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We examine the determinants of private equity returns using a newly constructed database of 7,500 investments worldwide over forty years. The median investment IRR (PME) is 21% (1.3), gross of fees. One in ten investments goes bankrupt, whereas one in four has an IRR above 50%. Only one in eight investments is held for less than 2 years, but such investments have the highest returns. The scale of private equity firms is a significant driver of returns: investments held at times of a high number of simultaneous investments underperform substantially. The median IRR is 36% in the lowest scale decile and 16% in the highest. Results survive robustness tests. Diseconomies of scale are linked to firm structure: independent firms, less hierarchical firms, and those with managers of similar professional backgrounds exhibit smaller diseconomies of scale.

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Private equity (PE) became a global phenomenon in the past decade as it injected liquidity and fueled the M&A wave in the US and Europe.[1] Strömberg (2007) estimates that by 2007 PE firms worldwide had acquired almost 14,000 companies worth nearly $3.6 trillion. Although recent papers have begun to analyze investor returns in PE (Kaplan and Schoar 2005; Ljungqvist, Richardson, and Wolfenzon 2007), there is still little evidence on the cross-section of the performance of individual PE investments and, more importantly, on the drivers of this performance.

For this reason, we have put together the largest and hitherto most up-to-date dataset on PE investment performance and characteristics. Our data comes from fund-raising private placement memorandums (PPMs) collected over the past eight years from investors on all continents. After applying a number of filters, our final sample contains 7,453 investments made in eighty-one countries by 254 PE firms between 1971 and 2005. This data allows us to derive statistics that contribute to several debates in private equity and to document the main drivers of the cross-section of returns. Prompted by the large increase in the size of PE funds, we pay special attention to the impact of scale on returns and provide evidence of the potential mechanisms of this relationship.

The first contribution of our paper is to provide new descriptive statistics and stylized facts on the distribution of performance, duration, and size of PE investments around the world. We find a dramatic dispersion of returns: investments at the seventy-fifth percentile have an IRR of 50%, whereas those in the tenth percentile earn nothing. Most investments in our dataset, as in the samples of Kaplan (1991) and Strömberg (2007), are relatively long-lived. The median duration of the investments is nearly four years. But these long-lived investments are not those that deliver high returns. Indeed, we document a strong negative association between performance and duration. Quick flips (investments held less than two years), accounting for 12% of all PE investments, have

[1] In this paper, we use the term private equity to refer to buyout investments. We do not include venture capital, real estate, or any other asset class that is sometimes also referred to as private equity.

median IRR (PME) of 85% (1.94),[2] whereas investments held more than six years, which account for nearly 18% of all PE investments, have a median IRR (PME) of only 8% (0.79).

Our statistics uncover additional stylized facts for investments across countries. We are the first to document substantial underperformance of investments in emerging countries, which may be of interest given their recent spectacular growth. The data also allows us to show for the first time that most PE investments around the world are small equity-wise. The median equity investment is a mere $10 million. The large deals trumpeted in the press are by far the exception.

A second contribution of our paper is to identify empirically the drivers behind the great variation in the performance of PE investments. Because data availability is limited, the literature has focused on analyzing aggregate performance over time (*e.g.*, Kaplan and Strömberg 2009) or across funds (*e.g.*, Kaplan and Schoar 2005). Our investment-level data allows us to document the performance impact of several investment and PE firm characteristics. We find that small investments outperform large ones. In addition, and contrary to some arguments by fund managers, our results show a close connection between public and private equity: the average stock-market return over the life of an investment has a significant impact on IRR.

Our most important finding, however, is that PE firm scale is a significant and consistent driver of returns. Casual evidence suggests that the scale of PE firms is an important concern of investors. Lerner *et al*. (2003, p.44) argue that "the unprecedented growth of the private equity industry appeared to have changed the industry in some permanent ways. First was the scale at which private equity groups operated. These concerns were particularly acute on the buyout side, where multi-billion-dollar funds have become the norm." Along similar lines, Swensen *et al*. (1999, p.5) report that "many LBO firms appear to have explicitly lowered their return hurdles […], pricing deals to yield returns in the mid-to-high teens." Indeed, the current scale of several PE firms

[2] As in Kaplan and Schoar (2005), the public market equivalent (PME), is calculated as the present value of the dividends over the present value of the investments. A PME greater than one is equivalent to outperformance of the CRSP value-weighted US stock index.

contrasts sharply with that of PE firms twenty years ago. When comparing the sixteen professionals at KKR and the 470 at RJR Nabisco's headquarters, Jensen (1989) implied that PE firms were positioned to generate superior performance partly because they were lean and focused organizations. Today, the industry has concentrated (Cornelius *et al*. 2007) and PE firms sometimes have hundreds of professionals of varied backgrounds doing a large number of deals around the world. Blackstone, a prominent PE firm, describes itself as "a firm of 1,300 professionals in fifteen offices worldwide. But we are more than that, our portfolio companies employ nearly one million people around the world making us a major factor in economies around the world. If our portfolio holdings and transactions were combined into a single company, [we] would rank as the equivalent of number thirteen in the Fortune 500."[3] A similar calculation would place KKR fifth in the Fortune 500 ranking, just ahead of General Electric. This change in the industry raises the question: can large PE firms deliver sufficient returns?

There is a large body of theoretical literature on the connection between firm size and performance. Williamson (1975) was among the first to point to "organizational diseconomies" as a potential mechanism of diseconomies of scale. Holmström and Roberts (1998) argued that, among other things, problems transferring knowledge may influence scale diseconomies. Models such as those of Bolton and Dewatripont (1994), Garicano (2000), Stein (2002), and Vayanos (2003) have provided additional insight into the importance of knowledge transfer and communication costs to diseconomies of scale. According to Garicano (2000, *abstract*), "the key trade-off an organization confronts occurs between communication and knowledge costs." He argues that as a firm scales up it benefits from an increased uptake of knowledge but is penalized by greater communication needs. Stein (2002) adds that the organizational diseconomies arising from coordination and communication costs in large firms may be more acute when the information that circulates is of a softer nature (trustworthiness of a borrower, company strategy, and so on).

[3] http://www.blackstone.com/cps/rde/xchg/bxcom/hs/the_firm.htm

Although diseconomies of scale may be important for industrial firms, they may not lead to differences in returns across financial intermediaries if agents are rational and the market for capital is competitive and without significant frictions. Berk and Green (2004) conjecture that there should be no differences in the performance of large mutual funds and that of small mutual funds because their market for capital is highly competitive. But the provision of capital for PE firms involves more frictions than the provision of capital for mutual funds. Investors can add capital to a PE firm only every two to four years, when it raises new funds, and arbitrage is significantly more limited (no short selling, capital is locked-in). In addition, the kind of investment information that is transferred in a PE firm is of a softer nature than the stock-trading strategies in mutual funds, making communication costs greater in PE. All of these arguments suggest that diseconomies of scale could be great and highly visible in PE.

In view of these theoretical arguments, communication costs should be a key determinant of performance. Since we have data for individual investments, we can create a proxy for the amount of communication of soft information in the firm over the life of each investment. Specifically, we measure firm scale for each investment as the average number of simultaneously held investments managed by the firm over the investment's life. We believe this is a good measure because it captures two key features connecting scale and returns in PE. First, PE firms are supposed to provide significant and continuous attention to each of the companies in their portfolio. In addition, each investment, regardless of its size, probably requires a similar amount of time and communication (Quindlen, 2000). So, the number of investments under management is a good proxy for firm scale. Second, the monitoring phase of the investment is the period during which the information that circulates is softer. The amount of communication of soft information may thus best be captured by looking at the average scale of the firm over the life of the investment rather than at a specific point such as the time of entering or exiting the investment.

Our empirical estimates show that firm scale is a robust and consistent driver of the cross-section of returns of PE investments. Investments held at times of a high number of "simultaneous investments" (SI) underperform substantially. The economic magnitude of the scale effect is large: a one-standard-deviation increase in SI decreases IRR by 9%. Investments in the lowest SI decile earn a median IRR (PME) of 36% (1.65), whereas those in the highest SI decile earn a median IRR (PME) of 16% (1.08). These results hold in a regression setting controlling for other factors that could be associated with performance, including several investment characteristics, PE firm characteristics, and fixed effects (country, industry, and time).

A series of tests corroborates the robustness of the negative scale effect. Diseconomies of scale are present across subsamples, they survive the use of alternative econometric methods, and they are not the result of a simple mechanical effect resulting from firms exiting best-performing investments faster. We also show that survivorship bias, differences in risk, and reverse causality are unlikely to explain our findings. Finally, the scale effect is robust to the inclusion of fund and firm fixed effects and it is still present when we aggregate investments by fund and by firm.

The third and final contribution of the paper is to test additional predictions of diseconomies of scale models and to provide evidence of the potential mechanisms explaining the negative scale effect. Although we believe that our measure of scale comes closest to key theoretical concepts connecting scale and returns, our data also allows us to create alternative proxies for both the activities of the PE firm and the type of investment information that travels within the PE firm. We find that the number of simultaneous investments over the life of the deal is a better predictor of negative returns than are other proxies. Finally, in the last section of the paper we collect additional data from PE directories, PE firm websites, managers' biographies and the PPMs to develop proxies for the organizational structure of PE firms. These measures provide empirical support for Stein's (2002) idea that hierarchical firms and organizations in which information flow is more difficult face higher marginal communication costs and thus display greater diseconomies of scale. Our data shows

that independent PE firms, those with flatter decision structures, and those with professionals of similar backgrounds exhibit less pronounced scale diseconomies.

Our paper is also connected to two strands of the finance literature. First, it builds on the recent work exploring the relationship between performance and size in mutual funds (Chen *et al*. 2004; Pollet and Wilson 2008) and in hedge funds (Fung *et al*. 2008; Teo 2009). Second, it complements the results of papers looking into venture capital, an asset class similar to PE. We provide empirical evidence consistent with that of the papers analyzing the trade-off between larger/smaller portfolios and diversified/concentrated portfolios (Kanniainen and Keuschnigg 2003; Bernile *et al*. 2007; Cumming 2006; Fulghieri and Sevilir 2008; Cumming and Dai 2010;Gompers *et al*. 2008; Hochberg and Westerfield 2009) and we find results consistent with those in Bottazzi, Da Rin, and Hellmann (2008), who show that greater management involvement is associated with greater success in venture capital.[4]

The paper is organized as follows. After this introduction, section II describes the data and provides the key performance and other descriptive statistics of PE investments. Section III deals with the drivers of performance and establishes the connection between returns and scale measured by the average number of simultaneous investments over the life of each investment. Section IV contains a series of robustness tests such as alternative performance measures, different subsamples, survivorship bias, reverse causality, and firm- and fund-level results. Section V is devoted to developing alternative proxies for firm scale, and disentangling potential sources of diseconomies of scale. Finally, section VI concludes by positing several supply and demand arguments that help account for the survival of the observed diseconomies of scale.

[4] Our paper is also related to the literature on conglomerates. Lang and Stulz (1994) found that diversified firms trade at a discount, which is consistent with our results on diseconomies of scope presented in section V. But this evidence has been challenged recently by a series of papers arguing that the data on conglomerates is too noisy to establish such a connection (Graham, Lemmon, and Wolf 2002; Campa and Kedia 2002; Schoar 2002; Villalonga 2004). Our paper may contribute to this debate because our data is less likely to suffer from the contamination of internal capital reallocation across the segments of a conglomerate (Maksimovic and Phillips 2002).

II. Private Equity Investments: Data and Stylized Facts

II.A. The Sample

In this paper, we put together the most comprehensive database of the individual investments made by private equity (PE) firms. Our data improves on other academic data-collection efforts in several ways. First, we go beyond fund-level performance (Kaplan and Schoar 2005) and provide results for individual investments; we also include a wealth of control variables. Second, unlike other investment-level datasets, such as the CEPRES data (Cumming and Walz 2010) or the data in Ljungqvist *et al*. (2007), our dataset contains the full track record of each PE firm, allowing us to compute the number of simultaneous investments a firm is holding at any point in time. This is essential to calculate a good measure of firm scale. Third, unlike these other databases, ours is more likely to represent the universe of PE investments because it comes from different investors and it includes PE firms these investors chose not to invest in. Finally, our dataset is, to the best of our knowledge, the largest panel of worldwide PE investment performance.

Table I details the construction of our sample. The data was assembled by the authors by collecting fund-raising prospectuses, usually referred to as private placement memorandums (PPMs). PPMs contain the performance and characteristics of all prior investments made by the firm.[5] We began in 2001 and stopped in 2007. We collected a total of 523 "unique" PPMs from both US and European investors.[6] Since the focus of our paper is on the PE industry, we asked investors to provide us with PPMs aimed at raising PE funds. Some, however, gave us PPMs to raise venture capital funds (104 cases) and other alternative investment funds such as timber, infrastructure, land, real estate, or mezzanine (twenty-nine cases). We exclude these PPMs from our sample. We also

[5] Private equity firms are organizations that manage private equity funds. A firm may have several funds running at each point in time. Funds have a finite life lasting ten to fourteen years. The typical firm launches a new fund every two to four years. When a firm raises a new fund, it gives a fund-raising prospectus to potential investors. Investors commit capital at fund inception and cannot add or withdraw capital during the fund's life. Several investors gave us access to their prospectuses, but under signed confidentiality agreements, which bar us from disclosing information about the identity of the PE firms and their investments.

[6] On some occasions, we received the same PPM from different investors. We disregard such duplicate PPM. Sometimes, we received more than one PPM of the same PE firm at different points in time (*e.g*., one PPM for its 2003 fund and another for its 2006 fund). In these cases, we keep the more recent PPM.

exclude seventy-three PPMs without a track record—these are all first-time funds. These exclusions leave us with a sample of 317 PPMs. As panel B shows, 301 PPMs contain the track record of only one firm. In a few cases, however, the PPMs also contains the track records of PE firms for which some of the partners had previously worked. For this reason, our sample contains the track records of 334 different PE firms with a total of 11,704 individual investments.

< Table I >

Table II compares our sample with the two most comprehensive publicly available PE datasets: Capital IQ (used by Bernstein *et al*. 2010), and Thomson Reuters (used extensively in the literature). Although these commercial databases keep track of the industry, country, and initiation date of the investments, they do not contain performance information, which is available for our sample.

To compare coverage across databases, we applied filters excluding certain observations.[7] After the filtering is done, the number of observations in our comparable sample represents 83% of the number of investments in Capital IQ and 96% of those in Thomson. Our coverage is much better before 2000 (we have 20% to 30% more investments than the commercial databases) than it is in more recent years (we have 40% to 50% fewer investments). Our database is less US-focused (it covers 74% of the US investments covered by the commercial databases) but has greater coverage of the rest of the world. Our particularly high coverage of the early years should alleviate concerns of survivorship bias, while the good geographic coverage reduces the potential risk of a sample bias.

< Table II >

Since our data is based on PPMs, it differs from earlier commercial and academic datasets in that it contains information about the returns of individual investments. Although not all PPM come

[7] For the comparison with Capital IQ (panel A), we need to exclude from our sample all non-buyout investments made by buyout funds. We also remove all loans, public equity, and venture capital investments. Additionally, we remove investments made after 2005 because we do not include them in our analysis as the performance of investments made within a few months before the end of our sampling period are not be reliable (see below). Finally, as in Bernstein *et al*. (2010), we include only investments made after 1986 and from OECD countries. For the comparison with the Thomson dataset, we apply the same filters as in panel A but we keep the pre-1986 investments and the non-OECD countries.

in the same format, most provide the same information. There are twelve pieces of useful investment-level data usually found in PPMs: (1) month and year of the initiation of the investment; (2) month and year of exit (date realized); (3) industry of the investment; (4) country where the investment is located; (5) value of equity invested (referred to as investment size below and often labeled as cost in PPMs); (6) total amount distributed (realized value); (7) current valuation of any unsold stake (unrealized value); (8) total value (the sum of (6) and (7)); (9) multiple (total value divided by investment size); (10) IRR; and (12) exit route (trade sale, IPO, and so on). Appendix table A.1 provides detailed definitions of all variables, and table A.2 reproduces a sample of a typical PE firm track record found in a PPM.

To carry out the analysis below, we need to eliminate several observations from the original 11,704 investments. Table III details the process of our sample construction. There are five different reasons for excluding observations from our initial sample. The specific filters used are listed in the first column of table III, whereas the second and third columns of the table show the number of PE firms and investments that remain in the sample after we impose each restriction.

