Private Equity Performance:

Returns, Persistence and Capital Flows

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Abstract

This paper investigates the performance and capital inflows of private equity partnerships. Average fund returns (net of fees) approximately equal the *S&P 500* although there is substantial heterogeneity across funds. Returns persist strongly across different funds raised by a partnership. Better performing partnerships are more likely to raise follow-on funds and larger funds. This relationship is concave so that top performing partnerships grow proportionally less than average performing partnerships. At the industry level, market entry and fund performance is cyclical; however, established funds are less sensitive to cycles than new entrants. Several of these results differ markedly from those for mutual funds.

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The private equity industry, primarily venture capital (VC) and buyout (LBO) investments, has grown tremendously over the last decade. While investors committed less than $10 billion to private equity partnerships in 1991, they committed more than $180 billion at the peak in 2000.[1] Despite the increased investment in the private equity asset class and the potential importance of private equity investments for the economy as a whole, we have only a limited understanding of private equity returns, capital flows, and their interrelation. One of the main obstacles has been lack of available data. Private equity, as the name suggests, is largely exempt from public disclosure requirements.

In this paper, we make use of a novel data set of individual fund performance collected by Venture Economics.[2] The Venture Economics data set is based on voluntary reporting of fund returns by the private equity firms (or general partners) as well as their limited partners. We study three issues with this data set that have not been closely examined before.

First, we investigate the performance of private equity funds. On average, LBO fund returns net of fees are slightly less than those of the *S&P 500*; VC fund returns are lower than the *S&P 500* on an equal-weighted basis, but higher than the *S&P 500* on a capital weighted basis.[3] These results combined with previous evidence on private equity fees, however, suggest that on average, both types of private equity returns exceed those of the *S&P 500* gross of fees. We also find large heterogeneity in returns across funds and time.

Second, we document substantial persistence in LBO and VC fund performance. General partners (GPs) whose funds outperform the industry in one fund are likely to outperform the industry in the next and vice versa. We find persistence not only between two consecutive funds, but also between the current fund and the second previous fund. These findings are markedly different from the results for mutual funds, where persistence has been difficult to detect and, when detected, tends to be driven by persistent underperformance rather than overperformance.[4] We investigate whether selection biases, risk differences, or industry differences can explain the results and conclude

[1] See Jesse Reyes, Private Equity Overview and Update 2002.

[2] We thank Jesse Reyes from Venture Economics for making the data available.

[3] These results and most of the analyses that follow do not explicitly adjust for differences in systematic risk or liquidity risk. We discuss this in some detail in the text.

[4] See Carhart et al.(2002) for a comprehensive review of this topic and Berk and Green (2003) for a model of mutual funds returns and capital flows. Our findings on persistence also differ from those for hedge funds, which provide little or modest evidence of persistence. See Bares, Gibson, and Gyger (2002), Brown, Goetzman and Ibbotson (1999), Edwards and Cagalyan (2001), and Kat and Menexe (2002).

that they are unlikely to do so.

Third, we study the relation of fund performance to capital flows, fund size and overall GP survival. We analyze the relation of a fund's track record to capital flows into individual GPs and the industry overall. Fund flows are positively related to past performance. In contrast to the convex relationship in the mutual fund industry, however, the relationship is concave in private equity (see Chevalier and Ellison (1997), Sirri and Tufano (1998) and Chen et al. (2003)). Similarly, new partnerships are more likely to be started in periods after the industry has performed especially well. But funds and partnerships that are raised in boom times are less likely to raise follow-on funds, suggesting that these funds perform poorly. A larger fraction of fund flows during these times, therefore, appears to go to funds that have lower performance, rather than top funds. Finally, the dilution of overall industry performance in periods when many new funds enter is mainly driven by the poor performance of new entrants. The performance of established funds is less affected.

In the last section of the paper, we discuss possible explanations for our findings. Underlying heterogeneity in general partners' skill and quality could lead to heterogeneity in performance and to more persistence if new entrants cannot compete effectively with existing funds. Several forces might make it difficult to compete with established funds. First, many practitioners assert that unlike mutual fund and hedge fund investors, private equity investors have proprietary access to particular transactions, i.e., "proprietary deal flow." In other words, better GPs may be able to invest in better investments. Second, private equity investors typically provide management or advisory inputs along with capital. If high-quality general partners are scarce, differences in returns between funds could persist.[5] Third, there is some evidence that better VCs get better deals terms (e.g., lower valuations) when negotiating with start-ups (see the paper by Hsu (2002)). A start-up would be willing to accept these terms if some investors provided superior management, advisory, or reputational inputs.

If heterogeneity in GP skills drives the persistence results, it is puzzling that the returns to superior skill are not appropriated by the GPs through higher fees and larger funds, as has been suggested for mutual funds (see Berk and Green (2003)). From Gompers and Lerner (1999), we know that compensation was relatively homogeneous during our sample period. Most funds used a compensation scheme of a 1.5% to 2.5% annual management fee and a 20% carried interest or

[5]See Hellman and Puri (2002) and Kaplan and Stromberg (2004).

share of the profits. To the extent that there are systematic differences, Gompers and Lerner (1999) find that profit shares are higher for older and larger GPs the GPs that tend to perform well. Alternatively, GPs could try to increase their compensation by growing the size of the fund.[6] But we find that on average, the top performing funds grew proportionally slower than the lower performing funds in our sample period.

Our results suggest that competitive forces did not drive away persistence in our sample period. It is possible these results will not survive the late 1990s, a period of substantial growth in fund size and increases in the carried interest of top performing VC funds. Unfortunately, the net effect of these changes will not be clear for several years until the returns of those funds have been realized.[7]

I. Related Literature on Private Equity

Private equity investing is typically carried out through a limited partnership structure in which the private equity firm serves as the general partner (GP). The limited partners (LPs) consist largely of institutional investors and wealthy individuals who provide the bulk of the capital. The LPs commit to provide a certain amount of capital to the fund. The GP then has an agreed time period in which to invest the committed capital - usually on the order of five years. The GP also has an agreed time period in which to return capital to the LPs - usually on the order of ten to twelve years in total. Each fund or limited partnership, therefore, is essentially a closed end fund with a finite life. When the GP exhausts a substantial portion of a fund's committed capital, the GP typically attempts to obtain commitments for a subsequent (and separate) fund.

There is a growing literature studying the economics of the private equity industry. Most of those studies either have focused on aggregate trends in private equity or on the relation between GPs and entrepreneurs. This restriction is mainly due to the difficulty of obtaining information on individual fund performance. Two recent exceptions are Jones and Rhodes-Kropf (2003) and Ljungqvist and Richardson (2003) who study private equity returns at the fund level. We discuss their results and the comparison to the current study in some detail in our section describing average returns.

[6] For related evidence for mutual funds, see Chen et al. (2003).

[7] Interestingly, in the last several years, many of the top VCs have voluntarily returned large fractions of the committed capital in their most recent funds to their limited partners, most likely because of concern of the effect of poor performance on their reputations.

Gompers and Lerner (1998) look at aggregate performance and capital flows. The authors find that macroeconomic factors like past industry performance and overall economic performance as well as changes in the capital gains tax or ERISA provisions are related to increased capital flows into private equity.

Cochrane (2003) characterizes VC returns based on the economics of individual investments in portfolio companies. He finds that venture returns are very volatile; later stage deals have less volatility than early stage deals; returns have a market risk or beta of 1.7; and (arithmetic) returns (gross of fees) shows a highly positive alpha (32% per year) over his sample period.

Papers that focus on the relation between general partners and entrepreneurs include Kaplan and Stromberg (2003) who document the structure of incentive contracts between VCs and entrepreneurs. Gompers and Lerner (2000) suggest that the valuation of individual deals is affected by overall macroeconomic conditions and the degree of competition in the VC industry.

II. Data

The data for this study have been obtained from Venture Economics. Venture Economics collects quarterly information on individual funds in the private equity industry. The data set is based on voluntary reporting of fund information by the GPs as well as by their LPs. Venture Economics claims that because they receive information from both the GPs and LPs, there is "little opportunity for inconsistent reporting." Given the private nature of the data, we cannot validate this statement. However, we believe that if there is a bias it would most likely take the form of under-reporting by worse-performing funds. If such a bias were present, this would create an upward bias on our results on average returns. As we argue later, we believe such a bias also would create a downward bias on persistence. After presenting our main results, we discuss and test for this and other potential biases in the data.

The sample covers the years 1980 to 2001. Because of the rapid industry growth in the 1990s, the earlier years contain relatively fewer fund observations. The Venture Economics data for each fund include the quarterly performance measures. These measures are the internal rate of return (IRR), the cumulative total value to paid-in capital (TVPI), and the distributed total value to paid-in capital (DPI). Venture Economics also collects the quarterly cash flows in and out of each fund for the life of the fund or through the end of 2001. All these performance measures, as well

as the cash flows, are reported net of management fee and carried interest. We do not know the identities of the particular GPs, but we do know the sequence number of each fund, i.e., if the fund is the first, second, etc. raised by the particular GP.

Throughout the paper, we use two samples of the data. In the main part of the analysis, we include funds: (1) that have been officially liquidated; or (2) whose returns are unchanged for at least the final six quarters we observe; and (3) whose reported unrealized value is less than 10% of committed capital. These criteria should ensure that the funds we include are largely liquidated and that the performance measures we calculate are based almost entirely on cash flows to LPs rather than subjective estimates of value by the GPs. We also exclude funds with less than $5 million of committed capital in 1990 dollars to focus on economically meaningful funds. We obtain 746 funds that satisfy these criteria, consisting largely of funds started before 1995.

We also use a larger sample of funds that have either been officially liquidated or were started before 1997. Again we exclude funds with less than $5 million of committed capital in 1990 dollars. Using these sample selection criteria, we obtain a sample of 1090 funds. Because these funds are not all fully realized and we cannot reliably calculate performance for all the funds, we use the Venture Economics reported IRRs. This sample is less likely to be subject to the look ahead bias described in Carhart et al. (2002). We report most of our results using the smaller sample. Unless otherwise noted, however, our findings are qualitatively unchanged when we use the second, larger sample.

