Private Equity Investments: Performance and Diseconomies of Scale

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Preliminary – Please do not quote nor circulate

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This paper uses a newly created dataset containing the performance of 4,848 investments of 151 Private Equity (PE) firms between 1973 and 2002. This data allows us to present new results on the cross-section of private equity investments. We find that private equity investments are held on average for 4 years with only 14% of quick flips (held less than 2 years). The average IRR gross-of-fees is 17% with 10% of the deals going bust. Our investment level data coupled with structural characteristics of PE firms help us shed light on the issue of managerial diseconomies of scale. Investments held during times when a high number (or amount) of investments are under management underperform substantially: the median IRR is 32% for the lowest quartile and 11% for the highest quartile. These results are robust to a number of controls and across all sub-samples. Diseconomies of scale are somewhat attenuated in more experienced firms, more seasoned managers, and in PE firms with flatter hierarchies and where managers have similar backgrounds. Our results seem consistent with theories of diseconomies of scale originating from hierarchy and communication costs occurring when soft information is transmitted.

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1. Introduction

Private Equity (PE) has become a global phenomenon.[1] Strömberg (2007) estimates the total value of companies acquired by private equity firms to be around $3.6 trillion, with close to 14,000 companies worldwide held by PE firms in early 2007. Although some papers have started to analyze PE from an investment perspective (e.g. Kaplan and Schoar, 2005, Phalippou and Gottschalg, 2007, Ljungqvist, Richardson and Wolfenzon, 2007, Metrick and Yasuda, 2008, Hochberg, Ljungqvist and Vissing-Jorgensen, 2008), we still have little evidence on the cross-section of PE performance, especially at the investment level.[2] Our unique dataset allows us to fill up this gap and helps us study a question alluded by Jensen (1989) on the relation between performance and PE firm size.[3]

The relation between firm size and performance is an old issue in economics, going back to the question on the boundaries of the firm raised by Coase (1937). Although, there are many sources of diseconomies of scale (Bolton and Scharfstein, 1998, and Holmström and Roberts, 1998, for surveys), according to Garicano (2000) the "key trade-off the organization confronts occurs between communication and knowledge acquisition costs." If a firm scales up (hire more employees to make more investments), it increases the "utilization rate of knowledge" but it also increases the communication/hierarchy required, which is costly especially for soft information (e.g. Bolton and Dewatripont, 1994, Stein, 2002, Vayanos, 2003).

This trade-off is best illustrated with an example. Assume two PE firms with the same workload per employee. Firm A is small (2 partners, 4 staffs) and firm B is large (10 partners, 20 staffs). Firm B could have 5 independent teams of 2 partners and 4 staffs, and make five times more investments than firm A. In this case, firms A and B should have the same performance. However, firm B is unlikely to operate this way. The employees are likely to communicate. On the one hand, this is good because doing so increase the knowledge pool and its utilization rate. On the other hand, as argued by the theoretical literature, communication is costly. For instance, because each of the 10

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[1] In this paper, private equity refers to buyout investments. We do not include venture capital, real estate or any other asset class sometimes also referred to as private equity.

[2] To our knowledge, the only other study of private equity investment returns is that of Ljungqvist, Richardson and Wolfenzon (2007). They present a model that links buyout fund investment timing, risk-taking attitude and performance to credit market conditions and perceived fund abilities. They have take their model to the data and confirm their theoretical hypotheses. Although they do not look at the impact of scale on performance, but they have fund size as a control variable and find no significance. Kaplan and Schoar (2005), however, find a negative relation between fund size and performance. Fund size is, however, imperfectly correlated to firm scale since firms run several funds in parallel and the amount invested varies over fund's life. Cumming and Walz (2004) have mainly venture capital investment returns.

[3] When Michael Jensen (1989) predicted the eclipse of public equity by Private Equity, he argued that one of the reasons stemmed from PE firms having few investment professionals working to add value to a handful of portfolio companies, unlike traditional corporate headquarters and their army of employees supervising multiple divisions.

partners has a stake in all the investments, they may intervene in several investment decisions; perhaps in all of them. This creates lengthy discussions or disputes which prevent timely decision making. If the communication costs are large enough, the quality of the decision making will be lower in firm B. In this example, firm B would generate lower returns on its investments than firm A because of communication costs. The hierarchy cost argument works similarly. Firm B may have 2 partners, 4 managing directors and 40 staff. For simplicity assume that firm B employees have the same workload if they manage 5 times as many investments as firm A. Absent hierarchy costs, firm A and B would have the same performance. But because information has to flow from staff to managing directors to partners, some relevant information dies on the way. Each employee summarizes the information and passes it on to the next level. The quality of the decision making is negatively affected. Hence, in this example, firm B would have lower returns than firm A on its investments because of hierarchy costs.

We defer the discussion on whether firm A and B may co-exist in an equilibrium to the text but we note that these two firms are more likely to co-exist in private equity because of the large frictions on the PE capital allocation market (investors can not quickly increase or decrease their allocation to a PE firm). In addition, one may note that firm B might be more profitable even if it offers lower returns.

The above example illustrates what the theoretical literature has proposed as the core source of diseconomies of scale and thus the core determinant of optimal firm size. To empirically document the existence, relevance and source of diseconomies of scale, we constitute the most comprehensive panel of private equity investment performance to date (4,848 investments made by 151 private equity firms in 33 countries from 1973 to 2002).

We find that performance is negatively related to both the number of parallel projects (Number of investments Under Management, NUM) and their amount (Assets Under Management, AUM). The quartile of investments made by the smallest firms (AUM < $132 million) earns an average (*median*) annual IRR of 36% (*32%*) while the quartile of the largest firms (AUM > $1 billion under management) earns an average (*median*) IRR of 12% (*11%*). This spread is substantial and is similar when we form NUM-quartiles. After controlling for various investment and firm characteristics as well as various fixed effects (firm, fund, country, industry, focus and time), we find that our two measures are always significantly negatively related to performance. A one standard deviation increase in AUM (or NUM) decreases IRR by a whopping 10%, which is statistically significant at a 1% level test. We find similar evidence with NUM even though only 61% of the investments are common to the low AUM-quartile and low NUM-quartile.

Our results also survive a series of robustness checks. First, results are unlikely to be driven by differences in risk, systematic or idiosyncratic. Second, our findings are unlikely to come from sample bias. We show that our sample is biased neither in terms of performance nor in terms of coverage compared to existing databases. Third, results continue to hold when we aggregate investments at the fund level. Fourth, we instrumentalize NUM and AUM using firm age and results still hold. Fifth, results are unaffected by using a rate of return based on cash-on-cash multiples; which we denote Modified IRR. Finally, results are robust to changes in samples: using only liquidated investments, only US investments, and across time periods.

Having established the negative effect of scale on performance, we delve deeper to isolate more the source of the diseconomies of scale. First, size may penalize purchase prices. Firms may have a limited number of good ideas. Hence, the more investments they make, the lower the marginal expected return. We find that the number/value of investments made around acquisition time is negatively related to performance but it is dominated by NUM and AUM. We interpret this as showing that the driving force is the number (or value) of projects that are in the firm's hands *during* the investment's life rather than the number (or value) of project bought at about the same time. In other words, the problem seems to be mostly acute during the value-adding process. This is what theory would predict since the information is softer during the holding period than at purchasing time. In addition, we control for the investment sequence within a fund. We find that funds start with better investments but it is not statistically significant and this control does not affect our results. We also control for fund vintage year. The idea is that funds that belong to the same cohort may face similar competitive environment. Again, results are unaffected. Throughout, we also control for investment year fixed effects, which should also take away most of changes in opportunity set.

Second, we investigate whether there are diseconomies of *scope* and whether they dominate diseconomies of *scale*. PE firms that invest in many companies may invest in too many *different types* of companies. Hence, diseconomies of scope rather than scale may be behind our findings. Following the conglomerate literature, we construct two measures of focus: an industry Herfindhal index (sum of the squared fraction invested in each industry), and the number of different industries in which the firm invests. We find robust evidence of diseconomies of scope but these come in addition to diseconomies of scale. That is, after controlling for diseconomies of scope, NUM and

AUM remain significant at a 1% level test.

Third, firms may not scale up resources proportionately to the workload. Hence, employees at large firms may have a higher workload. To test this hypothesis, we construct the number/amount of parallel projects per manager and the number/amount of parallel projects per employee. We find that although these variables are negatively related to performance, their effect is dominated by NUM and AUM. These results suggest that our findings more likely due to communication/hierarchy costs than to employee workload or limited capacities.

In addition to offering a wealth of control variables, our dataset also contains the management team characteristics (school and professional background). This enables us to provide new and suggestive evidence on the nature of diseconomies of scale by offering proxies for both communication costs and hierarchy costs. Communication cost is proxied by the heterogeneity of the team in terms of background. There are three main professional backgrounds in private equity. Individuals coming from the finance industry used to dominate the industry. An increasing number of individuals come from the consulting industry. Finally, the third category contains people who had senior positions in corporations or have always worked in private equity. An Herfindhal index of manager backgrounds capture the heterogeneity of the team. The more heterogeneous the team is, the higher we expect communication costs to be.

Hierarchy costs are proxied by the number of job titles divided by the number of managers. We conjecture that more job titles per manager reflect a more hierarchical firm. These proxies address directly the theoretical arguments mentioned above and - to our knowledge - are novel to the literature. Our results show that firms with lower communication costs and those firms with flatter hierarchies have weaker diseconomies of scale. We also find that firms with more experience (more past deals) and especially firms with more experienced managers have weaker diseconomies of scale. Overall, the various pieces of evidence are consistent with the view that PE performance suffers when the value-added capacity of a management team needs to be shared across more investments. The negative effects are minimized by experience, more homogenous teams and flatter hierarchies.

Our results relate to two strands of empirical literature in finance. First, in the area of mutual funds, Chen, Hong, Hwang and Kubik (2004) conclude that hierarchy costs are relevant because smaller funds outperform and are better at picking local stocks for which information is conjectured to be softer. However, small fund outperformance is not significant for the recent time period (1981-1999) nor is it present in an international sample (Ferreira, Miguel and Ramos, 2008). The mixed results may be related to the fact that mutual funds vary greatly in the fraction of their portfolio they hold passively (Cremers and Petajisto, 2008). This implies that their size may not be closely related to the amount of necessary communication. Furthermore, it may be hard to distinguish between increasing communication costs and increasing transaction costs (i.e. liquidity needs) for mutual funds because size and liquidity are highly correlated (Massa and Phalippou, 2005).

Private Equity may offer a better testing ground because the management team is supposed to provide continuous and sizeable attention through value adding activities to a set of portfolio companies. The utilization rate of knowledge and costs of communication at each point in time can thus be reasonably measured by the number (or value) of portfolio companies under management. Furthermore, it is plausible that the managerial information communicated in a private equity firm is of a softer nature than that of stock trading strategies. Finally, as pointed out by Berk and Green (2005) diseconomies of scale do not lead to performance predictability if the economy is competitive and frictionless. Since arbitrage is significantly more limited in private equity (no short selling, capital is locked-in) than in mutual funds, scale effects could be magnified in private equity firms.

A second strand of the finance literature has approached the issue of diseconomies of *scope* by looking at the valuation of conglomerates. Consistent with sizeable diseconomies of scope, Lang and Stulz (1994) find that diversified firms trade at a discount. However, it has been argued that conglomerate data may be too noisy to conclude one way or the other (e.g. Graham, Lemmon, Wolf, 2002, Campa and Kedia, 2002, Schoar, 2002, Villalonga, 2004). Compared to conglomerate data, our PE data present the advantage of giving a return for each and every investment made. Our data on PE also helps us address the fact that conglomerates reallocate capital internally (Maksimovic and Phillips, 2002), which may blur the effect of communication/hierarchy costs. This issue is not present in the case of private equity.

Our study relates to Liberti and Mian (2008) who empirically document that greater hierarchical distance discourages the use of subjective and more abstract information. Our study also relates to a number of studies in venture capital – a similar asset class. First, Bottazzi, Da Rin and Hellmann (2007) examine how human capital (prior experience, education) and organizational form (captive venture capitalist or independent)[4] affect managers' involvement level and how involvement, in turn, influences the likelihood of investment success. Gompers, Kovner, Lerner and Scharstein (2006) document diseconomies of scope in venture capital. Our results are also related to

[4] In buyout in general and in our dataset in particular, firms are mostly independent.

a recent theoretical literature in *venture capital* which studies the trade-off between larger/smaller portfolios and diversified/concentrated portfolios (e.g. Kanniainen and Keuschnigg, 2003, Bernile, Cumming and Lyandres, 2005, and Fulghieri and Sevilir, 2008; Jones and Rhodes-Kropf, 2004, propose such a model for private equity). Empirical studies on the determinants of portfolio size in venture capital include Cumming (2006), Dai and Cumming (2008) and Gompers, Kovner, Lerner and Scharstein (2008). None of these papers, with the partial exception of Gompers et al. (2008), address the relation between investment performance and firm scale/scope, which is the focus of this paper.

Our study makes a number of side contributions. First, we provide stylized facts on private equity investment performance. We find that the overall gross-of-fees performance is relatively low, consistent with what has been documented using other databases (Kaplan and Schoar, 2005, and Phalippou and Gottschalg, 2008). The average IRR is 17% while the average duration of an investment is 4 years. Importantly, we also find that 11% of PE investments go bankrupt (return no capital), which is much higher than for publicly held companies but lower than for junk bonds. We also bring hard evidence on the debate on quick flips (investments held less than two years). Complementing the findings in Strömberg (2007), we find that quick flips represent 14% of all the investments and that there is no clear time trend. Additionally, we show performance across countries, industries, time, by schools, consultancy firms, and investment banks. A second side contribution is to document economically large and significant performance persistence in a large cross section of private equity investments.[5]

The paper is organized as follows. Section 2 describes the data, their sources and their coverage. Section 3 is devoted to establish the key performance characteristics of the PE industry and other descriptive statistics. Section 4 deals with the main empirical tests on performance and the number and amount of investments under management. This section also covers the persistence of performance, and tests for the effects of other variables likely affecting PE returns. Section 5 is devoted to disentangling between different sources of diseconomies to scale. Finally, section 6 briefly concludes.

[5] Kaplan and Schoar (2005) find mild evidence of performance persistence in a sample of 76 US buyout funds. This may be due to the low amount of observations. For venture capital funds, for which they have more observations, they find strong evidence. Also, Hochberg, Ljungqvist and Vissing-Jorgensen (2008) find strong evidence of venture capital funds persistence but not for their smaller sample of buyout funds.

2. Data and Hypothesis

2.1. Institutional background

Buyout firms– also called private equity firms – are run by General Partners (GPs). GPs have control over all important decisions (e.g. investments, divestments, operational changes) for all the funds managed by the buyout firm. Funds have a finite life of ten to fourteen years. At each point in time a firm may have several funds running. Typically, buyout firms launch a new fund every two to four years. Fund investors, called Limited Partners (LPs), commit a certain amount of capital to buyout funds at inception. LPs cannot add or withdraw capital during the fund's life.[6] They are principally institutional investors, such as endowments and pension funds. When buyout firms raise a new fund, they send fund raising prospectuses called Private Placement Memoranda (PPMs), which contains the performance of *all* previous investments.

2.2. Data source and coverage

Our main data source consists of hand-collected PPMs of buyout firms.[7] Our collaborating investors are based in both Europe and the US and gave us PPMs irrespective of their final investment decisions. Table 1 – Panel A shows the number of observations per year and compares it to Thomson Venture Economics (TVE).[8]

Our data collection efforts started in 2001 and we thus have less coverage over recent years. For the 1973-2002 time period, we have 4,848 investments for a value of $197 billion versus 5,919 investments for a value of $205 billion in TVE. Our coverage is thus slightly inferior to that of TVE. Strömberg (2007) shows the coverage of Capital IQ. He reports – in his Table 3 – 304 deals from 1985 to 1989 (we have 409), 473 deals between 1990 and 1994 (we have 990), 1952 deals between 1995 and 1999 (we have 2,317). However, after 2000, our coverage is lesser (Strömberg counts 2110 deals between 2000 and 2002 while we have 1,008). Our coverage is thus significantly superior to that of CapitalIQ before 2000, which is what most of our working sample contains.[9] Finally,

[6] Selling stakes to another investor is increasingly feasible. For most of our sample, this option was not available.

