

How Fair are the Valuations of Private Equity Funds?

Tim Jenkinson*, Miguel Sousa** and Rüdiger Stucke***

Abstract

The ultimate performance of private equity funds is only known once all investments have been sold, and the cash returned to investors. This typically takes over a decade. In the meantime, the reported performance depends on the valuation of the remaining portfolio companies. Private equity houses market their next fund on the basis of these interim valuations of their current fund. In this paper we analyze whether these valuations are fair, whether the extent of conservative or aggressive valuations differ during the life of the fund, and at what stage interim performance measures predict ultimate performance. This paper is the first to use the quarterly valuations and cash flows for the entire history of 761 fund investments made by Calpers – the largest U.S. investor in private equity. Our main findings are as follows. First, over the entire life of the fund we find evidence that fund valuations are conservative, and tend to be smoothed (relative to movements in public markets): valuations understate subsequent distributions by around 35% on average. We find a significant jump in valuations in the fourth-quarter, when funds are normally audited. Second, the exception to this general conservatism is the period when follow-on funds are being raised. We find that valuations, and reported returns, are inflated during fundraising, with a gradual reversal once the follow-on fund has been closed. Third, we find that the performance figures reported by funds during fund-raising have little power to predict ultimate returns. This is especially true when performance is measured by IRR. Using public market equivalent measures increases predictability significantly. Our results show that investors should be extremely wary of basing investment decisions on the returns – especially IRRs – of the current fund.

Date: February 2013

JEL classification: G24, G32, G34

Keywords: Private equity, fund valuation, fund returns

* Saïd Business School, University of Oxford and CEPR, tim.jenkinson@sbs.ox.ac.uk ** Economics and Management School, University of Porto and CEF.UP miguel.sousa@oba.co.uk *** Saïd Business School, University of Oxford, ruediger.stucke@sbs.ox.ac.uk.

1. Introduction

The valuation of private and illiquid assets is as much art as science. In the case of private equity funds, estimating fair values of their portfolio companies is particularly challenging. As a consequence, quarterly fund valuations – reported by the fund managers themselves – have an inevitably subjective component. This issue has recently attracted considerable attention in the aftermath of the financial crisis. The U.S. Securities and Exchange Commission (SEC) has started independent investigations into conflicts of interests of private equity fund advisors², a main focus of which is the “consistency and comparability of valuation methods” associated with “misleading reporting [on private equity fund performance] to current or prospective investors”.³ One of the current mysteries of private equity is that performance persistence seems to be strongest in the *bottom* quartile, and understanding how such managers continue to raise successive funds is an important question. That fund managers might be misled by the valuation and performance figures produced by managers is one possible explanation.

While accounting standards, valuation frameworks and industry guidelines have been moving towards standardization of valuation principles⁴, they still inevitably allow considerable discretion with respect to the valuation methodology and input parameters for private companies. This results in a similarly wide range of possible equity values.⁵ The responsibility of fund auditors (who typically audit the funds annually) is primarily to verify and confirm that the chosen method has been correctly applied, the underlying assumptions are adequate, and the derived value is within a reasonable range. As a result, fund managers have various degrees of freedom when valuing their portfolio companies. This raises the possibility that funds are valued opportunistically at certain times. For example, there will be inevitable temptations to present interim performance numbers in a particularly favorable light when raising a follow-on fund, or limiting write-downs during down markets. On the other hand, there may be general incentives to

² Such investigations are related to the registration of private equity fund advisors with the U.S. SEC following the enactment of the Dodd-Frank Act.

³ Speech by SEC staff member Carlo V. di Florio, 3 May 2011.

⁴ In particular the International Private Equity Valuation guidelines have been developed in recent years, and are now endorsed by 39 national and international private equity associations. The latest version of the guidelines was published in December 2012. The U.S. industry associations have not endorsed the guidelines.

⁵ The magnitudes of such ranges can be observed in practice, for example, when comparing the valuations of two separate fund managers who have jointly invested in one company, but independently report to their respective fund investors. There has been increasing anecdotal evidence on such patterns from institutional investors who were invested in both funds, especially since the financial crisis in 2008.

smooth returns, by using conservative values in normal or good times, so that investors get no nasty surprises when assets are ultimately sold.

In this paper we analyze the fund cash flow, valuation and performance data for the entire current and historical portfolio of 761 private equity funds invested in by Calpers – the California Public Employees Retirement System. Calpers is one of the largest U.S. investors in private equity, and we are the first to get access to this rich set of data for academic purposes. Calpers were among the first large investors to publish information about their investments on their website, and our data is essentially every quarterly update of this data, but starting from many years before they released the data to the public. Consequently, we have information on funds going back to 1990, which raised close to \$1 trillion, covering venture capital, buyouts, and other variants of private equity. We study the characteristics and dynamics of the valuation of private equity funds and test for systematic patterns associated with behavioral incentives by the fund managers. Since net asset values form the basis of a fund's interim performance during most of its lifetime, we further examine the implications for reported performance numbers and the relationship with final fund returns. Our research questions can be summarized as follows: are funds aggressive or conservative in their valuations, does behavior change during fundraising, and are the resulting interim performance measures useful to investors as predictors of final fund performance?

As a motivation for the issues we study in this paper, consider one example, shown in Figure I. This U.S. buyout fund reported an interim IRR on its fund of around 30-50% during the time it was seeking to raise a follow-on fund. By the time the fund had finally liquidated all its investments, the final IRR was only slightly above 10%. Our results suggest that while this is an extreme example of the type of valuation and interim performance reversal, it is by no means an isolated case.

Our main findings are as follows. First, over the entire life of the fund we find evidence that fund valuations are conservative, and tend to be smoothed (relative to movements in public markets): valuations understate subsequent distributions by around 35% on average. Therefore, we find evidence of significant long-term smoothing of returns over the life of the fund, consistent with conservative valuation of portfolio companies. We also find a significant jump in valuations in the fourth-quarter, when funds are normally audited, which suggests that the fund

managers delay updating valuations during the year, and that the revisions are, on average, positive.

Second, the exception to this general conservatism is the period when follow-on funds are being raised. We find that valuations of remaining portfolio companies, and therefore reported returns, are inflated during fundraising, with a gradual reversal once the follow-on fund has been closed. This finding is clearly relevant to recent regulatory concerns about conflicts of interest facing private equity fund managers.

Third, and linked to the previous point, we find that the performance figures reported by funds during fundraising have little power to predict ultimate returns. This is especially true when performance is measured using internal rates of return (IRR). Using public market equivalent measures increases predictability significantly. Our results show that investors should be extremely wary of basing investment decisions on the returns of the current fund, especially when looking at reported IRRs.

As well as being relevant to potential investors in private equity, the results of this paper are also important for academic research on the performance of private equity. Given that the final performance of funds is only known once all investments have been sold (which can take a decade or more) all researchers have to make judgments on whether to include funds where a significant proportion of the investments are unrealized (and so the performance figures depend on the NAVs). In general, there has been understandable caution about whether the performance figures for funds are reliable before they are substantially liquidated, so the early papers to obtain access to private equity return data tended to exclude those with significant remaining NAVs (see, for instance, Kaplan and Schoar (2005) and Phalippou and Gottschalg (2009)), although this meant that the huge growth in capital allocations to private equity funds in more recent years was excluded from the analysis. The results for venture capital tended to be quite positive but buyout performance was in line with, or below, public market returns. More recently, Harris, Jenkinson and Kaplan (2011) and Higson and Stucke (2012) include vintages up to 2008 in their analysis and find the results to be much more positive for U.S. buyout funds. Given that some of these more recent vintages include significant NAVs the results of this paper suggest that, if anything, the final returns that will be found in due course, once the investments are sold, will be higher.

