Smart Institutions, Foolish Choices?:

The Limited Partner Performance Puzzle

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The returns that institutional investors realize from private equity investments differ dramatically across institutions. Using detailed and hitherto unexplored records of fund investors and performance, we document large heterogeneity in the performance of different classes of limited partners. In particular, endowments' annual returns are nearly 14% greater than average. Funds selected by investment advisors and banks lag sharply. These results are robust to controlling for the type and year of the investment, as well as to the use of different specifications. Analyses of reinvestment decisions and young funds suggest that the results are not primarily due to endowments' greater access to established funds. Finally, we examine the differences in the choice of intermediaries across various institutional investors and their relationship to success. We find that LPs that have higher average IRRs also tend to invest in smaller and slower growing funds and have a smaller fraction of GPs in their geographic area.

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1. Introduction

Over the past three decades, institutional investors have controlled an increasing share of the U.S. equity markets: Gompers and Metrick (2001) calculate that their share of U.S. public equity markets exceeded the 50% threshold in 1995.[1] There is a significant and growing literature in financial economics that seeks to understand the investment decisions of institutional investors and the differences between the various classes of investors. Gompers and Metrick (2001) document that institutional investors prefer stocks that have greater market capitalizations, are more liquid, and with higher book-to-market ratios and lower returns in the prior year.[2] The focus of this literature thus far has been on the differences between institutional and individual investors.

One question that has attracted much less scrutiny, however, is the heterogeneity in investment strategies and sophistication *across* different types of institutional investors. (Table 2 of Gompers and Metrick (2001) is a rare exception.) This neglect is surprising because of the large differences in the organization, investment objectives, and sophistication of various institutions. Moreover, recent theoretical literature highlights the extent to which agency problems between the ultimate investors and financial institutions can have profound implications for investment decisions, portfolio allocations, and

[1]Their calculation only examines institutions with greater than $100 million of securities under discretionary management that are required to file a 13F form with the U.S. Securities and Exchange Commission, and thus excludes hedge and private equity funds and those with less than $100 million in assets. Thus, their estimate is a lower bound on institutional holdings.

[2]Other studies have suggested that institutional investors are less likely to buy stocks on days with high trading volume (Barber and Odean (2003)) or to herd into particular stocks (Lakonishok, Shleifer, and Vishny (1992) and Grinblatt, Titman, and Wermers (1995)) and that their investments fall into a few well-defined styles (Froot and Teo (2004)).

ultimately investment returns. For example, Shleifer and Vishny (1997) suggest that information asymmetries between investors and intermediaries create limits to arbitrage that can affect the portfolio strategies and eventually the returns of the latter. (Similarly, see Gromb and Vayanos (2002).) Because the extent of agency problems may differ dramatically across institutions, considerable differences in the behavior of institutional investors could be expected.

This paper looks at a specific class of investment decisions made by institutions: their investments in private equity funds. We analyze investment styles and performance across several different classes of investors, known as limited partners (LPs). We begin with the identification of a puzzle: different classes of investors in private equity have enjoyed dramatically different returns over the past two decades. Using detailed records of the composition and performance of funds that are selected by different classes of investors hitherto unexplored by academics, we document very substantial differences across the returns that investors enjoy. On average, endowments' average annual returns from private equity funds are nearly 14% greater than the average investor. Funds selected by investment advisors and banks lag sharply.

A natural concern is whether these substantial differences are driven by variations in the time periods in which the investments were made. Many endowments began investing in private equity funds before other investors. Even after controlling for fund type and the year in which the investment was made ("vintage year"), we continue to see superior annual performance of between 8 and 10 percent by endowments. The results are

robust to examining patterns at the fund, rather than the investment, level: performance is positively related to the number of endowments investing in the fund, but negatively related to the number of banks investing. We also find that within the different groups, older LPs tend to have better performance than LPs that enter the industry at a later time. These differences are particularly significant for corporate pension funds, advisors, and insurance companies. We suggest that this may at least partially due to the fact that younger LPs are less experienced in private equity investing and also might have inferior access to established and successful funds.

Another issue is whether these variations in performance are due to systematic differences in the risk profiles of the funds that the LPs choose. For example, endowments could be systematically investing in riskier funds and therefore have higher returns. To address this concern, we control for a number of observable characteristics that are often considered risk factors, such as the focus and maturity of the investments selected by the fund and the fund's size, age, and location. While our results are robust to these controls, we cannot completely rule out the possibility of unobservable differences in risk profiles. Alternatively, performance differences across LPs could in part be driven by differences in the objectives that LPs have in investing in private equity (and not necessarily their ability). For example, Hellmann, Lindsey, and Puri (2004) suggest that banks as limited partners might diverge from maximizing returns on investments in order to maximize future banking income from the portfolio firms in which they invested.

We explore the importance of funds' reinvestment strategies in explaining the differences in LP performance. We find that endowments and public pension funds generally are much less likely to reinvest in a given partnership. Moreover, those LPs are better at forecasting the performance of follow-on funds. Funds in which endowments (and to a lesser extent, public pension funds) decided to reinvest show much higher performance than those where endowments decided not to reinvest. Other LP classes do not display these performance patterns. In fact, corporate pension funds and advisors are more likely to reinvest if the *current* fund had high performance, but this does not necessarily translate into higher future performance. These findings suggest that endowments proactively use the information they gain as inside investors, while other LPs seem less willing or able to use information they obtained as an existing fund investor.

We also explore the possibility that the superior performance of endowments or public pension funds results from historical accident: *i.e.*, that these LPs through their early experience as limited partners may have greater access to established private equity groups that manage high performing funds. To test this hypothesis, we examine investments in young private equity groups (those established after 1990) across all classes of LPs. If the performance difference is mainly driven by the superior access that older LPs have in established private equity groups (also known as general partners (GPs)), conditioning on younger GPs should erase the difference in performance between the different classes of LPs. When we repeat our analysis conditioning on young GPs, we still find a performance premium for endowments and public pension funds, though the

difference is much smaller than in the analysis using all GPs. While this finding does not support the idea that the superior performance of these LPs is merely driven by historical accident, we cannot rule out that some of the performance difference is due to their early access to superior funds.

Finally, we examine the LP-specific differences in the selection of intermediaries. In recent years, there has been a growth of academic research into investment style (e.g., Barberis and Shleifer (2003) theoretically discuss investors' choices between value and growth stocks and their implications). But many institutions do not invest all—or even most—of their funds directly, but rather do so through intermediaries. The choices that institutions make when selecting institutions, what we may term "intermediary style," are poorly understood.

Despite the limited attention to this question by academics, intermediary style seems to be important. One of the clearest examples is the Yale endowment. The fundamental characteristics of their investments vary dramatically: in hedge funds, for instance, they prefer value-oriented funds while they heavily back technology-focused venture funds in private equity. But they have a consistent style in selecting intermediaries, whatever the investment style they employ: they favor long-term relationships with seasoned groups based in the United States which have well-aligned incentives (Lerner, Hardymon, and Leamon (2004)).

We find that significant differences in investment styles appear in the sample. Moreover, these investment styles are significantly correlated with the performance differences between LPs. LPs that have higher IRR fixed effects also tend to invest in smaller and slower growing funds and have a smaller fraction of GPs in the same geographic area as the LP.

This paper is also related to the literature on the establishment of private equity funds. Poterba (1989) and Gompers and Lerner (1998) explore how tax and other public policies affect venture capital (VC) fundraising. Gompers and Lerner (1996) and Lerner and Schoar (2004) examine the contracts entered into between investors and funds, and how they are affected by the nature of the targeted investments and the limited partners. Mayer, Schoors, and Yafeh (2003) examine the sources of venture capital financing across countries, and how these are correlated with investment choices. Kaplan and Schoar (2004) study how the level of returns affects the ability of private equity groups to raise follow-on funds. But the drivers and consequences of the decisions by individual limited partners to invest in private equity funds have been hitherto unexplored, largely because the data has been unavailable until very recently.

The results shed light on the large cycles in the private equity market that a number of papers, including Gompers and Lerner (1998, 2000) and Kaplan and Schoar (2004), have documented. The work of Lerner and Schoar (2004) implies that, optimally, LPs would use their inside information to screen out poorly performing general partners (GPs). The fact that many LPs appear not to be using their information optimally distorts

the resulting equilibrium. The presence of inefficient LPs allows poorly performing GPs to raise new funds and thus makes the governance mechanism of exit by sophisticated LPs less effective.

The organization of this paper is as follows. Section 2 briefly describes the selection of private equity funds by institutional investors. Section 3 summarizes the data used in the analysis. Section 4 presents the analysis. The final section concludes the paper.

2. Institutions and Private Equity[3]

Institutional investors frequently choose to invest in private businesses through funds. This choice is largely driven by the difficulties of directly investing in the private firms. The selection of appropriate direct investments requires intensive relationships and excellent due diligence skills, which few institutional investors have. Similarly, most institutional investors do not have the resources to intensively monitor a portfolio of private firms. Efforts to jointly invest in private firms with private equity groups have frequently encountered agency problems. Moreover, the limited partnership structure protects the investors from potential liability issues that could arise if they were to invest directly in a firm.

As a result, the bulk of institutional investment in private equity is done through funds. These funds are raised for a specified period (typically a decade, though

[3]This section is largely based on the industry notes and cases in Lerner, Hardymon, and Leamon (2004).

extensions may be possible) and are governed by an agreement between the investors (the limited partners) and the principals in the fund (the general partners), which specifies the nature of the fund's activities, the division of the proceeds, and so forth. Private equity groups will typically raise a fund every few years, beginning the fundraising process as the process of investing the previous fund is being completed.

Institutional investors are reputed to widely differ in their sophistication in their approach to private equity investments. University and foundation endowments are often regarded as being on average the most sophisticated investors, while public pensions are considered the least. These differences are attributed to a number of considerations:

- *Experience and access.* Universities and foundations began many of the earliest private equity investment programs. These groups thus frequently have a deeper understanding of private equity investments, as well as "grandfather" rights that allow them to continue to invest in subsequent funds of venture capital groups that are closed to new investors.
- *Governance.* Political appointees dominate the investment boards at many public pension funds. These directors frequently have little understanding of the private equity industry, and may in some cases be seeking to direct investments in ways that are personally advantageous to themselves. These problems, while not unknown, are less severe at other classes of institutions.
- *Turnover.* Many public pension funds offer compensation levels that are very modest by the standards of the financial services industry. As a result, there frequently is high turnover among their investment professionals, and average

level of experience is modest. Moreover, in some cases, career concerns may shape the investment decisions of some pension fund investors. Some universities have been very successful at preventing turnover by offering a variety of financial and non-pecuniary benefits to their investment professionals.

Two other classes of investors also deserve discussion. An increasingly important LP is the investment advisor, sometimes known as a "fund-of-funds". Institutional investors initially relied primarily on consultants such as Cambridge Associates to guide their private equity investments. Consultants typically help institutions assess the past performance of previous funds by private equity groups, as well as evaluate the groups' future prospects. In recent years, as more public pension funds and individual investors have begun investing in private equity, funds-of-funds have become more prominent. These groups will aggregate capital from a number of limited partners, and then invest it in a variety of private equity funds.

Banks have long been important private equity investors. The motivations for their investment activity, however, are frequently more complex than those of other LPs. While they also seek to earn high returns, their investment decisions are often shaped by indirect considerations as well. For instance, many banks garner substantial profits from lending to firms undergoing leveraged buyouts or else from advising on these transactions. As a result, they may invest in a buyout fund that they do not expect to yield high returns, if the investment will increase the probability that they will generate substantial fee income from the group's transactions.

3. The Data

As noted in the introduction, the primary barrier to research of this question has been data availability. The greater disclosure in recent years of private equity investments has allowed us to overcome this barrier. This section describes the data sources we employ.

Investment decisions. To ascertain which institutional investors had invested in which private equity funds, we employ two sources. The first comes from the investors themselves. Numerous public pension funds disclose the funds in which they have invested. In some cases, this information was contained in annual reports that were posted on the Internet; in other cases, these were provided by funds after a written request. In addition, a number of private investors with whom the authors had personal relationships provided us with confidential listings of the funds in which they had invested. We obtained detailed information about these portfolio allocations from 20 different institutional investors.