Finally, in the analysis of persistence, we also use fund performance data that have recently been made public by several large public LPs (CALPERS, University of California, UTIMCO, and the University of Michigan). These sources yield only 150 funds that have been largely liquidated and include 42 GPs with more than one liquidated fund in the sample. (We only use funds raised before 1998 to proxy for liquidation because these sources do not provide explicit information about whether a fund has been liquidated). For these funds, IRRs are reported, but cash flows are not, making it impossible to verify the IRRs and make any market adjustments. The disadvantages of this sample are that the data quality is relatively poor, the sample size is small, and the LPs may not be representative. The advantage, however, is that there is no question of selective GP reporting.

III. Descriptive Statistics

Columns (1) to (3) of Table 1 report descriptive statistics for the sub-sample of 746 funds that are largely liquidated and for which we have calculated performance measures. Roughly 78% of the funds are VC funds while 22% are LBO funds. To get a sense of potential selection bias in our sample of fund returns, columns (4) to (6) of Table 1 report the same statistics for all 1814 funds that are described in Venture Economics as having been raised before 1995. We exclude funds that have a vintage year of 1995 or later to match the sample period of the funds we use in our analyses. Our sub-sample covers about 40% of the funds in Venture Economics over the same time period. Roughly 50% of the funds raised do not provide performance data. The remaining 10% of the funds are not fully liquidated. The funds for which we have performance measures are larger on average than the funds in the full sample.

The average size of the funds in our sample is $172 million (all figures in 1990 dollars), with VC funds being substantially smaller than LBO funds, $103 million versus $416 million. These compare to average fund size in the full sample of $116 million for all funds, $53 million for VC funds, and $262 million for LBO funds. These averages imply that our performance sample includes 88% of capital committed to VC funds and 49% of capital committed to LBO funds.[8]

Table 1 also documents the fraction of first, second and third time funds in the two samples. In the sample with returns, 41% of the funds are first time funds, 23% are second time funds and 14% are third time funds. The remaining 22% are funds with higher sequence numbers. The corresponding percentages for the full sample are similar: 40% are first time funds, 21% are second time funds, 13% are third time funds, and 25% are funds with higher sequence numbers.

One potential bias in our returns sample, therefore, is toward larger funds. We also over-sample first time funds for buyouts. As we show later, larger funds tend to outperform smaller ones, potentially inducing an upward bias on the performance of funds for which we have returns. Also, first-time funds do not perform as well as higher sequence number funds. Therefore, our results for average returns should be interpreted with these potential biases in mind. We will address these issues in more detail in the next section.

[8] As mentioned previously, we obtain similar results with the larger sample of 1090 funds. That larger sample includes 92% of capital committed to VC funds and 54% of capital committed to LBO funds for all funds started before 1997.

A. Private Equity Performance

In this section, we describe private equity performance and compare it to the performance of the *S&P 500*. We do not attempt to adjust for differences in systematic risk in these basic analyses.[9] We report performance at the fund level in three ways: (1) the IRR of the funds calculated by Venture Economics, (2) the IRR of the funds that we calculate ourselves using the funds' cash flows, (3) the public market equivalent (PME). The PME compares an investment in a private equity fund to an investment in the *S&P 500*. We implement the PME calculation by investing (or discounting) all cash outflows of the fund at the total return to the *S&P 500* and comparing the resulting value to the value of the cash inflows (all net of fees) to the fund invested (discounted) using the total return to the *S&P 500*. A fund with a PME greater than one outperformed the S&P 500 (net of all fees). We (not Venture Economics) perform the PME calculations using fund cash flows.

We think PME is a sensible measure for LPs as it reflects the return to private equity investments relative to public equities. For example, a private equity fund investing $50 million in March 1997 and realizing $100 million in March 2000 would have generated an annualized IRR of 26%. However, a limited partner would have been better off investing in the *S&P 500* because $50 million in the *S&P 500* would have grown to $103.5 million over that period. The PME of 0.97 (or 100 / 103.5) for this investment reflects the fact that the private equity investment would have underperformed the *S&P 500*. Alternatively, a private equity fund investing $50 million in March 2000 and realizing $50 million in March 2003 would have generated an IRR of 0%. However, a limited partner would have been better off investing in the private equity fund because $50 million invested in the *S&P 500* would have declined to $29.5 million over that period. The PME of 1.69 (or 50 / 29.5) for this investment reflects the fact that the private equity investment would have outperformed the *S&P 500*.

Before proceeding, we want to come back to the issue of PME and systematic risk or beta. If private equity returns have a beta greater (less) than one, PME will overstate (understate) the true risk-adjusted returns to private equity. In most of our measures of performance, we do not attempt to make more complicated risk adjustments than benchmarking cash flows with the

[9] This is a realistic if not appropriate comparison for institutional investors who invest in private equity expecting returns to exceed public equity returns. We address issues of risk adjustment in the following section.

S&P 500 because of the lack of true market values for fund investments until the investments are exited. Instead in the analysis that follows, particularly the persistence regressions, we consider how differences in risk might affect our results and attempt to control for observable differences such as industry composition and stage of investment.

Table 2 reports the three different performance measures for all private equity funds, VC funds only, and LBO funds for the 746 funds with largely complete cash flow data. The first number in each cell is the median return; the next is the average return; followed by the standard deviation. The last row in each cell contains the returns at the 25th and 75th percentile.

Panel A of Table 2 reports the performance measures on an equal weighted basis while panel B reports them on a commitment value- or fund size-weighted basis. Panel A indicates that the equal-weighted median and average IRRs reported by Venture Economics over the sample period are 12% and 17%, respectively. Returns to LBO funds are slightly higher than the returns to VC funds. The IRRs that we calculate from the cash flows are virtually identical. Panel A also indicates that the median and average funds have PMEs of 0.74 and 0.96, respectively, indicating that private equity has returned slightly less then an investment in the *S&P 500* over the sample period. The average PMEs to VC and LBO funds are roughly the same at 0.96 and 0.97.

Finally, the table is suggestive of one additional quality of private equity returns. There are large differences in the returns of individual funds. The funds at the 25th percentile show a cash flow IRR of 3% while the funds at the 75th percentile exhibit a cash flow IRR of 22% per year. The amount of variation seems qualitatively similar for all performance measures, and is greater for VC funds alone.

The value-weighted performance in Panel B of Table 2 exceeds the equal-weighted performance. The Venture Economics IRRs are a median 14% and average 18% while the cash flow IRRs are a median of 12% and an average of 18%. The PMEs increase to a median of 0.82 and an average of 1.05, indicating that an investment in private equity slightly outperforms the *S&P 500* on average. There is a substantial difference between the average PMEs for VC and LBO funds. VC funds have average PMEs of 1.21 while buyout funds have average PMEs of 0.93. This difference is driven by the fact that the larger VC funds of the 1990s outperformed the smaller VC funds of the 1980s while the opposite was true for LBO funds.

It is worth pointing out that the average returns net of fees of 0.96 (equal-weighted) and 1.05

(value-weighted) suggest that the average returns to private equity gross of fees in both cases exceed the *S&P 500*. While we do not have information on GP compensation in individual funds, we know from Gompers and Lerner (1999) that GP compensation was fairly uniform during our sample period. They find that the carried interest or profit share for VC funds is almost always 20%. (Subsequently, some of the more successful VC funds have raised their profit share to 25% and 30%.) Our discussions with industry participants indicate that the same is true for the LBO funds in our sample. Gompers and Lerner (1999) also find that the discounted value of management fees for VC funds (discounted at 10%) equals 16% to 19% of committed capital. Conservatively, the management fees would reduce the denominator of PME by 8% (half of the Gompers and Lerner estimate) while adding back the private equity profit share of 20% would increase the numerator by at least 5%. The effect of these two adjustments is to increase the net PME by at least 13% leading to gross PMEs well above one, both on an equal- and value-weighted basis for both VC and LBO funds.

Table 3 presents performance results for the 1090 funds in the larger sample. To put all the funds on an equal footing, we use the IRR calculated by Venture Economics five years after the fund began. We also report the TVPI calculated by Venture Economics five years after the fund began where TVPI is the ratio of cumulative total value: distributed value plus estimated residual value to paid-in capital. These results reflect a somewhat greater number of more recent funds. Relative to the results for the smaller (less recent) sample, Table 3 shows that the VC returns are somewhat higher and the LBO returns somewhat lower reflecting the performance of more recent funds included in this sample. The TVPI results in Table 3 also indicate that the average private equity fund returns roughly twice the capital committed to it.

B. Performance Correlations

Tables 2 and 3 present five different measures of performance. Table 4 shows the correlations of those performance measures for the sample of 746 funds for which we can calculate all five measures. All five measures are highly correlated. For example, the IRR we calculate from cash flows is strongly positively correlated with the IRR calculated by Venture Economics (at 0.98). PME is strongly correlated with both the IRR calculated by Venture Economics and the IRR we calculate (at 0.88). These results suggest that our IRR and PME calculations accurately reflect

the actual performance of the funds. Finally, the IRR calculated by Venture Economics for a fund after 5 years of existence also is strongly positively correlated with PME (at 0.86) and the IRR we calculate from actual cash flows (at 0.89). This suggests that calculated performance five years out is a strong indication of final or ultimate fund performance.

In the persistence and fundraising analyses that follow, we use PME and the IRR that we calculate from cash flows. As we mentioned earlier, we repeat all our tests using both Venture Economics IRR measures, the final IRR and the five-year IRR and obtain qualitatively and statistically similar results.

C. Industry Returns Over Time

The performance of private equity overall in Tables 2 and 3 masks a great deal of time series variation in that performance. In Table 5 we detail that variation by presenting the average performance of the funds started each year from 1980 to 1997, weighted by the capital committed to each fund. We do not include returns prior to 1980, because we have fewer than three observations per vintage year in most years prior to 1980. Table 5 presents three measures of performance. For the 746 funds that are largely liquidated, the table presents the IRR and PME we calculate. For the 1090 fund sample, the table presents the average Venture Economics IRR.

