

Risk and *Expected* Returns of Private Equity Investments: Evidence Based on Market Prices^{*}

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Abstract

We estimate the risk and expected returns of private equity investments based on the market prices of publicly traded funds of funds that invest in unlisted private equity funds. Our results indicate that the market expects the limited partners of unlisted private equity funds to earn positive abnormal returns of approximately 0.5% per year. We also find that the market expects listed private equity funds to earn abnormal returns that are statistically indistinguishable from zero after fees. Both listed and unlisted private equity funds have market betas close to one and positive factor loadings on the Fama-French SMB factor. Private equity fund returns are negatively related to the credit spread and positively related to GDP growth. In addition, we find that the returns of publicly traded funds of funds and listed private equity funds predict changes in self-reported book values of unlisted private equity funds.

Keywords: Private equity; listed private equity; risk-return characteristics; funds of funds

JEL Classification Code: G12

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I. Introduction

Private equity (PE) refers to equity securities in private companies that are not publicly traded. Private equity funds that specialize in PE investments opened up this asset class to institutional investors and other capital market participants. The early success of some large PE funds led to the rapid growth of this asset class. According to Prequin (2009), capital commitments to new private equity funds have grown from approximately \$6 billion in 1991 to more than \$340 billion in 2008. As of 2008, this same report indicates that private equity funds manage approximately \$2.5 trillion.¹

Although PE has experienced rapid growth, the risk and return profile of this asset class is not well understood. Many news stories suggest that PE investments yield higher returns than traditional asset classes.² A recent news release by Thomson Financial and the National Venture Capital Association (NVCA) announced that Thomson Reuters' All Venture Private Equity Performance Index³ for the United States (US) “across all horizons outperformed public market indices, NASDAQ and the S&P 500, through December 31, 2008.” Indeed, the capital weighted Private Equity Performance Index (PEPI) including both venture capital partnerships and buyout partnerships earned an annualized return of 7.4% compared to the analogous annualized return of 6.5% earned by S&P 500 during our sample period.

A number of academic papers also report positive abnormal performance for private equity investments. Ljungqvist and Richardson (2003) find that private equity investments outperformed the S&P 500 by more than 5% per year. Cochrane (2005), Kaplan and Schoar (2005), and Peng (2003) also find that private equity funds outperform the S&P 500. However, these papers use databases that potentially suffer from selection bias because performance information is usually compiled from data self-reported by the general partners (GPs) of the funds and augmented by data voluntarily

¹ See <http://www.prequin.com/> to download PESpotlight_February09_NonSubscribers.pdf.

² See Phalippou and Gottschalg (2009) for examples of several news articles that report high expectations for returns from PE investments. For instance, the *Financial Times* (September 26, 2005) reports that a survey of large U.K. investors found that these “investors hope to make an average annual net return of 12.8 percent from their private equity investments.”

³ See <http://www.nvca.org/> to download Q408VCPerformanceRelease.pdf. The All Venture Private Equity Performance Index is computed using “the latest quarterly statistics from Thomson Reuters' Private Equity Performance Database analyzing the cashflows [*sic*] and returns for over 1266 US venture capital partnerships with a capitalization of \$224 billion. Sources are financial documents and schedules from Limited Partner investors and General Partners.”

provided by large private equity investors participating as limited partners (LPs). It is quite likely that GPs and LPs who do not have good experiences choose not to report their performance. Hence, PE funds that performed poorly are less likely to be included in these databases.

Moreover, the estimated performance of PE funds depends critically on the valuation of non-exited investments at the end of the sample period. For instance, Kaplan and Schoar use the book values of such non-exited investments determined by the funds themselves and find that the value-weighted performance of PE funds exceeds S&P 500 return by five percent over the life of the fund. This cumulative estimate is equivalent to outperformance of about 1% per year according to the approximation provided by Phalippou and Gottschalg (2009). However, Phalippou and Gottschalg (2009) argue that it is more reasonable to write-off non-exited investments after a certain period of time and they find that PE funds underperform the market by 3% to 6% per year.⁴ Setting such disagreements aside, it is still the case that these estimates of PE performance are not based on market prices.

The existing literature also attempts to estimate the risk characteristics of PE investments based on cash payouts to investors and intermediate valuations of these investments. Because it is difficult to determine the intermediate market valuation of all investments made by PE funds using cash distributions or follow-up financing rounds, additional assumptions are necessary to determine the risk of these investments. The estimates of systematic risk in this literature seem to depend significantly on these assumptions. For example, the estimates of beta range from about 0.5 in Hwang, Quigley, and Woodward (2005) to 4.66 in Peng (2001).