It is also worth noting that significant problems have been found with NAV figures provided by some data providers. Stucke (2011) finds that a significant proportion of the valuation data in Thomson-Reuters VentureXpert is not being updated over time. This explains the finding of Harris, Jenkinson and Stucke (2010, 2012) that estimates of private equity performance produced using VentureXpert tend to be lower than other data sources. However, no such problems apply to the data we employ. Calpers reports the updated cash flows into and out of all their funds, along with the precise NAVs, each quarter.

The remainder of the paper proceeds as follows. In the next section we explain the structure of private equity funds, how their performance is measured and the importance of interim valuations for reported performance, and the time-line for typical fund investing, realization and follow-on fund raising. In section 3 we explain our data. The main results on how the valuations evolve over the life of the fund, and how these are influenced by fund-raising, are reported in section 4. We then consider whether reported interim performance at the time of fundraising (and thereafter) has power to predict the ultimate cross-section of fund returns. Section 6 concludes.

2. Institutional framework

In this section we focus on the institutional framework that underlies investments in private equity. We start by discussing key features of private equity and the most common structure in which private equity operates, namely, in the form of private limited partnership funds with a finite lifetime. We exploit certain features of the fund structure in our empirical analysis. Finally, we discuss the valuation issues for private equity funds and how reported returns and interim valuations are related.

2.1. Private equity as an asset class

Institutionalized private equity refers to an asset class that invests in companies whose equity claims are not registered and traded on an organized stock exchange. Early funds focused on venture and growth capital for early-stage and small mid-stage companies in the 1970s, but the 1980s saw the emergence of buyout and restructuring capital for mature companies, often involving high levels of financial leverage. In the 1990s further sub-asset classes beside

corporate private equity gained traction, such as mezzanine funds which includes both debt and equity claims, distressed debt which may result in a debt-to-equity swap, as well as investments in real estate.

In contrast to public equity, private equity explicitly focuses on the combination of ownership and control to maximize the alignment of interests. The management of an investee company is expected to contribute a substantial fraction of their net wealth into the most junior part of the capital structure. Fund managers co-invest into their own funds and, occasionally, in the individual companies, which they then closely monitor from the board as external directors. In addition to this, fund managers share 20% of the profits that the private equity fund generates – their “carried interest” – provided the internal rate of returns (IRR) exceeds a certain hurdle rate, which is traditionally 8 percent.

2.2. The structure of private equity funds

Common for all sub-asset classes of private equity is the concept of investing via closed-end funds with a finite lifetime, usually structured as private limited partnerships and incorporated in favorable jurisdictions like Delaware for U.S. funds or the Channel Islands for European vehicles. Private equity funds have a normal contractual lifetime of ten years, with an optional extension of up to three more years. The first five to six years represent a fund’s investment period. Instead of paying the entire amount of capital upfront when the fund is raised, fund investors (Limited Partners, LPs) commit capital to a private equity fund, which the fund manager (General Partner, GP) then calls when a new investment is identified or fund management fees are due. Following the expiration of a fund’s investment period no more capital can be called from LPs⁶ and the GP has another five to seven years to realize all investments. This arrangement gives private equity funds a self-liquidating character.

In order to maintain an “active deal flow”, GPs aim to raise a follow-on fund well before the investment period of the current fund has expired. However, depending on the interim success of the current fund as well as overall market conditions, the interval between any two subsequent funds may range from two to seven years. The main marketing period for a follow-on fund normally starts about one year in advance. As soon as the targeted minimum fund size has

⁶ An exception are ongoing management fees, though, these are regularly funded from realizations in the second half of a fund’s lifetime.

been raised, the follow-on fund has its first close and GPs start investing from it. In fact, most private equity funds have several closing rounds, and there can be up to two years between the first close of a (follow-on) fund and its final close. Figure 2 illustrates the different stages of a private equity fund's lifecycle and gives an example of the timing relationship between a fund and its follow-on fund.

2.3. Interim valuation of private equity funds

Throughout the life of a private equity fund the GP reports the net asset value of the fund's portfolio companies, after provisions for carried interests, on a quarterly basis to the LPs. As neither the investments of a private equity fund, nor the partnership interests of the fund itself are traded in a liquid and transparent market, the valuation of the portfolio companies is at the discretion of the GP. Although accounting frameworks and valuation guidelines require GPs to mark their investments and funds to market, they still contain a high degree of freedom with respect to applicable methodologies. In fact, the entire spectrum of valuation methods can be applied, starting with various types of relative valuations in line with observed enterprise value multiples in the public market, discounted cash flow methods such as net or adjusted present values, and even real option valuation, which became increasingly popular during the recent financial crisis when equity values were deep "under water".

Consequently, the value that a fund manager applies to a portfolio company carries a high level of individual judgment and subjectivity. Fund valuations are typically audited once a year – normally in the final calendar quarter. We find a significant 4th quarter effect in our empirical analysis. Even when fund valuations are audited, however, discretion remains. This is seen most directly when GPs engage in club deals and individually report their holding values for their fund's stake. Investors regularly observe material differences in the valuation of the same portfolio company, and examples of divergent valuations did not go unnoticed by financial regulators.

This discretion in portfolio company, and therefore overall fund, valuation naturally could be used by GPs in different ways. They could be excessively conservative in valuation, perhaps due a desire to smooth investor returns over time and to avoid having to report reductions in valuation. Alternatively, GPs might exploit their discretion by increasing the valuations, in particular when fundraising for their next fund. Note, however, that over-optimistic

valuations cannot be maintained forever, as eventually the portfolio companies are sold and their value is revealed. Therefore, high reported returns during the fundraising period would be followed by much lower returns later in the life of the fund. Consequently, an interesting question is whether, in the cross-section, returns at the time of fundraising predict final fund returns. We explore this in section 5. Before that, we explain the data and our methodology, and explore how valuations evolve over the life of the fund, and in particular around fundraising periods.

3. Sources of data and sample description

In this section we introduce our sample of data, and how we identify fund-raising periods (which we are able to do for a sub-set of the funds). We also describe the methodology we apply in the following two sections.

3.1. Our sample of private equity funds

Our dataset contains the complete current and historical portfolio of private equity funds of California's Public Employees Retirement System. Calpers is by far the largest pension fund in the U.S. with approximately \$250 billion in assets under management, \$45 billion of which are currently committed to private equity. Calpers started its private equity program in 1990 and has since invested in more than 800 different private equity funds with a combined value of over \$1 trillion. Since the enactment of the Freedom of Information Act in the mid-2000s, Calpers regularly publishes information on the interim performance of their current funds, and has become an unofficial reference standard for the performance of the asset class.

We are the first to get access to the full history of private equity fund investments by Calpers since inception. We have detailed time-series data on capital calls (when investors pay part of their capital commitments into the funds), capital distributions (when the fund returns cash to investors), as well as the fund managers' fund valuations (the net asset value, or NAV, of the remaining investments they hold) on a quarterly basis. Note, that Calpers simply publish the valuations that are reported to them by the GPs, and apply no judgment themselves as to an appropriate valuation. We also know the identity and characteristics of all private equity funds,

which is essential when identifying follow-on funds. The final quarterly update to our data is March 31, 2012.