The second source was the compilation of private equity investors by Asset Alternatives. Since 1992, Asset Alternatives has sought to compile the investors in private equity funds though informal contacts with the funds and investors themselves. This information is included as part of their *Directory of Alternative Investment Sources*, though the underlying data has not been made hitherto available to researchers. While

their database is not comprehensive, it covers a large and diverse fraction of the private equity industry.

Fund characteristics. We collected information on the fund size, stage, the previous funds raised, etc., from the Asset Alternatives funds database (included as part of their *Galante's Venture Capital and Private Equity Directory*, though typically again not shared with researchers) and the Venture Economics' on-line funds database. These two databases were merged and discrepancies reconciled. We distinguished between the overall count of the fund, and the sequence of this particular family of funds. (For instance, a mezzanine fund might be the eighth fund raised by a large private equity group, but the first specializing in mezzanine investments.) In addition, we used the data on management fees and carried interest of funds from Gompers and Lerner (1999), updated through the review of the records of a number of limited partners who gave us access to their files. In total, our database covers 1,398 separate funds that belong to an LP portfolio in our sample.

Fund returns. Our primary source for return data was Private Equity Intelligence's *2004 Private Equity Performance Monitor*, which presents return data on over 1,700 private equity funds. This information is compiled by Mark O'Hare, who over the past five years has created a database of returns from public sources (e.g., institutional investors who have posted their returns on-line), Freedom of Information Act requests to public funds, and voluntary disclosures by both general and limited partners. O'Hare has been highly successful at gathering data not only on the returns of new funds, but also

many of the most established in the industry. We supplemented this with the return data that we had previously gathered from public sources. Note that we will only use IRR data in our sample for funds established prior to 2002 (and often earlier), since this performance metric is unlikely to be very meaningful for younger funds.

Institutional investor characteristics. We compiled information on the overall size of the assets managed by the limited partner, the length of each institution's experience with private equity investing and location from the Venture Economics' *Directory of Private Equity Investors* and Asset Alternative's *Directory of Alternative Investment Sources.* We obtained information on the senior management of the investors from *Pensions and Investments*' annual survey of the largest 200 pension funds in the US.

4. Analysis

4. 1. Descriptive Statistics

Table 1 presents descriptive statistics of the 1,398 funds and 417 limited partners in our main sample. Data on characteristics of interest were not always available. We indicate in Table 1 the number of non-missing observations. Panel A of Table 1 shows statistics of the funds, broken down into three categories: early-stage venture capital, later-stage venture capital, and buyout funds. Our sample is split relatively evenly across these three types of funds. We have a limited amount of data on carried interest and management fees, while we have fund performance data for close to half of the funds in our sample.

Fund Characteristics. We find that the average fund in our sample that LPs invested in is a fourth fund (the average sequence number is 3.7), but there is substantial variation ranging from partnerships that are in their first fund to those that have raised 32 funds. Our sample contains funds that were raised between 1991 and 2001, and the average fund in our sample was closed in 1997. We find that venture capital funds tend to be somewhat older (average sequence number of later-stage VC funds is 4.2), reflecting the longer history of this segment of the private equity market. The average fund is $406 million, but again we find that there is large heterogeneity between funds. The smallest fund is $4.5 million dollars, while the largest one is $6.1 billion. Not surprisingly, buyout funds are much larger with an average size of $660 million, while later stage venture funds average $330 million and early stage VC funds $210 million.

Performance. In terms of performance, we find that the average fund in our sample has an (unadjusted) IRR of 6.7 percent, but again with a great amount of dispersion: the worst fund returned negative 94 percent while the best performing fund had an IRR of more than 500 percent. We also find that early and later stage venture funds in our sample had significantly higher performance than the buyout funds; 14 percent and 8 percent versus 0 percent, respectively. The returns for buyout and venture funds in our sample are somewhat lower than what Kaplan and Schoar (2004) found. This may reflect both the time period (the most recent years have seen very poor returns for private equity funds), as well as the differences in the mix of funds. The discrepancy is particularly large for the buyout funds. Consistent with prior research (see Gompers

and Lerner (1999)), we find that the average management fee is two percent and the average carried interest 20 percent.

Geographic Distribution. Finally, we see that the funds in our sample are concentrated on the East and West Coasts, with 47 percent and 31 percent of the U.S. funds in the sample respectively. Only 23 percent of the funds are based in the South or the Midwest. When differentiating by type of fund, we see that the majority of early-stage venture capital funds are based in the western United States (56 percent), while 50 percent of later-stage VC and 62% of buyout funds are based in the northeastern region. This is not surprising since the buyout industry tends to be concentrated around New York and early-stage venture funds around Silicon Valley.

Composition of Limited Partners. Panel B of Table 1 shows the distribution of limited partners in our sample and their characteristics. Endowments comprise the largest group, with 100 LPs, followed by public pension funds (74) and corporate pension funds (72). There are 66 advisors in the sample, 32 insurance companies, 30 commercial and investment banks, and 43 LPs that cannot be classified in any of the above categories. (Among such LPs are investment agencies of foreign governments, corporate venturing departments of large corporations, and religious organizations.) Advisors and public pension funds constitute the largest amounts of capital committed to the industry overall (averaging $3.6 billion and $2.2 billion committed to private equity investments, respectively).

Sample Period. Finally, Panel C shows the breakdown of vintage years for the funds in our sample. The number of funds in our sample increases over the 1990s. This is due to two different phenomena. First, the coverage of the Galante's database appears to become more comprehensive in the later part of the sample period. Second, the 1990s represent a period of massive growth of the private equity industry, in terms of the number of funds raised and the number of investors participating in the industry. To alleviate concerns that sample selection issues due to improved coverage of LPs over time might drive our result, we replicate our findings for the sample of 20 limited partners where we have their complete investment history.

4.2. Performance Differences

Table 2 provides an overview of the investments made by each type of limited partner in the different fund categories. There is enormous heterogeneity in the performance of funds in which different groups of institutions invest. The funds that endowments invested in have by far the best overall performance. The average IRR of funds that endowments invested in is 20 percent. This high performance is, however, entirely driven by their VC investments. On average, early- and later-stage VC funds that endowments invested in returned an IRR of 35 and 19 percent, respectively. In contrast, the buyout investments of endowments only had an IRR of less than one percent. Overall, endowments had a very positive average, since they invested in many more venture capital than buyout funds.

The picture looks quite different for public and corporate pension funds (and to some extent, insurance companies). On average, the funds that these classes of LPs invested in had more moderate IRRs (eight percent and five percent, respectively). But the drivers of positive returns are less skewed for this group. The average VC fund these LPs invested in had an IRR of slightly over 10 percent, while their buyout funds had an IRR of two percent. Finally, we see that the funds picked by advisors and banks on average had very poor performance (IRRs of negative two and negative three percent, respectively). This trend seems to hold across all different types of private equity investments. Interestingly, bank and finance companies picked particularly poor performing funds among the early stage VC funds (IRR of negative 14 percent). We must be careful not to interpret these findings as the overall performance of the private equity portfolio of these groups, however, since this calculation does not reflect the *actual size* of the allocations to each of the different funds. This exercise represents the ability of different groups of LPs to identify (good) funds on average.

We also estimated the LPs' investment performance by assigning weights to each LP's portfolio constituents as follows. For investments where the dollar amount committed to the fund and the overall private equity commitments by the LP are available, we weighted the returns from each fund by the amount committed to the fund in relation to the LP's total private equity commitments. For all remaining funds in an LP's portfolio for which the commitment amount was not known, we simply assumed

that the LP invested an equal amount in each fund. The results of this exercise indicate that the performance changes little.[4]

4. 3. Are the Performance Patterns Robust?

A natural question is whether these univariate results are robust to controlling for the time period when the investments were made, or the choice between venture and buyout funds. We address this concern through regression analyses of fund returns.

For these and subsequent analyses, we will analyze investments at the LP-fund level (except for Table 4, which is conducted at fund and LP-year level): that is, we will use each investment by a limited partner in a fund as a separate observation. (We will control for the fact that we have multiple observations by clustering the standard errors at the fund level.) We regress the realized IRR of a fund on a set of dummies for the different classes of LPs and control variables for year fixed effects, fund category fixed effects, the year the LP's private equity investment program was launched,[5] and the geographical co-location of the fund and LP. Public pension funds are the omitted category from the set of LP dummies. We only include funds that were started before 1999 to guarantee that a majority of the returns of the funds have already been realized.

[4]Panel A also reveals that public and corporate pension funds tend to invest in larger funds, whereas endowments and insurance companies invest in smaller funds. Public pension funds also tend to invest in funds with higher sequence numbers. Interestingly, we see that the smaller fund size for endowments is driven by their allocations to small buyout funds and the greater share of venture capital funds in their portfolio: the VC funds they invest in are larger on average. We find that insurance companies and banks tend to invest in early funds (lower sequence number) across all fund categories.

[5]The vintage is expressed relative to that of the median LP in the sample, which began its private equity program in 1987. Thus, a program begun in 1991 would be coded as +4.

In Table 3, column (1), we find that only funds in which endowments invest in outperform public pension funds, while other LPs on average pick funds that underperform relative to those groups. In particular, corporate pension funds and banks invest in funds with significantly lower IRRs. In column (2), we include a dummy equal to one if the LP and GP are in the same region of the United States and a control for the age of the private equity program of the LP. The geographical proximity factor is negatively associated with fund performance, which might suggest that LPs are willing to invest in funds with lower performance if they are in the same local area. The coefficient on LP vintage is positive but insignificant. We then interact the LP type dummies with the vintage of the LP's private equity investment program to find out whether, within the different classes of LPs, those that started investing in private equity earlier display different performance from those that started to invest later. We find negative coefficients on all the interaction terms. In particular, among advisors, corporate pension funds, insurance companies, and banks, those LPs that started investing in private equity earlier have higher IRRs.

To analyze how sensitive fund returns are to market cycles, in column (4) we replace year fixed effects with a measure of the aggregate annual inflow of capital into the industry. The coefficient on the aggregate inflow of capital is negative and highly significant.[6] This is in line with previous papers that have shown that funds started in

[6]This pattern continues to hold when we employ other proxies, such as the inflows into venture capital funds only or the level of the NASDAQ. We employ similar alternative controls in subsequent analyses.

times when a lot of money is flowing into the industry have significantly lower performance. Parallel to before, we now interact the LP dummies with the measure of aggregate capital inflow. Column (5) shows that the coefficient on the interaction term between LP type and aggregate inflow of capital is negative, but it is only significant for advisors (at the 1% level) and corporate pension funds and insurance companies (at the 10% level). These results suggest that advisors, insurance companies, and corporate pension funds have significantly lower returns if they invest during periods of high capital inflows into the industry. This result is consistent with an interpretation where the latter LPs tend display more herding behavior when the market is "hot," which leads to investments in lower return funds.

Finally, in columns (6) to (8) we include a number of other LP-specific controls such as the logarithm of the LP size (measured as committed capital) and dummies for the region the LP is located in. We find that the main results described above are not affected by the inclusion of these controls.

We replicate the results in Table 3 using excess IRR as the performance measure. Excess IRR is measured as the fund's own IRR minus the average IRR of all private equity funds in that year and category. These results are reported in the appendix Table 3A. The results are equivalent to the results reported above. We also repeat our analysis for the full sample of LP investments, including those made after 1999. Again the overall picture is very similar. We also repeat the analysis using median regressions to reduce the importance of extreme values and the results are qualitatively similar. The

interaction terms between the different LP classes and industry capital flows become statistically more significant, while the interaction terms with LP age become less significant. The other results are unchanged.

Lastly, in Table 3, we used the individual investment decisions by LPs as an observation. We might be concerned that this overstates the amount of independent variation we have in the sample despite the fact that we are clustering at the fund level. Therefore, in Table 4 we now turn to an alternative empirical approach where we collapse the data at the fund level. We use the number of LPs of each class that invested in a given fund in our sample as explanatory variables for fund performance, together with fund size and controls for year fixed effects and fund category effects. We again use two measures of fund performance, IRR and excess IRR. As in Table 3, we find a significant positive correlation between the performance of a fund and the number of endowments that invest in it. For all other classes of LPs, the coefficient is again negative, but it is only significantly negative for banks and corporate pension funds. Overall these results reconfirm our earlier findings in Table 3.