We start at the top of the table with the 11,704 investments in our database. First, we remove the 210 debt and public equity investments because they are unlikely to receive the same kind of monitoring as buyout or venture capital investments do. We then exclude investments for which we could not find key pieces of information.[8] These exclusions are: (1) 261 investments for which we cannot compute the public market equivalent (PME) a performance measure because the date of investment initiation or the multiple is missing; (2) the 132 investments of one firm that does not report investment size; and (c) 628 investments whose industry could not be identified.[9] Since part of the focus of our paper is on the scale of PE firms, we must also exclude the 288 investments of thirteen firms with selected track records. These firms indicated that they were including only the

[8] Although PPMs provide most of this information for each investment, sometimes a few items are missing. We search for the missing information on the website of the PE firm that carried out the transaction, as well as in Thomson and Capital IQ. The distribution of the sources of information for these variables is provided in appendix table A.1.
[9] We need the industry of the investment because it is a proxy for risk, and we use it to measure firm scope in section V.

performance history of current management, or of particular sectors or countries in which the fund intended to invest.[10] We also exclude 1,064 investments of forty-nine firms because they correspond to the managers' personal track records before they joined the fund-raising firm and we cannot be certain that the investments reported in this form represent the full track record of the firm where they worked before.[11] Finally, we exclude all investments made two years or less before the date of the PPMs. Nearly 45% of these investments are reported as "held at cost" with an IRR of zero, which is unlikely to be their true performance.[12] After all of these restrictions, our final sample contains 7,453 investments with minimal sample bias and all necessary information to carry out the analysis.

The last four columns of the table calculate four different return measures for the remaining observations in the sample at each step; these measures help us assess if the exclusions affect the sample characteristics. The four measures are the median of: (1) IRR, which is the measure of rate of return used in the industry and reported in PPMs: (2) PME, which measures total value created in excess of the benchmark of the CRSP US stock index; (3) MIRR (modified internal rate of return),

[10] Six of the thirteen excluded firms were raising regional funds and showed the track record for that region only, three firms included the track record of current management alone, and the final four firms included only the investments that fell within the mandate of the new fund. There may be a concern that some PE firms show a selected track record but do not say so. To assess this potential problem, we first went to the databases of Thomson and Capital IQ and verified that all the investments reported for each of our PE firms in those databases were also in our dataset. We find it to be the case. Second, we read the legal disclaimers of our PPMs. The typical PPM disclaimer states that the fund has "taken all reasonable care to ensure that the facts stated in the Memorandum are true and accurate in all material respects and there are no other facts, the omission of which would make misleading any statement in the Memoranda, whether of fact or of opinion. The General Partner accepts responsibility accordingly." Typically, the firm is only exempted from liability for estimates of economic trends, projected performance, forward looking statements, and economic and market information prepared by third parties. Third, we mentioned this concern to the investors who provided us with the PPM and to industry lawyers. They dismissed the concern arguing that the legal disclaimer limiting the responsibility of the firm applies in practice only to forecasts and that a PE firm misrepresenting its past investment record could be sued. They also pointed out to us that, unlike hedge fund investors, PE investors know the investments made by the firm because investors are asked to provide capital for each investment separately and they receive audited annual reports containing the list of investments. Finally, they argued that new investors generally ask old investors about their experience with the PE firm. In these circumstances, excluding past investments from the PPM could cause great damage to the firm.

[11] These forty-nine track records are part of forty-three different PPMs. Of these forty-three PPMs: (i) twenty-seven have one track record but it is not the track record of the firm that is raising funds, these are all first-time funds; (ii) eleven have a track record of a firm other than the one raising funds; (iii) four have two track records of a firm other than the one raising funds; and (iv) one has three track records of a firm other than the one raising funds. Since we eliminate the track records that do not belong to the firm that is raising funds, we exclude a total of forty-nine track records.

[12] If we excluded all the investments held at cost we risk introducing an upward bias since these transactions could have performed less well than those exited quickly. We chose two years as the break point because the percentage of investments held-at-cost goes down substantially to 11% and 8% of all investments made three and four years before the date of the PPM.

which alleviates potential problems with the re-investment assumption used to compute IRR (Ljungqvist *et al*. 2007); and (4) multiple. These columns show that each filter, with the exception of the last, leaves performance virtually unaffected. Excluding investments made within two years of the date of the PPM does increase the performance of the sample because, as mentioned above, nearly half have an IRR of 0%. In the robustness section, we restore some categories of excluded investments and show that the results still hold.

< Table III >

II.B. Basic Statistics for Private Equity Investments

Table IV presents descriptive statistics that provide new information on several debates in the literature. The table shows the basic statistics of PE investments, including several performance measures (median IRR, PME, MIRR, and multiple), and the fraction of investments that went bankrupt (returning no equity to investors) or that could be described as home runs (IRR greater than 50%) or quick flips (held for less than two years). It also provides numbers on the median duration, the median investment size, and our measure for firm scale, which is the average number of simultaneous investments (SI) held by the firm over the life of the focal investment. These statistics are shown for our full sample of 7,453 observations and for several subsamples that classify investments by exit route (panel A), duration (panel B), size (panel C), country of investment (panel D), and year of investment initiation (panel E). Figure 1 complements the data with histograms of performance, duration, and size. The detailed definition of each variable is provided in table A.1.

< Table IV > < Figure 1 >

The first row of panel A describes the full sample. The median investment has an IRR of 21%, an MIRR of 17%, a PME of 1.27, and a multiple of 1.90. The numbers are comparable to the

returns found in studies using cash flows to investors (*e.g.*, Kaplan and Schoar 2005).[13] A unique feature of our data is that we have the distribution of performance. Table 4 shows that 10% of all investments went bankrupt while 25% of the deals were home runs. Figure 1 gives more details about the cross-section of performance. There is a much greater dispersion of individual investment returns than of fund returns (Kaplan and Schoar 2005). A quarter of investments either go bankrupt or fail to provide gains to investors; half earn less than 50% percent, and the final quarter post an IRR above 50%. The distribution of PME is very similar; nearly 40% of investments have a PME less than 1 and nearly 20% have a PME greater than 3. This dramatic and fat-tailed return distribution has implications for performance and risk evaluation.

The rest of the numbers describing the full sample provide important additional statistics that we explore in other panels of table IV. The median investment is (equity stake) $15 million, lasts about four years, and is held along with seventeen other investments in the firm's portfolio; in other words, the median number of simultaneous investments (SI) for our sample is eighteen. Finally, only 12% of investments are quick flips, a percentage similar to that in Strömberg (2007) for Capital IQ data.

The bottom rows of panel A split investments by type of exit to explore the common association in the literature between fund performance and the fraction of investments exited through an IPO. About 22% of the investments for which we know the exit route are exited by an IPO. Our data shows that IPO-exited investments do have higher returns than the rest. Yet investments exited through a sale (a trade sale or secondary buyout) or recapitalization, refinancing, or other methods also perform well. The performance statistics for these subgroups suggest that these deals could also

[13] Our median statistics cannot be interpreted as the overall performance of the private equity industry. Since we do not have the detailed cash flows, it is difficult to aggregate performance in a meaningful way. As we show below, most of the high performing investments are short-lived, so a buy-and-hold investor obtains a return much lower than the average investment IRR. Yet if we consider the typical fees, which are around 15% of capital invested (Metrick and Yasuda 2010), the median PME after fees in our sample would be close to one, which is similar to what Kaplan and Schoar (2005) find.

be considered successful transactions; the importance formerly accorded the fraction of IPOs as the basic measure of success may have been overstated, at least for PE investments.

The evidence in figure 1 and panel B of table IV provides two pieces of evidence on the role of PE firms. First, the distribution of investment duration does not suggest that PE firms are merely flipping deals. The third graph of figure 1 shows that nearly half of the deals are held between three and four years, and nearly 20% for more than six years.[14] However, panel B provides a second piece of evidence that shows a strong negative relationship between performance and duration. The median IRR (MIRR) of the investments held less than two years is 85% (79%) and the median PME (multiple) is 1.94 (2.40). In contrast, the 1,347 investments held longer than six years have significantly lower returns with a median IRR (MIRR) of 8% (6%) and a median PME (multiple) of 0.79 (1.59). Our data allows us to understand and put in context recent criticism in the press suggesting that flashy PE returns come mainly from quick flips.[15] In addition, although our data does not identify the specific actions associated with the high returns of short-lived deals, it suggests that it does not take too long to carry them out. The high returns on these deals may be the result of quick operational or financial therapy by the PE firm (Rappaport 1990), or of the ability of PE firms to buy low and sell high fairly quickly as a result of greater bargaining power or ability to time the debt-equity market (Kaplan and Strömberg 2009).

The connection between duration and returns may also help us understand the poor post-IPO performance of listed quick flips documented in Cao and Lerner (2009). The low performance post-IPO of quick-flips may be the result of investors extrapolating too optimistically the high pre-IPO returns documented in panel B rather than of these deals having received little added value. More detailed evidence about these transactions is needed for a fuller picture.

[14] These statistics are similar to those in Strömberg (2007), confirming that our dataset appears representative.
[15] One of those press articles argues that "over the last three years, private equity firms have had record returns through a series of quick flips. In recent months, several high-profile quick flips have left critics wondering whether buyout firms were using such offerings simply to line their pockets, rather than using the proceeds to support companies." (November 13, 2005. *New York Times*. The Great Global Buyout Bubble).

After exploring duration, panel C of table IV presents statistics by investment size. We do not observe any significant differences in performance across size categories. More interestingly, perhaps, this panel and the complementary graph in figure 1 show that most PE investments are quite small. The median (average) size of the investments in our sample is only $15 ($36) million (2006 US dollars). Nearly 20% of the deals involve less than $5 million of equity. The multi-billion-dollar deals covered in the press are in fact a small minority: only 10% of the investments in our sample involve more than $100 million of equity.

Panel D of table IV provides statistics by country of investment. Investments in developed countries have similar duration and performance, although Scandinavian deals stand out with higher PME (1.66 versus 1.33 for the US) and lower bankruptcy rates (5% versus 12% for the US). Investments in developing countries, however, seem different. They exhibit poorer performance across all measures, with the exception of bankruptcy rate. We might have expected to see the opposite as a result of the higher cost of capital in developing countries. The low returns of these deals may be the result of a combination of such factors as costly learning, lower leverage, poorer legal environments, and limited exit routes (Cumming and Walz 2010; Lerner and Schoar 2004).[16]

The last panel of table IV (panel E) shows statistics by year of investment initiation. The size of investments increases over time. The median deal was less than $13 million every year until 1997. By 2005, at $44 million, it had more than tripled. The increase in fund size over time probably allowed funds to target larger companies in later years. Similar to the findings in Strömberg (2007), our data shows no evidence of an increased frequency of quick flips over time. It does, however, show a cyclical pattern with a higher frequency of quick flips during good times. Until 1986, the heyday of the junk bond market and just two years before the peak of the first PE cycle, performance measures are all statistically significantly higher than during the rest of the period and quick flips

[16] In terms of industry composition, we find a substantial number of deals in each of the forty-eight Fama-French industries (non-tabulated). The notion that PE focuses heavily on cash-rich industries is not borne out by our data.

peaked at 28% of all investments made in 1986. After that year, the sharp decline in quick flips coincides with the collapse of the junk bond market and declining investment returns. The frequency of quick flips bottoms out at 6% in 1990. The evidence of the recent cycle is quite similar: quick flips peaked at 18% in 2005, two years, once again, before the end of the cycle; and performance measures were substantially higher for the investment cohorts between 2002 and 2005.[17]

III. Determinants of the Performance of Private Equity Investments

The great difference in investment returns calls for a formal analysis of the determinants of performance. This is the main goal of this section, in which we pay particular attention to the role of diseconomies of scale. Because of the similarity of results across all performance measures, we stop presenting results for MIRR and multiple in the rest of the paper. In the first sub-section we explain the construction of our measure of scale diseconomies. The rest of the section explores diseconomies of scale in a regression setup and uncovers other determinants of the performance of PE investments.

III.A. Firm Scale and Investment Performance

As explained in the introduction, the theoretical connection between firm scale and returns implies that, as the PE firm scales up, its larger communication costs outweigh the benefits of its higher knowledge utilization rate. To implement this idea in our setting, we conjecture that if during the life of investment *i* the PE firm holds many other investments simultaneously, it is possible that the quality of the communication and the attention provided to investment *i* may be lower, ultimately leading to poorer performance. A simple illustration may help explain this idea.

[17] These time-series variation in returns is consistent with the evidence in Kaplan (1989), who finds significant operational improvements in the companies that PE firms invested in during the 1980s, the evidence in Guo, Hotchkiss, and Song (2010) and Leslie and Oyer (2008), who show that PE firms made fewer operational improvements in the companies that they invested in during the 1990s, and the evidence in Acharya *et al*. (2009) and Nikoskelainen and Wright (2005),who find significant operational improvements for a subset of UK investments in more recent years.

Consider two PE firms identical in every respect except in the number of their personnel. Firm A has two partners and four staff members, whereas firm B, five times larger, has ten partners and twenty staff members. In theory, firm B could be organized into five independent teams of two partners and four staff members each and therefore be in a position to make five times more investments than firm A. All else being equal, we should not expect the performance of the investments of firm A to be any different from that of firm B. Firm B, however, is unlikely to operate as five independent units, as its partners may need to agree on strategic decisions, and the employees need to communicate with each other and pass along information about the investments. Although firm B has a larger knowledge pool, the communication of soft information about each investment is more difficult and may lead to lengthier discussions that could prevent timely decision-making (Garicano 2000). Moreover, as argued in Stein (2002), some information may get lost as employees in charge of an investment report to the partner above them, who in turn reports to the rest of the partners. All of these factors may lower the quality of the decisions and lead to lower returns for firm B.

As we argued in the introduction, our data is particularly suited to addressing this setup. If we assume that each investment requires a similar amount of attention and communication, we can measure firm scale at any point in time as the total number of investments managed simultaneously by the firm at that moment. Because we have individual investment returns, we can calculate this measure for each investment by computing the average number of simultaneous investments (SI) of the PE firm across all months of the investment's life (from the month of investment initiation to the month of exit) (see table A.1 for a more detailed definition).

The last column of table IV shows the median number of simultaneous investments for the full sample and for the various subsamples of investments discussed in the previous section. The median investment in our full sample has eighteen simultaneous investments (SI). Bankrupt and very large investments have a higher SI, whereas those of shorter duration have a lower SI. SI for

investments in the UK (twenty-five) and Germany (twenty-eight) is higher than that for the rest of the sample. Panel E also shows that SI has increased steadily over time and that in 2005 median SI peaked at twenty-four.

III.B. Regression Analysis

In the rest of the section, we explore empirically the connection between scale and returns in a multivariate context. Table V develops our "base specification" that controls for potential determinants of returns other than firm scale. Starting with this table, we present regressions with the IRR (panel A) and PME (panel B) of investments as dependent variables. All independent variables are expressed as a z-score (that is, we subtract the sample mean and divide by the standard deviation of the sample).[18] Standard errors are obtained by two-dimensional clustering (firm and time) to account for the dependence in residuals within a given firm and a given year, since SI may exhibit some time-series persistence and PE performance is cyclical.

The first specification of each panel regresses investment IRR or PME on the log of SI and fixed effects for time, country, and industry of the investment. We control for time fixed effects to capture such important time-dependent drivers of performance as the number of "money-chasing deals" or credit conditions at the time of investment initiation (Ljungqvist *et al*. 2007; Gompers and Lerner 2000; Axelson, Jenkinson, Stromberg and Weisbach 2010). We also control for investment location and industry fixed effects to capture risk differences.[19] In this first specification, the coefficient of the log of SI is negative and statistically significant at one percent. The magnitude of

[18] This means that regression coefficients measure the change in the dependent variable arising from a one-standard-deviation increase in the independent variable. The transformation has no impact on inference but allows us to make direct comparisons of the economic magnitude of the different explanatory variables.

[19] The specifications do not show each fixed effect. We find that investments initiated before the peak of PE cycles (that is, from 1984 to 1986 and from 2002 to 2005) have higher returns, whereas those initiated from 1998 to 2000 have lower returns. Several country fixed effects are also significant. The two strongest country effects are the positive coefficients for Swedish and Finish investments. We do not find any significant industry fixed effect.

the scale effect is large: a one-standard-deviation increase in the log of SI decreases IRR by 8.4% annually and lowers PME by 0.142.