Panel A of Table 1 shows the distribution of the funds, by vintage year, investment stage, location and size. After removing funds that were acquired in a secondary transaction, general and customized fund of funds, as well as real estate funds, we arrive at a total of 761 private equity funds, 627 of which focus on corporate private equity including venture capital, growth capital and buyouts.⁷ Compared to commercial private equity performance databases such as Cambridge Associates, Burgiss or StateStreet, the total of corporate private equity funds in the Calpers sample compares well: our sample size is approximately one-third (by number) of the largest private equity datasets that include valuation and performance figures.⁸ Note, however, that we do not analyze performance in this paper, and so the size of the dataset *per se* is less important. Similarly, whether or not Calpers chose funds well is irrelevant. For our purposes, we need high-quality, quarterly cash-flow and valuation data, for a large set of funds which is what we have. The only bias that might be relevant is if, for some reason, Calpers invested in funds that had atypical accounting practices; this seems unlikely.

3.2. *Information on the start of follow-on funds*

To analyze the time-series of quarterly valuations and (implied) interim returns for patterns that may be associated with raising a follow-on fund, we need to know when a fund manager started marketing his new fund to potential investors. Private equity funds usually have several closing rounds that can stretch over a period of up to two years. However, key to our analysis is the first close of the follow-on fund (at which point they can start investing, but may continue trying to raise additional capital), as this information allows us to infer its main marketing period which, on average, starts about one year in advance of the first close.

As one of the world's largest investors in private equity with "more capital to invest than attractive fund managers available", Calpers usually commits capital prior to the first close of a new fund and, hence, invests right from the start of a new fund.⁹ In order to confirm the first closing round for each of the follow-on funds in the Calpers portfolio, we use different sources

⁷ In the following we combine the sub-asset classes venture and growth capital due to a natural overlap.

⁸ For a comparison of private equity performance databases see Harris, Jenkinson and Stucke (2010, 2012).

⁹ An exception are the vintage years 2009 to 2011, since Calpers had a large overhang of uncalled capital from significant commitments between 2006 and 2008.

including lists on historical fund raising activity and fund closings from Preqin, LP Source, Thomson Reuters and CapitalIQ, registration filings with the U.S. Securities and Exchange Commission, as well as archives of press releases.

As of March 2012, 349 of the 627 corporate private equity funds in the Calpers portfolio had raised a follow-on fund (56%), with Calpers reinvesting in 220 of these new funds (63%). Adding information on the time of the first close for follow-on funds that Calpers did not reinvest in, we arrive at a total of 330 follow-on funds.¹⁰ Table 1, Panel B, shows the distribution of all corporate private equity funds, those funds that had a follow-on fund, as well as the vintage years in which follow-on funds started investing. The gap between 627 and 330 is explicable by the fact that many recent funds have not yet launched a follow-on fund, some fund managers never launched a follow-on fund, and for some funds we could not identify reliably the first closing date. Nonetheless, this is a sizeable sample of funds for which we can identify the period over which they were marketing their next fund.

4. How fair are valuations of private equity funds?

In the first part of this section we examine the general characteristics of the quarterly net asset values reported by the private equity fund managers. In the second part we narrow our focus on the behavior of fund valuations during follow-on fundraising times.

4.1. Fund valuations, capital flows and public equity markets

In order to analyze the valuations of funds we start with the following simple observation. The NAV of a fund will change for one of three reasons: (1) cash is called from investors, which is either used to pay management fees (which will have no impact on the NAV) or is invested in a portfolio company, (2) the valuation of an existing portfolio company is changed, due to developments in the performance of the company and/or changes in the market valuation of companies (for instance if price/earnings ratios change), or (3) if cash is paid back to investors, when dividends are paid from existing portfolio companies, or they are sold. Using this approach we can analyze the behavior of the net asset value (NAV) reported by the GP through the life of

¹⁰ For 19 follow-on funds, we could not confirm or identify the time of the first close with certainty.

the fund using the (unbalanced) panel data of quarterly fund observations. We estimate the following fixed effects model:

$$y_{it} = \alpha_{it} + \mathbf{x}'_{it}\boldsymbol{\beta}_{it} + u_{it} \quad (1)$$

Our dependent variable (y) is the quarterly change in a fund's NAV, normalized by the size of the fund. Explanatory variables (\mathbf{x}) include capital flows into and out of a fund during a quarter (also normalized by the size of the fund), the quarterly returns of the S&P 500 index, a fourth quarter dummy variable to control for end-of-year effects (when fund valuations are audited) and dummy variables for each quarter of the fund life. These last dummy variables control for the fact the fund's NAV may behave differently during the life of the fund. For instance, it may be that few changes are made to the valuation of portfolio companies for the first few quarters after they are bought, whereas later in the funds the valuations may be changed frequently. We limit the time series component to, at most, 40 observations for each fund, as most of the activity occurs within the 10-year term of the fund (even though extensions are common, the remaining assets at that stage are usually minimal). In all our regressions we control for serial correlation, and report standard errors that are robust to heteroskedasticity and are clustered at the fund level.

Table 2 presents our findings on the behavior of the NAVs over the life of the fund. As shown in column I, capital that flows into a private equity fund translates almost perfectly into an equal change of the fund's NAV. In fact, the coefficient is slightly below one, as would be expected as some cash payments include management fees charged by the GP and the LPs share in certain transaction costs associated with acquiring portfolio companies. In terms of the impact of cash distributions on NAVs we find a coefficient of 0.648 – for every dollar that is returned to LPs after an investment has been realized, a fund's NAV decreases only by an average of about 65 cents (at the sample mean). This is the first important result: it shows that GPs are, on average over the life of the fund, conservative in the estimation of the fair value of their investments.

In column II we add the quarterly returns of the S&P 500 as a proxy for general changes in public equity markets, as well as a control variable for the final quarter of a calendar year. Not surprisingly, changes in public equity markets are significantly correlated to changes in the valuation of portfolio companies and, hence, reported fund NAVs. However, the coefficient of 0.258 is far below one, suggesting that, on average, GPs only mark-to-market to a limited extent

on a quarterly basis. Clearly, the expected value of this coefficient will depend on the systematic (beta) risk of the underlying portfolio companies. This cannot be observed. The equity beta (allowing for leverage in buyout deals) of portfolio companies is likely, on average, to be in excess of one. Consequently, the coefficient suggests that valuations of private equity funds are significantly smoothed relative to public equity markets.

With respect to a possible 4th quarter effect, also called “Santa effect” among LPs, we find that fund NAVs experience an upward correction at year’s end, when fund accounts and portfolio company valuations are audited. The average change in NAV at year’s end is significantly more pronounced than for the other three quarters. While this observation is interesting in its own right, it further emphasizes that private equity funds are conservatively valued most of the time. Figure 3 visualizes the significance of the 4th quarter effect by stacking-up the time-series of quarterly changes in NAVs (Chart A) and S&P 500-adjusted NAVs (Chart B) of our buyout funds by their 4th quarters.

In column III we add a lagged dependent variable in order to verify the presence of lagged effects on the fund’s NAV. The small value of the coefficient on the lagged dependent variable (0.059) suggest that smoothing is being captured by the contemporaneous relationship between quarterly cash-flows and the NAVs and so we drop the lagged dependent variable for the remaining of our paper.

Finally, we split our samples between buyout funds and venture capital funds. As detailed in columns IV and V, buyout funds tend to be valued more conservatively by their GPs than venture capital funds. While the mean NAV of a buyout fund decreases, on average, by about 61 cents for every dollar in capital distributions, a venture fund’s NAV decreases by an average of about 83 cents per dollar, at the sample mean. Moreover we also see that the 4th quarter effect is driven by buyout funds only, while venture capital funds show no significant effect. This result is consistent with the finding that venture capital fund NAVs tend to be closer to market value than buyout funds. Finally, the sensitivity of buyout fund NAVs to S&P 500 returns is slightly higher than for venture capital funds.