[7] Selected past investments are always excluded. Also, we eliminate the investments made by fund managers when they were working for another buyout firm (257 cases, 3% of total size and average IRR of 37%; versus 24% for rest of the sample). Sometimes, firms provide a track record where all its previous investments are pooled together without information on which fund did which and less than 75% of the investments are LBOs, the firm is excluded. If a firm reports the performance for each of its funds separately then we exclude funds with less than 75% of LBO investments.

[8] In TVE we restricted the search to "private equity firms managing their own capital", investment size above $100,000, "private equity" fund focus and "buyout" investment stage.

[9] Previous academic studies of private equity investments either have US only data or recent Europe data only, never both. The largest US sample is that of Cotter and Peck (2001) with 763 transactions between 1984 and 1989. We have

although our sample is not directly comparable to that of Ljungqvist, Richardson and Wolfenson (2007), their 2,274 buyout investments (1981 to 2003) are about half of our sample.

In Table 1 – Panel B, we show our coverage and that of TVE for the five main countries. We have a superior coverage to TVE outside the US. US investments represent, nonetheless, as much as 55% of all our investments. The UK dominates the rest of the world. It has about 4 times as many investments as the third largest country (France).

2.3. Data content and corrections

In the PPMs, we observe for each investment, the equity invested, total amount distributed and current valuation of any unsold stake (as of date PPM was written). The corresponding multiple (current valuation divided by investment) for each investment is always reported. In most cases, the following information is given: month and year of acquisition, IRR, month and year of exit, status (realized or unrealized). A majority of PPMs also contain information about the exit route, the investment type, the industry, the country, and the biography of the senior managers (including those who left the firm). Whenever possible, we use TVE, Galante Private Equity directory, Capital IQ, and web resources (both present and older via webarchive.org) to complement our data.

< TABLE 1 >

In Appendix A and Table A.1, we provide details on the frequency of missing information on duration and IRR as well as the extrapolations we make to replace these missing observations. Investment industry descriptions are manually assigned (except if we have the SIC classification from TVE) to one of the 48 Fama-French industries.

The first unique aspect of our sample is that we have performance of private equity investments. Only two other datasets have such data to our knowledge, those of Ljungqvist, Richardson and Wolfenson (2007) and the CEPRESS dataset (used by Cumming and Walz, 2007, among others). On the one hand, these two datasets are superior in that they have the cash flow details of each investment, while we have only two summary variables (IRR and multiple). On the other hand, what we need for our analysis is to have, in addition of performance, the full track record of a firm. This is what our dataset uniquely provides. In addition, these two other datasets are not linked to biographical data of the managing team unlike ours. Moreover, our dataset is likely to be

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about half that number. The largest European sample is that of Wright, Renneboog, Simons and Scholes (2006) with 5,000 investments from 1996 to 2000. This is four times what we have for this sub-sample. Note also that Stromberg's sample is not restricted to private equity firm sponsored buyout, unlike our sample.

more representative of the universe than that of Ljungqvist, Richardson and Wolfenson (2007) because the investments they have are those made by a single investor. Even if this investor does not maximize returns as argued by Ljungqvist, Richardson and Wolfenson (2007), the fact that the investor kept on investing for 25 years and is happy to share its track record with academics may indicate that its investments are above average.

2.4. Sample representativeness

In terms of sample bias, only firms with good track records will send fund raising prospectuses during our collection period. However, it is rare that major buyout firms stop fund raising, even following poor performance. But smaller organizations probably have. Note also that our performance data are audited, which implies that buyout firms need to disclose all the investments they made including the bad ones. As a consequence, our sample contains numerous poorly performing investments but probably less than the universe.

In Table 1 – Panel C, we compare the fraction of successful exits in TVE between the firms that are in our sample and those that are not. Successful-exit rate is the fraction of investments exited by sale (merger, acquisition) or IPO; it is frequently used as a proxy for performance in the literature (e.g. Hochberg, Ljungqvist and Lu, 2008). We find that our sample is more representative among well performing firms and less representative among poorly performing firms. Overall, the firms in our sample are slightly more successful than those in TVE but the spread is not significant. Hence, our dataset does not appear significantly biased compared to the major existing database.

3. Descriptive statistics

From here on, we restrict the sample to investments made at least two years before the PPM is written. This is because investments are typically held at cost (hence IRR is zero) unless there is good news. In the first two years of an investment, therefore, we either observe exceptional performance or zero return, rarely negative returns. To avoid any bias, these observations do not enter subsequent analysis.[10] In this section, we first show the distribution of performance and duration. Next, we show statistics on performance for different sub-samples.

[10] About half of the investments made in the last two years are held at cost. 80% of those not held at cost have positive returns (average is 55%). This is a consequence of the widely applied rule that investments are held at cost unless there is material changes that justify otherwise. Poorly performing investments tend to be held at cost while well performing investments get marked to market. This effect continues beyond year two but the fraction of investments held at cost drops substantially then. In our working sample, only 4.9% of the investments are held at cost.

3.1. Distribution of Performance and Duration

Figure 1 shows the distribution of performance (gross of fees) and duration. These unique statistics are important as they are at the core of many debates in private equity.

The first question is: how many companies go bankrupt? We label bankrupt, an investment that returns no capital at all. An important advantage of our dataset is that it measures 'bankrupt.' As pointed out by Strömberg (2007), measuring bankruptcy rates is typically difficult as this is not a well publicized exit route. In the full sample, the answer is 9% and in the liquidated sample, it is 11%. As some poorly performing investments may be held longer before being written off, these figures are by definition a lower bound. This lower bound is slightly higher than the 7% reported by Strömberg (2007). But as he points out, it is difficult to deduct failure from Capital IQ and other public sources. Our figure is, however, consistent with the 12% that Wright et al. (2006) report for the universe of UK buyouts over the last 20 years.

The average duration is 4 years (Table 2 – Panel A), meaning that the annualized failure rate is around 3%, which is much higher than the 0.6% annual default rates for US publicly traded firms according to Compustat between 1983 and 2002 (Ben-Ameur et al., 2005). Reassuringly for our data, it is higher than the 1.6% default rate of corporate bond issuers and less than the 4.7% default rate of speculative grade debt (Moody's figures, see Hamilton et al., 2006).

The second question is: how many quick flips are present? A quick flip is an investment held for less than 2 years. A lot of popular critics of private equity focuses on these deals, hence it is important to know their frequency. Figure 1 shows that quick flips represent 14% in the full sample and 20% in the liquidated sample. Our number is slightly higher than the 12% that Strömberg (2007) reports but Strömberg (2007) finds higher quick flips before 2000 and in PE firm sponsored deal (our sample). Hence, our data are consistent with Strömberg (2007) finding. Also our average duration is in the same range as what Strömberg (2007) reports.

< Figure 1>

3.2. Performance and Duration

We now show average performance, fraction of investments going bust, fraction of quick flips, median NUM and average duration for a number of sub-samples: per exit route (Panel A), per country (Panel B), per industry (Panel C), and per year (Panel D).

As mentioned above, PPMs provide us with two performance measures. The first measure is

IRR. It is however known that because of the re-investment assumption implicit in its calculation, IRR exaggerates performance (Phalippou, 2008). The correlation between the cross section and true rate of return should be nonetheless high enough for cross sectional inference not to be significantly biased. To verify this empirically, we construct a rate of return that makes an assumption at the other extreme, i.e. the re-investment rate is zero. This performance measure is simply the so-called cash-on-cash multiple raised to the power one over duration. It is used in Ljungqvist et al. (2007) for example and we label it Modified IRR (MIRR). It is a lower bound for performance.

To show aggregate performance measures, we cannot simply average IRRs or MIRRs (Phalippou, 2008). Following Phalippou and Gottschalg (2008), when averaging IRRs (or Modified IRRs), we weight by both (winsorized) Size and (winsorized) Duration, labeled 'DVW'.[11] The reason is a large negative correlation between IRR and duration (-41%; see Table A.4). This negative correlation also holds in the sub-set of liquidated investments (non-tabulated). This is similar to what Phalippou and Gottschalg (2008) found with TVE fund data. This robust result is very important. It means that the typical IRRs in private equity are as follows: Project 1 has 50% IRR for 2 years and project 2 has 0% IRR for 10 years. Hence, taking the average IRR creates a misleadingly high number. Someone investing in these two projects equally did not experience a 25% return. As a rough correction, we weight IRR by both size and duration.

Table 2 - Panel A shows that multiple averages 2.6, median IRR is 19%, average (duration value weighted) is 17% and average MIRR is 9%. Average duration of an investment is 4.1 years. These performance figures cannot be benchmarked as we do not have the underlying cash flows. Nonetheless, they appear consistent with the literature that finds private equity performance close to that of public stock-markets (Kaplan and Schoar, 2005, and Phalippou and Gottschalg, 2008). The reader may bear in mind the usual pitfall of aggregating and benchmarking IRRs (Phalippou, 2008). In addition, it is worth bearing in mind that performance is gross of fees and average fees are in the range of 7-9% (Phalippou, 2009).

< TABLE 2 >

The sub-sample of liquidated investments has higher performance. As mentioned above this is related to the tendency to liquidate more quickly the best investments. Conservative accounting may also play a role. In addition, we note that the literature has often used sales and IPO exits as

[11] Their 95th percentile is 7.6 years and $139 million respectively. Note also that duration is the time between beginning and end of the investment. It is a proxy since we do not know the timing and amount of intermediary dividends and investments.

proxy for success. We confirm that IRRs are indeed much higher for these investments, especially those exited by IPO.

Table 2 – Panel B shows performance statistics per country. France, the UK and especially Germany tend to have low performance while at the other end of the spectrum, the Netherlands, Sweden, Italy and Spain appear as the best performers. Their average multiple is above 2.4 and their average IRRs above 27%. We have 8 countries in the working sample that can be classified as developing countries. These are Argentina, Brazil, Chile, China, Indonesia, Korea, Mexico and Poland. There are only 35 investments made in these countries but their total size is relatively large (as much as Italy). Their performance is lower than average.

We note large differences across countries in terms of fraction of bust investments; from a high 16% in Germany to none in the Netherlands. Similarly, for quick flips, it varies from a high 25% in the Netherlands to a low 9% in Italy.

Table 2 – Panel C shows the same statistics per industry. We further group the 48 industries in the 13 industries displayed here (see Table A.2.). As pointed out by Strömberg (2007), private equity spans a large number of industries. The service industry has the highest average IRR while the finance industry has a largest multiple. Wholesale and natural resources have the lowest IRR.

In Table 2 – Panel D shows performance statistics per year. Buyout performance is very cyclical. Performance is high in 1985 and 1986 in the hey-days of the junk bond market, followed by a sharp decrease in 1989-1990 when the same junk bond market collapsed. 15% of the 1989 investments went bankrupt. Then, it picked again in 1993, to reach another low in the late 1990s to pick up again in 2002, which triggered the huge capital flow to PE and subsequent purchasing frenzy of 2004-2007.

Also, as Strömberg (2007), we do not see evidence that the frequency of quick flips has increased over time. However, we note strong cyclicality. In good times, quick flips as more frequent, consistent with casual observations in the press. Quick flips had a high in 1986-1987 at more than 25% and a low in 1990 at 5%.

4. Main result

Our working hypothesis – motivated in the introduction – can be written as follows: If during the life of a given investment *i*, the private equity firm had to share its value added capacity with more (other) investments, the quality of the value-added services provided to investment *i* is lower, thus performance of investment *i* will be lower.

We thus need to measure the number (or value) of the investments that the firm was operating during the life of the focal investment. To construct it, we proceed as follows. Every month during the life of firm's *f* investment, we compute i) the number of on-going firm *f* investments, ii) sum of the size of on-going firm *f* investments. Next, we take the average of these variables across all the months of the investment's life. We label these variables, respectively, Number of investments Under Management (NUM) and Asset Under Management (AUM).

We see NUM and AUM as two different dimensions of diseconomies of scale. Casual evidence indicates that investments require similar amount of time irrespective of the size (see Quindlen, 2000, for venture capital). This would make NUM the best proxy but AUM is a natural proxy and helps disentangle some alternative explanations.

In this section, we test our working hypothesis. We begin by showing the performance across NUM-quartiles and AUM-quartiles. Next, we evaluate differences in risk across quartiles. Next, we show results from regression analysis, controlling for a number of determinants of performance. Finally, we show robustness tests.

4.1. Quartile analysis

We form quartiles based on AUM and NUM. Each quartile contains about 1,000 investments. Table 3 shows that investments held when fewer parallel investments were on-going have a much higher performance; consistent with our working hypothesis. Investments in the lowest NUM-quartile (less than 8 other investments running at the same time on average) have a median IRR of 30% (Table 3 – panel A). At the other end of the spectrum, the highest NUM-quartile (more than 35 other investments running at the same time on average) have a median IRR of 9%. This decrease is observed irrespective of either the weighting of investments (equally weighted or duration value weighted) or the performance measure used.[12] The difference in performance is always economically

[12] For equally weighted average IRR we use winsorized IRRs – otherwise some 10,000% observations blur the picture. As noted above, equally weighted average IRR is artificially higher than duration-value-weighted average IRR and exaggerate the spread in performance.

large.

< TABLE 3 >

Table 3 – Panel B shows that the same holds when using Asset Under Management (AUM) instead of NUM. NUM and AUM are correlated but not perfectly so (coefficient of correlation is 64%). Firms with higher AUM tend to invest in more projects but they also invest in larger projects. Only 61% of the investments that are in the low AUM-quartile are also in the high NUM-quartile. Hence these two effects are distinct.

In non-tabulated results we run the same analysis with the sub-set of liquidated investments and find the same results. The lowest NUM-quartile has a median IRR of 40% and the highest NUM-quartile has a median IRR of 22%. Hence the spread is the same. We also perform the same analysis on deciles and show results in figure 2. The bottom decile (either AUM or NUM) has a median IRR of 36% while the top decile has a median of 8%, hence the spread is larger with deciles.

< Figure 2 >

4.2. Risk differences

It is important to verify that the differences in performance are not due to differences in risk. Although the nature of the data prevents a direct measure of systematic risk at the investment level, we proxy for beta by regressing the cross-section of IRRs (or MIRRs) on 'market return' in each NUM/AUM quartile. Because IRR exaggerates returns due to the re-investment assumption and, in addition, early dividends are likely to be observed more frequently after large stock-market returns, our proxy for beta is likely upward biased. The proxy for beta obtained with MIRR does not have this problem but it is nonetheless a proxy. However, accounting values may smooth returns and produce lower betas (see appendix C for details and discussion).[13] nonetheless, these distorting effects are not expected to differ systematically across quartiles.

Results in Table 3 show no significant differences in betas across NUM-quartiles. It is 1.2 for low NUM and 1.3 for high NUM (Panel A). Hence, if anything it is the high NUM investments that show more dependence on market returns rather than low NUM investments. For AUM quartiles, there is a higher beta for low AUM investments (1.6 versus 1.4) but this is not statistically significant and cannot explain the wide spread in performance. The two betas are also not statistically different

[13] Driessen, Lin and Phalippou (2008) propose a methodology to measure risk exposure of buyout funds (net of fees) and find that it is slightly below one. Their buyout sample, however, is small and produces a fairly noisy proxy – unlike their venture capital sub-sample.

from one another.

It is also worth pointing out that an important driver of differences in systematic risk across investments is the industry and country of the investments and we always control for those in subsequent tables. Finally, there is empirical evidence that larger firms leverage more, not less. Hence we would expect more systematic risk with high NUM/AUM rather than the other way around. Specifically, Demiroglu and James (2008) find that larger PE firms pay narrower loan spreads, have fewer and less restrictive financial loan covenants, use less traditional bank debt, borrow more and at a lower cost from institutional loan markets. Overall, larger PE firms use more leverage to finance the buyout but do not make buyouts at higher valuations.

Table 3 also indicates that total volatility or tail risk is not higher for low-NUM or low-AUM investments. If anything, it is the opposite. Table 3 – Panel A shows that the variance of IRRs within each NUM quartile is the same across quartiles. It also shows that low-NUM investments are less frequently bankrupt (6% versus 13% for high-NUM investments), less frequently losses (17% versus 32% for high-NUM investments), and more successes (33% of the investments have IRRs above 50% versus 20% for high-NUM investments). Hence, low NUM coincides with both fewer losses and more successes.

Some of the results are different for AUM (Panel B) but the conclusion is the same. The variance is higher for low-AUM investments but it is all due to extreme winners. The downside variance (i.e. computed only among losses) is the same across AUM-quartiles. Again, low-AUM have less frequent losses and more frequent home runs.