4. 4. Differences in Reinvestment Decisions of LPs

In the subsequent analyses, we will try to explain what drives these differences in the performance of LPs. One of the most important decisions for LPs is whether they reinvest in the next fund of a partnership or not. Reinvestment decisions of LPs are particularly important in the private equity industry, where information about the quality of different private equity groups is more difficult to learn and often restricted to existing

investors (see Lerner and Schoar (2004) for a discussion of asymmetric information in private equity). Moreover, LPs have very few governance tools except for exit, *i.e.*, not reinvesting in the next fund.

For each fund in our sample, we identify whether the private equity organization raised a follow-on fund of the same type. For each LP investing in the fund, we then determine whether the same LP reinvested in the follow-on fund. In this way, we make sure that we do not miscode situations where no follow-on fund was raised as a decision not to reinvest.

Panel A of Table 5 shows the reinvestment outcomes by class of LP and fund type. Public pension funds and insurance companies reinvest in roughly 60 percent of the funds where a next fund was raised. They are followed by endowments and advisors, who reinvest in about 50 percent of the cases, while corporate pension funds and banks reinvest in only 39 percent of the cases. Interestingly, endowments and advisors differ in their reinvestment rates across different fund categories. They are both more likely to reinvest in venture funds than in buyout funds. Most other LPs do not show a pronounced difference in reinvestment rate across fund categories. Moreover, funds in which endowments choose to reinvest have much higher average IRR than those of other classes of LPs. Again these higher average IRRs are especially driven by investments in venture capital funds. By way of contrast, the funds banks and advisors reinvested in show particularly poor performance.

Panel B of Table 5 explores some of the consequences of reinvestment decisions. We find that, across all LP classes, there are significant performance (IRR) differences between funds in which LPs did and did not reinvest. We see that LPs tend to reinvest in the next fund of the partnership if the current fund has high IRR (on average these funds have an IRR of 25 percent). In those instances where LPs decided not to reinvest, the current fund on average had a significantly lower IRR of 17 percent. The same pattern holds when we look at the IRRs of the subsequent fund. Funds in which LPs reinvested have significantly higher performance than those in which they did not reinvest (seven versus negative two percent respectively).

In Panel C, we now break out the reinvestment decisions differentiated by class of LP. The difference in the average current fund performance between reinvested and discontinued funds we found in Panel B is largely driven by the reinvestment decisions of public and corporate pension funds and advisors, who tend to reinvest when the current fund performance is higher. Interestingly, endowments do not show a significant difference in the current performance of partnerships in which they decided to reinvest versus those they did not (39 versus 37 percent). This picture reverses when we look at the performance of the next fund. Funds in which endowments decided to reinvest have much higher performance than those they decided not to (31 versus 7 percent). They appear to be able to select funds that maintain their high performance and avoid those that will have lower performance going forward. Moreover, they tend to re-invest when current funds are smaller in size. Public pension funds show a similar ability to differentiate between good and bad performers, but at, however, a much lower average

performance level. Funds they reinvested in on average have six percent returns, while those they passed on had negative 2 percent. Advisors also appear to follow a similar approach of reinvesting when the current fund is smaller, but are less successful at picking the better performing next funds. In short, some investors appear far more able to benefit from and/or act on the inside information that being a limited partner provides.

In Table 6, we present the results from a linear probability model of reinvestment. The dependent variable is a dummy equal to one if an LP decided to reinvest in the next fund of a given partnership (conditional on a next fund being raised) and zero otherwise. In column (1), we find a positive but barely significant relationship between reinvestment and the past performance of the prior fund. Once we control for overall industry conditions (measured as aggregate inflows of capital into the industry), LP vintage, and a dummy for whether LP and GP are in the same area, this relationship becomes slightly more significant (see column (2)). By way of contrast, market cycles have a much more significant effect on reinvestments: in times when more capital flows into the private equity industry, LPs are also more likely to reinvest. Moreover, we see that LPs' vintage has no significant effect on the reinvestment decision, but LPs tend to be more likely to reinvest if the GP is geographically proximate. We add dummies for the different types of LPs in Column (3). We see that corporate pension funds and endowments are less likely to reinvest on average. This might indicate that these groups follow a more proactive investment strategy, in which they exercise their exit right if they are not happy with the relationship.

In column (4), we now add interaction terms between the LP type dummies and the LP vintage. This allows us to test whether older LPs in different LP classes are more likely to reinvest. We find that among corporate pension fund and banks, older LPs are more likely to reinvest in a GP. This result could suggest that corporate pension funds and banks tend to be less proactive in their investment strategy. Of course one could also conjecture that these older LPs tend to have valuable long-standing relationships with their GPs. Given the lower performance results we documented for these types of LPs in Table 3, however, this interpretation seems less plausible.

Finally we also interact LP types with fund IRR or aggregate capital inflow. By doing so, we hope to test whether different types of LPs are more sensitive to the past performance of a fund or the market conditions when deciding whether to reinvest. While across most funds the coefficient on this interaction term is positive, it is not significant. We also repeated all the analyses in Table 6 using logit specifications with qualitatively the same results (not reported).

4. 5. Are the Patterns Driven by Fund Access?

One possible explanation is that the superior performance of endowments is an accident of history. As Kaplan and Schoar (2004) document, private equity funds display a concave relationship between fund size and performance: The best funds apparently limit their size, even if they could raise far more funds. Typically, these limitations are implemented by restricting access to existing limited partners, who are given the right to

reinvest a set amount, but not accepting new investors. Thus, many well-regarded venture groups have long waiting lists of prospective limited partners.

These facts imply that endowments could enjoy superior returns not because of better fund selection, but because their early experience gave them a "seat at the table" among superior groups. More recent investors, who cannot access these funds, nonetheless can recognize them equally well. To explore the possibility that the results simply reflect superior access, we analyze recent investment decisions in young private equity groups. In these cases, access to the funds is much less critical: existing limited partners should have little preferential access. (It is possible that existing relationships and prestige of an established limited partner help somewhat in getting access to the hottest new funds, but typically new funds are not in the position of turning away new investors.)

Panel A of Table 7 summarizes the performance of different classes of LPs for funds managed by recently established private equity groups. We use the median founding year (1990) of all private equity groups in our sample as a cut-off, and explore whether endowments continue to enjoy superior performance when they invest in the younger private equity groups.

The top half of Panel A shows the results if we include all funds started after 1990. In this case we find that endowments and public pension funds do not outperform the sample anymore. Moreover the differences in performance between the different LPs

are less pronounced. But advisors and banks seem to perform most poorly when we condition on the younger GPs. One might be concerned that including all funds started after 1990 in the sample could create bias, if some type of LPs such as endowments are more likely to invest in recent years when returns have not been realized. We therefore repeat the analysis restricting the sample to young funds that closed before 1999. The picture changes significantly if we use this cut-off, since now endowments and public pension funds tend to outperform the rest of the LPs, while banks and other LPs do worst. The difference between the LP classes, however, is again less pronounced than in Table 2.

Finally, in Panel B of Table 7, we adopt a regression approach along similar lines as Table 3. As before, we use fund IRR and excess IRR as the dependent variables, but restrict the sample to investments made in young private equity groups (*i.e.*, those established after 1990). As in Table 3, we restrict the analysis to funds begun before 1999. In the basic specification in column (1), young funds in which banks and other LPs invest do significantly worse. All LP dummies except for endowments have a negative coefficient relative to the omitted category, public pension funds, but none of the other differences are significant. When we use excess IRR as the dependent variable, endowments have significantly positive performance in two of the three reported regressions. (Results across LP classes using weighted IRR are similar in sign and again generally insignificant.)

Overall, these results suggest that some of the differences in the performance of LPs (in particular, endowments and public pension funds) might be attributable to preferential access of these LPs that have been in the industry for a long time. Over time, they may have developed good relationships with established and successful funds in the industry. But endowments still outperform other LPs to some extent, even when choosing among the younger GPs. Moreover, it might be optimal for established LPs like CALPERS or Yale endowment to invest in a number of younger funds if they feel that this experimentation is necessary to create a pipeline of a new generation of GPs with whom they will have preferential relationships going forward.

5. LP-Specific Differences

Our analysis so far has focused on the differences between LP classes. But not all endowment or pension fund investors are equal. Therefore, we now turn to analyzing the importance of the underlying heterogeneity between individual LPs. Some of our previous results on differences in performance by LPs of different vintage or size already suggest that there might be a lot of heterogeneity between the LPs in a given category. The analysis that follows will allow us to investigate whether differences in investment styles are systematically related to differences in the performance of LPs.

For that purpose, we estimate a model with LP-specific fixed effects. We augment the standard model we used in Table 3 by adding a full set of LP-specific fixed effects instead of dummies for LP classes. This allows us to test whether individual LPs differ in their intermediary investment styles, e.g., their propensity to invest in younger, larger, or

better performing funds. Table 9 reports the results from this exercise for a number of different dependent variables. The first row of this table reports the R^2 of a regression of the raw fund IRR on controls for fund type and vintage year fixed effects. The R^2 in this regression is 28.9%. We now add the dummies for LP classes to this specification. Row 2 shows that the R^2 goes up to 29.7%. Moreover, the F-test for the joint significance of the LP class dummies is significant at the 1% level. When we include the full set of individual LP fixed effects, the R^2 of the regression increases to 35.2%. This increase is much more pronounced relative to the base model than when we included the LP type dummies in row 2. This finding suggests that LP-specific heterogeneity explains a bigger fraction of the overall variation of LP performance than differences between LP types. We also find that an F-test on the joint significance of the LP fixed effects is significant at the 1% level.

We also repeat this analysis using excess IRR as the dependent variable. Similarly to before, we find that R^2 between the base model and the model with LP type dummies increases from 11.7% to 12.7%, but when we include the individual LP fixed effects the R^2 goes up to 19.2%. The same patterns hold for the other dependent variables: GP founding year, GP size, and the change in size between two consecutive funds. In each case, the increase in R^2 is much larger when including the individual LP fixed effects. Overall, these findings suggest that LP-specific differences in investment styles are more important than differences between LP types in understanding the variation in LP performance.

5.1. Differences within LP Classes

A natural question is whether some classes of LPs are more heterogeneous than others. To look at the heterogeneity in LP styles by class of LP, we collect the estimated LP fixed effects and calculate the mean, median, and standard deviations of these fixed effects by LP type. If the distribution of the estimated fixed effects is very tight around the sample mean, it would suggest that LPs do not vary greatly within LP classes, and *vice versa* if the distribution is very wide. Moreover, we can analyze if there are differences in the distribution across different LP class.

The results in Table 10 suggest that the standard deviations for advisors and corporate pension funds are somewhat larger than the other LPs. The standard deviation of the IRR fixed effects for advisors and corporate pension funds are 85 and 67 respectively, versus 60 and lower for the other LP classes. More strikingly, the standard deviations are relatively similar across the different LP classes, which suggest that there is no striking asymmetry in the amount of heterogeneity across LP classes.

5. 2. Correlation between the Dimensions of LP Investment Styles

Finally, we want to analyze how the different dimensions of an LP's investment style correlate with each other and with performance. For that purpose, we accumulate the estimated LP fixed effects in one matrix, where each row contains all the estimated fixed effects from the regressions with different dependent variables for a given LP. So an LP who has high performance across its different funds and invests in smaller funds on average will have a high fixed effect in the performance regression and a lower fixed

effect in the GP size regression. We can now correlate these different fixed effects to understand how these different investment dimensions are related to one another.

Table 11 shows the correlation structure within our sample of LPs. Each cell in this table represents the correlation between one set of fixed effects, described in the top row of the table, and another set of fixed effects described on the left hand side of the table. The first cell shows that, not surprisingly, the correlation between the raw IRR fixed effects and the excess IRR fixed effects is very high (point estimate of 0.88) and strongly significant. When we look at the correlation of raw IRR fixed effects and other dimensions of LP investment style, we find that LPs who have high GP size fixed effects and higher fixed effects on the change in fund size are correlated with lower performance fixed effects. The interpretation of these results is that LPs who invest in larger and faster growing funds on average tend to have lower average IRRs. Similarly, we find that LPs who invest in a high fraction of GPs in the same region as the LP have lower average performance. This confirms our previous result from the LP-fund level regression in Table 3. And finally, we document a positive (but weak) correlation between the IRR fixed effect of an LP and the average GP founding year fixed effects.