4.2. Fund valuations during fundraising

While our results so far provide evidence that GPs generally value their funds conservatively, we now focus on the periods during which GPs were actively marketing a follow-on fund to

investors. The point in the life of a current fund at which its GP starts marketing a follow-on fund varies, as does the duration of the total fundraising period, although within a limited range. With respect to the 330 follow-on funds in our sample we know the time of their first close, so we can identify the period in our sample funds' lives, during which the main marketing activities for the follow-on fund have taken place.¹¹ We run regressions similar to those in the previous section, but this time we add dummy variables to control for the quarters preceding and the years succeeding the first close of the follow-on fund to check for abnormal changes in the current funds' NAVs at those times. We use a fine (quarterly) analysis for the fundraising, as this tends to take place over three to six quarters before the first close, and so the quarterly pattern is interesting. Any over-valuation during the fundraising period could be unwound gradually over the remaining life of the fund, and so our analysis post-fundraising is on a coarser (annual) basis.

Table 3 presents our findings. Results are similar for the whole sample (column I), as well as for the sub-samples of buyout (column II) and venture funds (column III). Over the five quarters preceding the first close of the follow-on fund, the valuations of our sample of funds show a significant abnormal increase. This increase peaks in statistical and economical terms three to four quarter before the follow-on fund had its first close, and there is another local peak one quarter before the first close when the LPs' commitments are finalized. Notably, these significant abnormal increases in NAVs stop immediately once the follow-on fund starts investing. The NAVs of the old funds then change as expected during the first two years following the first close of the new funds, perhaps reflecting the fact that fundraising continues for many funds after the first close, and, as noted above, any inflated valuation can be unwound slowly over the remaining life of the fund. Figure 4 visualizes the cumulative pattern of "abnormal" changes in NAVs over the quarters before and after the first close of the follow-on fund, and clearly shows the gradual reversal of valuations.

The results of this section clearly show that, on average across the 330 funds for which we have information about their follow-on funds, NAVs tend to be inflated during the fundraising period. The unwinding of these inflated valuations happens gradually over the remaining years of the fund. This raises two important questions, which we consider in the next section. First, how does the pattern of NAVs we observe impact on reported performance? And,

¹¹ In this version of the paper we treat the 19 funds in our sample, for which we could not (yet) identify the start of the follow-on fund with certainty, as if they have not had a follow-on fund.

second, how useful are the performance figures that are reported during the fundraising period? In particular, we consider whether, in the cross-section, the interim performance reported during the fundraising period is useful in predicting the final fund performance.

5. The impact of valuation patterns on fund performance

Until now our results show that over the entire life of the fund valuations are conservative, and tend to be smoothed. However, we also find a significant jump in valuations in the fourth-quarter and when follow-on funds are being raised. This pattern of valuations is particularly interesting for its implications on reported returns. The main measures of performance that GPs and LPs discuss for private equity funds are IRRs and investment multiples (sometimes referred to as the ratio of total value – cash realizations plus remaining NAV – to paid in capital, or “TVPI”). Any inflation in the NAV will have an immediate effect on the reported IRR and TVPI. The IRR is heavily dependent on the timing of cash flows into and out of the fund, and so will also be dependent on the holding period of the investment. Unless the NAV continues to rise, the IRR will naturally fall over time. Therefore, after an upward revision to the NAV, the IRR relative to other funds will start to fall unless valuations continue to increase.

Table 4 confirms these patterns, where the dependent variable in the regressions is the quarterly change in the IRR or TVPI. We again include quarterly dummies for the fundraising period. The “abnormal” IRR and TVPI peak at the start of the fundraising period (around 4 or 5 quarters before the first close of the follow-on fund), which would typically coincide with when marketing materials were being finalized and distributed. In the case of IRRs, the performance measures start to unwind even before the first close of the follow-on fund as NAVs stagnate and so the progression of time has its natural effect on the IRR. For both performance measures, the unwinding continues fairly steadily over the years following the close of the follow-on fund. Again the results are similar for buyout funds and venture capital funds. Note that, as would be expected, we find much less significant effects of cash-in and cash-out on IRR than TVPI, but continue to include them for comparability.

This raises the interesting question as to whether investors should use reported interim performance as a guide to the ultimate performance of the fund. Eventually, of course, as cash is returned to investors, the interim and final performance measures will converge, but we consider whether the cross-sectional variation in interim performance measures is related to the final

performance around the critical fundraising period. In order to analyze this issue the following regressions are estimated:

$$\text{Performance}_i^{40} = \alpha_i + \beta_i \text{Performance}_i^{\text{interim}} + \mathbf{x}'_i \boldsymbol{\lambda}_i + u_i \quad (2)$$

We measure performance using the IRR and TVPI – as used by most LPs and GPs – and also by the public market equivalent measure (Kaplan and Schoar (2005)). As proxy for the fund’s final performance we use the IRR, TVPI or PME at quarter 40, since after the 10th year of the fund these will typically only vary to a limited extent. For the interim fund valuation we use the fund’s performance at quarters -4, -2, 0 and +2 relative to the first close of the follow-on fund. As control variables (\mathbf{x}) we include dummy variables for each fund vintage year, the natural logarithm of the fund size and the natural logarithm of number of quarters between the fund and the follow-on fund. This last control variable is particularly important since as the gap between interim performance and final performance measures closes naturally as the two dates converge, so the predictability will tend to increase. In all our regressions the IRR variables are winsorized at 1% level (given that IRRs can have some extreme values). Standard errors are robust to heteroskedasticity.

Panels A and B of Table 5 present the relationships for buyout funds and venture capital funds respectively. Starting with buyout funds, regressions I to IV show that there is no statistically significant cross-sectional relationship between IRRs four and two quarters before the follow-on fund had its first close and final performance. This is particularly important since, as mentioned above, it is around that period that the marketing documents for the follow-on fund are printed and sent to the LPs. The predictability of interim IRRs increases at the quarter the follow-on fund had its first close. Although there is a statistically significant relationship between the interim IRR and the final IRR, there is limited power to predict ultimate returns since the coefficients are significantly different from one. In sum, these results suggest that investors should be put little, or no, weight on the IRRs that they read in marketing documents when deciding whether to invest in a follow-on fund.

We run similar regression using TVPI and PME as the performance measures in regressions V to XII. In both cases the predictability starts earlier, and the coefficients converge on one. In particular, the results show that the interim fund PME is a relatively good predictor of

buyout funds' final PME. The coefficients associated with the interim PMEs are all statistically significant and PMEs at the quarter the follow-on fund had its first close and two quarters after are not significantly different from one, and so are good predictors of the fund's ultimate PME. Results using TVPI are similar, although predictability develops slightly later.

For venture capital funds, the regressions in Panel B show that interim performance has much less power in predicting final performance. Cross-sectional predictability occurs later, around two quarters after the close of the follow-on fund, for venture funds. The results are weakest for the IRR, where even two quarters after the follow-on-fund the interim IRR has only marginal value to investors. The same is broadly true for the interim PMEs for VC funds, where again we find no significant cross-sectional relationship until two quarters after the follow-on had its close. But even then the coefficient is statistically different from one. Similar results are found for TVPI.