Finally, one may wonder whether investments have a different duration across quartiles. We find that there is no statistically significant differences across NUM-quartiles. For AUM-quartiles, duration is shorter for low-AUM investments. It is statistically significant but not economically large (3.8 years for low-AUM investments versus 4 years for high-AUM investments).

4.3. Multiple regression – Base specification

The statistics in the previous sub-section suggest that our hypothesis holds. But one ought to add a number of control variables. The investments made by low-NUM firms may differ from those made by high-NUM firms in many dimensions and that could in turn explain our findings. In this section, we thus perform multiple regressions with investment IRR or MIRR as a dependent variable.

As both IRRs and MIRRs take extreme values, we winsorize them at the 95th percentile.[14]

All the independent variables are expressed as a z-score (subtract sample mean and divide all by the sample standard deviation). This does not affect the t-statistics but enables us to directly compare the economic magnitude of the variables. Since we obtain an equation of the type: IRR = coef.(size-μ)/σ, the coefficient measures the change in IRR due to an increase of one standard deviation in size. All the standard errors are obtained by two-dimensional clustering (time and firm) as we expect dependence in residuals within a given firm (NUM/AUM are quite persistent) and within a year (IRR being cyclical and expected to be correlated across firms within a year).

4.3.1. Time, country, industry and focus fixed effects

First, it is natural to include time fixed effects. This is equivalent to subtract the yearly average to all variables. It is important because i) NUM increases over time (Table 2 – Panel D). This increase may coincide to increasing competition and decreasing performance, ii) credit spreads and more generally, cost of capital, varies over time. When prospects are good for private equity we can conjecture low expected returns and more investments. Again, this means a negative NUM-performance relation. All these alternative explanations are controlled for by time fixed effects.

Time fixed effects are taken at investment inception. As investments vary in their duration, market-wide conditions *during* investment's life may not be fully captured by time fixed effects and we thus always control for average S&P 500 index return during investment life (label 'market return').

Results are shown in Table 4A – Panel A specification 1. We find a very large effect of NUM on performance after controlling for both time fixed effects and stock-market returns. A one standard deviation increase in NUM decreases IRR by 10%, which is statistically significant at a 1% level test. We also note the very large dependence between IRR and stock-market returns.

Second, country statistics show that firm scale (NUM) varies dramatically across countries. It is above 40 in the UK, Italy and Germany and lower than 15 in Spain, the Netherlands, Sweden and the US. Interestingly, UK and Germany are worse performers the Netherlands, Spain, Sweden and the US. Hence the above evidence that NUM relates to performance may be a country effect (e.g. better legal environment). To control for all country-based explanations, we add country fixed effects. Specification 2 shows that this has no consequence on the relation between performance and

[14] After winsorizing, the IRR distribution is symmetric. The 95th percentile is 208% for IRR and 167% for MIRR.

either NUM or AUM.

Third, we add industry fixed effects. High-NUM investments may take place in different industries than low-NUM investments. We control for this and find no change for the relation between performance and either NUM or AUM.

Fourth, we add stage fixed effects. Private equity firms make some investments that are not buyout investments. They sometimes invest in publicly traded stocks (very rare) or in venture capital (7% of the observations; 4% in terms of size). Also, buyout investments can be sub-divided into growth capital, MBO and traditional buyout. We add a fixed effect for these different focuses. Again, they leave results unaffected.

4.3.2. Controlling for investment size, firm age and experience, and volatility

Specification 5 controls for investment size. Although size is unlikely to explain the NUM-performance relation given its low negative correlation with NUM (Table A.4), it is natural to control for it as it is sometimes used as a risk factor for public equity. We find that size is negatively related to performance when controlling for NUM and positively related to performance when controlling for AUM. In neither case, it affects the relation between performance and NUM/AUM.

Specification 6 controls for firm age. It is not significant. Specification 7 controls for experience, which we measure by the number of investments made by the firm at the time of investment that are now liquidated. It is not significant either.

Jones and Rhodes-Kropf (2004) argue that not only systematic risk should be priced but also total risk. They propose a model for private equity that hold more total risk should outperform. We proxy for the volatility of the investment portfolio using the investment industry and the variance-covariance matrix of the returns of publicly traded companies in each industry. More specifically, we first compute the variance covariance matrix Ω of the 48 industry based on the industry returns provided by Ken French on its website. Next, we compute the fraction (in terms of size) $w_{i,t}$ invested in industry $i = 1,\ldots,48$ in month t. Volatility in month t is given by $[w_{1,t} \ldots w_{48,t}].\Omega.[w_{1,t} \ldots w_{48,t}]'$. Finally, we average the volatility across all the month during which the investment is held. Specification 8 shows that volatility is not significant.

4.3.3. Controlling for past performance

In specification 9 we control for past performance; there are two reasons. One, Kaplan and

Schoar (2005) show that it is an important driver of performance. Second, one may argue that the choice of NUM depends on past performance. For example, a firm may make many investments following poor past performance in the hope that one of them will make it to the news; a sort of betting the house attitude. In this case, NUM could be negatively related to performance but that would be dominated by past performance.

Past performance is the average IRR of all previously made investments. Past performance is strongly positively correlated to current performance at a 1% level test and slightly weaken the NUM/AUM-performance relation, but the latter stays significant at a 1% level test.

Another way to refute the above story is that AUM is unlikely to be readily increased following poor performance. So if the house betting story holds, AUM should not be related to past performance, only NUM would be. We find it not to be the case. AUM is also significantly negatively related to performance (Table 4A – Panel B). Hence, the house betting story is not supported by the data.

Kaplan and Schoar (2005) found only weak evidence of persistence on the sub-sample of buyout funds. The reason is probably due to our larger number of observations and more disaggregated level of data. Kaplan and Schoar (2005) have 76 buyout funds and we have nearly 4,000 buyout investments. We thus provide the first evidence of large persistence in buyout investments performance.

< TABLE 4 >

4.3.4. Firm and fund fixed effects

In specification 10, we control for firm fixed effects. A number of unobservable firm characteristics could be behind our results. For example, one may argue that firms with high NUM/AUM have less talented people. A talented individual is likely better off running a small fund than being an employee of a large firm. Our results actually become stronger with firm fixed effects. The economic effect nearly triples. This shows that the effect happens within a firm. As a firm does more parallel investments than in the past, its performance goes down.

This piece of evidence also shows that firm unobserved fixed characteristics are not being our results. Nonetheless, firms evolve over time. For example, KKR in 2000 has little to do with KKR in 1980. To further control for unobserved firm characteristics, we use fund fixed effects. Specification 11 shows that NUM and AUM remains statistically significant at a 1% level test.

Note that we know which fund did which investment in only two thirds of the cases. For the other third, the firm presents a pooled track record. This may be voluntary or because the firm does not have a limited-life fund partnership structure (e.g. this is the case of publicly traded closed end private equity funds). For the latter, we create artificial funds by grouping investments in 5-years groups. In the end, we have 311 funds.

In Table 4B we show results for the same regressions as in Table 4A when using MIRR instead of IRR as a dependent variable. We do not observe any difference. Panel B shows the results for AUM (instead of NUM). Again, results are unaffected.

We pursue without funds/firms fixed effects – they make the estimation heavy (more than 200 explanatory variables) and including them would somewhat change the story. Specification 12 is the specification we will carry throughout the rest of the paper. It contains the variables that are significant (NUM or AUM, market return and investment size). It also contains time, country, industry and focus fixed effects.

4.4. Robustness

We now assess the robustness of our main results. We first show the final specification (spec 12) for different sub-samples. Next, we show instrumental variable regression results. Finally, we show results at the fund level.

4.4.1. Sub-sample – Liquidated and excluding inferred performance

Table 5A shows results when we exclude the inferred IRRs (or MIRRs). As mentioned above and in appendix A, prospectuses do not always report IRR, hence some were deducted from duration and multiple. Similarly, if duration and multiples are not both available, MIRR has to be inferred. We verify that our results hold without those observations. They do and get actually stronger, especially for MIRR.

< TABLE 5 >

We also show results when we exclude non-liquidated investments. As these investments performance is partly subjective (self reported) and not final, one may prefer to exclude these investments. However, as shown above, liquidated investments have higher performance partly because of a negative relation between performance and duration. Hence, including only liquidated investments introduce a sample bias but improves the accuracy of performance. Another reason why one may want to look at the sub-set of liquidated investments is that smaller funds (low NUM/AUM) may have less reputation and may thus be more aggressive with their accounting valuations. This would consistent with the results above but it should disappear on the sub-set of liquidated investments. We find that results are the same on this sub-sample despite this being about half the size of the original sample.

Finally, we exclude both inferred IRRs/MIRRs and unrealized investments. Again, results are not affected despite a dramatic decrease in sample size. If anything, they get stronger.

4.4.2. Sub-sample – US versus non-US

As shown in the descriptive statistics, US represents more than half of our sample and it is thus important to verify that our effect holds outside the US. Table 5B shows that results are weaker outside the US but are still significant. This may be because there is less dispersion in NUM and AUM for non-US investments. Naturally, when we include only US investments, results are stronger. This means that the geographical composition of our sample – and the fact that we may underweight the US – should not be a concern for our results.

4.4.3. Time sub-periods

Table 5C shows results for time sub-periods. We cut the sample at the beginning of the second private equity wave. Table 1 shows a large increase in investment in 1995 that marks the start of a second private equity wave. Hence we show result for 1973-1994 and 1995-2002. There are still more observations for the second part of the sample due to a steady increase in number of investments. We find that results are significant but there is a clear decline in the effect of diseconomies of scale. This may be a sign that investors are learning about diseconomies of scale.

4.4.4. Skill and School network differences – direct proxies

Firm fixed effects and fund fixed effects should control for differences in skills and network across firms. Our data, however, allows some more direct tests. We then compute the fraction of the managers with a master degree and an MBA degree at the time of the investment. We also compute the fraction of the managers with a consultancy background and a finance background. Finally, as mentioned in the introduction, we compute background concentration of the team and hierarchy steepness.

Table A.5 shows descriptive statics on the background of managers. Panel A shows performance per master degree school; which are mainly MBAs.[15] University of Chicago is the best among the top 5 with an average IRR of 20% for the 447 investments where at least a Chicago graduate was present. Second best performer is Harvard at 15%. Upenn graduates have the lowest performance. Graduates from other schools and non-master holders have similar performance as the top 5 schools. Probably the most striking statistics in this table is the formidable concentration of Harvard master (90% are MBAs, rest is mainly Harvard law school). They represent more than a third of all master holders and are more numerous than the four next schools together (Upenn, Stanford, Columbia and Chicago).

Panel B and Panel C show performance per investment banks and consultancy firms. Ex Goldman Sachs and Merrill Lynch employees have average IRRs above 25%. Managers are quite equally distributed across the finance institutions. The same is observed for consultancy firms. Unlike with finance institutions, however, we observe wide differences in performance for ex-consultants. Ex-BCG managers and ex-Bain have very high performance while ex-McKinsey managers have negative average performance.

In Table 5D, we show that none of the background variables relate to performance nor weaken the relation between NUM and performance. This holds for both NUM (Panel A) and AUM (Panel B). Only IRR results are shown but results are the same with MIRR.

These results show that NUM/AUM effects resist control for educational and professional background. The fact that having more people from top 5 schools does not affect results also shows that school networks are not behind our results. Finally, note that our results also complement the literature on the impact of educational and professional backgrounds in various financial activities (e.g. Zarutskie, 2008, for venture capital).

4.4.5. Instrumental variables

Despite all the control variables, one may still think that NUM is endogenous and that there might be some unobserved variables that jointly determine NUM/AUM and performance. This would be surprising, however, given that this variable would be positively related to performance but

[15] For each investment, we compute the fraction of managers (among those that have a senior rank at the time of this investment) that have an MBA from school XYZ, that have previously worked for consultancy firm XYZ or investment bank XYZ. Details are given in Appendix B. We compute the average performance per school (or ex-employer) by weighting each investment performance by the fraction of managers from that school (or ex-employer) and the size of the investment and, in addition when using IRR, times its duration.

negatively related to firm scale. Hence it would be a kind of bad skill/quality that would increase with firm scale – this seems counter intuitive. We nonetheless attempt to use an instrument for firm scale. An important determinant of firm scale is certainly firm age. As firms get older they get more capital under management. We saw in Table 4 that firm age, however, is not related to performance. This may then be a good instrument.

Results are shown in Table 5E. Panel A shows the results of the second step regression while Panel B shows results from the first step. Both NUM and AUM is found to be positively and significantly related to firm age at 1% level test. From the first stage regression, we compute the fitted NUM and AUM. Panel A shows results from regressing IRR and MIRR on all the control variables and the fitted NUM and AUM. The fitted NUM/AUM is significant at a 5% level test and with an economic magnitude that is virtually the same as the one of NUM/AUM. When using MIRR, the economic magnitude is lower yet still large and the level of significance is 10%. We see such results as extra indicative evidence that the endogeneity of NUM is unlikely to be an issue.

4.4.6. Fund level aggregation

We also reproduce our findings at the fund level. The idea is that despite our clustering of standard error at the firm level, we do not have independent observations and that affects our inference. Hence, at the fund level, the effect should be weaker. We aggregate our variable at the fund level and run one regression with the 311 funds. Results are similar, funds that have many investments in parallel have lower performance. It is significant at the 1% level test. Note also that at the fund level, Kaplan and Schoar (2005) found a negative relation between size and performance. To the extent that AUM and fund size are correlated, this result is consistent with ours. But, private equity firms run many small funds parallel to large funds so fund size, firm size and AUM are not the same thing.

Results are shown in table 5E. We find that fund size is negatively related to performance but the effect is not statistically significant when using MIRR. We find also that fund size effect is always dominated by NUM. When AUM is in the regression, fund size actually flips signs and gets positive but the two variables are correlated at 87%. In contrast, average NUM and fund size have a 46% correlation. In addition, one should note that fund size is noisy. We took fund size from TVE whenever available and noticed some incompatibilities with the total amount invested we had in our data. Hence we took the maximum of these two numbers. Also, almost half of the funds in our sample have not finished investing. Hence, our measure of fund size is sometimes temporary. In sum, our data are not well suited for a fund level analysis. This is why we work at the investment level. It is also the case that testing our hypothesis at the investment level is more natural and should have more statistical power.

Panels A and B show the results when each investment is equally weighted in the fund. Panel C shows the results when investments are value weighted and Panel D shows the results when investments are both duration and size weighted. This is yet additional evidence of the robustness of our results. They hold even when weighting each investment differently. In non-tabulated results, we also find that the results hold on the sub-sample that excludes pooled track records.

4.4.7. Sample bias

Our data are biased in the sense that if a PE firm did a few investments in the 1980s that failed, it probably stopped fund raising and will not be in our sample. As firms usually start with fewer investments, this sample bias could create the observed effect. However, if true, time fixed effects should capture most of this effect but as we have noted above, results hold controlling for time fixed effects. Moreover, as shown in section 2.4, our sample does not present a significant bias towards winners (at least compared to TVE). In addition, as shown below, the NUM/AUM-performance relation is significant in time sub-periods. Finally, firm experience and firm age should capture most of the effect and have a negative sign. As shown in Table 4, neither is statistically significant.

5. Diseconomy of Scale and Alternative Hypotheses

The above evidence shows that high NUM/AUM is negatively related to performance. Irrespective of the control variables, the effect is always significant at the 1% level test. We also find that this result is very robust. This shows that there are diseconomies of scale but isolating value-added capacity constraints require additional analysis - which we take up in this section.

5.1. Financial versus Operational Arbitrage

There are two main sources of return generation. One is “buy low – sell high”; sometimes referred to as financial arbitrage. The second is adding value; sometimes referred to as operational arbitrage. In this sub-section, we disentangle these two sets.

We see two main channels by which financial arbitrage can be negatively affected by firm scale. The first is that large firms have to invest in more companies, and because of limited time and communication/hierarchy costs, it will make inferior screening. The second is that as the number of investments increase, firms invest in less promising companies because the opportunity set is fixed.[16]

If this financial arbitrage channel dominates, then the first driver of performance should be the number of investments a firm has to do at about the same time (N_inv_entry) rather than how many they have under management during investment's life (NUM). The two are highly correlated but are different. Assume that a firm makes a single investment in 1985 and exit it in 1988. If the firm makes many investments in 1986-1987, the 1985 investment will have high NUM but low N_inv_entry. Table A.4 shows an 87% correlation between number of investments done +/-6 months around acquisition time of the focal investment (N_inv_entry) and NUM. Table 6A shows that, in a multiple regression, N_inv_entry is negatively related to performance but is not significant once we control for NUM.

