Interim Fund Performance and Fundraising in Private Equity

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Abstract

We study the interim performance of private equity (PE) funds around the time of fundraising events using fund level cash flow and valuation data for over 800 funds raised between 1993 and 2009. We first show that interim performance, measured as the current fund's percentile rank relative to its vintage year cohort funds, materially affects the PE firm's ability to raise a follow-on fund and the size of the follow-on fund. Given these incentive results, we hypothesize and find that PE firms time their fundraising activities to coincide with periods when the current fund's interim performance is at its peak relative to its vintage year cohort. We further document that the size and frequency of net asset value (NAV) markdowns increases in the period following fundraising, which suggests that fund valuations are inflated during the fundraising period. Consistent with this interpretation, we find the size and frequency of markdowns increases most for small, young, and low-reputation PE firms, which have the clearest incentives to report strong interim performance. For buyout funds, we find evidence of erosions in fund performance post-fundraising but only among the small, young, and low-reputation PE firms. Our results indicate that PE firms, particularly small, young, and low-reputation firms, are good at timing their fundraising activities to coincide with periods of peak performance and are reluctant to mark down the valuations of portfolio companies during fundraising periods.

Valuations, while always important, take on greater significance during the period of fund marketing. One type of manager misconduct that we've observed involves writing up assets during a fund raising period and then writing them down soon after the fund raising period closes. Because investors and potential investors often question the valuations of active holdings, managers may exaggerate the performance or quality of these holdings. This type of behavior highlights something that I'm sure many of you already know — that interim valuations do, in fact, matter.

Bruce Karpati
Chief, SEC Enforcement Division's Asset Management Unit
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Investors participate in private equity primarily by making capital commitments to new funds that are run for 10 or more years, during which time their capital commitments are tied up in the funds. Typically, a private equity (PE) fund manager will raise a new fund in the third through sixth year of an existing fund's life and the stakes are large, as the PE fund manager's long-term prospects depend critically on successful fundraising and the size of follow-on funds. Given the long-term nature of private equity investments, investors face the difficult task of screening prospective investments based on information they possess about the quality of the PE fund manager including the performance of the manager's current fund. In this setting, the SEC has raised concerns that PE fund managers have incentives to "exaggerate the performance or quality" of the current fund when engaged in fundraising for a follow-on fund.

Extant research shows successful fundraising is of paramount importance to the career goals of PE fund managers. Metrick and Yasuda (2010a) find that successful PE general partners (GPs) are able to increase their per-partner compensation sharply by raising much larger follow-on funds. Chung et al. (2012) argue that the current fund's performance affects a GP's lifetime income through two channels of roughly equal importance – the carried interest earned on the current fund and the ability to raise a follow-on fund.

However, we know relatively little about how the interim performance of a current fund relates to fundraising for follow-on funds. A fund's interim performance has two components: (1) exited investments to date and (2) the net asset value (NAV) of unrealized investments. GPs are responsible for reporting NAVs to investors in the fund, and these NAVs are generally externally audited. However, it is well known that the

illiquid nature of underlying investments in private companies makes real-time adjustment of NAVs difficult or unrealistic, leading to infrequent price adjustments and stale prices (Gompers and Lerner (1997), Woodward (2009), Metrick and Yasuda (2010b)). For example, NAVs of venture firms are often marked up significantly around the time of subsequent capital injections (Cochrane (2005), Korteweg and Sorensen (2010)).[1] Prospective investors in the follow-on fund must thus evaluate the current fund's interim performance in the presence of significant information asymmetry, particularly with respect to the NAVs reported by the fund.

In this paper, we use fund level cash flow and quarter NAV data for over 800 US-focused private equity funds (both buyout and venture capital (VC) funds) raised between 1993 and 2009 to address the following questions: Does good interim fund performance (observed at the time of fundraising) materially affect the ability of PE firms to raise a follow-on fund? If so, do PE firms respond to these incentives by timing their fundraising campaigns to coincide with periods when their current fund's interim performance is at its peak? Do PE firms keep their NAV valuations inflated during the fundraising period, and subsequently mark them down once the fundraising is concluded?

A key presumption of the SEC's concerns is that interim performance materially affects the ability of a GP to successfully fundraise. We find strong evidence that this underlying assumption is true and particularly so for less reputable GPs. Specifically, the current fund's most recent percentile rank (relative to its vintage-year cohort funds) has a positive and economically significant effect on the GP's probability of successfully raising a follow-on fund and on the size of the fund raised. These results hold for both buyout and VC funds. Moreover, LPs seems to be focused on what GPs have done for them lately, as the impact of having a top quartile current fund on a GP's ability to fundraise is much greater than the impact of having a *prior* top quartile fund for both buyouts and VCs. In a further analysis, we split the sample based on the size, age, and reputation (measured based on the performance of past funds) of GPs. The basic idea is that interim performance will be more important for small, young, and low-reputation GPs, since they have little track record or accumulated reputation capital.[2] Consistent

[1] Also see Phalippou and Gottschalg (2009) and Stucke (2011).

[2] Gompers and Lerner (1998b) find that older and larger VC GPs raise larger funds. Gompers (1996) finds that young VC GPs take portfolio companies public earlier than older VC GPs in order to establish a

with this idea, the impact of interim performance of fundraising success is stronger for small, young, and low-reputation GPs relative to other funds in both our buyout and VC samples.

Given these incentive results, we hypothesize and find that GPs time their fundraising activities to coincide with periods when the current fund's interim percentile rank is at its peak.[3] We define the conclusion of the fundraising period as the quarter in which we observe the first cash flow activity in the follow-on fund. For buyout fundraisers, the performance of the current fund peaks three quarters prior to the conclusion of fundraising; for VC funds, the peak performance is observed at the conclusion of fundraising. For both buyout and VC funds, we observe a significant improvement in the performance rank of fundraisers prior to the conclusion of fundraising and a subsequent deterioration post-fundraising. Both the upward and downward slope are pronounced and significant for small, young, and low-reputation GPs, while only the upward slope (leading up to the fundraising event) is significant for old, large, or high-reputation GPs. These results suggest that GPs, particularly small, young, and low-reputation GPs, are good at timing their fundraising activities to coincide with periods of peak performance. The erosion in performance ranks after fundraising, particularly for small, young, and low-reputation GPs, is consistent with the SEC's concerns regarding NAV inflation during fundraising events. However, the erosion in fundraisers' performance ranks might also naturally occur as a result of mean reversion (e.g., as a top-ranked fund fails to retain its top status).

To investigate whether the erosion in the performance rank is partially attributable to NAV inflation during the fundraising period, we conduct two analyses. First, we examine the size and incidence of NAV markdowns in the post-fundraising period. We define a markdown as a decrease in a fund's reported NAV (after adjusting for calls and distributions). For both the buyout and VC sample, we document that the size and the frequency of NAV markdowns significantly increases in the post-fundraising periods, which suggests the presence of NAV inflation during the fundraising period. Consistent

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reputation and successfully raise capital for new funds. Similarly, Ljungqvist et al. (2007) find that younger buyout GPs invest in riskier buyouts in an effort to establish a track record.

[3] Note that our results are not about timing with respect to market performance (the hot market effect discussed by Gompers and Lerner (1998b), Kaplan and Schoars (2005), Robinson and Sensoy (2011) and others) since we are analyzing the performance rank of funds *relative* to their cohort.

with the peaking result, the size and frequency of markdowns in the post-fundraising period increases most for small, young, and low-reputation firms, which have the clearest incentives to report strong interim performance.

In our second approach, we restrict our analysis to mature funds and analyze the post-fundraising performance of funds. To do so, each time there is a fundraising event for a vintage year cohort, we calculate a pseudo value multiple (PVM) for each vintage year cohort fund assuming an investor buys the fund at its end-of-quarter NAV and holds the fund to liquidation. In this analysis, we document that the PVMs of buyout funds purchased at the time of fundraising are reliably lower than those purchased at other times or those of other funds. Moreover, this result is once again more pronounced for small, young, and low-reputation GPs. Though our point estimates for VC funds are suggestive of performance erosions post-fundraising, they are not statistically significant.

Overall our results indicate that PE firms, particularly small, young, and low-reputation firms, face strong incentives to report good interim performance and are good at timing their fundraising activities to coincide with periods of peak performance. Faced with these incentives, PE firms increase the size and frequency of markdowns following fundraising events. For buyout funds, we are able to detect reliable erosions in performance during the post-fundraising period. Once again, the markdowns and post-fundraising performance erosion tend to be the greatest for small, young, and low-reputation firms. In combination, these results lend credibility to the SEC's concerns regarding the valuation of private equity investments during fundraising periods.

Our results complement those in two recent working papers that examine related questions. Brown et al. (2013) use fund-level data provided by Burgiss and find that the current fund's public-market-equivalent[4] (PME)-based cumulative (risk-adjusted) excess returns do not decline around fundraising events for those GPs that successfully raise follow-on funds. In contrast, the cumulative excess returns peak and decline near the end of fund's life for those GPs that are ultimately unable to raise follow-on funds. The authors interpret that latter result as evidence of NAV inflation by unsuccessful desperate GPs. They also find that both the interim performance and the change in performance between fundraising dates and final fund resolution dates positively affect the GP's ability to raise follow-on funds.

[4] Kaplan and Schoar (2005).

Jenkinson et al. (2013) use fund-level data for PE investments made by CalPERS and find that quarterly changes in NAV valuations are positive during fundraising periods, and negative in year 3 to 6 after fundraising events, which is consistent with our observation that the size and frequency of markdowns increase in the post-fundraising period. They also find that quarterly changes in internal rates of returns (IRRs) and value multiples (VMs) are positive in periods shortly before fundraising events, but turn negative by fundraising dates and remain negative for 6 years after fundraising events.

Our analysis differs from these papers in two ways. First, we document that the reputation capital of a GP is an important determinant of their behavior during fundraising events. GPs with significant accumulated reputation capital likely have less incentive to time their fundraising events to coincide with periods of peak performance and/or inflate the valuations of their current fund. High reputation GPs can point to their prior success when raising capital and may tarnish their reputation by inflating NAVs (if subsequently revealed) during the fundraising period. Since investors have less precise priors about younger less-established PE firms and might update their beliefs more drastically based on the interim performance of the current fund alone (as compared to a long track record of an old, venerable PE firm)[5], temptations to engage in timing and/or NAV management are predicted to be the most severe for small, young, and low-reputation GPs. This is precisely what we find.

Second, our analysis focuses on the interim performance measured as the fund's percentile rank relative to its vintage year cohort funds. We believe this focus is important given the prevalent industry practice of benchmarking against vintage year cohorts and using "top-quartile" status as evidence of a good track record in marketing.[6] Since the lack of time-weighted returns and sample selection issues make it difficult to estimate the fund manager's alpha using standard asset-pricing models (Metrick and Yasuda (2011)), investors might substitute top-quartile status as de-facto evidence of alpha;[7] if so, then GPs might gain more from maximizing the relative percentile rank vis-

[5] Chung et al. (2012).

[6] Evidence of performance persistence in private equity (Kaplan and Schoar (2005), Harris et al. (2013)) further supports the idea of investing in GPs with top-quartile funds.

[7] This benchmarking practice using quartiles may change in the future if the necessary data to compute PMEs become easily available to prospective investors. As of the writing of this article, however, prospective investors for follow-on funds in general lack access to the cash flow and valuations data to the

à-vis vintage year cohorts at the time of fundraising than from maximizing the absolute return at the end of the fund's life.[8] Finally, the use of performance ranks naturally controls for two important characteristics of private equity performance: (1) there is strong variation in performance over boom and bust market cycles and (2) standard performance measures (e.g., internal rates of return and value multiples) are generally low early in a fund's life and gradually improve (the J-curve).

In a recent working paper, Chakraborty and Ewens (2014) use portfolio company level data for a sample of VC funds and provide evidence that dovetails neatly with our analysis. Specifically, they document that, after fundraising, VC funds write off past portfolio company investments more often, while investments done after fundraising have lower returns and a lower probability of successful exit.[9] These results are quite consistent with our observations based on the analysis of NAV markdowns, which tend to be more frequent and of greater size in the post-fundraising periods for both VC and buyout funds.[10]

The remainder of the paper is organized as follows. Section I describes fundraising in the private equity industry and the research hypotheses to be tested. Section II describes the data and presents sample summary statistics. Section III presents the empirical methods. Section IV presents and discusses the estimation results. Section V concludes.

1 Fundraising in the Private Equity Industry

Typically, private equity (PE) funds are organized as limited partnerships, with private equity firms serving as general partners (GPs) of the funds, and large institutional investors and wealthy individuals providing the bulk of the capital as limited partners (LPs). These funds typically last for ten years, so successful PE firms stay in business by raising a new fund every three to six years. When a PE firm decides to raise a new fund,

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current fund to compute its PMEs. Also see Korteweg and Nagel (2013) and Sorenson and Jagannathan (2013) for more generalized analysis and extension of the PMEs.

[8] Put another way, it might be more advantageous to fundraise when their relative performance is at its peak even if their absolute performance is below its lifetime maximum, than the other way around.

[9] In a related paper, Braun and Schmidt (2014) find that returns to investments exited during fundraising are significantly higher than those exited post-fundraising. Crain (2013) finds that conditional on achieving a good performance early in a fund's life and thus securing a follow-on fund, GPs subsequently increase riskiness of their fund portfolios.

[10] Also see Arcot et al. (2014) and Degeorge et al. (2013) for evidence of strategic participation in SBOs (secondary buyouts) by fundraising GPs.

the GPs of the current fund begins a fundraising campaign that lasts anywhere between a few months to more than a year and a half, depending on the prestige and perceived ability of the PE firm, overall market conditions, and the size and terms of the fund being raised.

Unlike mutual funds, private equity fund performance is reported using internal rates of return (IRRs) and value multiples (VMs).[11] Before the Freedom of Information Act (FOIA) forced large public LPs to disclose returns of individual funds they invested, leading to emergence of third-party data aggregators such as Preqin in recent years, Venture Economics provided summary information about IRRs and VMs for a cohort of same-vintage-year, same-fund-type, same-geographic-region funds while maintaining anonymity of individual funds who provided them with their performance data. In particular, the cutoffs for the median and top-quartile of performance for each vintage year are closely watched statistics and have become the de facto benchmarks for private equity funds. Because it is very difficult to measure risk for individual funds, the dominant performance measures in the industry are these vintage year comparisons.