This paper examines the risk and return of private equity investments using market prices of two samples of publicly traded firms that invest in private equity. The first sample contains 24 publicly traded funds of funds (FoFs) that predominantly invest in unlisted private equity funds. FoFs that invest in unlisted PE funds are traded on exchanges outside the United States (US), including the London Stock Exchange and exchanges in Continental Europe. The aggregate size of the constituent unlisted PE funds

⁴ Phalippou and Gottschalg (2009) also discuss other explanations for the differences between the estimates of realized performance for PE investments in their paper and the estimates in Kaplan and Schoar (2005).

held in part by the portfolios of these FoFs and matched to observations in the VentureXpert database is approximately 29% of the combined size of all PE funds in the VentureXpert universe in 2007.⁵ Although these FoFs only control a small fraction of the capital invested in PE funds, the unlisted PE funds in which they invest represent a large fraction of the PE fund universe. We estimate the risk and return profile of the underlying portfolio of unlisted PE funds using the market prices for our sample of FoFs.

The dataset we employ has several advantages. First, it is free from the standard sources of selection bias. As Cochrane (2005) notes, “overcoming selection bias is the central hurdle” in evaluating the performance of PE investments. Moreover, we rely on market prices instead of self-reported accounting data and information about cash flows and estimates of intermediate valuation. Therefore, we are able to circumvent critical shortcomings that affect the results of previous studies. Our approach extracts an estimate of the market’s ex-ante expectation of abnormal returns for PE investments from market prices. In contrast, the existing literature examines ex-post performance of unlisted PE funds based. These studies find a wide range of abnormal returns, ranging from -6% in Phalippou and Gottschalg (2009) to 32% in Cochrane (2005). The findings in these papers provide interesting insights into past performance of PE funds found in various datasets and based on different sets of assumptions. However, both investors and practitioners are generally interested in understanding the expected return for private equity in the long run.

The intuition behind our approach is straightforward. The listed FoFs in our sample are structured as closed-end funds. The relation between the market prices of these FoFs and the amount they invest in unlisted PE funds provides a measure of the value added by the holding the underlying PE funds net of the extra layer of fees charged by the FoFs. After taking into account the present value of these fees, the market value of the equity invested in unlisted PE funds enables us to estimate the abnormal return that these underlying PE funds are expected to earn in the long run. Our methodology implies that the estimates of the expected abnormal return for the portfolio of unlisted PE investments will include any ability that FoFs might have in selecting unlisted PE funds,

⁵ We are able to precisely match approximately 70% of the unlisted PE funds held by the FoFs to corresponding observations in VentureXpert by name.

i.e. selection skill of FoFs, in addition to the abnormal performance of the average unlisted PE fund, i.e. management skill. We cannot directly disentangle selection skill from management skill based on data for FoFs. However, in a related context, Fung and Hsieh (2000) find that the performance of hedge fund FoFs and the general population of hedge funds are about equal after accounting for selection bias in hedge fund databases and for the second layer of fees charged by hedge fund FoFs. Their results indicate that FoFs exhibit little selection skill for hedge funds. To the extent that their findings can be generalized, the selection skill of FoFs for PE funds is unlikely to be a significant factor in our analysis.

We present an analytically tractable model to determine the range of possible values for FoF fees based on the fee structure we observe in the data. The results of this model provide upper and lower bounds for abnormal returns that the market expects from investments in underlying PE funds. We find that the market expects PE funds to earn abnormal returns greater than -0.25% and less than 1.75% for a fund with a typical fee structure (e.g. base management fee of 1% and incentive fee of 10%) and a fund discount between 5% and 19% . Even for an implausibly high payout ratio of close to one and a fund discount two standard deviations above the average discount reported in our data, the lower bound for the expected abnormal returns is greater than -0.25% . We use simulations to capture the actual fee structure of each individual FoF as well as the observed fund discount to narrow the range of abnormal return expectations. Our results indicate that the expected abnormal return is between 0.25% and 0.75% for plausible payout ratios between 0.3 and 0.7 .

While the wide range of estimates in the existing literature is based on the particular datasets as well as additional assumptions used in the respective studies, our results imply that the market does not expect PE funds to earn such extreme abnormal returns in the long run. Indeed, under any reasonable set of assumptions, we find that the market prices of FoFs are inconsistent with either significant negative expected abnormal returns or positive expected abnormal returns in excess of 2% in the long run.