We also repeat the same exercise with AUM and the value of the acquisitions made at the same time (Value_inv_entry). The same result is obtained. Finally, we use a third variable to capture this effect: the investment sequence number in the fund. For that, we use only the sub-sample that excludes pooled track records. If the problem is related to a fixed opportunity set, we would expect the fund to start with its best ideas. Hence investment sequence should be negatively related to performance. And, importantly, it should dominate NUM/AUM effect. Specification 5 shows that funds start with their best ideas but it is not statistically significant.

Obviously, one can always say that funds do not start with their best ideas and yet have a fixed opportunity set. Also, in the example above, it can be argued that even though the fund made one investment in 1985, it knew that many investments would have to be made in the following years and therefore lowered its required rate of return for the 1985 investment. Our conversations with practitioners indicate that funds can not readily anticipate future activity. What commands the activity is mainly the availability of debt and it is difficult to forecast. The fact that the liquidity of the debt market is an important driver is confirmed empirically by Axelson, Jenkinson, Strömberg and Weishback (2008).

Hence they can not readily anticipate and we think that it is more likely that the driving force is the number of projects that are in the firm's hands *during* investment's life - during the operational

[16] Consistent with financial arbitrage in venture capital, Cumming and Dai (2008) show that venture capital firms buy companies at a higher price when they have more asset under management.

arbitrage phase. This is consistent with lesser value added being distributed to each portfolio company rather than buying pressure. In addition, these findings are consistent with the fact that the information that circulates among mangers is softer during the holding period than at purchase. At purchase time, the information is mainly accounting statements while in the operational phase it is more about strategy.

< TABLE 6 >

5.2. Diseconomies of scale versus Diseconomies of scope

We find that the issue arises during the operational arbitrage phase. In this sub-section, we attempt to disentangle between diseconomies of scale and diseconomies of scope.

The literature has emphasized the benefits of specialization and NUM/AUM may be a proxy for the lack of focus/specialization. To test for this, we construct an industry Herfindhal index and the number of industries spanned by the firm. The idea is that if focus is the problem – and not value added capacity – then what matters most in the number of different industries the firm invest in (N_indus) rather than the number of companies in which it invests. Yet another proxy is the industry Herfindhal index which takes into account the share in each industry instead of simply counting them.

Table A.4 shows that Herfindhal index and N_indus have an 84% correlation. NUM has a correlation of 89% with N_indus and 68% with Herfindhal. Hence, firms that buy more companies, buy more different companies. Similarly, Herfindhal index has a -66% correlation with NUM, showing that there is less industry concentration when NUM is higher. Interestingly, these correlations are lower with AUM. Larger firms invest in more industries but the correlation is 56%. NUM is also highly correlated with the number of investments made around the focal investment. The correlation is 87%. For AUM, the correlation is lower at 52%.

In the multiple regression analysis in Table 6B, the number of industries is not always significant but the Herfindhal is. Importantly, both NUM and AUM remain significant at a 1% level test after adding these focus variables. Hence, we find evidence of both diseconomies of scope and of scale but diseconomies of scale have a larger economic magnitude.

5.3. Value Added Capacity versus Employee Capacity

Still in the operational arbitrage explanation, we now investigate whether this is about the firm reaching its capacity constraints or if, for some reasons, it is about managers being over-used in high NUM/AUM firms, hence managers going beyond their capacity. Importantly, hierarchical or communication costs are at the heart of the argument. If 10 people could do 10 times as much as 1 person then we should not observe any negative effect of NUM/AUM. It is thus important to scale by the number of investment professionals to isolate hierarchy costs.

We then construct the number (and amount) of investments per manager by simply dividing NUM and AUM by the number of managers present in the firm at the time of the investment; which we denote NUM p.m. and AUM p.m., respectively.

Although, intuitive this exercise is somewhat arbitrary in the sense that one needs to decide which employees to count. It is difficult because we do not know which employees to count and what weight to put on each type (e.g. analyst versus partner). You may have 20 analysts and 2 decision makers or 5 analysts and 5 decision makers. We would expect less managerial workload in 2nd case than in the first case. In this version, we count only key executives, also called senior managers. In the next version of the article we will include all employees as an extra proxy. Most PPMs list senior managers and the job titles that correspond to senior managers is fairly consistent across firms. The senior managers are those that can be responsible for a portfolio company, hence they may sit on a board. They include the partners of the firm. More details and the list of titles are given in Appendix B. Note that CapitalIQ also separate key executives and also use job titles but we notice that their list is too restrictive and not consistent. Our list is based on PPM classification of senior managers.

To partially solve this we count in each firm, each year the senior managers. These are managers that can sit on the boards of portfolio companies. Like in CapitalIQ – which call them key executives – we identify them with their title; the list is given in appendix X. We do not use Capital IQ or other databases for this information because they do not have a time series. They only give number today. In the PPM we have a list of professionals, with their titles. It is also often mentioned when key employees have left the firm. In addition, using webarchive and other online resources, we reconstruct the investment team at any point in time to the best we can.

Table 6C shows that AUM and NUM per manager are always significant when they are on their own. When we control for AUM and NUM respectively, they are no longer significant if we use IRR; but resist if we use MIRR. AUM and NUM, however is always significant, although weaker. Hence, there seems to be a problem at the firm level, which is consistent with hierarchy/communication costs being the core issue. In other words, the problems do not go away by hiring more managers.

5.4. Experience and Value Added Capacity

To delve deeper about communication/hierarchy costs, we investigate what organizational characteristics reduce the negative effect of NUM/AUM. We find that firms with more experience (more deals made in the past) and especially firms with more experienced managers have a much weaker performance NUM/AUM relation, hence lesser diseconomies of scale. Table 7A – Panel A shows that when firm experience is high, there is relation between NUM and performance. In contrast when the firm is unexperienced, the relation is steep. The spread is statistically significant at a 1% level test.

In Panel B, we find that manager experience has a similar effect but weaker. For teams in which mangers are more experienced, the NUM effect is present but not statistically significant. For teams with low manager experience, the effect is twice as large and statistically significant. The spread is not statistically significant.

Results with AUM are a bit different. Firm experience does not matter. AUM is strong for both experienced and inexperienced firms. For manager experience, however, AUM is not significant when the team is unexperienced and strong when the team is experienced. One way to read these results is that manager experience matters more for handly large amounts of money while firm experience matters more when handling more investments.

< TABLE 7 >

5.5. Organizational Structure and Value Added Capacity

In addition, we construct direct proxies for both communication and hierarchy costs. Communication cost is proxied by the Herfindhal index based on the fraction of managers with a consultant background, with a finance background and with another background (corporate, private equity). As managers have either of these three distinct backgrounds, we conjecture that communication is more difficult when managers are spread more equally across the three backgrounds. Hierarchy cost (or steepness) is measure by the number of job titles divided by the number of managers.

Table 7B – panel A shows that there is no diseconomies of scale among firms with flat hierarchies and strong diseconomies of scale for firms with steep hierarchy. The spread is statistically significant. The median is 50% and appears to be a natural cutoff also because there is a break in the distribution around 50%. This is strong evidence in support of our working hypothesis. We think this is the most direct evidence of the importance of hierarchy costs available in the literature. The same holds with AUM but the effect is weaker.

For communication costs, we find that the sub-sample of firms with lower communication costs (managers tend to have the same background) diseconomies of scale are weaker. The effect is stronger with AUM but overall, the effect of background concentration is weaker than the effect of hierarchy.

All this evidence is consistent with the view that performance suffers when the limited value-added capacity of a management team needs to be shared across more investments. And that the negative effect is minimized by experience, more homogenous teams and flatter hierarchies.
On its own hierarchy is negatively related but not significant.

6. Conclusion

This paper uses a newly created dataset containing the performance of 5,867 investments of 191 Private Equity (PE) firms between 1973 and 2003. This data allows us to present new and complementary results on the cross-section of private equity investments. We find that private equity investments are held on average for 4 years, only 14% are held for less than 2 years. The average IRR is 17% and 10% of the deals go bust. The structure of PE firms and our access to investment level data help us shed light on the issue of managerial diseconomies of scale. Investments held during times of high number (or amount) of investments under management underperform substantially: the lowest quartile boosts a 32% median IRR, while the highest quartile has a median IRR of 11%. These results are robust to a number of control variables and are present in all sub-samples. The negative effect is somewhat attenuated by having more experienced managers, more experienced firms, flat hierarchies and managers with similar backgrounds. Our results seem consistent with theories of diseconomies of scale originating from hierarchy and communication costs occurring during the value-adding process.

An interesting follow-up question for future research is why underperforming organizations survives.

First, the effect we uncover is at the investment level. We document that it is both a within fund effect and an inter fund effect. Investors cannot arbitrage at the investment level, only at the fund level. So a large part of the effect documented can simply not being arbitraged. The only option we see is investors asking for covenants to limit the number or size of parallel investments.

Second, organizations that are currently busy may have had high performance in the past. Investors may not put enough weight on recent performance. Investors may see as top firms whose that made some stellar performance in the past be it relatively far away. For example, when Metrick (200x) lists the firms perceived as top tier in VC, he cites a few deals these firms are famous for. Some less sophisticated investors may pay more attention to this star status than to the detail of the track record. For example, KKR 200x fund has an IRR of 10% (see their IPO prospectus) yet thy raised billions in subsequent funds.

Another possibility is that such organizations may window dress. For example, by pooling track records, one can make recent performance carry almost no weight ion the overall IRR.

Third, some firms may have had relative problems with fund raising after we observe their performance. Some young firms that started with lots of capital or made many investments may have had difficulties raising a new fund following poor performance. Our data does not allow us to investigate this but it is possible.

Fourth, our returns are at the individual investment level, we do not know what is the net present value of the funds. We cannot conclude that funds that made many investments have a negative NPV. It is likely but we do not know. Our results are from a cross section. Both IRR and MIRR are proxies for effective rate of returns. Investors cannot arbitrage at the investment level, only at the fund level. Our analysis at the fund level suggests that the anomaly is present at the fund level but we only have a proxy for performance.

Several investors have very large amounts to invest in private equity. They cannot consider small PE firms due to fixed cost of information collection. They can only focus on large firms. Some of the investors may have low performance but agency frictions couple with the difficulty of judging performance may keep them alive.

Some investors do not invest for returns. Some investors give large allocation to large funds in expectation of consultancy or underwriting work. For example, the investor who gave its data to Ljungqvist et al. (2007) is one of the largest in private equity and argues that it invests primarily to build client relationships. PE firms do a lot of M&A and IPOs they thus generate huge fees.

Check whether there is persistence of load from one fund to the next. Maybe hard to predict.

Alpinvest invest about $5 billion a year; they cannot invest in small funds. It is like a different asset class. They cannot invest in VC either.

Co-investments – only large funds offer this option and only to the top investors.

Our results seem consistent with diseconomies of scale arising during the value-adding process. However, we do not know what is exactly the mechanism at work, whether the limited value added capacity means less monitoring or less pertinent operational changes. We nonetheless believe that we have narrowed down the problem and leave some good questions for future research.

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Appendix A. Details on data treatment

For each investment, we have multiple and year of acquisition. Two variables are sometimes missing: duration (difference between exit or valuation date and acquisition date) and IRR. Table A.1 shows the frequency of each missing information and the different choices we made.

There are 3,018 (out of 4,108) investments with duration information.[17] These investments have a multiple below that of the full sample (average multiple is 2.3 – sample average is 2.6). Note that exit dates that are reported as 'date of first realization' are considered as missing.

When duration is missing but an IRR is reported, we deduct duration from the value of the IRR and multiple. The idea is to use the equation (1+irr)^duration = multiple. This is an approximation as this equation holds only if they are no intermediate cash flows. We use this relation to deduct duration for the 718 observations that are in this case. These observations have a high multiple and their inferred duration is on average 3.7 years. The rest of the observations (372 cases) gets the average duration.

When the multiple is 0, the IRR is always missing and we set it to -100%. When multiple is 1 and IRR is missing we set IRR to 0%. Including these two cases, there are 3,352 observations with IRR information. Their multiple is above average (2.9 versus 2.6).

If IRR is missing but both duration and multiple is available (571 cases), we set IRR to multiple^(1/duration)-1, which is what we call Modified IRR (MIRR). The multiple for these observations is very low (slightly less than 1), hence the average IRR is -8%. When both IRR and duration are missing, we run a regression of multiple on IRR. The R-square is 75% and we use multiple to extrapolate IRR. This is done for 187 observations.

MIRR can be computed whenever duration is available and whenever irr is -100%. For the rest, we set to equal to irr, if irr is available. For those still missing, we use the formula above.

Note that the relation irr = multiple^(1/duration)-1 that we use to complete data is fairly reliable because on the sample with all information, this regression leads to an R-square of 85%.

Appendix B. Identification of senior managers

We focus on the senior firm managers. That is someone who either sits on the board of at least one portfolio company or receives some of the carried interest or both.

Individuals with the following titles are considered senior managers: Chief Executive Officer, Chief Executive, Chief Financial Officer, Chief Investment Officer, senior managing director, managing partner, partner, founder, founding partner, strategic partner, operating partner, special partner, financial partner,

[17] If the 'month' is missing but the year is provided, then we assume the investment happened in June unless acquisition year and exit year are the same in which case we assume the acquisition month to be March and exit month to be September so that duration is 6 month. There are 208 such investment and they have lower performance (multiple is 1.9).

industrial partner, chairman, company secretary, president, senior principal, senior private equity professional, non-executive group chairman, non-executive director, managing director, managing member, member of executive committee, operating principal, executive director, deputy head, and vice chairman.

Individuals that are not considered have the following titles: associate, associate director, senior investment manager, investment manager, senior vice president, vice president, analyst, controller, marketing associate, assistant controller, transactional professional, senior investment professional, legal professional, investor relations professional, senior accountant, treasurer, investment principal, financial controller, solicitor, funds legal advisor, consultant, head of legal affairs, head of distribution and external relations, fundraising team, origination team, external relations team, administration group, technology director, group compliance director, general counsel, treasurer, senior financial controller, business analyst, assistant to president, financial administrator, office manager, information systems administrator, advisory committee, chief sales officer, chief marketing officer, advisors.

The following titles are ambiguous as they refer to senior managers in some firm but not in others: Principal, director, investment director, finance director, member of the advisory board. In this case, we look if there is someone with this title in the firm who either sits on the board of at least one portfolio company or receives some of the carried interest. If so, all the individuals with this title in this firm are classified as senior managers, otherwise they are not.

Biography information is provided in the PPM for half of the firms. The biographies for all the people involved with the track record are shown. In some cases, the names of the managers that left the firm are mentioned as well as the date at which a manager is promoted to a partner position.

For half of the firms, the information on the PPM is either missing or incomplete. We do four things. First, we systematically access both current and all the previous versions of the buyout firm website. Using webarchive.org, we can track firm managers as far back as 1998 in the best cases. Second, we systematically consult the firm description in Wikipedia.org. It often provides the names of the founding partners and in some cases the list of partners at different points in time and the date at which some managers left and joined. Third, a report by the University of Texas gives a senior manager list for the funds they invested in:
http://www.utwatch.org/utimco/022003ActivePartnerships.pdf

Fourth, we gave our database to several Limited Partners for them to report any missing senior fund managers (this information is not confidential). We also looked at Thomson Venture Expert database but it did not prove useful.

In total, we have the biographies of 965 senior managers. Next, we need to establish when someone is promoted to a senior manager position. The date is mentioned explicitly or can be readily inferred (e.g. date of the earliest portfolio company board sit occupied) in about half of the cases (44%). For these individuals, we compute the average time between entry in the firm and the time at which the individual became a senior manager. The average is 2 years. For most cases, we also observe the age and can refine this estimate. For individuals that are more than 40 years old, the average time to partner after entering the firm is 1 year. This is due to the fact that most individuals join at a senior manager position directly. For managers that are less than 40 years old, the average time is 3 years. We then extrapolate the starting year: individuals that are older than 40 years old when entering are assumed to start as a senior manager 1 year after they enter the firm. Individuals that are less than 40 years old are assumed to start as a partner 3 years after they enter the firm. 158 managers have no age information and are assumed to start as a senior manager 2 years after they enter the firm.

For each manager, we record its main past experience: consultant, investment banking, corporate (was in the industry before) started in this firm or unknown. We also record the school attended and their diploma.

