only Model 6 exhibits a coefficient that is statistically significant at the 10%-level. We therefore conclude that, besides industry-specific

knowledge, general managerial experience or education cannot explain PE investment performance.

4.2 Manager investment expertise and performance persistence

Having shown that industry experience helps to explain deal performance, we proceed to show that industry experience also determines performance persistence. Results can be found in Table 8. For comparison, Models 1 and 2 correspond to Models 2 and 4 of Table 4. Models 3 and 5 follow Model 1, but split the sample according to whether the manager's previous deal is in the same industry as the deal at present. Similarly, Models 4 and 6 mimic the baseline Model 2.

The results suggest that performance persistence is only present when a manager remains in the same industry. While Models 3 and 4 document a strong link between the performance of past and current deals for same-industry deals, the opposite is true when managers switch industries. For same-industry deals, the persistence coefficient amount to approximately 0.1 and they are statistically significant at the 1%-level. In contrast, for managers who switch industries, the persistence coefficients are close to zero and far from statistical significance. Comparing the coefficients of lagged performance of Model 3 and Model 5 (Model 4 and Model 6) reveals that they are significantly different with a p-value of 0.011, and 0.006 respectively. Thus, the results suggest that PE managers that perform deals in the same industry are not only associated with higher PME, but they are also able to achieve stable returns over time.

In line with the results from Section 4.1, Models 7 to 14 suggest no differences in performance persistence when managers perform deals in different countries or size brackets. While it appears that performance persistence is only present when a manager invests in other countries or in different size quartiles, further (unreported) analysis suggests that the

coefficients in Models 7 and 9, and 11 and 13 respectively, are not statistically significantly different from one another (p-values of 0.591 and 0.112). This result also holds when comparing the coefficients of Models 8 and 10 (p-value: 0.595), as well as the coefficients from Models 10 and 12 (p-value: 0.153).

Table 9 repeats the analysis from Table 8, but now we use interaction terms instead of sample splits. Overall, the table confirms the results from Table 8. In Model 1, the coefficient for the interaction of previous deal performance and an indicator for whether a manager stays in the same industry is positive and statistically significant at the 5%-level. Again, we do not observe cross-sectional differences in performance persistence conditioning on whether a manager switches the investment country or investment size. Model 4, which combines all types of style drifts confirms this.

In Table 10, we examine the robustness of the results by repeating several tests from Table 5, but now we split the sample based on whether a manager performs an industry style drift or not. For comparison, Models 1 and 2 repeat the analysis from Models 4 and 6 of Table 8.

First, we only examine partially and fully realized deals. Second, we only look at deals from the “Who’s Who in private equity” directories to deal with potential self-reporting and survivorship bias. Third, we only consider deals with a minimum time lag between two consecutive deals of more than one year to reduce the effects of contemporaneous deals.

Even though these sample splits reduce the power of the tests considerable, all the robustness tests confirm that performance persistence is only present when a manager performs a deal in the same industry as the previous deal. Unreported tests confirm that the coefficients of lagged performance statistically differ when comparing Model 3 and Model 4, Model 5 and 6, and Model 7 and 8, with p-values of 0.000, 0.027, and 0.075 respectively.

5 Conclusions

In this paper, we have empirically investigated buyout performance persistence and cross-sectional differences in performance at the individual manager level. In reality, in absence of alternatives, many buyout fund investors put an emphasis on individual manager's track record when making investment calls. Our research indicates they may be right in doing so. We take advantage of a large, proprietary list of buyouts for which responsible private equity managers (and the PE firm they worked for at this point in time) were identified. Then, for each individual we collected timed information on human capital variables. For each buyout we also observe monthly cash flows gross of management fees and profit share. This enables us to compute actual financial outcomes of these investments. We use deal-level gross KS PME as success variable in our paper. This aspect sets us apart from other studies on venture capital or buyout persistence.

Our analysis of performance persistence at the individual buyout manager level, using transition matrices and running regressions of current performance on performance of the previous deal by the same manager, reveals that buyout persistence persists here. While persistence at the PE firm level has substantially declined over the last years, it still exists at the individual level. Regressions of deal PME returns on the group of managers as well as firm fixed effects shows that the former is about four times more important in explaining performance.