Column (1) of Table 5 shows a large increase in the number of funds in the mid-1980s as well as in the second half of the 1990s. The three measures of performance show a consistent pattern: VC funds performed relatively poorly in much of the 1980s with IRRs in the single digits and PMEs below one. Since 1988, VC funds have had higher IRRs as well as PMEs that always exceed one. LBO funds exhibit almost the reverse pattern with substantial IRRs and PMEs greater than one in the first half of the 1980s, followed by relatively poor performance in the first half of the 1990s. For funds raised from 1987 to 1994, the average PME of LBO funds exceeds 1.00 only in one year, 1990.

D. Relation to Other Studies and Implications

As mentioned earlier, Jones and Rhodes-Kropf (2003) use the same data set that we employ, but a different empirical methodology. They estimate quarterly private equity returns using GP estimates of value changes rather than realized returns at the end of a funds lifetime as we do. Their

focus differs from ours in that they are interested in whether and how idiosyncratic risk is priced in private equity. They estimate alphas that are positive 4.68% per year for VC funds and 0.72% per year for LBO funds but not statistically significant using value-weighted regressions. They find betas of 1.80 for VC funds and 0.66 for LBO funds. The results for VC funds are qualitatively similar to ours. Our average PME of 1.21 translates into a cumulative alpha of 21% over the life of the VC fund (assuming a beta of one). Although we cannot calculate an annual alpha given the nature of our data, the cumulative 21% is the same order of magnitude as the annual 4.68%. Our results for LBO funds are more negative with an average PME of 0.93 (again assuming a beta of one). This may be driven by the different sample size and the fact that we restrict our sample to realized returns.

Ljungqvist and Richardson (2003) study the returns to investments in 73 venture and buyout funds by one large limited partner in funds raised from 1981 to 1993. They find that the funds in their sample (19 VC funds and 54 LBO funds) outperform the equity market and have positive alphas. They estimate betas of roughly 1.10 for VC and LBO funds. The results for VC funds, despite the small sample, are qualitatively similar to ours. The results for LBO funds are more positive than ours (and those of Jones and Rhodes-Kropf (2003)). The primary differences in our samples (aside from the number of funds) is that most of the funds in Ljungqvist and Richardson (2003) were raised in the 1980s, a period for which we also find higher returns for LBO funds. Moreover, they under-sample first-time funds, only 29% of their funds are first time funds. On the other hand, our LBO sample over samples first-time funds, 50% of our LBO funds are first time funds, relative to the Venture Economics universe of 40% first time funds.

What can we conclude from these two studies and ours? First, the results are consistent with VC funds having generated positive alphas over the estimated time period. This conclusion, however, is by no means certain, as all three studies potentially suffer from a positive selection bias and all three may understate systematic risk. At the same time, the results for LBO funds are more ambiguous. It is worth noting that all three studies assume betas of LBO funds or portfolio companies roughly equal to one. We believe it is possible that the systematic risk for LBO funds exceeds one because these funds invest in highly leveraged companies.

IV. Characteristics of Fund Returns

A. Relation of Performance to Fund Size and Sequence Number

In this section, we explore how realized fund returns correlate with partnership and fund characteristics. The basic empirical specification is as follows:

$$PME_{it} = \alpha_t + \beta(FundSize_{it}) + \lambda(Sequence_{it}) + \gamma_{VC} + \epsilon_{it} \quad (1)$$

where PME_{it} is calculated from the cash inflows and outflows of each fund, $FundSize_{it}$ is the logarithm of the capital committed to the fund, $Sequence_{it}$ is the logarithm of the sequence number of the fund (later funds of the same private equity partnership), and γ_{VC} is a dummy equal to one if the partnership is a venture capital firm and zero otherwise. We also include year fixed effects in all specifications to control for the large inter-year variation in returns. In the reported regressions, standard errors are corrected for heteroscedasticity and clustered at the GP level. We obtain, but do not report, *lower* standard errors when we cluster by year.[10]

Columns (1) to (4) of Table 6 show the cross sectional relations between fund performance and fund characteristics. The estimates in column (1) indicate that larger funds and higher sequence numbers funds have significantly higher realized PMEs. The estimates also confirm that the VC funds in our sample have higher PMEs on average than LBO funds. The point estimate on the VC dummy is 0.24 with a standard error of 0.09. In column (2) of Table 6, we include squared terms of Fund Size and Sequence number along with the direct effects in the regression to analyze the functional form of this relation. The point estimate on the linear term of (log) Fund Size increases significantly when including the squared term, and the coefficient on the squared (log) Fund Size is negative and significant. This suggests a concave relation between Fund Size and performance. While larger funds have higher PMEs, when funds become very large, performance declines.

The relationship between fund performance and the sequence number of the fund is convex, although not significantly so. The coefficient on the squared term of Sequence Number is positive, but not significant while the coefficient on the linear term is smaller, but remains positive and significant.

To check the robustness of the size result, column (3) reports the results of a piece-wise regression that allows for different slope coefficients across four different ranges of the size distribution. The results show a concave pattern similar to the quadratic specification.

[10]We thank Gene Fama for suggesting that we do this.

To check the robustness of the sequence number relation, we estimate a different specification in column (4) in which we include a dummy variable (First Time Fund) equal to one if the fund is a first time fund. The coefficient on this dummy is negative (-0.10) and significant.

In columns (5) and (6) of Table 6, we estimate the same specifications as in columns (1) and (2), but include GP fixed effects. In the linear specification in column (5), the signs on the Fund Size and Sequence Number variables switch from positive to negative (compared to the specification without GP fixed effects). The Fund Size coefficient is significant while the coefficient on Sequence Number is not. The Fund Size result indicates that while larger funds have higher returns in the cross-section, when a given GP raises a larger fund, fund returns decline for that GP. The Sequence Number result has a similar interpretation. In the cross-section, higher sequence number funds have higher returns. However, when a given GP raises a subsequent fund, its returns decline, albeit not in a statistically significant way. When we add squared terms to the firm fixed effects regressions in column (6), we find the same concave pattern for Fund Size found in the cross section, but with a smaller turning point.

Columns (7) and (9) estimate the quadratic regression specification of column (2) (without GP fixed effects) separately for VC and LBO funds, respectively. The concave relationship with Fund Size is present for both type of funds, but statistically significant only for VC funds. Sequence number is no longer significant for either type of fund. Columns (8) and (10) repeat the linear specification in column (5) with GP fixed effects separately for VC and LBO funds, respectively. The signs and magnitude of the coefficients are similar for both types of funds, but, again, with greater standard errors than in the regression that uses the combined data.

B. Persistence of Fund Performance

We now turn to persistence in fund performance. The results in Table 6 provide an initial indication of persistence in the private equity industry. The R^2 of the regressions in columns (1) and (2) increase by roughly 13 percent when we include firm fixed effects, in columns (5) and (6). An F-test on the joint significance of these GP fixed effects is strongly significant (not reported). The importance of firm fixed effects suggests that GPs vary systematically in their average performance.

To test persistence more directly, we use a parametric approach. We extend the basic specification of the previous section to include lagged performance as right hand side variables. We

use lagged PME of the first, second, and third previous funds raised by the GP. In Table VIII, we repeat our regressions using IRRs.

$$Performance_{it} = \alpha_t + \delta(Performance_{it-1}) + \beta(FundSize_{it}) + \lambda(Sequence_{it}) + \gamma_{VC} + \epsilon_{it} \quad (2)$$

Because we include the lagged PME or IRR as a right hand side variable, we cannot simultaneously control for firm fixed effects in the persistence regressions. In this analysis, we implicitly assume that private equity funds have a systematic or market risk equal to one. As described earlier, due to the illiquidity and reporting of private equity performance, it is difficult to estimate the market risk of a partnership. Therefore, we do not rely on partnership betas estimated from quarterly reported data. Instead, we present several additional tests that control for observable differences in GP risk profiles.

Table 7 presents our basic results. We find strong persistence in fund returns across different funds for the same GP. Column (1) contains the results of a regression of PME on lagged PME, controlling for year fixed effects and a VC dummy. The coefficient on lagged PME is positive and strongly significant; the point estimate is 0.54 with a standard error of 0.17. The coefficient implies that a fund with 1% higher performance in the previous fund is associated with 54 basis point better performance in the current fund.[11] The regression in column (2) includes the performance of both the previous fund and the fund before that. Again the coefficients on both performance measures are positive and significant. The coefficients imply that a 1% increase in past performance is associated with a combined 77 basis point increase in performance in subsequent funds (the sum of the two coefficients on lagged performance).

It is possible that the current and previous fund of a particular GP have some investments in common. This could mechanically induce persistence in our sample.[12] To account for this possibility, column (3) of the table presents estimates of a regression that includes only the performance of the second previous fund. Because the second previous fund is typically raised six years before the current fund, there is likely to be little, if any overlap. The coefficient on the performance of the second previous fund is positive and significant (at the 1% level). The coefficient of 0.39 compares

[11] As mentioned earlier, all performance results hold if we use last reported Venture Economics IRR, cash flow IRR, and TVPI to measure performance.

[12] Investment across funds is likely to be more of an issue for VC funds than LBO funds because VC funded companies are more likely to require multiple equity financings than buyout funded companies.

to that of 0.54 on the first previous fund suggesting that overlap does not drive our results. In column (4), we include only the performance of the third previous fund. The point estimate on third previous fund performance is 0.32. Because this reduces our sample size to only 128 funds, that coefficient is not significant. It is worth noting that we do obtain a statistically significant result on the third previous fund when we use the larger sample of 1090 funds.

An additional concern is that overlapping time periods across funds could induce some persistence. If such overlaps are important, however, persistence should decline with the amount of time that elapses between funds. In unreported regressions, we test for this possibility by interacting the PMEs for the first and second previous funds with the log of the number of years between the current fund and the respective previous fund. When we do this, the coefficients on the interaction terms are positive not negative (but statistically not significant). This result suggests that our persistence results are not caused by either investment overlap or time period overlap. If anything, this result is consistent with more persistence for GPs who invest more slowly.

In columns (6) through (9), we estimate the earlier persistence regressions in separately for VC and LBO funds. The coefficients for the VC fund regressions are larger than those for the overall sample at 0.69 versus 0.54 for first previous fund and 1.10 versus 0.77 for the sum of the two coefficients on the two previous funds. The coefficients are statistically significant. The coefficients for the buyout funds, in contrast, are smaller at 0.17 for the first previous fund and 0.26 for the sum of the two previous funds. Despite the smaller magnitude and smaller sample size, the coefficient on the first previous fund is statistically significant.