Appendix C. Systematic risk

Assuming that there is no intermediate distribution, in a one-factor risk model economy, we have for each investment:

$I * \Pi (1 + alpha + Rf\_t + beta*(Rm\_t - Rf\_t) + u\_t) = D$

Taking the log on both sides give

$\Sigma \ln(1 + alpha + Rf\_t + beta*(Rm\_t - Rf\_t) + u\_t) = \ln(D/I)$

Then introducing IRR,

$\Sigma \ln(1 + alpha + Rf\_t + beta*(Rm\_t - Rf\_t) + u\_t) = \ln(1+IRR)^T$

Which we can approximate by the following (we work at a monthly frequency):

$alpha + Average (Rf\_t + beta*(Rm\_t - Rf\_t)) + Average (u\_t) = IRR$

or

$constant + beta*Average (Rm\_t - Rf\_t) + epsilon = IRR$

A cross-sectional OLS regression of IRR on Average (Rm_t – Rf_t) over the same time period would then give beta under the above assumptions. In practice, beta is expected to be exaggerated because high IRRs are higher than realized rate of return (because the re-investment rate is lower than the IRR) and higher realized rate of return coincide to high stock-market returns. Hence IRRs exaggerate the co-movements with the stock-market returns because of the re-investment assumption.

Table 1: Coverage

Panel A compares the coverage of our working sample to that of Thomson Venture Economics (TVE) in terms of number and size (equity) of investments. Panel B shows coverage per country. In TVE, we restrict the sample to investments above $100,000 made by private partnerships with a buyout focus. Panel C shows firms' successful-exit rates. Successful-exit rate is the fraction of investments exited by sale or IPO as of June 2008 according to TVE. TVE sample consists of buyout firms founded before 2000 with at least 5 investments made before 2002. t-statistics for difference in mean are in italics. Size is in million of 2005 US dollars.

Panel A: Coverage per year

Year	Working sample		Thomson VE		Coverage	
	N_inv	Total size	N_inv	Total size	N_inv	Total size
≤ 1984	124	3,619	438	2,014	0.28	1.80
1985	51	1,594	124	808	0.41	1.97
1986	77	2,176	223	1,748	0.35	1.24
1987	74	1,789	179	4,025	0.41	0.44
1988	107	4,316	247	3,890	0.43	1.11
1989	100	10,629	244	7,144	0.41	1.49
1990	153	4,023	144	4,692	1.06	0.86
1991	149	5,077	98	2,248	1.52	2.26
1992	181	5,578	145	3,948	1.25	1.41
1993	208	5,928	130	2,573	1.60	2.30
1994	299	6,313	165	3,910	1.81	1.61
1995	314	12,686	226	4,990	1.39	2.54
1996	376	14,532	452	12,665	0.83	1.15
1997	455	19,662	420	13,070	1.08	1.50
1998	517	21,741	543	21,985	0.95	0.99
1999	655	30,014	597	32,271	1.10	0.93
2000	573	26,632	648	32,909	0.88	0.81
2001	261	10,425	499	21,585	0.52	0.48
2002	174	10,312	397	28,334	0.44	0.36
Total	4,848	197,046	5,919	204,809	0.82	0.96

Panel B: Coverage per country

Country	Working sample		Thomson VE		Coverage	
	N_inv	Total size	N_inv	Total size	N_inv	Total size
US	2,344	120,020	3,947	115,756	0.59	1.04
UK	1,026	25,559	467	16,802	2.20	1.52
France	242	4,305	112	3,747	2.16	1.15
Germany	153	5,721	60	2,196	2.55	2.61
Sweden	122	4,535	23	1,101	5.09	4.12

Panel C: Difference in firm successful-exit rate

	Working sample not TVE-covered	Working sample TVE-covered	TVE Ex. working sample	Diff.
Number of firms	43	108	203	
Mean IRR	0.27	0.24		0.03
				0.81
Median IRR	0.18	0.15		0.03
Successful Exit				
20th percentile		0.50	0.47	0.03
50th percentile		0.62	0.60	0.02
80th percentile		0.78	0.78	-0.01
Average		0.63	0.60	0.03
				1.23

Table 2: Performance of Buyout Investments

For various sub-samples, this table shows size and number of investments, the median number of investment under management (NUM), the fraction of investments held less than two years, average duration (Value Weighted), the fraction of investments that went bankrupt (no capital returned), average multiple (Value Weighted), average Modified IRR (Duration and Value Weighted), average IRR (Duration and Value Weighted), and median IRR. Panels A, B, C and D show statistics as a function of investments exits, countries, industries and investment years respectively. Both duration and size are winsorized when used as weights. Size is in million of 2005 US dollars.

Panel A: Performance by exit status and type

	Tot. size (million)	N_inv	NUM Median	% Quick Flip	Duration VW	% Bankrpt	Multiple VW	MIRR DVW	IRR DVW	IRR Median
All	171,749	4,108	16.47	0.14	4.11	0.09	2.61	0.09	0.17	0.19
Liquidated	100,872	2,609	15.17	0.20	3.92	0.11	3.26	0.13	0.23	0.30
. IPO exit	19,510	402	15.13	0.20	4.21	0.00	4.99	0.40	0.70	0.53
. Sale exit	21,928	767	10.98	0.25	3.50	0.00	3.51	0.42	0.50	0.41
. Bankrupt	12,313	287	20.47	0.09	4.27	1.00	0.00	-1.00	-1.00	-1.00
Unrealized	70,877	1,499	20.93	0.02	4.38	0.05	1.74	0.04	0.10	0.04

Panel B: Performance by country

	Tot. size (million)	N_inv	NUM Median	% Quick Flip	Duration VW	% Bankrpt	Multiple VW	MIRR DVW	IRR DVW	IRR Median
US	119,332	2,200	13.82	0.13	4.31	0.10	2.79	0.08	0.15	0.21
UK	23,280	948	44.99	0.17	3.61	0.07	2.08	0.10	0.18	0.16
France	3,968	199	30.96	0.11	3.84	0.06	2.08	0.15	0.21	0.15
Germany	4,180	130	40.63	0.13	3.98	0.13	2.22	0.01	0.17	0.19
Sweden	4,888	121	12.48	0.16	3.46	0.06	2.45	0.26	0.33	0.24
Italy	1,233	82	51.82	0.09	3.38	0.10	2.52	0.13	0.31	0.16
Netherlands	1,638	53	14.98	0.25	3.95	0.00	3.84	0.25	0.27	0.24
Spain	632	50	10.23	0.16	4.12	0.04	2.57	0.17	0.32	0.16
Developing	963	35	25.41	0.14	3.72	0.06	1.69	0.08	0.16	0.03
Other	11,634	290	9.32	0.12	3.95	0.09	2.45	0.11	0.19	0.21

Panel C: Performance by industry

	Tot. size (million)	N_inv	NUM Median	% Quick Flip	Duration VW	% Bankrpt	Multiple VW	MIRR DVW	IRR DVW	IRR Median
Industrial	18,984	662	16.21	0.12	4.29	0.09	2.30	0.08	0.14	0.16
Services	26,065	651	21.21	0.13	4.01	0.09	2.62	0.11	0.36	0.18
High-tech	19,569	492	17.11	0.19	3.60	0.08	2.84	0.16	0.27	0.26
Household	7,303	277	16.57	0.12	4.34	0.12	2.32	0.03	0.11	0.14
Leisure	10,417	270	13.56	0.16	4.02	0.08	2.24	0.10	0.15	0.21
Health	7,110	230	21.13	0.10	4.04	0.04	2.60	0.14	0.17	0.18
Transport	9,089	221	14.25	0.18	4.09	0.05	2.73	0.14	0.17	0.25
Wholesale	5,508	210	12.43	0.12	3.89	0.10	2.44	0.01	0.05	0.25
Finance	7,029	190	15.73	0.16	3.90	0.05	2.70	0.19	0.25	0.27
Food	7,226	188	12.01	0.15	3.98	0.07	2.51	0.07	0.10	0.24
Natural res.	6,025	138	14.50	0.13	3.86	0.11	1.95	0.06	0.08	0.14
Retail	4,410	128	17.32	0.09	4.73	0.09	5.23	0.11	0.15	0.14

Panel D: Performance by year

	Tot. size (million)	N_inv	NUM Median	% Quick Flip	Duration VW	% Bankrpt	Multiple VW	MIRR DVW	IRR DVW	IRR Median
1985	3,618	124	11.01	0.06	4.75	0.09	6.78	0.35	0.40	0.45
1986	1,594	51	11.44	0.20	4.49	0.04	4.18	0.32	0.42	0.54
1987	2,176	77	11.56	0.27	5.20	0.06	13.06	0.40	0.45	0.50
1988	1,789	74	10.72	0.30	4.86	0.11	3.85	0.22	0.30	0.39
1989	4,316	107	13.53	0.13	5.73	0.08	4.13	0.15	0.20	0.18
1990	10,629	100	9.22	0.08	5.63	0.13	3.57	0.04	0.06	0.19
1991	4,023	153	13.53	0.05	5.41	0.08	3.01	0.06	0.10	0.15
1992	5,068	148	15.05	0.10	4.04	0.04	3.06	0.17	0.19	0.30
1993	5,578	181	16.12	0.08	4.19	0.10	2.89	0.05	0.08	0.25
1994	5,928	208	16.14	0.15	4.16	0.04	3.42	0.24	0.33	0.34
1995	6,300	298	23.78	0.13	4.49	0.08	2.67	0.08	0.14	0.25
1996	12,642	312	25.01	0.10	3.98	0.07	3.14	0.15	0.23	0.27
1997	13,178	363	17.89	0.15	4.06	0.10	2.38	0.12	0.19	0.18
1998	19,151	438	19.96	0.17	4.01	0.07	2.67	0.11	0.20	0.18
1999	18,578	446	20.23	0.17	4.38	0.11	2.10	0.00	0.28	0.11
2000	24,004	458	16.92	0.16	3.91	0.09	1.60	0.00	0.04	0.06
2001	19,571	358	20.64	0.11	3.54	0.15	1.41	-0.06	-0.04	0.00
2002	6,207	142	19.18	0.14	3.17	0.06	2.01	0.18	0.20	0.21

Table 3: Quartile Analysis

This table shows the performance characteristics of investments falling in either NUM-quartiles (Panel A) or AUM-quartiles (Panel B). Beta is obtained by regressing the cross-section of investment IRRs on the average stock-market return during investment's life in each quartile. The variance within each quartile is shown on either all the investments or the investments with negative IRR (losses) or the investments with positive IRR (gain). Observations are equally weighted. For Equally Weighted average and variance calculations, variable of interest (IRR or duration) is winsorized at the 95th percentile.

Panel A: NUM quartiles

	Low	Q2	Q3	High	L-H	*t-stat*
Lower bound NUM	0.00	7.56	15.46	34.89		
Upper bound NUM	7.56	15.46	34.89	143.50		
Median IRR	0.30	0.20	0.17	0.09		
Average IRR – EW	0.41	0.26	0.17	0.15	0.26	*8.50*
Average IRR – DVW	0.24	0.15	0.16	0.11		
Average Multiple – VW	2.85	3.02	2.35	2.33		
Average MIRR – DVW	0.19	0.08	0.06	0.05		
Beta_IRR	1.21	1.61	1.38	1.34	-0.13	*-0.47*
Beta_MIRR	1.08	1.31	1.33	1.16	-0.08	*-0.31*
Variance (IRR) – All	0.46	0.48	0.45	0.49		
Variance (IRR) – Losses	0.17	0.17	0.16	0.15		
Variance (IRR) – Gain	0.33	0.32	0.28	0.32		
% Bankrupt	0.06	0.10	0.12	0.13		
% Losses (IRR<0%)	0.17	0.25	0.30	0.32		
% Home run (IRR>50%)	0.33	0.25	0.21	0.20		
Quick Flip	0.18	0.13	0.12	0.12		
Average Duration – EW	3.80	4.14	4.15	3.81	-0.02	*-0.25*

Panel B: AUM quartiles

	Low	Q2	Q3	High	L-H	*t-stat*
Lower bound AUM	0.00	131.60	425.81	1013.54		
Upper bound AUM	131.60	425.81	1013.54	8493.25		
Median IRR	0.32	0.21	0.14	0.11		
Average IRR – EW	0.42	0.26	0.17	0.13	0.29	*9.35*
Average IRR – DVW	0.36	0.23	0.16	0.12		
Average Multiple – VW	3.35	2.73	2.58	2.47		
Average MIRR – DVW	0.25	0.16	0.11	0.04		
Beta_IRR	1.61	1.14	1.20	1.44	0.17	*0.58*
Beta_MIRR	1.45	1.07	1.00	1.31	0.14	*0.55*
Variance (IRR) – All	0.57	0.46	0.40	0.43		
Variance (IRR) – Losses	0.16	0.14	0.15	0.15		
Variance (IRR) – Gain	0.38	0.30	0.25	0.26		
% Bankrupt	0.08	0.08	0.09	0.12		
% Losses (IRR<0%)	0.20	0.26	0.29	0.31		
% Home run (IRR>50%)	0.36	0.25	0.21	0.19		
Quick Flip	0.19	0.16	0.10	0.10		
Average Duration – EW	3.77	3.89	4.22	4.02	-0.25	*-3.15*

Table 4A: Base Regression Analysis – IRR

This Table shows OLS regression results. Dependent variable is investment IRR. T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics. Variable definitions are in Table A.1. All explanatory variables are transformed into a z-score before the regression. Fixed effects based on investment inception year (time FE), investment country headquarter, investment industry and firm may be included. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively.

Panel A: NUM

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8	Spec 9	Spec 10	Spec 11	Spec 12
NUM	-0.10[a]	-0.11[a]	-0.10[a]	-0.10[a]	-0.10[a]	-0.09[a]	-0.10[a]	-0.09[a]	-0.07[a]	-0.26[a]	-0.23[a]	-0.08[a]
	-7.11	*-7.58*	*-7.10*	*-6.71*	*-6.78*	*-6.10*	*-6.00*	*-5.45*	*-4.36*	*-6.76*	*-5.85*	*-4.45*
Market return	0.21[a]	0.22[a]	0.21[a]	0.22[a]	0.22[a]	0.22[a]	0.22[a]	0.24[a]	0.23[a]	0.23[a]	0.23[a]	0.23[a]
	7.88	*7.97*	*7.97*	*8.06*	*8.04*	*8.02*	*8.04*	*9.05*	*8.17*	*8.39*	*7.80*	*8.13*
Size					-0.03[b]							-0.03[b]
					-2.47							*-2.20*
Firm_age						-0.01						
						-0.90						
Firm_experience							0.00					
							0.14					
Volatility								0.00				
								0.34				
Past IRR									0.06[a]			0.06[a]
									3.90			*3.98*
Time Fixed Effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Country Fixed Effects	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Fixed Effects	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Stage Fixed Effects	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm Fixed Effects	no	no	no	no	no	no	no	no	no	yes	no	no
Fund Fixed Effects	no	no	no	no	no	no	no	no	no	no	yes	no
Adj. R-square	0.09	0.09	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.16	0.16	0.12
N-obs	4108	4108	4108	4108	4108	4108	4108	3656	3745	4108	4108	3745

Panel B: AUM

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8	Spec 9	Spec 10	Spec 11	Spec 12
AUM	-0.10[a]	-0.10[a]	-0.10[a]	-0.10[a]	-0.12[a]	-0.10[a]	-0.11[a]	-0.10[a]	-0.09[a]	-0.35[a]	-0.21[a]	-0.10[a]
	-8.27	*-8.23*	*-7.59*	*-7.59*	*-7.86*	*-7.02*	*-6.81*	*-6.51*	*-5.82*	*-9.54*	*-7.37*	*-5.78*
Market return	0.21[a]	0.21[a]	0.21[a]	0.21[a]	0.21[a]	0.21[a]	0.21[a]	0.23[a]	0.22[a]	0.21[a]	0.22[a]	0.22[a]
	7.95	*8.02*	*7.94*	*8.04*	*8.03*	*8.04*	*8.06*	*8.80*	*8.10*	*7.99*	*7.89*	*8.10*
Size					0.03[c]							0.02
					1.91							*1.22*
Firm_age						0.01						
						0.59						
Firm_experience							0.02					
							1.28					
Volatility								0.00				
								0.32				
Past IRR									0.07[a]			0.07[a]
									4.45			*4.24*
Time Fixed Effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Country Fixed Effects	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Fixed Effects	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Stage Fixed Effects	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm Fixed Effects	no	no	no	no	no	no	no	no	no	yes	no	no
Fund Fixed Effects	no	no	no	no	no	no	no	no	no	no	yes	no
Adj. R-square	0.09	0.09	0.10	0.11	0.11	0.11	0.11	0.12	0.12	0.17	0.17	0.12
N-obs	4108	4108	4108	4108	4108	4108	4108	3656	3745	4108	4108	3745

Table 4B Base Regression Analysis – MIRR

This Table shows OLS regression results. Dependent variable is investment Modified IRR. T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics. Variable definitions are in Table A.1. All explanatory variables are transformed into a z-score before the regression. Fixed effects based on investment inception year (time FE), investment country headquarter, investment industry and firm may be included. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively.

