Limited partner performance and the maturing of the private equity industry ☆

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ABSTRACT

We evaluate the performance of limited partners' (LPs') private equity investments over time. Using a sample of 14,380 investments by 1,852 LPs in 1,250 buyout and venture capital funds started between 1991 and 2006, we find that the superior performance of endowment investors in the 1991–1998 period, documented by prior literature, is mostly due to their greater access to the top-performing venture capital partnerships. In the subsequent 1999–2006 period, endowments no longer outperform, no longer have greater access to funds that are likely to restrict access, and do not make better investment selections than other types of institutional investors. Nevertheless, all investor types' private equity investments continue to outperform public markets on average. We discuss how these results are consistent with the general maturing of the industry, as private equity has transitioned from a niche, poorly understood area to a ubiquitous part of institutional investors' portfolios.

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1. Introduction

The private equity industry has experienced dramatic changes in the last 30 years. Because of high returns on early investments, the industry has grown enormously, both in terms of assets under management and its overall importance in the economy. Total fundraising by buyout and venture funds has increased from approximately $6.7 billion in 1990 to over $261.9 billion just before the financial crisis in 2008, the vast majority of which comes from institutional investors.[1] Instead of a niche alternative,

private equity has become a mainstay of institutional investment portfolios.

The performance of institutions' private equity investments sheds light on a fundamental question in delegated asset management: Why do some investors, or classes of investors, have systematically different performance over time? Historically, practitioners have claimed that the best private equity partnerships have not increased fund sizes or fees to market-clearing levels. Instead they have rationed access to their funds to favored investors, most notably prestigious educational and other nonprofit endowments. Further, industry observers (e.g. Swensen (2000)) have historically argued that endowments are much better equipped to assess and evaluate emerging alternative investments, such as private equity, that are relatively unfamiliar+ and in which asymmetric information problems are especially severe. Lerner, Schoar and Wongsunwai (2007) show that superior access as well as experience of investing in the private equity sector led endowments to outperform other institutional investors substantially during the 1990s.

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  [1] The numbers are estimated by summing up fund size by year in Preqin.

However, private equity is no longer an emerging, unfamiliar asset class, and the distribution of private equity fund returns has also changed over time. In particular, venture capital returns fell dramatically in the technology bust of the early 2000s, and the boom of the late 1990s has not repeated. Against this backdrop of a maturing industry, it is unclear whether the unusually good performance of endowments has continued.

In this paper, we evaluate the relative performance of different types of private equity investors over time. Using a sample of 14,380 limited partner (LP) investments in 1,250 buyout and venture funds raised between 1991 and 2006, we first confirm the Lerner, Schoar, and Wongsunwai (2007) finding that endowments substantially outperform other types of investors on their investments in funds raised between 1991 and 1998. The performance gap is driven entirely by endowments' investments in the venture industry, which benefited most from the 1990s technology boom. However, when we examine funds raised in the subsequent eight-year period, between 1999 and 2006, endowments no longer outperform other types of limited partners. In this later period, no statistically or economically significant differences exist in returns across types of LPs.[2]

Our evidence suggests that during the 1991–1998 period, the main source of endowments' unusually good performance was their superior access to the best venture funds. Compared with other types of institutions, endowments were more likely to invest in older partnerships, which not only were more likely to restrict access but also earned higher returns in this period. Endowments were also more likely to invest in the later funds of a venture capital partnership when the increase in fund size from the partnership's prior fund was abnormally low given the prior fund's performance. It is likely that such funds were restricting access, and they also performed better over this period.

In the later 1999–2006 period, endowments are still more likely than other LP types to invest in older partnerships, but much less so than in the earlier period. They are no longer more likely to invest in slowly growing funds. Further, the performance advantages of both of these types of funds largely dissipate over time, which is consistent with the general decline in both the level and the dispersion of venture capital returns since the 1990s. Thus, the 1999–2006 period saw a decline in both endowments' superior access to later and slowly growing funds and the returns to such access.

The endowment advantage in skill or sophistication in selecting investments has also declined over time. Lerner, Schoar, and Wongsunwai (2007) propose that a way to evaluate the skill of private equity investors is to measure the quality of the reinvestment decisions of investors. Because investors in a private equity fund are usually given the option of reinvesting in a partnership's next fund, their decisions of whether to reinvest capital in this new fund reflect their skill at assessing the skill of the fund's general partners instead of any differences in access to the funds.

Like Lerner, Schoar, and Wongsunwai (2007), we find that, during the 1991–1998 period, endowments' reinvested funds outperformed funds in which they chose not to reinvest. Endowments' reinvested funds earned an average internal rate of return (IRR) of 37.8% and multiple of 3.41 (implied public market equivalent (PME) of 2.53), compared with an IRR of 24.6% and multiple of 2.11 (implied PME of 1.62) for funds they chose not to reinvest. These differences are larger than those of most other LP types. Yet, even those funds in which endowments chose not to reinvest outperformed the funds in which other types of LPs reinvested. This is especially true for investments in venture capital. The venture capital funds in which endowments reinvested in 1991–1998 earned a 62.6% IRR (4.94 multiple and 3.60 implied PME) on average, compared with a 59.1% IRR (4.71 multiple and 3.48 implied PME) for funds in which they did not reinvest. The average performance of these follow-on funds in which endowments declined to invest is also higher than that of reinvested funds of any other LP types. In the 1991–1998 period, therefore, endowments chose not to invest in many funds that ended up performing very well, suggesting that access to the top funds, and not the ability to select among them, was the primary driver of endowments' investment success.

During the more recent 1999–2006 period, endowments' reinvested funds still outperform those in which they did not reinvest, but by a much smaller margin. Other types of LPs see similar differences in returns to reinvested and not reinvested funds. In short, in the later period, the reinvestment decisions of endowments are not economically or statistically unusual relative to other institutional investors.

Another way to analyze the quality of investment decisions independent of differences in access is to examine investments in a partnership's very first fund. Such funds are unlikely to restrict access because they lack a track record and compete with established partnerships for capital. We find no evidence that endowments show superior ability to select among first-time funds, in any time period.

Overall, our findings suggest that endowments enjoyed an embarrassment of riches in the 1991–1998 period in terms of their access to the best venture capital groups. Since then, their access, investment decisions, and ultimate performance have been unremarkable compared with other types of LPs. These results are consistent with the DaRin and Phalippou (2012) survey of LPs, according to which endowments' organizational approach to private equity investing is similar to that of other LP types.

The disappearance of abnormal performance by endowments is consistent with changes in the economics underlying the private equity industry. In the industry's early years, high returns to buyout were earned in part by purchasing mismanaged companies and improving their operations (Kaplan (1989)), and investments in high-tech companies

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[2] None of our conclusions is sensitive to the measure of performance. We find similar results using internal rate of return (IRRs), fund multiples (the ratio of the undiscounted sum of distributions to LP divided by the undiscounted sum of capital calls) and the implied Kaplan and Schoar (2005) public market equivalent (PME). The implied PME is generated from the fund IRR and multiple using the method described by Harris, Jenkinson, and Kaplan (forthcoming).

in the 1990s were an important driver of venture capital returns. The large recent capital inflows into the sector suggest that whatever "low-hanging fruit" existed previously should naturally dissipate.[3] Consequently, it is likely that as the industry matured and became more competitive, the relationships between general partners and investors in their funds changed as well. If limited access reflects rents being distributed to limited partners, then as the rents decline over time, it is natural to expect a concurrent decline in rationing access to limited partner stakes and in the dispersion of limited partner returns.

Though the performance of endowments has declined relative to that of other institutional investor types, we emphasize that the estimates suggest that the average performance of institutional private equity portfolios remains high relative to a public equity benchmark. In fact, for each type of institutional investor we consider, and for each subperiod, the estimates suggest that the average private equity investment has outperformed the Standard & Poor's (S&P) 500.[4]

The remainder of the paper is structured as follows: Section 2 describes the historical importance of access to private equity funds. Section 3 discusses the sample. Section 4 presents the industry changes that we observe. Sections 5 and 6 present our empirical results on changing LP returns and the role of investment selection and access, respectively. Section 7 concludes.

2. Access to private equity funds

Private equity funds are usually limited partnerships, structured to facilitate investments that would not be financed by traditional sources of capital. A private equity partnership typically serves as the general partner (GP) in a fund and raises funds from limited partners (LPs), who are usually large institutional investors. The fund then uses that money to provide venture capital to startup firms or to facilitate a change in control through a leveraged buyout. If a fund earns sufficient returns for its investors, the private equity partnership usually attempts to raise subsequent funds. Both the partnership's ability to raise a subsequent follow-on fund and the size of such a fund are highly related empirically to the performance of the original fund (see Kaplan and Schoar (2005); Chung, Sensoy, Stern, and Weisbach (2012)).

The empirical relation between performance and subsequent fundraising likely comes from LPs updating their assessments of a partnership's ability (see Berk and Green (2004); Chung, Sensoy, Stern, and Weisbach (2012)). In other words, good performance leads to an increase in demand for stakes in subsequent funds. Yet, because of

diminishing returns to investments and the scarcity of GPs' time, the most successful GPs, especially in venture capital funds, sometimes limit the quantity of capital they take in a particular fund. As shown by Kaplan and Schoar (2005), top performing funds do not grow as rapidly as they could if they maximized capital under management. These partnerships occasionally do raise their fees and carried interest in response to good performance, but not sufficiently to equate the demand for their funds with the amount of capital they are willing to accept.[5] The combination of high demand for funds from successful partnerships and lack of growth in these funds can lead to limited access. As a result, LPs often claim that the top-performing funds tend to be highly oversubscribed, and GPs with high returns can often have a choice over their investors (see Hochberg, Ljungqvist, and Vissing-Jorgensen (2014)).

If GPs are restricting access to their funds, they are charging fees lower than the level at which demand for their fund equals the quantity of capital they wish to raise. Because charging fees lower than the market-clearing level has monetary costs to the GPs, there must be some offsetting benefit that they receive. One possible benefit is that restricting access gives GPs control over who their investors are. Keating (2006) surveys general partners and finds that they claim to prefer knowledgeable, long-term investors who will invest in future funds as well as the current one. Given that GPs place value on a long-term relationship with investors, LPs' portfolio strategies can in turn be affected by concern about being able to invest in future funds. For example, David Swensen, the head of the Yale University endowment and perhaps the most well-known and successful investor in private equity, explicitly follows a policy of reinvesting in partnerships to maximize Yale's access to their future funds (see Lerner and Leamon (2011)).

While practitioners commonly discuss the way in which private equity partnerships limit capital in their funds, there are no estimates documenting the way limited access works in practice. Since it is in the interest of GPs to appear relatively exclusive, it is possible that statements from practitioners are exaggerated. An additional contribution of our work is to provide evidence on the existence of limited access, the sectors and time periods in which it appears to have been present, and the implications of limited access for returns.

3. Sample of LP investments in private equity funds

In this section, we describe how we constructed the sample and describe the performance of different types of LPs.

3.1. Sample construction

To study limited partners' private equity investments, we construct a list of LPs and their investments using data

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[3] Also consistent with increasing commoditization of the industry, the dispersion of returns across different private equity groups has shrunk dramatically over time, and the persistence in the performance of sequential funds raised by a given private equity group, first shown by Kaplan and Schoar (2005), appears to have declined as well (Chung (2012), Robinson and Sensoy (2011), Harris, Jenkinson, Kaplan, and Stucke (2013), Braun, Jenkinson, and Stoff (2013)).

[4] See Hochberg and Rauh (2013) for evidence that some limited partners nevertheless systematically invest in underperforming private equity partnerships. An open question is whether such underperforming partnerships nevertheless outperformed public equities.

[5] Gompers and Lerner (1999) find that carried interest profit shares are higher for older and larger GPs. However, the majority of private equity funds have carried interest of 20% and management fees between 1.5% and 2.5%. See also Metrick and Yasuda (2010) and Robinson and Sensoy (2013) for recent evidence on private equity fund fees and carried interest.

obtained from two sources: VentureXpert and S&P's Capital IQ. While neither source contains a complete list of all LPs in a given fund, each does contain an extensive list of LPs.[6] VentureXpert provides LPs' investments and commitment data dating back to 1969. Capital IQ has detailed information, including investor identity, on more than 18,000 private equity firms. We identify 8,120 investments made by 1,236 LPs from VentureXpert and 24,479 investments made by 2,028 LPs from Capital IQ.

To be consistent with Lerner, Schoar, and Wongsunwai (2007) and to minimize potential problems from incomplete coverage, our analysis considers LPs' private equity investments only in the two most common types of funds after 1990: buyout and venture capital. Fund-level performance data are collected from Preqin, which contains performance information for 5,200 individual funds and which claims to cover 76% of all North American private equity funds ever raised, 63% of European funds, and 46% of funds from Asia and the rest of the world. Because we analyze LPs' investment returns, we drop funds without IRR or vintage year information, and we drop funds raised after 2006 to minimize any potential bias coming from unrealized investments of funds. This process leads to a sample containing 14,380 investments from 1,852 unique LPs in 1,250 unique venture and buyout funds between 1991 and 2006. Of the 14,380 LP investments, 10,219 are unique to Capital IQ, 818 are unique to VentureXpert, and 3,343 are included in both databases.[7] As a result of our sample selection procedure, we have data on the performance of all of these investments as of the end of 2011.[8]

We divide the full sample into two eight-year periods, the Lerner, Schoar, and Wongsunwai (2007) sample period (1991–1998) and the subsequent eight years (1999–2006) because we wish to study how the relations between GPs and LPs changed over time. The 1991–1998 subperiod contains 3,685 investments by 996 unique LPs in 412 unique funds. Our sample for this subperiod is somewhat larger than that of Lerner, Schoar, and Wongsunwai (2007), whose sample consists of 352 LPs and 341 funds with performance information. The 1999–2006 subperiod contains 10,695 investments made by 1,533 LPs in 838 funds.