Looking at the other dimensions of LP investment style, we find that LPs that have higher fixed effects on the change in fund size (that is, those investing in funds that increase their fund size more from one fund to the next) also have higher GP founding year fixed effects, lower reinvestment fixed effects, and a lower fraction of GPs in the same area. Moreover, we find a positive and significant relationship between the fixed

effect for GP size and the fraction of GPs in the same region and a negative correlation with the average number of funds per GP. And finally we find a positive correlation between the number of funds per GP and the reinvestment decision.[7]

Overall, this analysis supports the hypothesis that LPs vary in their overall investment styles along a number of dimensions. These include the average size, growth rate, and founding year of GPs they invest in, the tendency to reinvest in funds, and the proclivity to invest in GPs that are geographically close to the LP. Most interestingly, these different investment styles are systematically related to differences in the performance of LPs.

6. Conclusion

The differences between institutional and individual investors have attracted growing attention by financial economists. The diversity of strategies *across* the various classes of institutional investors, however, has been much less scrutinized. This paper seeks to address this gap, examining the experience of various institutional investors in private equity funds.

[7]We also use a similar approach to take another look at the risk and return question alluded to in the introduction. We compute for each LP a rough measure of the total (not, as we would prefer, the systematic) risk of its portfolio: the standard deviation of the logarithm of raw and excess IRRs of the funds in its portfolio. (We use logarithms to reduce the impact of the skewness of the distribution.) We find a positive correlation—which in some specifications is statistically significant and in others is not—between this proxy for risk and the LP-specific fixed effects from the IRR and excess IRR regressions.

Using data on investment choices and performance that have not been hitherto explored by economists, we document a puzzling pattern: dramatic differences in the performance of investments by different institutions. Endowments have an annual return some 14% better than other institutions, while funds selected by investment advisors and banks perform particularly poorly. These differences remain present when we employ a variety of controls and specifications. We explore the importance of funds' reinvestment strategies in explaining the differences in LP performance. We find that endowments and corporate pension funds are much less likely to reinvest in a given partnership. Moreover, those LPs are better at forecasting the performance of follow-on funds. Funds in which endowments decided to reinvest show much higher performance than those where endowments decided not to reinvest. This suggest that endowments proactively use the information they gain from being an inside investor, while other LPs seem less willing or able to use information they obtained as an existing fund investor.

We also explore the possibility that the superior performance of endowments or public pension funds results from historical accident: *i.e.*, that these LPs through their early experience as limited partners may have greater access to established, high-performing funds. To test this hypothesis, we examine investments in young private equity funds (those raised after 1990) across all classes of LPs. If the performance difference is mainly driven by the superior access that older LPs have in established funds, conditioning on younger funds should erase the difference in performance between the different classes of LPs. When we repeat our analysis conditioning on young funds, we still find a performance premium for endowments and public pension funds, though,

the difference is much smaller than in the funds formed before 1990. While this finding does not support the idea that the superior performance of these LPs is merely driven by historical accident, we cannot rule out that some of the performance difference is due to their early access to superior funds.

Finally, we examine the LPs' "intermediary style": the systematic patterns they display when selecting private equity funds. We show that LP-specific differences in investment styles are significantly correlated with the performance differences between LPs. LPs that have higher IRR fixed effects also tend to invest in smaller and slower growing funds and have a smaller fraction of GPs in the same geographic area as the LP.

This paper poses a number of follow-on questions that would reward further research:

- First, better understanding the sources of the performance puzzle is an important challenge. What specific agency problems, for instance, have led to the poor selection of funds by investment advisors and banks? While we can speculate on some of the causes—for instance, the weak incentive compensation offered many advisors and the desire on the part of many banks to attract lending and advisory business by investing in new funds—clearly more work is needed to understand these issues.
- Second, we noted in the introduction that the differing experience levels of the LPs might exacerbate cycles in the private equity market. To fully investigate this question, it would be necessary to link the records of LP investments that we have

investigated here with the characteristics of the individual companies backed by private equity funds.

- Finally, it would be interesting to explore the generality of these results. Are the same patterns seen, for instance, in the returns from hedge fund and public equity managers? If so, it may be interesting to explore the broader consequences of the changing mixture of institutional investors.

References

Barber, Brad M., and Terrance Odean, 2003, "All that Glitters: The Effect of Attention and News on the Buying Behavior of Individual and Institutional Investors," Unpublished working paper, University of California at Berkeley and Davis.

Barberis, Nicholas, and Andrei Shleifer, 2003, "Style Investing," *Journal of Financial Economics*, 68, 161-199.

Froot, Kenneth, and Melvyn A. Teo, 2004, "Equity Style Returns and Institutional Investor Flows," Working paper no. 10355, National Bureau of Economic Research.

Gompers, Paul, and Josh Lerner, 1996, "The Use of Covenants: An Analysis of Venture Partnership Agreements," *Journal of Law and Economics*, 39, 463-498.

Gompers, Paul, and Josh Lerner, 1998, "What Drives Venture Capital Fundraising?," *Brookings Papers on Economic Activity: Microeconomics*, 49-192.

Gompers, Paul, and Josh Lerner, 1999, "An Analysis of Compensation in the U.S. Venture Capital Partnership," *Journal of Financial Economics*, 51, 3-44.

Gompers, Paul, and Josh Lerner, 2000, "Money Chasing Deals? The Impact of Fund Inflows on Private Equity Valuations," *Journal of Financial Economics*, 55, 281-325.

Gompers, Paul, and Andrew Metrick, 2001, "Institutional Investors and Equity Prices," *Quarterly Journal of Economics*, 116, 229-260.

Grinblatt, Mark, Sheridan Titman, and Russ Wermers, 1995, "Momentum Investment Strategies, Portfolio Performance and Herding: A Study of Mutual Fund Behavior," *American Economic Review*, 85, 1088-1105.

Gromb, Denis, and Dmitiri Vayanos, 2002**, "**Equilibrium and Welfare in Markets with Financially Constrained Arbitrageurs," *Journal of Financial Economics*, 66, 361-407.

Hellmann, Thomas, Laura Lindsey, and Manju Puri, 2004, "Building Relationships Early: Banks in Venture Capital," Unpublished working paper, University of British Columbia, Arizona State University, and Duke University.

Kaplan, Steven N., and Antoinette Schoar, 2004, "Private Equity Performance: Returns, Persistence and Capital Flows," *Journal of Finance*, forthcoming.

Lakonishok, Josef, Andei Shleifer, and Robert W. Vishny, 1992, "The Structure and Performance of the Money Management Industry," *Brookings Papers on Economic Activity: Microeconomics*, 339-379.

Lerner, Josh, G. Felda Hardymon, and Ann Leamon, 2004, *Venture Capital and Private Equity: A Casebook*, New York, John Wiley, 3rd edition.

Lerner, Josh, and Antoinette Schoar 2004, "The Illiquidity Puzzle: Theory and Evidence from Private Equity," *Journal of Financial Economics*, 72, 3-40.

Mayer, Colin, Koen Schoors, and Yishay Yafeh, 2003, "Sources of Funds and Investment Activities of Venture Capital Funds: Evidence from Germany, Israel, Japan, and the U.K.," Working paper no. 9645, National Bureau of Economic Research.

Poterba, James, 1989, "Venture Capital and Capital Gains Taxation," in Lawrence Summers, editor, *Tax Policy and the Economy*, Cambridge, MIT Press, volume 3, 47-68.

Shleifer, Andrei, and Robert Vishny, 1997, "The Limits of Arbitrage," *Journal of Finance*, 52, 35–55.

Table 1. Descriptive statistics

Panel A: Descriptive statistics - Funds

	Overall					Early-stage VC funds					Later-stage VC funds					Buyout funds				
	N	Mean	Std dev	Min	Max	*N*	Mean	Std dev	Min	Max	*N*	Mean	Std dev	Min	Max	*N*	Mean	Std dev	Min	Max
Overall fund sequence number	*1,393*	3.66	3.59	1	32	*393*	3.69	2.71	1	14	*527*	4.18	4.25	1	32	*473*	3.05	3.33	1	29
Closing year	*1,398*	1997	2.70	1991	2001	*395*	1998	2.63	1991	2001	*530*	1997	2.77	1991	2001	*473*	1997	2.60	1991	2001
Total closing (MM$)	*1,398*	406.3	663.9	4.5	6,100	*395*	207.7	242.0	5.2	1,600	*530*	327.6	466.0	4.5	4,600	*473*	660.5	952.6	10	6,100
Internal rate of return (%)	*576*	6.7	51.0	-94.2	513	*159*	13.8	79.3	-66.8	513	*224*	7.6	42.4	-49.9	268.4	*193*	-0.4	21.2	-94.2	57.9
Excess IRR (%)	*564*	6.5	43.6	-90.5	493	*156*	17.2	67.8	-62.5	493	*217*	5.6	34.5	-78.4	248.8	*191*	-1.3	19.0	-90.5	45.5
Carried interest (%)	*199*	20.7	2.2	20	30	*58*	21.8	3.3	20	30	*54*	20.5	1.8	20	30	*87*	20.2	1.2	20	30
Management fee (%)	*115*	2.1	0.5	0.9	4	*38*	2.4	0.5	1	4	*32*	2.1	0.4	1.25	3	*45*	1.8	0.3	0.9	2.5
Total number of LPs investing in fund	*1,397*	5.4	5.7	1	46	*394*	4.9	4.5	1	31	*530*	5.2	5.4	1	33	*473*	6.2	6.8	1	46
Geographical location of US-based funds:																				
West	*1,117*	0.31		0	1	*331*	0.56		0	1	*442*	0.27		0	1	*344*	0.11		0	1
Northeast	*1,117*	0.47		0	1	*331*	0.27		0	1	*442*	0.50		0	1	*344*	0.62		0	1
South	*1,117*	0.12		0	1	*331*	0.12		0	1	*442*	0.11		0	1	*344*	0.12		0	1
Midwest	*1,117*	0.11		0	1	*331*	0.06		0	1	*442*	0.12		0	1	*344*	0.15		0	1

Panel B: Descriptive statistics - Mean characteristics of limited partners, by class of LP

	N	Year of establishment of private equity investment program	Total funds under management (MM$)	Total Private Equity commitments (MM$)	Percentage committed to VC funds (%)	Percentage committed to buyout funds (%)	Number of funds in which LP invested
Public pension funds	*74*	1987	24,753	2,212	45.1%	50.2%	31.3
Corporate pension funds	*72*	1986	10,728	635	44.0	31.4	10.5
Endowments	*100*	1985	1,565	200	51.1	33.7	14.3
Advisors	*66*	1988	4,811	3,654	42.8	35.5	25.3
Insurance companies	*32*	1983	36,631	1,171	31.3	31.8	18.6
Banks and finance companies	*30*	1983	85,435	671	26.8	57.0	19.1
Other investors	*43*	1989	933	108	57.3	31.1	5.7
Overall	*417*	1986	18,032	1,173	44.9%	39.4%	18.2

Panel C: Fund observations by vintage year and type

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	All years
Early-stage VC funds	8	15	11	24	19	21	45	41	69	102	40	395
Later-stage VC funds	22	20	31	36	49	43	66	69	76	78	40	530
Buyouts funds	8	19	28	41	35	41	72	75	52	68	34	473
Overall	38	54	70	101	103	105	183	185	197	248	114	1,398

The sample of funds consists of 1,398 distinct funds listed in *Asset Alternatives*. Panel A summarizes fund characteristics according to the type of fund (early-stage VC, later-stage VC, and buyout funds). Excess IRR is internal rate of return minus the median IRR of the portfolio formed for each fund category every year. Geographical location by region follows the US Census classification of states: *West* includes California; *Northeast* includes Massachusetts, New York, Pennsylvania; *South* includes Texas; *Midwest* includes Illinois, Ohio. Panel B summarizes overall investment characteristics of 417 limited partners (LPs) who invested in those 1,398 funds, presented according to class of LP (public pension fund, corporate pension fund, endowment, etc). Percentage committed to VC funds includes both early-stage and later-stage VC investments. Percentages committed to VC funds and to buyout funds do not add up to 100% because LPs also invest in other types of specialized private equity funds, such as oil, gas and energy, real estate, or venture leasing funds, which are not covered by our analyses. Panel C shows the distribution of the funds by vintage year.