Panel A: NUM

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8	Spec 9	Spec 10	Spec 11	Spec 12
NUM	-0.09[a]	-0.09[a]	-0.09[a]	-0.08[a]	-0.08[a]	-0.08[a]	-0.09[a]	-0.08[a]	-0.07[a]	-0.24[a]	-0.21[a]	-0.07[a]
	-7.26	*-7.61*	*-7.09*	*-6.63*	*-6.68*	*-6.29*	*-6.51*	*-5.41*	*-4.78*	*-7.43*	*-6.04*	*-4.82*
Market return	0.20[a]	0.20[a]	0.20[a]	0.20[a]	0.20[a]	0.20[a]	0.20[a]	0.22[a]	0.21[a]	0.21[a]	0.21[a]	0.21[a]
	8.42	*8.51*	*8.50*	*8.62*	*8.60*	*8.60*	*8.62*	*9.68*	*8.43*	*8.98*	*8.39*	*8.39*
Size					-0.02							-0.02
					-1.59							*-1.46*
Firm_age						0.00						
						0.10						
Firm_experience							0.02					
							1.33					
Volatility								0.00				
								0.30				
Past IRR									0.03[b]			0.03[b]
									2.13			*2.23*
Time Fixed Effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Country Fixed Effects	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Fixed Effects	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Stage Fixed Effects	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm Fixed Effects	no	no	no	no	no	no	no	no	no	yes	no	no
Fund Fixed Effects	no	no	no	no	no	no	no	no	no	no	yes	no
Adj. R-square	0.09	0.09	0.10	0.11	0.11	0.11	0.11	0.12	0.11	0.15	0.15	0.11
N-obs	4108	4108	4108	4108	4108	4108	4108	3656	3745	4108	4108	3745

Panel B: AUM

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8	Spec 9	Spec 10	Spec 11	Spec 12
AUM	-0.08[a]	-0.08[a]	-0.08[a]	-0.08[a]	-0.10[a]	-0.09[a]	-0.10[a]	-0.08[a]	-0.07[a]	-0.32[a]	-0.19[a]	-0.09[a]
	-7.97	*-7.88*	*-7.30*	*-7.24*	*-7.94*	*-6.95*	*-6.85*	*-6.08*	*-5.78*	*-10.24*	*-7.42*	*-6.26*
Market return	0.20[a]	0.20[a]	0.20[a]	0.20[a]	0.20[a]	0.20[a]	0.20[a]	0.22[a]	0.20[a]	0.20[a]	0.21[a]	0.20[a]
	8.50	*8.56*	*8.48*	*8.61*	*8.61*	*8.63*	*8.64*	*9.45*	*8.36*	*8.57*	*8.49*	*8.36*
Size					0.04[a]							0.03[b]
					2.79							*2.09*
Firm_age						0.02						
						1.34						
Firm_experience							0.03[b]					
							2.06					
Volatility								0.00				
								0.40				
Past IRR									0.04[a]			0.03[a]
									2.92			*2.60*
Time Fixed Effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Country Fixed Effects	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Fixed Effects	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Stage Fixed Effects	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm Fixed Effects	no	no	no	no	no	no	no	no	no	yes	no	no
Fund Fixed Effects	no	no	no	no	no	no	no	no	no	no	yes	no
Adj. R-square	0.09	0.09	0.10	0.11	0.11	0.11	0.11	0.12	0.11	0.16	0.15	0.11
N-obs	4108	4108	4108	4108	4108	4108	4108	3656	3745	4108	4108	3745

Table 5A: Robustness – Change Sample

This Table shows regression results with investment IRR or Modified IRR as dependent variable. T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics underneath the coefficient. Variable definitions are in Table A.1. All explanatory variables are transformed into a z-score before the regression. Fixed effects based on investment inception year (time FE), investment country headquarter, investment industry and private equity firm may be included but are not shown in the table. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively. Results are shown for different sub-samples: sample that includes only investments for which IRR or MIRR was available in the fund raising prospectus, that includes only liquidated investments, and that includes only liquidated and available IRR/MIRR.

	Excluding inferred IRR/MIRR				Liquidated				Both (ex. inferred and liquidated)			
Dependent variable	IRR	IRR	MIRR	MIRR	IRR	IRR	MIRR	MIRR	IRR	IRR	MIRR	MIRR
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8	Spec 9	Spec 10	Spec 11	Spec 12
NUM	-0.08[a]		-0.10[a]		-0.10[a]		-0.09[a]		-0.07[a]		-0.14[a]	
	-3.89		*-5.10*		*-4.02*		*-4.24*		*-2.91*		*-4.18*	
AUM		-0.11[a]		-0.16[a]		-0.14[a]		-0.12[a]		-0.13[a]		-0.23[a]
		-5.83		*-7.98*		*-5.96*		*-6.07*		*-5.27*		*-7.72*
Market return	0.24[a]	0.23[a]	0.22[a]	0.21[a]	0.22[a]	0.21[a]	0.19[a]	0.18[a]	0.21[a]	0.20[a]	0.24[a]	0.23[a]
	7.96	*7.94*	*7.74*	*7.65*	*6.04*	*6.00*	*5.77*	*5.74*	*5.64*	*5.55*	*5.26*	*5.19*
Size	-0.03[b]	0.03	-0.02	0.07[a]	-0.02	0.05[b]	-0.01	0.06[a]	-0.03	0.04[c]	-0.02	0.10[a]
	-2.06	*1.32*	*-1.18*	*3.68*	*-1.37*	*2.19*	*-0.58*	*2.95*	*-1.48*	*1.65*	*-0.89*	*4.47*
Past IRR	0.06[a]	0.07[a]			0.06[a]	0.06[a]			0.06[a]	0.06[b]		
	3.74	*3.76*			*2.68*	*2.69*			*2.70*	*2.53*		
Past MIRR			0.03[b]	0.03[c]			0.03	0.03[c]			0.03	0.02
			1.98	*1.87*			*1.50*	*1.66*			*1.23*	*0.97*
T, C, I, S FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Adjusted R-square	0.11	0.12	0.14	0.16	0.12	0.12	0.11	0.11	0.11	0.12	0.18	0.21
N-obs	3177	3177	2470	2470	2478	2478	2478	2478	2157	2157	1471	1471

Table 5B: Country sub-samples

This Table shows regression results with IRR or Modified IRR as dependent variable. T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics underneath the coefficient. Variable definitions are in Table A.1. All explanatory variables are transformed into a z-score before the regression. Fixed effects based on investment inception year (time FE), investment country headquarter, investment industry and private equity firm may be included but are not shown in the table. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively. Results are shown for different sub-samples: sample that excludes US investments, that excludes both US and UK investments, that includes only US investments.

	Excluding US				Including only US			
Dependent variable	IRR	IRR	MIRR	MIRR	IRR	IRR	MIRR	MIRR
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8
NUM	-0.04[c]		-0.04[c]		-0.09[a]		-0.08[a]	
	-1.79		*-1.80*		*-4.59*		*-4.87*	
AUM		-0.07[a]		-0.06[a]		-0.11[a]		-0.11[a]
		-3.10		*-3.01*		*-4.52*		*-5.07*
Market return	0.25[a]	0.24[a]	0.23[a]	0.22[a]	0.20[a]	0.21[a]	0.19[a]	0.19[a]
	6.49	*6.27*	*6.80*	*6.59*	*5.57*	*5.56*	*5.70*	*5.69*
Size	0.02	0.05[a]	0.02	0.04[a]	-0.07[a]	-0.01	-0.04[a]	0.01
	1.05	*2.72*	*1.08*	*2.71*	*-3.59*	*-0.55*	*-2.65*	*0.44*
Past IRR	0.03[c]	0.03			0.09[a]	0.09[a]		
	1.65	*1.55*			*4.11*	*4.47*		
Past MIRR			0.02	0.02			0.04[b]	0.05[a]
			1.31	*1.21*			*2.43*	*2.91*
T, C, I, S FE	yes	yes	yes	yes	yes	yes	yes	yes
Adjusted R-square	0.12	0.13	0.13	0.13	0.13	0.13	0.11	0.12
N-obs	1722	1722	1722	1722	2023	2023	2023	2023

Table 5C: Time sub-periods

This Table shows OLS regression with investment IRR or Modified IRR as dependent variable. T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics underneath the coefficient. Variable definitions are in Table A.1. All explanatory variables are transformed into a z-score before the regression. Fixed effects based on investment inception year (time FE), investment country headquarter, investment industry and private equity firm may be included but are not shown in the table. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively. Results are shown for different time sub-samples: 1973 to 1994 and 1995 to 2002.

	1973-1994				1995-2002			
Dependent variable	IRR	IRR	MIRR	MIRR	IRR	IRR	MIRR	MIRR
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8
NUM	-0.13[a]		-0.12[a]		-0.06[a]		-0.06[a]	
	-5.55		*-5.71*		*-3.09*		*-3.44*	
AUM		-0.13[a]		-0.12[a]		-0.08[a]		-0.08[a]
		-5.28		*-5.45*		*-4.25*		*-4.58*
Market return	-0.05	-0.05	-0.04	-0.04	0.31[a]	0.31[a]	0.29[a]	0.28[a]
	-1.41	*-1.43*	*-1.34*	*-1.35*	*9.36*	*9.36*	*9.61*	*9.61*
Size	-0.03	0.04	-0.01	0.05[b]	-0.03[c]	0.01	-0.02	0.02
	-1.36	*1.59*	*-0.55*	*2.42*	*-1.87*	*0.60*	*-1.40*	*1.16*
Past IRR	0.09[a]	0.10[a]			0.04[b]	0.05[b]		
	3.64	*3.82*			*2.10*	*2.37*		
Past MIRR			0.06[a]	0.07[a]			0.00	0.01
			2.66	*3.15*			*0.20*	*0.55*
T, C, I, S Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Adjusted R-square	0.12	0.11	0.11	0.10	0.13	0.14	0.13	0.13
N-obs	1410	1410	1410	1410	2507	2507	2507	2507

Table 5D: Performance and Education/Professional Background

This Table shows OLS regression results. Dependent variable is investment IRR or Modified IRR. T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics underneath the coefficient. Variable definitions are in Table A.1. All explanatory variables are transformed into a z-score before the regression. Fixed effects based on investment inception year (time FE), investment country headquarter, investment industry – denoted T, C, I Fixed Effects – are always included, and private equity firm fixed effects are always excluded. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively. Control variables include market return, size, firm experience and past IRR (or MIRR).

Panel A: NUM, dependent variable is IRR

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7
NUM	-0.12[a]	-0.12[a]	-0.12[a]	-0.10[a]	-0.11[a]	-0.10[a]	-0.13[a]
	-4.75	*-4.74*	*-4.59*	*-3.19*	*-3.41*	*-3.22*	*-4.54*
Master degree	-0.01						
	-0.36						
MBA degree		-0.01					
		-0.37					
Master_top5			-0.02				
			-0.68				
Ex-consultant				0.02			
				0.74			
Ex-finance					-0.04		
					-1.54		
Concentration background						-0.02	
						-0.75	
Hierarchy Steepness							-0.02
							-0.79
Control variables	yes	yes	yes	yes	yes	yes	yes
T, C, I, S Fixed Effects	yes	yes	yes	yes	yes	yes	yes
Adj. R-square	0.12	0.12	0.12	0.14	0.14	0.14	0.12
N-obs	1909	1909	1909	1290	1290	1290	1776

Panel B: AUM, dependent variable is IRR

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7
AUM	-0.11[a]	-0.11[a]	-0.11[a]	-0.09[a]	-0.10[a]	-0.10[a]	-0.12[a]
	-4.79	*-4.78*	*-4.62*	*-3.37*	*-3.52*	*-3.46*	*-4.62*
Master degree	0.00						
	0.24						
MBA degree		0.00					
		0.05					
Master_top5			-0.01				
			-0.25				
Ex-consultant				0.02			
				0.94			
Ex-finance					-0.03		
					-1.23		
Concentration background						-0.02	
						-1.05	
Hierarchy Steepness							-0.02
							-0.97
Control variables	yes	yes	yes	yes	yes	yes	yes
T, C, I, S Fixed Effects	yes	yes	yes	yes	yes	yes	yes
Adj. R-square	0.11	0.11	0.11	0.14	0.14	0.14	0.12
N-obs	1909	1909	1909	1290	1290	1290	1776

Table 5E: Instrumental Variable Regression

This Table presents two-stage least squares regressions. The second stage (Panel A) uses either IRR or Modified IRR as dependent variable; and the fitted value of NUM and AUM from the first stage regression as independent variable. The first stage (Panel B) uses either NUM or AUM as dependent variable. Explanatory variables are as in previous tables except for firm age (the instrument). T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics underneath the coefficient. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively.

Panel A: Second stage regression

Dependent Variable	IRR	IRR	MIRR	MIRR
	Spec 1	Spec 2	Spec 3	Spec 4
Market return	0.23[a]	0.22[a]	0.21[a]	0.20[a]
	8.15	*8.02*	*8.38*	*8.26*
Size	-0.03[b]	0.03	-0.02	0.03
	-2.12	*1.14*	*-1.34*	*1.17*
Past IRR	0.04[c]	0.07[a]		
	1.80	*3.64*		
Past MIRR			0.02	0.03[b]
			0.81	*2.27*
NUM	-0.17[b]		-0.12[c]	
	-2.20		*-1.85*	
AUM		-0.12[b]		-0.09[c]
		-2.20		*-1.85*
T, C, I, S Fixed Effects	yes	yes	yes	yes
Adjusted R-square	0.37	0.11	0.37	0.10
N-obs	3745	3745	3745	3745

Panel B: First stage regression

Dependent Variable	NUM	AUM	NUM	AUM
	Spec 1	Spec 2	Spec 3	Spec 4
Market return	0.01	0.00	0.01	0.00
	0.37	*-0.02*	*0.36*	*-0.02*
Size	-0.07[a]	0.44[a]	-0.06[b]	0.45[a]
	-2.60	*16.71*	*-2.30*	*17.02*
Past IRR	-0.22[a]	-0.12[a]		
	-6.55	*-4.72*		
Past MIRR			-0.23[a]	-0.12[a]
			-6.75	*-4.63*
Firm age	0.19[a]	0.27[a]	0.20[a]	0.28[a]
	4.77	*9.50*	*5.03*	*9.70*
T, C, I, S Fixed Effects	yes	yes	yes	yes
Adjusted R-square	0.37	0.47	0.37	0.47
N-obs	3745	3745	3745	3745

Table 5F: Fund level performance

This Table shows OLS regression with fund performance as dependent variable. Fund performance is set to the average winsorized IRR (Panel A) or Modified IRR (Panel B) of all its investments. T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics underneath the coefficient. Explanatory variables are average NUM of each investment in the fund, average AUM of each investment in the fund, the log of fund size (sum of all equity invested), fund sequence number and the average of the average market return during each investment's life (see Table A.1. for definition of investment level variables). Vintage year (time) fixed effects may be included but are not shown in the table. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively.