We divide LPs into eight categories: Public pension funds, Corporate pension funds, Endowments, Advisors, Insurance companies, Banks/finance companies, Investment firms, and Others. Public pension funds and Corporate pension funds are pension funds provided by the public and private sector, respectively. Endowments are

private and public university endowments as well as foundations. Advisors are investment advisors and consulting firms. Insurance companies include any firm with a primary business in insurance. Banks/finance companies are all banks and bank-affiliated investment arms. Investment firms are private equity firms, investment companies, and hedge fund sponsors. LPs not included in the previous seven classes are classified as Others.

Table 1 presents summary statistics on the characteristics of each class of limited partner in our sample. Public pension funds make the most investments per LP, with each LP making 32.4 investments, followed by endowments (16.6 investments per LP) and investment firms (16.4 investments per LP). All LP classes have more investments in the second half of the sample period than in the first half; this increase reflects the high growth of the private equity industry as well as more comprehensive data coverage over time.

In addition to differing in the quantity of investments made, classes of LPs differ in their tendency to invest in the first fund raised by a particular private equity partnership. Over the full sample period, endowments have the lowest percentage of their investments in a GP's first fund, while insurance companies and banks invest most often in those funds. This pattern is driven by LPs' investments in both venture and buyout funds in the first half of the sample period. From 1999 to 2006, there is little difference between endowments' investments in GPs' first funds and those of other investors.

3.2. Performance of different LP types

Table 2 shows characteristics of the sample private equity funds by LP type. We use three measures of fund performance: the IRR; the multiple, defined as the ratio of the sum of undiscounted distributions to undiscounted capital calls; and what we term the "implied PME". The PME, or public market equivalent, equals the ratio of the sum of discounted distributions to the sum of discounted capital calls, in which the discount rate for each cash flow is the total return of the S&P 500 from the date of the fund's inception to that of the cash flow (see Kaplan and Schoar (2005)). A PME greater than one means that the fund outperformed the S&P 500. Although Preqin reports multiples, it does not report PMEs and calculating them requires the underlying cash flow data, which we do not have. Therefore, to compute the implied PME, we rely on regression coefficients reported by Harris, Jenkinson, Kaplan, and Stucke (2013) to impute PMEs from IRRs and multiples.

Funds in which endowments invest have the highest performance of any LP type over the entire 1991–2006 sample period, averaging a 13.4% IRR, a 1.94 multiple, and a 1.47 implied PME. Sharp differences in performance over time are revealed when we break down performance into the 1991–1998 and 1999–2006 subperiods. Consistent with Lerner, Schoar, and Wongsunwai (2007), endowments' investments in private equity did remarkably well in the 1991–1998 period, with an average IRR of 35.7%, a multiple of 2.16, and an implied PME of 2.43, which is substantially higher than the next highest class, Investment firms (IRR of

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[6] Unfortunately, data on the dollar amount of each LP's investment are not available for the majority of the investments.

[7] Stucke (2011) finds evidence of a bias in the performance information reported by VentureXpert (also known as Venture Economics). We do not use any performance data from VentureXpert, and all of our conclusions are unchanged if we drop the 818 LP investments unique to VentureXpert from the sample.

[8] Harris, Jenkinson, and Kaplan (forthcoming) provide evidence that many 2005 and 2006 funds are largely unrealized as of the end of 2011, so that performance information for those funds is based on potentially subjective net asset values (NAVs) determined by the fund managers. However, there is no reason that any bias would affect the reported performance of endowments differently than that of other LP types. Further, our conclusions are unchanged if we restrict the sample to funds raised no later than 2004.

Table 1

Limited partner (LP) characteristics.

This table shows characteristics of the sample of 1,852 LPs and their 14,380 investments in 1,250 buyout and venture capital funds raised between 1991 and 2006. Statistics are shown for the full sample period as well as the 1991–1998 and 1999–2006 subperiods. *Total # of LPs* is the total number of LPs that make at least one investment in a given fund type in a given period. Means are reported for all other variables. *LP Experience* is the total number of investments made by an LP prior to the current investment. *Investments in first-time funds* is the percentage of an LPs' total investments in a given fund type in a given period that are investments in the first fund raised by a private equity firm. Panel A reports statistics for all funds; Panel B, for venture capital funds only; and Panel C, for buyout funds only.

LP type	Full sample period (1991–2006)				1991–1998				1999–2006			
	Total # of LPs	Avg # of investments per LP	LP experience	Investments in first-time funds (%)	Total # of LPs	Avg # of investments per LP	LP experience	Investments in first-time funds (%)	Total # of LPs	Avg # of investments per LP	LP experience	Investments in first-time funds (%)
Panel A: All funds												
Endowments	210	16.6	14.5	17	137	4.6	4.5	28	178	8.7	18.5	12
Public pension funds	137	32.4	28.8	20	90	9.1	7.7	38	131	18.4	35.9	14
Corporate pension funds	89	16.0	14.0	23	67	5.4	4.3	44	79	8.6	19.0	11
Advisors	144	13.6	11.6	24	66	3.3	4.1	38	123	5.6	14.0	18
Insurance companies	153	13.3	11.2	28	78	23.0	3.6	47	129	4.5	14.3	18
Banks/finance companies	381	11.5	9.4	30	173	3.1	3.4	46	334	4.9	11.4	23
Investment firms	387	16.4	13.6	24	188	3.1	2.8	42	338	7.6	16.1	20
Others	351	7.5	5.8	26	197	1.6	1.5	36	221	2.6	8.2	16
Overall	1,852	18.3	15.8	23	996	3.7	4.4	39	1,533	7.0	19.7	17
Panel B: Venture funds												
Endowments	162	8.5	13.2	17	92	3.6	4.4	28	149	5.9	16.7	12
Public pension funds	99	13.7	29.0	20	60	6.4	78.0	39	91	13.6	36.5	14
Corporate pension funds	66	7.5	12.9	23	41	4.1	4.6	41	61	6.2	16.9	12
Advisors	90	8.9	12.8	24	30	3.4	5.3	34	78	4.6	15.0	19
Insurance companies	81	7.3	10.4	27	32	3.2	4.0	44	73	4.4	12.8	18
Banks/finance companies	222	5.0	8.3	30	75	3.2	3.1	45	207	4.3	9.6	25
Investment firms	262	8.5	11.9	25	94	3.2	23.0	42	240	6.5	13.6	21
Others	202	2.4	3.5	27	78	1.7	1.1	35	154	2.3	4.3	19
Overall	1,184	8.4	14.2	23	502	3.6	4.5	39	1,053	5.9	17.2	17
Panel C: Buyout funds												
Endowments	155	9.7	15.5	16	107	3.5	4.5	29	133	6.3	20.2	11
Public pension funds	121	21.1	28.7	20	78	6.4	7.5	38	117	12.4	35.6	14

Corporate pension funds	10	20.6	6.1	61	46	4.2	3.9	57	23	14.7	11.5	74
Advisors	18	13.5	4.8	88	41	3.4	3.2	49	25	11.0	8.8	100
Insurance companies	18	15.1	4.0	93	48	3.3	2.7	62	28	11.7	8.6	114
Banks/finance companies	21	12.6	4.4	235	46	3.5	2.8	136	29	10.0	8.7	279
Investment firms	19	18.2	6.8	221	42	2.6	2.7	137	24	15.1	10.9	254
Others	13	12.1	2.6	110	36	1.8	1.6	139	26	7.7	7.7	210
Overall	16	21.5	6.1	1,058	40	4.3	3.3	765	23	16.8	12.6	1,307

25.8%, multiple of 2.46, and implied PME of 1.84), and the average fund in the sample (IRR of 23.7%, multiple of 2.43, and implied PME of 1.74). In contrast, in the latter 1999–2006 period, endowments' performance is not statistically significantly or economically meaningfully different from that of other LP types.

When we divide the investments into venture and buyout, stark differences emerge in performance, both across investor types and over time. Endowments earned a spectacular 63.8% IRR, 6.13 multiple, and 3.73 implied PME on their venture capital investments during the 1991–1998 period, by far the highest of any LP type. However, endowments' venture capital returns between 1999 and 2006 were lower in absolute terms (average IRR of −1.9%, multiple of 0.98, and implied PME of 0.86) and much closer to those of other LP types. In contrast, buyout returns for endowments were typical of most classes of investors in both subperiods.

4. Changes in the industry

Recent work has shown that private equity fund returns have changed since the 1990s (see Robinson and Sensoy (2011); Harris, Jenkinson, and Kaplan (forthcoming)). Venture capital performance, both in absolute terms and relative to public markets, has declined substantially. Buyout performance has been more or less flat in both absolute and relative terms. In addition, the cross-sectional dispersion of fund returns has decreased. These patterns point to a maturing and general commoditization of the industry. Below, we present statistics from our data consistent with these trends observed in prior work.

Panel A of Table 3 presents the mean, median, first quartile, and third quartile values of size and returns of funds in our sample. Results are further broken down by fund type. The funds are evenly split between venture and buyout; out of the 1,250 funds, 629 are venture funds and 621 are buyout funds. The number of funds, the number of investors in a fund, and fund size all increase over time, consistent with a rapid growth of the industry. The total number of funds and fund size both double in the second subperiod, and the average (median) number of investors in a fund increases from 9 (6) in the first period to 13 (8) in the second period. These patterns hold for both venture and buyout funds. Average performance statistics, particularly implied PMEs, are similar to those reported in Robinson and Sensoy (2011) and Harris, Jenkinson, and Kaplan (forthcoming). As the industry becomes larger in the second subperiod and due to the technology bust of the early 2000s, venture fund returns decrease, while buyout returns are similar in the two subperiods.

The dispersion of venture capital returns is also lower in the 1999 − 2006 subperiod. Panel B of Table 3 shows the cross-sectional fund-level standard deviation of performance of different fund types in the two subperiods. For all performance measures, the full sample shows a decline in the standard deviation of returns from 1991–1998 to 1999–2006. This decrease is driven entirely by venture funds. In addition, separating funds by GP experience shows that the funds of more mature venture partnerships experience an even larger drop in return dispersion. Therefore, the combined evidence in Table 3 indicates that the returns of the venture industry have decreased

Table 2

Fund characteristics.

This table shows fund characteristics at the limited partner (LP) level. The unit of observation is an LP investment. *Fund sequence* is the order in which a fund was raised by a private equity firm. For example, a fund sequence of three indicates that the fund is the third fund raised by the firm. *Fund size* is the fund's total committed capital. *Fund IRR* is the fund's internal rate of return. *Fund Multiple* is the fund's multiple of invested capital, i.e. the ratio of the undiscounted sum of distributions to the undiscounted sum of capital calls. *Fund implied PME* is the fund's implied Kaplan and Schoar (2005) public market equivalent. The implied PME is calculated as a linear function of the fund IRR and multiple using the method and coefficients described in Harris, Jenkinson, Kaplan, and Stucke (2013). Implied PME statistics begin with funds raised in 1993. All performance measures are as of the end of 2011. Reported statistics are the average across all LP investments by a given LP type in a given fund type in a given period. *Difference between endowments and non-endowments* is the difference in mean values between endowments and all non-endowment LP investors. Significance levels for this difference are determined by regressing each dependent variable on the endowment dummy, with standard errors clustered by fund. Panel A reports statistics for all funds, Panel B for venture capital funds only, and Panel C for buyout funds only. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