Overall, the results in table VII suggest a statistically and economically strong amount of persistence in private equity, particularly for VC funds.

C. Robustness Checks

Because the persistence results are unusual compared to mutual funds and hedge Funds and because of the difficulty in controlling for systematic risk, we undertake a number of additional checks to test the robustness of our findings. In Table 8 we re-estimate the persistence results measuring performance using fund IRRs based on the cash inflows and outflows to the funds. The regression in column (1) of panel A, Table 8 confirms that performance increases with fund size and with sequence number (without GP fixed effects). When squared terms are included in column

(2), fund size remains concave while sequence number becomes insignificant. The regressions in columns (3) and (4) of Table 8 show that our key persistent results hold for IRRs. The performance of the previous fund and the second previous fund are statistically significantly related to current fund performance, both individually and when included together. The coefficients are similar in magnitude to those using PME to measure performance.

Panel B estimates the regressions separately for VC and LBO funds. Columns (1) and (5) indicate that the concavity results with respect to fund size are mainly driven by the VC funds. But columns (2) and (6) of panel B indicate that the IRRs persist both for VC funds and LBO funds. In contrast to the results for PMEs, the magnitudes of the coefficients on previous fund and second previous fund IRRs are similar and statistically indistinguishable for VC and LBO funds.

C.1. Differences in Risk

As discussed above, a concern about the persistence we have documented is that some GPs might consistently take on more systematic or market risk than others. High systematic risk GPs would have persistently higher returns in a rising stock market. We attempted to control for potential differences in systematic risk in several different ways by controlling for differences in average market risk, dividing funds according to investment stage focus and industry composition, and analyzing the cross sectional dispersion of fund returns.

We attempt to adjust for average market risk by including the average annual return to the *S&P 500* in the five years after a fund is raised and excluding year fixed effects. This allows us to control for variations in market returns over time in the private equity industry. As mentioned earlier, we cannot calculate true "betas" for individual funds because we choose not to rely on interim IRRs of a fund (that are necessarily based on subjective valuations by the fund's GP).

In column (5) of Panel A in Table VIII, we include the *S&P 500* return, but do not include past performance. The coefficient on the *S&P 500* is 1.12. In columns (3) and (7) of panel B, we estimate the regression separately for VC and LBO funds. The coefficient on the *S&P 500* is 1.23 for VC funds and 0.41 for buyout funds. The 1.23 for VC funds is higher than that found by Ljungqvist and Richardson (2003), but lower than those found by Jones and Rhodes-Kropf (2003) and (for individual deals) Cochrane (2003). The coefficient for buyout funds is low

compared to that in Ljungqvist and Richardson (2003), but (with a standard error of 0.29) not

statistically different from the 0.66 estimated by Jones and Rhodes-Kropf (2003).

In column (6) of panel A, we include the returns of the two previous funds and the *S&P 500* returns. This adjustment increases the measured persistence. The coefficient on the previous fund increases from 0.40 to 0.67 while the coefficient on the second previous fund of 0.32 is unchanged. In columns (4) and (8) of panel B, we estimate coefficients for VC and LBO funds separately. The adjustment strengthens the persistence results for VC funds and leaves them essentially unchanged for LBO funds.

Next, we divide the sample of private equity funds into early stage, later stage, expansion stage, leveraged buyout, and mezzanine funds. If these different stages are correlated with differences in market risk, we would expect to see decreases in persistence after controlling for the differences. We obtain (but do not report in the table) qualitatively and statistically similar persistence results controlling for the different types of private equity funds.

To control for industry, we asked Venture Economics (VE) to construct measures of industry focus for the funds in our sample. The industry classes VE uses are biotech, communications and media, computer hardware, computer software and services, consumer related, industrial/energy, internet, medical/health and semiconductors and other electronics. Any fund that has more than 60% of its investments in one industry is classified as focused. These data were available for 412 funds in our sample.[13] We estimated the regressions in Columns (6) to (8) controlling for industry fixed effects. We also estimated the regressions in these tables including only a dummy for whether the partnership is focused or not. In either case, the persistence results are qualitatively unchanged.

Finally, we also considered the possibility that differences in total risk might drive our results. To do so, we look at the dispersion in fund returns conditional on having been in the top, medium or bottom tercile of performance in the previous fund. If differences in investment risk that GPs take on explains persistence, funds with high returns in the first period (which would imply they took on a lot of risk and had good return realizations) should show more dispersion in returns in the follow on funds. In contrast, low return funds should have relatively little return dispersion in their next funds, since they make more conservative investment choices. When we look at the raw PME's, we find that the dispersion increases slightly for funds in the middle and high performance tercile. However when we use residual PME (after controlling for size and year fixed effects), we

[13]Because of disclosure concerns by Venture Economics, we could not obtain more precise information about the industry composition of the portfolio firms.

find no increase in dispersion; if anything we see a decrease.

Overall, while we cannot rule out the possibility that differences in market and total risk drive the persistence results, we believe that such an explanation is unlikely.

C.2. Selection Bias

The last issue we consider in this section is whether selection bias and data collection issues drive our persistence results. Several mutual fund studies have found that return persistence can be affected by sample selection. Cahart et al. (2002) provide an in-depth discussion of this issue in mutual funds. Our sample differs from the mutual fund studies because we only use realized returns at or near the end of a fund's lifetime. Observations are not dropped from the dataset if returns in a given period fall below a certain threshold as is sometimes the case in mutual fund data sets. In an interview in the Asset Alternative Newsletter (Asset Alternative 2002), Jesse Reyes from Venture Economics states that Venture Economics observes very few incidents of funds that stop reporting when returns worsen. Furthermore, Venture Economics does not rely solely on the GPs for performance information, but also from LPs who are not prone to this type of selection bias.

Selective reporting could create an upward bias in measured persistence if funds initially report good performance, but if performance declines, they stop reporting. We test whether GPs stop reporting performance of a fund after large (negative) changes in quarterly reported performance in the previous period. To do so, we construct a panel of quarterly reported performance for all funds in our sample from the first quarter of the fund to the final quarter in which they are liquidated. Given the nature of the data, it is impossible for us to know if a fund was really liquidated or just stopped reporting. Therefore, we construct a dummy variable equal to one for the last quarter in which a fund reported performance and zero otherwise. We regress this dummy variable on quarterly reported IRR (or changes in IRR) including controls for log of fund size, sequence number, and fund fixed effects. The coefficient on IRR (change in IRR) is economically equal to zero, indicating that funds do not stop reporting in periods after an abnormally large change in performance in the prior quarter.

A second concern is that partnerships do not report the performance of subsequent funds after a particularly poor or particularly good fund. To investigate this, we test whether the likelihood of

reporting the performance of a follow on fund is a function of the previous fund's performance. We find that GPs of better performing funds are more likely to report the performance of a follow on fund. This is not surprising since better performing GPs also have a higher probability of raising a subsequent fund. We rerun these regressions with firm fixed effects and again obtain a positive coefficient on the performance measure. Funds that experience an increase in performance from one fund to the other are more likely to report the performance of the next fund. These results do not support the hypothesis that once funds become very good they stop reporting their performance to VE.

It is worth pointing out that these stories of selection or survivorship biases would predict that persistence of returns is driven either by the positive end of the performance distribution or by the negative end. To test for this in Table 9 we sort all the funds for which we have follow-on funds into performance terciles. We then calculate the conditional probability that a partnership's next fund will either stay in the same performance tercile, or move into one of the other two terciles. The results in Panel A measure fund performance using PME. The results in Panel B use the Venture Economics IRR at the end of five years. We find persistence at both ends of the distribution. In both panels, funds in the top (and bottom) terciles have at least a 44% chance of remaining in those terciles and at most a 21% chance of moving to the bottom (and top) terciles. In both panels, a chi-squared test rejects the equality of all cells at the 1% level.

Finally, we estimate the persistence regressions using publicly available data reported by public pension funds. The advantage of this sample is that funds cannot stop reporting to their LPs. As we noted earlier, while this sample is smaller and likely less reliable than the VE sample, it does provide an additional independent sample with no reporting bias. We restrict our analysis to mature funds, those funds raised before 1997. (Given the limited disclosure by LPs we do not have information about whether a fund was truly liquidated or not.) We are able to estimate regressions using 126 subsequent funds for more than 40 different GPs. The last two columns of Table VIII show that the observed persistence in this data set is stronger than that in the VE sample. If we include only one lag of IRR, the coefficient on the previous fund IRR is 0.66 with a standard error of 0.08 (compared to 0.47 in the VE sample). When we include two lags, in column 8, the coefficient on the second lag is large and significant (the point estimate is 0.60 and the standard error 0.29). The sum of the two lags is 1.06 compared to 0.72 in the VE sample.

While we cannot rule out that risk differences and selection biases affect our results, we believe that our evidence favors the existence of persistence in private equity.

V. Capital Flows and Fund Performance

We now analyze the relationship between past performance and the flow of capital into subsequent funds. Using mutual funds as a benchmark again, studies by Sirri and Tufano (1998) and Chevalier and Ellison (2000) indicate that funds that outperform the market experience increased capital inflows. This relationship tends to be convex; mutual funds with above average performance increase their share of the overall mutual fund market.

We estimate the relationship between fund size and performance using Tobit regressions that control for the left censoring in the size variable. If poorly performing GPs are unable to raise follow-on funds, a simple OLS estimator will be biased because poor first-time funds will drop out of the sample. Yet not being able to raise a fund at all is clearly an (extreme) outcome of poor initial performance.

In Table 10, we find that capital flows into private equity funds are positively and significantly related to past performance. Column (1) of Table 10 shows the basic specification controlling for sequence number and VC Dummy. (The logarithm of) Fund size is positively and significantly related to the performance of the previous fund. Fund size also increases with sequence number controlling for performance. This suggests that the sequence number may also be picking up some aspect of fund quality and / or past performance. The sequence number result also indicates that GPs of higher sequence number funds are better able to survive the poor performance of one particular fund. Finally, VC funds are smaller than LBO funds. In Column (2), we include lagged fund size to control for partnership specific effects, given that we cannot use firm fixed effects in the specification with lagged return variables. The only effect of this control is to render the VC dummy insignificant. The coefficient on previous performance is still positive and significant.