< Table V >

Although specification 1 suggests that the hypothesis of diseconomies of scale holds for PE firms, several of the panels in table IV indicate that such variables as market conditions and firm and investment characteristics may also account for some of the great variation in PE investment returns. The investments made by small firms may differ from those of large firms in ways that must be controlled for. Specifications 2 to 6 of table V test the explanatory power of other potential determinants of performance. We introduce each variable one at a time keeping investment time, country, and industry fixed effects. The detailed definition of all variables is provided in table A.1.

In specification 2 we explore the connection between private and public equity markets. Our measure of "market return" for each investment is the average return of the CRSP value-weighted index over the life of the investment. This variable captures the change in equity valuations from the start of the life of the investment to the exit date. Stock-market performance has a significant impact on IRR: a one-standard-deviation increase in market return increases IRR by 13.7%. Market return is not significant, however, for PME. It may be because beta is close to one, so PME (the value added in addition to the stock market) is unrelated to stock-market returns.

The risk characteristics of investments may also be a major determinant of returns. For this reason, specifications 3 and 4 introduce risk proxies in addition to the fixed effects already considered. In specification 3, we introduce the log of investment size as an additional risk measure. We find that there is a significant negative relationship between size and both investment performance measures. Specification 4 adds a risk measure suggested by Jones and Rhodes-Kropf (2004), who argue that private equity firms that hold higher total risk should be expected to outperform. To proxy for the volatility of a PE firm's portfolio, we use the volatility and the cross-

industry correlations of publicly traded companies in the same industry. Specification 4 shows that portfolio volatility is positively but only weakly related to performance.

Specifications 5 and 6 in table V introduce variables to control for PE firm characteristics that may be linked to its scale. First, as a result of different horizon preferences or of firm skills that affect their ability to exit deals, not all PE firms hold their investments for the same length of time. All else equal, firms holding investments longer would be expected to be running more investments simultaneously. To take this possibility into account, in specification 5 we compute the average duration of all investments held by the firm other than the focal investment. Specification 6, which introduces the firm's age, adds another potential firm-specific factor. PE firm performance may improve over time so controlling for past experience is important. Results show that the duration of the rest of the portfolio and firm age are weakly related to returns only when measured by IRR.

The final specification of the table is our base specification, which includes all the previously introduced variables plus the log of SI. The base specification shows that, holding SI constant, all other determinants of returns have effects similar to those in previous specifications, with the exception of portfolio volatility, which loses its impact. And even after other determinants of returns are controlled for, scale is strongly negatively related to investment performance for both IRR and PME. The economic magnitude of the log of SI is unaffected by all of these control variables.

IV. Robustness

In this section, we do six sets of checks to assess the robustness of diseconomies of scale. First, we split investments into SI deciles to look at the risk differences between investments in lower and higher scale groups. Second, we take the base specification of table V and show that the scale effect is not driven by a specific sub-set of observations or by some of the methodology choices we make. We also remove the effect of duration from SI to ensure that diseconomies of scale are not a simple mechanical outcome resulting from firms selling their best investments faster. Third, because

our data may suffer from a survivorship bias, we collect information on "dead" firms and add their investments, making conservative assumptions about their performance. Fourth, we present results with fund and firm fixed effects. Fifth, we test for the possibility of reverse causality. Finally, we aggregate investments at the fund and firm levels. The negative scale effect found in the previous section survives all of these robustness checks.

IV.A. Assessing Risk: Decile Analysis

Country fixed effects, industry fixed effects, portfolio volatility, and investment size capture some of the differences in risk across investments in the base specification. But since these are only proxies, we verify further that low-SI investments are not simply riskier than high-SI deals. In table VI, we do an additional risk assessment by splitting investments into SI deciles and calculating Value-at-Risk measures and variances across deciles.

The first two rows show the lower and upper bounds of SI in each decile. The range of SI is extremely large: investments in the lowest-SI decile have less than six simultaneous investments, whereas investments in the highest-SI decile have more than fifty-eight. For each SI decile the table provides several statistics similar to those in table IV. The last column shows the difference between the lowest and the highest deciles and its statistical significance.

Consistent with the base specification results, the performance statistics in table VI show that investments held at times of fewer simultaneous investments post higher returns. The magnitude of the performance difference is substantial. Investments in the lowest-SI decile have a median IRR of 36% and a median PME of 1.65, whereas those at the other end of the spectrum post a median IRR of only 16% and a median PME of 1.08. Figure 2 complements the evidence by plotting the performance measures across SI deciles and shows that the differences are not limited to the comparisons between the lowest and the highest deciles. There is a marked downward slope across

all performance measures. In addition, investments in the lowest-SI decile are of a duration ten months shorter than that of those in the highest-SI decile, and are quick-flipped twice as often.

< Figure 2 > < Table VI >

Although the nature of the data prevents us from constructing a direct measure of systematic risk, we can assess the risk differences by looking at Value-at-Risk measures across SI deciles. An advantage of these measures is that they are not sensitive to the non-normality of return distribution. Table VI shows that deals in low-SI deciles are less likely to lose money, underperform the stock market, and go bankrupt than are those in high-SI deciles. These Value-at-Risk measures indicate that low-SI investments are less rather than more risky. Moreover, low SI deciles are characterized by higher rates of home runs (IRR above 50%) and strong outperformers (PME above 2).

The bottom of table VI presents statistics on the variance of performance. They show that low-SI deciles have higher variance, but the variance difference is driven by the high performers. Investments losing money have practically the same variance across SI deciles. On the whole, the statistics in this table do not support the view that small-scale PE firms hold riskier investments.

IV.B. Sample Selection, Methodology, and Investment Subsamples

In table VII, we assess the robustness of the negative scale effect to our sample selection and methodological choices. Each row of table VII subjects our base specification to a different check. For each regression, we show the coefficient for the log of SI, the adjusted R-squared, and the number of observations. Panel A presents results for IRR and panel B for PME. The message of table VII is simple: diseconomies of scale are not driven by our methodology and are present across scale sub-samples, time sub-periods, and different investment locations.

The first part of panels A and B checks the robustness of our findings to the sample selection choices and the inference approach used for observations with some missing information. The first four rows reproduce the base specification results, excluding four different groups of investments.

First, we exclude the 1,617 unrealized investments because of the flexibility in valuing non-liquidated deals. In the second row, we also exclude all partially realized investments. The regression in the third row excludes the 1,024 investments for which IRR was not reported in the PPM and we had to infer it from the investment's duration and multiple (see table A.3.) Finally, the fourth row shows regression results excluding all three groups of investments mentioned above. Although the sample is sharply reduced by some of these exclusions, the negative scale effect survives with a similar and significant coefficient.

Instead of excluding observations, the fifth row of table VII restores to the sample used in the base specification all the investments initiated within two years of the writing of the PPM. As in the previous rows, the significance of the scale effect remains but the magnitude falls by 15%.

< Table VII >

The second part of each panel of table VII presents robustness results using alternative methodological choices. Since IRR and PME can take on very high values, the base specification winsorized these measures at their ninety-fifth percentile. Specification 6 in each panel shows that the scale effect is very similar when we winsorize at the ninety-ninth percentile. In specification 7 we switch from OLS to a Tobit regression that takes into account that IRR cannot be less than -100% and PME cannot be less than zero. Firm scale is still statistically significant. In specification 8 we consider the possibility that the scale effect may be a mechanical result of PE firms selling their best-performing investments faster and SI naturally increasing over the life of the firm. Figure 2 and the correlations in table A.4 certainly suggest this may be a possibility. To deal with this issue, we remove the effect of duration from SI by regressing the log of SI on investment duration[20] and using the residual log of SI from this regression instead of the log of SI. Scale diseconomies are still significant at a 1% level test, although the effect is slightly weaker.

[20] The coefficient of duration on the log of SI is negative with a t-statistic of 6.91.

The rest of the specifications in table VII present results using different investment subsamples. The scale decile results in table VI and figure 2 suggest that the scale effect could be driven only by the lowest SI deciles. To check this possibility, specifications 9 and 10 present our base regression with the sample split above and below median SI. Diseconomies of scale are similar in both subsamples. Rows 11 and 12 split the sample in 1995 to see if the scale effect is present in the two different PE industry cycles.[21] SI is significant at a 1% level test in both sub-periods but the effect is twice as large for the first time period. The relatively lower magnitude of the scale effect in the second period may be the result of investors starting to arbitrage away the effect. In addition, our sample ends before the 2007 financial crisis. High-SI firms experienced large returns from 2002 to 2005 and recent anecdotal evidence suggests that these firms may have been among those that suffered the most with the crisis.[22] So it is possible that if we had post-crisis data the diseconomies of scale in the second cycle would be of a magnitude similar to those of the first cycle.

The last 3 rows of table VII split the sample into groups of countries. The descriptive statistics presented in panel D of table IV show that 40% of our sample are US investments. So, it is important to verify that the scale effect holds for investments inside and outside the US. We present results for investments in the US, other developed countries, and developing countries. For both IRR and PME the scale effect is strongest for the subsample of developing countries and smallest for that of other developed countries. The negative scale effect for US investments is smaller than for developing countries, but about a third larger than that for other developed countries.

[21] Although our data starts in 1973, panel E of table 4 shows that the buyout industry really takes off in the mid 1980s. So, splitting our sample in 1995 allows us to capture the differences across the two decades of large PE activity.

[22] A recent Moody's research report, "$640 Billion & 640 Days Later: How Companies Sponsored by Big Private Equity Have Performed during the U.S. Recession," points out that in the wake of the recent financial crisis, the worst performing deals are those made by large PE firms. According to the report, "it appears that when you do a large dollar value transaction and you lever that company up, you seem to be at more risk of having problems in a downturn."

IV.C. Survivorship Bias

It is common for PE firms to start small, with a handful of investments, and to grow as they raise additional funds. So, there can be survivorship bias that creates a spurious relationship between scale and performance if small PE firms give up raising funds following poor performance and we fail to include them in our sample.[23] For at least two reasons, the evidence presented in the previous sections should alleviate the concern over this bias. First, our base specification already controls for firm age at the time of the investment. If survivorship bias were a major problem, we would expect firm age to be negatively related to returns. But this is not the case. Second, the survivorship bias argument is a cross-year effect: investments in the 1980s should outperform investments in the 1990s because they are the survivors. Since our base specification includes time fixed effects, we make sure that this mechanism is not in play, and our results can be interpreted as within-year effects.

Although these results are reassuring, in table VIII we take a more direct approach to dealing with the potential survivorship bias in our sample. We use the Thomson PE firm directory of past years to retrieve firms that stopped fund raising and collect information on the investments made by these firms to "complete" our sample.[24] We define as "dead" those PE firms that, according to Thomson, did not raise a new fund after 2000. Most dead firms are small: nearly 90% of them are in the bottom quartile of the size distribution of the firms in our database. PE firms, unlike hedge funds and mutual funds, have only rarely gone bust. We identified forty-five dead PE firms that had made a total of 464 investments. The average (median) number of simultaneous investments of dead firms is fifteen (nine). Since we do not have the returns of these investments, we impute a very conservative return to each of them according to their exit status.[25] To run regressions similar to those we have

[23] We are in a better situation than in the case of small hedge funds, which tend to report only after they have done well. Unlike hedge funds, PE funds do not choose whether to report performance or not. PE firms need to raise money to survive and so to show what they have done.

[24] Thomson is the database with most comprehensive PE firm coverage in early years.

[25] We assign a –100% return to any investment reported as defunct (32%) or without an exit (11%). For investments exited via an IPO (12% of the sample), we assign half of the median IRR and PME of IPO-exited investment in our sample (21% IRR and 1.09 PME). Finally, to investments exited via a sale (45% of the sample), we assign half of the

been presenting, we also calculate the rest of the control variables in the base specification for each of the investments made by dead PE firms.

The first two regressions of table VIII present the results when the 464 investments of dead firms are added to our sample. That the magnitude of the scale effect is reduced is, in view of the low returns we assigned these investments, hardly surprising. But the reduction is small and the statistical significance of the scale effect remains strong. To be even more conservative and cover the possibility that Thomson missed half of the dead PE firms, the last two regressions of table 8 artificially double the number of investments made by dead firms. Although we are adding nearly one thousand investments made by dead firms, the coefficient on SI decreases only marginally and remains significant. These results suggest that it would take an implausible number of dead firms for survivorship bias to account for diseconomies of scale.

< Table VIII >

IV.D. Firm and Fund Fixed Effects

Including firm and fund fixed effects makes it possible to control for unobserved fixed fund and firm characteristics and thus addresses problems with omitted variables. Some important investment characteristics are determined at the firm or fund level. For instance, one may argue that manager efforts would be positively related to performance but negatively related to SI. Indeed, the professionals of small PE firms have better incentives because they typically have a larger carried interest, they are said to be "closer to the carry." Since all the investments in a fund have the same carry distribution among employees of the firm, a fund fixed effect helps control for such differences in incentives. In addition, we could argue that firms and funds differ in their styles, attitudes to risk taking, or strategies and that these differences may be an important omitted variable in our regression analysis.

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median IRR of the sale-exited investments in our sample (18% IRR and 0.85 PME).

Table IX reruns our base specification with firm and fund fixed effects. The first two specifications with firm fixed effects continue to show significant diseconomies of scale for both IRR and PME.[26] A large part of the negative effect of scale seems to take place within the firms. Firms that grow their SI beyond their average SI see significant performance deterioration. The last two regressions in table 19 show that results with fund fixed effects are similar to those with firm fixed effects. Our sample for fund fixed effects includes 590 different funds with only 6,358 investments because in some PPMs investments are listed without specifying the fund that made them. On the whole, the evidence suggests that neither firm nor fund unobservable characteristics are the main driver of diseconomies of scale.

< Table IX >

IV.E. Reverse Causality

The next issue we address is the classic concern of reverse causality. A common test to deal with this problem is to lag the variable of interest. But in our setup this test may be particularly weak because SI does not change much from one investment to the next. For this reason, we create two-year "investment blocks" containing all the investments initiated by a firm within a specific two-year window. With this method, we create 1,170 two-year investment blocks in our dataset. For each block, we compute the average log of SI, market return, and investment size for all investments in the block, as well as the volatility of returns across all block investments. Finally, as Kaplan and Schoar (2005) did for their funds, we measure experience with the log of the block sequence number in the firm's track record.

[26] Coefficients obtained with and without fund/firm fixed effects are not strictly comparable. The coefficient of the log of SI in table 9 should be read as the negative scale effect as the firm/fund increases its scale above its average. This interpretation points to a mechanical bias introduced with the use of fund/firm fixed effects in our setting. If a PE firm starts out small and gets bigger as a result of abnormally good performance, its performance in the periods when it is bigger will look below average when compared to a firm-specific mean. This mechanical effect may explain the substantially larger magnitude of the diseconomies of scale in the fixed-effects regressions.

Table X shows results in which the units of observation are the two-year investment blocks we created. We start by replicating our base specification in specification 1 for two-year investment blocks. The results are very similar to those in previous tables. Specifications 2 and 3 show that lagged firm scale has a strong relation to current block performance. This result holds for both one-block and two-block lags in both panels and it means that the SI of investments initiated more than two years before the investments in the focal block is significantly negatively related to the performance of the focal investments, thereby alleviating concerns about reverse causality

Specifications 4 and 5 test if the growth of SI between the earlier and the current block of investments (the difference in the means of the log of SI in successive blocks) is related to performance. We find that scale growth is negatively related to performance, but its significance is low in the PME specifications. Moreover, SI remains statistically significant when we control for scale growth (specification 5). On the whole, the results in table X suggest that reverse causality is hardly likely to be a major concern for our sample.

< Table X >

IV.F. Fund- and Firm-Level Analysis

To close the section on robustness, we look at the evidence when we aggregate investments by fund. There are three benefits to this approach.[27] First, results by fund allow us to benchmark our findings to the results in Kaplan and Schoar (2005). Second, it could be argued that investors care about fund return volatility. Funds with more investments are more diversified and can thus offer lower returns. Although this hypothesis is very similar to that we tested by controlling for portfolio volatility, fund-level evidence is an alternative means of addressing this issue. Finally, showing inter-

[27] There are also drawbacks. First, the aggregation generally reduces statistical power. Second, we lose valuable investment information, such as investment year, country, and industry. Third, a sizable part of the scale effect is present within-fund and is thus lost. Fourth, we lose a number of observations by restricting the sample to funds that are old enough, as explained in the text. Fifth, since the average investment IRR differs from the IRR of the fund, our measure of fund return is a noisier proxy than the returns of individual investments.

fund effects complements the within-fund results just presented. If the diseconomies of scale were present only within funds, it would be hard for investors to arbitrage. But if they are also present inter-fund, investors who can anticipate SI may earn abnormal returns.