Next, we look for sources of cross-sectional differences in deal PME returns that can be attributed to individual managers. When looking at investment-related expertise, tests reveal that industry specific expertise is associated with higher deal returns while geographic and investment size-related expertise does show a significant effect. Interestingly, none of the other general human capital proxies (manager age, PE tenure, Ivy League attendance, or MBA) plays a role in this regard. This finding is in contrast to studies on venture capital, where human

capital indeed seems to matter for investment success (see, e.g., Zarutskie, 2010). A possible explanation could be that the human capital required to identify and successfully develop early-stage technology-driven firms in venture capital is much more specific than in buyout investing.

Finally, we document that managers' style drifting behaviour translates into performance persistence. Whereas managers who remain in the same industry category in two adjacent deals show persistent performance, the predictive power of previous returns for current deal performance disappears when managers switch industries.

Altogether, our research might be particularly relevant for investors. While buyout organizations per se obviously lose in importance, assessing individual manager's track records of past performance seems to be a valuable exercise when committing money to funds. This insight should be particularly meaningful when considering that imbalances in the allocation of fund allocations, often ignoring past performance, team instability, and departure of investment professionals are relevant phenomena in the private equity industry (Ivashina and Lerner, 2019).

References

- Abowd, John M., Robert H. Creedy, and Francis Kramarz, 2002, Computing person and firm effects using linked longitudinal employer-employee data, Technical Report 2002-06, U.S. Census Bureau.
- Abowd, John M., Francis Kramarz, and David N. Margolis, 1999, High wage workers and high wage firms, *Econometrica* 67, 251-333.
- Barber, Brad M. and Ayako Yasuda, 2017, Interim fund performance and fundraising in private equity, *Journal of Financial Economics* 124, 172-194.
- Bertrand, Marianne, and Antoinette Schoar, 2003, Managing with style: The effect of managers on firm policies, *Quarterly Journal of Economics* 118, 1169-1208.
- Braun, Reiner, Tim Jenkinson, and Ingo Stoff, 2017, How persistent is private equity performance? Evidence from deal-level data, *Journal of Financial Economics* 123, 273-291.
- Braun, Reiner, Tim Jenkinson, and Christoph Schemmerl, 2019, Adverse selection and the performance of private equity co-investments, *Journal of Financial Economics*, Forthcoming.
- Brown, Gregory W., Oleg Gredil, and Steven N. Kaplan, 2017, Do Private Equity Funds Manipulate Reported Returns?, Working paper available at ssrn.com/abstract=2271690.
- Cressy, Robert, Federico Munari, and Alessandro Malipiero, 2007. Playing to their strengths? Evidence that specialization in the private equity industry confers competitive advantage, *Journal of Corporate Finance* 13, 647-668.
- Ewens, Michael and Matthew Rhodes-Kropf, 2015, Is a VC Partnership Greater Than the Sum of Its Partners?, *The Journal of Finance* 70, 1081-1113.

- Graham, John R., Si Li, and Jiaping Qiu, 2012, Managerial attributes and executive compensation, *Review of Financial Studies* 25, 144-186.
- Harris, Robert S., Tim Jenkinson, Steven N. Kaplan, and Ruediger Stucke, 2014, Has Persistence Persisted in Private Equity? Evidence from Buyout and Venture Capital Funds, Working paper available at ssrn.com/abstract=2304808.
- Ivashina, Victoria, and Josh Lerner, 2019, Pay now or pay later? The economics within the private equity partnership, *Journal of Financial Economics* 131, 61-87.
- Jenkinson, Tim, Miguel Sousa, and Ruediger Stucke, 2013, How Fair are the Valuations of Private Equity Funds?, Working paper available at ssrn.com/abstract=2229547.
- Kaplan, Steven N and Antoinette Schoar, 2005, Private equity performance: returns, persistence, and capital flows, *The Journal of Finance* 60, 1791–1823.
- Metrick, Andrew and Ayako Yasuda, 2010, The Economics of Private Equity Funds, *Review of Financial Studies* 23, 2303-2341.
- Zarutskie, Rebecca, 2010. The role of top management team human capital in venture capital markets: Evidence from first-time funds, *Journal of Business Venturing* 25, 155-172.