LP type	Full sample period (1991–2006)					1991–1998					1999–2006				
	Fund sequence	Fund size (millions of dollars)	Fund IRR (%)	Fund multiple	Fund implied PME	Fund sequence	Fund size (millions of dollars)	Fund IRR (%)	Fund multiple	Fund implied PME	Fund sequence	Fund size (millions of dollars)	Fund IRR (%)	Fund multiple	Fund implied PME
Panel A: All funds															
Endowments	3.9	2,181.0	13.4	1.94	1.47	2.8	672.0	35.7	3.74	2.43	4.4	1,662.1	5.8	1.24	1.09
Public pension funds	3.7	3,233.1	9.7	1.49	1.25	2.4	922.7	21.4	2.16	1.58	4.1	2,528.3	9.3	1.28	1.14
Corporate pension funds	3.3	1,042.5	9.9	1.47	1.20	2.0	786.0	20.1	1.94	1.44	3.9	1,763.1	6.3	1.22	1.08
Advisors	3.2	901.2	11.0	1.57	1.30	2.2	951.9	24.7	2.45	1.79	3.5	1,842.8	8.7	1.29	1.15
Insurance companies	3.1	814.6	11.1	1.52	1.26	2.1	645.7	21.2	2.06	1.52	3.5	1,479.5	9.4	1.31	1.16
Banks/finance companies	2.9	2,180.3	9.0	1.44	1.21	2.1	822.4	16.2	1.90	1.44	3.2	1,314.7	8.9	1.28	1.13
Investment firms	3.3	3,140.8	8.9	1.46	1.23	2.3	738.7	25.8	2.46	1.84	3.6	1,573.5	7.3	1.24	1.10
Other investors	3.1	890.3	10.5	1.56	1.28	2.1	924.3	19.4	2.13	1.60	3.6	1,545.2	7.2	1.26	1.11
Overall	3.4	1,534.4	10.2	1.55	1.27	2.3	807.5	23.7	2.43	1.74	3.8	1,784.8	7.9	1.26	1.12
Difference between endowments and non-endowments	0.6***	− 185.9**	3.7***	0.46**	0.23**	0.6***	− 163.4**	14.6***	1.59**	0.83***	0.7***	− 144.3	−1.4*	−0.03	−0.03
Panel B: Venture funds															
Endowments	3.5	525.0	16.5	2.40	1.65	2.8	241.0	63.8	6.13	3.73	3.8	616	−1.9	0.98	0.86
Public pension funds	3.6	526.9	8.6	1.50	1.16	2.6	226.3	38.7	2.99	1.99	4	589.8	−1.8	0.98	0.87
Corporate pension funds	3.4	512.6	9.6	1.47	1.12	2.2	214.4	37.1	2.71	1.85	4	602.1	−3.5	0.91	0.80
Advisors	3.2	478.3	9.7	1.68	1.26	2.4	200.2	47.6	4.02	2.57	3.4	536.3	−1.4	0.98	0.86
Insurance companies	3.2	386.8	7.2	1.41	1.09	2.6	222.7	32.1	2.70	1.70	3.5	447.3	−2.2	0.92	0.82
Banks/finance companies	2.8	391.4	4.1	1.29	1.03	2.2	165.5	29.9	2.77	1.85	2.9	437.5	−1.4	0.95	0.84
Investment firms	3.3	490.0	6.0	1.39	1.13	2.3	181.4	46.9	3.58	2.54	3.5	522.4	−1.2	0.98	0.86
Others	2.9	387.5	8.4	1.55	1.22	2.2	190.9	33.1	3.08	2.13	3.1	463.2	0.3	1.02	0.90
Overall	3.3	478.8	8.8	1.62	1.23	2.5	209.4	44.1	3.79	2.47	3.6	535.6	−1.9	0.97	0.86
Difference between endowments and non-endowments	0.3**	58.0**	9.4***	0.96**	0.52***	0.5**	40.4**	25.2***	3.01**	1.61***	0.3***	91.3***	−0.2	0.01	0.00
Panel C: Buyout funds															
Endowments	4.3	2,145.9	10.6	1.51	1.30	2.8	1,039.3	11.8	1.62	1.28	4.9	2,608.9	10.1	1.47	1.30
Public pension funds	3.7	2,870.7	10.2	1.48	1.29	2.3	1,271.5	12.7	1.70	1.36	4.2	3,395.1	9.4	1.42	1.27
Corporate pension funds	3.2	2,055.6	10.1	1.46	1.26	1.9	1,141.3	9.6	1.47	1.19	3.8	2,568.5	10.4	1.46	1.30
Advisors	3.2	2,271.0	11.7	1.50	1.32	2.2	1,349.0	12.7	1.64	1.39	3.6	2,571.5	11.3	1.46	1.30
Insurance companies	3.1	1,700.3	13.2	1.57	1.35	1.9	866.9	15.4	1.73	1.38	3.5	2,038.5	12.3	1.51	1.34
Banks/finance companies	3	1,655.0	11.9	1.51	1.30	2	1,077.2	10.9	1.59	1.29	3.4	1,877.0	12.3	1.48	1.31
Investment firms	3.4	2,195.7	11.3	1.51	1.32	2.2	1,104.9	11.9	1.70	1.38	3.7	2,475.6	11.2	1.46	1.30
Others	3.2	2,063.2	12.2	1.56	1.33	2.1	1,268.9	12.9	1.67	1.35	4	2,665.5	11.6	1.48	1.32
Overall	3.5	2,231.2	11.1	1.51	1.30	2.2	1,147.3	12.1	1.64	1.32	3.9	2,633.9	10.8	1.46	1.30
Difference between endowments and non-endowments	1.0***	− 98.9	− 0.6	0.01	−0.01	0.7**	− 126.1	− 0.3	− 0.03	−0.05	1.1***	− 28.7	−0.8	0.02	0.01

Table 3

Changes in fund characteristics and performance over time.

   The table shows summary statistics of the characteristics and performance of funds in our sample. The unit of observation is a fund. Panel A reports the number of funds as well as mean, median, first quartile (Q1), and third quartile (Q3) values of fund vintage year (year of fund inception), the number of limited partners (LPs) investing in the fund, and the fund's size, internal rate of return (IRR), multiple, and implied public market equivalent (implied PME). Panel B shows the dispersion of fund returns, measured by the cross-sectional standard deviations of fund IRR (in %), multiple and implied PME. These dispersions are calculated separately for first-time funds and later sequence funds, as well as for all funds taken together.

Panel A: Fund-level characteristics

Fund characteristics	Full sample (1991–2006)					1991–1998					1999–2006				
	Number of funds	Mean	Median	Q1	Q3	Number of funds	Mean	Median	Q1	Q3	Number of funds	Mean	Median	Q1	Q3
All funds															
Vintage year	1,250	2000	2000	1998	2003	412	1996	1996	1994	1997	838	2002	2002	2000	2005
Number of LPs investing in fund	1,250	12	7	3	15	412	9	6	3	12	838	13	8	3	16
Size (millions of dollars)	1,250	702.5	288.0	125.0	682.6	412	405.0	169.5	75.5	399.9	838	848.8	354.0	163.0	770.0
IRR (%)	1,250	11.2	6.3	-4.9	19.1	412	25.6	12.8	2.2	30.7	838	6.1	4.4	-5.2	15
Multiple	1,112	1.62	1.22	0.87	1.82	379	2.42	1.69	1.13	2.58	733	1.23	1.09	0.83	1.50
Implied PME	1,076	1.28	1.04	0.76	1.47	343	1.69	1.27	0.83	1.85	733	1.09	0.99	0.74	1.33
Venture funds															
Vintage year	629	2000	2000	1998	2003	201	1996	1996	1994	1997	428	2002	2001	2000	2004
Number of LPs investing in fund	629	9	10	3	12	201	7	4	2	9	428	10	7	3	14
Size (millions of dollars)	629	280.3	16	80.0	320.0	201	129.1	100.0	51.0	170.0	428	351.3	227.5	111.4	450.0
IRR (%)	629	11.7	1.3	-6.9	12.7	201	37.0	13.5	1.4	48.8	428	-1.8	-2.5	-8.7	5.5
Multiple	557	1.70	1.04	0.76	1.55	185	3.12	1.72	1.08	3.39	372	1.00	0.92	0.73	1.18
Implied PME	536	1.25	0.87	0.64	1.22	164	2.11	1.25	0.73	2.28	372	0.88	0.81	0.0.63	1.04
Buyout funds															
Vintage year	621	2000	2000	1997	2004	211	1996	1996	1994	1998	410	2002	2003	2000	2005
Number of LPs investing in fund	621	14	15	4	19	211	11	8	3	15	410	15	10	4	22
Size (millions of dollars)	621	1,130.2	500.0	2500	1,188.9	211	667.8	350.0	165.0	806.4	410	1,368.2	658.8	300.0	1,500.0
IRR (%)	621	14.8	12.7	4.1	24.0	211	14.8	12.5	3.1	22.7	410	14.8	12.7	4.2	24.9
Multiple	555	1.58	1.45	1.05	2.00	194	1.76	1.68	1.18	2.24	361	1.48	1.37	1.02	1.82
Implied PME	540	1.31	1.23	0.93	1.62	179	1.30	1.27	0.86	1.64	361	1.31	1.21	0.95	1.61

Panel B: Dispersion (cross-sectional standard deviation) of returns

Returns	All funds		Venture funds		Buyout funds	
	1991–1998 (1)	1999–2006 (2)	1991–1998 (3)	1999–2006 (4)	1991–1998 (5)	1999–2006 (6)
First-time funds						
IRR (%)	47.3	20.6	65.3	15.4	18.0	22.6
Multiple	2.31	0.72	3.21	0.62	0.82	0.73
Implied PME	1.25	0.64	1.70	0.56	0.60	0.56
Later sequence funds						
IRR (%)	57.5	17.7	75.0	11.6	20.8	20.4
Multiple	4.09	0.59	5.46	0.41	0.91	0.64
Implied PME	2.59	0.50	3.51	0.37	0.68	0.37
All funds						
IRR (%)	52.0	18.8	70.1	13.2	19.3	21.3
Multiple	3.21	0.64	4.40	0.50	0.86	0.68
Implied PME	1.97	0.56	2.71	0.45	0.63	0.45

and that the late period has few exceptionally good performers.

   We find that the positive correlation between GP experience and performance drops from the first to the second subperiod as well. Table 4 shows regression results of performance (IRR, multiple, and implied PME) on fund sequence number. Consistent with Kaplan and Schoar (2005), we find a positive relation between fund sequence and returns in the

Table 4
The relationship between general partner (GP) experience and fund returns.

The table relates fund performance (internal rate of return (IRR), multiple, and implied public market equivalent (implied PME)) to the experience of the GP, measured by the (log) sequence number of the fund. The unit of observation is a fund. All variables are defined in Table 2. Vintage year fixed effects are included in all specifications. Panel A reports results for all funds, Panel B for venture capital funds only, and Panel C for buyout funds only. For specifications involving all funds, a fund type fixed effect is also included (not reported). Coefficient estimates and robust standard errors clustered by vintage year are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Sample period:	1991–2006			1991–1998			1999–2006		
Dependent variable:	IRR (1)	Multiple (2)	Implied PME (3)	IRR (4)	Multiple (5)	Implied PME (6)	IRR (7)	Multiple (8)	Implied PME (9)
Panel A: All funds									
Log fund sequence	4.45***	0.30	0.17*	11.31***	1.00*	0.60**	1.77**	0.02	0.01
	(1.54)	(0.19)	(0.09)	(2.72)	(0.57)	(0.25)	(0.90)	(0.03)	(0.03)
Log fund size	− 1.54*	− 0.05**	− 0.05***	0.01	0.05	0.02	− 1.60***	− 0.06***	− 0.05***
	(0.80)	(0.02)	(0.02)	(2.28)	(0.069)	(0.05)	(0.51)	(0.01)	(0.01)
Fund type fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	1,250	1,112	1,076	412	379	343	838	733	733
Adjusted R^2	0.12	0.11	0.05	0.07	0.09	0.05	0.24	0.22	0.19
Panel B: Venture funds									
Log fund sequence	6.55**	0.45	0.25	22.33***	1.90*	1.23**	1.31	− 0.05	− 0.05
	(3.23)	(0.32)	(0.18)	(8.65)	(1.05)	(0.54)	(1.12)	(0.04)	(0.04)
Log fund size	− 0.36	0.09	0.04	2.44	0.30	0.15	− 1.37**	− 0.02	− 0.01
	(1.91)	(0.084)	(0.06)	(7.44)	(0.29)	(0.19)	(0.60)	(0.03)	(0.03)
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	629	557	536	201	185	164	428	372	372
Adjusted R^2	0.20	0.17	0.11	0.05	0.08	0.08	0.04	0.01	0.02
Panel C: Buyout funds									
Log fund sequence	2.75**	0.14***	0.08**	3.93	0.21	0.07	2.32**	0.10***	0.08***
	(1.11)	(0.05)	(0.04)	(3.35)	(0.17)	(0.14)	(0.95)	(0.03)	(0.02)
Log fund size	− 1.75***	− 0.10***	− 0.07***	− 1.65***	− 0.13***	− 0.08***	− 1.75*	− 0.08***	− 0.06***
	(0.66)	(0.02)	(0.01)	(0.43)	(0.03)	(0.01)	(1.06)	(0.02)	(0.02)
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	621	555	540	211	194	179	410	361	361
Adjusted R^2	0.21	0.23	0.10	0.15	0.16	0.01	0.23	0.25	0.16

1991–1998 subperiod, suggesting that returns increase with GP experience. As in Kaplan and Schoar (2005), these results are driven by venture funds. However, between 1999 and 2006, venture capital fund performance is no longer related to GP experience. Buyout GP experience is statistically significantly positively related to fund performance in this later period, but the coefficients are economically smaller than the statistically insignificant coefficients in the earlier period.[9]

The changes in returns, capital flows, and investor participation in the private equity industry are likely to have altered the manner in which private equity firms operate and their relations with LPs. In particular, to the extent that rationed access to top-performing venture groups was a key reason for the outperformance of endowment portfolios in the 1990s, the results presented above suggest this is unlikely to have continued. Fewer, if any, recent venture funds have experienced the enormous success of those raised in the early to mid 1990s. Later sequence funds no longer outperform, calling into question the value of access to these funds. At a deeper level, if access reflects rents distributed to LPs by successful GPs, we should observe

a decline in the importance of access. We explore the potential changes in the following sections.

5. Limited partner returns and reinvestment decisions

5.1. Returns to different types of LPs over time

Table 5 reports estimates of multivariate equations predicting the returns on a particular LP investment. The primary covariates of interest are indicator variables for the type of investor. To absorb as much residual variation as possible, especially that potentially related to heterogeneity in fund risk or economic conditions, the specification contains a host of control variables, including vintage year fixed effects, fund type fixed effects (only in specifications including all funds), the log of the fund's size, LP experience (measured by the number of private equity investments made by the LP in the sample prior to the time of the investment), fixed effects for the LP's country of origin, the regional and industry focus of the fund's investments, the location of the GP (country), and interactions between the fund focus and vintage year fixed effects.[10] Because the same fund enters the equation

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[9] Even though fund sequence and fund size are usually correlated and have opposite correlations with fund performance, the relation between performance and fund size is similar to that reported in Table 4 if we reestimate the equations omitting fund sequence from the specification.

[10] A fund's regional focus is classified as either US, Europe, Rest of the World, or Unknown. A fund's focus refers to the type of a venture fund's investments (e.g., early stage seed, start-up, or general venture). Fund investment type focus information is not available in Preqin for buyout

multiple times whenever more than one investor holds the fund in our sample, we cluster by fund when calculating standard errors.[11]

Panel A of Table 5 reports estimates of this base equation for the full sample of funds, broken into the overall 1991–2006 period and the 1991–1998 and 1999–2006 subperiods. Over the full sample period, the funds in which endowments invest outperform those of non-endowments by 2.2 percentage points of IRR, a 0.38 higher multiple, and a 0.21 higher implied PME. Each of these differences is statistically significant and large enough to be economically meaningful. For example, an implied PME difference of 0.21 implies about a 4% per year outperformance over the life of the fund (assuming a five-year holding period for the fund's underlying investments).

Comparing the results for the two subperiods shows that the outperformance of endowments in the overall sample period is driven entirely by the 1991–1998 sub-period, the period of the Lerner, Schoar, and Wongsunwai (2007) sample. In this period, endowments' fund investments outperformed those of other LP types by 7.0 percentage points of IRR, a 1.21 higher multiple, and a 0.66 higher implied PME. In the 1999–2006 subperiod, no statistically or economically significant difference exists between the performance of endowments and other LPs.