To do fund-level analysis, we must recalculate all our variables accordingly. To obtain fund performance, we compute the average IRR and PME of all the investments in each fund.[28] We must also restrict the analysis to funds that have finished their investment period, and since this is not observable, we can assume only that, as in Kaplan and Schoar (2005), it is the typical five years. For this reason, we lose some investments in our sample, which leaves us with a fund-level sample of 471 funds and 5,570 underlying investments.

Fund-level results are shown in table XI for IRR (panel A) and PME (panel B). We start by benchmarking our results to those of Kaplan and Schoar (2005). Since they consider only US funds, specifications 1 to 3 of each panel are run on this subset of funds. The first specification of each panel is the equivalent of our base specification for investments aggregated by fund for all US funds. It shows that the log of SI remains statistically significant for both performance measures. Specifications 2 and 3 reproduce those in Kaplan and Schoar (2005) with our US-fund sample. As in their study, we find a negative relationship between PE fund size and performance (specification 2) and a increasing and concave relationship between fund size and performance (specification 3). Likewise, neither of these coefficients is statistically significant. The rest of the specifications in the table use the full (worldwide) sample of funds. Except that the log of fund size squared changes from negative to positive, the results closely mimic those of US funds. The log of SI is still significant in the worldwide sample even when we hold fund size constant in the last specification of the table.

We have also done the same analysis at firm level. We obtain the same findings showing significant diseconomies of scale.[29] These results also suggest that SI may capture different elements

[28] The averages are value-weighted by investment size.
[29] Results aggregating investments by firm are not included here but are available from the authors on request.

of these diseconomies. A fund may be small, but if it runs several funds at the same time, it may have a large number of simultaneous investments to monitor. In the next section, we analyze additional proxies for scale and attempt to shed light on some of the mechanisms behind diseconomies of scale.

< Table XI >

V. Alternative Scale Measures and the Mechanisms of Diseconomies of Scale

The evidence of diseconomies of scale presented in the previous sections is consistent with the theoretical arguments in the literature (Garicano 2000; Stein 2002). But although we believe that SI captures major features connecting scale and returns in PE firms, there are certainly other proxies we can consider with our data. These alternative measures enable us to test additional predictions of the theoretical models. In the last part of the section, we test for potential mechanisms behind diseconomies of scale. In particular, we develop proxies to test Stein's (2002) idea that more hierarchical firms and those in which communication is more difficult may exhibit larger diseconomies of scale.

V.A. Alternative Scale Measures of the Activity in the Firm

The documented diseconomies of scale suggest that firms that "do too much" do less well. But there may be alternative dimensions to doing too much. It may be that what matters is not so much the number of projects in the firm as the amount of assets under management or the (industry) scope of such projects or the actual number of projects managed by each employee. We look at the impact of these alternative proxies in table XII. The first four rows of the table present results using four alternative measures of activity in the PE firm for IRR (panel A) and for PME (panel B). All regressions in the table include the same controls as our base specification in table V. Each row shows the most relevant parameters of two econometric specifications. The first specification uses all

the controls of our base specification in table V, adding the alternative measure specified in the first column of the table. The second specification includes the log of SI as an additional regressor to ascertain if the effect of the alternative measure remains when SI is held constant.[30]

The first and possibly simplest alternative measure of scale we can test for with our data is the total (equity) size of the portfolio under management. The literature on venture capital provides some empirical evidence of links between this measure and returns. Cumming and Dai (2010) show that venture capital firms that have more assets under management end up buying companies at higher prices. In the context of our paper, we can proxy for assets under management with the average of total equity invested in investments held simultaneously by the PE firm over the life of the focal investment. The first row of table XII shows that the inclusion of the log of such a measure (Log EUM) is negatively related to returns, but only if the log of SI is not included. In other words, although EUM and SI are highly correlated, the proxy for the size of the portfolio under management loses its significance when the log of SI is controlled for.

A second measure of activity is firm scope. PE firms investing in multiple industries may spread into too many unrelated sectors and lose focus. To test for the impact of diseconomies of scope, we follow the methodology in the conglomerate literature and construct two measures: (1) a counter of the number of industries in which the PE firm has investments over the life of the focal investment; and (2) one minus the industry Herfindhal index for the sectors in which the PE firm invests over the life of the focal investment. The second and third rows of each panels A and B of table XII present the results of including each of these measures of scope. When introduced alone, these measures are statistically and economically significant. Both a higher industry concentration and a lower number of industries in the portfolio improve performance. However, the introduction of SI renders both scope measures insignificant in most specifications. These findings provide evidence

[30] We should be careful about the interpretation of results as several of these proxies are highly correlated with our scale measure and with each other (see panel B of table 4-A).

for the notion that it is the amount of information that matters (the number of projects) rather than the diversity of this information.

A third proxy for scale is the number of simultaneous investments per employee. One of the key insights of the theoretical models mentioned above is that a PE firm with twice as many projects and twice as many employees as another PE firm would underperform as a result of its greater communication needs. Hence an empirical prediction that we can test is that returns should be more closely related to the total number of projects under the firm's management than to the number of projects handled by each employee of the firm.

Testing this hypothesis required the collection of additional data. We use the Galante Private Equity Directory, which lists the "key personnel," also called "professionals," in each PE firm. With this information, we compute the ratio of the number of simultaneous investments to the number of professionals working at the firm in the year in which the investment is initiated.[31] Although Galante is the best available source, it does not cover all the firms in our sample, since the first edition of Galante appeared only in 1996 (covering year 1995) and it sometimes begins coverage of a particular firm a few years after it is founded. For these reasons, the number of investments with coverage is reduced to a bit more than 40% of our sample. The results of using this proxy are reported in the fourth row of each panel of table XII. The estimates show that, with or without controlling for the log of SI,[32] workload per professional does not have a significant impact on performance.

< Table XII >

[31] Our data shows that PE firms do not scale up human resources proportionately. Regressing the number of professionals in the firm during the investment's initiation year on the number of simultaneous investments (SI) and a constant yields a slope of 61% and an R-squared of 36%.

[32] For a subset of firms, the Galante Private Equity Directory also reports the total number of people working at the firm under "total staff." We use this information to compute an alternative measure of employee workload as the log of the ratio of SI to the number of total staff working for the PE firm during the investment's initiation year. The results are similar to those presented in table XII.

V.B. Scale Measures for Different Investment Phases

Our proxy for scale has the advantage of covering the life of the project, which is equivalent to the monitoring phase of the investment. This phase usually deals with information of a soft nature, and it is during this time that most value-added activities by management are likely to take place. But the scale of the PE firm may also matter during the investment selection and divestiture phases. One could argue that if there are too many projects in any of these other two phases the information flow may also be hampered and returns will suffer. Although there is certainly information that needs to be communicated at all times, the nature of the information may differ. During monitoring, information is mostly soft, as it pertains to the evolution of the strategy and its implementation. During entry and exit, much of the information takes the form of valuation exercises using hard data.

Our data allows us to test the relative impact on returns of the number of investments in each of these three investment phases. Although the number of investments across phases is highly correlated (see table A.4), we can attempt to use our large panel to give us enough statistical power to distinguish between them as much as possible. Using a method similar to that which we use to calculate SI, we put together measures of the number of simultaneous investments at entry and at exit of each investment by adding the number of investments initiated or exited by the firm in the three months before and the three months after the focal investment initiation or divestment dates.

These two new proxies also help us analyze an alternative take on our results, an interpretation that relates them to the existence of limited financial arbitrage either at entry or at exit. This interpretation argues that PE firms have a limited number of "good ideas;" each firm would then have a fixed investment opportunity set. If this is the case, when a firm invests in more companies, marginal returns will be lower. A similar argument would say that large-scale firms are forced to exit too many projects at any given time and the existence of a limited number of potential buyers is the reason for their poorer performance.

The fifth and sixth rows of panels A and B of table XII present results using the two new proxies. As before, we start by adding each of the new measures to our base specification in table V without the log of SI. The table shows that in such specifications there is evidence in favor of the two alternative measures. The number of investments made (divested) around acquisition (exit) time is negatively related to performance. The economic magnitude of these effects is about two-thirds of that of the log of SI in the base specification. In addition, the statistical significance of the new proxies disappears for most specifications in the table when we control for the log of SI. At the same time, the log of SI still has a negative and significant effect on performance. As with some of the other proxies, the correlation of these measures is high, but these regressions suggest that, although a large number of projects at time of entry or exit may be problematic, the problem seems more severe with a large number of projects over the life of the focal investment.

The last row of both panels in table XII provides another test of the idea of limited financial arbitrage. If the negative returns of larger firms are linked to the existence of a fixed opportunity set for each firm, then it is possible that the firm starts with its best investments, leaving the least profitable transactions for last. We can test this interpretation by computing the sequence number of the focal investment in the sequence of investments made by the firm. The results of using this proxy are similar to those just described: investment sequence is statistically and economically significant on its own but loses its power once we include the log of SI.[33]

To conclude this section, it is important to clarify that our position is not that the alternative measures analyzed here are unimportant. There is empirical evidence confirming their role. But SI is closer to the theoretical models of diseconomies of scale and seems to dominate other proxies.

[33] One could still argue that although the firm made only a few investments at the time of the initiation of the focal investment, it knew that it would make many investments in the future and therefore lowered its required rate of return for the focal investment. We do not have a direct test for these interpretations, but our conversations with practitioners indicate that funds cannot readily anticipate future activity.

V.C. Testing Mechanisms of Diseconomies of Scale

To close the empirical part of the paper, we attempt to get at the potential mechanisms of the documented diseconomies of scale. Stein (2002) posits that when the information about the projects of a firm is of a soft nature hierarchical organizations or firms in which communication is more difficult may face greater such diseconomies as information erodes through more management layers or cannot be credibly transmitted. We develop three proxies of the organizational structure of PE firms to test these ideas.

The first two measures focus on the concept of hierarchy and management layers of the firm. Our first proxy is constructed by separating independent PE firms from those that belong to a financial group (non-independent). This classification is based on information provided by the "type of organization" field in the Galante Private Equity Directories. In our sample, then, there are 4,900 investments made by independent firms and 2,322 made by firms part of financial groups. The second measure counts the number of different job titles of the key employees listed in Galante during the investment's initiation year. This measure is closer to the concept of hierarchy but is available for only about one-third of our sample.

The third measure is a proxy for possible communication breakdowns stemming from the diversity of management backgrounds.[34] The development of this measure required the collection additional data. In particular, we collect the list of professionals working at each PE firm from Galante and their biographies from either the PPM (65% of cases) or the PE firms' websites (35% of cases). We classify each professional as having one of three possible backgrounds: finance, consulting, or other. Our measure is one minus the Herfindhal index of the professional background of the employees working at the PE firm the year of the initiation of the investment. Table A.1 provides details for the construction of all three measures.

[34] Acharya *et al*. (2009) explore the impact of the skills of partners with different backgrounds. General partners with an operational background generate significantly higher outperformance in organic deals, whereas those with a finance background generate higher outperformance in M&A deals.

< Table XIII-A and Table XIII-B >

The theoretical prediction is about the cross-effect; that is, flatter organizations or those with less diverse management backgrounds should exhibit smaller diseconomies of scale because soft information travels more easily. For this reason, table XIII-A assesses the impact of the organizational structure of PE firms on investment returns by breaking firms in the sample down by the degree to which they are hierarchical and by the diversity of the professional backgrounds of their staff. Panel A separates the investments made by independent firms from those made by firms belonging to a financial group. Panel B separates the investments made by "flat" firms from those made by "steeper" (*i.e.*, more hierarchical) firms. Panel C separates the investments made by firms in which the diversity of the background of professionals is above or below the median. Each panel presents results for both IRR and PME.

All three panels yield the same results. Diseconomies of scale are substantially smaller in flatter organizations and in those in which management has more homogenous backgrounds. In panel A, diseconomies of scale are about half as great for independent firms as they are for firms belonging to a financial group. If we look at panel B, which splits the sample by number of management layers, the negative scale returns are more than twice as big in steep organizations as they are in flat ones. Panel C shows similar results, with companies with more homogenous management exhibiting negative scale results only half the size of those with less homogenous management. The difference between the coefficients of scale diseconomies across subgroups is statistically significant for all three classifications and for both return measures (IRR and PME). We also obtain the same results when we run pooled regressions with all the observations and include the interaction terms between the log of SI and our measures of hierarchy (results not shown).

In table XIII-A, we assume that the organizational structure of PE firms is optimized once and for all when the firm is set up, which may be too restrictive. It is possible that PE firms optimize their hierarchy over time and that organizations that handle more investments may be more

hierarchical. Although table XIII-A focuses on the cross-effect and although the endogeneity argument is not as clear cut for some of our measures (*i.e.*, independence), we attempt to address the issue in table XIII-B.

In panel A of table XIII-B, we regress each of the three measures of organizational structure on firm scale (*i.e.*, the log of SI). Hierarchy and the diversity of professionals' backgrounds are strongly related to scale, but the independence of a PE firm is not. In panels B, C, and D, we run the same regressions as in table XIII-A, but we substitute the log of SI for the residual of each of the three regressions in panel A. The results for the measure of independence are very similar to those in table XIII. At the same time, panels C and D show stronger results than those in the previous table: given the size of PE firms, less hierarchical firms and those with managers of more homogenous backgrounds show significantly smaller diseconomies of scale.

The findings in tables XIII-A and XIII-B are among the first to illustrate empirically some of the mechanisms of diseconomies of scale and to link these diseconomies to the higher communication costs posited in the theoretical literature.[35]

VI. Conclusion

Our study makes three main contributions. First, it provides a series of new facts and statistics about PE investments that shed light on issues currently being debated in the industry and in academe. We show that a large proportion of high-return deals are quick flips and that quick flips are cyclical. Second, our paper documents the presence of substantial diseconomies of scale in PE. We find that, as the number of simultaneous investments increases, returns fall. Firms pursuing fewer investments obtain higher returns. Third, the evidence is consistent with the view that PE performance suffers from structural features of the firm that curtail information flows and reduce the

[35] An alternative interpretation of our two organization structure variables is that they proxy for the "distance to carry;" *i.e.*, non-independent organizations and those with more layers may provide fewer incentives to lower-end managers. If we include these two measures in the same regression format as other alternative measures in table 12, neither variable is significant.

value-added capacity of management in more hierarchical firms and those in which communication is more difficult. Although our evidence has narrowed down the number of potential mechanisms of diseconomies of scale, there are several other interesting questions that our paper opens up for future research. For example, does a large scale hamper management oversight or operational changes?

To conclude the study, and although it is beyond the scope of the paper, we want to review several potential supply-and-demand factors allowing underperforming PE firms to survive. First, as shown by Chung *et al.* (2010), being large increases fees today, but lower returns hurt fees in the future. PE firms may have different time horizons, so they may choose different growth rates. Therefore, publicly traded PE firms or those run by managers closer to retirement may opt for large size today at the cost of poorer future performance. Fund managers with longer horizons may opt to remain smaller to ensure a steady income flow in the medium term. These arguments also seem consistent with findings in the literature on performance persistence. That literature shows a tendency for high-performing firms to restrict their size to remain top performers and for low-performing firms to offer the lowest returns acceptable to investors (Kaplan and Schoar 2005; Hochberg, Ljungqvist, and Vissing-Jorgensen 2008; Glode and Green 2008).

A second possibility is that, as argued by Lerner, Schoar, and Wong (2007), some investors are ill-equipped to invest in PE. Firms with extensive track records may find it easier to window dress. In addition, less sophisticated investors may be more comfortable investing in large, well-established firms, which our data shows as poor performers (on average). Metrick (2007) lists the firms perceived to be the top tier in venture capital and the few investments that made them famous. So, investors may associate the quality of PE firms more closely with a handful of highly successful investments than with the full track record.