We also examine the risk and return profile of another unique sample of 155 publicly traded funds that invest in private equity. We refer to these funds as listed private equity (LPE). LPEs are similar to unlisted PE funds in several respects. The

managers of LPEs are compensated through management and performance fees similar to unlisted PE funds.⁶ The LPEs primarily invest directly in PE deal rather than holding limited partnerships in unlisted PE funds. These LPEs have the same opportunity sets as unlisted PE funds, to the extent that excess returns are available to skilled managers who specialize in private equity transactions. Following the logic underpinning the analysis of FoFs, we are able to infer the performance characteristics of PE investments based on the market prices available for the listed private equity vehicles in our database. Indeed, LPEs do not have a second layer of fees, and therefore, the relation between the market prices of these LPEs and the amount of capital under management provides a direct measure of the value added by PE.

However, there are several practical differences between LPEs and unlisted PE funds that may lead to a disparity in performance benefits. For example, Jensen (2007) argues that the unlisted PE funds' partnership structure may contribute to their value since they are not exposed to agency costs associated with diffusely owned publicly traded firms. Also, since unlisted PE funds have finite lives, the general partners are forced to revisit the pool of limited partners to raise capital to finance the next set of transactions. Therefore, general partners have an added incentive to perform well due to reputational considerations. Since LPEs have an indefinite life, they are more insulated from such concerns because they have the option to indefinitely retain earnings to finance the next deal. If the performance benefits associated with unlisted PE funds are derived from the incentives induced by these specific differences, then the unlisted funds will add more value than LPEs. Therefore, the abnormal return that the market expects LPEs to earn for their shareholders provides a lower bound for the abnormal return that unlisted PE funds are expected to provide their LPs.

We find that the market expects listed private equity funds to earn zero or marginally negative abnormal returns net of fees. Similar to our results for FoFs, market prices of LPEs are inconsistent with either significant negative expected abnormal returns or significant positive expected abnormal returns for private equity in the long run. In

⁶ Gompers and Lerner (1999) as well as Kaplan and Schoar (2005) find that the compensation schemes for PE funds are relatively homogeneous. Most funds use fee structure with an annualized base management fee between 1.5% and 2.5% of assets under management along with a 20% incentive fee.

related work, Martin and Petty (1983) and Brophy and Guthner (1988) use listed venture capital funds (a subset of LPEs) to examine risk and ex-post returns for extremely small samples during sample periods of approximately five years. In the more closely related paper, Brophy and Gunthner (1988) find that the portfolio of listed funds outperforms the S&P 500 and has low systematic risk. Although these studies use market prices of listed private equity funds, they suffer from a selection bias because both studies require the vehicles in their respective samples to survive until the end of the sample period.

Based on our estimates from the market model, the risk profiles of FoFs and LPEs imply that unlisted PE funds have market betas close to one. Augmenting our analysis with additional factors, we find significantly positive loadings on Fama-French SMB factor. Even after controlling for the stock market, the performance of the FoF index is negatively related to the credit spread and positively related to GDP growth. In analogous specifications, the performance of the LPE index is negatively related to the credit spread, however, the coefficient for GDP is positive but not statistically significant.

We also find that the returns of FoFs based on market prices predict future changes in the book valuation of unlisted private equity funds. This result indicates that the performance of FoFs provides timely information about the subsequent performance of the unlisted PE industry. This finding also indicates that it is critical to use market prices to estimate the risk and return profile of PE because the accounting data based on the intermediate valuation of assets attenuates any sharp movements in the true value of these assets due to changing market conditions.

The remainder of this paper is organized as follows: Section II describes the data and sample criteria. Section III provides estimates of market's ex-ante expected abnormal returns for unlisted PE funds held by FoFs as well as the expected performance of LPEs. Section IV examines the risk characteristics of PE based on the performance of these vehicles and the sensitivity of PE performance to macroeconomic conditions. Section V examines the ability of FoF performance to predict future changes in unlisted PE funds' self reported book values and Section VI concludes.

II. Sample

A. PE Fund of Funds

Unlisted PE funds are typically organized as limited partnerships. Outside investors have partnership interests in the funds as limited partners and fund managers as general partners. PE FoFs are intermediaries that raise capital from investors to finance investments in unlisted PE funds as LPs. In the US, only large institutions and qualified investors, who meet certain minimum wealth and income criteria, are usually allowed to invest in unlisted PE funds. Even though the unlisted PE funds typically impose minimum thresholds for investment as a limited partner, small investors can hold stakes in unlisted PE funds through FoFs. Some FoFs are actively traded on stock exchanges outside of the US.