1.1 Interim Performance and Fundraising

A key presumption underlying the SEC's concerns regarding the reporting of interim performance is that interim performance matters when a GP is engaged in fundraising. To the extent that GPs compete with other GPs when seeking to raise capital for a new fund, the interim performance of the fundraising GP's current fund relative to those of the same-vintage-year cohort funds is likely an important signal of the GP's ability to prospective investors. Ceteris paribus, the higher the current fund's interim performance relative to its cohort funds, the higher the probability that the GP can successfully raise the next fund.

The effect of interim performance on fundraising depends on the relative importance of interim performance as an information signal. We hypothesize that interim performance of existing funds is particularly important in the fundraising efforts of young GPs that lack a strong reputation among LPs. Young GPs with only a short firm history

[11] Value multiple, also called investment multiple or Total Value to Paid-in Capital (TVPI), is defined as (Cumulative Distributions to LPs to date + NAV of unrealized investments)/Cumulative Calls to date. A value multiple of one implies that the sum of realized and unrealized investment values equals the amount of dollars that the LP paid into the fund. Fund level performance is typically reported using VMs and IRRs.

do not have past track records, and good interim performance is needed to boost the investors' demand for their new fund. Similarly, GPs who have raised relatively little capital in the past or who have never had a top-quartile fund before (the aforementioned key benchmark in the industry) likely lack the strong reputation that would generate investor demand for their new fund. In contrast, old, large, or high-reputation GPs with previous top-quartile funds rely less on the current fund's interim performance to appeal to their prospective investors, and hence we predict their ability to raise funds will be less sensitive to the interim performance of existing funds.

In summary, for the SEC concerns regarding the reporting of interim valuations to have credibility, interim performance must materially affect the ability of GPs to fundraise. To set the stage for our subsequent analysis, we test the following incentive hypothesis:

> H1: Interim performance of a fund affects the ability of a GP to raise a follow-on fund.

To the extent that interim performance matters, we conjecture that these effects are more pronounced for small, young, and low-reputation GPs:

> H1a: Interim performance of a fund affects the fundraising ability of a small, young, and low-reputation GPs more than more established GPs.

In our empirical analysis, we test these hypotheses by analyzing the probability of successfully raising a follow-on fund and the size of the follow-on fund.

1.2 The Timing of Fundraising

If the current fund's interim performance positively affects the GPs' probability of successful fundraising, GPs have incentives to time fundraising to coincide with a period of strong *relative* performance for the current fund. This timing would be plausible if the GP possesses private information regarding the performance of portfolio companies held by the fund (Lerner (1994), Gompers and Lerner (1998a)). Hence, we expect the current fund's interim performance rank to peak around the fundraising events. In our empirical tests, we formally test the following timing hypothesis:

> H2: The performance rank of a GP's current fund peaks during the fundraising period for a follow-on fund.

We further hypothesize that the incentive to time fundraising events around periods of peak performance are stronger for small, young, and low-reputation GPs. This leads us to also test the following hypothesis:

H2a: The performance rank of small, young, and low-rep GP's current fund peaks more than more established GPs.

Note that evidence in favor of these timing hypotheses does not necessarily imply that GPs are manipulating reported valuations to influence their performance ranking for two reasons. First, GPs may time their fundraising efforts to coincide with a period of peak performance, but there need not be a decline in the performance rank in the post-fundraising period. Second, a decline in the performance rank of a fund in the post-fundraising period might naturally occur if the companies held in the current fund have average performance in the post-fundraising period. For example, a GP might time a fundraising event to coincide with a period when its fund is the top-ranked fund among its vintage year cohort. Subsequent to the fundraising event, this top-ranked fund might perform on par with its peers, but be overtaken in the rankings by other funds with superior performance. Thus, evidence consistent with the timing hypothesis would suggest that GPs are good at timing their fundraising events to coincide with periods of peak performance, but does not necessarily imply valuations are inflated at the time of the fundraising event.

1.3 Valuation of Portfolio Companies and Fundraising

To distinguish the timing hypothesis described above from NAV inflation at the time of fundraising, conduct two analyses. First, we analyze the frequency with which GPs engage in markdowns, which we define as a downward adjustment in the fund's reported NAV (adjusted for calls and distributions) following a fundraising event. If NAVs are inflated at the time of a fundraising event, we expect to observe larger and more frequent markdowns following fundraising events. Second, we analyze the post-fundraising performance of GPs by assuming an LP invests in the fund at the NAV as of the fundraising quarter. In our empirical analysis, we test the following two hypotheses related to NAV management hypothesis:

H3: The size and frequency of NAV markdowns increase following fundraising events

H4: Investments in fundraising GPs' current funds at stated NAVs at the time of fundraising perform poorly.

As in the case for the timing hypothesis, we expect that the small, young, and low-rep GPs face a greater temptation to upwardly bias valuations during the fundraising period for a follow-on fund. Thus, we also test the following hypothesis:

H3a: The size and frequency of NAV markdowns increases following fundraising events more for small, young, and low-rep GPs than for more established GPs.

H4a: The post-fundraising performance erosion is greater for small, young, and low-rep GPs than for more established GPs.

To summarize, we investigate the following questions in this paper: Does interim performance significantly affect the ability of a GP to raise capital for a follow-on fund (the incentive hypothesis)? Do GPs time the fundraising for a follow-on fund to coincide with periods of peak performance (the timing hypothesis)? Is there evidence that GPs inflate valuations when engaging in fundraising for a follow-on fund (the NAV management hypothesis)? For each of these questions, we also consider whether the incentive, timing, and NAV management effects are more pronounced for small, young, and low-rep GPs.

To preview our results, we generally find strong support for each of our hypotheses. Interim performance rank has a material impact on the ability to raise a follow-on fund and the size of the follow-on fund. GPs engage in fundraising when the performance rank of its current fund is at a peak. We also find evidence that NAV markdowns are larger and more frequent in the post-fundraising period, while there is reliable evidence of erosions in post-fundraising performance for buyout funds. In general, these effects are most pronounced for small, young, and low-rep GPs. Moreover, we separately analyze buyout and VC funds and find generally similar patterns for the two types of funds.

2 Data and Descriptive Statistics

2.1 Data Sources

We construct our fund dataset using two data sources. The first is the Private Equity Cash Flow data by Preqin, which provides full cash flow information (calls, distributions, and quarterly NAVs) for private equity funds, and is the key data that

allows us to measure the interim performance of sample funds. All cash flow information and NAVs are scaled by fund size and represent a hypothetical LP capital commitment of $10,000. We use the cash flow data updated as of January 2013. The second is the Performance Analyst Database by Preqin, which provides the net private equity fund performance, performance benchmarks, as well as fund type, vintage year, and size. We use this database to construct our key fund manager attributes as described below.

While both Preqin databases are global and span multiple fund types, we focus our analysis on the U.S. buyout (BO) and venture capital (VC) funds. This is primarily because our research design requires us to measure relative performance ranking among peer groups that are matched on (i) vintage year, (ii) fund type (BO or VC), and (iii) region (U.S.). By focusing on the U.S. BO and VC markets, we have a sufficient number of funds in each vintage year to estimate interim performance rankings for each sample fund. Outside of the U.S. BO and VC markets, the number of funds available for ranking is generally small. We drop the vintage years before 1993 for our sample of U.S. BO and VC funds because the number of funds per cohort year drops sharply prior to 1993. We also drop the vintage years after 2009 because as of January 2013 it is too early for many of these funds' GPs to consider fundraising for the next fund. Using the above criteria, we obtain a sample of 425 BO funds and 450 VC funds raised between 1993 and 2009.

2.2 Descriptive Statistics

In Table 1, we provide descriptive statistics on VMs, IRRs, and size by vintage year for the 425 BO and 450 VC funds that constitute our sample of funds with periodic cash flow data. The performance measures represent the fund's performance as of the date of the last reported cash flow or net asset value. For BO funds in our cash flow sample (panel A), the mean (median) IRR is 11.1% (10.2%) and the mean (median) VM is 1.47 (1.37). The mean (median) size of BO funds is $1.5 billion ($650 million). We also separately identify mature funds, which we define as either liquidated funds (as coded by Preqin) or funds with at least eight years (32 quarters) of cash flow data. The performance of mature funds is somewhat better than that of all funds. For VC funds in our cash flow sample (panel B), the mean (median) IRR is 7.0% (0.9%) and the mean (median) VM is 1.46 (1.04). Consistent with Metrick and Yasuda (2010a), VC funds

tend to be smaller than BO funds with a mean (median) size of $362 million ($250 million). The mean performance of mature VC funds is also better than that of all VC funds, though the median performance is slightly worse.

The general pattern of fund performance over time in our cash flow sample is consistent with prior work. BO funds raised in the late 1990s are relatively weak performers as are funds raised in the years leading up to the financial crisis (2005-2008). VC funds raised through 1998 tend to perform exceptionally well, while those raised since this period have been relatively weak performers.

To assess whether our sample funds are representative of the universe of private equity funds, we calculate the correlation between our sample funds' median value multiple (VM) and Preqin's benchmark VM by vintage year. The correlation is 92% for BO funds and 94% for VC funds. Since our research design requires us to rank a given fund's interim performance relative to its vintage year cohorts, the high correlation in final performance between our sample funds and Preqin funds is reassuring.[12]

3 Methods

3.1 Test of the Incentive Hypothesis

3.1.1 Hazard Rate Model of PE Fundraising

To examine our first question regarding the effect of interim performance on the probability of fundraising, we use a duration model. As discussed in Section 2, PE firms need to raise new funds every several years in order to stay in business because funds have finite lives. At the same time, the fund partnership agreements signed at the funds' inceptions contractually guarantee a highly predictable stream of payments to GPs in the form of management fees for the duration of the fund, typically 10 years. Thus, GPs have considerable latitude in deciding when to raise their next fund, though it is vital that they do so before the current fund expires and they lose the steady payments of fees. Also, in the early few years of the funds' lives GPs are busy prospecting new investments and deploying the current fund's capital, which they are contractually allowed to do anytime

[12] Harris et al. (forthcoming) report that fund performance in Preqin data is qualitatively similar to that in Burgiss and Cambridge Associates, two other leading data vendors, whereas Thomson Venture Economics data yields downwardly biased performance estimates for buyout funds. Also see Sensoy et al. (2014), which report mean (median) IRR of 14.8% (12.7%) for BO funds and 11.7% (1.3%) for VC funds in their sample of 621 (629) BO (VC) funds raised between 1991-2006.

until the end of the investment period, typically 5 years. Once the current fund is nearly or fully deployed, GPs have more time to devote to fundraising campaigns, as managing existing portfolio companies takes less time. Thus, the probability of fundraising at a given point in the life of a current fund is not expected to be constant, but rather will typically start low at the beginning of a fund's life, rise in the middle, and decline toward the end of a fund's life. To control for this temporal variation in the probability of raising a follow-on fund, we use a Cox proportional hazard rate model, which is well suited to handle this feature of our sample data.

We define as a "failure" event for fund *n* managed by GP *i* as the completion of fundraising their next fund *n+1*. GPs are allowed to "fail" anytime during fund *n*'s lifetime up to 10 years. Once fund *n*'s GP "fails" and raises the next fund, it leaves the sample for the remainder of the analysis, much like a patient leaves the sample of a medical study once she dies. We define the fundraising quarter for fund *n* as the quarter in which we first observe cash flow activity in the follow-on fund (generally a first call for the follow-on fund) in the Preqin cash flow data.

We specify the hazard rate for raising a follow-on fund of GP *i* as:

$$h(t|x_i) = h_0(t)\exp\left(x_{it}'\beta_x\right) \quad (1)$$

where x_{it} are fund characteristics (some of which are time-invariant and some are time-dependent), β_x is a parameter vector, and $h_0(t)$ is the baseline hazard function common to all funds in the sample.

Figure 1 reports the Kaplan-Meir survival graphs for the sample funds' fundraising events over fund quarters 1 through 40 (year 1 through 10 of fund lifetime). Panel A presents the graph for buyout funds; Panel B presents the result for VC funds. The graph plots the nonparametric maximum likelihood estimate of *S(t)*, the probability that a fund's GP will not engage in a fundraising event by the end of fund quarter *t*.[13] Number at risk along the *x*-axis shows the number of funds "at risk" of fundraising at a given fund quarter, i.e., the number of funds which have neither failed (engaged in a fundraising event) nor otherwise been censored by that point.

[13] Formally, for *t = 1* to *40*, let n_t be the number of funds "at risk" of fundraising just prior to quarter *t,* and d_t be the number of fundraising events ("failures") during quarter *t*. The Kaplan-Meier estimator for *S(t)* is:

$$\hat{S}(t) = \prod_{i=1}^{t} \frac{n_t - d_t}{n_t}$$

The graphs indicate that most fundraising events for buyout fund GPs occur between year 3 and 8 (quarter 8 and 31), as the curve is fairly flat before quarter 8 and after 32. In contrast, VC fund GPs start fundraising as early as year 2 (quarter 4) and conclude most fundraising events by the end of year 7 (quarter 27). About one third (two fifths) of BO (VC) fund GPs in our sample have not raised follow-on funds by the end of the current funds' tenth year.[14]

Since the slope of the empirical survival function curve is clearly not constant over time, but is changing over the lifetime of a fund, it is important that our analysis of the hypotheses regarding the effects of the interim performance on fundraising probability controls for this empirical pattern. Note that $h_0(t)$ in the Cox proportional hazard model non-parametrically captures this shape and imposes a common shape to all individual funds in the sample. Further, the model allows the individual funds to vary in their hazard rate parametrically, and this individual variation enters the model multiplicatively through $\exp(x_{it}'\beta_x)$.

For the baseline model specification, we include the following independent variables: a fund's interim performance rank, the fund's final performance rank, the log size of the current fund, and a dummy variable that is equal to one if the GP had a top quartile fund *prior* to the current fund. Interim performance rank is a fund performance percentile rank among its vintage-year cohort funds based on its value multiple (VM) at quarter *t*-1. To calculate this variable, we proceed as follows: First, using Preqin's cash flow data, we calculate the fund's value multiple each quarter. Second, in each quarter, we rank all *N* funds within a given vintage year cohort from highest (*rank* = 1) to lowest (*rank*=*N*) by the calculated value multiple. Fund *i*'s interim percentile rank for quarter *t* is:

$$\frac{(rank_{it}-1)}{(N-1)}. \qquad (2)$$

[14] Our research design requires that both the current and follow-on funds are in our cash flow data sample, so that we can observe the fundraising quarter as the quarter in which the first cash flow or NAV is reported for the follow-on fund. While this enables us to observe fundraising events more precisely and in a consistent manner, the drawback of this approach is that sometimes we are missing actual fundraising events. For instance, suppose fund I was raised in 1995, fund II in 2000, and fund III in 2006, but fund II is missing from the Preqin cash flow data and we only observe the cash flow activities of fund I and III. We would then code fund I as never raising a follow-on fund during its first 10 years. To the extent that this adds noise to our coding of fundraising quarters, the missing data biases us *against* finding support for our hypotheses.