Table 2. Mean fund characteristics by class of LP and by fund type

	Overall					Early-stage VC funds				
	N	Fund size (MM$)	Fund sequence number	Fund IRR (%)	Weighted fund IRR (%)	*N*	Fund size (MM$)	Fund sequence number	Fund IRR (%)	Weighted fund IRR (%)
Public pension funds	*2,317*	983.8	4.77	7.61	2.63	*365*	319.6	4.77	12.12	1.06
Corporate pension funds	*759*	826.2	4.55	5.07	3.07	*141*	228.1	4.37	9.38	3.10
Endowments	*1,433*	587.7	4.69	20.47	16.87	*542*	309.4	4.75	34.65	28.90
Advisors	*1,667*	781.8	4.59	-1.79	-2.96	*551*	343.2	4.45	-0.51	-0.58
Insurance companies	*594*	542.2	3.98	5.47	2.13	*148*	237.7	4.28	2.57	-5.25
Banks and finance companies	*573*	721.0	3.48	-3.17	-4.06	*89*	252.0	3.38	-13.93	-13.19
Other investors	*244*	429.1	3.72	4.81	5.87	*98*	148.3	2.91	-6.79	-6.48
Overall	*7,587*	776.6	4.50	6.88	3.76	*1,934*	298.7	4.45	12.84	7.66

	Later-stage VC funds					Buyout funds				
	N	Fund size (MM$)	Fund sequence number	Fund IRR (%)	Weighted fund IRR (%)	*N*	Fund size (MM$)	Fund sequence number	Fund IRR (%)	Weighted fund IRR (%)
Public pension funds	*910*	593.4	5.60	10.80	4.67	*1,042*	1557.5	4.05	3.22	1.50
Corporate pension funds	*260*	375.9	5.54	10.94	8.07	*358*	1388.8	3.90	0.35	0.31
Endowments	*493*	465.5	5.37	19.32	15.31	*398*	1118.1	3.76	0.08	0.47
Advisors	*601*	680.2	5.50	-1.03	-3.84	*515*	1369.5	3.68	-4.35	-4.46
Insurance companies	*218*	443.0	4.63	12.25	7.92	*228*	834.6	3.15	-0.64	0.73
Banks and finance companies	*177*	443.7	3.82	1.04	-0.43	*307*	1016.9	3.32	-2.23	-3.29
Other investors	*86*	480.0	5.42	17.81	20.23	*60*	814.7	2.63	-2.27	-2.31
Overall	*2,745*	543.7	5.34	9.41	5.23	*2,908*	1314.2	3.75	0.41	-0.30

The table shows groupings of 7,587 investments by 417 LPs in 1,398 funds, and mean values of selected characteristics of those funds. *Fund size* refers to the total dollar value raised from all investors in the fund, *fund sequence number* is by reference to the private equity firm's funds portfolio, *fund IRR* is the internal rate of return of the fund obtained from *Private Equity Performance Monitor*, and *weighted fund IRR* is internal rate of return weighted by commitment to a fund as a fraction of each LP's total commitments to private equity funds.

Table 3. Fund performance regressions

Dependent variable: Fund IRR								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy for LP class:								
(comparison category is public pension funds)								
Corporate pension funds	-6.5870 **	-5.4562 *	-7.1335 **	-6.7217 **	-0.4116	-7.8294 **	-9.9264 ***	-7.4005
	(2.8265)	(2.8564)	(3.1150)	(2.9853)	(4.6984)	(3.7007)	(3.7460)	(6.0078)
Endowments	11.5822 ***	12.3675 ***	11.6058 ***	12.4461 ***	25.8624 **	9.0675 **	9.8123 **	25.0122 ***
	(4.3691)	(4.5227)	(4.0435)	(4.3582)	(12.1752)	(4.2518)	(4.3866)	(8.1523)
Advisors	2.9228	2.2354	0.6416	-0.0106	17.9427 **	2.9406	1.8525	26.5239 **
	(2.8536)	(2.9442)	(3.0392)	(3.2223)	(7.0722)	(5.1142)	(5.4077)	(10.6368)
Insurance companies	-5.6477	-4.8812	-6.3373	-6.2943	2.9383	-3.4351	-4.9482	7.4143
	(3.8855)	(3.8245)	(4.3423)	(4.4212)	(7.0318)	(4.3295)	(4.5916)	(8.5949)
Banks	-9.0478 ***	-6.8852 **	-7.1776 *	-8.4130 **	-9.8440 *	-4.9245	-5.8094	-11.2334
	(2.9587)	(2.7998)	(3.6431)	(3.3569)	(5.3896)	(4.4917)	(4.4857)	(9.2872)
Other LPs	-7.9039	-11.7519 *	-12.6116 **	-8.5333	-15.8420	-31.3311 ***	-27.6223 **	-40.7735 **
	(5.0256)	(5.9730)	(5.8084)	(6.1498)	(11.6684)	(9.9807)	(10.9740)	(15.6256)
LP vintage		-0.0065	0.9757 **	0.8701 *	0.8402 *	0.3464	0.3050	0.7133
		(0.0984)	(0.4419)	(0.4545)	(0.4530)	(0.2222)	(0.2364)	(0.4340)
LP and GP in same region		-5.8225 **	-5.6076 **	-4.8298 **	-4.8360 **	-7.3505 ***	-6.8066 ***	-6.3099 ***
		(2.2443)	(2.1989)	(2.0763)	(2.0480)	(2.3820)	(2.3272)	(2.2989)
Total private equity fund inflow				-34.8557 ***	-23.5321 ***		-31.5496 ***	-23.0483 ***
				(8.1715)	(6.4089)		(6.6909)	(6.4271)
LP size (natural logarithm of total commitments to private equity)						-0.8031	-0.8363	-0.3869
						(0.6951)	(0.7761)	(0.7879)
Dummy for region in which LP headquartered:								
(comparison category is Northeast)								
Midwest						-1.3284	-1.0928	0.0033
						(2.8342)	(2.9258)	(3.0646)
South						9.0804 *	9.8261 *	10.4194 *
						(5.3059)	(5.8409)	(6.0087)
West						-2.5517	-3.0269	-3.0475
						(2.7567)	(2.8933)	(2.9654)
Interaction effects:								
Corporate pension funds * LP vintage			-1.3415 **	-0.7243	-0.6839			-0.9879
			(0.6694)	(0.5892)	(0.5834)			(0.6473)
Endowments * LP vintage			-1.0360	-0.9248	-0.8113			-0.4631
			(0.6437)	(0.6468)	(0.6402)			(0.6065)
Advisors * LP vintage			-1.2407 **	-1.2550 **	-1.2970 **			-0.0707
			(0.5010)	(0.5233)	(0.5208)			(0.8341)
Insurance companies * LP vintage			-1.1669 **	-1.4162 **	-1.3551 **			-0.8553
			(0.5527)	(0.5941)	(0.5923)			(0.8603)
Banks * LP vintage			-0.9454 *	-0.7629	-0.6591			-0.6852
			(0.4841)	(0.4873)	(0.4872)			(1.2902)
Other LPs * LP vintage			-0.7599	-0.6774	-1.0803			-2.2641
			(0.9429)	(0.8187)	(0.8913)			(1.5255)
Corporate pension funds * inflow					-13.6367 *			-8.0493
					(8.1508)			(10.5967)
Endowments * inflow					-29.2971			-30.4974 **
					(20.0454)			(12.4482)
Advisors * inflow					-33.9334 ***			-48.2257 ***
					(10.9648)			(15.5688)
Insurance companies * inflow					-19.0795 *			-28.2780 **
					(10.6747)			(13.9280)
Banks * inflow					3.3446			9.6254
					(8.5946)			(13.1579)
Other LPs * inflow					13.1476			38.4921
					(23.2490)			(24.6395)
Year fixed effects	Yes	Yes	Yes	No	No	Yes	No	No
Fund category fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	26.9%	26.4%	26.7%	24.0%	24.7%	23.5%	20.9%	22.0%
Number of observations	2,755	2,348	2,348	2,269	2,269	1,582	1,531	1,531

The sample consists of investments by 417 LPs in 1,398 funds as compiled by *Asset Alternatives*, and excludes funds closed in 1999 and after. Several versions of the following pooled regression are run and coefficient estimates and standard errors are reported by columns in the table:

$$\text{FundIRR}_{ij} = \beta_0 + \sum_j \beta_{0j} \text{DummyLP}_j + \sum_j \beta_{1j} \text{DummyLP}_j \times \text{FundInflow}_i + \sum_k \beta_{2k} \text{DummyLP}_k \times \text{LPage}_{ij} + \beta_3 \text{D\_sameregion}_{ij} + \text{controls}$$

$FundIRR_{ij}$ is the internal rate of return of fund i in %. Six dummy variables identify the class of LP for each LP-fund pair, with $DummyLP_k = 1$ for each observation consisting of an investment in fund i by LP j belonging to LP class k and = 0 otherwise. "Public pension funds" is the 'base LP class', with zero values for all LP dummy variables. $FundInflow_i$ is the year-on-year change in the amount of funds inflow into venture capital in the country and in the year of closing of fund i, and is a proxy for market conditions. $LPage_{ij}$ is the number of years since the establishment of the private equity program at LP j when it made an investment in fund i. $D\_sameregion_{ij}$ is a dummy variable and = 1 if both LP j and private equity firm managing fund i are headquartered in the same region in the US (Midwest (includes Illinois and Ohio), Northeast (includes Massachusetts, New York and Pennsylvania), South (includes Texas), and West (includes California)), and = 0 otherwise. Robust standard errors allowing for data clustering by funds in all the regressions are shown in brackets below the coefficient estimate. Intercepts are not reported.

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 4. Fund performance regressions (using individual funds as observations)

Dependent variable:	Fund IRR (1)	Fund IRR (2)	Fund IRR (3)	Excess IRR (4)	Excess IRR (5)	Excess IRR (6)
Number of public pension funds investing	0.3208	-0.1016	-0.2532	-0.9001	-0.8605	-1.2425
	(1.3112)	(1.2827)	(1.2643)	(1.2433)	(1.2104)	(1.2318)
Number of corporate pension funds investing	-5.5057 *	-5.6761 **	-5.6053 **	-3.3722	-3.3547	-4.3956
	(2.8481)	(2.7621)	(2.8184)	(2.8430)	(2.7337)	(2.8067)
Number of endowments investing	3.8811 ***	4.0182 ***	4.1456 ***	5.3604 ***	5.3961 ***	5.0979 ***
	(1.2801)	(1.2427)	(1.2577)	(1.2192)	(1.1782)	(1.1906)
Number of advisors investing	0.9962	2.1008	0.9980	2.0525	2.3234	3.2203 *
	(2.1324)	(2.1022)	(1.9774)	(1.9031)	(1.8444)	(1.9269)
Number of insurance companies investing	-4.1347	-2.5106	-1.7932	-3.5325	-2.2007	-1.9727
	(3.6907)	(3.5979)	(3.6342)	(3.6915)	(3.5683)	(3.5624)
Number of banks investing	-6.7417 *	-5.8088	-6.8710 *	-7.6021 **	-6.6976 *	-6.6767 *
	(3.8277)	(3.8015)	(3.8086)	(3.7602)	(3.7027)	(3.6935)
Number of other classes of investors investing	-5.1396	-8.8989	-8.8492	-9.0502	-12.6950 *	-11.9236
	(7.4529)	(7.2774)	(7.3631)	(7.6027)	(7.4159)	(7.4138)
Log(size of fund)	4.5101	7.6774 *	8.1881 *	-0.0400	3.0363	4.8499
	(4.1185)	(4.2783)	(4.2865)	(3.3918)	(3.6113)	(3.7839)
Average vintage of LPs that invest in fund		1.4694	1.2553		1.0292	0.9907
		(0.8972)	(0.9002)		(0.8849)	(0.8830)
Average total commitment to private equity of LPs investing in fund		-0.2108 **	-0.1928 *		-0.1900 *	-0.1895 *
		(0.1052)	(0.1059)		(0.1047)	(0.1044)
Total inflows into private equity			-32.7856 ***			-16.7819
			(10.7270)			(10.7175)
Year fixed effects	Yes	Yes	No	No	No	No
Fund category effects	Yes	Yes	Yes	No	No	No
Adjusted R-squared	20.0%	21.2%	18.5%	6.6%	7.9%	8.3%
Number of observations	324	309	309	316	301	301

The sample consists of 324 funds that were closed prior to 1999 and for which data is available to run the following ordinary least squares regressions:

$$\text{FundPerformance}_i = \beta_0 + \sum_k \beta_{1k} \text{NumLP}_{ik} + \beta_2 \log(\text{FundSize}_i) + \text{controls}$$

Fund performance is measured in two ways: (1) internal rates of return for individual funds, obtained from *Private Equity Performance Monitor*, (2) excess IRR, calculated by subtracting from each fund's IRR the median IRR of the portfolio formed that year and in that category. $NumLP_{ik}$ is the number of LPs of class k that invested in fund i. $FundSize_i$ is the total closing amount for fund i in MM$.