Table 1: Deals

This table shows descriptive statistics for our sample of 5,030 unique deals. Panel A reports mean, median, and quartile measures, and the standard deviation of all deal-level variables. Panel B documents a split of all deals according to their realization status. Panel C shows the regional split of the sample. Panel D splits deals across ten main industries according to the Industry Classification Benchmark (ICB). The public market equivalent (PME) measures deal performance and is calculated relative to three regional MSCI indices (Asia, Europe, and North America) in local currency. The variable is winsorized at the 99th percentile. Equity Investment denotes the private equity firm's investment measured in million USD. Holding Period is the time a private equity firm is invested in a deal, measured in years. Managers on Deal is the number of managers assigned to a single deal. Investment Year is the year an investment is made. Realization Status is a dummy set to one for deals that are partially or fully realized, and zero otherwise.

Variables	N	Mean	1 st Quartile	Median	3 rd Quartile	SD
Panel A						
Public Market Equivalent (PME)	5,030	1.95	0.85	1.36	2.43	2.03
Equity Investment	5,030	79.03	12.90	31.43	84.55	126.91
Holding Period	5,030	4.05	1.83	3.67	5.75	2.77
Managers on Deal	5,030	2.05	1.00	2.00	3.00	1.53
Investment Year	5,030	2003	2000	2004	2007	4.90
Realization Status	5,030	0.77	1.0	1.0	1.0	0.42
Panel B: Realization Status						
Unrealized	1,143	23%				
Fully Realized	2,436	48%				
Partially Realized	1,451	29%				
Total	5,030					
Panel C: Region Categories						
North America	2,252	45%				
United Kingdom	822	16%				
Continental Europe	1,549	31%				
Asia	170	3%				
Australia	45	1%				
South America	62	1%				
Other	130	3%				
Total	5,030					
Panel D: Industry Categories						
Oil and Gas	76	2%				
Basic Materials	105	2%				
Industrials	1,415	28%				
Consumer Goods	851	17%				
Health Care	518	10%				
Consumer Services	832	17%				
Telecommunications	216	4%				
Utilities	52	1%				
Financials	276	5%				
Technologies	669	13%				
No information	20	0%				
Total	5,030					

Table 2: Managers and deal involvements

This table shows summary statistics for our full sample of 3,977 managers and 10,330 deal involvements. The table reports mean, median, and quartile measures, and the standard deviation of all manager-related (Panel A) and deal involvement-related variables (Panel B). Number of Deals measures the number of deal involvements of a single manager. Female takes the value of one if the manager is female, and zero otherwise. Date of Birth is the year the manager was born. Start of PE career is the year when a manager started working in a private equity firm. Ivy League Attendance and MBA indicate whether the manager has obtained a degree from an Ivy League university or has an MBA degree. Manager Deal Sequence is the number of a certain deal for a given manager, where deals are sorted in chronological order based on the investment date. The public market equivalent (PME) measures deal performance and is calculated relative to three regional MSCI indices (Asia, Europe, and North America) in local currency. The variable is winsorized at the 99th percentile. Equity Investment denotes the private equity firm's investment measured in million USD. Holding Period is the time a private equity firm is invested in a deal, measured in number of years. Manager Age at Deal is the age of the manager in the investment year. Manager PE Tenure at Deal is the time difference between the investment year and the start of the manager's PE career measured in years. Investment Year is the year an investment is made. Realization Status is a dummy set to one for deals that are partially or fully realized, and zero otherwise. Manager Industry Expertise at Deal is the share of same-industry deals a manager has performed until the current deal. Manager Geographic Expertise at Deal is the share of same-country deals a manager has performed until the current deal. Manager Investment Size Expertise at Deal is the share of same-size quartile deals a manager has performed until the current deal. We observe investment size quartiles on an annual basis.