Final rank is a fund's final percentile rank and is based on its final performance relative to cohort funds. Finally, we include the natural log of the current fund's committed capital ($million) as a control variable.

Our key coefficient of interest is the parameter estimate on interim fund performance, which measures the impact of a fund's interim performance rank on the hazard ratio for raising a follow-on fund. To test the incentive hypothesis (Hypothesis 1), we test for a reliably positive coefficient estimate associated with interim fund performance.

The baseline model constrains an incremental unit change in the interim performance rank to affect the hazard rate by a multiplicative constant independent of whether the fund has a low or a high performance rank. To test whether our results are sensitive to this model assumption, we consider two alternative specifications. First, we include a square term of the interim performance rank variable. Second, given the importance placed on quartile rankings in the PE world, we replace the interim performance rank variable with 3 dummy variables that take a value of one if a fund's performance rank in quarter *t* is in the top (second/third) quartile among its vintage year cohort funds.

Finally, we examine whether the effect of interim performance on fundraising varies with the reputation of the GP (Hypothesis 1a). To test this hypothesis, we estimate a fully interactive model that uses quartile dummy variables resulting in separate coefficient estimates for (i) young, small, and low-reputation GPs and (ii) old, large, or high-reputation GPs. Small, young and low-rep GPs are funds run by BO (VC) GPs (i) whose cumulative capital raised prior to the sample fund is less than $1B ($250M) (small), (ii) who have raised fewer than three funds in the past (young), *and* (iii) who had no top-quartile performing funds that are more than 5 years old as of the inception of the sample fund (low-rep). Large, old or hi-rep GPs are the complements of small, young, and low-rep GPs.

3.1.2 Tobit Regression of Follow-on Fund Size Growth

While the key determinant of a GP's long-term success is the ability to raise a follow-on fund, we are also interested in whether interim performance has a material impact on the size of the follow-on fund that a GP is able to raise, since larger funds also

redound to the benefit of the GP. To do so, we estimate a regression where the dependent variable is the percentage growth in the size of the follow-on fund relative to the GP's current fund. For example, a GP with a current fund size of $500 million that raises a follow-on fund with capital commitments of $600 million experiences a 20% growth in fund size. GPs that fail to raise a follow-on fund are assigned a percentage growth of -100%.

The independent variables are similar to those described above, but adapted to accommodate the fund-level nature of the analysis. Specifically, interim performance rank for fundraisers is the performance rank of the fund averaged across the four quarters prior to the fundraising event, and the quartile dummy variables are based on this mean interim performance rank. For non-fundraisers, we use the interim performance rank averaged across quarters 13 to 28 (i.e., years three to seven of a fund's life), and the quartile dummy variables are based on this mean performance rank (i.e., a fund with a mean performance rank less than 0.25 would be a bottom-quartile fund). As controls, we include the final performance rank of the fund. Models are estimated with year fixed effects, where year is defined as the vintage year of the follow-on fund for fundraisers and the sixth year of current fund's life for non-fundraisers.[15] Finally, to account for the fact that growth is bounded from below at -100%, we estimate these models using a Tobit specification.

3.2 Event Study Test of Timing Hypothesis

To test the timing hypothesis, we analyze the pattern of funds' interim performance rank around fundraising events. In principle, this is similar to a standard event study common in analyses of stock returns around corporate actions. However, instead of stock returns, we analyze a fund's percentile rank relative to its lifetime average percentile rank around the time of a fundraising event. We define event quarter *t=0* as the quarter in which we observe the first cash flow activity for the follow-on fund in Preqin.

[15] We are forced to make assumptions regarding the relevant interim performance and year to use for non-fundraisers in this analysis. Our results are qualitatively similar if we measure interim performance over quarters 9 to 28. Similarly, results are unchanged if we base the non-fundraisers' year on the fourth or fifth year of the fund's life.

We define the excess rank for fund *i* in quarter *t* as its quarter *t* percentile rank less the mean percentile rank for the fund across all reporting quarters. By construction, the excess rank has a mean of zero across quarters. Excess rank measures the extent to which a fund's rank in quarter t deviates from its lifetime average rank. We calculate the average of this excess rank variable across GPs that successfully fundraise between event quarters *-7* to *+14* where quarter *t=0* is the fundraising quarter. If the current fund's interim performance peaks around the fundraising event, that would predict significantly positive excess ranks around $t = 0$.

The timing hypothesis predicts that the excess rank for fundraising GPs will peak around quarter *t=0*. To address our ancillary prediction that the extent of performance peaking depends on the reputation of the GP (hypothesis 2a), we conduct the excess rank analysis separately for (i) small, young, *and* low-reputation GPs and (ii) large, old, or high-reputation GPs.

3.3 Tests of NAV Management Hypothesis

3.3.1 NAV Markdowns

We first test the NAV management hypothesis by analyzing the size and frequency of markdowns after the fundraising period (hypothesis 3). The NAV management hypothesis maintains that NAVs are held at inflated valuations during the fundraising period for a follow-on fund. If true, we would expect to observe a higher incidence of downward revisions of NAVs, what we refer to as NAV markdowns, following the completion of a fundraising event. NAV markdowns can occur in two ways: (1) a GP may mark down the valuation of portfolio companies, or (2) a GP may exit a portfolio company that was held at valuation greater than the exit value.

We estimate NAV markdowns by assuming calls are booked at cost and distributions are held at market value when they occur. For example, we assume a $100 call will increase the NAV of a fund by $100 and a $100 distribution will decrease the NAV of a fund by $100. Our assumption regarding calls is close to what we observe in practice. Our assumption regarding distributions overstates the booked valuation associated with the average distribution, since portfolio companies are generally held at

valuations below their exit values.[16] However, this assumption ensures that when we observe a decline in NAV that exceeds the value of the exited investment, we have indeed observed a markdown in the NAV of the fund. With these assumptions, we define a markdown (*MD*) on a $10,000 LP capital commitment as:

$$MD_{qt} = \min\left(NAV_t - (NAV_{t-1} + C_t - D_t), 0\right) \quad (3)$$

We require a minimum level of markdown (-$50) to ensure that our results are not driven by economically small markdowns by setting $MD_{qt}=0$ when equation (3) results in a markdown between 0 and -50; results are qualitatively similar without the filter on small markdowns. In Table 2, we present descriptive statistics on the NAVs, Calls, Distributions, and markdowns for the VC and buyout samples.

For buyout funds, the mean reported NAV is approximately $5,500 on a scaled LP capital commitment of $10,000. The average call and distribution is quite small (less than $300) because many quarters have no calls or distributions. We observe calls in 60% of buyout fund quarters and distributions in 46% of fund quarters. For VC funds, the mean reported NAV is approximately $5,400. The mean call and distribution is also less than $300 with VC funds reporting calls in 51% fund quarters and distributions in 25% of fund quarters. As expected, VC distributions are less frequent and more positively skewed than buyout distributions. In Figure 2, we plot the average NAV and the interquartile range of NAVs for our sample funds through quarter 40. There is predictable variation in the average NAV, which peaks around quarter 20 (year 5) and then declines as the fund reaches maturity.

Returning to Table 2, the key dependent variable of interest is the size and incidence of markdowns. For buyout funds, markdowns occur in 29% of fund quarters and the mean markdown is -$166. Conditional on observing a markdown, the interquartile range for markdowns is -$111 to -$656. Markdowns are more common (occurring in 45% of fund quarters) and slightly larger in absolute value (mean -$260) for

[16] To estimate the average effect of a call and distribution on NAV changes, we regress NAV changes (dependent variable) on distributions and calls (independent variables) with year and fund quarter fixed effects. The coefficients on the distribution and call variables can be interpreted as the average effect of a $1 distribution or call on NAV. For buyout funds, the call and distribution coefficients are 0.98 and 0.76 (respectively); for VC funds, the call and distribution coefficients are 0.92 and 0.44. Thus, for both buyout and VC funds calls are booked close to their value. The values of exited investments tend to be held conservatively, with the conservatism being more pronounced for VC funds.

VC funds, which is expected given the generally skewed payoffs associated with VC funds relative to buyout funds.

For both buyout and VC funds, the absolute size and incidence of markdowns tends to be highest in the aftermath of the internet bubble (2000 to 2002) and at the beginning of the financial crisis (2008). In Figure 3, we present the median markdown (conditional on observing a markdown) and markdown incidence by calendar year for buyout (panel A) and VC (panel B) funds. For buyout funds, the size of markdowns varies across years from about -$100 in 1997 to about -$400 in 1998, 2000 to 2002, and 2008. The incidence of markdowns for buyout funds also peaks in 2000 to 2002 and 2008. There is more variation in the size and incidence of markdowns for VC funds. For VC funds, the size of markdowns varies from about -$100 in 1999 to about -$900 in 2000 – the year of the NASDAQ meltdown – with large markdowns in the 2001 and 2002 period as well. The incidence of markdowns is the highest in 2001, 2002, and 2008 for VC funds. These patterns provide comfort that NAV markdowns are picking up economically meaningful variation in the valuation of PE portfolio companies.

Though there is some variation in the size and incidence of markdowns over a fund's life, this variation is modest relative to that across calendar years. In Figure 4, we present the median markdown (conditional on observing a markdown) and markdown incidence by year in a fund's life. For both buyout and VC funds, markdown size is somewhat smaller in the first three years of a fund's life and reaches a relatively stable level in years four through ten. In contrast to the size of markdowns, we tend to observe a steady decline in the incidence of markdowns over a fund's life (with a somewhat steeper decline for VC funds).

Our key independent variable of interest is a dummy variable (POSTFUND) that takes a value of one in periods after a fundraising event. Specifically, $POSTFUND_{iq}$ is a dummy variable that takes on a value of one in quarters *+1* to *+14*, where quarter *0* is the quarter in which we observe the first call of the follow-on fund.[17] The NAV management hypothesis predicts that inflated valuations during a fundraising period will be unwound post-fundraising as the fund either marks down its portfolio companies or exits the investments at valuations that are below their booked valuations. To formally test this

[17] Results are qualitatively similar when we define *POSTFUND* = 1 in quarters +1 to +8.

hypothesis, we estimate a Tobit regression where the dependent variable is the size of a markdown in quarter q for fund *i* (MD_{iq}):

$$MD_{iq} = a + bPOSTFUND_{iq} + \mu_i + \mu_q + \mu_y + \varepsilon_{iq} \quad (4)$$

As a further robustness check to ensure our results are not driven by a few large markdowns, we also estimate a conditional logit regression where the dependent variable is a dummy variable that takes a value of one if there is a markdown in quarter *q* for fund *i* (MD_DUM_{iq}).

In both models, we include fixed effects for calendar year, fund quarter, and fund (μ_y, μ_q, μ_i, respectively). The calendar year fixed effect controls for the variation in markdowns across market conditions, and the fund quarter fixed effect controls for the variation in markdowns over a fund's life. Finally, fund fixed effects control for any systematic variation in the size and incidence of markdowns across funds. With fund fixed effects, the coefficient estimate on the key *POSTFUND* variable is an estimate of whether the size or incidence of markdowns is large in the period following fundraising relative to other quarters in a fund's life. To test our ancillary prediction that the size and frequency of markdowns in the post-fundraising periods varies with GP reputation (hypothesis 3a), we compare results for (i) small, young, *and* low-reputation GPs and (ii) large, old, or high-reputation GPs.

3.3.2 Pseudo Value Multiples (PVM) and Post-Fundraising Performance

The advantage of the markdown analysis outlined in the prior section is that it allows us to use all fund-quarter observations to detect unusual patterns in the evolution of NAVs. We also test the NAV management hypothesis by analyzing the post-fundraising performance of fundraisers relative to an appropriate benchmark (hypothesis 4). To do so, we introduce the concept of a pseudo value multiple (PVM), which is the value multiple that is calculated assuming that a prospective investor (LP) buys a fund at its end-of-quarter NAV in quarter t and holds the fund until liquidation:

$$PVM_{it} = \frac{\sum_{\tau=t+1}^{T} D_{i\tau}}{NAV_{it} + \sum_{\tau=t+1}^{T} C_{i\tau}}, \quad (5)$$

where $D_{i,\tau}$ and $C_{i,\tau}$ are distributions and calls, respectively, for fund i in quarter τ, and T is the fund's liquidation quarter. If the fund does not liquidate, we include the last reported NAV for the fund in the numerator of the PVM calculation, but restrict the analysis to mature funds (i.e., funds with a minimum of 32 quarters of cash flow observations) to ensure that we have a reasonable portrait of the fund's final performance.

To test whether the PVMs of funds that are fundraising at t are reliably less than those of funds that are not actively fundraising, we calculate the PVM for all vintage year cohort funds *each* time there is a fundraising event. For example, for the vintage year 1993, our sample includes 10 buyout funds and 8 of the 10 raise a follow-on fund. The 8 funds that raise a follow-on fund yield 7 fundraising events (two funds have a common fundraising quarter of 1997Q3). Thus, there are 7 fundraising events for the 1993 cohort and for each of these fundraising events, we calculate the PVM for the ten cohort funds yielding a total of 70 observations (8 PVMs for fundraisers and 62 PVMs for non-fundraisers across the 7 fundraising events). We repeat the calculations for each vintage year (y=1993,2007) for the F_y fundraising events and N_y cohort funds in vintage year y.

Armed with observations for all cohort funds ($i=1,N_y$) for each of the fundraising events ($f=1,F_y$) and all vintage years ($y=1993, 2007$), we estimate the following regression:

$$PVM_{ify} = a + bFUNDRAISER_{ify} + \mu_{fy} + \mu_i + \varepsilon_{ify}, \tag{6}$$

where $FUNDRAISER_{ify}$ is a dummy variable that takes a value of one if fund i is the fundraiser associated with fundraising event f for vintage year y. We include vintage year-and-event fixed effect (μ_{fy}) to take out the mean PVM across funds associated with each fundraising event, and fund fixed effect (μ_i) to take out the average PVM over a fund's life. We winsorize the dependent variable, PVM, at the 5th and 95th percentile to deal with outliers. As an alternative, we estimate regressions where the dependent variable is the percentile rank of a fund's PVM relative to other cohort funds. In both specifications, the coefficient of interest (b) measures whether fundraisers have unusual PVMs relative to cohort funds and the fund's own PVM outside of the fundraising window.