A third possibility is that some investors invest in PE for reasons other than returns. Ljungqvist *et al*. (2007), for example, report that their data provider is one of the largest PE investors and acquires stakes in other companies to generate business for other company divisions (the M&A

or the underwriting arm, for example). Large PE firms generate substantial investment banking fees that could lead some investors to back investments in hopes of earning the fees. Similarly, there is anecdotal evidence that large PE investors are often invited to co-invest in selected investments without paying fees. In such circumstances, large PE firms may thus increase the returns of their most sophisticated investors.

A fourth possibility is that investors do not find it easy to back-test fund-selection strategies, making learning and optimally adjusting firm size a difficult task. After all, it took us several years to build our own dataset. It is also important to bear in mind that arbitrage is difficult in PE, as investors cannot really pick and choose; they must take all the investments in a fund. Finally, many investors have told us that they are forced to invest large amounts in PE, an obligation that causes them to focus on large-scale firms.

All of these possible explanations of the survival of unprofitable PE funds are promising areas of research. If PE firms continue to behave as described by the findings in our paper, a better understanding of these issues will be important in the coming years, as giant PE firms, with potentially disappointing results, divest.

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Table I - The sample of PPM and firm track records

The table describes our sample of PPM and firm track records. Panel A shows the total number of private placement memorandum (PPM) collected and their type. Panel B splits PPM by number of PE firm track records contained in each PPM and provides the total number of firms and investments in each of the groups.

Panel A: Private placement memoranda (PPM)

	Number of PPM
PPM collected	523
PPM of venture capital funds	104
PPM of other alternative funds (timber, real estate, infrastructure, debt, and so on)	29
PPM without track record	73
PPM available for analysis	**317**

Panel B: PE firm track records per private placement memorandum (PPM)

	Number of PPM	Number of firms	Number of investments
PPM containing one track record	301	301	11,116
PPM containing two track records	15	30	512
PPM containing three track records	1	3	76
Total	**317**	**334**	**11,704**

Table II - Coverage analysis

The table compares our sample of PE investments and the two largest commercial databases available: Capital IQ (panel A) and Thomson Reuters (panel B). The Capital IQ sample is from Bernstein *et al*. (2010). The Thomson Reuters sample corresponds to the "buyouts and acquisitions" made by all "buyout funds". Each panel shows the filters applied to make the datasets comparable. Sample comparisons are shown splitting investments by period of investment initiation and by investment location.

Panel A: Comparison with Capital IQ data

	Number of observations in		
	Our dataset	Capital IQ	Coverage
Filters to make the samples comparable			
Our initial sample	**11,704**		
Exclude debt and public equity investments	11,483		
Exclude venture capital investments	10,855		
Exclude post-2005 investments	10,104		
Exclude pre-1986 investments	9,827		
Exclude non-OECD countries	9,062		
Comparison samples	**9,062**	**10,969**	**83%**
Comparison by period of investment initiation			
1986–1995	2,601	2,020	129%
1996–2000	3,954	3,398	116%
2001–2005	2,507	5,217	48%
Comparison by investment location			
North America	4,055	5,514	74%
Europe	4,842	4,642	104%
Other OECD: Australia, Israel, Japan, South Korea	165	161	102%

Panel B: Comparison with Thomson Reuters data

	Number of observations in		
	Our dataset	Thomson Reuters	Coverage
Filters to make the samples comparable			
Our initial sample	**11,704**		
Exclude debt and public equity investments	11,483		
Exclude venture capital investments	10,855		
Exclude post-2005 investments	10,104		
Comparison samples	**10,130**	**10,515**	**96%**
Comparison by period of investment initiation			
1973–1995	3,014	2,354	128%
1996–2000	4,327	3,336	130%
2001–2005	2,789	4,825	58%
Comparison by investment location			
North America	4,318	5,910	73%
Europe	4,966	4,122	120%
Rest of the world	846	483	175%

Table III – Construction of the sample of investments

The table describes the filters applied to our initial sample to attain the sample used in the empirical analysis. The first two columns of each row show the number of firms and the number of private equity investments available for our analysis after each filter. The last four columns show the median of four different performance statistics (IRR, PME, Modified IRR [or MIRR], and Multiple) for the sample resulting after each filter is applied. The last row of the table corresponds to our final sample used in the rest of the tables.

	Number of		Median			
	Firms	Investments	IRR	PME	MIRR	Multiple
Initial sample	334	11,704				
Exclude debt and public equity investments	333	11,494				
Exclude investments for which PME cannot be computed	329	11,233	0.16	1.15	0.13	1.55
Exclude investments for which investment size is not reported	328	11,101	0.15	1.13	0.13	1.53
Exclude investments with missing industry information	320	10,473	0.16	1.15	0.13	1.57
Exclude firms with selected track record	307	10,185	0.16	1.14	0.13	1.55
Exclude firms reporting investments made by the managers before they worked at the firm	258	9,121	0.17	1.15	0.14	1.60
Exclude investments made less than two years before date at which PPM is written	254	7,453	0.21	1.27	0.17	1.90

Table IV – Private equity investment performance, duration, and other characteristics

The table shows basic statistics about our sample of private equity investments. Statistics are shown for the full sample of 7,453 observations and for several sub-samples that classify investments by: exit route (panel A), duration (panel B), size (panel C), country of investment (panel D), and year of initiation (panel E). The statistics include: the median of four different performance measures (IRR, PME, MIRR, and Multiple), the fraction of investments that went bankrupt (returned no equity to investors), the fraction of "home runs" (investments with an IRR above 50%), and the fraction of "quick flips" (investments held for less than two years). The last three columns of the table provide the median duration, the median investment size, and the median SI (the number of simultaneous investments by the firm over the life of each investment). Investments with "duration set to median" are investments whose duration was not known and could not be inferred (see table A.3).

Panel A: Performance by exit status

	Number of investments	Median IRR	Median PME	Median MIRR	Median Multiple	Fraction Bankrupt	Fraction Home-run	Fraction Quick Flip	Median Duration	Median Investment size	Median SI
Full sample	7453	0.21	1.27	0.17	1.90	0.10	0.25	0.12	3.92	15	18
Realized	5106	0.26	1.40	0.23	2.10	0.15	0.30	0.17	3.92	12	17
. IPO exit	631	0.46	2.18	0.39	3.36	0.00	0.46	0.20	3.62	18	17
. Sale exit	1350	0.36	1.70	0.31	2.57	0.00	0.36	0.18	3.67	12	16
. Bankrupt	749	-1.00	0.00	-1.00	0.00	1.00	0.00	0.08	4.00	14	21
. Other	81	0.33	1.33	0.25	2.42	0.00	0.31	0.05	4.75	5	12
. Unknown	2295	0.29	1.53	0.26	2.20	0.00	0.31	0.18	3.58	12	17
Partially Realized	730	0.26	1.66	0.21	2.41	0.03	0.28	0.08	4.17	25	19
Unrealized	1617	0.05	0.96	0.04	1.18	0.00	0.09	0.00	3.92	19	19

Panel B: Performance by duration of investment

	Number of Investments	Median IRR	Median PME	Median MIRR	Median Multiple	Fraction Bankrupt	Fraction Home run	Fraction Quick Flip	Median Duration	Median Investment size	Median SI
0 to 2 years	903	0.85	1.94	0.79	2.40	0.07	0.67	1.00	1.33	13	15
2 to 3 years	1557	0.38	1.63	0.35	2.12	0.05	0.39	0.00	2.42	18	17
3 to 4 years	1289	0.27	1.44	0.25	2.10	0.07	0.26	0.00	3.42	16	17
4 to 5 years	993	0.17	1.23	0.15	1.87	0.07	0.14	0.00	4.35	15	18
5 to 6 years	734	0.16	1.22	0.14	2.00	0.08	0.11	0.00	5.42	15	18
≥ 6 years	1347	0.08	0.79	0.06	1.59	0.08	0.06	0.00	7.42	13	18
Investments with duration set to median	630	-0.45	0.06	-0.45	0.10	0.48	0.03	0.00	4.00	14	24

Panel C: Performance by investment size

	Number of Investments	Median IRR	Median PME	Median MIRR	Median Multiple	Fraction Bankrupt	Fraction Home run	Fraction Quick flip	Median Duration	Median Investment size	Median SI
< $5 US million	1632	0.21	1.21	0.18	1.90	0.12	0.29	0.14	4.00	3	16
$5 to $10 US million	1272	0.20	1.23	0.17	1.90	0.09	0.26	0.12	4.00	7	16
$10 to $20 US million	1454	0.20	1.26	0.17	1.87	0.10	0.24	0.12	3.83	14	18
$20 to $30 US million	748	0.23	1.37	0.19	1.90	0.11	0.25	0.13	3.77	25	18
$30 to $50 US million	864	0.21	1.29	0.17	1.80	0.10	0.22	0.11	3.83	38	18
$50 to $100 US million	720	0.20	1.26	0.17	1.90	0.09	0.23	0.10	3.83	67	18
> $100 US million	763	0.20	1.39	0.17	1.91	0.09	0.21	0.11	3.92	174	21

Panel D: Performance by investment location

	Number of investments	Median IRR	Median PME	Median MIRR	Median Multiple	Fraction Bankrupt	Fraction Home run	Fraction Quick flip	Median Duration	Median Investment size	Median SI
U.S.	3163	0.22	1.33	0.18	1.96	0.12	0.27	0.13	4.00	19	16
Rest developed Countries	3524	0.22	1.27	0.18	1.90	0.08	0.25	0.12	3.75	13	20
. UK	1427	0.21	1.18	0.17	1.83	0.09	0.25	0.14	3.67	14	25
. France	478	0.22	1.27	0.18	1.92	0.08	0.21	0.09	3.75	9	20
. Scandinavia	428	0.24	1.66	0.21	2.24	0.05	0.31	0.10	3.92	12	18
. Germany	259	0.25	1.42	0.22	2.11	0.13	0.28	0.08	4.00	23	28
. Italy	259	0.20	1.10	0.18	1.75	0.08	0.25	0.15	3.58	7	13
. Netherlands	174	0.20	1.36	0.18	1.89	0.06	0.26	0.14	3.79	16	18
. Other	504	0.23	1.32	0.19	1.90	0.07	0.26	0.13	3.71	14	13
Developing countries	759	0.13	1.10	0.12	1.54	0.11	0.16	0.09	4.00	9	16

Panel E: Performance by period of investment initiation

	Number of investments	Median IRR	Median PME	Median MIRR	Multiple	Fraction Bankrupt	Fraction Home run	Fraction Quick flip	Duration	Median Investment size	SI
≤ 1985	226	0.48	2.29	0.40	4.40	0.08	0.48	0.09	4.00	4	9
1986	87	0.48	2.13	0.36	3.50	0.07	0.48	0.28	4.08	9	10
1987	75	0.31	1.54	0.28	2.10	0.16	0.33	0.23	4.00	9	12
1988	121	0.22	1.05	0.16	2.30	0.08	0.26	0.11	4.40	10	11
1989	135	0.18	1.13	0.15	2.02	0.13	0.21	0.08	4.50	12	9
1990	174	0.15	0.96	0.13	2.12	0.11	0.18	0.06	5.00	13	13
1991	198	0.27	1.31	0.22	2.43	0.05	0.28	0.10	4.04	8	15
1992	280	0.26	1.16	0.21	2.34	0.09	0.25	0.07	4.01	10	16
1993	280	0.35	1.36	0.28	2.37	0.07	0.36	0.14	4.00	11	15
1994	453	0.23	0.97	0.19	1.97	0.11	0.26	0.12	4.00	8	19
1995	480	0.19	0.91	0.17	1.90	0.13	0.23	0.10	4.00	11	22
1996	584	0.19	1.02	0.16	1.84	0.12	0.26	0.15	4.00	12	18
1997	665	0.16	1.09	0.13	1.61	0.10	0.24	0.14	4.00	13	20
1998	647	0.11	1.19	0.09	1.43	0.13	0.19	0.14	4.00	16	19
1999	736	0.10	1.41	0.09	1.44	0.11	0.14	0.10	4.00	21	19
2000	740	0.03	1.29	0.03	1.09	0.18	0.09	0.09	4.00	17	19
2001	398	0.22	1.62	0.19	1.88	0.09	0.21	0.11	3.86	18	19
2002	361	0.31	1.54	0.27	2.14	0.04	0.32	0.12	3.42	22	21
2003	389	0.47	1.73	0.39	2.60	0.04	0.45	0.17	2.92	26	20
2004	289	0.37	1.50	0.32	2.10	0.04	0.40	0.13	2.65	30	21
2005	135	0.32	1.35	0.27	1.80	0.06	0.34	0.18	2.25	44	24
1973-1995	2509	0.26	1.17	0.21	2.30	0.10	0.29	0.11	4.00	9	15
1996-2005	4944	0.18	1.33	0.15	1.70	0.11	0.23	0.13	3.67	18	19

Table V - Base regression

The table shows regression results using ordinary least squares. The dependent variables are the investment's IRR (panel A) and the investment's PME (panel B). All explanatory variables are expressed as a z-score. Standard errors are clustered by PE firm and investment year. All variables are defined in table A.1.

Panel A: The dependent variable is the investment's IRR

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	**Base**
Log SI	-0.084[a]						-0.087[a]
	0.010						*0.011*
Market return		0.137[a]					0.137[a]
		0.019					*0.019*
Log investment size			-0.058[a]				-0.054[a]
			0.012				*0.012*
Portfolio volatility				0.048[a]			0.017
				0.011			*0.011*
Duration rest portfolio					-0.016[c]		0.003
					0.009		*0.010*
Log firm age						-0.021[b]	0.019[b]
						0.009	*0.010*
Time fixed effects	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.095	0.098	0.087	0.086	0.082	0.082	0.118
Number of investments	7453	7453	7453	7453	7453	7453	7453

Panel B: The dependent variable is the investment's PME

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	**Base**
Log SI	-0.142[a]						-0.164[a]
	0.024						*0.025*
Market return		-0.036					-0.039
		0.034					*0.033*
Log investment size			-0.184[a]				-0.184[a]
			0.030				*0.030*
Portfolio volatility				0.090[a]			0.030
				0.026			*0.027*
Duration rest portfolio					0.038		0.077[a]
					0.024		*0.025*
Log firm age						-0.022	0.040
						0.023	*0.026*
Time fixed effects	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.067	0.061	0.070	0.063	0.061	0.061	0.078
Number of investments	7453	7453	7453	7453	7453	7453	7453

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Table VI – Statistics by PE firm scale decile

The table breaks the sample of investments down into SI deciles and provides various statistics for each group. The last column shows the difference between the lowest and the highest deciles and the statistical significance of the difference. We use a sign test for differences in medians, a t-test for differences in averages, an F-test for differences in variance, and a Chi-squared test for differences in proportions. All variables are defined in table A.1.

SI deciles	Low	2	3	4	5	6	7	8	9	High	Low-High
Lower bound SI	1.00	5.93	8.44	11.37	14.28	17.64	21.63	27.90	39.56	58.06	
Upper bound SI	5.93	8.44	11.37	14.28	17.64	21.63	27.90	39.56	58.06	136.10	
Fraction of quick flips	0.21	0.15	0.14	0.10	0.12	0.11	0.10	0.10	0.09	0.10	0.11[a]
Mean duration	3.42	3.81	3.95	4.27	4.17	4.19	4.22	4.16	3.95	4.16	-0.74[a]
Median IRR	0.36	0.26	0.23	0.19	0.21	0.23	0.12	0.12	0.18	0.16	0.20[a]
Median PME	1.65	1.51	1.31	1.21	1.30	1.41	1.10	1.10	1.17	1.08	0.57[a]
Median MIRR	0.32	0.21	0.19	0.15	0.17	0.19	0.11	0.10	0.15	0.13	0.19[a]
Median Multiple	2.50	2.10	1.96	1.85	1.96	2.00	1.50	1.50	1.80	1.78	0.72[a]
% Bankrupt	0.07	0.08	0.09	0.10	0.10	0.08	0.11	0.12	0.14	0.12	-0.06[a]
% With losses (IRR<0%)	0.13	0.18	0.22	0.27	0.26	0.22	0.31	0.31	0.29	0.31	-0.18[a]
% Home runs (IRR>50%)	0.39	0.29	0.28	0.25	0.27	0.27	0.16	0.20	0.22	0.19	0.20[a]
% Underperformance (PME<1)	0.26	0.32	0.38	0.41	0.40	0.38	0.47	0.47	0.45	0.47	-0.21[a]
% Strong outperformance (PME>2)	0.41	0.36	0.33	0.32	0.31	0.35	0.22	0.27	0.31	0.26	0.16[a]
Variance (IRR) – All	0.46	0.40	0.44	0.42	0.44	0.40	0.38	0.42	0.47	0.39	0.07[b]
Variance (IRR) if IRR<0%	0.16	0.17	0.17	0.16	0.15	0.15	0.16	0.17	0.15	0.16	0.00
Variance (IRR) if IRR>0%	0.31	0.25	0.27	0.25	0.26	0.25	0.23	0.26	0.25	0.20	0.10[a]
Variance (PME) – All	3.51	2.87	2.82	2.63	2.69	2.82	2.22	2.91	3.04	1.97	1.53[a]
Variance (PME) if PME<1	0.13	0.13	0.12	0.11	0.12	0.11	0.12	0.10	0.12	0.10	0.03
Variance (PME) if PME>1	3.12	2.57	2.57	2.33	2.42	2.49	2.18	2.72	2.73	1.72	1.40[a]

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Table VII – Robustness of diseconomies of scale to empirical approach

The table shows regression results using ordinary least squares. The dependent variables are the investment's IRR (panel A) and the investment's PME (panel B). The control variables in each regression are those of the base specification in table 5 (market return, log investment size, portfolio volatility, duration rest portfolio, log firm age, time fixed effects, country fixed effects, and industry fixed effects). All explanatory variables are expressed as a z-score. Standard errors are clustered by PE firm and investment year. All variables are defined in table A.1.