Variables	N	Mean	1 st Quartile	Median	3 rd Quartile	SD
Panel A: Managers						
Number of Deals	3,977	2.61	1.00	2.00	3.00	2.56
Female	3,651	0.05	0.00	0.00	0.00	0.22
Date of Birth	2,564	1963	1957	1964	1971	10.38
Start of PE Career	2,144	1998	1993	1999	2003	7.87
Ivy League Attendance	3,648	0.33	0.00	0.00	1.00	0.47
MBA	3,649	0.49	0.00	0.00	1.00	0.50
Panel B: Manager deal involvements						
Manager Deal Sequence	10,330	3.05	1.00	2.00	4.00	3.06
Public Market Equivalent (PME)	10,330	1.91	0.87	1.35	2.39	1.93
Equity Investment	10,330	107.56	16.48	41.03	122.93	163.31
Holding Period	10,330	3.97	1.83	3.67	5.75	2.67
Manager Age at Deal	7,437	40.37	34.00	39.00	46.00	8.94
Manager PE Tenure at Deal	5,705	8.67	4.00	7.00	12.00	6.41
Investment Year	10,330	2004	2001	2005	2007	4.48
Realization Status	10,330	0.74	0.00	1.00	1.00	0.44
Manager Industry Expertise at Deal	10,287	0.24	0.00	0.00	0.50	0.36
Manager Geographic Expertise at Deal	10,120	0.45	0.00	0.00	1.00	0.48
Manager Investment Size Expertise at Deal	10,330	0.29	0.00	0.00	0.50	0.39

Table 3: Performance transition matrix

This Markov transition matrix reports probabilities that a manager makes the top, middle, or bottom performance tercile with their current deal involvement ($n=0$) conditional on the performance of the previous deal involvement ($n=-1$). Deal performance is measured by public market equivalent (PME). Performance terciles are constructed by ranking all deal involvements in an investment year according to their performance. We do not include the sample's first and last year (1983 and 2013) due to an insufficient number of observations in these years. Median PME values are reported for each performance tercile. Pearson's chi-square and the corresponding p-value for a test on random transition probabilities between terciles are reported below. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

		Tercile deal _{n=0} (%)			Median PME
		Top	Mid	Bottom	
Tercile deal _{n=-1} (%)	Top	39.4	32.4	28.2	2.9
	Mid	31.4	37.3	31.3	1.4
	Bottom	30.5	31.8	37.7	0.7
Median PME		1.5	1.4	1.2	N = 6,349

*Pearson chi2(4) = 71.4518*** p-value = 0.000*

Table 4: Performance persistence

In Models 1-4, this table reports the results of ordinary least square (OLS) regressions of the public market equivalent (PME) of the current deal on the PME of the previous deal made by the same manager. The analysis is at the manager-deal involvement level. In Models 5-6, instead of including lagged performance, we include manager fixed effects to test for performance persistence. The joint F-test in the last row of the table indicates whether the manager fixed effects are statistically different from zero. LN denotes the natural logarithm of a variable. Standard errors are in parentheses. In Models 1-4, standard errors are clustered at the manager level. In Models 5-6, standard errors are not clustered. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable		Deal _{n=0} PME				
Analysis		OLS: Full Sample			Manager Fixed Effects	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Deal _{n=-1} PME	0.0903*** (0.0154)	0.0489*** (0.0159)	0.0398** (0.0158)	0.0365** (0.0155)		
Realization Status (%)	1.064*** (0.0494)	1.158*** (0.056)	1.041*** (0.0794)	1.119*** (0.0787)	1.316*** (0.0559)	1.228*** (0.0752)
LN Manager Deal Sequence				-0.0518 (0.0497)		-0.074 (0.0669)
LN Equity Investment				-0.123*** (0.029)		-0.177*** (0.0216)
LN Holding Period				0.209*** (0.0386)		0.158*** (0.0391)
PE Manager FE	NO	NO	NO	NO	YES	YES
PE Firm FE	NO	YES	YES	YES	NO	NO
Industry FE	NO	NO	YES	YES	NO	YES
Region FE	NO	NO	YES	YES	NO	YES
Investment Year FE	NO	NO	YES	YES	NO	YES
Observations	6,352	6,352	6,342	6,275	8,375	8,269
Adj. R-squared	0.088	0.120	0.135	0.148	0.113	0.152
F-test on Manager FE				F(2022,6351) = 1.178***		F(2022,6198) = 1.186***