In sum, the results show that an investor wanting to base, at least in part, the decision to invest (or not) in a new fund on the performance of the current fund being run by a GP, the performance figures during the marketing period should be treated with extreme caution. The inflation of asset values during fundraising we identified in the previous section has a particularly strong effect on IRRs which quickly reverse. Consequently, interim IRRs have little relation to final IRRs in the cross-section of funds. Instead, investors should pay attention to alternative performance measures that are more highly correlated to the final outcome of the fund, such as the PME (for buyout funds) and TVPI (for venture funds) or alternatively should postpone the decision to the second or third close of the follow-on fund.

6. Conclusions

In this paper we have analyzed whether private equity funds value their assets fairly. This is an important question not just from an accounting and regulatory perspective, but also because fund valuations impact directly on reported performance figures, which in turn are likely to influence investors' decisions as to whether to invest in new funds. Our results can be summarized as follows.

First, using quarterly data for a large sample of over 600 private equity funds over the period 1990-2012, on average – over the entire life of the funds – private equity valuations are

conservative relative to the final cash-flows that investors receive. This is particularly true of buyout funds, where a cash distribution of \$1 results, on average, in a reduction in NAV of around 60 cents.

Second, during fundraising periods the valuations tend to be inflated compared to other periods in the life of the fund. This has large effects on reported interim performance measures that appear in fundraising documents. We find a distinctive pattern of abnormal valuations which matches quite closely the period up to the first close of the follow on fund. It is hard to rationalize the pattern we observe except as a positive bias in valuation during fundraising.

Third, we analyze whether these biases in valuation render useless the interim measures of performance that are presented to potential investors. We find no statistically significant relationship between interim and final fund IRRs in the cross section of our funds. PME's are better predictors for buyout funds, and investment multiples are better predictors for VC funds.

Taken together our results represent a cautionary tale for investors. They may also go some way to explain one of the major puzzles associated with private equity – why the highest level of persistence in returns across funds is in the bottom quartile. Perhaps all private equity fundraising documents should contain the caveat “interim performance is no guarantee of final performance”.

References

Harris, Robert, Tim Jenkinson and Rüdiger Stucke, “A White Paper on Private Equity Data and Research”, 2010, Working Paper.

Harris, Robert, Tim Jenkinson and Rüdiger Stucke, “Are too many Private Equity Funds top quartile?”, 2012, *Journal of Applied Corporate Finance*, 24 (4), 77-89.

Harris, Robert, Tim Jenkinson and Steven Kaplan. “Private Equity Performance: What Do We Know?”. 2011, Working Paper

Higson, Chris and Ruediger Stucke, “The Performance of Private Equity”, 2012 Working Paper.

Kaplan, Steven, and Antoinette Schoar. “Private Equity Returns: Persistence and Capital flows”. 2005, *Journal of Finance* 60, 1791-1823.

Phalippou, Ludovic, and Oliver Gottschalg. “Performance of Private Equity Funds”. 2009, *Review of Financial Studies* 22, 1747–1776.

Table 1- Calpers' portfolio of private equity funds

This table shows the vintage year distribution of private equity funds in the Calpers' portfolio. Panel A clusters all funds by their main investment stage (VC, Buyout and Other which includes Mezzanine, Distress Debt, etc.) and region, and shows the total by number and fund size. Panel B presents the distribution of corporate private equity funds (VC and Buyout) that started a follow-on fund by March 2012 and the vintage years of their respective follow-on funds.

Panel A: Distribution of all private equity funds by type and region.

Vintage Year	# of Funds			# of Funds			Total	
	VC	Buyout	Other	U.S.	Europe	RoW	# of Funds	Size (\$m)
1990	4	0	0	1	3	0	4	2,109
1991	1	3	0	3	1	0	4	1,341
1992	2	1	2	5	0	0	5	748
1993	0	4	1	5	0	0	5	2,088
1994	2	12	5	18	1	0	19	7,288
1995	6	7	0	11	2	0	13	6,499
1996	7	8	3	15	2	1	18	8,328
1997	2	8	2	11	1	0	12	10,811
1998	6	12	3	16	3	2	21	22,293
1999	27	5	4	34	1	1	36	23,170
2000	51	22	3	66	4	6	76	60,997
2001	42	13	5	50	5	5	60	45,967
2002	13	8	8	24	5	0	29	21,876
2003	6	12	5	17	4	2	23	25,785
2004	16	17	8	36	3	2	41	33,975
2005	19	24	10	37	7	9	53	65,236
2006	27	23	13	48	7	8	63	163,363
2007	45	45	24	84	11	19	114	158,681
2008	37	38	18	62	13	18	93	168,752
2009	11	12	4	24	1	2	27	14,671
2010	9	10	6	20	2	3	25	25,904
2011	3	7	10	18	0	2	20	49,983
TOTAL	336	291	134	605	76	80	761	919,864

Panel B: Distribution of corporate private equity funds and follow-on funds.

Vintage Year	# of Funds Corporate PE	Funds with follow-on Fund			VY of follow-on Fund		
		VC	Buyout	Total	VC	Buyout	Total
1990	4	2	-	2	-	-	-
1991	4	1	3	4	-	-	-
1992	3	1	-	1	-	-	-
1993	4	-	3	3	-	-	-
1994	14	2	8	10	-	1	1
1995	13	3	6	9	1	2	3
1996	15	6	6	12	3	2	5
1997	10	2	6	8	1	6	7
1998	18	5	10	15	5	13	18
1999	32	21	4	25	5	2	7
2000	73	37	18	55	16	8	24
2001	55	29	10	39	9	4	13
2002	21	10	6	16	3	-	3
2003	18	3	11	14	5	4	9
2004	33	9	14	23	14	6	20
2005	43	15	19	34	24	18	42
2006	50	14	14	28	28	23	51
2007	90	16	9	25	20	17	37
2008	75	-	4	4	21	19	40
2009	23	2	1	3	5	6	11
2010	19	-	-	-	7	9	16
2011	10	-	-	-	10	12	22
2012	-	-	-	-	1	-	1
TOTAL	627	178	152	330	178	152	330

Table 2 - The general behavior of fund NAVs

This table shows the results of a panel data regression (fixed effects model). The dependent variable is the quarterly change in a fund's NAV. Independent variables are the quarterly capital calls and distributions of a fund and the quarterly returns in the public equity market. We also control for the impact of the fourth quarter of a calendar year, the age of a fund (quarter fixed effects) and fund fixed effects. In all regressions we control for serial correlation; robust and clustered (at fund level) standard errors are presented in brackets for all variables. *, **, *** indicate statistical significance at the 10%, 5%, and 1% level, respectively (t-test).

	(I)	(II)	(III)	(IV)	(V)
	$\Delta\text{NAV} / \text{Fund size}$				
Variables:	BO & VC		BO only		VC only
$\Delta\text{NAV} / \text{Fund size [n-1]}$			0.059 ** (0.028)		
Cash-In / Fund size	0.982 *** (0.033)	0.972 *** (0.033)	0.961 *** (0.035)	0.964 *** (0.026)	0.972 *** (0.064)
Cash-Out / Fund size	-0.648 *** (0.110)	-0.653 *** (0.110)	-0.659 *** (0.114)	-0.612 *** (0.110)	-0.829 *** (0.134)
S&P 500 Return		0.258 *** (0.012)	0.254 *** (0.013)	0.308 *** (0.018)	0.217 *** (0.016)
Fourth quarter fixed effects		0.008 *** (0.003)	0.009 *** (0.003)	0.013 *** (0.003)	0.004 (0.004)
Constant	0.003 (0.004)	-0.005 (0.004)	0.009 ** (0.005)	-0.011 * (0.006)	-0.004 (0.005)
Quarter fixed effects	YES	YES	YES	YES	YES
Fund fixed effects	YES	YES	YES	YES	YES
Observations	16,678	16,678	16,051	7,392	9,286
Number of funds	627	627	626	291	336
R-squared					
within	0.347	0.365	0.360	0.517	0.253
between	0.613	0.605	0.519	0.576	0.656
overall	0.351	0.368	0.365	0.514	0.261

Table 3 - Fund valuations during follow-on fundraising

This table shows the results of a panel data regression (fixed effects model). The dependent variable is the quarterly change in a fund's NAV. Independent variables are the quarterly capital calls and distributions of a fund and the quarterly returns in the public equity market. We also control for the impact of the fourth quarter of a calendar year, the age of a fund (quarter fixed effects) and fund fixed effects. Additionally we control for quarters preceding and years succeeding the first close of the follow-on fund. In all regressions we control for serial correlation; robust and clustered (at fund level) standard errors are presented in brackets for all variables. *, **, *** indicate statistical significance at the 10%, 5%, and 1% level, respectively (t-test).