Parallel to our analysis of persistence in returns, we also consider the relationship between fund size and performance in the second previous fund. Column (3) shows that current fund size is positively and significantly related to the performance of each of the two previous funds. These findings indicate that funds with persistently good performance are especially favored in the fund raising process. This timing effect makes sense given that returns take some time to realize in the

private equity industry. When a GP raises the first follow-on fund, investors may not have learned completely about the true performance of the previous fund. By the time of the second follow-on fund, limited partners are able to evaluate a longer track record of the GP.[14]

In column (4) Table 10, we test whether the relation between fund size and prior performance is best characterized by a linear relation. To do this, we include a squared term of the PME_{it-1}. The relationship between fund size and performance is positive but concave. The coefficient on the squared term is negative and significant. This result differs from that for the mutual fund industry where researchers find a convex relation between fund size and excess returns. In column (5), we repeat this exercise by including a squared term for the PMEs of the two previous funds along with the linear terms. We find a concave relation between fund raising and returns for both previous funds.

In columns (6) and (7), we estimate regressions for VC funds only; in columns (8) and (9), for LBO funds only. The results are economically and qualitatively identical to the results for the entire sample. The only difference is that the coefficient on the squared term for PME is not significant in the LBO fund regression, although it is negative and economically larger than the corresponding coefficient in the VC funds regression.

The findings in table X suggest that the top performing funds in the private equity industry grow less than proportionally with the increase in performance than do the lower performers. Given that most limited partners claim that the top funds are all highly oversubscribed, it seems likely that the better funds voluntarily choose to stay smaller. This result, in turn, might help explain the persistence in performance that we find. By growing relatively less rapidly than the market on a performance adjusted basis, top funds are able to avoid moving into regions of diminishing returns.

There are at least two reasons why superior GPs might choose to do so. On the demand side, it is possible that the number of good deals in the economy is limited at each point in time. If GPs believe that they face diseconomies of some sort even on their infra-marginal deals when moving down the quality curve, it could be in their interest to grow slowly. On the supply side, better funds might face constraints if GP human capital is not easily scalable and new, qualified individual GPs are scarce. Under either of these constraints, superior GPs have to trade off staying small (and

[14]We also estimated, but do not report, probit regressions of the likelihood a GP raises a next fund. The likelihood of raising a next fund is negatively related to the performance of the previous fund.

having high returns) or growing at the same speed as the market (or at a higher speed), but moving down the marginal returns curve. In the next section, we look at the flow of funds and the entry and exit decisions of GPs in more detail.

VI. Market Dynamics and Entry of Funds

In this section, we analyze the overall dynamics of performance and capital flows in the private equity industry. So far, our results indicate that there is strong persistence in performance across funds. But at the same time mediocre performing GPs grow proportionally faster than the top GPs. This raises the question of how capital is allocated to poorly performing funds and whether this has a spill over effect on the industry overall.

A. Timing of Entry and Cyclicality of Returns

We first consider the entry and exit of GPs into the private equity market and the fundraising activities of existing GPs. To this end, we turn to the general database collected by Venture Economics. The benefit of this data is that it is more comprehensive in coverage of funds than the performance data. Venture Economics estimates that this data set covers 70 percent of the overall private equity market. The drawback is that we do not observe performance for all of the funds. As a result, we rely on aggregate measures of industry returns as well as information on fund size and fund sequence number (which we found to be positively related to performance in the previous analyses).

In Table 11, we look at the timing of funds raised by new private equity partnerships. We regress the logarithm of the total number of partnerships started in a given year on different measures of market returns in the current and previous year. We have 26 years of data for this exercise. In column (1) of Table 11, we relate the number of partnerships that are started each year to the returns on the Nasdaq Composite index in the current and the prior year. Lagged Nasdaq returns have a coefficient of 1.46 and a standard error 0.9, while current Nasdaq returns have a smaller coefficient of 0.47 with a standard error of 0.88. Similarly, in column (2) of Table 11, we include current and lagged returns on the *S&P 500*. These have a positive and significant relation (at the 10% level) to the number of partnerships that are started each year as well. The point estimate is 2.6 with a standard error of 1.4 for the current *S&P* returns, and the coefficient on the lagged

returns is 2.41 with a standard error of 1.4. Finally, we repeat this exercise for the aggregate returns of the venture capital industry. Column (3) of Table 11 shows that there is an increase in partnership starts when lagged venture capital returns are high, while the contemporaneous relation between industry returns and partnership starts is positive but not significant.

We also repeat these estimates using the aggregate amount of capital that is raised by first time partnerships in a given year. We report the results in columns (4) to (6) of the same Table 11. The results are consistent with the previous findings based on the number of new entrants. In fact, the relationship between lagged returns and partnership entry becomes stronger. This suggests that not only do more partnerships decide to start up after a period in which the industry performed well, but also, first time funds tend to raise bigger amounts of capital when the private equity industry performed well. Gompers and Lerner (1999) find similar results for aggregate industry returns.

B. Which Type of Funds are Raised in Boom Times?

We now consider how the allocation of capital flows across funds varies in boom versus bust times. In particular, do funds that are started in boom times have systematically lower performance than those started in downturns. As mentioned before, we do not observe individual fund performance for the all of the funds in the full Venture Economics data set. However, we do observe whether a GP raises a follow on fund. Our earlier analysis indicates that the ability to raise a follow on fund is a rough proxy for fund performance.

In Table 12, we report the results of a linear probability model in which we relate the likelihood of raising a follow-on fund to market conditions at the time the initial fund was raised. We construct a dummy variable equal to one if a given GP raises a follow-on fund and zero if the current fund is the last fund. Because we do not want to bias the results for GPs that only recently raised a fund (and therefore, have not had enough time pass to need to raise a next fund), we drop any fund that was started after 1998. We regress this dummy variable on the measures of market performance we have used throughout the paper: *S&P 500*, Nasdaq Composite Index, and venture industry returns. We include contemporaneous performance at the time the current fund was raised, and market performance one year before the current fund started.

Columns (1) and (4) of Table 12 report that funds raised when market returns are higher are

less likely to raise a follow on fund. This negative relation is significant for all contemporaneous and lagged performance measures for Nasdaq and *S&P*. This suggests that funds raised in boom years are more likely to perform poorly and, therefore, are unable to raise a follow on fund. Column (7) uses the annual return to venture funds as calculated by Venture Economics. The results of this regression are more ambiguous. The coefficient on contemporaneous venture performance is positive and of the same magnitude as the negative coefficient on lagged performance.

In columns (2), (5) and (8) of Table 12, we also include a measure of market returns in the third year after the current fund was raised. From anecdotal evidence, we know that GPs tend to raise new funds about every three years. Therefore, we include this three year leading market indicator to capture market conditions at the time the partnership is most likely to be trying to raise a next fund. The coefficient on the three-year leading market index is positive and strongly significant for all measures of market returns. Again, this finding is consistent with private equity firms being able to raise capital more easily when overall market conditions are good.

Finally, we repeat the above estimation for follow on funds by new GPs or first-time funds (as opposed to follow on funds by an existing GP). We report the results in columns (3), (6) and (9) of Table 12. The same pattern we observe for individual funds holds true for GP starts. GPs that enter the market in boom times are less likely to raise a follow on fund. However, if the market conditions are positive three years after the initial funds were raised, the likelihood of being able to raise a follow-on fund improves significantly.

In sum, it appears that the marginal dollar invested in boom times goes towards financing funds which are less likely to be able to raise a subsequent fund (which we interpret as a proxy for poor performance).

C. Are Fund Returns Affected by the Number of New Entrants?

Finally, we consider the effects of the entry of new GPs and funds on overall industry performance and on the performance of particular types of funds. In Table 13, we regress the performance of individual funds on the number of new funds entering the industry in the year the fund was started as well as controls for fund size, sequence number and VC Dummy. For this table, we use the larger sample of private equity funds and we measure performance using the Venture Economics IRR after five years. The variable Entry is the logarithm of the aggregate number of new private equity

funds in a given year. We also control for the returns on the Nasdaq Composite Index in the year a fund was started, as we know from the results in the previous table that funds are more likely to get started in boom years.[15]

We report results for the overall industry in columns (1) and (2) of Table 13. Column (1) shows the correlation between fund returns and the logarithm of the number of new entrants. The point estimate is negative (-0.14), but statistically insignificant. However, when we include an interaction term between the entry variable and the logarithm of the sequence number of a fund, the coefficient on the interaction term is positive and statistically significant (the point estimate is 0.76 with a standard error of 0.28). At the same time, the coefficient on the direct effect of entry is now negative and statistically significant as well (point estimate of -0.61 and a standard error of 0.20). These results suggest that in periods of increased entry of funds into the industry overall, we observe a larger negative effect on the young funds (those with lower sequence numbers) than on the older, more established funds.

In columns (3) and (4), we repeat the above analysis only for the sub-sample of VC funds. In this specification, we base the aggregate number of new entrants only on new VC funds that enter the industry in a given year. We find that the effect is stronger in the VC industry. In column (3), we only include the direct effect of the number of new entrants. The coefficient on this variable is negative and barely significant (coefficient of -0.34 with a standard error of 0.18). In column (4), we again include the interaction term between the entry variable and the logarithm of the sequence number of a fund. The coefficient on this term is positive and significant, with a coefficient of 1.13 and a standard error of 0.42. When we combine the direct effect and the interaction effect, the returns of older funds are relatively unaffected by the inflow of new funds. The returns of the entering funds, however, are significantly lower in these periods. The overall effect on the industry returns, therefore, is negative in periods with a large number of new entrants.