Panel A: Fund IRR – equally weighted

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6
NUM (average)			-0.08[b]		-0.09[a]	
			-2.51		*-2.92*	
AUM (average)				-0.10[a]		-0.04[a]
				-2.93		*-3.32*
Fund size (log)	-0.03[b]	-0.02[c]	0.00	0.06[c]		
	-2.15	*-1.90*	*-0.29*	*1.91*		
Market return (average)		1.50[a]	1.50[a]	1.58[a]	1.50[a]	1.52[a]
		4.66	*5.39*	*5.92*	*5.46*	*4.90*
Time FE	yes	yes	yes	yes	yes	yes
Adjusted R-square	0.19	0.20	0.17	0.12	0.20	0.19
N-obs	311	311	311	311	311	311

Panel B: Fund MIRR – equally weighted

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6
NUM (average)			-0.08[a]		-0.08[a]	
			-3.14		*-3.37*	
AUM (average)				-0.08[a]		-0.03[a]
				-2.89		*-2.78*
Fund size (log)	-0.02	-0.02	0.00	0.06[b]		
	-1.63	*-1.38*	*0.38*	*2.08*		
Market return (average)		1.42[a]	1.41[a]	1.48[a]	1.40[a]	1.42[a]
		5.55	*6.60*	*6.93*	*6.46*	*5.74*
Time FE	yes	yes	yes	yes	yes	yes
Adjusted R-square	0.19	0.20	0.17	0.12	0.20	0.19
N-obs	311	311	311	311	311	311

Panel C: Fund IRR – value weighted

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6
NUM (average)			-0.05[b]		-0.05[b]	
			-2.07		*-2.57*	
AUM (average)				-0.06[c]		-0.03[a]
				-1.87		*-2.70*
Fund size (log)	-0.02[c]	-0.02[c]	-0.01	0.04		
	-1.83	*-1.66*	*-0.53*	*1.13*		
Market return (average)		1.01[a]	0.96[a]	0.99[a]	0.96[a]	0.99[a]
		3.74	*3.73*	*4.20*	*3.77*	*3.93*
Time FE	yes	yes	yes	yes	yes	yes
Adjusted R-square	0.19	0.20	0.17	0.12	0.20	0.19
N-obs	311	311	311	311	311	311

Panel D: Fund IRR – duration value weighted

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6
NUM (average)			-0.06[a]		-0.06[a]	
			-2.73		*-3.15*	
AUM (average)				-0.05		-0.03[b]
				-1.50		*-2.34*
Fund size (log)	-0.02[c]	-0.02[c]	0.00	0.02		
	-1.76	*-1.65*	*-0.29*	*0.74*		
Market return (average)		0.90[a]	0.83[a]	0.88[a]	0.83[a]	0.88[a]
		3.09	*3.18*	*3.36*	*3.21*	*3.24*
Time FE	yes	yes	yes	yes	yes	yes
Adjusted R-square	0.19	0.20	0.17	0.12	0.20	0.19
N-obs	311	311	311	311	311	311

Table 6A: Performance, Entry, and Holding period

This Table shows OLS regression results. Dependent variable is investment IRR (Panel A) or Modified IRR (Panel B). T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics underneath the coefficient. Variable definitions are in Table A.1. All explanatory variables are transformed into a z-score before the regression. Fixed effects based on investment inception year (time FE), investment country headquarter, investment industry and investment focus – denoted T, C, I, S Fixed Effects – are always included. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively. Control variables include market return, size, and past IRR (or MIRR).

Panel A: IRR

	Dependent var: IRR								
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8	Spec 9
NUM				-0.08[a]		-0.07[a]		-0.06[b]	
				-2.77		*-2.93*		*-2.20*	
AUM					-0.12[a]		-0.08[a]		-0.09[a]
					-3.80		*-4.03*		*-4.08*
N_inv_entry	-0.06[a]			0.01					
	-3.78			*0.23*					
Value_inv_entry		-0.08[a]			0.02				
		-4.34			*0.69*				
Inv_seq_fund			-0.02			0.00	0.00		
			-1.37			*0.07*	*0.03*		
Fund vintage Fixed Effects	no	no	no	no	no	no	no	yes	yes
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
T, C, I, S Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Adj. R-square	0.11	0.11	0.11	0.11	0.12	0.11	0.11	0.12	0.12
N-obs	3745	3745	2896	3745	3745	2896	2896	2896	2896

Panel B: MIRR

	Dependent var: MIRR								
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8	Spec 9
NUM				-0.09[a]		-0.07[a]		-0.07[a]	
				-3.36		*-3.63*		*-3.43*	
AUM					-0.12[a]		-0.08[a]		-0.09[a]
					-4.31		*-4.68*		*-4.80*
N_inv_entry	-0.05[a]			0.02					
	-3.87			*0.66*					
Value_inv_entry		-0.07[a]			0.03				
		-4.53			*1.08*				
Inv_seq_fund			-0.02			0.01	0.00		
			-1.28			*0.43*	*0.28*		
Fund vintage Fixed Effects	no	no	no	no	no	no	no	yes	yes
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
T, C, I, S Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Adj. R-square	0.10	0.10	0.09	0.11	0.11	0.10	0.10	0.10	0.11
N-obs	3745	3745	2896	3745	3745	2896	2896	2896	2896

Table 6B: Diseconomies of scale versus Diseconomies of scope

This Table shows OLS regression results. Dependent variable is investment IRR or Modified IRR. T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics underneath the coefficient. Variable definitions are in Table A.1. All explanatory variables are transformed into a z-score before the regression. Fixed effects based on investment inception year (time FE), investment country headquarter, investment industry – denoted T, C, I Fixed Effects – are always included, and private equity firm fixed effects are always excluded. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively. Control variables include market return, size and past IRR (or MIRR).

	Dependent var: IRR						Dependent var: MIRR					
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8	Spec 9	Spec 10	Spec 11	Spec 12
NUM			-0.08[b]	-0.06[a]					-0.07[b]	-0.06[a]		
			-2.55	*-2.86*					*-2.48*	*-3.16*		
AUM					-0.09[a]	-0.08[a]					-0.07[a]	-0.07[a]
					-3.90	*-4.10*					*-3.81*	*-4.30*
Number_industries	-0.07[a]		-0.01		-0.02		-0.06[a]		-0.01		-0.02	
	-4.12		*-0.18*		*-1.16*		*-4.24*		*-0.26*		*-1.29*	
Herfindhal_industries		0.08[a]		0.04[b]		0.04[b]		0.06[a]		0.03[c]		0.03[b]
		4.29		*2.04*		*2.23*		*4.19*		*1.78*		*2.03*
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
T, C, I, S Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Adj. R-square	0.11	0.11	0.11	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11
N-obs	3319	3319	3319	3319	3319	3319	3319	3319	3319	3319	3319	3319

Table 6C: Performance and Manager Workload

This Table shows OLS regression results. Dependent variable is investment IRR or Modified IRR. T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics underneath the coefficient. Variable definitions are in Table A.1. All explanatory variables are transformed into a z-score before the regression. Fixed effects based on investment inception year (time FE), investment country headquarter, investment industry – denoted T, C, I Fixed Effects – are always included. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively. Control variables include market return, size and past IRR (or MIRR).

	Dependent var: IRR				Dependent var: MIRR			
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8
NUM		-0.06[a]				-0.05[b]		
		-2.70				*-2.47*		
AUM				-0.06[b]				-0.07[a]
				-2.18				*-2.91*
NUM per manager	-0.05[a]	-0.03			-0.06[a]	-0.03[b]		
	-3.18	*-1.31*			*-3.80*	*-2.07*		
AUM per manager			-0.10[a]	-0.05[c]			-0.10[a]	-0.03
			-6.16	*-1.67*			*-6.82*	*-1.22*
Control variables	yes	yes	yes	yes	yes	yes	yes	yes
T, C, I, S Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes
Adj. R-square	0.12	0.12	0.13	0.13	0.12	0.12	0.13	0.13
N-obs	2917	2917	2917	2917	2917	2917	2917	2917

Table 7A: Effect of Experience

This Table shows OLS regression results. Dependent variable is investment IRR or Modified IRR. T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics underneath the coefficient. Variable definitions are in Table A.1. All explanatory variables are transformed into a z-score before the regression. Fixed effects based on investment inception year (time FE), investment country headquarter, investment industry – denoted T, C, I Fixed Effects – are always included, and private equity firm fixed effects are always excluded. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively. Control variables include market return, size, and past IRR (or MIRR). Panel A shows results for two sub-samples based on the median of manager experience, Panel B shows results for two sub-samples based on the median of fraction of managers who hold a master degree from a top 5 university experience, Panel C shows results for two sub-samples based on the median of firm experience.

Panel A: Firm experience

	Low Firm Experience				High Firm Experience							
Dependent variable	IRR	MIRR	IRR	MIRR	IRR	MIRR	IRR	MIRR	Spread coefficients			
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4
NUM	-0.13[a]	-0.12[a]			0.01	0.00			-0.13[a]	-0.12[a]		
	-5.25	*-5.79*			*0.19*	*-0.01*			*-3.53*	*-3.69*		
AUM			-0.11[a]	-0.10[a]			-0.09[a]	-0.08[a]			-0.02	-0.03
			-3.91	*-4.35*			*-2.93*	*-2.94*			*-0.51*	*-0.73*
Control variables	yes	yes	yes	yes	yes	yes	yes	yes				
T, C, I, S Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes				
Adj. R-square	0.11	0.10	0.10	0.09	0.12	0.12	0.13	0.13				
N-obs	2006	2006	2006	2006	1739	1739	1739	1739				

Panel B: Manager experience

	Low Manager Experience				High Manager Experience							
Dependent variable	IRR	MIRR	IRR	MIRR	IRR	MIRR	IRR	MIRR	Spread coefficients			
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4
NUM	-0.08[a]	-0.09[a]			-0.03	-0.04			-0.05	-0.05		
	-2.67	*-3.18*			*-1.12*	*-1.38*			*-1.20*	*-1.34*		
AUM			-0.16[a]	-0.15[a]			-0.05	-0.05			-0.10[c]	-0.10[b]
			-3.98	*-4.55*			*-1.51*	*-1.61*			*-1.92*	*-2.12*
Control variables	yes	yes	yes	yes	yes	yes	yes	yes				
T, C, I, S Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes				
Adj. R-square	0.09	0.09	0.10	0.10	0.11	0.12	0.11	0.12				
N-obs	976	976	976	976	969	969	969	969				

Table 7B: Effect of Organizational Structure

This Table shows OLS regression results. Dependent variable is investment IRR or Modified IRR. T-statistics based on two dimensional standard error clustering (time and firm) are shown in italics underneath the coefficient. Variable definitions are in Table A.1. All explanatory variables are transformed into a z-score before the regression. Fixed effects based on investment inception year (time FE), investment country headquarter, investment industry – denoted T, C, I Fixed Effects – are always included, and private equity firm fixed effects are always excluded. *a*, *b*, and *c* next to the coefficient denotes significance at the 1%, 5% and 10% level test respectively. Control variables include market return, size, and past IRR (or MIRR). Panel A shows results for two sub-samples based on the concentration of professional background in the manager team measured by an Herfindhal index based on the fraction of managers with a consultant background, with a finance background and with another background (corporate, private equity), Panel B shows results for two sub-samples based on the steepness of the hierarchy measured by the number of job titles divided by the number of managers.

Panel A: Hierarchy

	Steep Hierarchy				Flat Hierarchy				Spread coefficients			
Dependent variable	IRR	MIRR	IRR	MIRR	IRR	MIRR	IRR	MIRR				
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4
NUM	-0.09[a]	-0.08[a]			-0.01	-0.01			-0.08[b]	-0.08[b]		
	-3.80	*-4.10*			*-0.17*	*-0.29*			*-2.18*	*-2.20*		
AUM			-0.12[a]	-0.11[a]			-0.08[b]	-0.08[a]			-0.04	-0.03
			-4.07	*-4.36*			*-2.55*	*-2.86*			*-0.97*	*-0.82*
Control variables	yes	yes	yes	yes	yes	yes	yes	yes				
T, C, I, S Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes				
Adj. R-square	0.13	0.13	0.14	0.13	0.10	0.10	0.11	0.11				
N-obs	1493	1493	1493	1493	1202	1202	1202	1202				

Panel B: Concentration background

	Different background				Similar background				Spread coefficients			
Dependent variable	IRR	MIRR	IRR	MIRR	IRR	MIRR	IRR	MIRR				
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4
NUM	-0.04[c]	-0.05[b]			-0.02	-0.03			-0.02	-0.02		
	-1.70	*-2.07*			*-0.97*	*-1.19*			*-0.56*	*-0.72*		
AUM			-0.12[a]	-0.11[a]			-0.04	-0.04[c]			-0.07[c]	-0.07[c]
			-4.00	*-4.30*			*-1.55*	*-1.76*			*-1.75*	*-1.95*
Control variables	yes	yes	yes	yes	yes	yes	yes	yes				
T, C, I, S Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes				
Adj. R-square	0.12	0.12	0.13	0.13	0.13	0.14	0.13	0.14				
N-obs	1494	1494	1494	1494	1151	1151	1151	1151				

Figure 1: Distribution of IRR, Multiple and Duration in the full sample and in the sample of liquidated investments