Panels B and C of Table 5 repeat the analysis for venture and buyout LP investments separately. The main takeaway is that the results discussed above for all investments are driven by venture capital investments. In the buyout industry, endowments do not outperform in either the earlier or the more recent time period.[12]

In Appendix A we present similar tests for the investment performance of the top 15 and top two (Harvard University and Yale University) endowments, as well as the top 15 public pension plans, in private equity funds raised in the 1999–2006 period (rankings are based on assets under management at the end of 2011). We find no evidence of outperformance by top 15 public pension plans. For endowments, the evidence is mixed. There is some weakly significant evidence of outperformance by the top 15 (and top two) endowments when performance is measured by multiples or implied PMEs, but not with IRRs. Further, the economic magnitude of this outperformance is substantially smaller than that shown above for the 1991–1998 period.

(*footnote continued*)
funds. All of our conclusions hold in alternative specifications including only the vintage year and fund type fixed effects as controls, as well as in specifications that include only one of LP experience or fund size controls but not both.

[11] Here and in every other table in which we report standard errors clustered by fund, results are similar if we instead cluster by vintage year or by LP or double cluster by fund and vintage year or by LP and vintage year.

[12] The results are similar if we drop all funds with vintage years later than 2004, thereby focusing on a sample of funds whose returns are largely realized.

5.2. LPs' reinvestment decisions

A possible source of superior endowment performance is through better investment selection. Endowments receive information about GPs while investing in their funds; potentially they could use this information to make more informed investment decisions, particularly when deciding whether to invest in new funds from partnerships with which they have invested in the past. Accordingly, Lerner, Schoar, and Wongsunwai (2007) suggest that one way to measure an investor's skill is to examine the quality of their reinvestment decisions. LPs are normally given the option of investing the subsequent funds of the partnerships in which they invest. Therefore, it is unlikely that there is differential access affecting funds' reinvestment decisions.

When faced with a reinvestment decision, an LP has observed the quality of the GP's decision-making while managing the initial fund. Because we can observe the returns of the funds in which LPs chose to reinvest, as well as the returns of the funds in which the LP chose not to reinvest (abandoned funds), we can gauge the quality of the LP's decision-making by comparing the returns on these two groups of funds. Lerner, Schoar, and Wongsunwai (2007) show that, in their sample, funds in which endowments reinvest do substantially better than the ones they abandon, while other types of investors are not nearly as good at picking investments as endowments are.

We present evidence on reinvestment decisions in Table 6. Panel A presents results for the full sample of investments; Panel B, for venture capital funds; and Panel C, buyout funds. Each panel is broken down by investments over the entire time period and for investments in the 1991–1998 and 1999–2006 subperiods. We divide each class of LPs' investments by those for which the LP invested in the follow-on fund and those for which the LP chose not to invest in the follow-on fund. If a fund has no follow-on fund, it is dropped from the sample.

Panel A of Table 6 compares reinvested and abandoned funds for venture and buyout funds taken together. In the full sample period, for each type of investor, follow-on funds in which LPs choose to reinvest perform better than those in which they choose not to reinvest. This conclusion holds for all three performance measures (IRR, multiple, and implied PME). With few exceptions, it also holds for each LP type in each subperiod. The panel also shows that the likelihood of reinvestment is positively related to the performance of the original (current) fund. In most cases, the average IRR of the current funds for which the LP decided to reinvest in the follow-on fund is statistically significantly higher than the funds for which they did not reinvest. Though not shown in the panel, this pattern holds for multiples and implied PMEs as well. These results suggest that, as a whole, LPs use information in the returns of the original funds and the private information they receive as investors in the fund (e.g., through periodic reports from the GPs) to make reinvestment decisions that have substantially higher returns than a random reinvestment rule would have had.

Table 5
Investment performance by limited partner (LP) type and period.

This table shows regression results of LPs' investment performance for the full 1991–2006 sample period and two subsample periods from 1991 to 1998 and 1999 to 2006. The unit of observation is an LP investment. The dependent variable in all columns is fund performance (internal rate of return (IRR), multiple, implied public market equivalent (PME)). Eight indicator variables are used to identify investments made by different LP types. Each indicator variable takes on the value of one for observations consisting of investments in funds by the corresponding investor type, and zero otherwise. *Public pension funds* is the omitted reference group in all regressions. *Log LP experience* is the log of the total number of LPs' investments prior to the current fund. *Log fund size* is the natural logarithm of the fund's size in millions of dollars. All specifications include but do not report vintage year fixed effects, LP location (country) fixed effects, and additional controls for fund risk. These controls are fixed effects for the regional focus of the fund's investments, the general partner's (GP's) location (country), the fund's industry focus, and interactions between fund region and industry focus and vintage year fixed effects. Panel A reports results for all funds, and includes a fund type (buyout or venture) fixed effect. Panels B and C report results separately for venture and buyout funds, respectively. Fund focus fixed effects and the interaction variables are not included in Panel C because Preqin does not have more detailed focus classifications for buyout funds. *Difference between endowments and non-endowments* reports separate regression results with just the endowment indicator variable and the control variables. All other non-endowment LPs serve as the reference group. Only the coefficient on the endowment indicator is reported. Coefficient estimates and standard errors clustered by fund are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: All funds

Sample period:	1991–2006			1991–1998			1999–2006		
Dependent variable:	IRR (1)	Multiple (2)	Implied PME (3)	IRR (4)	Multiple (5)	Implied PME (6)	IRR (7)	Multiple (8)	Implied PME (9)
Endowments	2.70***	0.37**	0.20**	10.15***	1.33**	0.74**	0.44	0.01	0.00
	(0.90)	(0.18)	(0.09)	(2.78)	(0.60)	(0.29)	(0.58)	(0.03)	(0.02)
Corporate pension funds	−0.95	−0.16***	−0.10***	0.41	−0.22*	−0.14*	−0.80	−0.04*	−0.03*
	(0.85)	(0.05)	(0.03)	(2.24)	(0.11)	(0.08)	(0.56)	(0.02)	(0.02)
Advisors	2.19**	0.10	0.06	7.90**	0.45*	0.28*	0.60	−0.00	0.00
	(0.94)	(0.06)	(0.04)	(3.28)	(0.24)	(0.15)	(0.70)	(0.02)	(0.02)
Insurance companies	0.92	−0.03	−0.02	4.86**	0.02	0.02	−0.99	−0.03	−0.02
	(0.93)	(0.05)	(0.03)	(2.67)	(0.15)	(0.10)	(0.67)	(0.03)	(0.02)
Banks/finance companies	0.21	−0.05	−0.04	2.43	0.14	0.07	0.23	−0.03	−0.02
	(0.71)	(0.04)	(0.03)	(2.16)	(0.17)	(0.10)	(0.58)	(0.021)	(0.02)
Investment firms	1.52**	0.07	0.05	8.64***	0.54**	0.36**	0.11	−0.01	−0.00
	(0.74)	(0.05)	(0.03)	(2.94)	(0.23)	(0.15)	(0.50)	(0.02)	(0.02)
Others	0.55	−0.03	−0.00	3.78*	0.17	0.17	0.21	−0.00	0.00
	(0.91)	(0.06)	(0.04)	(2.18)	(0.19)	(0.12)	(0.80)	(0.03)	(0.03)
Log LP experience	0.55*	0.04**	0.03**	3.54***	0.07	0.06	0.11	0.02**	0.01**
	(0.29)	(0.02)	(0.01)	(1.31)	(0.08)	(0.06)	(0.21)	(0.01)	(0.01)
Log fund size	0.50	0.01	−0.01	2.07	0.25	0.12	0.09	−0.03	−0.03
	(0.57)	(0.04)	(0.03)	(1.37)	(0.16)	(0.09)	(0.61)	(0.03)	(0.02)
Fund type fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LP country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional fund risk controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	14,084	12,983	12,841	3,609	3,356	3,214	10,475	9,627	9,627
Adjusted R^2	0.37	0.15	0.09	0.29	0.16	0.10	0.45	0.34	0.300
Difference between endowments and non-endowments	2.19***	0.38**	0.21**	7.03***	1.21**	0.66**	0.43	−0.01	0.01
	(0.85)	(0.17)	(0.08)	(2.68)	(0.54)	(0.26)	(0.48)	(0.54)	(0.02)

Panel B: Venture funds

Sample period:	1991–2006			1991–1998			1999–2006		
Dependent variable:	IRR (1)	Multiple (2)	Implied PME (3)	IRR (4)	Multiple (5)	Implied PME (6)	IRR (7)	Multiple (8)	Implied PME (9)
Endowments	6.10***	0.82**	0.47***	21.76***	3.07***	1.82***	0.39	−0.01	−0.01
	(1.77)	(0.33)	(0.16)	(6.16)	(1.14)	(0.57)	(0.67)	(0.03)	(0.03)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Corporate pension funds	0.17	−0.10	−0.08	4.20	0.06	−0.01	−0.84	−0.07***	−0.07**
	(1.90)	(0.10)	(0.06)	(5.66)	(0.32)	(0.20)	(0.81)	(0.03)	(0.03)
Advisors	4.41**	0.31*	0.16	16.21**	1.35**	0.73*	0.37	−0.04	−0.03
	(2.15)	(0.16)	(0.10)	(8.18)	(0.61)	(0.38)	(0.77)	(0.03)	(0.03)
Insurance companies	1.30	0.00	−0.03	5.30	0.13	−0.00	−0.31	−0.07*	−0.04
	(1.94)	(0.15)	(0.09)	(6.41)	(0.48)	(0.31)	(0.88)	(0.04)	(0.03)
Banks/finance companies	1.48	0.18	0.07	8.91	0.86	0.41	0.23	−0.04	−0.03
	(1.56)	(0.15)	(0.07)	(6.83)	(0.60)	(0.33)	(0.65)	(0.03)	(0.02)
Investment firms	4.06**	0.36**	0.21***	20.71***	1.70***	1.08***	0.18	−0.01	−0.01
	(1.60)	(0.15)	(0.08)	(7.45)	(0.62)	(0.36)	(0.62)	(0.02)	(0.02)
Others	3.31*	0.27	0.18*	10.98*	1.02	0.70*	1.26	0.04	0.04
	(1.72)	(0.120)	(0.11)	(6.21)	(0.68)	(0.39)	(1.06)	(0.04)	(0.03)
Log LP experience	1.49**	0.03	0.03	9.17**	0.22	0.19	0.34**	0.01	0.01
	(0.59)	(0.04)	(0.03)	(3.69)	(0.21)	(0.17)	(0.27)	(0.01)	(0.01)
Log fund size	2.24**	0.17	0.07	11.83***	0.75*	0.34	0.70	0.01	0.00
	(1.04)	(0.10)	(0.05)	(4.50)	(0.46)	(0.24)	(0.70)	(0.03)	(0.03)
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LP country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional fund risk controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	5,606	5,180	5,110	1,312	1,246	1,176	4,294	3,934	3,934
Adjusted R²	0.38	0.28	0.21	0.23	0.17	0.07	0.17	0.08	0.06
Difference between endowments and non-endowments	4.18**	0.67**	0.39***	13.35**	2.43***	1.45***	0.28	0.01	0.01
	(1.66)	(0.27)	(0.27)	(0.27)	(0.27)	(0.48)	(0.48)	(0.02)	(0.02)

Panel C: Buyout funds

Sample period:	1991–2006			1991–1998			1999–2006		
Dependent variable:	IRR (1)	Multiple (2)	Implied PME (3)	IRR (4)	Multiple (5)	Implied PME (6)	IRR (7)	Multiple (8)	Implied PME (9)
Endowments	0.09	−0.00	−0.01	0.62	−0.06	−0.07	0.45	0.02	0.02
	(0.79)	(0.03)	(0.03)	(1.35)	(0.09)	(0.07)	(0.84)	(0.03)	(0.03)
Corporate pension funds	−1.44	−0.08***	−0.06**	−1.79	−0.22***	−0.17***	−0.61	−0.02	−0.01
	(0.66)	(0.03)	(0.03)	(1.12)	(0.07)	(0.06)	(0.72)	(0.03)	(0.02)
Advisors	0.82	0.01	0.02	1.49	−0.04	0.01	0.80	0.02	0.02
	(0.82)	(0.03)	(0.03)	(1.43)	(0.08)	(0.07)	(0.95)	(0.03)	(0.03)
Insurance companies	0.20	0.00	0.01	2.34	0.02	0.05	−0.13	−0.00	−0.00
	(0.97)	(0.03)	(0.03)	(2.12)	(0.08)	(0.07)	(0.94)	(0.03)	(0.03)
Banks/finance companies	−0.63	−0.05*	−0.03	−0.09	−0.09	−0.06	−0.15	−0.03	−0.02
	(0 0.71)	(0.03)	(0.02)	(1.10)	(0.06)	(0.05)	(0.80)	(0.03)	(0.02)
Investment firms	0.01	−0.01	−0.00	0.65	−0.01	−0.02	0.43	−0.00	0.00
	(0.60)	(0.02)	(0.02)	(0.95)	(0.06)	(0.05)	(0.63)	(0.02)	(0.02)
Others	−0.55	−0.05	−0.01	0.48	−0.08	0.00	−0.74	−0.04	−0.03
	(0.99)	(0.04)	(0.03)	(1.73)	(0.07)	(0.06)	(1.09)	(0.04)	(0.04)
Log LP experience	−0.16	0.01	0.00	−0.00	0.00	−0.00	−0.07	0.01	0.01
	(0.24)	(0.01)	(0.01)	(0.40)	(0.03)	(0.03)	(0.26)	(0.01)	(0.01)
Log fund size	−0.23	−0.01	−0.00	−0.66	0.00	0.01	−0.05	−0.01	−0.01
	(0.69)	(0.03)	(0.03)	(1.08)	(0.07)	(0.06)	(0.83)	(0.03)	(0.03)
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LP country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional fund risk controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	8,478	7,803	7,731	2,297	2,110	2,038	6,181	5,693	5,693
Adjusted R²	0.38	0.32	0.21	0.32	0.17	0.04	0.42	0.40	0.31
Difference between endowments and non-endowments	0.30	0.02	0.01	0.44	−0.00	−0.04	0.45	0.03	0.02
	(0.69)	(0.033)	(0.03)	(1.41)	(0.08)	(0.07)	(0.74)	(0.03)	(0.02)

Table 6

Returns on reinvested and abandoned funds.