Panel A: The dependent variable is the investment's IRR

	Log SI	Control variables	Adjusted R^2	Number of investments
Sample selection				
1. Excluding unrealized investments	-0.096[a]	yes	0.123	5836
	0.013			
2. Excluding unrealized and partially realized investments	-0.100[a]	yes	0.122	5106
	0.015			
3. Excluding all investments with inferred IRR	-0.092[a]	yes	0.118	6430
	0.012			
4. Excluding unrealized, partially realized investments, and all investments with inferred IRR	-0.109[a]	yes	0.125	4575
	0.015			
5. Adding investments made less than two years before date the PPM is written	-0.076[a]	yes	0.092	9121
	0.012			
Change of methodology				
6. Winsorize at 99th percentile instead of 95th percentile	-0.107[a]	yes	0.090	7453
	0.017			
7. Tobit estimation instead of OLS	-0.093[a]	yes	0.123	7453
	0.010			
8. Substituting Log SI by the residual Log SI obtained from a regression of Log SI on investment duration	-0.081[a]	yes	0.113	7453
	0.012			
Sub-samples of investments				
9. Investments with firm scale (SI) below sample median	-0.070[a]	yes	0.123	3726
	0.015			
10. Investments with firm scale (SI) above sample median	-0.059[a]	yes	0.110	3727
	0.014			
11. Investments made before 1995 (1973-1995)	-0.128[a]	yes	0.143	2509
	0.017			
12. Investments made after 1995 (1996-2005)	-0.061[a]	yes	0.126	4944
	0.013			
13. US investments	-0.108[a]	yes	0.125	3163
	0.016			
14. Rest developed countries	-0.064[a]	yes	0.117	3531
	0.014			
15. Developing countries	-0.127[a]	yes	0.199	759
	0.030			

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Panel B: The dependent variable is the investment's PME

	Log SI	Control variables	Adjusted R^2	Number of investments
Sample selection				
1. Excluding unrealized investments	-0.180[a]	yes	0.091	5836
	0.029			
2. Excluding unrealized and partially realized investments	-0.181[a]	yes	0.089	5106
	0.033			
3. Excluding all investments with inferred or assumed duration (hence with inferred PME)	-0.187[a]	yes	0.073	5698
	0.029			
4. Excluding unrealized and partially realized investments, and excluding all investments with inferred or assumed duration	-0.218[a]	yes	0.086	3352
	0.044			
5. Adding investments made less than two years before date at which PPM is written	-0.140[a]	yes	0.067	9121
	0.025			
Change of methodology				
6. Winsorize at 99th percentile instead of 95th percentile	-0.145[a]	yes	0.073	7453
	0.023			
7. Tobit estimation instead of OLS	-0.155[a]	yes	0.069	7453
	0.023			
8. Substituting Log SI by the residual Log SI obtained from a regression of Log SI on investment duration	-0.151[a]	yes	0.065	7453
	0.027			
Sub-samples of investments				
9. Investments with firm scale (SI) below sample median	-0.219[a]	yes	0.086	3726
	0.038			
10. Investments with firm scale (SI) above sample median	-0.093[a]	yes	0.074	3727
	0.031			
11. Investments made before 1995 (1973-1995)	-0.273[a]	yes	0.165	2509
	0.045			
12. Investments made after 1995 (1996-2005)	-0.095[a]	yes	0.051	4944
	0.030			
13. US investments	-0.202[a]	yes	0.092	3163
	0.042			
14. Rest developed countries	-0.115[a]	yes	0.059	3531
	0.034			
15. Developing countries	-0.244[a]	yes	0.140	759
	0.064			

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Table VIII – Survivorship bias

The table shows regression results using ordinary least squares. The sample of investments used in this table consists of our full sample of investments plus the 464 investments made by forty-five private equity firms that did not raise a new fund after 2000 (dead firms). The source used to identify dead firms and the information to compute the explanatory variables of the investments made by these firms is Thomson. Since the information provided by Thomson does not include investment returns, we impute returns according to the exit status of each investment. We assign an IRR of -100% and a PME of 0 to any investment reported as defunct (32% of all cases) or without an exit (11% of all cases). For investments exited via an IPO (12% of all cases), we assign half of the median IRR and PME of the IPO-exited investment in our sample (*i.e.*, 21% IRR and 1.09 PME). Finally, for investments exited via a sale (45% of all cases), we assign half of the median IRR of the sale-exited investments in our sample (*i.e.*, 18% IRR and 0.85 PME). The dependent variables are the investment's IRR (panel A) and the investment's PME (panel B). All explanatory variables are expressed as a z-score. Standard errors are clustered by PE firm and investment year. All variables are defined in table A.1.

	Adding the investments made by dead firms		Adding twice the investments made by dead firms	
Dependent variable:	IRR	PME	IRR	PME
Log SI	-0.086[a]	-0.147[a]	-0.083[a]	-0.139[a]
	0.011	*0.025*	*0.011*	*0.025*
Market return	0.129[a]	-0.045	0.125[a]	-0.030
	0.018	*0.031*	*0.018*	*0.029*
Log investment size	-0.018	-0.108[a]	0.000	-0.071[b]
	0.013	*0.032*	*0.014*	*0.033*
Portfolio volatility	0.011	0.023	0.010	0.021
	0.011	*0.027*	*0.011*	*0.026*
Duration rest portfolio	0.018[c]	0.103[a]	0.024[b]	0.113[a]
	0.010	*0.025*	*0.010*	*0.024*
Log firm age	0.000	-0.002	-0.009	-0.021
	0.010	*0.025*	*0.010*	*0.025*
Time fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes
Adjusted R^2	0.097	0.052	0.101	0.050
Number of investments	7917	7917	8381	8381

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Table IX – Firm and fund fixed effects

The table shows regression results using firm and fund fixed effects. The sample used in firm fixed effects regressions is our full sample. The sample used in fund fixed effects regressions excludes all investments for which we do not know the identity of the fund that made them. The dependent variables are the investment's IRR (panel A) and the investment's PME (panel B). All explanatory variables are expressed as a z-score. Standard errors are clustered by PE firm and investment year. All variables are defined in table A.1.

	Firm fixed effects		Fund fixed effects	
Dependent variable:	IRR	PME	IRR	PME
Log SI	-0.271[a]	-0.631[a]	-0.301[a]	-0.768[a]
	0.028	*0.072*	*0.033*	*0.081*
Market return	0.135[a]	-0.059[c]	0.151[a]	-0.049
	0.020	*0.035*	*0.022*	*0.040*
Log investment size	-0.087[a]	-0.293[a]	-0.085[a]	-0.291[a]
	0.014	*0.036*	*0.016*	*0.040*
Portfolio volatility	0.019	0.000	0.003	-0.045
	0.016	*0.041*	*0.018*	*0.044*
Duration rest portfolio	0.023	0.130[a]	0.031[c]	0.141[a]
	0.015	*0.038*	*0.017*	*0.042*
Log firm age	0.055[a]	0.117[a]	0.063[a]	0.142[a]
	0.014	*0.039*	*0.015*	*0.041*
Time fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes
Firm fixed effects	yes	yes	no	no
Fund fixed effects	no	no	yes	yes
Adjusted R^2	0.155	0.116	0.156	0.112
Number of investments	7453	7453	6358	6358

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Table X – Reverse causality

The table shows regression results using ordinary least squares for two-year investment blocks of each PE firm. Each investment block contains all the investments initiated by each PE firm during a two-year period. The dependent variables are the mean IRR of block *t* (panel A) and the mean PME of block *t* (panel B). The means of these two performance measures are calculated as the (size-weighted) average of the performance of all investments in the block, winsorizing investment return and investment size at the 95th percentile. All explanatory variables are expressed as a z-score. Standard errors are clustered by PE firm and investment year. All variables are defined in table A.1.

	Panel A: The dependent variable is the mean IRR of block *t*					Panel B: The dependent variable is the mean PME of block *t*				
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5
Mean log SI of block *t*	-0.109[a]				-0.066[a]	-0.455[a]				-0.297[a]
	0.019				*0.013*	*0.056*				*0.038*
Mean log SI of block *t*-1		-0.068[a]					-0.311[a]			
		0.016					*0.043*			
Mean log SI of block *t*-2			-0.064[a]					-0.312[a]		
			0.023					*0.045*		
Mean log SI of block *t* minus mean log SI of block *t*-1				-0.032[a]	-0.026[b]				-0.142[a]	-0.116[a]
				0.012	*0.012*				*0.041*	*0.038*
Mean log investment size of block *t*	-0.027[b]	-0.032[c]	-0.036[c]	-0.046[b]	-0.041[c]	-0.085[b]	-0.079[c]	-0.091[c]	-0.122[b]	-0.100[c]
	0.013	*0.017*	*0.019*	*0.023*	*0.022*	*0.034*	*0.043*	*0.048*	*0.061*	*0.057*
Mean market return of block *t*	0.688[b]	0.867[b]	0.849[b]	0.068[b]	0.069[b]	-0.948	-0.204	0.067	-0.076	-0.068
	0.301	*0.353*	*0.397*	*0.033*	*0.033*	*0.764*	*0.844*	*0.705*	*0.079*	*0.076*
Block volatility	0.042	0.013	-0.022	-0.009	0.012	0.396[a]	0.391[a]	0.353[a]	0.291[a]	0.378[a]
	0.043	*0.048*	*0.065*	*0.015*	*0.016*	*0.056*	*0.065*	*0.077*	*0.056*	*0.053*
Log block sequence number	0.023	0.025	0.011	-0.010	0.001	0.146[b]	0.216[b]	0.150	0.006	0.059
	0.021	*0.035*	*0.059*	*0.016*	*0.018*	*0.059*	*0.096*	*0.139*	*0.045*	*0.050*
Time fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.173	0.155	0.162	0.147	0.166	0.184	0.140	0.116	0.114	0.171
Number of blocks	1170	916	685	916	916	1170	916	685	916	916

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Table XI - Fund level analysis

The table shows regression results using ordinary least squares. The sample of investments used in the table is the subset of investments for which we know the fund that made the investment. We also restrict the sample to those funds that have finished their investment period, but since this is not observable, we follow Kaplan and Schoar (2005) and assume that the investment period is five years. The dependent variables are the fund's IRR (panel A) and the fund's PME (panel B). These two performance measures are calculated as the (size-weighted) averages of the performance of the investments made by the fund, winsorizing investment returns and investment size at the 95th percentile. All explanatory variables are expressed as a z-score. Standard errors are clustered by PE firm and investment year. All variables are defined in table A.1.

Panel A: The dependent variable is Fund IRR

	Spec 1 US funds	Spec 2 US funds	Spec 3 US funds	Spec 4 All funds	Spec 5 All funds	Spec 6 All funds	Spec 7 All funds
Mean Log SI of fund	-0.055[a]			-0.079[a]			-0.068[a]
	0.018			*0.015*			*0.014*
Log fund size		-0.031	0.062		-0.044[b]	-0.163	-0.036
		0.023	*0.171*		*0.021*	*0.175*	*0.024*
Log fund size square			-0.110			0.113	
			0.159			*0.163*	
Mean market return of fund	0.109[a]			0.092[a]			0.092[a]
	0.029			*0.028*			*0.026*
Fund volatility	0.006			0.002			0.003
	0.021			*0.012*			*0.012*
Log fund sequence number	-0.001	-0.024	-0.101[b]	0.027	0.000	-0.044	0.034[c]
	0.021	*0.025*	*0.040*	*0.018*	*0.020*	*0.036*	*0.020*
Log fund sequence number Square			0.122[a]			0.053	
			0.043			*0.036*	
Time year fixed effects	yes	yes	yes	yes	yes	yes	yes
Country focus fixed effects	no	no	no	yes	yes	yes	yes
Industry focus fixed effects	yes	yes	yes	yes	yes	yes	yes
Firm fixed effects	no	yes	no	no	yes	no	no
Adjusted R^2	0.183	0.128	0.121	0.169	0.122	0.113	0.175
Number of funds	264	264	264	471	471	471	471

Panel B: The dependent variable is Fund PME

	Spec 1 US funds	Spec 2 US funds	Spec 3 US funds	Spec 4 All funds	Spec 5 All funds	Spec 6 All funds	Spec 7 All funds
Mean Log SI of fund	-0.169[a]			-0.230[a]			-0.205[a]
	0.060			*0.044*			*0.043*
Log fund size		-0.084	0.344		-0.118[c]	-0.184	-0.080
		0.060	*0.499*		*0.065*	*0.463*	*0.057*
Log fund size square			-0.481			0.059	
			0.488			*0.421*	
Mean market return of fund	-0.026			-0.034			-0.032
	0.075			*0.076*			*0.073*
Fund volatility	0.336[a]			0.324[a]			0.324[a]
	0.040			*0.035*			*0.034*
Log fund sequence number	0.035	-0.125	-0.294[b]	0.088[b]	-0.040	-0.143	0.102[b]
	0.061	*0.079*	*0.142*	*0.044*	*0.055*	*0.099*	*0.045*
Log fund sequence number Square			0.311[b]			0.150[c]	
			0.128			*0.085*	
Vintage year fixed effects	yes	yes	yes	yes	yes	yes	yes
Country focus fixed effects	no	no	no	yes	yes	yes	yes
Industry focus fixed effects	yes	yes	yes	yes	yes	yes	yes
Firm fixed effects	no	yes	no	no	yes	no	no
Adjusted R^2	0.234	0.139	0.100	0.234	0.095	0.074	0.239
Number of funds	264	264	264	471	471	471	471

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Table XII – Alternative scale measures

The table shows regression results using ordinary least squares. The dependent variables are the investment's IRR (panel A) and the investment's PME (panel B). The control variables in each regression are those of the base specification in table 5 (market return, log investment size, portfolio volatility, duration rest portfolio, log firm age, time fixed effects, country fixed effects, and industry fixed effects). Each line shows a summary of the results obtained after running two different regressions. The first regression includes the above-mentioned control variables and the alternative measure, while the second regression includes, in addition, Log SI. All explanatory variables shown are expressed as a z-score. Standard errors are clustered by PE firm and investment year. All variables are defined in table A.1.