Table 5: Performance persistence - robustness

In Models 1-2 and 4-5, this table reports the results of ordinary least square (OLS) regressions of the public market equivalent (PME) of the current deal on the PME of the previous deal made by the same manager. The analysis is at the manager-deal involvement level. In Models 3 and 6, instead of including lagged performance, we include manager fixed effects to test for performance persistence. In Models 1-3, we restrict our sample to partially or fully realized deals. In Models 4-6, we only consider deal involvements which we also identify through the book directories “Who’s Who in private equity”. The joint F-test in the last row of the table indicates whether the manager fixed effects are statistically different from zero. LN denotes the natural logarithm of a variable. Standard errors are in parentheses. In Models 1-2 and 4-5, standard errors are clustered at the manager level. In Models 3 and 6, standard errors are not clustered. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable	Deal _{n=0} PME					
Analysis	Only realized deals			“Who’s Who in private equity” sample		
Model	(1)	(2)	(3)	(4)	(5)	(6)
Deal _{n=-1} PME	0.101 ^{***} (0.0186)	0.0376 [*] (0.0194)		0.0918 ^{**} (0.0373)	0.0312 (0.0390)	
Realization Status (%)	0.848 ^{***} (0.0626)	0.798 ^{***} (0.101)	0.8681 ^{***} (0.1120)	0.920 ^{***} (0.108)	1.064 ^{***} (0.190)	1.165 ^{***} (0.198)
LN Manager Deal Sequence		-0.0871 (0.0703)	-0.0857 (0.0891)		-0.0358 (0.161)	-0.148 (0.174)
LN Equity Investment		-0.142 ^{***} (0.0455)	-0.2281 ^{***} (0.0307)		-0.498 ^{***} (0.0980)	-0.462 ^{***} (0.0729)
LN Holding Period		0.174 ^{**} (0.0704)	0.0831 (0.0598)		-0.135 (0.133)	-0.231 [*] (0.125)
PE Manager FE	NO	NO	YES	NO	NO	YES
PE Firm FE	NO	YES	NO	NO	YES	NO
Industry FE	NO	YES	YES	NO	YES	YES
Region FE	NO	YES	YES	NO	YES	YES
Investment Year FE	NO	YES	YES	NO	YES	YES
Observations	4,424	4,361	6,184	1,195	1,185	1,783
Adj. R-squared	0.041	0.106	0.118	0.047	0.235	0.103
F-test on Manager FE	F(1848,4288) = 1.197 ^{***}			F(586,1139) = 1.265 ^{***}		

Table 6: Manager and firm fixed effects

This table reports the results from ordinary least square (OLS) regressions including manager and private equity firm fixed effects. The dependent variable across all model specifications is the public market equivalent (PME). The analysis is at the manager-deal involvement level. We only include managers with at least four deal involvements. The sample is further limited to private equity firms with at least one manager who switches their firms. The top part of the table reports the share of the variation in the dependent variable that is attributable to the group of manager and private equity firm fixed effects, respectively, as well as the relative importance of the manager and the firm fixed effects. For both groups of fixed effects, the table further reports the results of the joint F-tests. LN denotes the natural logarithm of a variable. Standard errors are in parentheses. Standard errors are clustered at the manager level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable		Deal PME		
Sample		OLS: >3 deals	OLS: >3 deals	OLS: >3 deals and partially and fully realized
Model		(1)	(2)	(3)
$\frac{cov(Y, PE \text{ Manager FE})}{var(Y)}$		0.147	0.145	0.200
$\frac{cov(Y, PE \text{ Firm FE})}{var(Y)}$		0.040	0.037	0.044
Relative importance: Manager FE vs. Firm FE		3.7	3.9	4.5
F-test on FE				
PE Manager FE	F-statistic	1.15	1.12	1.18
	p-value	0.02	0.03	0.01
PE Firm FE	F-statistic	1.26	1.12	1.35
	p-value	0.08	0.24	0.05
Realization Status (%)		1.239*** (0.0874)	1.186*** (0.120)	0.855*** (0.158)
LN Manager Deal Sequence			-0.0852 (0.133)	-0.0533 (0.160)
LN Equity Investment			-0.103** (0.0495)	-0.123 (0.0767)
LN Holding Period			0.115 (0.0762)	0.0198 (0.128)
PE Manager FE		YES	YES	YES
PE Firm FE		YES	YES	YES
Industry FE		NO	YES	YES
Region FE		NO	YES	YES
Investment Year FE		NO	YES	YES
Observations		3,429	3,394	2,636
Share of movers		0.12	0.12	0.10