Finally, in columns (5) and (6), we repeat these regressions for the sub-sample of buyout funds. We base the aggregate number of new entrants only on new buyout funds that enter the industry in a given year. In column (5), we find that the direct effect of the number of new entrants is negative and statistically significant for the buyout industry. The coefficient on the entry variable

[15] We also repeat the regressions in Table 13 when measuring entry as the number of new *partnerships* entering the industry in a given year. The results are qualitatively unchanged. Similarly, we also include annual returns on the *S&P 500* or the venture capital index as measures of market performance. Again the results are qualitatively the same.

is -1.35 with a standard error of 0.25. Overall returns in the buyout industry are significantly diluted in periods where many new funds enter the market. In column (6), we again include the interaction term between the entry variable and the logarithm of the sequence number of a fund. The coefficient on this term is positive, but smaller than for the sample of VC funds and it is not statistically significant. This result suggests that unlike in the VC industry, the returns of older funds in the buyout industry (those with higher sequence numbers) are less isolated from the entry of new funds.[16] However, since our sample of buyout funds is relatively small and less comprehensive than the sample of venture capital funds, we do not want to overstate the inference we can draw from the differences between VC and buyout funds.

VII. Summary and Implications

In this paper, we investigate the performance of private equity partnerships using a data set of individual fund returns collected by Venture Economics. Over the entire sample period (1980 to 1997), average fund returns net of fees are roughly equal to those of the *S&P 500*. Weighted by committed capital, venture funds outperform the *S&P 500* while buyout funds do not. Our estimates also suggest that gross of fees, both types of private equity partnerships earn returns exceeding the *S&P 500*. We acknowledge, however, that the average return results are potentially biased because we do not control for differences in market risk and because of possible sample selection biases.

We find that returns persist strongly across funds raised by individual private equity partnerships. We observe persistence for all measures of fund performance and at both ends of the performance distribution. We also observe persistence in a different sample of funds with publicly available data. We present a number of analyses that indicate that these results are unlikely to be induced by differences in risk or sample selection biases. We also perform a number of robustness checks that suggest that industry or investment stage differences, and positive performance biases do not drive the results.

We also document that performance increases (in the cross-section) with fund size and with

[16] One could speculate about the reasons, why we observe such a difference between the returns in the buyout versus the venture capital industry. There are a number of practitioners as well as academics who suggest that buyout returns are more sensitive to market timing and herding effects, see for example Kaplan and Stein (1993). In contrast, it is often stated that VC returns are crucially driven by the specific human capital or networks of a fund's general partners.

the GP's experience. The relation with fund size is concave, suggesting decreasing returns to scale. Similarly, a GP's track record is positively related to the GP's ability to attract capital into new funds. In contrast to the convex relationship in the mutual fund industry, this relationship is concave in private equity. Finally, the fact that past performance (measured both as PME or IRR) is strongly related to a GP's ability to raise future funds and the amount of those funds is consistent with our hypothesis that the persistence of PMEs and IRRs measures persistence in performance rather than differences in risk.

Finally, we find some evidence that funds and partnerships that are raised in boom times are less likely to raise follow-on funds, suggesting that these funds perform worse. In conjunction with our results on average returns, this suggests a boom and bust cycle in which positive market-adjusted returns encourage entry, which leads to negative market-adjusted returns, etc.

These empirical relations between performance and capital flows differ substantially from the ones found for mutual funds. We think the most likely explanation for these results is a model of underlying heterogeneity in the skills of GPs, and concavity in the production function. Successful GPs might choose not to grow their funds until the excess returns have been diluted if there are strong diseconomies from scale and scope. This could be true for a number of reasons. First, successful GPs might not easily scale up investments by putting more money in any particular deal or investing in more companies, because they provide other inputs that are difficult to scale, such as time and advice. Similarly, it may be difficult to hire partners of the same quality as the existing partners. Second, one could imagine that top GPs choose to raise less capital than they could because the number of good start ups in the economy is limited at each point in time. However, passing up less profitable (but potentially still positive NPV projects) could only be an optimal choice for the GP if there are negative spill-over effects on the *infra-marginal* deals from engaging in these investments.

If, indeed, the persistence results are driven by heterogeneity in GP skill and limited scalability of human capital, it remains puzzling that these returns to superior skills are not appropriated by the scarce input (i.e., the GP) in the form of higher fees. Moreover, we need to understand why during boom times capital flows disproportionately to funds with lower performance (which subsequently have very low returns) instead of flowing to the best GPs.

One could conjecture that better performing GPs have better governance structures or limited

partners who provide more value added (see for example Lerner and Schoar (2002) for a possible mechanism). However, we do not have a way to test these theories in the current paper. Our findings highlight the need for future work that aims to better understand the organizational structure of the private equity industry.

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Table I: Descriptive Statistics [a]

Sample:	*Funds with Performance Data*			*Full Sample of VE Funds*		
	All Funds	*VC Funds*	*Buyout Funds*	*All Funds*	*VC Funds*	*Buyout Funds*
Size	172.2 (378.1)	102.9 (138.6)	415.79 (612.1)	115.5 (279.2)	53.3 (78.6)	261.5 (430.4)
Fraction 1st	0.41	0.38	0.50	0.40	0.39	0.42
Fraction 2nd	0.23	0.24	0.21	0.21	0.21	0.22
Fraction 3rd	0.14	0.16	0.10	0.13	0.13	0.11
N of Observations	746	577	169	1814	1272	542

[a] In Columns (1) to (3) we restrict the sample to funds for which all relevant cash flows have been realized. This restricts the sample mainly to funds that were started before 1996. In the following we base most of the performance analysis on this sample of funds with realized performance. Size is measured as the dollar amount of capital that is committed to a fund. The first entry in this cell is mean fund size, and the second entry is the standard deviation. Sequence is the sequence number of a fund. Fraction 1st, 2nd 3rd indicates the fraction of funds in the overall sample that are first time, second time and third time funds respectively. Columns (4) to (6) are based on the full sample of private equity funds in the Venture Economics database over the equivalent time period. We exclude funds that are not private equity funds and those that have missing information on size and year of closing. Standard deviations are in parenthesis.

Table II: Private Equity Returns: Cash Flow Based[a]

	Equal Weighted Peformance Measures		
Sample:	*All Funds*	*VC Funds*	*Buyout Funds*
IRR_{VE}	0.12	0.11	0.13
	0.17	0.17	0.19
	(0.32)	(0.34)	(0.27)
	[0.04;0.20]	[0.03;0.19]	[0.06;0.24]
IRR_{CF}	0.12	0.11	0.13
	0.17	0.17	0.18
	(0.31)	(0.30)	(0.22)
	[0.03;0.22]	[0.03;0.22]	[0.05;0.22]
PME	0.74	0.66	0.80
	0.96	0.96	0.97
	(0.81)	(0.69)	(0.52)
	[0.45;1.14]	[0.43;1.13]	[0.62;1.12]
N of Observations	746	577	169
	Size Weighted Peformance Measures		
IRR_{VE}	0.14	0.14	0.15
	0.18	0.18	0.19
	(0.19)	(0.19)	(0.19)
	[0.08;0.22]	[0.05;0.22]	[0.09;0.23]
IRR_{CF}	0.12	0.13	0.13
	0.18	0.17	0.18
	(0.26)	(0.31)	(0.26)
	[0.04;0.23]	[0.03;0.23]	[0.06;0.20]
PME	0.82	0.92	0.83
	1.05	1.21	0.93
	(0.70)	(0.74)	(0.65)
	[0.67;1.11]	[0.55;1.40]	[0.72;1.03]
N of Observations	746	577	169

[a]Fund IRRs and PME (Public Market Equivalent) are calculated based on the actual cash flows of the funds. For each cell we report four different entries: The first is the median return, the second the average return, the third the standard deviation and finally we report the distribution of returns at the 25th and 75th percentile. The first panel of the table reports equal weighted performance measures, while the second panel reports size weighted performance measures (where size is the amount of committed capital that a fund has). PME is calculated by discounting cash inflows and outflows with the returns in the public markets over the same time period. The benchmark we use here to discount fund are the returns on the *S&P 500* index. Only funds that did not have a cash inflow or outflow for at least 2 years are included in this calculation. IRR_{CF} is the IRR at the end of a fund's lifetime based on actual cash inflows and outflows. On average this excludes funds which were started after 1994. IRR_{VE} contains the IRR that are reported to Venture Economics at the end of a fund's lifetime for the sample for which we can calculate IRR_{CF}.

Table III: Private Equity Returns: Sample of Mature Funds[a]

	Equal Weighted Peformance Measures		
Sample:	*All Funds*	*VC Funds*	*Buyout Funds*
IRR_{VE5}	0.11	0.10	0.12
	0.18	0.20	0.14
	(0.36)	(0.40)	(0.24)
	[0.02;0.22]	[0.02;0.21]	[0.02;0.22]
TVPI	1.66	1.75	1.53
	2.24	2.42	1.83
	(2.30)	(2.54)	(1.55)
	[1.12;2.49]	[1.15;2.75]	[1.09;2.02]
N of Observations	1090	754	336
	Size Weighted Peformance Measures		
IRR_{VE5}	0.13	0.15	0.12
	0.18	0.30	0.13
	(0.32)	(0.46)	(0.23)
	[0.03;0.23]	[0.04;0.42]	[0.02;0.21]
TVPI	1.58	2.09	1.43
	1.97	2.87	1.61
	(1.83)	(2.83)	(1.00)
	[1.09;2.13]	[1.27;3.47]	[1.06;1.83]
N of Observations	1090	754	336

[a]Fund IRRs and TVPI (Total Value to Paid-in-Capital) are obtained from Venture Economics. IRR_{VE5} is the reported IRR after 5 years of fund existence. We only use funds that have at least a five year horizon. For each cell we report four different entries: The first is the median return, the second the average return, the third the standard deviation and finally we report the distribution of returns at the 25th and 75th percentile. The first panel of the table reports equal weighted performance measures, while the second panel reports size weighted performance measures (where size is the amount of committed capital that a fund has under management).

Table IV: Fund Performance Measures [a]

	IRR_{VE}	IRR_{CF}	PME	IRR_{VE5}	TVPI
IRR_{VE}	1				
IRR_{CF}	0.98	1			
PME	0.88	0.88	1		
IRR_{VE5}	0.92	0.89	0.86	1	
TVPI	0.74	0.75	0.65	0.60	1

[a]Each entry reports the correlation between the different measures of fund perofrmance based on a sample of 746 funds that have information about cash flow data. IRR_{VE} is based on the realized IRR of funds started in a given period as reported by Venture Economics. PME (Public Market Equivalent) is the ratio of capital outflows to capital inflows discounted by the cummulative returns on the *S&P 500* during the same period. IRR_{VE5} is based on the IRR reported to Venture Economics at the end of five years after the first closing of the funds. TVPI (Total Value to Paid-in-Capital) is the sum of all cash outflows to LPs divided by the sum of all cash contributions to the fund.