The table reports the average returns of limited partners' (LPs') reinvested funds as well as abandoned funds. The unit of observation is an LP investment. A current fund is considered *Reinvested* if the LP invests in the next fund raised by the same private equity firm (if a follow-on fund is raised) and *Abandoned* if the LP does not invest in the follow-on fund. Column 1 , *N*, reports the number of reinvested or abandoned funds by LP type. Column 2, *Current Fund IRR*, reports the internal rate of return (IRR) of the current fund. Columns 3, 4, and 5 report the IRR, multiple, and implied public market equivalent (implied PME), respectively, of the follow-on fund. *Diff* is the difference in average returns between reinvested funds and abandoned funds, reported for each LP type and sample subperiod. Statistical significance of *Diff* is determined by regressing each performance measure on an indicator variable for whether the fund is reinvested, with standard errors clustered by fund. Panel A reports statistics for all funds; Panel B, for venture funds only; and Panel C, for buyout funds only. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: All funds

Reinvestment decision	Full Sample (1991–2006)					1991–1998					1999–2006				
	N	Current fund IRR (%)	Follow-on fund IRR (%)	Follow-on fund Multiple	Follow-on fund implied PME	N	Current fund IRR (%)	Follow-on fund IRR (%)	Follow-on fund multiple	Follow-on fund implied PME	N	Current fund IRR (%)	Follow-on fund IRR (%)	Follow-on fund multiple	Follow-on fund implied PME
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Endowments															
Reinvested	1,200	25.8	19.6	2.07	1.65	466	42.3	37.8	3.41	2.53	734	16.6	8.1	1.36	1.21
Abandoned	402	17.8	9.4	1.38	1.14	105	36.9	24.6	2.11	1.62	297	11.9	4.0	1.18	1.02
Diff		8.0*	10.3***	0.69***	0.51***		5.4	13.2*	1.30**	0.91*		4.7	4.2**	0.18**	0.19***
Public pension funds															
Reinvested	1,804	22.8	17.3	1.79	1.46	667	32.7	24.5	2.45	1.78	1,137	17.9	13.2	1.50	1.32
Abandoned	417	15.2	9.1	1.43	1.18	107	26.8	20.1	2.10	1.58	310	12.0	5.3	1.24	1.07
Diff		7.6**	8.3***	0.36***	0.28***		5.9	4.3	0.35	0.20		5.9	7.9***	0.26***	0.25***
Corporate pension funds															
Reinvested	591	26.1	15.8	1.62	1.33	274	35.4	23.2	2.03	1.52	317	20.4	9.4	1.39	1.22
Abandoned	136	11.3	8.0	1.44	1.17	50	25.5	14.6	2.07	1.49	86	4.6	4.2	1.17	1.02
Diff		14.8***	7.8***	0.18	0.16		10.0**	8.6	−0.04	0.03		15.7***	5.2**	0.22**	0.20***
Advisors															
Reinvested	442	27.5	18.9	1.87	1.52	147	39.3	31.5	2.89	2.10	295	22.8	12.7	1.46	1.29
Abandoned	159	16.7	7.7	1.39	1.18	48	27.1	12.5	1.85	1.47	111	12.9	5.6	1.25	1.08
Diff		10.9***	11.3***	0.48***	0.34***		12.2**	19.1***	1.04*	0.63		9.9**	7.1***	0.21***	0.21***
Insurance companies															
Reinvested	412	26.4	18.7	1.89	1.50	167	35.3	25.4	2.52	1.81	245	21.7	14.2	1.55	1.37
Abandoned	134	19.3	8.3	1.38	1.12	45	31.3	11.7	1.57	1.21	89	14.8	6.6	1.25	1.09
Diff		7.0*	10.4***	0.51***	0.38***		4.0	13.7***	0.95**	0.6**		6.9	7.6***	0.30**	0.28***
Banks/finance companies															
Reinvested	1,011	23.5	15.5	1.63	1.37	338	32.9	21.7	1.96	1.50	673	19.7	12.4	1.50	1.32
Abandoned	423	18.1	8.7	1.44	1.15	145	26.8	13.7	1.73	1.37	278	14.5	6.0	1.23	1.06
Diff		5.4*	6.8***	0.19**	0.22**		6.1*	8.0**	0.23	0.13		5.2	6.3***	0.27**	0.26***
Investment firms															
Reinvested	1,560	22.6	16.0	1.71	1.42	446	38.8	30.2	2.81	2.13	1,114	17.3	10.3	1.38	1.22
Abandoned	556	18.8	8.2	1.35	1.13	115	38.6	23.2	2.37	1.80	441	14.8	4.2	1.15	1.00
Diff		3.8*	7.9***	0.36***	0.29***		0.3	7.0	0.44	0.33		2.5	6.1***	0.23***	0.22***
Others															
Reinvested	341	23.1	13.6	1.61	1.34	125	30.7	19.1	1.88	1.45	216	19.3	10.4	1.47	1.28
Abandoned	316	20.8	13.2	1.73	1.37	192	32.3	19.5	2.23	1.82	124	9.2	3.3	1.17	1.01
Diff		2.4	0.4	−0.12	−0.03		−1.6	−0.4	−0.35	−0.37		10.1*	7.1***	0.30***	0.27***

All non-endowments

	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME
Reinvested	6,136	23.7	16.6	1.73	1.42	2,231	35.3	25.1	2.40	1.71	3,905	18.9	11.8	1.46	1.29
Abandoned	1,825	17.6	9.1	1.45	1.18	510	31.0	17.5	2.05	1.54	1,315	12.8	5.0	1.20	1.04
Diff		6.2**	7.4***	0.28***	0.24***		4.3	7.5***	0.35*	0.17		6.1**	6.9***	0.26***	0.25***

Panel B: Venture funds

	Full Sample (1991–2006)					1991–1998					1999–2006				
Reinvestment decision	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME
Endowments															
Reinvested	532	32.6	24.6	2.47	1.90	220	57.1	62.6	4.94	3.60	312	16.2	−2.3	0.94	0.83
Abandoned	223	21.1	8.5	1.25	1.03	37	60.6	59.2	4.71	3.48	186	14.1	−1.5	0.90	0.78
Diff		11.6	16.0***	1.22***	0.87***		−3.5	3.5	0.23	0.12		2.1	−0.8	0.04	0.05
Public pension funds															
Reinvested	550	28.0	17.1	1.89	1.42	218	44.3	43.8	3.58	2.42	332	18.6	−0.4	1.03	0.91
Abandoned	169	15.9	8.1	1.37	1.05	38	37.7	39.9	3.16	2.06	131	10.4	−1.2	0.95	0.82
Diff		12.1**	9.1***	0.52***	0.37***		6.7***	3.9	0.42	0.36		8.2	0.8	0.08	0.09*
Corporate pension funds															
Reinvested	238	33.2	17.3	1.54	1.20	106	49.0	42.3	2.62	1.88	132	23.0	−2.8	0.90	0.79
Abandoned	62	10.6	6.7	1.54	1.18	13	52.2	38.6	6.11	3.75	49	3.4	−1.8	0.98	0.86
Diff		22.5***	10.6**	0.00	0.02		−3.3	3.7	−3.49	−1.87		19.7**	−1.0	−0.08	−0.07
Advisors															
Reinvested	152	38.2	22.4	2.24	1.65	54	55.2	60.1	4.56	3.12	98	29.6	1.6	0.98	0.88
Abandoned	62	14.5	−0.2	1.05	0.83	10	23.4	16.5	4.57	2.01	52	13.7	−3.3	0.93	0.80
Diff		23.8**	22.6***	1.19***	0.82***		31.8**	43.7**	−0.01	1.11		15.9	4.9**	0.05	0.08
Insurance companies															
Reinvested	150	28.2	17.3	1.95	1.39	68	35.4	38.7	3.36	2.25	82	22.9	−0.5	0.91	0.83
Abandoned	46	23.6	−0.0	1.00	0.82	11	70.1	6.8	1.70	1.08	35	15.9	−2.2	0.90	0.79
Diff		4.6	17.3***	0.95***	0.57***		−34.7*	31.9***	1.66**	1.17**		7.0	1.7	0.01	0.04
Banks/finance companies															
Reinvested	341	27.3	11.7	1.43	1.15	102	42.2	39.0	2.80	1.97	239	21.5	−0.0	0.93	0.84
Abandoned	175	17.7	3.2	1.11	0.87	36	47.7	25.4	3.26	2.02	139	12.8	−2.5	0.85	0.75
Diff		9.6	8.4**	0.32	0.28*		−5.5	13.7	−0.46	−0.05		8.7	2.5*	0.08	0.09
Investment firms															
Reinvested	676	24.9	13.5	1.68	1.33	181	53.5	51.2	4.11	2.99	495	16.5	−0.3	0.98	0.86
Abandoned	300	17.0	4.7	1.24	1.02	44	58.9	45.0	4.62	3.55	256	12.2	−2.2	0.93	0.80
Diff		8.0	8.8***	0.44**	0.31***		−5.4	6.2	−0.51	−0.56		4.3	1.9	0.05	0.06
Others															
Reinvested	147	25.1	11.1	1.50	1.15	48	35.5	30.9	2.41	1.70	99	20.1	1.5	1.04	0.92
Abandoned	142	21.6	14.3	1.84	1.45	70	42.7	30.2	4.44	3.38	72	9.8	−1.1	0.97	0.84
Diff		3.5	−3.2	−0.34	−0.3		−7.2	0.71	−2.03	−1.68		10.3	2.6	0.07	

Table 6 (*continued*)

Panel B: Venture funds

Reinvestment decision		Full Sample (1991–2006)					1991–1998					1999–2006			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME
															0.08
All non-endowments															
Reinvested	2,254	28.1	15.2	1.73	1.33	777	48.2	46.3	3.46	2.42	1,477	19.8	−0.3	0.98	0.87
Abandoned	956	17.3	6.0	1.31	1.05	222	53.9	39.0	3.93	2.78	734	11.4	−2.0	0.93	0.80
Diff		10.9**	9.2***	0.42***	0.28***		−5.7	7.3	−0.47	−0.36		8.4	1.8*	0.05	0.07*

Panel C: Buyout funds

		Full Sample (1991–2006)					1991–1998					1999–2006			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME	N	Current Fund IRR (%)	Follow-on Fund IRR (%)	Follow-on Fund Multiple	Follow-on fund Implied PME
Endowments															
Reinvested	668	20.2	15.7	1.77	1.45	246	27.2	15.6	1.80	1.41	422	16.9	15.8	1.75	1.47
Abandoned	179	13.6	10.4	1.51	1.26	68	23.8	5.8	1.28	1.01	111	8.5	13.2	1.63	1.37
Diff		6.6**	5.4**	0.26*	0.19**		3.4	9.8**	0.52**	0.40*		8.4***	2.7	0.12	0.10
Public pension funds															
Reinvested	1254	20.4	17.4	1.77	1.47	449	26.5	15.1	1.74	1.41	805	17.6	18.8	1.78	1.49
Abandoned	248	14.7	9.7	1.51	1.28	69	19.9	9.2	1.46	1.29	179	13.2	9.9	1.53	1.28
Diff		5.7	7.7***	0.26***	0.19***		6.6*	5.8*	0.28*	0.12		4.4	8.8***	0.25***	0.21***
Corporate pension funds															
Reinvested	353	20.8	14.8	1.70	1.43	168	24.8	11.1	1.50	1.23	185	18.4	18.1	1.81	1.53
Abandoned	74	11.8	9.1	1.37	1.16	37	18.4	6.1	1.29	1.06	37	6.3	12.1	1.45	1.25
Diff		9.0***	5.7**	0.33***	0.27***		6.5**	5.1	0.21	0.17		12.2***	5.9	0.36***	0.28***
Advisors															
Reinvested	290	21.5	17.1	1.69	1.45	93	27.4	14.9	1.58	1.40	197	19.4	18.2	1.72	1.47
Abandoned	97	17.9	12.6	1.65	1.39	38	27.6	11.4	1.73	1.45	59	12.3	13.4	1.60	1.35
Diff		3.5	4.5**	0.04	0.06		−0.2	3.5	−0.15	−0.05		7.2*	4.7*	0.12	0.12
Insurance companies															
Reinvested	262	25.3	19.6	1.87	1.57	99	35.1	16.3	1.69	1.37	163	21.1	21.6	1.93	1.63
Abandoned	88	17.3	12.7	1.52	1.27	34	23.5	13.3	1.54	1.23	54	14.1	12.3	1.51	1.30
Diff		8.0**	6.9***	0.35**	0.30***		11.6***	3.0	0.15	0.14		7.0**	9.3***	0.42*	0.33***
Banks/finance companies															
Reinvested	670	21.6	17.4	1.75	1.48	236	28.3	14.2	1.57	1.29	434	18.8	19.2	1.83	1.55

Abandoned	248	18.4	12.5	1.56	1.32	139	21.7	9.7	1.49	1.27	109	16.2	14.6	1.60	1.36
Diff		3.2	4.9**	0.19	0.16		6.6**	4.4	0.08	0.02		2.6	4.6*	0.23*	0.19**
Investment firms															
Reinvested	884	20.8	17.9	1.78	1.49	619	28.8	15.8	1.73	1.44	265	18.0	18.8	1.80	1.51
Abandoned	256	20.9	12.2	1.53	1.28	185	28.2	9.7	1.46	1.15	71	18.6	13.1	1.56	1.33
Diff		−0.2	5.7***	0.25***	0.21***		0.6	6.2	0.27	0.29**		−0.6	5.7**	0.24***	0.18***
Others															
Reinvested	194	21.8	15.5	1.71	1.44	117	27.7	11.8	1.58	1.32	77	18.7	18.0	1.77	1.50
Abandoned	174	20.1	12.2	1.53	1.32	52	27.3	13.4	1.56	1.34	122	8.3	9.4	1.49	1.28
Diff		1.7	3.3*	0.18	0.12		0.4	−1.7	0.02	−0.02		10.4**	8.6**	0.28	0.22
All non-endowments															
Reinvested	3,907	21.2	17.3	1.76	1.48	2,520	27.6	13.7	1.65	1.37	1,387	18.4	18.9	1.80	1.52
Abandoned	1,185	17.8	11.6	1.53	1.29	705	24.0	10.0	1.50	1.26	480	14.3	12.2	1.55	1.31
Diff		3.4	5.7***	0.23***	0.19***		3.6*	3.7*	0.15	0.11		4.1	6.7***	0.25***	0.21***

Panel A of Table 6 also shows that endowments appear relatively better than other types of LPs at reinvestment decisions in the 1991–1998 period, consistent with Lerner, Schoar, and Wongsunwai (2007). Endowments' reinvested funds outperformed funds in which they chose not to reinvest. Endowments' reinvested funds in this period returned an average IRR of 37.8%, a multiple of 3.41, and an implied PME of 1.49, compared with an average IRR of 24.6%, a multiple of 2.11, and an implied PME of 1.22 earned by funds endowments did not reinvest. These differences in performance between reinvested and abandoned funds are larger than for all other investor types.