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 5. Reinvestment decisions by LPs

Panel A: Reinvestments by LPs by fund categories

	Overall					Early-stage VC funds				
	N	Reinvested (Yes=1; No=0)	Next fund size (MM$)	Percent change, current to next fund size (%)	Next fund IRR (%)	*N*	Reinvested (Yes=1; No=0)	Next fund size (MM$)	Percent change, current to next fund size (%)	Next fund IRR (%)
Public pension funds	*976*	0.607	1330.4	100.3	2.52	*202*	0.540	377.8	106.4	7.61
Corporate pension funds	*346*	0.384	1180.6	96.3	0.59	*88*	0.364	344.1	100.8	11.77
Endowments	*777*	0.481	808.5	95.3	18.73	*346*	0.543	405.3	102.5	35.83
Advisors	*671*	0.478	1041.0	103.0	-8.74	*250*	0.508	459.9	117.5	-7.35
Insurance companies	*227*	0.577	781.1	99.6	-1.33	*86*	0.663	323.2	101.4	-6.09
Banks and finance companies	*197*	0.396	1053.2	107.9	-9.15	*25*	0.480	361.9	120.9	-17.66
Other investors	*90*	0.344	653.7	144.1	-5.79	*37*	0.351	219.7	188.4	-26.36
Overall	*3,284*	0.505	1058.8	100.9	2.64	*1,034*	0.520	393.4	110.2	10.82

	Later-stage VC funds					Buyout funds				
	N	Reinvested (Yes=1; No=0)	Next fund size (MM$)	Percent change, current to next fund size (%)	Next fund IRR (%)	*N*	Reinvested (Yes=1; No=0)	Next fund size (MM$)	Percent change, current to next fund size (%)	Next fund IRR (%)
Public pension funds	*315*	0.654	765.3	96.4	4.43	*459*	0.603	2137.4	100.2	-1.21
Corporate pension funds	*93*	0.387	648.7	113.9	0.03	*165*	0.394	1926.6	84.0	-4.52
Endowments	*264*	0.481	612.7	82.1	11.91	*167*	0.353	1953.1	101.4	-2.53
Advisors	*258*	0.539	924.3	106.7	-12.84	*163*	0.337	2116.9	75.0	-3.24
Insurance companies	*75*	0.613	662.8	91.9	2.59	*66*	0.424	1512.1	106.0	-0.28
Banks and finance companies	*60*	0.400	587.8	96.5	-15.05	*112*	0.375	1456.7	111.1	-4.56
Other investors	*33*	0.485	520.5	125.9	8.32	*20*	0.100	1676.4	92.4	-3.87
Overall	*1,098*	0.541	732.0	97.5	0.72	*1,152*	0.458	1967.6	95.8	-2.44

Table 5. Reinvestment decisions by LPs (continued)

Panel B: Consequences of LPs' re-investment decisions

		LPs re-invested	LPs did not re-invest	Test p-value
Current fund IRR (%)	Mean	24.81	16.86	0.0021 ***
	Median	11.20	3.40	0.0000 ***
Current fund excess IRR (%)	Mean	15.96	12.13	0.0880 *
	Median	3.50	1.60	0.0001 ***
Next fund IRR (%)	Mean	6.92	-2.25	0.0001 ***
	Median	-7.00	-12.20	0.0006 ***
Next fund excess IRR (%)	Mean	13.58	7.72	0.0029 ***
	Median	1.60	-0.30	0.0006 ***
Size of current fund (MM$)	Mean	564.7	675.8	0.0001 ***
	Median	275.0	311.0	0.0072 ***
Percent change, current to next fund size	Mean	+106.4%	+95.3%	0.0050 ***
	Median	+90.0%	+83.9%	0.0000 ***

Panel C: Consequences of reinvestment decisions by class of LP

		Mean fund IRR (%)	Mean excess IRR (%)	Mean next fund IRR (%)	Mean next excess IRR (%)	Mean size of current fund (MM$)	Mean percent change, current to next fund size
Public pension funds	Reinvested	+22.91%	+13.11%	+5.56%	+10.74%	763.7	+112.33%
	Did not reinvest	+15.78%	+7.36%	-2.35%	5.50%	811.5	+81.72%
	t-test	*0.0755* *	*0.1046*	*0.0213* **	*0.0649* *	*0.4440*	*0.0000* ***
Corporate pension funds	Reinvested	17.28	8.28	-0.56	5.43	680.7	105.0
	Did not reinvest	9.08	0.71	1.42	6.76	796.1	90.9
	t-test	*0.1171*	*0.0713* *	*0.6916*	*0.7342*	*0.2808*	*0.1531*
Endowments	Reinvested	39.26	25.79	30.49	31.39	336.2	94.3
	Did not reinvest	36.60	30.64	7.10	16.70	528.5	96.3
	t-test	*0.7094*	*0.4383*	*0.0010* ***	*0.0173* **	*0.0000* ***	*0.7359*
Advisors	Reinvested	20.60	17.62	-7.83	7.07	527.2	110.7
	Did not reinvest	5.98	9.80	-9.72	5.28	743.5	96.0
	t-test	*0.0129* **	*0.1104*	*0.6748*	*0.6444*	*0.0007* ***	*0.1495*
Insurance companies	Reinvested	21.70	13.30	1.70	10.35	366.5	104.4
	Did not reinvest	14.06	6.08	-6.78	3.34	443.7	93.0
	t-test	*0.4371*	*0.3859*	*0.2884*	*0.2611*	*0.2994*	*0.2690*
Banks and finance companies	Reinvested	4.19	0.38	-6.89	0.12	567.9	111.8
	Did not reinvest	2.31	-1.55	-10.61	-0.55	638.9	105.3
	t-test	*0.6980*	*0.6437*	*0.2943*	*0.8173*	*0.5638*	*0.6439*
Other investors	Reinvested	39.32	24.75	6.79	16.09	239.3	93.7
	Did not reinvest	2.23	-0.38	-14.73	1.05	414.1	170.6
	t-test	*0.0013* ***	*0.0455* **	*0.0443* **	*0.0762* *	*0.1708*	*0.1890*

The sample consists of 2,198 reinvestment opportunities identified by reference to the sequence number of funds within the same family. Each reinvestment opportunity is coded 1 if the LP reinvested and 0 if investment in the follow-on fund was "discontinued".

Table 6. Reinvestment regressions

Linear probability models - Dependent variable: Reinvested (Yes=1, No=0)						
	(1)	(2)	(3)	(4)	(5)	(6)
IRR of previous fund in same family	0.0004 *	0.0005 *	0.0004 *	0.0004 *	0.0005	0.0005
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0004)	(0.0004)
Total market inflow in reinvestment decision year		0.0740 **	0.0819 ***	0.0793 **	0.0761 **	0.0499
		(0.0309)	(0.0310)	(0.0308)	(0.0309)	(0.0529)
LP vintage		0.0215	0.0249	-0.0077	-0.0077	-0.0077
		(0.0303)	(0.0300)	(0.0097)	(0.0097)	(0.0097)
LP and GP in same region		0.0050 **	0.0042 *	0.0228	0.0246	0.0252
		(0.0025)	(0.0024)	(0.0295)	(0.0297)	(0.0297)
Dummy for LP class (comparison category is public pension funds):						
Corporate pension funds			-0.2160 ***	-0.1742 **	-0.1870 ***	-0.1388
			(0.0626)	(0.0679)	(0.0685)	(0.0858)
Endowments			-0.1323 **	-0.1408 **	-0.1224 *	-0.1657 **
			(0.0576)	(0.0628)	(0.0661)	(0.0811)
Advisors			-0.0906	-0.0842	-0.0926	-0.1110
			(0.0678)	(0.0729)	(0.0726)	(0.0729)
Insurance companies			0.0100	0.0054	0.0059	0.0529
			(0.0978)	(0.1019)	(0.1082)	(0.1231)
Banks			-0.0981	0.0136	0.0266	0.0131
			(0.1128)	(0.1345)	(0.1456)	(0.1537)
Other LPs			-0.4041 ***	-0.4419 ***	-0.4672 ***	-0.4900 ***
			(0.1151)	(0.0850)	(0.0756)	(0.0902)
Interaction effects:						
Corporate pension funds * LP vintage				0.0250 **	0.0253 **	0.0262 **
				(0.0113)	(0.0113)	(0.0113)
Endowments * LP vintage				0.0084	0.0081	0.0083
				(0.0108)	(0.0108)	(0.0108)
Advisors * LP vintage				0.0123	0.0124	0.0124
				(0.0101)	(0.0101)	(0.0101)
Insurance companies * LP vintage				0.0096	0.0096	0.0089
				(0.0168)	(0.0169)	(0.0164)
Banks * LP vintage				0.0205 *	0.0210 *	0.0211 *
				(0.0108)	(0.0109)	(0.0109)
Other LPs * LP vintage				0.0314 **	0.0336 **	0.0343 *
				(0.0158)	(0.0167)	(0.0191)
Corporate pension funds * IRR of previous fund					0.0011	0.0011 *
					(0.0007)	(0.0006)
Endowments * IRR of previous fund					-0.0005	-0.0006
					(0.0006)	(0.0006)
Advisors * IRR of previous fund					0.0007	0.0006
					(0.0008)	(0.0008)
Insurance companies * IRR of previous fund					0.0000	0.0000
					(0.0007)	(0.0007)
Banks * IRR of previous fund					-0.0019	-0.0019
					(0.0025)	(0.0024)
Other LPs * IRR of previous fund					0.0030	0.0030
					(0.0023)	(0.0023)
Corporate pension funds * inflow						-0.0924
						(0.1035)
Endowments * inflow						0.1364
						(0.0847)
Advisors * inflow						0.0602
						(0.0826)
Insurance companies * inflow						-0.1386
						(0.1234)
Banks * inflow						0.0369
						(0.1331)
Other LPs * inflow						0.0543
						(0.1906)
Fund category effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	1.3%	2.4%	5.2%	6.2%	6.6%	7.0%
Number of observations	2,198	1,860	1,860	1,860	1,860	1,860

The sample consists of 2,198 reinvestment opportunities identified by reference to the sequence number of funds within the same family. The ordinary least squares regressions are:

$$\begin{aligned}\Pr(\text{Reinvested}_{ij}) = \beta_0 &+ \sum_k \beta_{0k}\,\text{DummyLP}_k + \sum_k \beta_{1k}\,\text{DummyLP}_k \times \text{CurrentIRR}_i \\ &+ \sum_k \beta_{2k}\,\text{DummyLP}_k \times \text{FundInflow}_i + \sum_k \beta_{3k}\,\text{DummyLP}_k \times \text{LPAge\_re-inv}_j \\ &+ \beta_4 \text{D\_sameregion}_{ij} + \text{controls}\end{aligned}$$

Reinvested$_{ij}$ is a dummy variable that takes the value 1 if LP *j* reinvested in the next fund in the same family as fund *i*. Six dummy variables identify the class of LP for each LP-fund pair, with *DummyLP*$_k$ = 1 for each observation consisting of an investment in fund *i* by LP *j* belonging to LP class *k* and = 0 otherwise. "Public pension funds" is the 'base LP class', with zero values for all LP dummy variables. *CurrentIRR*$_i$ is the internal rate of return of fund *i* in %. *FundInflow*$_i$ is the year-on-year change in the amount of funds inflow into either total private equity or venture capital in the country and in the year of closing of fund *i*, and is a proxy for market conditions. *LPAge_reinv*$_j$ is the age of LP *j*'s private equity investment program at the time of the reinvestment decision. *D_sameregion*$_{ij}$ is a dummy variable and = 1 if both LP *j* and private equity firm managing fund *i* are headquartered in the same region in the US (Midwest (includes Illinois and Ohio), Northeast (includes Massachusetts, New York and Pennsylvania), South (includes Texas), and West (includes California)), and = 0 otherwise. Robust standard errors allowing for fixed effects by LP in all the regressions are shown in brackets below the coefficient estimate. Intercepts are not reported.