	(I)	(II)	(III)
	$\Delta\text{NAV} / \text{Fund size}$		
Variables:	BO & VC	BO only	VC only
Cash-In / Fund size	0.953 *** (0.032)	0.949 *** (0.026)	0.950 *** (0.063)
Cash-Out / Fund size	-0.655 *** (0.111)	-0.614 *** (0.111)	-0.832 *** (0.134)
S&P 500 Return	0.254 *** (0.012)	0.303 *** (0.019)	0.215 *** (0.016)
Fourth quarter fixed effects	0.008 *** (0.003)	0.013 *** (0.003)	0.004 (0.004)
5 Quarters before FoF	0.026 *** (0.005)	0.030 *** (0.007)	0.021 ** (0.008)
4 Quarters before FoF	0.035 *** (0.006)	0.038 *** (0.009)	0.033 *** (0.009)
3 Quarters before FoF	0.030 *** (0.007)	0.026 ** (0.011)	0.035 *** (0.009)
2 Quarters before FoF	0.017 *** (0.007)	0.014 (0.009)	0.020 ** (0.009)
1 Quarter before FoF	0.024 *** (0.007)	0.023 ** (0.012)	0.028 *** (0.008)
FoF close Quarter	0.005 (0.007)	0.016 (0.010)	-0.001 (0.009)
1 Year after FoF	0.006 (0.005)	0.008 (0.007)	0.007 (0.006)
2 Years after FoF	0.001 (0.009)	0.002 (-0.008)	0.003 (0.016)
3 Years after FoF	-0.013 ** (0.005)	-0.007 (0.008)	-0.015 *** (0.006)
4 Years after FoF	-0.011 *** (0.004)	-0.012 * (0.007)	-0.008 * (0.005)
5 Years after FoF	-0.012 *** (0.003)	-0.009 * (0.005)	-0.012 *** (0.004)
6 Years after FoF	-0.008 ** (0.003)	-0.010 * (0.006)	-0.004 (0.004)
Constant	0.001 (0.004)	-0.004 (0.006)	0.000 (0.005)
Quarter fixed effects	YES	YES	YES
Fund fixed effects	YES	YES	YES
Observations	16,678	7,392	9,286
Number of funds	627	291	336
R-squared			
within	0.368	0.520	0.257
between	0.602	0.571	0.659
overall	0.371	0.517	0.264

Table 4 - IRRs and TVPIs during follow-on fundraising

This table shows the results of a panel data regression (fixed effects model). The dependent variable is the quarterly change in a fund's IRR winsorized at the 1% level (regressions I to III) and the quarterly change in a fund's TVPI winsorized at the 1% level (regressions IV to VI). Independent variables are the quarterly capital calls and distributions of a fund and the quarterly returns in the public equity market. We also control for the impact of the fourth quarter of a calendar year, the age of a fund (quarter fixed effects) and fund fixed effects. Additionally we control for quarters preceding and years succeeding the first close of the follow-on fund. In all regressions we control for serial correlation; robust and clustered (at fund level) standard errors are presented in brackets for all variables. *, **, *** indicate statistical significance at the 10%, 5%, and 1% level, respectively (t-test).

Variables:	(I)	(II)	(III)	(IV)	(V)	(VI)
	Δ IRR			Δ TVPI		
	BO & VC	BO only	VC only	BO & VC	BO only	VC only
Cash-In / Fund size	0.016 (0.031)	-0.010 (0.041)	0.040 (0.046)	0.076 ** (0.034)	-0.004 (0.044)	0.164 *** (0.058)
Cash-Out / Fund size	0.021 * (0.011)	0.029 *** (0.008)	-0.004 (0.038)	0.113 *** (0.022)	0.096 *** (0.017)	0.196 *** (0.044)
S&P 500 Return	0.209 *** (0.013)	0.245 *** (0.023)	0.175 *** (0.016)	0.307 *** (0.013)	0.371 *** (0.021)	0.250 *** (0.017)
Fourth quarter fixed effects	0.005 ** (0.002)	0.007 * (0.004)	0.003 (0.003)	0.008 *** (0.002)	0.015 *** (0.004)	0.003 (0.003)
5 Quarters before FoF	0.031 *** (0.010)	0.037 ** (0.015)	0.025 ** (0.012)	0.035 *** (0.008)	0.036 *** (0.013)	0.034 *** (0.009)
4 Quarters before FoF	0.029 ** (0.011)	0.011 (0.015)	0.046 *** (0.017)	0.037 *** (0.009)	0.038 *** (0.012)	0.035 *** (0.012)
3 Quarters before FoF	0.003 (0.011)	-0.010 (0.015)	0.013 (0.016)	0.022 ** (0.009)	0.003 (0.013)	0.036 *** (0.011)
2 Quarters before FoF	-0.040 *** (0.009)	-0.037 *** (0.012)	-0.041 *** (0.013)	-0.005 (0.007)	-0.009 (0.011)	-0.001 (0.009)
1 Quarter before FoF	-0.025 *** (0.009)	-0.028 ** (0.012)	-0.021 * (0.012)	0.007 (0.008)	0.002 (0.013)	0.010 (0.010)
FoF close Quarter	-0.043 *** (0.009)	-0.041 *** (0.012)	-0.045 *** (0.012)	-0.017 ** (0.008)	-0.015 (0.012)	-0.019 ** (0.010)
1 Year after FoF	-0.035 *** (0.005)	-0.034 *** (0.006)	-0.034 *** (0.007)	-0.005 (0.005)	-0.001 (0.007)	-0.009 (0.006)
2 Years after FoF	-0.028 *** (0.004)	-0.030 *** (0.006)	-0.026 *** (0.005)	-0.012 *** (0.004)	-0.005 (0.006)	-0.018 *** (0.006)
3 Years after FoF	-0.027 *** (0.004)	-0.029 *** (0.007)	-0.024 *** (0.005)	-0.017 *** (0.004)	-0.013 (0.008)	-0.020 *** (0.005)
4 Years after FoF	-0.026 *** (0.004)	-0.031 *** (0.007)	-0.022 *** (0.005)	-0.017 *** (0.004)	-0.016 *** (0.006)	-0.017 *** (0.005)
5 Years after FoF	-0.025 *** (0.004)	-0.028 *** (0.007)	-0.021 *** (0.004)	-0.018 *** (0.004)	-0.012 * (0.006)	-0.020 *** (0.004)
6 Years after FoF	-0.022 *** (0.004)	-0.027 *** (0.007)	-0.017 *** (0.004)	-0.013 *** (0.004)	-0.012 * (0.007)	-0.011 ** (0.004)
Constant	0.010 *** (0.003)	0.012 ** (0.006)	0.011 ** (0.004)	0.009 ** (0.004)	0.001 (0.006)	0.004 (0.004)
Quarter fixed effects	YES	YES	YES	YES	YES	YES
Fund fixed effects	YES	YES	YES	YES	YES	YES
Observations	16,678	7,392	9,286	16,678	7,392	9,286
Number of funds	627	291	336	627	291	336
R-squared						
within	0.064	0.065	0.070	0.063	0.072	0.070
between	0.063	0.028	0.132	0.079	0.000	0.125
overall	0.063	0.062	0.069	0.067	0.072	0.073