Panel A: The dependent variable is investment's IRR

	Log SI is not included		Log SI is included			Number of investments
Alternative measures	Alternative measure	Adjusted R^2	Alternative measure	Log SI	Adjusted R^2	
Log EUM	-0.077[a]	0.112	-0.006	-0.084[a]	0.117	7453
	0.014		*0.021*	*0.017*		
Log number of industries held	-0.075[a]	0.114	0.008	-0.095[a]	0.117	7453
	0.011		*0.023*	*0.022*		
One minus Herfindhal industries	-0.051[a]	0.11	-0.014	-0.081[a]	0.118	7453
	0.011		*0.012*	*0.012*		
Log SI per professional	-0.018	0.142	0.004	-0.064[a]	0.142	3068
	0.015		*0.014*	*0.018*		
Log number contemporary entry	-0.056[a]	0.112	0.030[c]	-0.114[a]	0.118	7453
	0.01		*0.016*	*0.018*		
Log number contemporary exit	-0.054[a]	0.115	0.029	-0.120[a]	0.122	5106
	0.014		*0.02*	*0.021*		
Log investment sequence number	-0.023[b]	0.107	0.021[b]	-0.099[a]	0.118	7453
	0.01		*0.011*	*0.012*		

Panel B: The dependent variable is investment's PME

	Log SI is not included		Log SI is included			Number of investments
Alternative measures	Alternative measure	Adj. R^2	Alternative measure	Log SI	Adj. R^2	
Log EUM	-0.124[a]	0.074	0.033	-0.184[a]	0.078	7453
	0.037		*0.054*	*0.039*		
Log number of industries held	-0.119[a]	0.075	0.104[c]	-0.253[a]	0.079	7453
	0.026		*0.054*	*0.053*		
One minus Herfindhal industries	-0.071[a]	0.073	0.006	-0.167[a]	0.078	7453
	0.027		*0.03*	*0.029*		
Log SI per professional	-0.010	0.070	0.007	-0.142[a]	0.074	3068
	0.035		*0.036*	*0.046*		
Log number contemporary entry	-0.123[a]	0.076	0.001	-0.165[a]	0.078	7453
	0.024		*0.043*	*0.047*		
Log number contemporary exit	-0.103[a]	0.085	0.042	-0.208[a]	0.089	5106
	0.03		*0.045*	*0.047*		
Log investment sequence number	-0.051[b]	0.073	0.029	-0.181[a]	0.078	7453
	0.02		*0.024*	*0.031*		

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Table XIII-A – Organization structure and diseconomies of scale

The table shows regression results using ordinary least squares. Regressions are run on two different sub-samples in each panel. In panel A, the two sub-samples are: (i) the investments made by independent PE firms; and (ii) the investments made by firms that are part of a financial group (non-independent firms). In panel B the two sub-samples are: (i) the investments made by PE firms with a hierarchy score below the median; and (ii) the investments made by PE firms with a hierarchy score above the median. In Panel C the two sub-samples are: (i) the investments made by PE firms whose employees' background diversity is less than the median; and (ii) the investments made by PE firms whose employees' background diversity is greater than the median. The dependent variables in each panel are the investment's IRR and the investment's PME. The control variables in each regression are those of the base specification in table 5 (market return, log investment size, portfolio volatility, duration rest portfolio, log firm age, time fixed effects, country fixed effects, and industry fixed effects). All explanatory variables are expressed as a z-score. Standard errors are clustered by PE firm and investment year. The table also presents a t-test of the difference in coefficients of Log SI in each of the two subgroups. All variables are defined in table A.1.

Panel A: Independent versus non-independent firms

Dependent variable is…	Investment's IRR			Investment's PME		
	Independent	not independent	difference	independent	not independent	difference
Log SI	-0.075[a]	-0.123[a]	0.049[a]	-0.132[a]	-0.260[a]	0.128[a]
	0.013	*0.021*	*0.016*	*0.031*	*0.051*	*0.039*
Control variables of base specification	yes	yes		yes	yes	
Adjusted R^2	0.124	0.123		0.081	0.088	
Number of investments	4900	2322		4900	2322	

Panel B: Hierarchy

Dependent variable is…	Investment's IRR			Investment's PME		
	below median	above median	difference	below median	above median	difference
Log SI	-0.043	-0.107[a]	0.064[b]	-0.031	-0.155[b]	0.124[c]
	0.028	*0.028*	*0.029*	*0.071*	*0.073*	*0.072*
Control variables of base specification	yes	yes		yes	yes	
Adjusted R^2	0.150	0.169		0.076	0.085	
Number of investments	1547	1353		1547	1353	

Panel C: Diversity of employees' background

Dependent variable is…	Investment's IRR			Investment's PME		
	below median	above median	difference	below median	above median	difference
Log SI	-0.063[a]	-0.106[a]	0.043[c]	-0.101	-0.220[a]	0.120[c]
	0.024	*0.026*	*0.025*	*0.068*	*0.061*	*0.064*
Control variables of base specification	yes	yes		yes	yes	
Adjusted R^2	0.108	0.146		0.041	0.085	
Number of investments	1647	1508		1647	1508	

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Table XIII-B – Organization structure (net of firm scale) and diseconomies of scale

The table shows regression results using ordinary least squares. Panel A runs regressions of the three organization structure proxies of independent PE firm, hierarchy and professionals' background diversity on the log of SI and a constant. The residuals of each of these regressions are used in the three subsequent panels B, C and D. As in the previous table, the regressions in the last three panels are run on two different sub-samples in each panel. In panel B, the two sub-samples are: (i) the investments made by independent PE firms; and (ii) the investments made by firms that are part of a financial group (non-independent firms). In panel C the two sub-samples are: (i) the investments made by PE firms with a hierarchy score below the median; and (ii) the investments made by PE firms with a hierarchy score above the median. In Panel D the two sub-samples are: (i) the investments made by PE firms whose employees' background diversity is less than the median; and (ii) the investments made by PE firms whose employees' background diversity is greater than the median. The dependent variables in each of the last three panels are the investment's IRR and the investment's PME. The control variables in each regression are those of the base specification in table 5 (market return, log investment size, portfolio volatility, duration rest portfolio, log firm age, time fixed effects, country fixed effects, and industry fixed effects). All explanatory variables are expressed as a z-score. Standard errors are clustered by PE firm and investment year. The last three panels also present a t-test of the difference in coefficients of Log SI in each of the two subgroups. All variables are defined in table A.1.

Panel A: Regression of organization structure measures on the log of SI

Dependent variable is…	Independent PE firm (1)	Hierarchy (2)	Professionals' background diversity (3)
Constant	0.684[a]	-11.412 [a]	0.424[a]
	0.019	*0.550*	*0.038*
Log SI	-0.002	5.900[a]	0.043[a]
	0.061	*0.174*	*0.012*
Adjusted R^2	0.000	0.284	0.004
Number of investments	7222	2900	3155

Panel B: Independent versus non-independent firms (using the residual from specification (1) of panel A)

Dependent variable is…	Investment's IRR			Investment's PME		
	independent	not independent	difference	independent	not independent	difference
Residual log SI	-0.061[a]	-0.121[a]	0.060[a]	-0.082[b]	-0.254[a]	0.172[a]
	0.014	*0.016*	*0.015*	*0.034*	*0.039*	*0.036*
Control variables of base specification	yes	yes		yes	yes	
Adjusted R^2	0.115	0.131		0.076	0.099	
Number of investments	3611	3611		3611	3611	

Panel C: Hierarchy (using the residual from specification (2) of panel A)

Dependent variable is…	Investment's IRR			Investment's PME		
	below median	above median	difference	below median	above median	difference
Residual log SI	-0.016	-0.083[a]	0.067[a]	0.020	-0.119[b]	0.140[b]
	0.027	*0.021*	*0.024*	*0.059*	*0.052*	*0.056*
Control variables of base specification	yes	yes		yes	yes	
Adjusted R^2	0.139	0.170		0.102	0.072	
Number of investments	1450	1450		1450	1450	

Panel D: Professionals' background diversity (using the residual from specification (3) of panel A)

Dependent variable is…	Investment's IRR			Investment's PME		
	below median	above median	difference	below median	above median	difference
Residual log SI	-0.051[b]	-0.113[a]	0.062[a]	-0.109[c]	-0.217[a]	0.108[c]
	0.021	*0.020*	*0.021*	*0.057*	*0.053*	*0.055*
Control variables of base specification	yes	yes		yes	yes	
Adjusted R^2	0.101	0.155		0.032	0.094	
Number of investments	1578	1577		1578	1577	

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Table A.1 – Variable descriptions

This table describes the variables used in the paper. The unit of observation is an investment made by a private equity firm (PE firm). Unless specified otherwise, the source of the variables is the private placement memorandum (PPM).

Variable name	Variable description
PE firm	A private equity firm (PE firm) is an organization that undertakes buyout investments. Since the focus of the paper is on the PE industry, we exclude from the sample firms specifically raising money for venture capital or other alternative investments such as timber, infrastructure, land, real estate, or mezzanine. These asset classes are sometimes also referred to as private equity.
PE fund	A private equity fund (PE fund) is a buyout investment fund that is managed by a PE firm. A PE firm may have several funds running at the same time. The typical PE firm launches a new fund every two to four years. Funds have a finite life lasting ten to fourteen years.
Investment	An investment is a private equity transaction realized by a PE firm. PE firms report their investments per company. So we follow this practice considering one company as a single investment including all "add-on" acquisitions and divestments made by the company as part of the same investments. We exclude debt and public equity investments.
Block of investments *t*	We define the block of investments of a PE firm at time *t* as the group of all the investments initiated by the PE firm in the two-year block starting at time *t*. As an illustration of the procedure we follow, consider a firm that made investments between 1994 and 1998. We would split its investments into three different blocks: block 1 would have investments made in 1994-95; block 2 investments made in 1996-97; and block three investments made in 1998.
Multiple	The multiple of the investment is the ratio of total cash received from the investment plus its current valuation (if not fully liquidated) to the total cash invested. The measure is gross of fees. Different PPM use different currencies to report performance: 57% of PPM use US dollars, 29% use euros, 9% use GBP, and 5% use other currencies such as yen and Canadian dollars.
Duration	The length in years between the investment initiation date and the investment exit date. The source of the year of investment initiation is the PPM in 100% of the cases. For the 730 partially realized and the 1,617 unrealized investments in the sample, the exit date is set as the date of the writing of the PPM. For 3351 realized investments, the exit date is the termination date reported in the PPM (81% of the cases) or in the website of the PE firm (19% of the cases). For the other 1,755 realized investments, we could not find the exit date in either source. So, for 1,125 of them, we infer the exit date using the date of the investment initiation, the investment's multiple, and its IRR according to the formula specified in table A.3. For the remaining 630 investments for which the lack of information prevented us from applying this formula, we assume the exit date to be four years after the investment initiation date because four years is the median holding period of our sample. There are 379 investments for which our sources do not provide the month of initiation and 260 for which they do not provide the month of exit. For these cases, we assume the month to be June of the reported year unless the resulting duration is less than one year. In such cases, we assume the month to be January for investment initiation and December for investment exit.
IRR	The internal rate of return, gross of fees, of the investment. Different PPM use different currencies to report performance: 57% of PPM use US dollars, 29% use euros, 9% use GBP, and 5% use other currencies such as yen and Canadian dollars. For the 1,024 investments with missing IRR in the PPM, we infer it using the multiple and the duration provided in the PPM according to the formula specified in table A.3. We Winsorize IRR at the 95th percentile (178%). Figures for IRR are often Winsorized at 1000%, and sometimes at 500% in the PPM.
PME	The public market equivalent (PME) is the ratio of the present value of dividends to the present value of the amount invested. To calculate this measure, we assume that the full amount of the investment is made at the investment initiation date, and that all distributions take place at the exit date. To discount the cash flows, we use CRSP value-weighted return series. The measure is gross of fees and is computed in the currency originally used in the PPM to report performance.
MIRR	To calculate the Modified IRR, we follow Ljungqvist *et al*. (2007) and compute the measure as the multiple of the investment raised to the power of one over the duration of the investment minus one. This calculation implicitly assumes that intermediary dividends are reinvested at a zero rate of return and that intermediate investments are also financed at a zero rate of return.

Table A.1 (cont')

Variable name	Variable description
Log SI	The natural logarithm of the average of the number of simultaneous investments by the PE firm during each month of the duration (life) of the investment. Where the same PE firm invests in the same company at the same time via different funds, we count the investment only once.
Log investment size	The natural logarithm of the total amount of equity paid by the PE firm for the investment. Total equity is also called investment size and is used to weight investment performance within a fund or a block. For 57% of the investments in our sample, investment size is reported in US dollars. In all other cases, we convert investment size to US dollars using the exchange rate provided in Datastream for the investment initiation date. The investment size is expressed in millions of 2006 US dollars using the consumer price index.
Bankrupt	We classify investments as "bankrupt" if they are reported as such in the PPM or if they are reported to return no capital.
Home run	We classify investments as "home runs" if their IRR is above 50%.
Quick flip	We classify investments as "quick flips" if the duration of the investment is (strictly) less than two years.
Exit status	The type of exit route for a realized or a partially realized investment. We group investments in five different exit routes: (1) investments exited via an IPO; (2) investments exited via a sale, which are those sold to a corporation or a financial institution; (3) bankrupt investments; and (4) other exits, which include recapitalizations, and all of those cases that the PPM reports as "other" or "complex". When a company is partially exited via an IPO, we classify the exit status as IPO irrespective of the method of the exit for the remaining shares. The information sources for the type of exit route are the PPM (57%), the Thomson database (34%), and the websites of PE firms (9%).
Developing and developed countries	We classify as developing those countries located in Africa, the Middle East, Asia (excluding Japan), Eastern Europe, and Latin America. We classify as developed countries the US, the UK, Canada, Western European countries, Japan, Australia, and New Zealand. The sources of information about the investments' country of location are the PPM (34%), the Thomson database (33%), the websites of PE firms (30%), and the Capital IQ database (3%).
Market return	The average of the monthly returns of the CRSP value-weighted index between the investment initiation and the investment exit dates. We annualize the rate by compounding the monthly average.
Portfolio volatility	The average of the monthly volatility of the portfolio of investments of the PE firm over the life (duration) of the focal investment. To compute this measure, we calculate for each month of the life of the focal investment the square root of $[w_{1,t} \dots w_{48,t}].\Omega.[w_{1,t} \dots w_{48,t}]'$ and then average across all months. We define $w_{i,t}$ as the (size-weighted) fraction of money invested by the PE firm in industry *i*, and Ω as the variance covariance matrix of the forty-eight Fama-French industry returns between 1973 and 2007 obtained from Ken French's website.
Duration rest of portfolio	The average duration of the rest of the investments in the portfolio of the PE firm over the life of the focal investment. To obtain this measure, we compute the duration of each investment in the portfolio of the PE firm (excluding the focal investment) and then calculate the (equally-weighted) average for each month over the life of the focal investment. We exclude all months during which there are no investments in the PE firm other than the focal investment.
Log firm age	The natural logarithm of one plus the number of years between the date of the first investment made by the PE firm and the investment initiation date of the focal investment.

Table A.1 (cont')

Variable name	Variable description
Time fixed effects	Fixed effects based on the year of investment initiation.
Country fixed effects	Fixed effects based on the country of investment location. The information sources for the country of the investment are the PPM (34%), the websites of PE firms (30%), the Thomson database (33%), and the Capital IQ database (3%).
Industry fixed effects	Fixed effects based on the industry of the investment. The industries are manually assigned to one of the forty-eight Fama-French industry classification using their SIC codes or their would-be SIC codes (based on the information in siccode.com). We classify as "machinery" the industry of 112 investments for which the PPM reported "manufacturing" as the sector and we could not find further details in other databases. The information sources for the industry of the investments are the PPM (60%), the websites of PE firms (16%), the Thomson database (20%) and the Capital IQ database (4%).
Fund or firm fixed effects	Fixed effects based on the fund or firm that made the investment according to the PPM. There are 1,095 investments for which we know the PE firm but not the PE fund that made them. These investments are excluded when running fund fixed effects or fund level regressions.
Mean log SI of block *t-h*	The equally-weighted average of the Log SI of all the investments that belong to a PE firm's block of investments, where *t-h* refers to the sequence of this block of investments in the track record of the PE firm.
Mean log investment size of block t	The equally-weighted average of the variable called "Log investment size" across all investments in block of investments *t*.
Mean market return of block *t*	The equally-weighted average of the variable called "market return" across all investments in a block of investments.
Block volatility	The standard deviation of the IRR or the PME of all the investments that belong to the block of investments *t*.
Block sequence number	The sequence number of block of investments *t* in the PE firm's track record.
Block country/industry	The most frequent country or industry of the investments in block of investments *t*. Where two countries or industries are equally frequent, we keep the country or the industry with the larger investments in terms of size. This variable is used to define the country and industry fixed effects in block-level regressions.
Mean log SI of fund	The equally-weighted average of the variable called "Log SI" across all investments that belong to a PE fund.
Log fund size	The natural logarithm of the capital committed to the PE fund in million of US dollars. The information sources for the variable are the PPM (72%), the websites of PE firms (12%), and the Thomson database (16%).
Mean market return of fund	The equally-weighted average of the variable called "market return" across the investments that belong to the fund of the focal investment.
Fund volatility	The standard deviation of the IRR or the PME of all investments that belong to the fund of the focal investment.
Fund sequence number	The sequence number of the PE fund in the PE firm's track record. If several funds of the same PE firm have the same starting year, we assume that smaller funds started earlier.
Fund country/industry	The most frequent country or industry of the investments in a PE fund. Where two countries or industries are equally frequent, we keep the country or the industry with the larger investments in terms of size. This variable is used to define the country and industry fixed-effects in fund-level regressions.