4 Results

4.1 Test of the Incentive Hypothesis

4.1.1 Success in Fundraising

Table 3 reports the estimation results for hazard rate models of fundraising events as a function of interim performance rank. Panel A presents the results for BO funds, Panel B for VC funds. In each panel, columns (1)-(3) show the results using all funds, and columns (4) and (5) show subsample results estimated using a single fully interactive model with separate baseline hazard rates for the two subsamples. Hazard ratios (exponentiated coefficient estimates) are shown in all columns.

The hazard ratio (coefficient) for the interim performance rank variable in column (1) of Panel A is 7.105 (1.961)[18] and is statistically significant at 1% level. Since this variable is a continuous variable ranging between 0 and 1, an incremental change in the percentile rank of 0.1 (e.g., from the 30th to 40th percentile rank) is associated with a proportional scaling of the hazard by 1.22.[19] Column (1) of Panel B indicates that the hazard ratio (coefficient) for the interim performance rank variable for VC funds is 5.388 (1.684) and statistically significant at 1 %; thus, an incremental increase in the percentile rank by 0.1 is associated with a proportional scaling of the hazard by 1.18.[20] The hazard ratio for the final performance rank variable is not significantly different from one, suggesting that, while the fund's interim ranking among its vintage-year cohorts in the quarter prior to the fundraising event significantly and positively affects its fundraising probability, its *final ranking* among its cohorts has no significant effect.[21] Similarly, fund size has no significant effect over and above the interim performance rank.

While the linear model imposes the constraint that an incremental change in the interim performance rank scales the hazard by the same constant proportion whether it

[18] For example, hazard ratio for the interim performance rank variable in column (1) of Panel A, 7.105, corresponds to the regression coefficient of ln(7.105) = 1.961. Hazard ratios are equal to exp(coefficient) and are particularly useful when interpreting economic significance of indicator variables such as top-quartile dummies, since it indicates the gross % change in the dependent variable as a result of changing the value of an explanatory variable by 1. Thus, a hazard ratio greater than (smaller than) 1 indicates a positive (negative) effect; a hazard ratio of 1 indicates zero effect.

[19] Exp(0.1*coefficient) = exp(0.1*1.961) = 1.22.

[20] Exp(0.1*coefficient) = exp(0.1*1.684) = 1.18.

[21] Hochberg et al. (forthcoming) find that final IRR has greater explanatory power than the interim IRR for predicting future fundraising for a sample of VC firms. As a robustness check we examine and find that for our VC sample funds, the final IRR also has greater explanatory power than the interim IRR in predicting fundraising.

increases from 0.1 to 0.2 or from 0.7 to 0.8, in practice the effect of a 10% jump in relative performance on the probability of fundraising may not be constant. For example, whether a fund is in the top 1% vs. 10% may matter less than whether it is in the top 50% vs. 60%. To account for this possibility, in column (2) of Table 3, the interim performance rank variable is allowed to enter the model non-linearly, with the addition of its quadratic term, (interim performance rank)^2. The hazard ratio for the level of the interim performance variable is greater than one, whereas the hazard ratio for the quadratic term is reliably less than one, suggesting a unit increase in the interim performance rank has a diminishing effect on the fundraising hazard ratio as it goes from 0 to 1. Figure 5 plots the hazard ratio for a unit change in interim performance rank for the quadratic model over the support of the interim performance rank variable (between 0 and 1). For both BO and VC funds, improving the interim performance rank has more dramatic positive effects on the fund's fundraising probability when the fund's performance is low; the higher the level of performance rank, the smaller the incremental effect of improving the current percentile rank.[22] The rate of deceleration is more pronounced for VC in the range between 0.7 and 1, suggesting that for VC funds, improving the interim performance rank beyond 0.7 has relatively little effect on the fund's fundraising probability.

In column (3) of Table 3, we further examine the possibility of non-monotonicity across the quartile marks by replacing the interim performance rank variable (a continuous variable between 0 and 1) with three indicator variables for being in the Top quartile, 2nd quartile, and 3rd quartile (the bottom quartile being the omitted category), respectively. The hazard ratio for being in the 3rd quartile (relative to being in the bottom quartile) is 2.441 for BO funds, and is statistically significant at 1% level. This implies that a fund in the 3rd quartile has a hazard ratio of 2.441 times that of a fund in the bottom quartile category. Likewise, a fund in the 2nd (top) quartile category has a hazard ratio of 3.759 (5.639) times that of a fund in the bottom quartile category. For VC funds, the effect of being in the 3rd and 2nd quartile category is quite similar to BO funds, with

[22] For example, a BO (VC) fund with a performance rank of 0.6 has a hazard ratio of 1.21 (1.19) times that of a fund with the performance rank of 0.5. For example, for BO funds:
exp(0.6*ln(48.07)+0.6^2*ln(0.169))/ exp(0.5*ln(48.07)+0.5^2*ln(0.169)) = 5.387/4.447 = 1.21.
In contrast, a BO (VC) fund with a performance rank of 1 has a hazard ratio of only 1.05 (1.01) times that of a fund with a performance rank of 0.9.

hazard ratios of 2.237 and 3.925, respectively. However, being in the top quartile category is associated with a hazard ratio of only 4.270, which is only marginally better than being in the 2nd category. Thus, for VC funds, there appears to be relatively little difference between being in the 2nd and top quartile brackets, whereas for BO funds there is a more measurable improvement in the hazard ratio.

Overall, the results reported in columns (1)-(3) imply that the interim performance rank of a fund has a positive and significant effect on the fund GP's probability of fundraising. These results are consistent with the incentive hypothesis (Hypothesis 1). Furthermore, the impact of a unit change in the interim performance rank has greater positive impacts on the hazard ratio when the fund's performance is lower than when it is higher. Thus, a fund whose performance is average has a lot more to gain from a 10% increase in its ranking than a fund that is already in the top quartile.

Do these effects vary by the reputation of the GP (hypothesis 1a)? Columns (4) and (5) of Table 3 report the subsample estimation results where the model specification is the same as in column (3) but the model is estimated as a fully interactive model with separate baseline hazard rates and coefficients for (i) small, young and low-rep GPs, and (ii) large, old, *or* hi-rep GPs. By construction, small, young and low-rep GPS do not have a prior past top quartile fund, so this variable only appears for large, old, or hi-rep GPs. Recall small, young and low-rep GPs are run by GPs who lack past track records and are expected to need the good interim performance of the current fund the most in order to successfully engage in a fundraising event. Thus we expect their fundraising probability to be more sensitive to the interim performance than that for large, old or hi-rep GPs.

For BO funds, Column (4) in Panel A of Table 3 indicates that indeed there is a much sharper increase in fundraising probability when a fund run by small, young and low-rep GPs improves its interim performance from the bottom quartile to 3rd, 2nd, or Top quartile. For these GPs having a top quartile fund increases the fundraising hazard ratio by 8.641 times – roughly twice the impact (4.332) we observe for large, old, or hi-rep GPs. The differential impact of interim performance for the two subsamples is also evident in the coefficient estimates on the 2nd and 3rd quartile dummy variables. We are able to reject the null hypothesis that small, young, and low-rep GPs are equally or less responsive to interim fund performance than large, old, or hi-rep GPs at *p=0.08*

significance level for 3rd Quartile funds. For the top two quartiles, the p-values are just shy of conventional levels of statistical significance (*p=0.11* and *0.17* for the top and 2nd quartiles, respectively). These results suggest that small, young and low-rep BO fund GPs have particularly strong incentives to demonstrate either the top or 2nd quartile interim performance in order to succeed in fundraising.

For VC funds, the results are equally interesting with some nuanced differences. It appears that for large, old or hi-rep VC fund GPs, there is virtually no difference in fundraising probability whether their current fund is in the Top or 2nd quartile category (3.05 vs. 2.96), and being in the 3rd quartile category is indistinguishable from being in the bottom quartile (1.26 and insignificant). Thus, beating the median is the main meaningful criteria when it comes to fundraising for established VC GPs. In contrast, the fundraising probability is significantly improved for small, young, and low-rep VC fund GPs when such a fund escapes being in the bottom quartile and continues to improve (though less dramatically) as it further hits the 2nd and top quartile marks. We are able to reject the null hypothesis that small, young, and low-rep GPs are equally or less responsive to interim fund performance than large, old, or hi-rep GPs at *p=0.02* significance level for 3rd Quartile funds. For the top two quartiles, the p-values are just shy of conventional levels of statistical significance (*p=0.11* and *0.16* for the top and 2nd quartiles, respectively). Overall, the results in columns (4) and (5) are consistent with our Hypothesis 1a, and suggest that the interim performance rank variable serves as a particularly important information signal for low reputation GPs who need the strong interim performance most in order to successfully raise their next fund.

While interim performance is clearly important when a GP seeks to raise a follow-on fund, it is natural to wonder if the effect of a current fund's performance is as important as having a strong prior (i.e., liquidated) fund. The results in column (3)-(5) allow us to address this question by comparing the hazard ratios associated with the two top quartile dummy variables – that for the current fund v. that for prior funds. Among all buyout funds (column (3), panel A), having a past top quartile fund reliably increases the hazard ratio to 1.73, but this effect is less than 1/3rd of that associated with having a top quartile performance for a current fund. For all VC funds (column (3), panel B), having a top quartile past fund *does not* reliably improve a GP's fundraising prospects, in stark contrast to the strong effect of having a top quartile current fund. The results are

qualitatively similar, though less in magnitude, when we focus on large, old, or hi-rep GPs (column (5)).

4.1.2 Follow-on Fund Size Growth

In Table 4, we provide additional evidence on the importance of interim fund performance by analyzing the growth in follow-on fund size as a function of interim performance. Consistent with the results for the probability of successful fundraising, we find that interim performance is positively related to the size of the follow-on fund. In the linear specification of column (1), the magnitude of the effect is roughly similar for buyout and VC funds and indicates that a 10 percentage point improvement in a fund's percentile rank (e.g., from the 30th to 40th percentile) increases the size of a follow-on fund by about 20%. The relation is nonlinear for VC funds, but there is only weak evidence of nonlinearities in the relation for buyout funds (see column (2)). The quartile dummy variable specification provides further confirmation of the importance of interim performance as a determinant of follow-on fund size.

To get a handle on the economic significance of these results, consider the dummy variable model. For buyout funds, the coefficient estimates on the top, second, and third quartile dummies are 1.693, 0.921, and 0.449, respectively. These estimates suggest that, for buyout funds, having a current fund in the top, second, or third quartile is associated with a 169%, 92%, and 45% increase in the size of the follow-on fund relative to that of a bottom-quartile fund. For venture funds, being in the top, second, or third quartile increases the size of the follow-on fund by 164%, 124%, and 85%, respectively. It is also interesting to note, as was the case for our hazard rate analysis, that the impact of strong interim performance on fund size is economically more important than having a *prior* top quartile fund. For buyout funds, the coefficient estimate on the interim top quartile dummy is roughly three times the coefficient on the *past* top quartile dummy. For VC funds, the past top quartile dummy is not reliably related to the size of a follow-on fund.

For buyout funds, we see strong evidence of differences in these incentives when GPs are partitioned into small, young, and low-rep GPs versus others. Interim performance is a much more important determinant of follow-on fund size for small, young, and low-rep GPs than others. These effects are economically large. For example, a top quartile buyout fund for a small, young, and low-rep GP increases the size of the

follow-on fund by 259%, while for other GPs the increase in the size of the follow-on fund is 91%. Formal tests of significance indicate the impact of interim performance on fund size is much greater for small, young, and low-rep GPs at conventional significance levels (p=.003, .03, and .02 for the top, 2nd, and 3rd quartile dummies, respectively). In contrast, the impact of interim performance on fund size is not reliably different for the two subsamples, perhaps because VC funds do not enjoy the same economies of scale as buyout funds (Metrick and Yasuda (2010a)).

To succinctly summarize the results of the prior two sections, for both buyout and VC funds, we find strong evidence that interim performance affects the probability that a GP is able to raise a follow-on fund and this effect is more pronounced for small, young, and low-rep GPs. We also find strong evidence that interim performance affects the size of the follow-on fund; for buyout funds, this effect is also more pronounced for small, young, and low-rep GPs.

4.2 Event Study Test of Timing Hypothesis

Figure 6 plots the mean percentile rank of funds based on value multiples (VMs) in event time, where t=0 is the quarter of a fundraising event. Thus, only funds run by GPs who have successfully raised follow-on funds by the end of the current funds' 10th fund year are included in the calculation. Furthermore, sample funds are split into (i) small, young, and low-rep GPs and (ii) large, old or high-rep GPs. Panel A presents the result for buyout funds; Panel B presents the result for VC funds.

Several observations can be made from the figure. First, fundraisers are above-average performers in their current funds, at least around the time of fundraising. Indeed, with the exception of the small, young and low-rep VC funds whose mean percentile rank dips below 0.50 between quarter +11 and +13, all other groups of fundraisers stay above 0.5 on average at all times between event quarters -7 and +14. Note that by construction 50% of sample funds have percentile rank below 0.5 at any given point, and over the lifetime of a fund close to two thirds (three fifths) of BO (VC) funds succeed in fundraising; thus, at least for some of these fundraisers, their above-average performance at the time of fundraising is excessively high relative to their usual performance rank.[23]

[23] We formally test the extent to which the average performance at the time of fundraising is excessive in the next section.

Second, the percentile rank performance of fundraisers appears to peak either at or shortly before the time of fundraising. For low (high) reputation BO GPs, the peak is at quarter -3 (-1) at 0.65 (0.62). For low (high) reputation VC GPs, the peak is at quarter 0 (0) at 0.60 (0.65). These results indicate that our sample fundraisers "look their best" exactly when doing so would help them the most – namely when they are about to conclude their fundraising campaigns and are soliciting commitments from prospective LPs.

Third, and perhaps most interestingly, small, young and low-rep GPs have the most dramatic improvement in their performance rank during the fundraising period, whereas it is much less dramatic for large, old or hi-rep GPs. This is consistent with the view that low-reputation GPs have the greatest incentive to time their fundraising events around periods of peak performance.

Finally, comparing the BO and VC fund samples, it is also interesting to note that low-reputation BO fund GPs manage to outperform their high-reputation counterparts in the 3 quarters prior to fundraising events, though on average they underperform. In contrast, low-reputation VC fund GPs never catch up on average with the high-reputation competition among their cohorts. Overall, the results shown in Figure 6 are suggestive of performance peaking around fundraising events, especially for low-reputation GPs.