Table 5 - Predictability of final performance

This table presents OLS regressions of interim performance against final performance. The dependent variable is the fund IRR (columns I to IV), TVPI (columns V to VIII) and PME (columns IX to XII) at quarter 40. Panel A shows the results for buyout funds, and Panel B includes venture funds only. Independent variables are the IRR/TVPI/PME of a fund's fourth and second quarter before the follow-on fund had its first close, the quarter of the first close and the second quarter after the fund had its first close. We further add the natural logarithm of fund size, the natural logarithm of the number of quarters between the start of the fund and the first close of the follow-on fund, and dummies variables controlling for vintage year fixed effects. Robust standard errors are presented in brackets for all variables. *, **, *** indicate statistical significance at the 10%, 5%, and 1% level, respectively (t-test).

Panel A: Buyout funds												
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Variables:	Fund IRR at Q40				Fund TVPI at Q40				Fund PME at Q40			
IRR/TVPI/PME 4 Quarters before FoF	0.141 (0.097)				0.309 (0.226)				0.426 ** (0.212)			
IRR/TVPI/PME 2 Quarters before FoF		0.179 (0.112)				0.389 ** (0.184)				0.564 *** (0.192)		
IRR/TVPI/PME FoF close Quarter			0.345 *** (0.115)				0.734 *** (0.231)				0.985 *** (0.253)	
IRR/TVPI/PME 2 Quarters after FoF				0.571 *** (0.116)				0.866 *** (0.167)				0.914 *** (0.158)
LN Fund size	0.021 (0.018)	0.021 (0.018)	0.011 (0.016)	0.017 (0.011)	0.123 (0.082)	0.121 (0.081)	0.081 (0.082)	0.124 ** (0.061)	0.069 (0.059)	0.057 (0.060)	0.015 (0.063)	0.062 (0.049)
LN FoF start quarter	0.038 (0.055)	0.065 (0.060)	0.053 (0.042)	0.067 ** (0.033)	0.145 (0.241)	0.132 (0.240)	0.015 (0.215)	0.092 (0.172)	0.134 (0.202)	0.112 (0.196)	-0.017 (0.173)	0.105 (0.140)
Constant	0.003 (0.294)	-0.053 (0.222)	0.031 (0.182)	-0.056 (0.130)	0.634 (1.239)	0.519 (1.174)	1.771 * (0.920)	1.160 (0.764)	0.065 (0.697)	0.336 (0.847)	0.340 (0.644)	-0.132 (0.542)
Vintage year fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	64	64	64	64	64	64	64	64	64	64	64	64
R-squared	0.291	0.248	0.417	0.614	0.306	0.323	0.390	0.487	0.348	0.384	0.473	0.525

Panel B: Venture funds

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Variables:	Fund IRR at Q40				Fund TVPI at Q40				Fund PME at Q40			
IRR/TVPI/PME 4 Quarters before FoF	-0.009 (0.019)				0.003 (0.200)				0.164 (0.246)			
IRR/TVPI/PME 2 Quarters before FoF		-0.031 (0.032)				-0.037 (0.162)				-0.018 (0.193)		
IRR/TVPI/PME FoF close Quarter			0.085 (0.062)				0.367 ** (0.162)				0.240 (0.222)	
IRR/TVPI/PME 2 Quarters after FoF				0.207 *** (0.070)				0.409 ** (0.172)				0.359 * (0.201)
LN Fund size	-0.001 (0.013)	0.001 (0.014)	-0.002 (0.014)	-0.005 (0.015)	-0.021 (0.053)	-0.020 (0.052)	-0.014 (0.052)	-0.021 (0.052)	-0.025 (0.045)	-0.030 (0.046)	-0.025 (0.046)	-0.028 (0.047)
LN FoF start quarter	0.034 (0.027)	0.023 (0.027)	0.047 * (0.027)	0.043 (0.028)	0.205 * (0.114)	0.189 * (0.106)	0.198 * (0.107)	0.187 * (0.108)	0.182 * (0.107)	0.152 (0.101)	0.187 * (0.108)	0.206 * (0.110)
Constant	0.212 ** (0.103)	0.334 *** (0.101)	0.243 ** (0.099)	0.236 ** (0.105)	2.245 *** (0.582)	3.344 *** (0.518)	1.512 *** (0.536)	1.488 ** (0.581)	0.830 (0.558)	1.617 *** (0.492)	1.138 * (0.598)	0.976 * (0.556)
Vintage year fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	94	96	96	96	94	96	96	96	94	96	96	96
R-squared	0.513	0.507	0.516	0.556	0.587	0.585	0.605	0.615	0.255	0.245	0.265	0.287

Figure 1- IRR development of an exemplary U.S. buyout fund

This figure shows the development of a U.S. buyout fund's IRR over its lifetime. The fund itself started investing in 1995. Its follow-on fund had its first close in the second quarter of 1998.

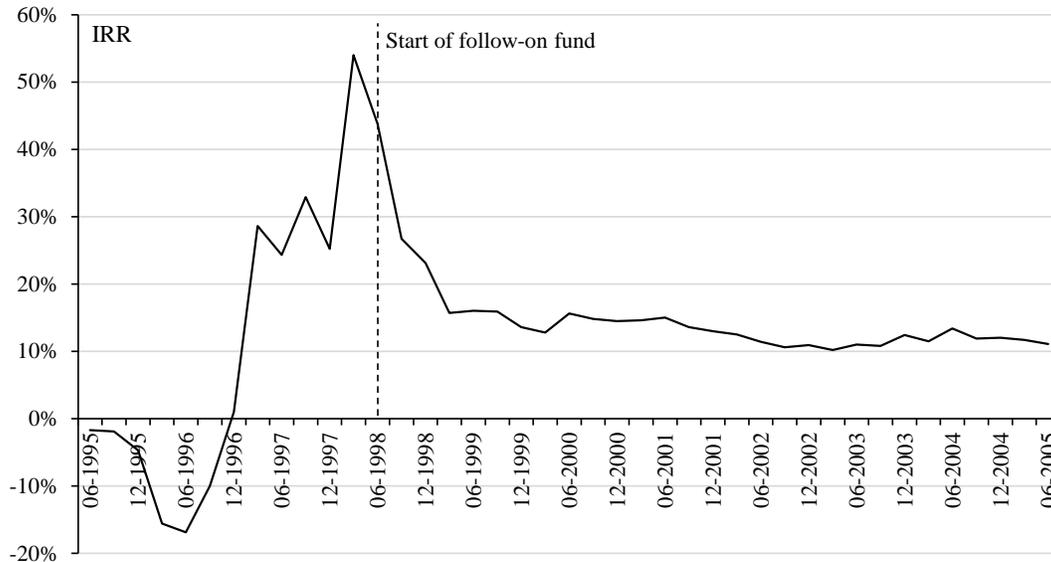


Figure 2 - Illustration of a private equity fund's lifecycle

This figure illustrates the lifecycle of a private equity fund and the timing of its follow-on fund. The upper part shows the time-series of cumulative drawdowns, distributions, and NAVs of the current fund. The lower part shows the corresponding periods of the current fund from fundraising to a possible extension, and adds the timing structure of the follow-on fund.