Panel A of Table 6 also shows that, during the more recent 1999–2006 period, endowments' reinvested funds still outperform those in which they did not reinvest, but by a much smaller margin. Other types of LPs see similar differences in returns to reinvested and not reinvested funds. In short, in the later period, the reinvestment decisions of endowments are not economically or statistically unusual relative to other institutional investors.

These results by themselves are consistent with superior investment skill among endowments in the 1991–1998 period. However, the results in Panels B and C of Table 6, which break the results down by venture and buyout LP investments, cast doubt on the view that endowments had superior selection skill even in the 1991–1998 period. Panel B shows that venture funds in which endowments reinvest in the 1991–1998 period perform exceptionally well, with a 62.6% average IRR, a 4.94 average multiple, and a 3.60 average implied PME. However, the funds in which they choose not to reinvest perform almost as well, with a 59.2% average IRR, a 4.71 average multiple, and a 3.48 average implied PME. Moreover, Panel B shows that these foregone returns are higher on average than those of the venture capital funds in which other types of LP could reinvest, whether or not these other LP types choose to reinvest.

Instead of reflecting investment skill, these results on endowments' reinvestment decisions suggest that endowments in the early 1990s were in the position of choosing between investments in the very best venture capital groups and did so only slightly better than randomly. The evidence suggests that regardless of their skill at reinvestment decisions, simply having been invested with these top venture partnerships led to endowments' superior returns relative to other classes in the 1991–1998 period. The venture groups managing the funds for which endowments earned these very high returns are all well-known firms with reputations for limiting access (Kleiner-Perkins, Sequoia, Benchmark, etc.). Presumably, if other types of investors could have invested with these partnerships, many of them would have done so.

Panel C of Table 6 shows that endowments similarly appear to make better reinvestment decisions in their buyout investments than do other types of LPs in the 1991–1998 period. This effect is primarily due to abandoning funds that turn out to do poorly. Endowments do not perform better on their reinvested funds than do other types of LPs, consistent with our evidence in Table 5 that endowments do not systematically outperform other LPs in their buyout investments.

Table 7
Probability of investing in a first-time fund.

The table shows probit models for the probability of an limited partner (LP) type investing in the first fund raised by a private equity firm for all funds, venture capital funds, and buyout funds. The unit of observation is an LP investment. The dependent variable equals one if the investment is in a first fund raised by a private equity firm, and zero otherwise. The omitted LP type is public pension plans. The difference between endowments and non-endowments is calculated in the same way as in Table 5. Marginal effects and robust standard errors clustered by fund are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: Indicator for investment in a first-time fund	All funds			Venture funds			Buyout funds		
	(1) Full Sample	(2) 1991–1998	(3) 1999–2006	(4) Full Sample	(5) 1991–1998	(6) 1999–2006	(7) Full Sample	(8) 1991–1998	(9) 1999–2006
Endowments	−0.08***	−0.13***	−0.06***	−0.07***	−0.15***	−0.04	−0.09***	−0.10*	−0.07***
	(0.02)	(0.04)	(0.02)	(0.03)	(0.05)	(0.03)	(0.02)	(0.05)	(0.02)
Corporate pension funds	−0.03**	0.04	−0.06***	−0.06**	0.02	−0.09***	−0.02	0.04	−0.04***
	(0.01)	(0.03)	(0.01)	(0.02)	(0.05)	(0.02)	(0.02)	(0.05)	(0.02)
Advisors	−0.01	−0.01	−0.02	−0.00	−0.01	−0.00	−0.02	0.01	−0.03
	(0.02)	(0.04)	(0.01)	(0.03)	(0.06)	(0.03)	(0.02)	(0.05)	(0.02)
Insurance companies	−0.00	0.06	−0.02	−0.03	−0.04	−0.03	0.02	0.12**	−0.01
	(0.02)	(0.05)	(0.02)	(0.03)	(0.07)	(0.03)	(0.03)	(0.06)	(0.02)
Banks/finance companies	0.02	0.06	0.01	0.03	0.04	0.02	0.02	0.05	0.00
	(0.02)	(0.04)	(0.02)	(0.03)	(0.06)	(0.03)	(0.02)	(0.05)	(0.02)
Investment firms	0.01	0.02	−0.000	0.00	−0.00	0.00	0.01	0.03	0.00
	(0.02)	(0.03)	(0.02)	(0.02)	(0.05)	(0.02)	(0.02)	(0.05)	(0.02)
Others	−0.07***	−0.06	−0.08***	−0.07***	−0.04	−0.08***	−0.08***	−0.08*	−0.08***
	(0.02)	(0.04)	(0.01)	(0.03)	(0.07)	(0.02)	(0.02)	(0.05)	(0.02)
Log LP experience	−0.06***	−0.09***	−0.05***	−0.06***	−0.09***	−0.05***	−0.06***	−0.10***	−0.04***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
Fund type fixed effects	Yes	Yes	Yes	–	–	–	–	–	–
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LP country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	14,084	3,609	10,475	5,677	1,364	4,333	8,407	2,245	6,142
Pseudo R^2	0.14	0.12	0.10	0.12	0.12	0.10	0.18	0.17	0.11
Difference between endowments and non-endowments	−0.08***	−0.14***	−0.05***	−0.06***	−0.15***	−0.03	−0.08***	−0.12***	−0.07***
	(0.01)	(0.03)	(0.01)	(0.02)	(0.04)	(0.03)	(0.02)	(0.04)	(0.02)

Panels B and C of Table 6 echo the message of Panel A: Whatever superior reinvestment decisions endowments may have made relative to other investors in the 1991–1998 period, there is no evidence that this continues to the 1999–2006 period.

6. The importance of access to limited partner returns

The evidence presented on LPs' returns and reinvestment decisions is consistent with endowments' success being driven by their early investments with exceptional GPs, which provides them access to the partnerships' later funds. In this section, we provide tests of the importance of access in driving LPs' returns. Because access is not observable, our tests involve comparing funds that are likely to have limited access to those in which it is likely that all investors can invest if they choose.

6.1. First-time versus. more mature funds

One way to distinguish between access-based and skill-based explanations for differences in returns is to consider first-time funds separately. Compared with funds from experienced partnerships, first-time funds tend to perform worse (at least in the 1991–1998 period), and they are generally considered extremely difficult to raise (see

Lerner, Hardymon, and Leamon (2011)). Therefore, it is unlikely that access to a first-time fund is restricted. The skill-based explanation then suggests that endowments and more experienced investors should outperform other investors when investing in first time, as well as higher sequence, funds. Alternatively, endowments' superior performance could occur if they were able to invest in funds from more experienced partnerships, which performed better than first-time funds.

We first estimate the likelihood that a particular LP invests in a first-time fund. Because of the substantial uncertainty about GP quality, LPs tend to be averse to investing in first time funds. For this reason, a greater tendency to invest in more established funds is likely to reflect better access. We estimate equations that predict whether a particular investment is in a first-time fund as a function of LP type, LP experience, fund size and type, vintage year, and country of LP origin. Because this dependent variable is dichotomous, we estimate the equation by probit models.

We report estimates of this equation on the entire sample and subsamples split by both time period and type of fund in Table 7. The top part of the table reports results for all LP types separately, and the bottom of the table reports otherwise identical specifications in which the LP type indicators are collapsed to a single indicator for endowments versus non-endowments (analogous to Table 5). For brevity, we

Table 8
Returns on limited partners investments in first-time funds and later sequence funds.

This table shows how differences in returns across limited partner (LP) types vary with fund sequence. The unit of observation is an LP investment. The dependent variable in all specifications is fund internal rate of return (IRR) (in %). The omitted LP type is public pension funds. All variables are defined in previous tables. Standard errors are clustered by fund. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable: Fund IRR (%)	First-time funds			Later sequence funds		
	1991–2006 (1)	1991–1998 (2)	1999–2006 (3)	1991–2006 (4)	1991–1998 (5)	1999–2006 (6)
Endowments	1.81	3.87	0.95	2.65**	9.75***	−-0.30
	(2.07)	(3.39)	(1.72)	(1.19)	(2.88)	(0.68)
Corporate pension funds	−0.74	1.35	−4.10**	−1.71	−1.58	−0.67
	(2.86)	(3.97)	(1.85)	(1.07)	(2.31)	(0.61)
Advisors	1.11	1.91	0.10	1.89*	6.68*	0.44
	(2.16)	(3.89)	(1.69)	(1.12)	(3.47)	(0.70)
Insurance companies	0.53	3.52	−2.75	0.12	−0.16	0.36
	(2.43)	(3.85)	(2.20)	(1.11)	(2.89)	(0.76)
Banks/finance companies	−0.40	2.32	−1.47	−1.08	−2.27	0.16
	(1.99)	(3.48)	(1.69)	(0.75)	(1.72)	(0.63)
Investment firms	2.08	4.22	0.58	0.44	4.08	0.09
	(2.23)	(4.41)	(1.57)	(0.83)	(2.87)	(0.51)
Others	0.70	1.92	−1.60	−0.58	2.15	0.90
	(2.54)	(3.59)	(1.90)	(1.09)	(2.33)	(0.89)
Log fund size	−1.37	−1.00	−0.44	−0.59	0.86	−0.68
	(1.18)	(1.81)	(1.27)	(0.92)	(2.13)	(0.85)
Log LP experience	0.92	2.69	−0.56	1.09***	2.55*	0.49**
	(0.81)	(2.08)	(0.43)	(0.42)	(1.32)	(0.22)
Fund sequence				0.52	1.54	0.20
				(0.34)	(0.97)	(0.29)
Fund type fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
LP country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	3,283	1,414	1,869	10,801	2,195	8,606
Adjusted R^2	0.10	0.08	0.32	0.21	0.22	0.40
Difference between endowments and non-endowments	1.41	2.44	1.71	2.95***	11.41***	−0.34
	(2.01)	(3.62)	(1.20)	(1.11)	(3.21)	(0.56)

omit the coefficients on the control variables when reporting these latter specifications.

The main message of Table 7 is that endowments are statistically and economically less likely to invest in first-time funds than are non-endowments, especially in the 1991–1998 period. In the 1999–2006 period, this remains true only for buyout funds. Taking both fund types together, the magnitude of the difference between endowments and non-endowments decreases by about two-thirds over time. In the 1991–1998 period, endowments are 14% less likely to invest in first-time funds, but only 5% less likely in the 1999–2006 period. Table 7 also shows that experienced LPs (regardless of type) are less likely to invest in first-time funds, with the gap again shrinking dramatically over time. Overall, these results suggest that to the extent endowments and experienced LPs enjoyed an advantage in access to more experienced partnerships (and, hence, less need to invest in first-time funds) in the 1991–1998 period, this advantage has attenuated substantially over time.

To test whether endowments, though less likely to invest in first-time funds, make better investment decisions when they do compared with other types of investors, we compare the returns of different classes of investors for funds of different sequence numbers. Table 8 presents estimates of equations that predict the returns of a particular fund, broken down by both time period and whether the fund was a first-time fund. In the 1991–1998 period, endowments outperform

other classes of investors substantially in their investments in later-sequence funds, with an 11.4 percentage point difference in IRR relative to non-endowments. In contrast, for first-time funds, the difference between endowments and other classes of investors is smaller (about 2.4 percentage points) and not statistically significantly different from zero.[13]

These results suggest that the superior returns to endowments were driven by their investments in experienced funds during the 1991–1998 period. Superior performance in experienced funds can in principle be driven both by access to the top funds and by skill at selecting good funds. We cannot rule out, therefore, that endowments' superior performance in experienced funds over 1991–1998 was due in part (or even in large part) to selection skill, even though they display no such skill in selecting among first-time funds. Even if so, however, Table 8 also shows that there is not a difference in endowments' performance compared with other LPs in any funds (first-time or experienced) in the 1999–2006 period. Overall, these results suggest that access to the experienced venture capital partnerships that did so well during the 1990s technology boom was the primary driver of endowments' superior performance in the 1990s.

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[13] To save space, Table 8 focuses on the IRR as a measure of performance. In unreported analysis, we confirm that conclusions are similar using multiples or implied PMEs.

Table 9

The probability of limited partners' investing in a fund with negative abnormal growth.