Table A.1 (cont')

Variable name	Variable description
Log EUM	The natural logarithm of the average of the total equity invested by the firm during each month of the life of the focal investment. The total equity invested in a given month is the sum of all the "investment size" for all the investments simultaneously held by the firm that month.
Number of industries held	The average of the number of different industries in which the PE firm has investments in each month of the life of the focal investment. The industry groups we use are the forty-eight Fama-French industries.
One minus Herfindhal industries	One minus the average of the monthly Herfindhal index of industry concentration during each month of the life of the focal investment. We calculate the monthly Herfindhal index of industry concentration based on the number of investments the PE firm has in each industry. We use one minus the Herfindhal index to have a measure of dispersion rather than concentration.
Number contemporary entry	The number of investments made by the PE firm from three months before to three months after the investment initiation date of the focal investment.
Number contemporary exit	The number of investments exited by the PE firms from three months before to three months after the exit date of the focal investment. This variable is available only for the subset of realised investments.
Investment sequence number	The sequence number of the investment in the fund's track record. The sequence is based on the year and month of investment initiation date. When several investments start at the same date, we sort investments by size and assume smaller investments come first. This variable is available only for the investments for which we know the fund identity (see "fund fixed effects" above).
Log SI per professional	The natural logarithm of the ratio of the number of simultaneous investments (SI) to the number of professionals working at the PE firm in the year of initiation of the investment. If the number of professionals is missing for one year but is known for the year t-1 and t+1, we assign to the missing year t the average of the years t-1 and t+1. Individuals with job titles containing the words "analysts" and "assistants" are not included in the count of professionals. The sources for the data are the Galante Private Equity Directories from 1996 (hence covering year 1995) to 2006.
Independent PE firm	A PE firm is classified as either independent or not independent (belonging to a financial group) based on the information contained in the field called "type of organization" in the Galante Private Equity Directory. A firm is classified as independent if none of the following terms is contained in the type of organization field: (i) private equity subsidiary; (ii) investment advisory firm; (iii) merchant banking; (iv) investment banking firm; (v) merger & acquisition firm. Other items that are found in the field are: (i) private venture capital investment firm; (ii) public venture capital investment firm; (iii) private buyout investment firm; (iv) public buyout investment firm; (v) private investment firm; (vi) public investment firm. There were seventy-six firms which were not found in the Galante Private Equity Directory. We classified these firms based on the information contained in the section called "about us" or "history" of their website. Of these seventy-six firms there were sixteen for which we could not find reliable information either because they did not have a website (twelve cases), or because their website did not provide the required information (four cases). We classified those sixteen cases as missing. There were only five cases in which we found that the PE firm changed its type of organization during our sample period. We have classified the investments made by those firms at different times according to the classification of the firm at the time of investment initiation.

Table A.1 (cont')

Variable name	Variable description
Hierarchy	The number of different job titles among the professionals working in the PE firm during the year of the initiation of the investment. We count all the titles provided in the Galante Private Equity Directories except those that contain the words "analyst" or "assistant." Because we are interested in constructing a proxy for the number of layers in a firm, in the cases of firms with multiple offices we count the job titles separately for each office and aggregate them for the firm. In some cases, the information of the title of a specific professional was missing. We discarded all the firm-years in which more than-one third of the listed professionals had no job title associated with their name. The sources of the variable are the Galante Private Equity Directories from 1996 to 2006.
Professionals' background diversity	One minus the Herfindhal index of the professional backgrounds of the employees working at the PE firm the year of the initiation of the investment. To construct this variable, we obtained the list of professionals working at each PE firm from the Galante Private Equity directories and collected the biographies of each professional. The sources of the biographies are the PPM (65% of cases) and the websites of the PE firms (35% of cases). Professionals at the PE firm are classified as having one of three different backgrounds: (1) finance background, if they spent most of their pre-PE career working in a financial institution; (2) consulting background, if they spent most of their pre-PE career working in a consulting or accounting firm; and (3) other background, if they spent most of their pre-PE career working in other industries or if they have always worked in PE. Individuals with job titles containing the words "analyst" or "assistant" are not included in the count of professionals. The Herfindhal index is based on the proportions of the three different backgrounds the year of the investment's initiation in the PE firm.

Table A.2 - Example of a PPM

Appendix D. Fund IV Track record
Status as at June 30, 2007, In million of Euro

Company	Date of investment	Date realized	Sector	Country	Cost	Realized value	Unrealized Value	Total value	Multiple	IRR	Exit
Realized investments											
X1	Apr-00	Apr-06	Healthcare	France	60	_	_	0	0.0	n.m.	
X2	May-01	May-06	Industrial	UK	140	120	_	120	0.9	n.m.	Trade sale
X3	Mar-01	Jun-03	Consumer	Germany	115	950	_	850	7.4	100%	IPO
X4	Mar-01	Jul-06	Chemicals	Germany	60	85	_	85	1.4	25%	Trade sale
Total Realized					375	1155		1055	2.8	51%	_
Partly realized investments											
X5	Oct-00	_	Healthcare	France	500	130	300	430	0.9	n.m.	
X6	Apr-04	_	Industrial	UK	200	150	190	340	1.7	100%	
X7	Feb-03	_	Healthcare	France	179	444	43	487	2.7	51%	
Total Partly Realized					879	724	533	1257	1.4	31%	
Unrealized investments											
X8	Dec-05	_	Healthcare	France	140	_	280	280	2.0	25%	
X9	Jul-02	_	Industrial	UK	450	_	450	450	1.0	n.m.	
Total Unrealized					590	_	730	730	1.2	10%	
Total					1844	1879	1283	3042	1.6	40%	

Table A.3 - Statistics on missing information

This table shows some descriptive statistics about different groups of investments classified according to the availability of the information in the PPM to compute the duration and the IRR of the investment. For the cases when a piece of information to calculate duration was missing, we inferred duration using the investment's IRR and the Multiple according to the following formula: Multiple = $(1+IRR)^{duration}$. We used the same formula to infer IRR when duration and the Multiple were provided in the PPM. Table A1 provides detailed definitions of all the variables.

	Number of investments	Median IRR	PME	MIRR	Multiple	Duration	Median Investment size	SI
Duration								
. Available in PPM	5698	0.20	1.26	0.16	1.89	3.83	15	17
. Assumed								
.. Inferred from IRR	1125	0.37	1.88	0.37	2.70	3.02	13	17
.. Set to median (IRR is -1 or 0)	325	-1.00	0.00	-1.00	0.00	4.00	13	23
.. Set to median (no IRR was available)	305	-0.14	0.38	-0.14	0.55	4.00	14	26
IRR								
. Available in PPM	6430	0.26	1.42	0.21	2.08	3.67	15	17
. Inferred from duration								
.. Inferred with available duration	719	-0.10	0.37	-0.10	0.60	5.00	16	25
.. Inferred with assumed duration	305	-0.14	0.38	-0.14	0.54	4.00	14	27

Table A.4 - Correlation matrix and distribution

Panels A and B of this table show the correlation matrix for the (z-score of the) main variables used in regressions. Panel C shows the distribution of these variables. All variables are defined in table A.1.

Panel A: Correlation matrix

		1	2	3	4	5	6	7	8
1	IRR	1.00							
2	MIRR	0.97[a]	1.00						
3	PME	0.76[a]	0.77[a]	1.00					
4	Log SI	-0.13[a]	-0.13[a]	-0.12[a]	1.00				
5	Market return	0.20[a]	0.20[a]	-0.05[a]	0.00	1.00			
6	Log investment size	-0.07[a]	-0.05[a]	-0.08[a]	0.07[a]	-0.12[a]	1.00		
7	Portfolio volatility	0.07[a]	0.05[a]	0.06[a]	-0.25[a]	0.02[c]	-0.15[a]	1.00	
8	Duration rest of portfolio	-0.04[a]	-0.05[a]	0.01	0.17[a]	0.02	-0.06[a]	-0.05[a]	1.00
9	Log firm age	-0.03[b]	-0.02[b]	-0.01	0.39[a]	-0.07[a]	0.23[a]	-0.15[a]	0.20[a]

Panel B: Correlation matrix

		4	10	11	12	13	14	15	16	17	18	19
4	Log SI	1.00										
10	Duration investment	0.07[a]	1.00									
11	Log EUM	0.67[a]	0.08[a]	1.00								
12	Log number of industries held	0.90[a]	0.08[a]	0.60[a]	1.00							
13	One minus Herfindhal industries	0.58[a]	0.06[a]	0.38[a]	0.84[a]	1.00						
14	Log number contemporary entry	0.83[a]	-0.01	0.52[a]	0.74[a]	0.46[a]	1.00					
15	Log investment sequence number	0.56[a]	-0.04[a]	0.27[a]	0.49[a]	0.26[a]	0.49[a]	1.00				
16	Log number contemporary exit	0.80[a]	0.12[a]	0.55[a]	0.72[a]	0.45[a]	0.68[a]	0.47[a]	1.00			
17	Log SI per professional	0.40[a]	0.04[c]	0.10[a]	0.26[a]	0.09[a]	0.35[a]	0.22[a]	0.23[a]	1.00		
18	Independent PE firm	0.00	0.02	-0.08[a]	0.02[c]	0.02[c]	0.01	-0.02[c]	0.02[c]	-0.11[a]	1.00	
19	Hierarchy	0.54[a]	-0.08[a]	0.32[a]	0.48[a]	0.24[a]	0.40[a]	0.56[a]	0.37[a]	-0.27[a]	0.20[a]	1.00
20	Professionals' background diversity	0.14[a]	-0.09[a]	0.07[a]	0.17[a]	0.12[a]	0.14[a]	0.11[a]	0.16[a]	-0.24[a]	-0.04	0.41[a]

Panel C: Distribution

		Mean	Stdev	Min	25th percentile	50th percentile	75th percentile	Max
1	IRR	0.24	0.66	-1.00	0.00	0.21	0.50	1.90
2	MIRR	0.19	0.58	-1.00	-0.01	0.17	0.43	1.55
3	PME	1.75	1.67	0.00	0.55	1.27	2.39	6.19
4	Log SI	2.89	0.87	0.00	2.28	2.87	3.50	4.91
5	Market return	0.12	0.10	-0.35	0.05	0.13	0.19	1.15
6	Log investment size	2.65	1.50	-8.77	1.74	2.70	3.66	5.31
7	Portfolio volatility	26.56	4.37	15.59	23.92	26.19	28.38	60.94
8	Duration rest of portfolio	4.65	1.02	0.00	3.98	4.73	5.35	8.11
9	Log firm age	1.41	1.30	-2.48	0.88	1.76	2.31	3.34
10	Duration investment	4.04	1.96	0.25	2.57	3.92	5.25	8.11
11	Log EUM	6.06	1.53	-2.02	4.97	6.08	7.23	9.25
12	Log number of industries held	2.28	0.67	0.00	1.84	2.33	2.79	3.58
13	One minus Herfindhal industries	0.81	0.14	0.00	0.78	0.86	0.90	0.95
14	Log number contemporary entry	1.79	0.88	0.00	1.10	1.79	2.40	3.85
15	Log investment sequence number	16.59	28.52	1.00	4.00	8.00	16.00	205.00
16	Log number contemporary exit	1.59	0.92	0.00	1.10	1.61	2.20	3.66
17	Log SI per professional	0.92	0.57	0.25	0.50	0.66	1.20	3.50
18	Independent PE firm	0.68	0.47	0.00	0.00	1.00	1.00	1.00
19	Hierarchy	6.74	7.90	1.00	3.00	4.00	7.00	42.00
20	Professionals' background diversity	0.49	0.12	0.13	0.44	0.50	0.59	0.67

[a] significant at 1%; [b] significant at 5%; [c] significant at 10%.

Figure 1: Distribution of performance, duration, and size

This figure shows histograms of IRR, public market equivalent (PME), investment duration (in years), and investment size (equity invested in millions of 2006 US dollars). The first bar of each histogram includes all observations below the threshold. The last bar of each histogram includes all observations in the threshold and above.

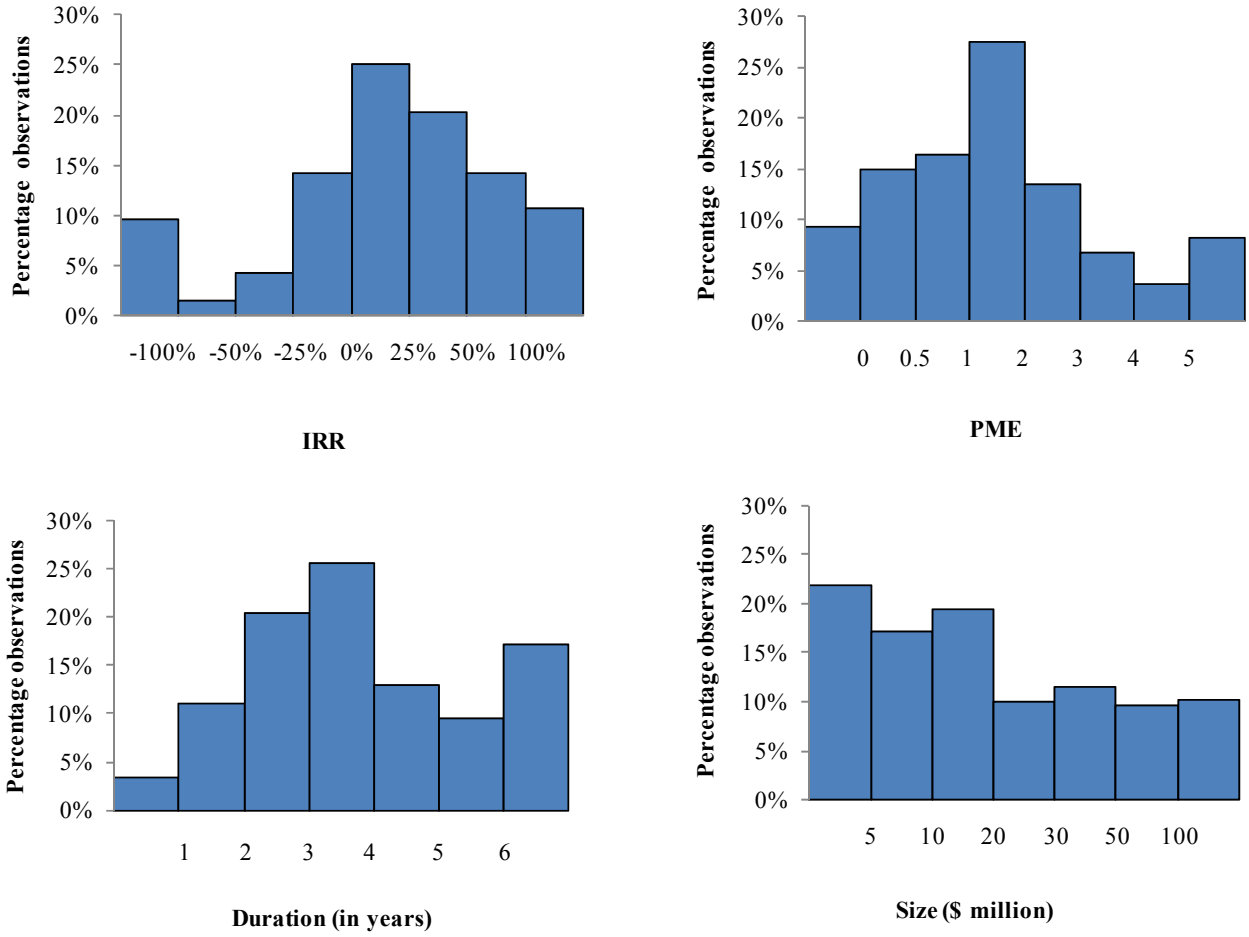

Figure 2: Performance and firm scale

The figure shows histograms for the median IRR and median PME for each firm scale decile based on SI.