We formally test whether the fundraisers' performance around fundraising events is excessive by conducting *t*-tests of the mean excess percentile ranks by event quarter. Table 5 reports the results (Panel A for BO funds and Panel B for VC funds). The first set of columns show the all-fund sample results; the sample funds are further split into (i) small, young and low-rep GPs and (ii) large, old or high-rep GPs, and these subsample results are shown in the next two sets of columns.

All-fund results in Panel A indicate that, BO fund GPs who fundraise are significantly above their own average percentile rank for 11 consecutive quarters between quarter -4 and +6. For example, in quarter -3, the average BO fundraiser is ranked on average 6.9% better than its lifetime average percentile ranks ($p<.01$). Moreover, the subsample results show that the results are driven primarily by low-reputation BO fund GPs. Low-reputation fund GPs' excess ranks peak at 10.1% in quarter -3, whereas high-reputation fund GPs' excess rank is only 5.3% at its peak in quarter -1. In every event

quarter between -4 and +6, low-reputation GPs' excess rank is greater than that of high-reputation GPs.

Results for VC funds shown in Panel B are qualitatively similar. VC fund GPs who fundraise are significantly above their own average percentile rank for 9 consecutive quarters from -3 to +5. Excess rank peaks in event quarter 0 at 6.2% for all VC fundraisers; for low- (high-) reputation fundraisers, the excess rank peaks in event quarter 0 at 8.6% (4.5%). Furthermore, in every event quarter between -3 and +3, low-reputation GPs' excess rank exceeds that of high-reputation GPs.

We test for a significant improvement in funds' performance ranks by testing the null hypothesis that the average cumulative change in performance rank for event quarter -7 to event quarter 0 is reliably positive. For both buyout and VC funds, the improvement in performance rank is reliably positive ($p<.01$). Similarly, we test for a deterioration in post-fundraising performance by testing the null hypothesis that the average cumulative change in performance rank from event quarter 1 to event quarter +12 is reliably negative. For both buyout and VC funds, the deterioration in performance rank is reliably negative ($p<.05$ for buyout funds and $p<.10$ for VC funds).

More interestingly, for both buyout and VC funds, these patterns differ for small, young, and low-rep GPs versus others. For buyout and VC funds, small, young, and low-rep GPs and big, large, or hi-rep GPs both experience improvements in performance from quarter -7 to 0. However, only small, young, and low-rep GPs experience a reliably significant deterioration in performance post-fundraising.

Together these results are consistent with our Hypotheses 2 and 2a, namely that there is significant performance peak around fundraising events, and the extent of performance peaking depends on the reputation of the GP, with lower-reputation GPs peaking more significantly than higher-reputation GPs.

4.3 Tests of the NAV Management Hypothesis

4.3.1 NAV Markdowns

Our prior results indicate interim performance has a material impact on the ability of a GP to raise a follow-on fund, and this relation is particularly strong for small, young, and low reputation GPs. These results lend credibility to the SEC's concerns that GPs may inflate valuations during fundraising periods, as undetected NAV inflation will,

ceteris paribus, improve the ability of a GP to raise a follow-on fund. Moreover, consistent with both the timing hypothesis and the NAV management hypothesis, we observe that fund performance relative to cohort funds tends to peak around fundraising events. In this section, to determine whether some of the performance peaking that we document in the prior section is a result of NAV inflation, we analyze the size and frequency of NAV markdowns in the post-fundraising period.

We present our main results in Table 6. As before the fund size is scaled to be $10,000 for all sample funds. Consistent with the predictions of the NAV management hypothesis, we observe markdowns are larger in absolute value and more frequent in the post-fundraising period. For example, for buyout funds the average size of a markdown in the post-fundraising period is larger in absolute value (-$121, $p<0.05$) while the incidence increases modestly (odds ratio of 1.13=$e^{.124}$) and has marginal statistical significance. These patterns are stronger for VC funds with a mean markdown of -$269 ($p<0.01$) and a larger increase in the frequency of markdowns (odds ratio of 1.31= $e^{.284}$, $p<0.01$).

Consistent with the notion that the incentives to inflate NAVs are greatest for small, young, and low-rep GPs, we tend to observe larger increases in the absolute size and frequency of markdowns for these funds. For example, among buyout funds the average size of markdowns is -$180 ($p<0.05$) for small, young, and low-rep GPs but a relatively modest -$68, which is unreliably different from zero, for large, old, or high-rep GPs. Moreover, the frequency of markdowns is greater in the post-fundraising period for small, young, and low-rep firms (odds ratio 1.26= $e^{.238}$, $p<0.05$) than for large, old, or hi-rep firms (odds ratio that is not reliably different from one). The differences in our results across fund types are even more pronounced for VC funds, though even among the large, old, or high-rep VC funds we find markdowns are larger and more frequent in the post-fundraising period.

It is comforting that we find generally similar patterns across buyout and VC funds, though the results are somewhat stronger for VC than buyout funds. These differences might arise because of the generally less certain valuations of VC funds relative to buyout funds. In many situations, VC funds will hold portfolio companies with little underlying earnings making valuation difficult and relatively subjective. In contrast, buyout funds generally hold portfolio companies with positive earnings that

operate in more established product markets, which provide a more verifiable source of information for valuation.

In summary, our results indicate that the size and frequency of NAV markdowns increases in the post-fundraising period. This effect is most pronounced for small, young, and low-rep GPs where we expect the incentives to inflate NAVs during fundraising are likely to be the most severe. We also find that these effects are more pronounced for VC funds, which likely have more subjective valuations of portfolio companies allowing GPs more discretion over the reported valuations of portfolio companies.

4.3.2 Post-Fundraising Performance

In the prior section, we document that the frequency and size of markdowns are large following fundraising events. In this section, we test whether the magnitudes of the markdowns are sufficient to affect the post-fundraising performance of the fund by analyzing the pseudo value multiple (PVM) of funds. Recall, the PVM is the value multiple that is calculated assuming that a prospective investor (LP) buys a fund at its end-of-quarter NAV in quarter t and holds the fund until liquidation and we calculate PVMs for all cohort funds each time a member of the cohort has a fundraising event. If fund NAVs are inflated relative to the fundamental values of the underlying portfolio companies during fundraising campaigns, then fundraiser PVMs would be lower than normal following a fundraising event.

The results of this analysis are presented in Table 7. Among all buyout funds, the mean PVM of fundraisers is reliably less than nonfundraisers by -5.66 ppts (*t=-1.97*). This effect is particularly pronounced for small, young, and low-rep GPs, where the mean PVM of fundraisers is -9.94 ppts less than nonfundraisers (*t=-2.42*). The results are qualitatively similar when we use the PVM rank as the dependent variable (see columns (4) to (6)). Though for all funds the rank underperformance of fundraisers is no longer reliably less than non-fundraisers, the underperformance of small, young, and low-rep GPs remains statistically significant. In both specifications, we find reliable evidence that small, young, and low-rep GPs have greater post-fundraising performance erosions than large, old, or hi-rep GPs (*p=.07* for the PVM specification and *p=.02* for the rank PVM specification, one-tailed tests).

For VC funds, we find consistently negative coefficient estimates on the key *FUNDRAISER* dummy variable, but they are not reliably negative nor do we find reliable evidence of differences between the two subsamples.

To summarize, our analysis of PVMs provides positive evidence of NAV inflation during fundraising periods for buyout funds, particularly funds run by small, young, and low-rep GPs. In contrast, the evidence is less convincing for VC funds. We emphasize that one reason we fail to find positive evidence of poor post-fundraising performance for VCs is that our tests, which require that we restrict our analysis to mature funds so that we have a complete portrait of post-fundraising performance, may lack power.

5 Conclusion

We analyze the interim fund performance of private equity funds around the time of fundraising events using fund historical level cash flow and valuation data for over 800 funds raised between 1993 and 2009. Using the current fund's percentile rank relative to its vintage year cohort funds as the measure of interim performance, we show that GPs with strong interim performance ranks are significantly more likely to raise a follow-on fund and to raise a larger fund. We also find that the current fund's performance rank is at its peak when the GP is concluding fundraising for a follow-on fund. Finally, we find that NAV markdowns are both larger and more frequent in the post-fundraising periods. For buyout funds, we find reliable evidence of post-fundraising performance erosions, also suggestive of NAV inflation at the time of fundraising. These results are generally stronger for small, young, and low-reputation GPs.

Taken together, our results indicate that LPs rely more heavily on the current fund's interim performance rank as an information signal when evaluating younger, less-established GPs. As a result, lower-reputation GPs, facing strong incentives to show superior interim performance, strategically time their fundraising events precisely to coincide with their peak performance and are reluctant to mark down NAV valuations during fundraising periods.

Our study contributes to the policy debate by lending credibility to the SEC's concerns that some PE funds' NAVs are inflated during fundraising periods, while also showing that manipulation is mostly confined to GPs with little accumulated reputation capital. GPs with established track records and strong reputations have little need to

inflate performance and potentially much reputation capital to lose by manipulating NAVs around fundraising events.

We close by noting that our results represent an equilibrium outcome during the last 20 years under a private equity regulatory regime that many have characterized as lax. One goal of studies like our own is to shine a spotlight on the potentially misleading disclosures by investment managers in general and private equity firms in particular. With increased scrutiny by regulators and the investing public on the valuation methods employed by private equity firms and their fundraising events, the potential costs associated with reporting inflated interim performance will no doubt increase and yield a new equilibrium where we hopefully rarely observe inflated performance around fundraising events.

References

Arcot, S., Fluck, Z., Gaspar, J., and U. Hege, 2014, Fund managers under pressure: rationale and determinants of secondary buyouts, forthcoming, *Journal of Financial Economics*.

Braun, R. and M. Schmidt, 2014, The Limited Partnership Model in Private Equity: Deal Returns over a Fund's Life, unpublished working paper, Technische Universität München.

Brown, G., O. Gredil, and S. Kaplan, 2013, Do Private Equity Funds Game Returns?, Unpublished working paper, University of Chicago.

Chakraborty, I., and M. Ewens, 2014, Bad News Can Wait: VC Fund-raising and Portfolio Strategy, unpublished working paper, Caltech.

Chung, J., B. Sensoy, L. Stern, and M. Weisbach, 2012, Pay for Performance from Future Fund Flows: The Case of Private Equity, Review of Financial Studies 25, 3259-3304.

Cochrane, J., 2005, The risk and return of venture capital, Journal of Financial Economics 75, 3–52.

Crain, N., 2013, Career Concerns and Venture Capital, Unpublished working paper, Vanderbilt University.

Degeorge, F., J. Martin, and L. Phalippou, 2013, Is the rise of secondary buyouts good news for investors?, unpublished working paper, University of Oxford.

Gompers, P.A., 1996, Grandstanding in the venture capital industry, Journal of Financial Economics 42, Sep, 133–56.

Gompers, P. and Lerner, J., 1997, Risk and reward in private equity investments: the challenge of performance assessment, Journal of Private Equity 1, 5–12.

Gompers, P. and Lerner, J., 1998a, Venture capital distributions: short-run and long-run reactions, Journal of Finance 53, 2161–83.

Gompers, P. and J. Lerner, 1998b, What Drives Venture Capital Fundraising?, Brookings Papers on Economic Activity (1998), 149-192.

Harris, R., T. Jenkinson, S. Kaplan, and R. Stucke, 2013, Has Persistence Persisted in Private Equity? Evidence from Buyout and Venture Capital Funds, Unpublished working paper.

Harris, R., T. Jenkinson, and S. Kaplan, Private Equity Performance: What Do We Know? Journal of Finance, forthcoming.

Hochberg, Y., Ljungqvist, A., and A. Vissing-Jorgensen, 2013, Informational Hold-up and Performance Persistence in Venture Capital, forthcoming in the *Review of Financial Studies*.

Jenkinson, T., M. Sousa, and R. Stucke, 2013, How Fair are the Valuations of Private Equity Funds?, Unpublished working paper, Oxford University.

Kaplan, S. N. and Schoar, A., 2005, Private equity performance: returns, persistence, and capital flows, Journal of Finance 60, 1791–823.

Korteweg, A., and S. Nagel, 2014, Risk-adjusting the returns to VC, unpublished working paper, Stanford University.

Korteweg, A. G. and Sorensen, M., 2010, Risk and return characteristics of venture capital-backed entrepreneurial companies, Review of Financial Studies 23, 3738–3772.

Ljungqvist, A., Richardson, M. P. and Wolfenzon, D., 2007, The investment behavior of buyout funds: theory and evidence, Working Paper, New York University.

Metrick, A. and Yasuda, A., 2010a, The economics of private equity funds, Review of Financial Studies 23, 2303–41.

Metrick, A. and Yasuda, A., 2010b, Venture Capital and the Finance of Innovation, John Wiley & Sons.

Metrick, A. and Yasuda, A., 2011, Venture Capital and Other Private Equity: a Survey, European Financial Management 17, 619-654.

Phalippou, L. and Gottschalg, O., 2009, The performance of private equity funds, Review of Financial Studies 22, 1747–76.

Robinson, D., and B. Sensoy, 2011, Cyclicality, performance measurement, and cash flow liquidity in private equity, unpublished working paper, Ohio State University.

Sensoy, B., Wang, Y., and M. Weisbach, 2014, Limited Partner Performance and the Maturing of the Private Equity Industry, Journal of Financial Economics 112, 320-343.

Sorensen, M., and R. Jagannathan, 2013, The public market equivalent and private equity performance, unpublished working paper, Columbia University and Northwestern University.

Stucke, R., 2011, Updating History, Working Paper, Oxford University.

Woodward, S., 2009, Measuring Risk for Venture Capital and Private Equity Portfolios, unpublished working paper.

Table 1: Descriptive Statistics on Private Equity Funds: 1993 to 2009

The sample consists of private equity funds with interim cash flow and valuation data in Preqin's database. Value multiple (VM) and internal rate of return (IRR) are the last observed VM/IRR for each fund. Mature funds are funds that Preqin records as liquidated or funds with a minimum of eight years of cash flow data. Fund size is missing for 6 buyout and 6 VC funds.