The table shows the probability of an limited partner (LP) type investing in a fund that did not grow as much as expected given its past return (negative abnormal growth). Two-stage regressions are used to predict this probability. Stage one predicts abnormal growth by estimating the following model with vintage year fixed effects. The unit of observation is a preceding or follow-on fund pair. The residual is the abnormal growth measure. A negative residual indicates that the fund did not grow as much as predicted given the preceding fund return.

$$Ln\left(\frac{Follow\text{-}on\ fund\ size}{Preceding\ fund\ size}+1\right)=\alpha+\beta \times Preceding\ fund\ IRR+Vintage\ FEs+Controls+\varepsilon \quad (1)$$

In stage two, probit models are used to predict the probability of an LP type investing in a fund with negative abnormal growth. The unit of observation is an LP investment in non-first-time fund. The dependent variable equals one if the residual term from the stage one regression is negative, and zero otherwise. *Preceding fund investment* is an indicator variable that equals one if the LP invested in the preceding fund, and zero otherwise. All other variables are defined in Tables 1 and 2. Marginal effects and robust standard errors clustered by fund are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable: Indicator variable for whether the investment is in a fund with negative abnormal growth	All funds			Venture funds			Buyout funds		
	Full Sample (1)	1991– 1998 (2)	1999– 2006 (3)	Full Sample (4)	1991– 1998 (5)	1999– 2006 (6)	Full Sample (7)	1991– 1998 (8)	1999– 2006 (9)
Endowments	0.05*	0.13***	0.02	0.06*	0.16***	0.02	0.01	0.08	-0.01
	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.06)	(0.05)
Corporate pension funds	−0.01	0.04	−0.03	0.02	0.07	0.01	0.02	0.12**	−0.03
	(0.02)	(0.05)	(0.03)	(0.04)	(0.05)	(0.04)	(0.03)	(0.05)	(0.05)
Advisors	−0.04*	0.01	−0.05*	−0.05	0.05	−0.07	−0.06**	−0.078*	−0.06**
	(0.02)	(0.05)	(0.02)	(0.04)	(0.06)	(0.05)	(0.03)	(0.05)	(0.03)
Insurance companies	−0.08***	−0.09	−0.08**	−0.08*	−0.04	−0.10*	−0.10***	−0.11**	−0.10**
	(0.03)	(0.05)	(0.03)	(0.05)	(0.07)	(0.06)	(0.03)	(0.05)	(0.04)
Banks/finance companies	−0.06**	−0.06	−0.06**	−0.03	0.02	−0.03	−0.10***	−0.04	−0.11***
	(0.02)	(0.04)	(0.03)	(0.03)	(0.05)	(0.04)	(0.03)	(0.04)	(0.03)
Investment firms	−0.03	0.03	−0.04*	−0.03	0.04	−0.04	−0.05**	−0.01	−0.06**
	(0.02)	(0.04)	(0.02)	(0.03)	(0.05)	(0.03)	(0.02)	(0.04)	(0.03)
Others	0.02	0.03	0.02	−0.02	0.06	−0.04	0.00	0.01	0.02
	(0.03)	(0.05)	(0.04)	(0.05)	(0.06)	(0.06)	(0.04)	(0.05)	(0.04)
Log fund size	−0.11***	−0.03	−0.13***	−0.14***	0.02	−0.18***	−0.12***	−0.07	−0.13***
	(0.03)	(0.06)	(0.03)	(0.04)	(0.07)	(0.05)	(0.03)	(0.05)	(0.04)
Log LP experience	0.00***	0.01**	0.00***	0.00	0.01	0.00	0.00*	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Preceding fund investment	0.12***	0.05	0.15***	0.11***	0.09*	0.12***	0.11***	0.03	0.14***
	(0.02)	(0.04)	(0.03)	(0.03)	(0.05)	(0.04)	(0.03)	(0.05)	(0.03)
Fund type fixed effects	Yes	Yes	Yes	–	–	–	–	–	–
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LP country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	10,823	2,326	8,497	4,322	906	3,434	6,501	1,420	5,063
Pseudo R^2	0.08	0.04	0.10	0.13	0.15	0.13	0.10	0.04	0.10
Difference between endowments and non-endowments	0.06**	0.15***	0.04	0.08***	0.14***	0.05	0.05	0.09	0.04
	(0.03)	(0.05)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.06)	(0.04)

6.2. Returns to investments in funds that are likely to be restricting access

We now present an alternative test of the importance of access to endowments' private equity performance from 1991 to 1998 in which we account for a broader implication of limiting access. Limited access to funds occurs when private equity partnerships choose to limit the amount of capital they raise for a particular fund and to ration capital to LPs of their choosing, instead of raising fees to the point where they can just raise the amount of capital they desire for the fund. As a consequence, some investors are not able to participate in the fund.

Theoretically, a fund will have limited access when its size does not grow sufficiently (compared with the size of the partnership's previous fund) to meet demand. Empirically, we cannot estimate demand separately from supply, but we can estimate the extent to which funds are likely to have limited

access by measuring which ones grew less than what is predicted from an econometric model of fund growth. We rely on a model similar to ones in the literature to calculate expected growth rates of private equity funds (see Chung, Sensoy, Stern, and Weisbach (2012)).

We estimate the following model:

$$Ln\left(\frac{Follow\text{-}on\ fund\ size}{Preceding\ fund\ size}+1\right)=\alpha+\beta$$
$$\times Preceding\ fund\ IRR+Vintage\ FEs+Controls+\varepsilon \quad (1)$$

The major factors affecting future fund size are the returns of the current fund and macroeconomic factors related to the state of the overall economy and the private equity industry. Therefore, we include the IRR of the partnership's prior fund in the equation and include vintage year fixed effects to control for macroeconomic

Table 10
Negative abnormal growth and fund returns.

  The table relates fund returns to the extent of abnormal growth in fund size from the partnership's prior fund. The unit of observation is a fund. The independent variable of interest is an indicator variable that equals one if the residual from Eq. (1) in Table 9 is negative, and zero otherwise. Coefficient estimates and robust standard errors clustered by vintage year are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Sample period	All funds			Venture funds			Buyout funds		
	1991– 2006 (1)	1991– 1998 (2)	1999– 2006 (3)	1991– 2006 (4)	1991– 1998 (5)	1999– 2006 (6)	1991– 2006 (7)	1991– 1998 (8)	1999– 2006 (9)
Panel A: Dependent variable: Fund IRR (%)									
Negative abnormal growth indicator	7.15***	20.85***	1.88	10.54**	43.84***	0.66	0.21	−3.93	2.23
	(2.76)	(2.73)	(1.55)	(4.95)	(16.44)	(1.38)	(1.99)	(4.01)	(2.25)
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	751	206	545	381	102	279	370	104	266
Adjusted R^2	0.16	0.04	0.13	0.25	0.06	0.07	0.26	0.19	0.29
Panel B: Dependent variable: fund multiple									
Negative abnormal growth indicator	0.48**	1.52***	0.05	0.79**	2.87***	0.07	−0.04	−0.27	0.05
	(0.21)	(0.46)	(0.06)	(0.39)	(0.98)	(0.05)	(0.07)	(0.17)	(0.06)
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	663	190	473	336	95	241	327	95	232
Adjusted R^2	0.15	0.06	0.08	0.22	0.07	0.05	0.32	0.26	0.33
Panel C: Dependent variable: fund implied PME									
Negative abnormal growth indicator	0.31**	0.99***	0.05	0.50**	1.87***	0.08	−0.04	−0.28	0.05
	(0.12)	(0.19)	(0.05)	(0.23)	(0.56)	(0.05)	(0.07)	(0.18)	(0.06)
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	649	176	473	327	86	241	322	90	232
Adjusted R^2	0.09	0.03	0.04	0.16	0.03	0.05	0.14	0.13	0.22

factors. We estimate this equation separately for buyout and venture capital funds.

  Because Eq. (1) predicts the expected size of the fund, its residuals represent departures from expected size. Therefore, any fund that has a negative residual has a negative "abnormal growth". We estimate equations that predict whether a particular LP's investment is in a fund with negative abnormal growth. The idea is that funds that have negative abnormal growth are more likely to have limited access, so that the residuals from Eq. (1) provide insight into which types of investors are more likely to invest in a fund with limited access.

  Table 9 presents estimates of these equations, for all types of funds in Columns 1 through 3, for venture funds in Columns 4 through 6, and for buyout funds in Columns 7 through 9. The estimates indicate that endowments are more likely than other LP types to invest in venture capital funds with negative abnormal growth in the 1991–1998 period, but not in the 1999–2006 period.[14] There is no difference in the propensity of different LP types to invest in negative-abnormal-growth buyout funds. This finding is consistent with the results reported above suggesting that endowments' access to the extremely successful venture capital funds in the 1991–1998 period is the primary driver of their superior performance.

  While funds that have negative abnormal growth are likely to have limited access for investors, it is unclear whether such limited access leads to better future performance. In principle,

the reason to limit capital in a fund is to be able to undertake fewer but higher-quality investments and to allow the fund's GPs to have sufficient time and energy to be able to manage them well. This argument predicts that funds that accept less capital than they otherwise could have raised could have superior performance than otherwise identical funds that did not limit their size. However, investment quality could be unaffected by fund growth rates. For this reason, we consider the issue empirically.

  To test this hypothesis, we examine whether abnormal growth of a fund is related to its performance.[15] Table 10 contains estimates of equations predicting fund returns as a function of abnormal growth. The main explanatory variable of interest is an indicator variable that equals one if there is negative abnormal growth [i.e., the residual from Eq. (1) is negative]. The unit of observation in this sample is the fund, not the LP investment as in most prior tables, and we include all funds for which we could calculate an abnormal growth.

  The estimated equations in Table 10 indicate that a clear association between abnormal growth and fund returns exists. Funds that grow more slowly than predicted by Eq. (1) earn higher returns in the 1991–1998 subperiod, regardless of which performance measure is used. This effect is driven entirely by venture funds; it does not exist for buyout funds in any period. Such slowly growing venture funds outperform other venture funds by 44 percentage points of IRR, and have an average PME 1.87 higher, during the 1991–1998 period. Thus, negative

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[14] We also find that endowments are more likely to invest in funds in the lowest quartile of abnormal growth than other LP types.

[15] See Chung (2012) for a related test.

Table A1

Top 15 endowments' investment performance, 1999–2006.

This table compares the top 15 endowments' investment performance to that of other limited partner (LP) types during the 1999–2006 period. The unit of observation is an LP investment. The dependent variable is fund internal rate of return (IRR) (%) in Columns 1, 4, and 7, fund multiple in Columns 2, 5, and 8, and fund implied public market equivalent (PME) in Columns 3, 6, and 9. *Top 15 Endowments* is an indicator variable that equals one if the endowment is one of the 15 largest endowments as of the end of 2011 and zero otherwise. All other variables are defined in Table 5. The omitted LP type is public pension funds. Standard errors clustered by fund are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable:	All funds			Venture funds			Buyout funds		
	Fund IRR (1)	Fund multiple (2)	Fund implied PME (3)	Fund IRR (4)	Fund multiple (5)	Fund implied PME (6)	Fund IRR (7)	Fund multiple (8)	Fund implied PME (9)
Top 15 endowments	0.53	0.02	0.02	1.04	0.04	0.04	0.69	0.02	0.01
	(0.79)	(0.03)	(0.03)	(0.92)	(0.03)	(0.03)	(1.07)	(0.04)	(0.03)
Other endowments	−0.24	−0.00	−0.00	−0.08	−0.02	−0.02	−0.12	0.02	0.02
	(0.73)	(0.0)	(0.03)	(0.87)	(0.03)	(0.03)	(0.92)	(0.04)	(0.03)
Corporate pension funds	−0.99	−0.04*	−0.03*	−1.28	−0.08***	−0.07**	−0.82	−0.02	−0.01
	(0.62)	(0.02)	(0.02)	(0.84)	(0.03)	(0.03)	(0.74)	(0.03)	(0.02)
Advisors	0.38	−0.00	−0.00	−0.11	−0.04	−0.03	0.71	0.02	0.02
	(0.71)	(0.02)	(0.02)	(0.80)	(0.03)	(0.03)	(0.95)	(0.03)	(0.03)
Insurance companies	−0.05	−0.03	−0.02	−0.24	−0.07*	−0.05	−0.11	−0.00	−0.00
	(0.74)	(0.03)	(0.02)	(0.89)	(0.04)	(0.03)	(0.97)	(0.03)	(0.03)
Banks/finance companies	−0.11	−0.03	−0.02	−0.06	−0.04	−0.03	−0.33	−0.03	−0.02
	(0.60)	(0.02)	(0.02)	(0.68)	(0.03)	(0.02)	(0.80)	(0.03)	(0.02)
Investment firms	−0.00	−0.01	−0.00	−0.19	−0.02	−0.01	0.28	−0.00	0.00
	(0.55)	(0.02)	(0.02)	(0.63)	(0.02)	(0.02)	(0.66)	(0.02)	(0.02)
Others	0.24	−0.00	0.00	1.62	0.04	0.04	−0.84	−0.04	−0.03
	(0.82)	(0.03)	(0.03)	(1.07)	(0.04)	(0.03)	(1.11)	(0.04)	(0.04)
Log LP experience	0.26	0.01*	0.01*	0.34	0.01	0.01	−0.01	0.01	0.01
	(0.23)	(0.01)	(0.01)	(0.25)	(0.01)	(0.01)	(0.28)	(0.01)	(0.01)
Log fund size	−0.24	−0.03	−0.03	1.13	0.01	0.01	−0.06	−0.01	−0.01
	(0.65)	(0.03)	(0.02)	(0.70)	(0.03)	(0.03)	(0.81)	(0.03)	(0.03)
Fund type fixed effects	Yes	Yes	Yes	–	–	–	–	–	–
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LP country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional fund risk controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	10,695	9,627	9,627	4,378	3,934	3,934	6,317	5,693	5,693
Adjusted R^2	0.36	0.34	0.30	0.10	0.08	0.06	0.41	0.40	0.31
Difference between top 15 endowments and all other LP types	0.63	0.03	0.02	1.20	0.07**	0.06*	0.76	0.02	0.01
	(0.69)	(0.03)	(0.02)	(0.82)	(0.03)	(0.03)	(0.95)	(0.04)	(0.03)

Table A2

Harvard and Yale investment performance, 1999–2006.