Table 7: Manager investment expertise

This table reports the results from ordinary least square (OLS) regressions of the public market equivalent (PME) on several measures of PE manager human capital. The analysis is at the manager-deal involvement level. LN denotes the natural logarithm of a variable. Standard errors are in parentheses. Standard errors are clustered at the manager level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable	Deal PME						
	OLS: Full Sample						
Sample							
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Manager Industry Expertise at Deal	0.225** (0.0971)	0.203** (0.0984)					0.225** (0.0994)
Manager Geographic Expertise at Deal			0.0908 (0.0885)	0.0399 (0.103)			0.0652 (0.0891)
Manager Investment Size Expertise at Deal					-0.0416 (0.0839)	-0.0156 (0.0923)	-0.102 (0.0869)
Manager Age at Deal	0.0012 (0.0042)	-0.0007 (0.0044)	-0.0007 (0.0040)	-0.0008 (0.0042)	0.0013 (0.0042)	0.0033 (0.0041)	-0.0005 (0.0040)
Manager PE Tenure at Deal	-0.0042 (0.0062)	-0.0008 (0.0066)	-0.0026 (0.0062)	-0.0035 (0.0067)	-0.0052 (0.0062)	-0.0099* (0.0056)	-0.0024 (0.0062)
Ivy League Attendance	0.0516 (0.0849)	0.0564 (0.0868)	0.0510 (0.0861)	0.0765 (0.0933)	0.0383 (0.0856)	0.0401 (0.0833)	0.0612 (0.0852)
MBA	0.0800 (0.0744)	0.0581 (0.0752)	0.102 (0.0737)	0.0728 (0.0778)	0.0822 (0.0742)	0.0832 (0.0742)	0.0995 (0.0733)
Realization Status (%)	1.120*** (0.0952)	1.148*** (0.102)	1.115*** (0.0961)	1.123*** (0.109)	1.117*** (0.0953)	1.073*** (0.0985)	1.118*** (0.0959)
LN Manager Deal Sequence	-0.0265 (0.0645)	-0.0365 (0.0691)	-0.0211 (0.0702)	0.0163 (0.0800)	0.0236 (0.0668)	0.0200 (0.0659)	-0.0274 (0.0760)
LN Holding Period	0.165*** (0.0470)	0.210*** (0.0537)	0.170*** (0.0474)	0.157*** (0.0521)	0.161*** (0.0471)	0.189*** (0.0506)	0.174*** (0.0474)
PE Manager FE	NO	NO	NO	NO	NO	NO	NO
PE Firm FE	YES	NO	YES	NO	YES	NO	YES
Industry FE	YES	NO	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	NO	YES	YES	YES
Investment Size Quartile FE	YES	YES	YES	YES	YES	NO	YES
Investment Year FE	YES	YES	YES	YES	YES	YES	YES
PE Firm-Industry FE	NO	YES	NO	NO	NO	NO	NO
PE Firm-Country FE	NO	NO	NO	YES	NO	NO	NO
PE Firm-Size Quartile FE	NO	NO	NO	NO	NO	YES	NO
Observations	4,540	4,076	4,471	4,078	4,555	4,197	4,460
Adj. R-squared	0.158	0.203	0.159	0.162	0.156	0.217	0.160