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 7. Recent investments in young private equity groups

Panel A: Fund performance by LP class for investments in funds managed by recently established private equity groups (post-1990)

	Overall			Early-stage VC funds			Later-stage VC funds			Buyout funds		
	N	Fund IRR (%)	Weighted IRR (%)	*N*	Fund IRR (%)	Weighted IRR (%)	*N*	Fund IRR (%)	Weighted IRR (%)	*N*	Fund IRR (%)	Weighted IRR (%)
All funds:												
Public pension funds	*506*	-1.95	-3.70	*65*	-11.34	-14.10	*183*	1.86	-1.05	*258*	-2.28	-2.97
Corporate pension funds	*139*	-1.65	-2.88	*20*	-6.10	-17.28	*41*	10.35	10.96	*78*	-6.82	-6.46
Endowments	*267*	-3.51	-4.20	*81*	-21.89	-22.08	*91*	12.05	10.14	*95*	-2.74	-2.68
Advisors	*417*	-11.08	-11.65	*122*	-22.64	-21.99	*163*	-5.21	-8.77	*132*	-7.63	-5.66
Insurance companies	*103*	-5.71	-5.72	*23*	-19.46	-17.78	*37*	3.93	2.99	*43*	-6.65	-6.76
Banks and finance companies	*121*	-7.73	-7.30	*18*	-22.36	-18.32	*39*	-4.47	-3.97	*64*	-5.60	-6.23
Other investors	*33*	-6.14	-6.14	*11*	-8.44	-8.44	*11*	-3.00	-3.00	*11*	-6.99	-6.98
Overall	*1,586*	-5.36	-6.26	*340*	-18.64	-19.31	*565*	1.68	-0.58	*681*	-4.56	-4.46
Pre-1999 funds only:												
Public pension funds	*281*	8.20	4.38	*18*	22.52	5.47	*83*	23.58	16.45	*180*	-0.33	-1.29
Corporate pension funds	*98*	6.75	6.72	*7*	28.21	27.59	*27*	27.16	26.46	*64*	-4.20	-3.89
Endowments	*134*	14.64	13.06	*14*	2.64	-1.16	*50*	38.56	34.54	*70*	-0.05	0.55
Advisors	*145*	7.26	5.19	*10*	20.31	19.25	*59*	20.36	13.83	*76*	-4.63	-3.37
Insurance companies	*58*	3.99	2.65	*6*	3.93	6.37	*18*	21.32	17.95	*34*	-5.17	-6.10
Banks and finance companies	*72*	-0.19	-0.38	*3*	7.13	7.13	*21*	5.46	5.31	*48*	-3.11	-3.33
Other investors	*17*	-1.34	-1.29	*1*	-3.80	-3.80	*7*	6.81	6.81	*9*	-7.40	-7.31
Overall	*805*	7.67	5.59	*59*	14.99	8.88	*265*	24.02	19.27	*481*	-2.24	-2.35

Panel A shows groupings of 1,586 investments for which fund performance data was available by 366 LPs in 686 funds managed by 442 "young" private equity groups (i.e. established after 1990) as compiled by *Asset Alternatives*. *Fund IRR* is the internal rate of return of each fund obtained from *Private Equity Performance Monitor*, and *weighted fund IRR* is *fund IRR* weighted by proportional commitment to the fund in each LP's private equity portfolio. Panel B excludes all funds established in 1999 and after.

Panel B: Regressions of fund performance of investments in young private equity groups						
Dependent variable:	Fund IRR	Fund IRR	Fund IRR	Excess IRR	Excess IRR	Excess IRR
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy for LP class:						
(comparison category is public pension funds)						
Corporate pension funds	-2.5651	-2.3899	-9.3498	-0.8108	-0.7337	-8.6850
	(4.4074)	(4.5046)	(7.0792)	(3.8392)	(3.9138)	(6.8150)
Endowments	1.5707	1.4603	-6.9448	9.7380 *	10.7735 *	1.0174
	(4.6396)	(4.9425)	(6.6689)	(5.0775)	(5.4440)	(6.3887)
Advisors	-1.3046	-0.8146	-4.6567	3.7035	4.8873	6.1521
	(4.2235)	(5.1975)	(8.3068)	(4.4032)	(4.9956)	(7.5223)
Insurance companies	-5.1202	-4.2005	-6.5593	-4.4310	-3.9260	-6.1964
	(4.4241)	(4.5300)	(7.1027)	(4.2414)	(4.4200)	(6.8056)
Banks	-8.7070 **	-3.6191	-4.8158	-1.5722	3.0515	0.1778
	(4.1380)	(3.5098)	(5.3869)	(4.1492)	(3.5009)	(5.8848)
Other LPs	-11.7644 *	-13.4024	-39.1450 ***	-1.7256	-6.9336	-51.6968 ***
	(6.8797)	(8.9812)	(13.9524)	(8.3251)	(11.5292)	(17.2433)
LP vintage		0.2672	0.6801 *		0.2488	0.7196 *
		(0.1802)	(0.3634)		(0.1690)	(0.3638)
LP size (natural logarithm of total commitments to private equity)			-3.6696 **			-3.9149 **
			(1.6171)			(1.8150)
Dummy for region in which LP headquartered:						
(comparison category is Northeast)						
Midwest			-5.7824			-2.2003
			(5.9859)			(5.9099)
South			7.9569			8.5589
			(9.8871)			(11.3674)
West			-2.8490			-1.2089
			(4.5445)			(4.2042)
LP and GP in same region		-5.3374	-10.2195 *		-4.8045	-7.1560
		(4.2428)	(5.3904)		(3.9813)	(4.9342)
Year fixed effects	Yes	Yes	Yes	No	No	No
Fund category fixed effects	Yes	Yes	Yes	No	No	No
R-squared	18.1%	18.0%	21.6%	1.3%	2.1%	6.5%
Number of observations	805	668	446	781	647	436

The sample in Panel B consists of investments by 366 LPs in 686 funds managed by 442 private equity groups established after 1990 as compiled by *Asset Alternatives*, and excludes funds closed in 1999 and after. Several versions of the following pooled regression are run and coefficient estimates and standard errors are reported by columns in the table:

$$\text{FundIRR}_{ij} = \beta_0 + \sum_j \beta_{0j}\text{DummyLP}_j + \sum_j \beta_{1j}\text{DummyLP}_j \times \text{FundInflow}_i + \sum_k \beta_{2k}\text{DummyLP}_k \times \text{LPage}_{ij} + \beta_3 \text{D\_sameregion}_{ij} + \text{controls}$$

$FundIRR_{ij}$ is the internal rate of return of fund i in %. Six dummy variables identify the class of LP for each LP-fund pair, with $DummyLP_k = 1$ for each observation consisting of an investment in fund i by LP j belonging to LP class k and = 0 otherwise. "Public pension funds" is the 'base LP class', with zero values for all LP dummy variables. $FundInflow_i$ is the year-on-year change in the amount of funds inflow into venture capital in the country and in the year of closing of fund i, and is a proxy for market conditions. $LPage_{ij}$ is the number of years since the establishment of the private equity program at LP j when it made an investment in fund i. $D\_sameregion_{ij}$ is a dummy variable and = 1 if both LP j and private equity firm managing fund i are headquartered in the same region in the US (Midwest (includes Illinois and Ohio), Northeast (includes Massachusetts, New York and Pennsylvania), South (includes

Texas), and West (includes California)), and = 0 otherwise. Robust standard errors allowing for data clustering by funds in all the regressions are shown in brackets below the coefficient estimate. Intercepts are not reported.

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 8. Descriptive statistics: Investment relationships between LPs and GPs

	Average GP founding year						Average fraction of GPs located in same region as LP						Average growth in fund size between consecutive investments in same family funds					
	N	Mean	Median	Std dev	Min	Max	*N*	Mean	Median	Std dev	Min	Max	*N*	Mean	Median	Std dev	Min	Max
Public pension funds	*74*	1986	1985	5.0	1973	2001	*74*	0.42	0.33	0.34	0	1	*61*	1.34	0.97	3.10	-0.71	24.86
Corporate pension funds	*72*	1986	1986	5.6	1971	1999	*72*	0.31	0.30	0.31	0	1	*62*	0.96	0.95	0.48	-0.20	2.16
Endowments	*98*	1985	1985	6.9	1955	1999	*100*	0.43	0.40	0.33	0	1	*78*	0.99	0.93	0.44	-0.15	2.31
Advisors	*64*	1988	1987	5.0	1972	2000	*66*	0.36	0.33	0.33	0	1	*47*	0.97	0.91	0.72	-0.58	4.89
Insurance companies	*32*	1984	1986	14.7	1912	1997	*32*	0.36	0.41	0.28	0	1	*23*	1.07	1.00	0.49	0.18	2.57
Banks and finance companies	*30*	1986	1988	8.7	1962	2001	*30*	0.46	0.41	0.31	0	1	*20*	0.97	1.03	0.51	0.03	2.01
Other investors	*42*	1989	1990	6.9	1972	2000	*43*	0.41	0.42	0.36	0	1	*26*	1.34	1.17	1.01	-0.87	4.21
Overall	*412*	1986	1986	7.3	1912	2001	*417*	0.39	0.33	0.33	0	1	*317*	1.08	0.95	1.46	-0.87	24.86

	Average carried interest						Average number of funds managed per GP					
	N	Mean	Median	Std dev	Min	Max	*N*	Mean	Median	Std dev	Min	Max
Public pension funds	*52*	20.42	20	1.02	20	25	*74*	1.8	1.7	0.7	1	4.6
Corporate pension funds	*50*	20.57	20	1.32	20	25	*72*	1.5	1.3	0.5	1	3.4
Endowments	*68*	21.64	20	2.44	20	30	*100*	1.6	1.5	0.6	1	3.4
Advisors	*50*	20.77	20	1.81	20	30	*66*	1.3	1.2	0.4	1	2.6
Insurance companies	*24*	20.72	20	1.70	20	25	*32*	1.5	1.3	0.5	1	2.9
Banks and finance companies	*23*	20.01	20	0.04	20	20.2	*30*	1.2	1.0	0.4	1	2.1
Other investors	*20*	20.39	20	1.16	20	25	*43*	1.4	1.0	1.0	1	7.2
Overall	*287*	20.78	20	1.74	20	30	*417*	1.5	1.3	0.6	1	7.222

The table shows summary statistics for 417 LPs in the sample, where investment relationships are measured for each individual LP and grouped by class of LP.

Table 9. LP class and individual LP effects in regressions explaining fund performance and other portfolio characteristics

		F-tests on fixed effects for:			
		LP class	Individual LPs	*N*	Adjusted R-squared
Fund IRR	Row 1			*4,618*	28.9%
	Row 2	3.64 (.0015, 6) ***		*4,618*	29.7%
	Row 3		4,170.79 (<.0001, 297) ***	*4,618*	35.2%
Excess IRR	Row 1			*4,514*	11.7%
	Row 2	3.28 (.0035, 6) ***		*4,514*	12.7%
	Row 3		230.88 (<.0001, 295) ***	*4,514*	19.2%
GP year founded	Row 1			*7,080*	3.1%
	Row 2	5.96 (<.0001, 6) ***		*7,080*	4.0%
	Row 3		351.93 (<.0001, 361) ***	*7,080*	15.8%
Percentage change in fund size between consecutive investments with same GP	Row 1			*3,284*	1.9%
	Row 2	1.05 (.3916, 6)		*3,284*	2.6%
	Row 3		>10,000 (<.0001, 265) ***	*3,284*	25.4%
GP size	Row 1			*7,115*	13.8%
	Row 2	28.11 (<.0001, 6) ***		*7,115*	17.5%
	Row 3		2,113.82 (<.0001, 361) ***	*7,115*	32.9%

The sample consists of investments by 417 LPs in 1,398 funds as compiled by Asset Alternatives. Reported in the table are the results from fixed effects panel regressions, where standard errors are clustered at the fund level. For each dependent variable (as reported in column 1), the fixed effects included are:

Row 1: fund type and vintage year fixed effects;

Row 2: fund type, vintage year, and LP class fixed effects;

Row 3: fund type, vintage year, and individual LP fixed effects.