This table compares the investment performance of Harvard and Yale (the top two endowments) with that of other limited partner (LP) types during the 1999–2006 period. The unit of observation is an LP investment. The dependent variable is fund internal rate of return (IRR) (%) in Columns 1, 4, and 7, fund multiple in Columns 2, 5, and 8, and fund implied public market equivalent (PME) in Columns 3, 6, and 9. *Harvard and Yale* is an indicator variable that equals one if the endowment is either Harvard or Yale and zero otherwise. All other variables are defined in Table 5. The omitted LP type is public pension funds. Standard errors clustered by fund are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable:	All funds			Venture funds			Buyout funds		
	Fund IRR (1)	Fund multiple (2)	Fund implied PME (3)	Fund IRR (4)	Fund multiple (5)	Fund implied PME (6)	Fund IRR (7)	Fund multiple (8)	Fund implied PME (9)
Harvard and Yale	1.59	0.03	0.03	2.29*	0.07	0.06	1.30	0.02	0.01
	(1.41)	(0.06)	(0.05)	(1.34)	(0.06)	(0.05)	(1.82)	(0.07)	(0.06)
Other endowments	−0.13	0.00	0.00	0.12	−0.01	−0.01	0.02	0.02	0.02
	(0.67)	(0.03)	(0.02)	(0.79)	(0.03)	(0.03)	(0.86)	(0.03)	(0.03)
Corporate pension funds	−0.89	−0.04*	−0.03*	−1.26	−0.07***	−0.07**	−0.82	−0.02	−0.01
	(0.61)	(0.02)	(0.02)	(0.84)	(0.03)	(0.03)	(0.74)	(0.03)	(0.02)
Advisors	0.39	−0.00	−0.00	−0.09	−0.04	−0.03	0.72	0.02	0.02
	(0.71)	(0.02)	(0.02)	(0.80)	(0.03)	(0.03)	(0.95)	(0.03)	(0.03)
Insurance companies	−0.04	−0.03	−0.02	−0.22	−0.07*	−0.05	−0.10	−0.00	−0.00
	(0.74)	(0.03)	(0.02)	(0.89)	(0.04)	(0.03)	(0.97)	(0.03)	(0.03)
Banks/finance companies	−0.10	−0.03	−0.02	−0.02	−0.04	−0.03	−0.32	−0.03	−0.02
	(0.60)	(0.02)	(0.02)	(0.67)	(0.03)	(0.02)	(0.80)	(0.03)	(0.02)
Investment firms	0.00	−0.01	−0.00	−0.17	−0.01	−0.01	0.29	−0.00	0.00
	(0.55)	(0.02)	(0.02)	(0.63)	(0.02)	(0.02)	(0.66)	(0.02)	(0.02)

Table A2 (*continued*)

Dependent variable:	All funds			Venture funds			Buyout funds		
	Fund IRR (1)	Fund multiple (2)	Fund implied PME (3)	Fund IRR (4)	Fund multiple (5)	Fund implied PME (6)	Fund IRR (7)	Fund multiple (8)	Fund implied PME (9)
Others	0.26	−0.00	0.00	1.68	0.04	0.04	−0.82	−0.04	−0.03
	(0.83)	(0.03)	(0.03)	(1.07)	(0.04)	(0.03)	(1.11)	(0.04)	(0.04)
Log LP experience	0.27	0.02**	0.01**	0.37	0.01	0.01	0.01	0.01	0.01
	(0.22)	(0.01)	(0.01)	(0.26)	(0.01)	(0.01)	(0.27)	(0.01)	(0.01)
Log fund size	−0.24	−0.03	−0.03	1.12	0.01	0.00	−0.06	−0.01	−0.01
	(0.65)	(0.03)	(0.02)	(0.70)	(0.03)	(0.03)	(0.81)	(0.03)	(0.03)
Fund type fixed effects	Yes	Yes	Yes	–	–	–	–	–	–
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LP country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional fund risk controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	10,695	9,627	9,627	4,378	3,934	3,934	6,317	5,693	5,693
Adjusted R^2	0.36	0.34	0.30	0.10	0.08	0.06	0.41	0.40	0.31
Difference between Harvard and Yale and all other LP types	1.67	0.04	0.03	2.37	0.09*	0.08**	1.35	0.02	0.01
	(1.32)	(0.05)	(0.05)	(1.30)	(0.05)	(0.05)	(1.70)	(0.07)	(0.06)

abnormal growth, which likely reflects limited access to a fund, is associated with unusually good performance among venture capital funds during the 1991–1998 period. This finding is consistent with the argument that there were extremely high returns to having access to the top venture funds during this period and that the exceptional performance of endowments at this time is largely due to their access to these funds.

7. Conclusion

Since the modification of the Prudent Man rule in 1978 that allowed institutional investors to allocate part of their portfolios to alternative assets, the private equity industry has changed substantially. In 1980, the largest fund raised was the Golder-Thoma $60 million fund that invested in many different kinds of deals, including both venture capital and buyouts. At the time, institutional investors were somewhat skeptical of the industry; GPs, LPs, and portfolio firms were experimenting with different contractual structures; and "private equity" itself was not an accepted term. By the time of the 2008 financial crisis, individual funds of over $20 billion were being raised, and funds became specialized in particular types of investments so that renewable energy or infrastructure funds were commonplace. Contracts have become standardized, and private equity has become an accepted part of the financial world in which most major business schools teach courses. Private equity has even become a topic for debate in presidential campaigns.

It is natural that such maturing of an industry can lead to changes in the fundamental relations between participants. In the private equity industry, the major participants are the limited partners, the general partners, and the portfolio companies. In this paper we explore the relationship between limited partners and general partners by focusing on access to funds and the way in which it has changed over recent years. An overarching hypothesis is that the fundamental changes brought on by the maturing of the private equity industry have changed the nature of relations between limited partners and general partners in private equity.

We examine this hypothesis empirically with special attention to the unusually good performance earned by endowments shown by Lerner, Schoar, and Wongsunwai (2007). To do so, we gather a sample of 1,852 LPs' stakes in 1,250 buyout and venture funds between 1991 and 2006, which is substantially larger than any previous sample of LP stakes. We start by showing changes in returns brought on by the maturing of the industry. Consistent with prior work, we find an industry-wide decline in returns and a decline in the relations between GP experience and return. These results are driven by the venture portion of the private equity industry.

We also confirm the Lerner, Schoar, and Wongsunwai (2007) finding that endowments outperform other investor classes during the 1991–1998 period. We argue that this unusually good performance was likely due to endowments' access to the best funds during this period, rather than superior skill at picking funds, for three reasons.

First, the superior performance demonstrated during 1991–1998 did not continue subsequently. During the 1999–2006 period, endowments' performance in their private equity investments was very similar to that of other investor classes. The unusual performance was limited to venture funds that benefited from the technology boom of the 1990s. The performance of endowments' investments in buyout funds was similar to that of other investor types. Presumably, superior skill would have manifested itself in other kinds of funds as well.

Second, endowments' reinvestment decisions are not consistently better than that of other investors, especially over time. In the venture sector during the 1991–1998 bull market, even if endowments had made random reinvestment decisions or had invested only in the fund families for which they chose not to invest, they still would have earned close to a 60% IRR on those investments and outperformed other classes of investors.

Table A3

Top 15 public pension funds investment performance, 1999–2006.

This table compares the top 15 public pension funds' investment performance to that of other limited partner (LP) types during the 1999–2006 period. The unit of observation is an LP investment. The dependent variable is fund internal rate of return (IRR) (%) in Columns 1, 4, and 7, fund multiple in Columns 2, 5, and 8, and fund implied public market equivalent (PME) in Columns 3, 6, and 9. *Top 15 public pensions* is an indicator variable that equals one if the public pension fund is one of the five largest endowments as of the end of 2011 and zero otherwise. All other variables are defined in Table 5. The omitted LP type is endowments. Standard errors clustered by fund are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable:	All Funds			Venture Funds			Buyout Funds		
	Fund IRR	Fund multiple	Fund implied PME	Fund IRR	Fund multiple	Fund implied PME	Fund IRR	Fund multiple	Fund implied PME
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Top 15 public pensions	−0.38	0.01	0.01	−0.42	0.03	0.03	−0.69	−0.02	−0.01
	(0.88)	(0.03)	(0.03)	(1.01)	(0.04)	(0.04)	(1.10)	(0.04)	(0.04)
Other pension funds	−0.27	−0.02	−0.02	−0.66	−0.02	−0.02	−0.43	−0.03	−0.03
	(0.57)	(0.02)	(0.02)	(0.73)	(0.03)	(0.03)	(0.74)	(0.03)	(0.03)
Advisors	0.38	−0.01	−0.00	−0.28	−0.03	−0.02	0.54	−0.00	0.00
	(0.77)	(0.03)	(0.03)	(0.94)	(0.04)	(0.03)	(1.03)	(0.04)	(0.03)
Insurance companies	−0.06	−0.03	−0.02	−0.42	−0.06	−0.04	−0.33	−0.03	−0.02
	(0.83)	(0.03)	(0.03)	(1.01)	(0.04)	(0.03)	(1.09)	(0.04)	(0.04)
Banks/finance companies	−0.11	−0.03	−0.03	−0.22	−0.03	−0.02	−0.53	−0.05	−0.04
	(0.66)	(0.03)	(0.02)	(0.72)	(0.03)	(0.02)	(0.95)	(0.04)	(0.03)
Investment firms	−0.02	−0.01	−0.01	−0.38	−0.01	−0.00	0.06	−0.03	−0.02
	(0.59)	(0.02)	(0.02)	(0.70)	(0.03)	(0.02)	(0.79)	(0.03)	(0.03)
Others	0.28	−0.01	−0.00	1.52	0.05	0.05	−0.98	−0.06	−0.05
	(0.80)	(0.03)	(0.03)	(1.04)	(0.03)	(0.03)	(1.07)	(0.05)	(0.04)
Log LP experience	0.31	0.02*	0.01*	0.41	0.01	0.01	0.04	0.01	0.01
	(0.23)	(0.01)	(0.01)	(0.26)	(0.01)	(0.01)	(0.28)	(0.01)	(0.01)
Log fund size	−0.24	−0.03	−0.03	1.11	0.01	0.01	−0.06	−0.01	−0.01
	(0.65)	(0.03)	(0.02)	(0.70)	(0.03)	(0.03)	(0.81)	(0.03)	(0.03)
Fund type fixed effects	Yes	Yes	Yes	–	–	–	–	–	–
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LP country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional fund risk controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	10,695	9,627	9,627	4,378	3,934	3,934	6,317	5,693	5,693
Adjusted R^2	0.36	0.34	0.30	0.10	0.07	0.06	0.41	0.40	0.31
Difference between top 15 public pension plans and all other LP types	−0.25	0.02	0.02	0.06	0.05	0.04	−0.47	0.00	0.01
	(0.71)	(0.03)	(0.02)	(0.89)	(0.04)	(0.03)	(0.86)	(0.03)	(0.03)

Third, even in the 1991–1998 period, endowments did not outperform other investor classes in their investments of first-time funds, for which access is unlikely to be limited and so represent a pure test of selection skill. Moreover, direct tests of access using abnormal growth of fund assets to measure limited access reveal that endowments were more likely to invest in venture funds with limited access during the 1991–1998 period and that these funds (venture funds with limited access during the 1991–1998 period) had unusually good performance.

Major changes clearly have occurred in private equity industry in recent years. We argue that the industry's maturing has had implications for the relations between GPs and LPs. The evidence presented here suggests that the huge inflows of capital and commoditization of the industry has lowered the rents to GPs. In addition, the evidence suggests that because limited access reflected the sharing of these rents, the importance of limited access decreased as well.

The private equity industry has become an important part of institutional portfolios. Yet, it has always been an industry that has been evolving at a rapid rate. Going forward, it is important for industry participants to understand the current state of the industry. Because of the industry's changes, past performance is unlikely to predict future performance. The enormous inflows of capital together with the increasing commonality of experience and knowledge of GPs have likely permanently changed the relations between GPs and LPs, and potentially investors' expected returns as well.

Appendix A

This appendix provides analyses of the private equity investment performance of the largest endowments and public pension funds compared with that of other LP types. To test for the possibility that the top endowments outperform other types of investors even if endowments as a whole do not, we create an indicator variable based on the size of the endowment or public pension plan as of the end of 2011.[16]

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[16] Information on endowments' size is obtained from Wikipedia, which lists the size of endowments greater than $1billion from 2005 to 2012. "List of Colleges and Universities in United States by Endowment," in *Wikipedia: The Free Encyclopedia;* See http://en.wikipedia.org/wiki/List_of_colleges_and_universities_in_the_United_States_by_endowment. To verify the list of top 15 endowments from Wikipedia, we also check other sources such as CBS news and MarketWatch. Information on public

Estimates of investment performance during the 1999–2006 period for the top 15 and top two (Harvard and Yale) endowments, respectively, are reported in Tables A1 and A2. There is no statistically significant outperformance of top endowments when performance is measured using the IRR. However, restricting attention only to venture capital investments, top 15 endowments have a marginally statistically significant 0.07 higher fund multiple and 0.06 higher implied PME than other types of LPs. Harvard and Yale outperform other LP types slightly in venture capital investments during the 1999–2006 period. These magnitudes are small compared with those for the 1991 to 1998 period reported in Panel B of Table 5.

We repeat the analysis for the top 15 public pension funds in Table A3. These results suggest that the top 15 pension funds do not perform differently than other LP types during the 1999–2006 period.

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(*footnote continued*)
pension fund size is obtained from Pension & Investments and Towers Watson.