		Value Multiple		IRR (%)		Fund Size ($Mil)		
Vintage Year	No. of Funds	Mean	Median	Mean	Median	N	Mean	Median
PANEL A: Buyout Funds								
1993	10	2.57	2.33	27.9	17.5	10	332	280
1994	13	2.01	1.94	24.9	19.0	13	455	312
1995	10	1.56	1.28	10.8	7.3	10	681	268
1996	18	1.38	1.36	7.3	7.5	18	451	394
1997	17	1.33	1.39	5.6	7.4	17	657	357
1998	36	1.34	1.30	3.6	5.1	36	920	425
1999	22	1.44	1.50	6.2	10.1	22	934	491
2000	35	1.83	1.74	15.4	13.5	35	1,487	1,053
2001	17	1.79	1.84	19.3	19.7	17	1,196	650
2002	15	1.58	1.80	14.4	16.6	15	1,016	500
2003	11	1.60	1.49	13.2	11.7	11	1,928	1,163
2004	27	1.68	1.66	14.1	12.6	27	939	450
2005	46	1.38	1.30	8.5	7.2	44	1,497	788
2006	42	1.19	1.20	4.2	6.3	41	3,039	1,000
2007	47	1.27	1.24	10.2	8.6	46	2,603	1,000
2008	38	1.29	1.29	13.7	15.3	38	2,007	653
2009	21	1.20	1.16	15.9	12.3	19	1,707	915
All Funds	425	1.47	1.37	11.1	10.2	419	1,532	650
Mature Funds	219	1.62	1.60	12.0	11.6	219	948	450
Panel B: VC Funds								
1993	7	4.00	3.11	41.4	40.8	7	110	104
1994	9	6.88	3.20	47.6	34.7	8	119	96
1995	14	3.89	2.01	47.3	26.5	14	135	100
1996	15	3.39	1.80	35.7	14.9	15	162	110
1997	18	1.98	1.27	31.4	8.8	17	146	150
1998	26	1.73	1.00	22.9	0.0	26	231	179
1999	36	0.76	0.67	-8.8	-6.7	35	374	275
2000	67	0.89	0.88	-3.5	-2.5	67	472	314
2001	39	1.16	1.10	0.0	1.6	39	480	350
2002	22	0.92	0.86	-2.9	-3.5	22	267	176
2003	16	0.94	0.90	-3.3	-2.7	16	245	250
2004	26	1.32	1.02	1.0	0.4	26	271	174
2005	24	1.15	1.01	0.9	0.3	24	308	295
2006	46	1.05	0.99	0.2	-0.4	46	505	300
2007	42	1.31	1.20	8.7	6.6	41	325	250
2008	30	1.20	1.08	7.8	4.1	30	507	350
2009	13	1.12	1.16	6.6	7.9	11	602	300
All Funds	450	1.46	1.04	7.0	0.9	444	362	250
Mature Funds	278	1.63	1.01	8.8	0.2	275	328	210

Table 2: Descriptive Statistics on Quarterly Net Asset Values, Calls, Distributions, and Markdowns

All net asset values (NAVs), calls, and distributions are scaled to represent a hypothetical LP capital commitment of $10,000. Equivalently, fund size is scaled to be $10,000 for all sample funds. Fund quarter observations are limited to those reported between quarters 5 and 40 (inclusive).

	N	Mean	Std. Dev.	25th Perc.	Median	75th Perc.
Panel A: 393 Buyout Funds						
NAV	8817	5556.01	3091.21	3260.28	5334.26	7524.16
Distributions (D)	8817	291.31	766.62	0	0	196.46
Nonzero D	4029	637.51	1032.25	49.48	252	769.03
Calls (C)	8817	251.7	480.42	0	20.83	301.21
Nonzero C	5327	416.61	559.76	45	200	613.77
Markdown (MD)	8817	-165.75	536.19	-73.2	0	0
Nonzero MD	2532	-577.2	873.98	-656.16	-270.04	-110.55
Panel B: 424 VC Funds						
NAV	10094	5368.52	6259.77	2836.68	4590.82	6555.63
Distributions (D)	10094	250.84	1685.55	0	0	0
Nonzero D	2538	997.63	3249.22	124.24	369.89	920.17
Calls (C)	10094	230.96	354.92	0	0	400
Nonzero C	5116	455.7	382.28	200	400	574.05
Markdown (MD)	10094	-260.35	1247.34	-188.37	0	0
Nonzero MD	4514	-582.19	1814.43	-521.24	-225.45	-100

Table 3: The Impact of Interim Performance Ranking on Fundraising

This table presents hazard rate models of fundraising events as a function of interim performance rank. We estimate a Cox semi-parametric hazard model using quarterly observations of interim performance for private equity funds that report quarterly cash flow data to Preqin. Panel A presents the results for BO funds; Panel B presents the VC funds. A "failure" event ("fundraising") is defined as the quarter in which either a cash flow activity or a NAV is reported for the first time for the GP's next fund. We allow the failure to occur anytime in the fund's life up to 10 years. Columns 1-3 present the all-fund sample; columns 4-5 present the subsample results, which are estimated as a fully interactive hazard model with separate baseline hazard rates and separate coefficients for each variable for two subsamples (small, young, and low-rep GPs and large, old or hi-rep GPs). Hazard ratios are shown. The interim performance rank variable is the percentile rank of a fund's VM (value multiple) among its vintage-year cohorts in quarter t-1. Models 3 to 5 include top (second/third) quartile dummy variable that takes a value of one if the quarter t-1 performance rank is in the top (second/third) quartile among its vintage-year cohort. Past top quartile is a dummy variable that is equal to one if the GP had a top quartile fund prior to the current fund. Final rank is a fund's final percentile rank. Ln Fund Size is the natural log of fund size ($mil). Small, young and low-rep GPs are funds run by BO (VC) GPs (i) whose cumulative capital raised prior to the sample fund is less than $1B ($250M) (small), (ii) who have raised fewer than three funds in the past (young), *and* (iii) who had no top-quartile performing funds that are more than 5 years old as of the inception of the sample fund (low-rep). Large, old or hi-rep GPs are the complements of small, young, and low-rep GPs. *t*-statistics are presented in parentheses.

Table 3, cont'd

	(1)	(2)	(3)	(4) Small, Young, and Low-Rep GPs	(5) Large, Old, or Hi-Rep GPs
	All Funds	All Funds	All Funds		
	Panel A: Buyout Funds				
Inter. Perf. Rank	7.105***	37.85***			
	(6.63)	(3.30)			
(Inter. Perf. Rank)^2		0.219			
		(-1.61)			
Top Quartile			5.639***	8.641***	4.332***
			(6.17)	(5.15)	(3.99)
2nd Quartile			3.759***	5.126***	3.020***
			(5.01)	(3.88)	(3.19)
3rd Quartile			2.441***	3.828***	1.733
			(3.31)	(3.19)	(1.48)
Past Top Quartile	1.772***	1.736***	1.730***		1.916***
	(3.73)	(3.59)	(3.57)		(3.10)
Final Rank	0.860	0.902	0.945	0.916	0.895
	(-0.50)	(-0.35)	(-0.20)	(-0.23)	(-0.28)
Ln Fund Size	1.024	1.021	1.025	1.258*	0.970
	(0.37)	(0.32)	(0.38)	(1.84)	(-0.36)
N Fund-Quarters	7768	7768	7768	7768	
N Funds	419	419	419	419	
N Fundraisers	204	204	204	204	
	Panel B: VC Funds				
Inter. Perf. Rank	5.388***	53.15***			
	(5.99)	(3.36)			
(Inter. Perf. Rank)^2		0.129**			
		(-2.03)			
Top Quartile			4.270***	5.865***	3.053***
			(5.06)	(4.32)	(3.14)
2nd Quartile			3.925***	4.974***	2.958***
			(4.92)	(3.96)	(3.13)
3rd Quartile			2.237***	4.037***	1.255
			(2.79)	(3.44)	(0.59)
Past Top Quartile	1.017	1.013	1.018		1.026
	(0.10)	(0.07)	(0.10)		(0.14)
Final Rank	1.385	1.377	1.484	1.064	1.846
	(1.19)	(1.16)	(1.44)	(0.16)	(1.61)
Ln Fund Size	1.079	1.062	1.060	1.185	1.007
	(0.99)	(0.79)	(0.76)	(1.24)	(0.06)
N Fund-Quarters	8148	8148	8148	8148	
N Funds	442	442	442	442	
N Fundraisers	205	205	205	205	

* p < 0.10, ** p < 0.05, *** p < 0.01.

Table 4: Interim Performance Rank and the Size of Follow-on Funds

The table presents results of a Tobit regression where the dependent variable is the percentage growth in the size of the follow-on fund relative to the current fund. Panel A presents the results for BO funds; Panel B presents the VC funds. For fundraisers, the interim performance rank variable is the percentile rank of a fund's VM (value multiple) among its vintage-year cohorts averaged across the four quarters prior to the fundraising event. For non-fundraisers, interim performance rank is the average percentile rank of the fund from quarter 13 to 28 of a fund's life. Models 3 to 5 include top (second/third) quartile dummy variable that takes a value of one if the interim performance rank is in the top (second/third) quartile among its vintage-year cohort. Past top quartile is a dummy variable that is equal to one if the GP had a top quartile fund prior to the current fund. Final rank is a fund's final percentile rank. Models are estimated with a constant term and year fixed effects (FE), where year is defined as the vintage year of the follow-on fund for fundraisers and the sixth year of current fund's life for non-fundraisers. Small, young and low-rep GPs are funds run by BO (VC) GPs (i) whose cumulative capital raised prior to the sample fund is less than $1B ($250M) (small), (ii) who have raised fewer than three funds in the past (young), *and* (iii) who had no top-quartile performing funds that are more than 5 years old as of the inception of the sample fund (low-rep). Large, old or hi-rep GPs are the complements of small, young, and low-rep GPs. *t*-statistics are presented in parentheses.

Table 4, cont'd

	(1)	(2)	(3)	(4) Small, Young, and Low-Rep GPs	(5) Large, Old, or Hi-Rep GPs
	All Funds	All Funds	All Funds		
Panel A: Buyout Funds					
Inter. Perf. Rank	2.248***	2.343*			
	(6.09)	(1.70)			
(Inter. Perf. Rank)^2		-0.0878			
		(-0.07)			
Top Quartile			1.693***	2.586***	0.914**
			(5.49)	(5.54)	(2.26)
2nd Quartile			0.921***	1.509***	0.386
			(3.21)	(3.49)	(1.00)
3rd Quartile			0.449	1.038**	-0.160
			(1.52)	(2.47)	(-0.37)
Past Top Quartile	0.574***	0.573***	0.568***		0.839***
	(3.02)	(3.01)	(2.99)		(3.16)
Final Rank	0.342	0.342	0.429	0.291	0.354
	(1.06)	(1.06)	(1.36)	(0.63)	(0.82)
Vintage Year FE	Y	Y	Y	Y	
N Funds	384	384	384	384	
Panel B: VC Funds					
Inter. Perf. Rank	1.995***	4.632***			
	(6.32)	(3.98)			
(Inter. Perf. Rank)^2		-2.428**			
		(-2.39)			
Top Quartile			1.638***	1.770***	1.603***
			(6.14)	(4.77)	(3.98)
2nd Quartile			1.236***	1.128**	1.365***
			(5.02)	(3.44)	(3.50)
3rd Quartile			0.849***	0.849**	0.915**
			(3.43)	(2.56)	(2.31)
Past Top Quartile	0.0503	0.0140	0.0687		0.136
	(0.31)	(0.09)	(0.42)		(0.69)
Final Rank	0.442	0.450	0.498*	0.373	0.623
	(1.59)	(1.62)	(1.80)	(0.95)	(1.59)
Vintage Year FE	Y	Y	Y	Y	
N Funds	409	409	409	409	

* p < 0.10, ** p < 0.05, *** p < 0.01.

Table 5: Excess Rank Performance around Fundraising Events

This table presents the mean excess percentile ranks by event quarter, where t=0 is the quarter of a fundraising event. Panel A presents the results for BO funds; Panel B presents the VC funds. A fundraising event is the quarter when either a cash flow or NAV is reported for the first time for the GP's next fund. We allow the fundraising event to occur anytime in the fund's life up to 10 years. Quarterly percentile rank for a fund-quarter is defined as the percentile rank of fund's VM (value multiple) among its vintage-year cohorts. Excess rank for a fund in quarter t is calculated as the quarter t percentile rank less the mean percentile rank for the fund across all reporting quarters (and is by construction zero when summed across quarters). Excess rank measures the extent to which a fund's rank in quarter t deviates from its mean rank. Small, young and low-rep GPs are funds run by BO (VC) GPs (i) whose cumulative capital raised prior to the sample fund is less than $1B ($250M) (small), (ii) who have raised fewer than three funds in the past (young), *and* (iii) who had no top-quartile performing funds that are more than 5 years old as of the inception of the sample fund (low-rep). Large, old or hi-rep GPs are the complements of small, young, and low-rep GPs.