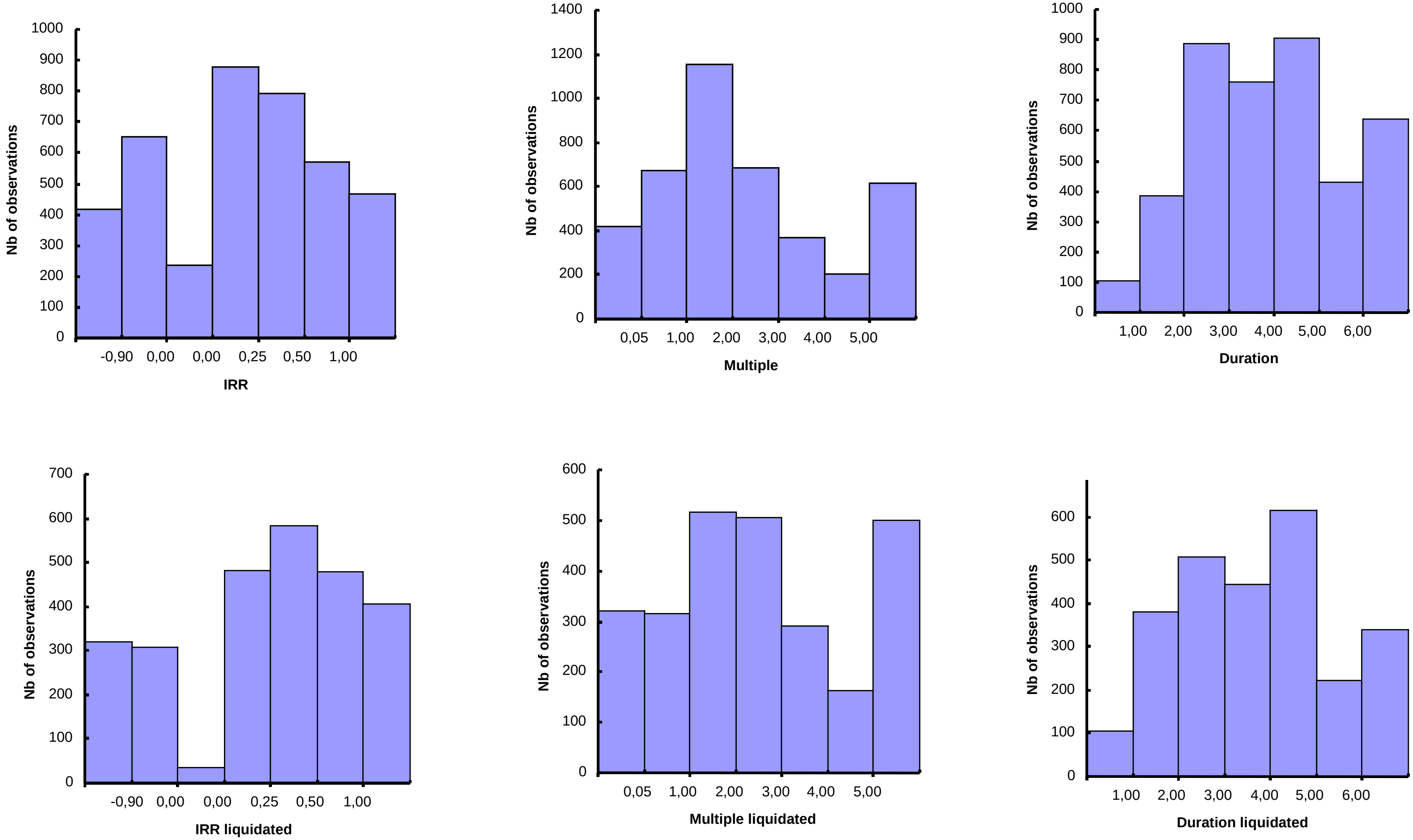

Figure 2A: NUM - deciles and Performance

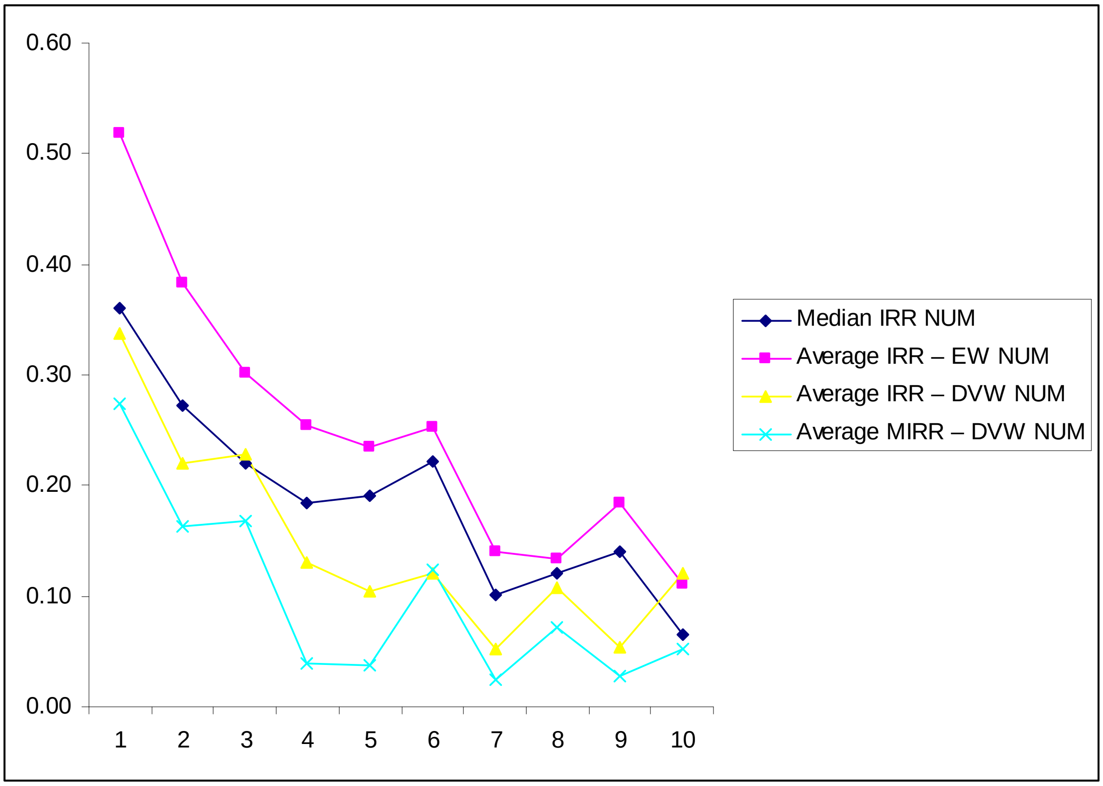

Figure 2B: AUM - deciles and Performance

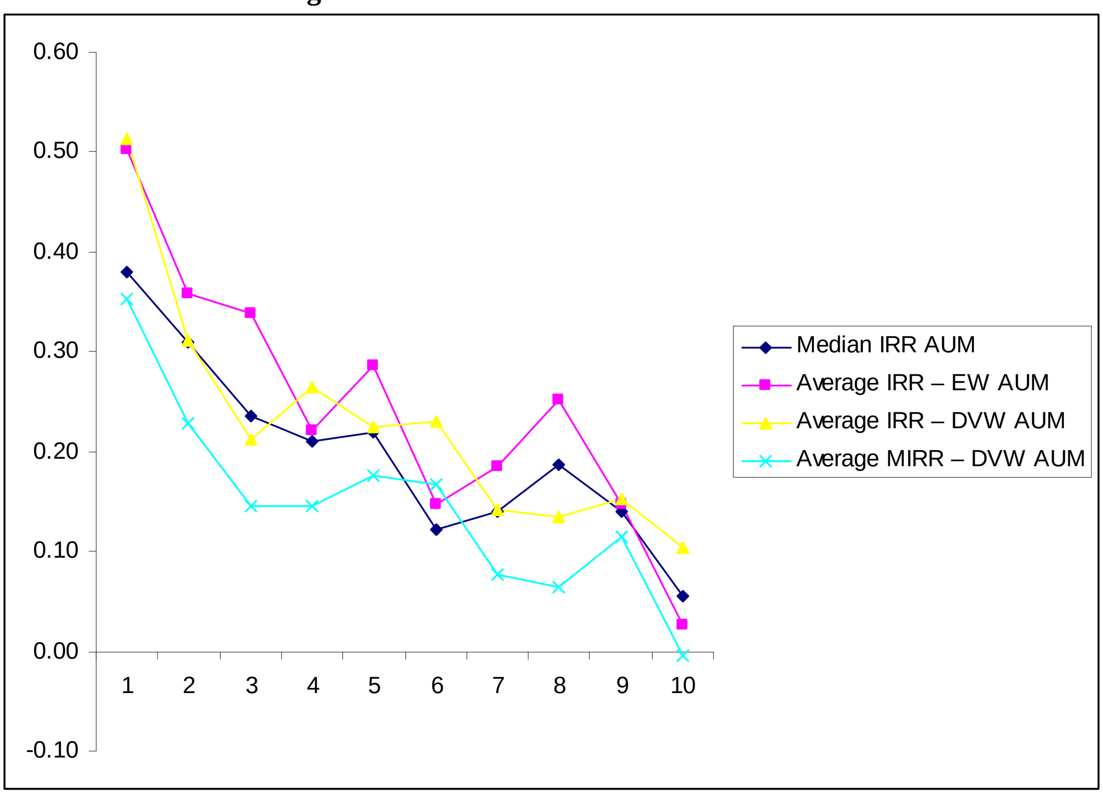

Table A.1. Statistics on Missing Information

This table shows descriptive statistics about missing information in PPMs about either duration or IRR. Total size is in million of deflated size in 2005 US dollar.

		Tot. size (million)	N_inv	Duration VW	Multiple VW	MIRR DVW	IRR DVW	IRR Median
All		171,749	4,108	4.11	4.11	0.09	0.17	0.19
Duration	Available	112,309	3,018	4.21	2.33	0.09	0.20	0.17
	Extrap from IRR-Mult	37,846	718	3.66	4.47	0.42	0.42	0.41
	Set to average	21,593	372	4.39	0.71	-0.48	-0.47	-0.53
IRR	Available	139,333	3,350	4.01	2.93	0.13	0.23	0.26
	Set to MIRR	19,503	571	4.67	0.97	-0.08	-0.08	-0.08
	Extrap from Mult	12,912	187	4.43	1.28	-0.10	-0.09	-0.30
MIRR	Available	119,559	3,183	4.22	2.20	0.02	0.13	0.15
	Set to IRR	39,277	738	3.68	4.35	0.40	0.40	0.40
	Extrap from Mult	12,912	187	4.43	1.28	-0.10	-0.09	-0.30

Table A.2. Industry classification

Industries	Nb inv.	Fama-French industry classification
Wholesale	215	Wholesale
Retail	138	Retail
Household	248	Consumer Goods, Apparel
Services	559	Personal Services, Business Services
Food	136	Food Products, Candy & Soda
High-tech	378	Communication, Computers, Electronic Equipment
Health	165	Healthcare, Medical Equipment, Pharmaceutical Products
Finance	143	Banking, Insurance, Real Estate, Trading
Leisure	185	Recreation, Entertainment, Printing and Publishing, Restaurants, Hotels, Motels
Transport	169	Automobiles and Trucks, Aircraft, Transportation
Natural resources	105	Agriculture, Mining, Coal, Petroleum and Natural Gas, Utilities, Business Supplies
Industrial	482	Chemicals, Textiles, Construction, Steel, Machinery, Equipment (Electrical, Lab), Products (Rubber, Plastic, Fabricated)
Other	20	Beer & Liquor, Defense, Shipping Containers, Other

Table A.3. Table of definition

Label	Definition
Duration	Number of years between the reported beginning and end of the investment. When the investment is not liquidated, the end date is the one at which the prospectus is written
IRR	Internal Rate of Return report by the firm, gross of fees; winsorized at its 95th percentile
MIRR	multiple^(1/duration)-1; winsorized at its 95th percentile
Multiple	Cash received divided by cash invested
NUM	Log of (time-series) average of the number of on-going firm *f* investments each month during focal investment's life
AUM	Log of (time-series) average of the total size of on-going firm *f* investments each month during focal investment's life
Market return	Average return of the public stock-market (S&P 500) during the life of the investment
Size	Log of the equity invested in million of 2005 US dollars and winsorized at its 95th percentile
Firm_experience	Log of the number of investments previously made by the buyout firm
Manager_experience	Number of years of work experience (at the time of investment inception)
Past IRR (MIRR)	Average (time-value weighted) winsorized IRR (MIRR) of all the investments previously made by the firm
Volatility	Average (time-series) portfolio volatility. Volatility in month *t* is given by $[w_{1,t} \ldots w_{48,t}].\Omega.[w_{1,t} \ldots w_{48,t}]'$; $w_{i,t}$ is the fraction invested in industry *i*, Ω is the variance covariance matrix of the 48 industry returns
N_inv_entry	Log of number of investments made +/- 6 months around (focal) investment date by (focal) PE firm
Value_inv_entry	Log of amount invested +/- 6 months around (focal) investment date by (focal) PE firm
N_indus.	Log of the (time-series) average of the number of industries in which the firm invest (during focal investment's life)
Herfindhal indus.	Herfindhal index of on-going firm *f* investments based on the 48 industry classification and investment size
NUM p.m.	Log of NUM per manager (at the time of investment inception)
AUM p.m.	Log of AUM per manager (at the time of investment inception)
Master	Fraction of managers in the firm that have an master degree (at the time of investment inception)
MBA	Fraction of managers in the firm that have an MBA degree (at the time of investment inception)
Master_top5	Fraction of managers in the firm that have an master degree (at the time of investment inception) from either Harvard, U Penn, Columbia, Stanford or Chicago.
MBA_Harvard	Fraction of managers in the firm that have an MBA degree from Harvard (at the time of investment inception)
Ex-consultant	Fraction of managers in the firm that have worked as consultants before working in private equity (at the time of investment inception)
Ex-finance	Fraction of managers in the firm that have worked in the finance industry (trader, asset manager, investment banker) before working in private equity (at the time of investment inception)
Concentration background	Herfindhal index based on the fraction of managers with a consultant background, with a finance background and with another background (corporate, private equity).
Hierarchy Steepness	Number of job titles divided by the number of managers

Table A.4: Correlation Matrix and Descriptive Statistics

This Table shows correlation matrices for the variables that are related to firm scale (Panel A) and for the control variables (Panel C). Panel B shows distribution statistics for the variables that are related to firm scale. Panel D shows distribution statistics for the control variables (Ex-cons. stands for the fraction of manager that are ex-consultant and Ex-bank. stands for the fraction of manager that worked in the finance industry). The (equally-weighted) mean and standard deviation are shown after log-transform if any. The 20^{th}, 50^{th} and 80^{th} percentile are shown before log-transformation. All variables are log-transformed except IRR, Past IRR and Herfindhal index based on investment industries (Herf_indus). Manager experience (M_Age) is expressed in years, investment size and AUM are in million of 2005 US dollars. N_indus stands for the number of industries in which the firm invests. Variable definitions are in Table A.1.

Panel A: Correlation matrix for scale variables

	NUM	AUM	NUM p.m.	AUM p.m.	N_ indus	Herf_indus	N_inv_entry	V_inv_entry	IRR	Duration
NUM	1.00									
AUM	0.64	1.00								
NUM p.m.	0.57	0.11	1.00							
AUM p.m.	0.41	0.86	0.33	1.00						
N_indus	0.89	0.55	0.44	0.27	1.00					
Herf_indus	-0.67	-0.52	-0.30	-0.30	-0.84	1.00				
N_inv_entry	0.87	0.49	0.47	0.28	0.78	-0.57	1.00			
V_inv_entry	0.52	0.88	0.03	0.75	0.44	-0.43	0.56	1.00		
IRR	-0.16	-0.18	-0.08	-0.18	-0.13	0.15	-0.13	-0.15	1.00	
Duration	0.04	0.12	0.07	0.18	0.02	-0.04	-0.07	-0.02	-0.41	1.00

Panel B: Distribution scale variables

	NUM	AUM	NUM p.m.	AUM p.m.	N_ indus	Herf_indus	N_inv_entry	V_inv_entry	IRR	Duration
Mean	2.93	5.92	1.51	4.42	2.36	0.23	1.81	4.77	0.25	1.26
Standard dev.	0.94	1.46	0.53	1.12	0.59	0.15	0.92	1.47	0.69	0.54
Before log-transformation										
25th prctile	8.56	132.60	2.07	39.30	5.97	0.12	3.00	46.12	-0.03	2.54
Median	16.46	426.81	3.21	79.62	9.74	0.18	6.00	129.88	0.19	3.83
75th prctile	35.89	1014.54	5.30	178.97	15.61	0.28	11.00	296.94	0.51	5.00
95th prctile	101.57	3880.27	11.12	494.87	24.44	0.50	34.00	1190.99	1.89	7.58

Panel C: Correlation matrix other variables

	NUM	IRR	MIRR	Mnger_exp	Master_top5	Firm_exp	Conc. Backg	Hierarchy	Past IRR	Past MIRR
NUM	1.00									
IRR	-0.16	1.00								
MIRR	-0.16	0.97	1.00							
Mnger_exp	-0.08	-0.11	-0.09	1.00						
Master_top5	0.03	-0.05	-0.03	-0.08	1.00					
Firm_exp	0.79	-0.14	-0.12	0.17	0.05	1.00				
Conc. Backg.	-0.31	0.05	0.05	-0.02	0.03	-0.37	1.00			
Hierarchy	-0.41	0.07	0.07	0.09	-0.37	-0.40	0.28	1.00		
Past MIRR	-0.34	0.14	0.14	-0.16	-0.13	-0.29	0.21	0.15	1.00	
Past IRR	-0.30	0.16	0.14	-0.14	-0.20	-0.32	0.19	0.20	0.93	1.00

Panel D: Distribution other variables

	NUM	IRR	MIRR	Mnger_exp	Master_top5	Firm_exp	Conc. Backg	Hierarchy	Past IRR	Past MIRR
Mean	2.93	0.25	0.19	3.74	0.35	2.88	0.64	0.56	0.14	0.17
Standard dev.	0.94	0.69	0.60	0.13	0.31	1.29	0.23	0.27	0.23	0.21
Before log-transformation										
25th prctile	8.56	-0.03	-0.02	14.00	0.00	7.00	0.47	0.38	0.04	0.06
Median	16.46	0.19	0.16	17.38	0.33	19.00	0.56	0.50	0.12	0.17
75th prctile	35.89	0.51	0.43	21.00	0.58	48.00	0.87	0.75	0.22	0.27
95th prctile	101.57	1.89	1.50	26.91	1.00	118.00	1.00	1.00	0.50	0.50

Table A.5: Performance and Background

This table Panels A, B and C, sub-samples are Master degree schools, investment banks where managers may have worked before and consultancy firms where managers may have worked before. Performance is weighted by size, fraction of individuals from the given background and, in addition, for IRR and MIRR, duration. The number of people falling in each category (N_people) and the number of investments where at least one person with the corresponding background participated (N_inv) are reported.

Panel A: Performance by Master school

	N_people	N_inv	Multiple	MIRR	IRR
Harvard	176	1,588	2.58	0.08	0.15
U. Penn	40	730	2.03	0.02	0.05
Columbia	40	836	2.95	0.05	0.09
Stanford	40	699	2.28	0.03	0.13
Chicago	22	447	2.57	0.15	0.20
Other School	118	2,265	2.44	0.09	0.16
No Master	484	2,524	2.50	0.08	0.16
All	925	3,072	2.50	0.07	0.15

Panel B: Performance by ex-finance company

	N_people	N_inv	Multiple	MIRR	IRR
Morgan Stanley	42	267	2.08	-0.01	0.10
Lehman Brothers	26	276	2.28	0.09	0.13
Citigroup	20	275	2.69	0.15	0.16
Goldman Sachs	18	212	2.36	0.09	0.27
Merrill Lynch	18	239	2.13	0.01	0.27
Other banking	46	2,316	2.61	0.07	0.12
No banking	673	2,828	2.49	0.08	0.15
All	925	3,072	2.50	0.07	0.14

Panel C: Performance by ex-consultancy company

	N_people	N_inv	Multiple	MIRR	IRR
Bain & Co	42	460	2.98	0.22	0.24
PwC	28	510	1.98	0.05	0.08
BCG	25	316	2.29	0.07	0.34
Andersen	23	523	3.63	0.10	0.09
McKinsey	21	397	2.44	-0.04	-0.02
Other Consulting	113	1,493	2.38	0.06	0.08
No Consulting	673	2,943	2.48	0.07	0.10
All	925	3,072	2.50	0.07	0.14