Table V: Private Equity Returns by Vintage Year [a]

Sample:	*All Funds*					*VC Funds*					*Buyout Funds*				
Year	Obs	IRR_{VE}	Obs	IRR_{CF}	PME	Obs	IRR_{VE}	Obs	IRR_{CF}	PME	Obs	IRR_{VE}	Obs	IRR_{CF}	PME
1980	22	0.23	21	0.22	0.99	20	0.21	20	0.22	0.95	–	–	–	–	–
1981	24	0.13	18	0.14	0.68	23	0.09	18	0.10	0.51	–	–	–	–	–
1982	29	0.05	25	0.05	0.35	28	0.05	23	0.05	0.35	–	–	–	–	–
1983	65	0.14	54	0.15	0.71	59	0.08	48	0.07	0.53	6	0.33	6	0.30	1.06
1984	74	0.15	63	0.16	0.89	68	0.06	57	0.07	0.54	6	0.29	6	0.29	1.30
1985	59	0.23	49	0.23	1.24	47	0.09	37	0.10	0.73	12	0.34	12	0.18	1.00
1986	61	0.13	52	0.14	0.91	45	0.10	36	0.10	0.76	16	0.17	16	0.18	1.13
1987	97	0.14	85	0.16	0.84	68	0.12	63	0.12	0.98	29	0.14	22	0.16	0.84
1988	71	0.12	63	0.14	0.90	48	0.18	42	0.20	1.16	23	0.11	21	0.13	0.79
1989	79	0.18	67	0.16	1.01	54	0.18	45	0.18	1.03	25	0.18	22	0.14	1.00
1990	45	0.21	36	0.22	1.18	27	0.27	20	0.29	1.53	18	0.18	14	0.20	1.05
1991	24	0.20	15	0.16	0.95	18	0.26	11	0.22	1.13	6	0.14	6	0.14	0.87
1992	50	0.23	35	0.23	0.99	26	0.26	18	0.32	1.31	24	0.22	17	0.09	0.79
1993	67	0.23	56	0.21	1.09	39	0.30	45	0.35	1.65	28	0.20	11	0.18	0.84
1994	68	0.23	55	0.38	1.45	42	0.32	49	0.48	1.81	26	0.17	6	0.19	0.89
1995	70	0.18	52	0.20	1.14	43	0.44	–	0.54	2.05	27	0.10	7	0.07	0.62
1996	67	0.19	–	–	–	31	0.61	–	–	–	36	0.05	–	–	–
1997	109	0.13	–	–	–	58	0.41	–	–	–	51	0.06	–	–	–

[a] IRR_{VE} is based on the realized IRR at the end of a fund's lifetime (as calculated by Venture Economics) for funds that were started in a given period. IRRCF is the IRR that we calculate based only on the actual cash flows of a fund. We base our IRR calculations only on the actual cash flows of funds, not reported net asset value. Therefore, we concentrate on funds that have already realized most of their investments. PME (Public Market Equivalent) is the ratio of capital outflows to capital inflows discounted by the cummulative returns on the *S&P 500* during the same period. Again we base our calculations only on actual cash flows. All fund performance measures are weighted by the capital under management. Obs is the number of observations per year. Since we have less than three observations per year for the buyout funds prior to 1983, we only start reporting annual performance measures for these funds in 1983.

Table VI: Fund Performance and Fund Characteristics[a]

Dependent Variable: PME (Public Market Equivalent)

	Full Sample						*VC only*		*Buyout only*	
log(Size)	0.08	0.53		0.09	-0.14	0.30	0.46	-0.14	0.08	-0.11
	(0.03)	(0.11)		(0.03)	(0.06)	(0.20)	(0.17)	(0.08)	(0.06)	(0.21)
log(Size)^2		-0.05				-0.05	-0.04		-0.01	
		(0.01)				(0.03)	(0.02)		(0.10)	
log(Sequence)	0.14	0.03	0.16		-0.37	-0.43	0.02	-0.18	0.19	-0.26
	(0.06)	(0.01)	(0.08)		(0.25)	(0.28)	(0.18)	(0.32)	(0.20)	(0.39)
log(Sequence)^2		0.07				0.07	0.09		-0.06	
		(0.09)				(0.12)	(0.11)		(0.11)	
First Dummy				-0.10						
				(0.04)						
Size Spline1			0.10							
			(0.07)							
Size Spline2			0.36							
			(0.17)							
Size Spline3			0.19							
			(0.15)							
Size Spline4			-0.19							
			(0.07)							
VC Dummy	0.24	0.20	0.28	0.05	0.03					
	(0.09)	(0.09)	(0.09)	(0.24)	(0.23)					
Firm F.E.	No	No	No	No	Yes	Yes	No	Yes	No	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.17	0.18	0.19	0.18	0.29	0.30	0.25	0.16	0.13	0.01
N of Observations	746	746	746	746	398	398	577	577	169	169

[a]The dependent variable is realized PME (Public Market Equivalent). PME is calculated by discounting the actual cash outflows and cash inflows that the fund received with the returns on the *S&P 500* over the same time period and forming the ratio of the discounted cash inflows over the discounted outflows. Since we only include funds for which the majority of the cash flows have been realized, on average this restricts the sample to funds that were started before 1996. All the data is obtained from Venture Economics. Size is the amount of capital a fund has under management. Sequence is the sequence number of a fund. VC Dummy is equal to one if the fund is a venture capital fund and zero for buyout, LBO and mezzanine funds. First is a dummy equal to one if the fund is a first time fund. Size Spline1-4 is a piecewise regression where we allow for different slopes of the log of size. Standard errors are in parenthesis and are adjusted for serial correlation and heteroskedasticity.

Table VII: Persistence of Fund Performance [a]

Dependent Variable: PME (Public Market Equivalent)

	Full Sample					*VC only*		*Buyout only*	
PME_{t-1}	0.54	0.49			0.46	0.69	0.62	0.17	0.19
	(0.17)	(0.21)			(0.21)	(0.21)	(0.25)	(0.08)	(0.06)
PME_{t-2}		0.28	0.39		0.28		0.48		0.07
		(0.13)	(0.14)		(0.13)		(0.26)		(0.05)
PME_{t-3}				0.32					
				(0.24)					
log(Size)					0.09				
					(0.05)				
log(Sequence)					0.20				
					(0.20)				
VC Dummy	0.41	0.51	0.46	0.49	0.60				
	(0.12)	(0.16)	(0.14)	(0.20)	(0.17)				
Firm F.E.	No	No	No	No	No	No	No	No	No
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.19	0.21	0.20	0.25	0.27	0.12	0.12	0.23	0.10
N of Observations	398	225	225	128	225	323	184	76	41

[a] The dependent variable is realized PME (Public Market Equivalent). PME is calculated by discounting the actual cash outflows and cash inflows that the fund received with the returns on the *S&P 500* over the same time period and forming the ratio of the discounted cash inflows over the discounted outflows. Since we only include funds for which the majority of the cash flows have been realized, on average this restricts the sample to funds that were started before 1996. All the data is obtained from Venture Economics. PME_{t-1}, PME_{t-2} and PME_{t-3} are lagged realized PMEs of a given private equity firm's previous fund, the fund before the last, and the third previous fund, respectively. Size is the amount of capital a fund has under management. Sequence is the sequence number of a fund. VC Dummy is equal to one if the fund is a venture capital fund and zero for buyout, LBO and mezzanine funds. Standard errors are in parenthesis and are adjusted for serial correlation and heteroskedasticity.

Table VIII: Fund Performance Based on IRR [a]

Panel A			*Full sample*				*Public Sample*	
log(Size)	0.03	0.18						
	(0.01)	(0.03)						
log(Size)^2		-0.02						
		(0.00)						
log(Sequence)	0.43	-0.01						
	(0.02)	(0.03)						
log(Sequence)^2		0.04						
		(0.03)						
IRR$_{t-1}$			0.47	0.40		0.67	0.66	0.46
			(0.13)	(0.15)		(0.15)	(0.08)	(0.09)
IRR$_{t-2}$				0.32		0.32		0.60
				(0.15)		(0.19)		(0.29)
S&P 500					1.12	0.52		
					(0.34)	(0.23)		
VC Dummy	0.08	0.06	0.10	0.12	0.09	0.11	0.14	0.13
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.06)
Year F.E.	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Adjusted R^2	0.25	0.16	0.29	0.32	0.19	0.21	0.47	0.51
N of Observations	746	746	398	225	746	225	126	95
Panel B		*VC only*				*Buyout only*		
log(Size)	0.15				0.01			
	(0.06)				(0.06)			
log(Size)^2	-0.02				-0.01			
	(0.01)				(0.03)			
log(Sequence)	-0.03				0.06			
	(0.05)				(0.07)			
log(Sequence)^2	0.04				-0.02			
	(0.04)				(0.04)			
IRR$_{t-1}$		0.36	0.61			0.53	0.45	
		(0.16)	(0.16)			(0.14)	(0.06)	
IRR$_{t-2}$		0.42	0.32			0.25	0.32	
		(0.21)	(0.23)			(0.18)	(0.14)	
S&P 500			1.07	1.23			0.38	0.41
			(0.38)	(0.42)			(0.25)	(0.29)
Year F.E.	Yes	Yes	No	No	Yes	Yes	No	No
Adjusted R^2	0.24	0.35	0.19	0.16	0.16	0.49	0.22	0.09
N of Observations	577	184	184	577	169	41	41	169

[a] The dependent variable is realized fund IRR at the end of the fund's existence. IRR is calculated based on the actual cash inflows and outflows of a fund (see text for details). IRR$_{t-1}$ and IRR$_{t-2}$ are lagged realized returns of a given private equity firm's previous fund and the fund before the last, respectively. All other indpendent variables are defined as in prior tables. Panel A, columns 1 to 6 is based on the sample of venture and buyout funds from Venture Economics. The last two columns of Panel A are based only on returns disclosed through public sources (see text for more details). Panel B shows results separately for venture and buyout funds. Standard errors are in parenthesis and are adjusted for serial correlation and heteroscedasticity.