Table 5, cont'd

	All Funds			Small, Young, and Low-Rep GPs			Large, Old, or Hi-Rep GPs		
Event Quarter	Excess Rank	t-stat		Excess Rank	t-stat		Excess Rank	t-stat	
				Panel A: Buyout Funds					
-7	-1.7%	-0.94		-3.6%	-1.30		0.0%	-0.01	
-6	1.0%	0.61		-2.6%	-0.97		4.1%	1.97	**
-5	1.0%	0.60		0.7%	0.25		1.3%	0.61	
-4	4.6%	2.72	***	4.7%	1.80	**	4.5%	2.04	**
-3	6.9%	4.17	***	10.1%	4.11	***	4.1%	1.88	**
-2	5.9%	3.74	***	7.6%	3.24	***	4.4%	2.08	**
-1	6.8%	4.51	***	8.6%	3.79	***	5.3%	2.62	***
0	4.7%	3.64	***	5.3%	2.64	***	4.2%	2.49	***
1	3.8%	2.96	***	5.2%	2.72	***	2.8%	1.55	*
2	2.9%	2.27	**	4.7%	2.80	***	1.3%	0.69	
3	3.4%	2.77	***	5.3%	3.25	***	1.6%	0.94	
4	4.2%	3.48	***	6.0%	3.59	***	2.6%	1.53	*
5	2.8%	2.53	***	4.8%	3.43	***	1.1%	0.64	
6	1.7%	1.54	*	3.6%	2.17	**	0.0%	-0.02	
7	1.0%	0.92		2.6%	1.53	*	-0.4%	-0.25	
8	0.1%	0.07		1.3%	0.75		-1.0%	-0.69	
9	-0.2%	-0.19		0.0%	0.03		-0.5%	-0.30	
10	0.3%	0.24		1.5%	0.99		-0.9%	-0.52	
11	-0.2%	-0.20		0.2%	0.13		-0.7%	-0.38	
12	0.0%	-0.03		0.8%	0.48		-0.8%	-0.47	
13	-0.4%	-0.38		0.0%	0.00		-0.8%	-0.50	
14	-0.5%	-0.46		-0.5%	-0.31		-0.6%	-0.34	
				Panel B: VC Funds					
-7	-2.0%	-0.97		-1.3%	-0.37		-2.5%	-1.00	
-6	-0.4%	-0.18		2.4%	0.67		-2.5%	-0.94	
-5	1.2%	0.55		2.3%	0.67		0.3%	0.12	
-4	1.5%	0.82		0.1%	0.03		2.5%	1.08	
-3	2.9%	1.54	*	5.1%	1.60	*	1.4%	0.58	
-2	4.6%	2.65	***	7.4%	2.63	***	2.5%	1.17	
-1	5.5%	3.44	***	6.9%	2.94	***	4.5%	2.07	**
0	6.2%	4.15	***	8.6%	3.49	***	4.5%	2.42	***
1	4.3%	2.95	***	5.6%	2.32	**	3.3%	1.86	**
2	5.2%	3.78	***	6.5%	2.81	***	4.3%	2.54	***
3	3.3%	2.50	***	3.8%	1.70	**	2.9%	1.83	**
4	2.7%	2.16	**	2.0%	0.99		3.2%	2.05	**
5	2.7%	2.32	**	1.8%	0.93		3.3%	2.35	**
6	1.0%	0.85		-0.2%	-0.10		1.9%	1.24	
7	0.9%	0.74		0.0%	0.03		1.5%	1.03	
8	0.3%	0.30		0.9%	0.48		-0.1%	-0.07	
9	0.2%	0.21		0.0%	-0.01		0.4%	0.31	
10	0.7%	0.62		0.2%	0.10		1.1%	0.75	
11	-0.5%	-0.48		-1.7%	-1.04		0.4%	0.26	
12	-0.7%	-0.60		-2.3%	-1.27		0.6%	0.45	
13	-0.6%	-0.57		-1.6%	-0.83		0.1%	0.05	
14	-0.5%	-0.43		-0.6%	-0.29		-0.4%	-0.31	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: The Size and Frequency of Markdowns in the Post-Fundraising Period

The table presents estimates of Tobit regressions of markdown size (first three columns) and conditional Logit regressions of markdown incidence (last three columns). Fund size (committed capital) is scaled to be $10,000 for all sample funds. POSTFUND is a dummy variable that takes a value of one for quarters +1 to +14, where quarter 0 is the quarter in which we observe the first call of the follow-on fund. All regression estimates are based on models with calendar year, fund quarter, and fund fixed effects (FE). *t*-statistics are presented in parentheses.

	Tobit Model of Markdown Size			Logit Model of Markdown Incidence		
	All Funds	Small, Young, and Low-Rep GPs	Large, Old, or Hi-Rep GPs	All Funds	Small, Young, and Low-rep GPs	Large, Old, or Hi-Rep GPs
Panel A: Buyout Funds						
POSTFUND	-121.2**	-179.5**	-67.91	0.120	0.229**	-0.0105
	(-2.53)	(-2.30)	(-1.21)	(1.54)	(2.03)	(-0.09)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes
N	8817	4579	4238	8817	4579	4238
Panel B: VC Funds						
POSTFUND	-268.8***	-330.4***	-205.9**	0.272***	0.403***	0.176*
	(-4.02)	(-3.93)	(-2.02)	(4.06)	(4.01)	(1.91)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes
N	10094	4742	5352	10094	4742	5352

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

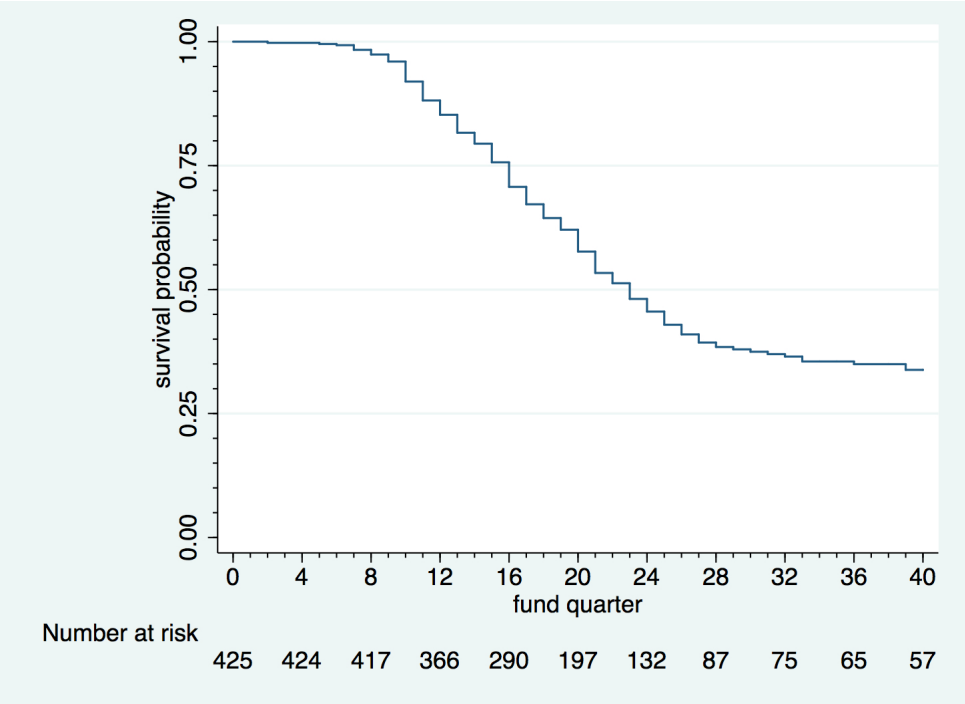
Table 7: Post-Fundraising Performance based on Pseudo Value Multiple

Each time there is a fundraising event among vintage year cohort funds, we calculate a pseudo value multiple (PVM) for each of the vintage year cohort funds assuming an investor purchased the fund at the stated NAV in the fundraising event quarter and held the fund to liquidation (or the last quarter in which we observe an NAV but at least fund quarter 32). Fundraiser is a dummy variable that takes a value of one if the fund's GP completes fundraising for a follow-on fund in the event quarter 0. We exclude neighborhood fundraisers, defined as those fundraising in event quarters -4 to +4. The first three columns present results where the PVM is the dependent variable (winsorized at 5th and 95th percentile) with event and fund fixed effects. The last three columns present results based on the percentile rank of PVM relative to vintage year cohort funds where we include fund fixed effects (by construction the mean rank across all funds for a particular event is 0.5 thus event fixed effects are unnecessary). The subsample results in the columns 2-3 and 5-6 are estimated as interactive models with separate Fundraiser coefficients for the two subsamples (small, young, and low-rep GPs and large, old or hi-rep GPs). *t*-statistics are presented in parentheses.

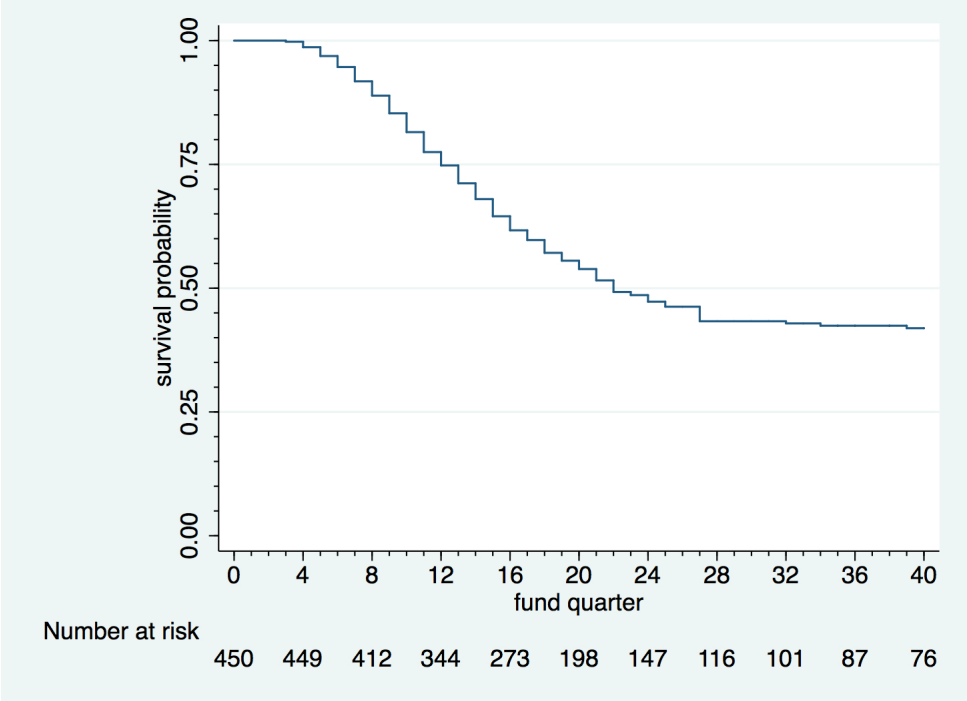
	Dependent Variable: Pseudo VM			Dependent Variable: Rank of Pseudo VM		
	(1)	(2)	(3)	(4)	(5)	(6)
	All Funds	Small, Young, and Low-Rep GPs	Large, Old, or Hi-Rep GPs	All Funds	Small, Young, and Low-rep GPs	Large, Old, or Hi-Rep GPs
			Panel A: Buyout Funds			
Fundraiser	-0.0566**	-0.0994**	-0.0146	-0.0117	-0.0460*	0.0217
	(-1.97)	(-2.42)	(-0.36)	(-0.70)	(-1.93)	(0.92)
Event FE	Yes	Yes		No	No	
Fund FE	Yes	Yes		Yes	Yes	
N	1396	1396		1386	1386	
			Panel B: VC Funds			
Fundraiser	-0.0189	-0.0335	-0.0083	-0.0139	-0.0140	-0.0139
	(-0.85)	(-1.00)	(-0.29)	(-1.03)	(-0.66)	(-0.78)
Year FE	Yes	Yes		No	No	
Fund FE	Yes	Yes		Yes	Yes	
N	2111	2111		2101	2101	

* p < 0.10, ** p < 0.05, *** p < 0.01.

Figure 1: **Kaplan-Meier Survival Graph for Private Equity Fundraising Events**
This graph shows the probability that a fund does not engage in a fundraising event by quarter.



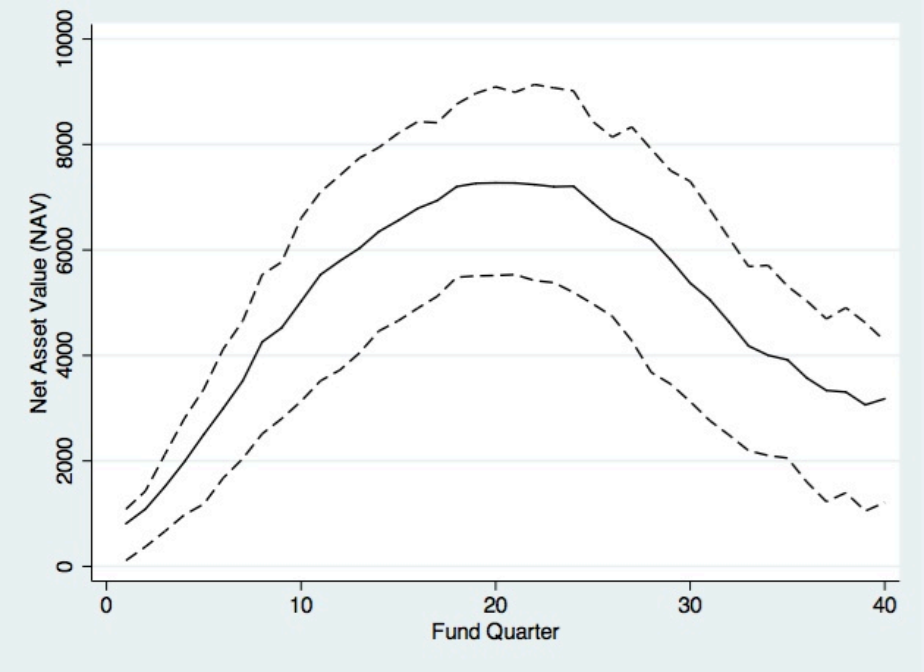
Panel A: Buyout Funds



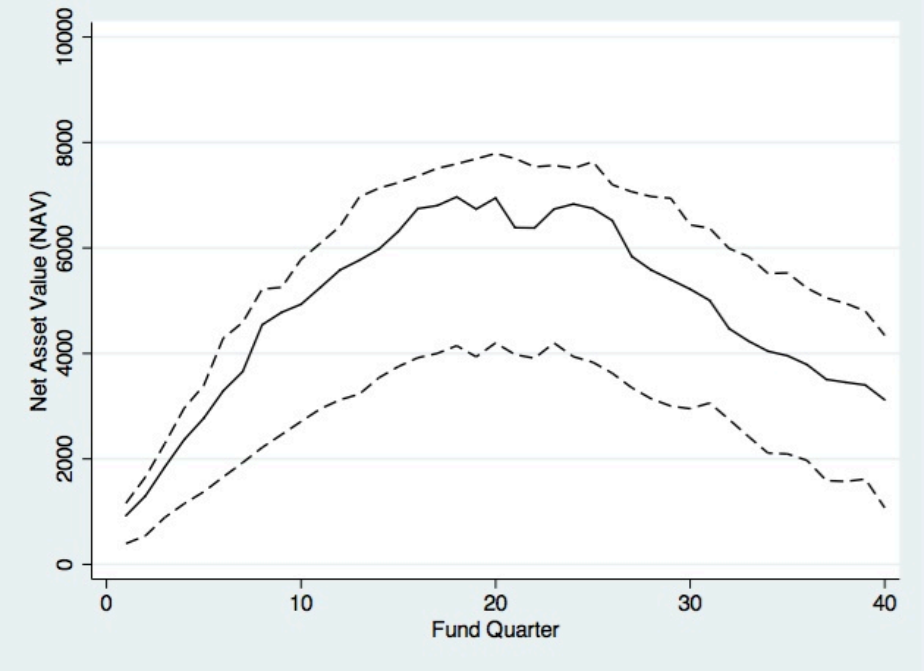
Panel B: VC Funds

Figure 2: Net Asset Value (NAV) by Fund Quarter

The figure presents the mean (solid line) and 25th and 75th percentiles (dashed lines) of NAVs by fund quarter. Fund size (committed capital) is scaled to be $10,000 for all sample funds.