Table 8: Performance persistence and manager style drifts

This table reports the results of ordinary least square (OLS) regressions of the public market equivalent (PME) of the current deal on the PME of the previous deal made by the same manager. The analysis is at the manager-deal involvement level. Models 1 and 2 show the basic model specification from Table 4. Regression models follow Model 4 of Table 4. In Models 3-6, we split the sample by whether the industry classification of the current deal equals the industry classification of the previous deal of the same manager. In Models 7-10, we split the sample by whether the country of the current deal equals the country of the previous deal of the same manager. In Models 11-14, we split the sample by whether the investment size quartile of the current deal equals the investment size quartile of the previous deal of the same manager. LN denotes the natural logarithm of a variable. Standard errors are in parentheses. Standard errors are clustered at the manager level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable		Deal _{n=0} PME												
Analysis	Base Model		Industry				Geography				Investment Size			
Sample	Full sample		No Style drift		Style drift		No Style drift		Style drift		No Style drift		Style drift	
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Deal _{n=1} PME	0.0489** (0.0159)	0.0365** (0.0155)	0.107*** (0.0332)	0.0976*** (0.0320)	0.0125 (0.0169)	-0.0013 (0.0169)	0.0397** (0.0189)	0.0258 (0.0181)	0.0570* (0.0298)	0.0421 (0.0288)	0.0576** (0.0259)	0.0557** (0.0256)	0.0137 (0.0211)	0.0101 (0.0206)
Realization Status (%)	1.158*** (0.0560)	1.119*** (0.0787)	1.181*** (0.0943)	1.327*** (0.136)	1.150*** (0.0707)	0.975*** (0.0972)	1.188*** (0.0675)	1.116*** (0.0983)	1.117*** (0.104)	1.197*** (0.142)	1.141*** (0.109)	1.231*** (0.107)	0.904*** (0.113)	0.977*** (0.111)
LN Manager Deal Sequence		-0.0518 (0.0497)		-0.0189 (0.0824)		-0.0761 (0.0623)		-0.0660 (0.0611)		-0.0300 (0.0735)		-0.0957 (0.0704)		-0.0292 (0.0667)
LN Equity Investment		-0.123*** (0.0290)		-0.154*** (0.0540)		-0.102*** (0.0315)		-0.149*** (0.0396)		-0.0593 (0.0437)		-0.105** (0.0507)		-0.126*** (0.0401)
LN Holding Period		0.209*** (0.0386)		0.231*** (0.0616)		0.237*** (0.0516)		0.227*** (0.0463)		0.105 (0.0742)		0.209*** (0.0543)		0.240*** (0.0545)
PE Manager FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
PE Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Region FE	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Investment Year FE	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Observations	6,352	6,275	2,474	2,440	3,877	3,835	4,525	4,479	1,777	1,755	3,136	3,104	3,206	3,171
Adj. R-squared	0.120	0.148	0.148	0.193	0.118	0.147	0.103	0.128	0.191	0.238	0.139	0.156	0.142	0.152

Table 9: Performance persistence and manager style drifts - interaction

This table reports the results of ordinary least square (OLS) regressions of the public market equivalent (PME) of the current deal on the PME of the previous deal made by the same manager. The analysis is at the manager-deal involvement level. $Deal_{n-1}$ PME is centred around the mean. No Ind. Style Drift takes the value of one if the industry classification of the current deal equals the industry classification of the previous deal of the same manager, and zero otherwise. No Geo. Style Drift takes the value of one if the country of the current deal equals the country of the previous deal of the same manager, and zero otherwise. No Inv. Size Style Drift takes the value of one if the investment size quartile of the current deal equals the investment size quartile of the previous deal of the same manager, and zero otherwise. LN denotes the natural logarithm of a variable. Standard errors are in parentheses. Standard errors are clustered at the manager level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable	Deal _{n=0} PME			
Analysis	OLS: Full Sample			
Model	(1)	(2)	(3)	(4)
Deal _{n-1} PME	0.0000 (0.0172)	0.0631** (0.0268)	0.0164 (0.0191)	0.0057 (0.0306)
No Ind. Style Drift	0.0700 (0.0494)			0.0733 (0.0494)
Deal _{n-1} PME * No Ind. Style Drift	0.0935** (0.0384)			0.0947** (0.0381)
No Geo. Style Drift		0.0457 (0.0559)		0.0452 (0.0558)
Deal _{n-1} PME * No Geo. Style Drift		-0.0357 (0.0315)		-0.0343 (0.0311)
No Inv. Size Style Drift			-0.0331 (0.0454)	-0.0389 (0.0454)
Deal _{n-1} PME * No Inv. Size Style Drift			0.0402 (0.0310)	0.0391 (0.0304)
Realization Status (%)	1.119*** (0.0786)	1.130*** (0.0783)	1.119*** (0.0786)	1.130*** (0.0782)
LN Manager Deal Sequence	-0.0471 (0.0499)	-0.0446 (0.0499)	-0.0522 (0.0498)	-0.0402 (0.0502)
LN Equity Investment	-0.122*** (0.0287)	-0.122*** (0.0292)	-0.121*** (0.0290)	-0.120*** (0.0288)
LN Holding Period	0.210*** (0.0387)	0.207*** (0.0391)	0.208*** (0.0386)	0.208*** (0.0392)
PE Manager FE	NO	NO	NO	NO
PE Firm FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Investment Year FE	YES	YES	YES	YES
Observations	6,275	6,234	6,275	6,234
Adj. R-squared	0.151	0.149	0.148	0.152