Table IX: Transition Probabilities: Fund Performance[a]

Panel A: PME	Lower Tercile	Medium Tercile	Upper Tercile
Lower Tercile	44%	37%	19%
Medium Tercile	24%	34%	42%
Upper Tercile	11%	34%	55%

Panel B: IRR_{VE5}	Lower Tercile	Medium Tercile	Upper Tercile
Lower Tercile	49%	31%	20%
Medium Tercile	30%	38%	32%
Upper Tercile	21%	31%	48%

[a]We sort all funds for which we have follow on funds into performance terciles and calculate the conditional probability that a partnership's next fund will either stay in the same performance tercile, or move into one of the other two terciles. The results in Panel A are based on PME (Public Market Equivalent over the entire lifetime of the fund). For this calculation we use 398 funds that have at least one follow-on fund in our sample of realized funds. In Panel B we use IRR_{VE5}, the IRR of a fund after five years of a fund's existence. This allows us to employ a larger sample of 639 funds that have at least one follow-on fund. Again we calculate conditional Markov probablilites as in Panel A.

Table X: Fund Size and the Track Record of the Firm[a]

Dependent Variable: Logarithm of Fundsize

	Full sample					*VC only*		*Buyout only*	
PME_{t-1}	0.27	0.20	0.23	0.88	0.49	0.17	0.89	1.17	2.32
	(0.09)	(0.08)	(0.09)	(0.18)	(0.19)	(0.08)	(0.18)	(0.44)	(0.94)
PME_{t-2}			0.34		0.65				
			(0.16)		(0.35)				
PME^2_{t-1}				-0.11	-0.06		-0.10		-0.36
				(0.02)	(0.02)		(0.02)		(0.25)
PME^2_{t-2}					-0.10				
					(0.05)				
log(Lagsize)		0.78	0.73	0.72	0.67	0.80	0.71	0.86	0.82
		(0.09)	(0.10)	(0.09)	(0.11)	(0.09)	(0.10)	(0.20)	(0.20)
log(Sequence)	1.07	0.73	0.43	0.71	0.52	0.53	0.53	1.04	1.04
	(0.14)	(0.14)	(0.21)	(0.18)	(0.21)	(0.15)	(0.15)	(0.34)	(0.34)
VC Dummy	-1.20	-0.25	-0.48	-0.29	-0.55				
	(0.22)	(0.24)	(0.27)	(0.23)	(0.27)				
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.16	0.22	0.25	0.22	0.25	0.07	0.08	0.08	0.09
N of Observations	746	746	399	746	399	577	577	169	169

[a]The dependent variable (fund size) is the logarithm of the amount of capital committed to the next fund of a partnership. We estimate a Tobit regression, since the size variable is censored at zero. If a partnership does not raise a follow on fund, the size of the next fund is zero. PME_{t-1} and PME_{t-2} are the Public Market Equivalent (for construction of PME please see Table 6) of the previous fund and the one prior to this, respectively. We only include funds that are raised prior to 1996, and only one observation per fund. Lagsize is the amount of capital a fund has under management in the fund before the current one. Sequence is the sequence number of a fund. VC Dummy is equal to one if the fund is a venture capital fund and zero for buyout, LBO and mezzanine funds. Standard errors are in parenthesis and are adjusted for serial correlation and heteroskedasticity.

Table XI: Entry of Private Equity Firms into the Industry[a]

Dependent Variable:	Number of New PE Firms				Capital Raised by New PE Firms			
Nasdaq_t	0.47				1.53			
	(0.88)				(1.66)			
Nasdaq_{t-1}	1.46				3.20			
	(0.90)				(1.81)			
$S\&P_t$		2.60				5.11		
		(1.41)				(2.66)		
$S\&P_{t-1}$		2.41				5.01		
		(1.41)				(2.60)		
VC Returns_t			0.02				-0.08	
			(0.07)				(0.13)	
VC Returns_{t-1}			0.20				0.45	
			(0.06)				(0.13)	
Buyout Returns_t				0.00				-0.03
				(0.01)				(0.02)
$\text{Buyout Returns}_{t-1}$				-0.01				-0.01
				(0.01)				(0.02)
Adjusted R^2	0.02	0.11	0.55	0.21	0.08	0.13	0.56	0.21
N of Observations	26	26	20	20	26	26	20	20

[a]The dependent variable in columns (1) to (3) is the aggregate number of new partnerships that are started in a given year from 1975 to 2000. The dependent variable in columns (4) to (6) is the logarithm of the total amount of capital raised by first time funds in a given year, again from 1975 to 2000. Nasdaq and Nasdaq_{t-1} are the annual returns on the Nasdaq Composite index in the current and the prior year, respectively. Similarly, $S\&P$ and $S\&P_{t-1}$ are the annual returns on the *S&P 500* index in the current and the prior year, respectively. And finally, VC Returns and Buyout Returns are the aggregate annual returns of the venture capital and the buyout industry, respectively, as reported by Venture Economics. Since we only have venture industry returns since 1980 the number of observations in columns (3), (4), (7) and (8) drops to 20. Moreover, entering firms in columns (3) and (7) are restricted to venture capital firms. Similarly entering firms in column (4) and (8) are restricted only to buyout firms. Standard errors are in parenthesis and are adjusted for serial correlation and heteroskedasticity.

Table XII: Probability of Raising a Follow-on Fund [a]

	Dependent Variable: Does Fund Raise a Follow-on Fund?								
Nasdaq$_t$	-0.26	-0.15	-0.16						
	(0.03)	(0.04)	(0.09)						
Nasdaq$_{t-1}$	-0.12	-0.06	-0.03						
	(0.04)	(0.04)	(0.09)						
Nasdaq$_{t+3}$		0.10	0.12						
		(0.04)	(0.05)						
$S\&P_t$				-0.30	-0.23	-0.24			
				(0.05)	(0.05)	(0.11)			
$S\&P_{t-1}$				-0.44	-0.25	-0.31			
				(0.05)	(0.06)	(0.11)			
$S\&P_{t+3}$					0.15	0.17			
					(0.05)	(0.10)			
VC Returns$_t$							0.04	0.01	0.01
							(0.00)	(0.01)	(0.01)
VC Returns$_{t-1}$							-0.04	-0.01	-0.01
							(0.00)	(0.00)	(0.01)
VC Returns$_{t+3}$								0.00	0.02
								(0.00)	(0.00)
log(Sequence)	0.09	0.07		0.09	0.07		0.09	0.07	
	(0.01)	(0.01)		(0.01)	(0.01)		(0.01)	(0.01)	
log(Size)	-0.01	-0.01	-0.01	-0.01	-0.02	-0.00	0.00	0.00	0.04
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.02)
Adjusted R^2	0.07	0.04	0.03	0.07	0.04	0.01	0.06	0.02	0.03
N of Observations	2789	2467	751	2831	2503	756	1608	1147	481

[a] Linear probability regression of the likelihood that an existing fund raises a follow on fund. The dependent variable is a dummy equal to one if the fund raises a next fund and zero otherwise. Nasdaq is the annual return on the Nasdaq Composite Index in the year the fund was raised, $Nasdaq_{t-1}$ and $Nasdaq_{t+3}$ are the returns in the one year lagged and the three year leading Nasdaq Composite index, respectively. The former captures the market conditions in which the current fund was raised and the latter capture the market conditions in which the next fund will be raised. Similarly, $S\&P_i$ is the annual return on the *S&P 500* and VC Returns is the annual return of the venture capital industry as reported by Venture Economics. To avoid bias for funds that were only raised very recently, we drop the last three years of data, 1999-2001. Size is the amount of capital under management in the current fund. Sequence is the sequence number of the current fund. VC Dummy is equal to one if the fund is a venture capital fund and zero for buyout, LBO and mezzanine funds. Columns (3), (6) and (9) only include the sup-sample of first time funds. Standard errors are in parenthesis and are adjusted for serial correlation and heteroskedasticity.

Table XIII: Market Entry and Fund Performance[a]

Dependent Variable: IRR_{VE5} (IRR after five years)

	All Funds		*VC Funds*		*Buyout Funds*	
Entry	-0.14	-0.61	-0.34	-0.89	-1.35	-1.54
	(0.14)	(0.20)	(0.18)	(0.36)	(0.25)	(0.36)
Entry*log(Sequence)		0.76		1.13		0.33
		(0.28)		(0.42)		(0.28)
log(Sequence)	0.44	-3.36	0.57	-4.86	0.12	-1.21
	(0.15)	(1.34)	(0.21)	(1.86)	(0.08)	(1.21)
log(Size)	0.09	0.09	0.20	0.15	0.01	0.01
	(0.05)	(0.05)	(0.08)	(0.08)	(0.04)	(0.05)
Nasdaq_t	0.28	0.29	0.79	0.50	0.17	0.17
	(0.11)	(0.11)	(0.31)	(0.16)	(0.11)	(0.11)
VC Dummy	0.66	0.63				
	(0.19)	(0.19)				
Adjusted R^2	0.05	0.07	0.06	0.10	0.22	0.23
N of Observations	1090	1090	754	754	336	336

[a]The dependent variable is realized fund IRR after five years of existence, which means we include one observation per fund. On average this restricts the sample to funds that were started before 1998, and only one observation per fund. Entry is logarithm of the number of private equity funds overall which are started in the same year as a given fund. This variable is calculated based on the full Venture Economics database. In columns (1) and (2) we use the sample of venture capital and buyout funds. In columns (3) and (4) we use only the sub-sample of venture capital funds. Accordingly the entry variable in these columns is based only on the number of venture capital funds entering the market in a given year. And in columns (5) and (6) we use only the sub-sample of buyouts funds. Parallel to before, we use only the number of buyout funds entering the market in a given year to calculate the entry variable. Nasdaq_t is the annual return on the Nasdaq Composite Index. Size is the amount of capital a fund has under management in the current fund. Sequence is the sequence number of the fund. VC Dummy is equal to one if the fund is a venture capital fund and zero for buyout, LBO and mezzanine funds. Standard errors are in parenthesis and are adjusted for serial correlation and heteroskedasticity.