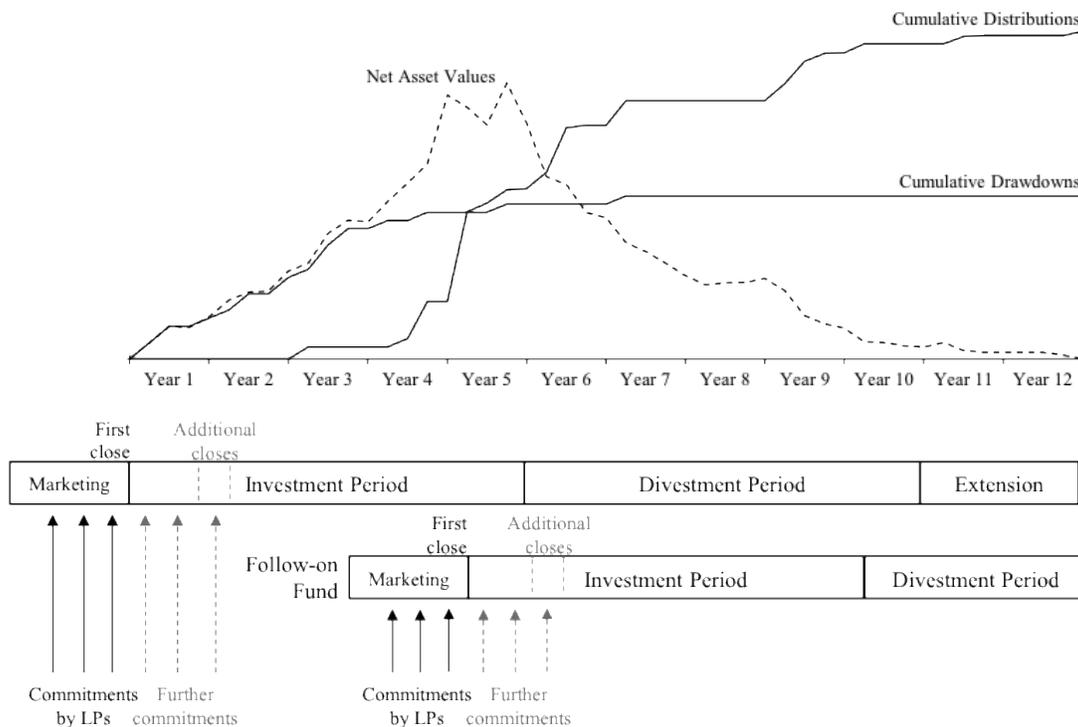


Figure 3- Fourth quarter effect

This figure shows the average quarterly change in NAVs of U.S. buyout funds with their first year-end quarter at time 4. The quarterly change in NAV (Chart A) is calculated as $(NAV_t - \text{Cash In}_t + \text{Cash Out}_t) / (NAV_{t-1}) - 1$ and the adjusted quarterly change in NAV (Chart B) as $[(NAV_t - \text{Cash In}_t + \text{Cash Out}_t) / (NAV_{t-1})] / [S\&P\ 500_t / S\&P\ 500_{t-1}] - 1$.

Chart A: Average quarterly changes in NAVs.

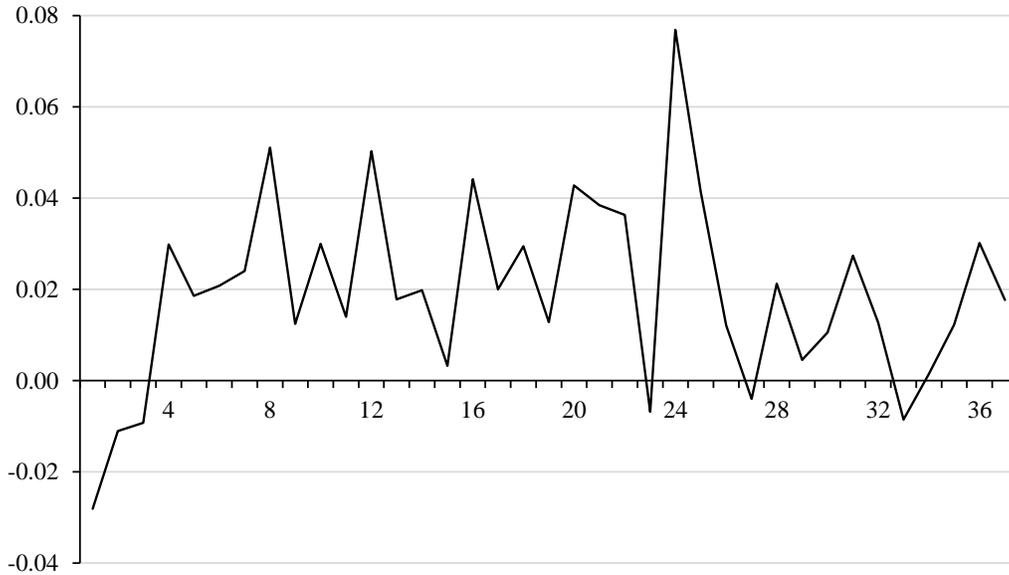


Chart B: Average quarterly changes in NAVs adjusted by the change in the S&P.

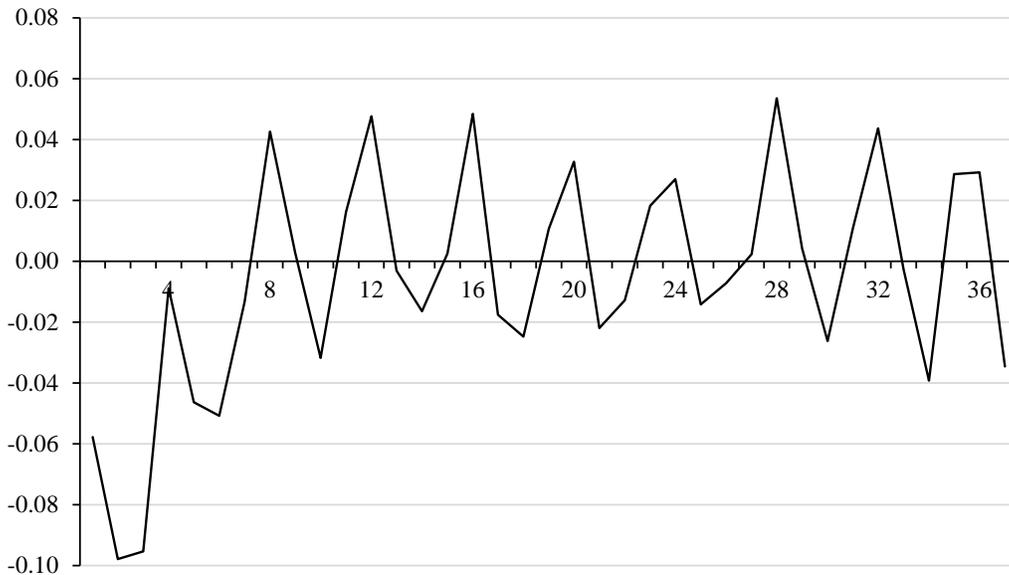


Figure 4 - Cumulative abnormal changes in NAVs

This figure shows the cumulative abnormal annual changes in our sample funds' valuations around the first close of the follow-on fund for all corporate private equity funds, as well as buyout and venture funds separately.