Table 10: Performance persistence and manager industry style drifts - robustness

This table reports the results of ordinary least square (OLS) regressions of the public market equivalent (PME) of the current deal on the PME of the previous deal made by the same manager. The analysis is at the manager-deal involvement level. Models 1 and 2 show the model specification from Table 8, Model 4 and 6. In Models 3 and 4, we restrict our sample to partially or fully realized deals. In Models 5 and 6, we only consider deal involvements which we also identify through the book directories “Who’s Who in private equity”. In Models 7 and 8, we only consider subsequent deal involvements with a time difference of more than one year. LN denotes the natural logarithm of a variable. Standard errors are in parentheses. Standard errors are clustered at the manager level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable		Deal _{n=0} PME							
Analysis	Base Model		Only realized deals		“Who’s Who in private equity” sample		Only time lag > 1 year		
Sample	No Style drift	Style drift	No Style drift	Style drift	No Style drift	Style drift	No Style drift	Style drift	
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Deal _{n=1} PME	0.0976 ^{***} (0.0320)	-0.0013 (0.0169)	0.143 ^{***} (0.0413)	-0.0163 (0.0205)	0.135 [*] (0.0717)	-0.0228 (0.0330)	0.0550 (0.0364)	-0.0165 (0.0209)	
Realization Status (%)	1.327 ^{***} (0.136)	0.975 ^{***} (0.0972)	0.968 ^{***} (0.179)	0.699 ^{***} (0.129)	1.120 ^{***} (0.394)	1.087 ^{***} (0.226)	1.394 ^{***} (0.171)	0.847 ^{***} (0.124)	
LN Manager Deal Sequence	-0.0189 (0.0824)	-0.0761 (0.0623)	-0.0394 (0.119)	-0.101 (0.0898)	-0.0375 (0.326)	0.0609 (0.202)	-0.0454 (0.109)	-0.0382 (0.0772)	
LN Equity Investment	-0.154 ^{***} (0.0540)	-0.102 ^{***} (0.0315)	-0.159 ^{**} (0.0692)	-0.101 [*] (0.0587)	-0.765 ^{***} (0.208)	-0.313 ^{***} (0.102)	-0.207 ^{**} (0.0830)	-0.151 ^{***} (0.0510)	
LN Holding Period	0.231 ^{***} (0.0616)	0.237 ^{***} (0.0516)	0.0686 (0.113)	0.265 ^{***} (0.0914)	-0.388 (0.291)	-0.0004 (0.146)	0.214 ^{***} (0.0787)	0.254 ^{***} (0.0685)	
PE Manager FE	NO	NO	NO	NO	NO	NO	NO	NO	
PE Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	
Region FE	YES	YES	YES	YES	YES	YES	YES	YES	
Investment Year FE	YES	YES	YES	YES	YES	YES	YES	YES	
Observations	2,440	3,835	1,692	2,669	417	768	1,382	2,217	
Adj. R-squared	0.193	0.147	0.185	0.096	0.209	0.168	0.220	0.175	