Reported are the F-tests for the joint significance of the LP class fixed effects (column 2), and individual LP fixed effects (column 3). For each F-test, we report the value of the F-statistic, the p-value and the number of constraints. Column 5 reports the number of observations and column 6 the adjusted R-squared for each regression.

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 10. Dispersion of estimated fixed effects from LP fixed effects regressions, by class of LP

	Panel A: Dependent variable - Fund IRR			Panel B: Dependent variable - Fund excess IRR		
	Mean	Median	Std dev	Mean	Median	Std dev
Public pension funds	69.11	66.62	58.02	70.89	80.19	48.71
Corporate pension funds	26.41	15.88	67.14	40.86	27.98	54.54
Endowments	19.99	-2.54	60.97	30.53	23.57	49.80
Advisors	55.15	58.96	84.96	50.95	62.27	69.49
Insurance companies	33.29	38.75	60.33	51.35	45.20	46.08
Banks and finance companies	59.91	59.22	55.30	63.50	57.89	41.22
Other investors	95.02	89.94	50.40	78.11	74.67	45.85
Overall	43.52	39.78	64.72	51.40	47.29	52.22

	Panel C: Dependent variable - Change in fund size			Panel D: Dependent variable - Year of founding of GP		
	Mean	Median	Std dev	Mean	Median	Std dev
Public pension funds	-0.71	-0.62	0.79	6.91	10.48	12.63
Corporate pension funds	-0.49	-0.54	0.92	2.85	3.95	12.17
Endowments	-0.57	-0.64	0.70	-2.34	-3.43	15.26
Advisors	-1.15	-1.02	0.54	-2.99	-3.35	17.90
Insurance companies	-0.62	-0.68	0.96	7.93	12.14	11.83
Banks and finance companies	-0.42	-0.42	0.88	1.66	0.64	7.08
Other investors	0.37	0.25	1.68	281.19	-0.99	764.43
Overall	-0.58	-0.60	0.88	15.86	1.99	164.86

	Panel E: Dependent variable - GP size (natural logarithm of total capital managed)			Panel F: Dependent variable - Reinvested in next fund of same family (Yes = 1, No = 0)		
	Mean	Median	Std dev	Mean	Median	Std dev
Public pension funds	-1.41	-1.71	2.43	0.33	0.34	0.30
Corporate pension funds	0.36	-0.08	2.14	0.17	0.09	0.40
Endowments	0.81	0.95	1.82	0.30	0.18	0.43
Advisors	-0.96	-0.65	3.10	0.37	0.31	0.29
Insurance companies	-1.75	-1.68	1.56	0.33	0.34	0.46
Banks and finance companies	-1.33	-0.97	2.63	0.32	0.24	0.35
Other investors	1.30	1.25	2.01	0.22	0.23	0.33
Overall	-0.34	-0.25	2.38	0.28	0.25	0.37

	Panel G: Dependent variable - Fraction of GPs located in same region			Panel H: Dependent variable - Average number of funds managed per GP		
	Mean	Median	Std dev	Mean	Median	Std dev
Public pension funds	-0.65	-0.51	0.49	0.56	0.40	0.50
Corporate pension funds	-0.69	-0.61	0.56	0.29	0.20	0.29
Endowments	-0.41	-0.28	0.56	0.35	0.18	0.44
Advisors	-0.59	-0.56	0.44	0.20	0.20	0.17
Insurance companies	-0.66	-0.61	0.52	0.42	0.20	0.90
Banks and finance companies	-0.66	-0.74	0.37	0.21	0.17	0.22
Other investors	-0.56	-0.69	0.52	0.43	0.19	0.41
Overall	-0.59	-0.51	0.52	0.40	0.28	0.49

The table shows the mean, median, and standard deviation of the LP fixed effects, grouped by LP class, from separate regressions of fund IRR, excess IRR, percentage change in size between successive funds, GP founding year, GP size, and reinvestment decisions on LP dummies, LP total commitments to private equity, dummies for the region of the LP and the co-location of the LP and GP, vintage years, and fund categories.

Table 11. Correlations among estimated LP fixed effects

	Fund IRR	Exess IRR	% change in fund size	GP founding year	GP size	Reinvested in follow-on fund	Average number of funds per GP
Excess IRR	0.8810 ***						
Percentage change in fund size	-0.1658 *	0.1464					
GP founding year	0.1647 *	0.1688 **	0.2283 ***				
GP size	-0.1815 **	-0.3573 ***	0.0575	-0.0411			
Reinvested in follow-on fund	-0.0371	-0.0491	-0.1637 *	-0.0221	-0.1090		
Average number of funds per GP	0.0721	0.1844 **	0.1101	0.1292	-0.1641 **	0.4275 ***	
Fraction of GPs in same region	-0.4318 ***	-0.7248 ***	-0.4188 ***	0.0770	0.1849 **	0.0438	-0.1364 *

The table shows pairwise correlations of estimated LP fixed effects when each of the listed variables is used as dependent variable in a regression on LP dummies, LP total commitments to private equity, LP region, a dummy for LP and GP in same region, vintage year, and fund category.

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

APPENDIX

Table 3A. Fund performance regressions using excess IRR as dependent variable

Dependent variable: Excess IRR								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy for investor type: (comparison category is public pension funds)								
Corporate pension funds	-4.7740 *	-3.9045	-4.9477 *	-4.5708	-0.3914	-8.6187 **	-10.2470 ***	-9.6310
	(2.6119)	(2.6603)	(2.9735)	(2.9953)	(4.8340)	(3.6531)	(3.7044)	(6.2386)
Endowments	21.7021 ***	22.6876 ***	21.3668 ***	21.1839 ***	32.3727 **	15.7158 ***	16.6267 ***	26.6948 ***
	(6.8308)	(6.8931)	(5.8800)	(5.9365)	(14.5336)	(4.5610)	(4.7058)	(8.3791)
Advisors	7.6311 **	9.0014 **	7.4493 **	8.6994 **	23.9685 ***	11.3542 **	11.5105 **	27.9029 ***
	(3.3985)	(3.5185)	(3.5770)	(3.6712)	(8.4727)	(4.9173)	(4.8553)	(10.1434)
Insurance companies	-0.5723	0.7368	-1.5475	-1.4600	9.5675	2.0860	0.8501	12.6848
	(3.7289)	(3.7719)	(4.3574)	(4.4689)	(7.4968)	(4.3712)	(4.5038)	(9.2409)
Banks	-9.1053 ***	-6.3177 **	-7.3341 **	-7.7415 **	-10.1042 **	-3.5518	-4.1704	-10.1863
	(2.8791)	(2.7433)	(3.2189)	(3.1745)	(4.9885)	(3.8421)	(3.8288)	(7.7812)
Other LPs	-2.5150	-8.3610	-9.3130	-7.5806	-19.5268 *	-39.3634 ***	-37.0243 ***	-53.8900 ***
	(5.1994)	(6.2167)	(6.1080)	(6.5515)	(11.1478)	(8.9284)	(9.7758)	(9.3152)
LP vintage		-0.0180	1.0559 **	1.0213 **	0.9950 **	0.2574	0.3417	0.8683 *
		(0.1017)	(0.4873)	(0.4917)	(0.4899)	(0.2344)	(0.2383)	(0.4608)
LP and GP in same region		-9.0234 ***	-8.7223 ***	-8.4787 ***	-8.4182 ***	-8.9011 ***	-8.7484 ***	-8.3371 ***
		(2.8062)	(2.7176)	(2.7294)	(2.6968)	(2.5732)	(2.5735)	(2.5172)
Total private equity fund inflow				-18.4588 **	-8.9133		-13.5551 **	-7.2800
				(8.4668)	(5.7415)		(6.0356)	(5.6728)
LP size (natural logarithm of total commitments to private equity)						-1.4185 *	-1.1280	-0.8649
						(0.7769)	(0.7755)	(0.7531)
Dummy for region in which LP headquartered: (comparison category is Northeast)								
Midwest						0.3906	-0.3617	0.3551
						(2.7038)	(2.7700)	(2.8600)
South						13.3493 **	11.3852 *	11.4601 *
						(6.0070)	(6.2646)	(6.3994)
West						-1.7493	-2.8215	-3.0821
						(2.5315)	(2.6082)	(2.6584)
Interaction effects:								
Corporate pension funds * LP vintage			-1.1851 *	-0.6786	-0.6553			-1.0071
			(0.6492)	(0.6107)	(0.6079)			(0.6851)
Endowments * LP vintage			-1.2481 *	-1.1692	-1.0717			-0.8317
			(0.7375)	(0.7417)	(0.7327)			(0.6555)
Advisors * LP vintage			-1.2793 **	-1.3266 **	-1.3586 **			-0.5673
			(0.5594)	(0.5599)	(0.5586)			(0.8671)
Insurance companies * LP vintage			-1.4152 **	-1.4020 **	-1.3245 **			-0.7011
			(0.6050)	(0.6095)	(0.6047)			(0.7875)
Banks * LP vintage			-1.0971 **	-1.1623 **	-1.0474 **			-0.6177
			(0.5134)	(0.5187)	(0.5165)			(1.1614)
Other LPs * LP vintage			-0.9112	-0.7743	-1.3269			-1.2300 *
			(0.8307)	(0.8495)	(0.8434)			(0.6866)
Corporate pension funds * inflow					-8.9225			-3.9950
					(7.0044)			(9.3486)
Endowments * inflow					-24.5149			-21.6610 *
					(22.3443)			(12.5707)
Advisors * inflow					-28.6135 **			-33.7476 **
					(11.5309)			(14.5153)
Insurance companies * inflow					-22.3579 **			-26.9972 **
					(10.2326)			(13.6475)
Banks * inflow					5.4404			11.6673
					(7.7765)			(10.3725)
Other LPs * inflow					22.4089			36.9123 ***
					(23.8721)			(8.7088)
Year fixed effects	No	No	No	No	No	No	No	No
Fund category fixed effects	No	No	No	No	No	No	No	No
R-squared	3.9%	4.6%	5.0%	6.4%	7.0%	5.2%	5.9%	6.8%
Number of observations	2,684	2,285	2,285	2,211	2,211	1,541	1,491	1,491

The sample consists of investments by 417 LPs in 1,398 funds as compiled by *Asset Alternatives*, and excludes funds closed in 1999 and after. Several versions of the following pooled regression are run and coefficient estimates and standard errors are reported by columns in the table:

$$\text{ExcessIRR}_{ij} = \beta_0 + \sum_j \beta_{0j}\text{DummyLP}_j + \sum_j \beta_{1j}\text{DummyLP}_j \times \text{FundInflow}_i + \sum_k \beta_{2k}\text{DummyLP}_k \times \text{LPage}_{ij} + \beta_3 \text{D\_sameregion}_{ij} + \text{controls}$$

$ExcessIRR_{ij}$ is the internal rate of return of fund i in % minus the median IRR of the portfolio formed for each fund category every year. Six dummy variables identify the class of LP for each LP-fund pair, with $DummyLP_k = 1$ for each observation consisting of an investment in fund i by LP j belonging to LP class k and = 0 otherwise. "Public pension funds" is the 'base LP class', with zero values for all LP dummy variables. $FundInflow_i$ is the year-on-year change in the amount of funds inflow into venture capital in the country and in the year of closing of fund i, and is a proxy for market conditions. $LPage_{ij}$ is the number of years since the establishment of the private equity program at LP j when it made an investment in fund i. $D\_sameregion_{ij}$ is a dummy variable and = 1 if both LP j and private equity firm managing fund i are headquartered in the same region in the US (Midwest (includes Illinois and Ohio), Northeast (includes Massachusetts, New York and Pennsylvania), South (includes Texas), and West (includes California)), and = 0 otherwise. Robust standard errors allowing for data clustering by funds in all the regressions are shown in brackets below the coefficient estimate. Intercepts are not reported.

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.