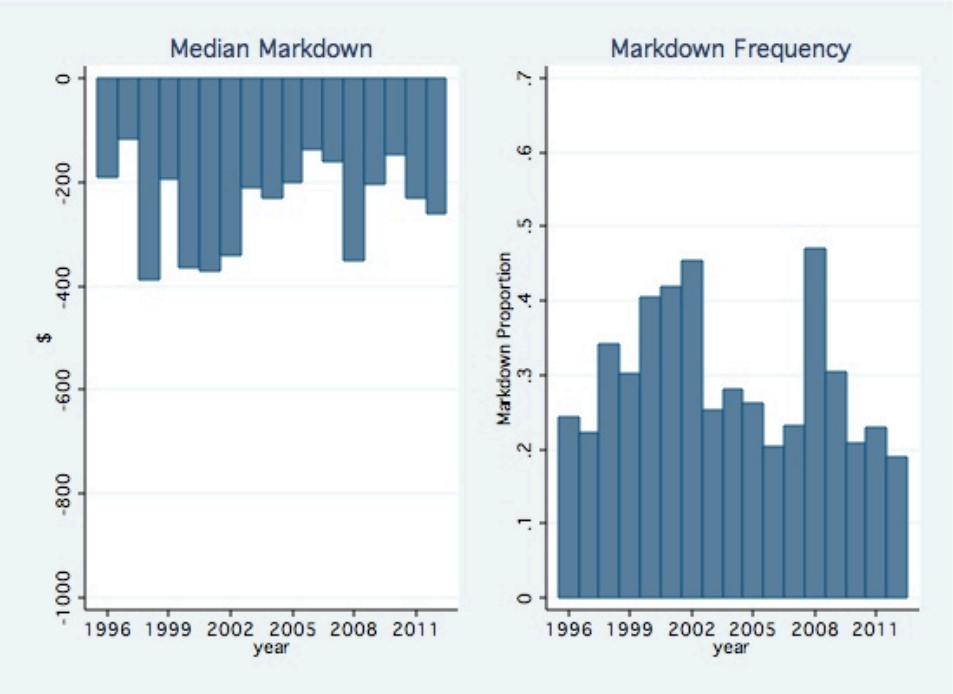


Panel A: Buyout Funds

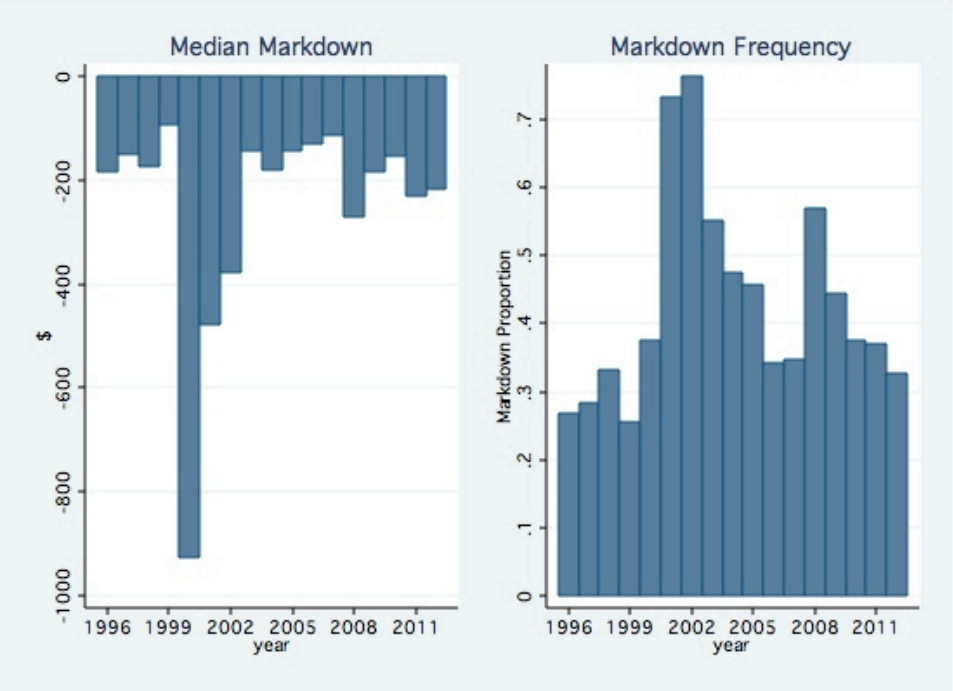


Panel B: VC Funds

Figure 3: Size and Incidence of NAV Markdowns by Year
The figure presents the median size of nonzero markdowns (left graph) and incidence of markdowns (right graph) by year. Fund size (committed capital) is scaled to be $10,000 for all sample funds.



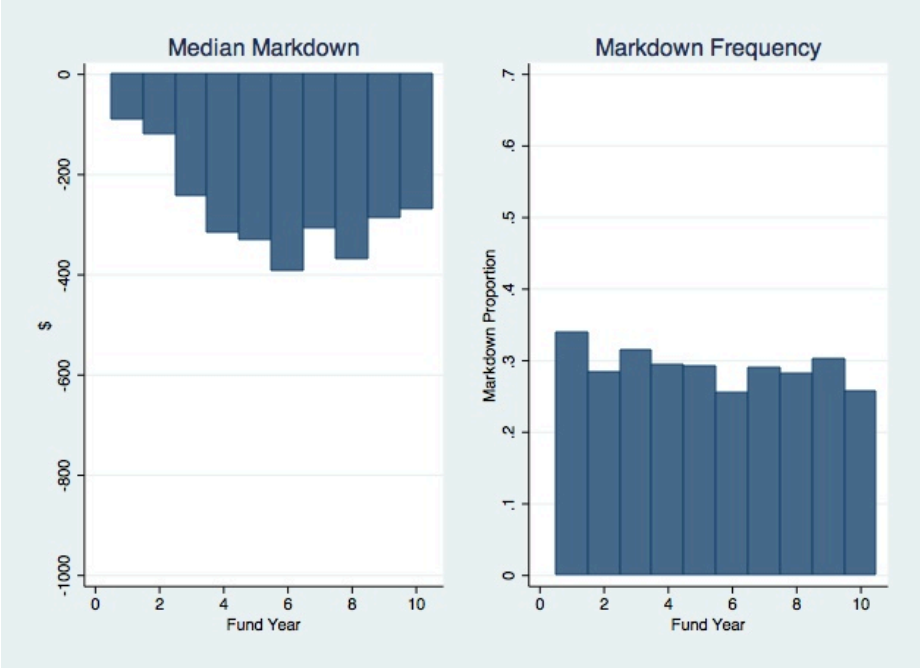
Panel A: Buyout Funds



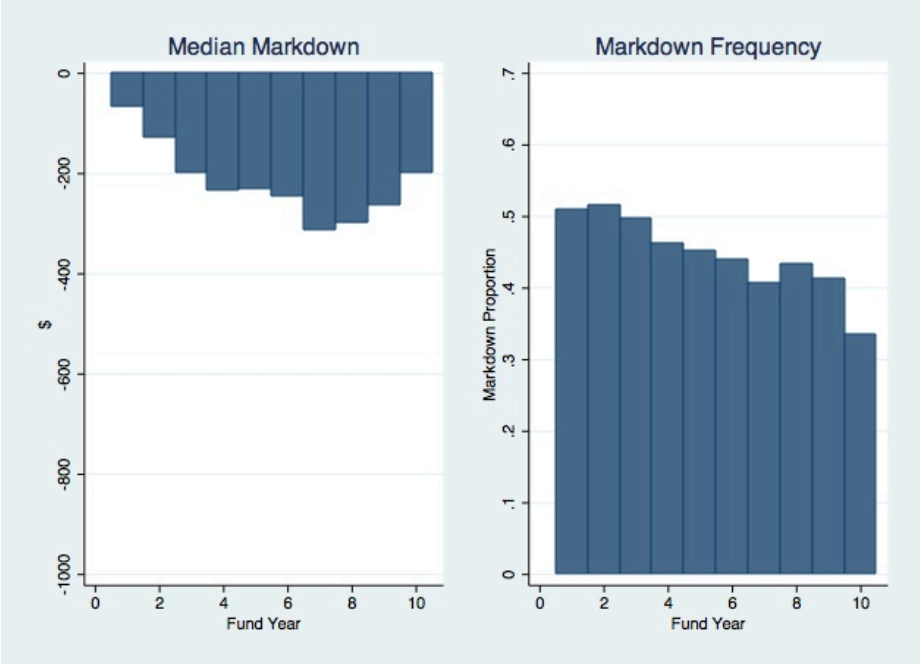
Panel B: VC Funds

Figure 4: Size and Incidence of NAV Markdowns by Fund Year

The figure presents the median size of nonzero markdowns (left graph) and incidence of markdowns (right graph) by year in a fund's life (fund year). Fund size (committed capital) is scaled to be $10,000 for all sample funds.



Panel A: Buyout Funds



Panel B: VC Funds

Figure 5: **The hazard ratio plot of the quadratic model for interim performance rank and fundraising events.**
This figure plots the hazard ratio for a unit change in interim performance rank for the quadratic model (columns (2) of Table 2) over the support of the interim performance rank variable (between 0 and 1).

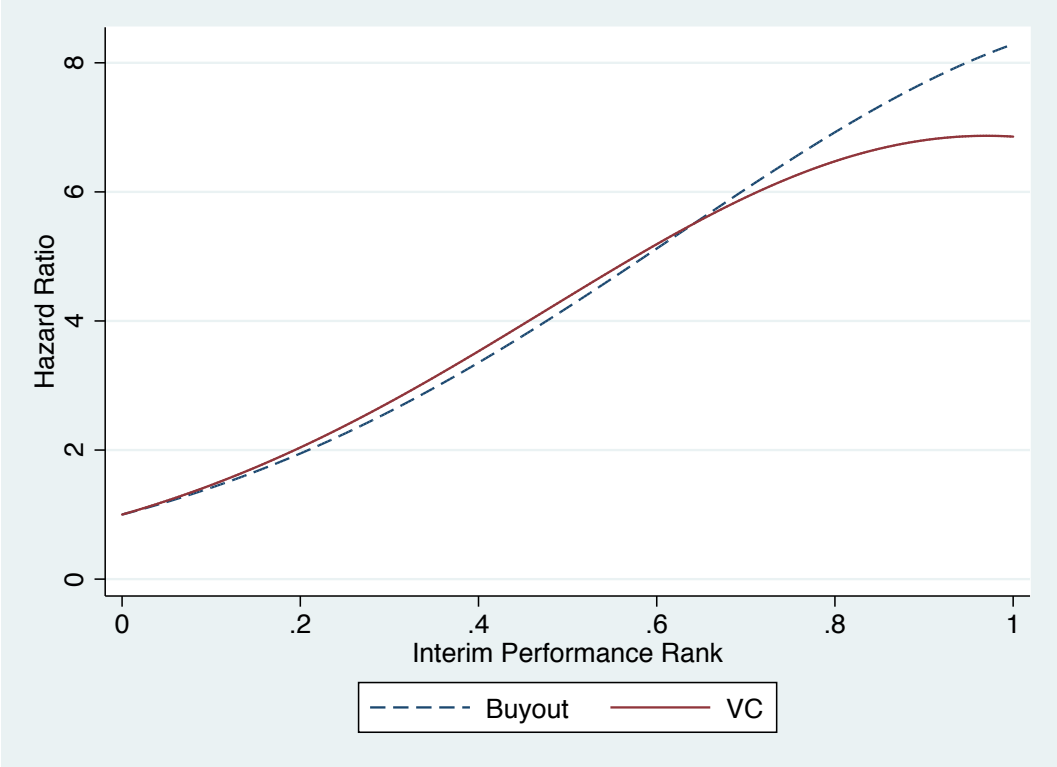
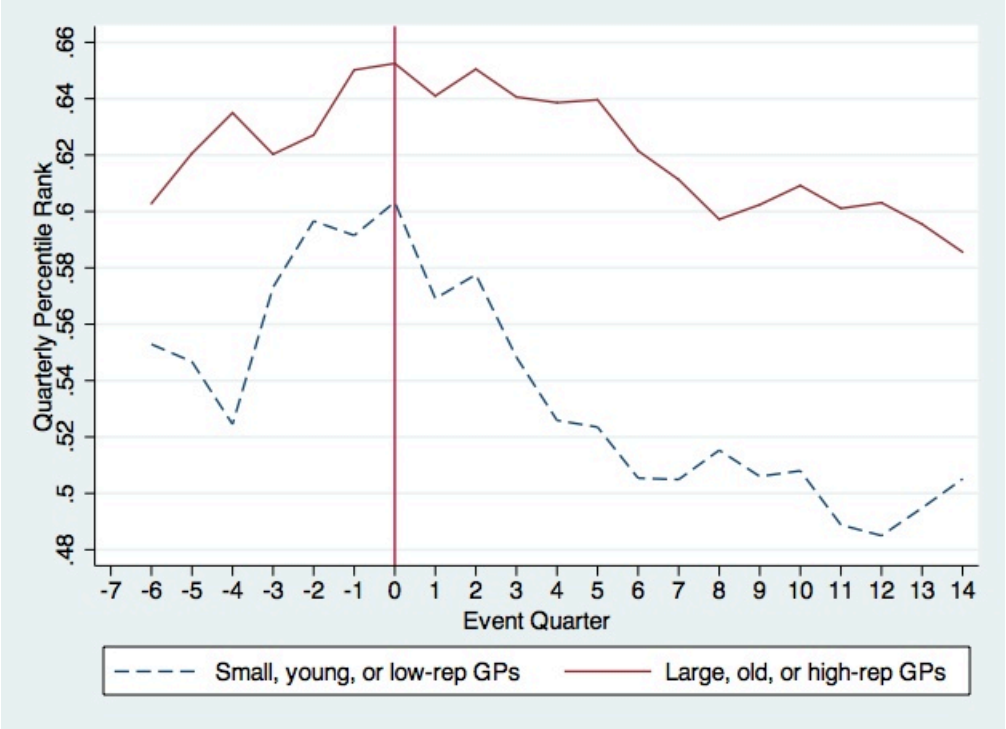


Figure 6: Fund Percentile Rank in Event Time
This figure plots the mean percentile rank of VMs in event time, where t=0 is the quarter of a fundraising event.

Panel A: Buyout Funds



Panel B: VC Funds