To find these publicly traded FoFs, we start by identifying FoFs from the VentureXpert database and the Dow Jones Private Equity Funds of Funds database. Next, we augment this list using the components for the S&P Listed Private Equity Index, PowerShares Listed Private Equity Fund, Power Shares International Listed Private Equity Fund, Listed Private Equity Index, and International Listed Private Equity Index. We match the names on this augmented list to the universe of traded stocks on Datastream. For the subset of FoFs that can be matched to trading data, we obtain annual reports from company websites and from industry sources for the sample period from 1994 to 2008. We examine each annual report to identify FoFs that invest at least 50% of their capital in unlisted PE funds and our final sample contains 24 listed funds of funds for private equity.

Table 1 and Table 2 present descriptive statistics for our sample of FoFs. Nine FoFs in the sample are listed in London, 13 are listed in Continental Europe and two are listed in Australia. The average market capitalization one year after IPO is \$385 million and the range for market capitalization is from \$11 million to \$1.8 billion. In our sample, 15 of the 24 FoFs indicate that their main focus is buyout PE funds. Although these FoFs are traded outside the US, 10 of them primarily hold North American PE funds. In terms of the value of investments, 59% of the assets are managed by FoFs that focus on North America. Therefore, although the FoFs are listed outside the US, unlisted private equity funds in North America dominate the underlying portfolio. The annual reports of these FoFs indicate that these funds invest in a wide variety of unlisted PE funds raised by

well-known PE groups.⁷ Since the median number of distinct underlying funds held by each fund of funds is 19, the combined portfolio of unlisted private equity funds appears to be well diversified.

To examine the breadth of the unlisted PE funds held by our sample of FoFs, we compare the aggregate size all unlisted PE funds held in part by the combined portfolio of FoFs with the size of the PE fund universe from VentureXpert. The annual reports of all but one of the FoFs in our sample present a complete list of investments in unlisted PE funds. We compile the list of all unlisted PE funds held by FoFs as of 2007. We attempt to match each fund by name with the PE funds in the VentureXpert database as of 2007 for which net asset value data are available. We match approximately 70% of unlisted PE fund investments held by FoFs to funds in the VentureXpert database by name. The aggregate size of the unlisted PE funds held in part by FoFs is 29% of the value of all the funds with size data in VentureXpert. Therefore, the PE funds held by our sample of FoFs represent a substantial fraction of the VentureXpert PE fund universe, even though they only manage a small portion of the capital raised by unlisted PE funds.

B. Listed Private Equity Funds

Our primary source for listed private equity funds is the VentureXpert database. The managers of listed private equity vehicles classified as “funds” in VentureXpert are compensated through management fees similar in structure to those of unlisted PE funds.⁸ Table 3 presents the descriptive statistics for this sample of 155 LPEs. Of these funds, 109 are listed in the London Stock Exchange and 9 are listed on US exchanges. In our sample, 16 of the 155 LPEs indicate that their main focus is buyout PE funds. In terms of the value of investments, 36% of the assets are managed by LPEs that focus on North America. Compared to FoFs, the LPEs in our sample invest more heavily outside of North America and are much less focused on buyout transactions.

⁷ Among others: Berkshire Fund VII, Blackstone Capital Partners V, Carlyle Partners V, KKR 2006 Fund, Silver Lake Partners III, TPG Partners V, and Warburg Pincus Private Equity X.

⁸ To check the completeness of VentureXpert, we examine a subsample of listed entities that were not classified in VentureXpert as “funds” but were included as components of the S&P Listed Private Equity

III. Expected abnormal returns for PE Investments

We begin by analyzing the market's expectation of the abnormal return for unlisted PE investments. Earlier papers in this literature follow the traditional approach and examine the ex-post performance of unlisted PE funds. For example, Kaplan and Schoar (2005) and Ljungqvist and Richardson (2003) use cash inflows and outflows from samples of PE funds and investigate whether these funds outperformed their benchmarks. The ex-post return is the sum of the ex-ante expected return and the unexpected return. One can appeal to rational expectations, and assume that the mean of the unexpected component of returns is zero, and use ex-post returns as an unbiased measure of expected returns. In most situations, ex-ante expected returns are unobservable and hence the ex-post realized return is the only feasible route to estimate expected returns.

While ex-post returns may provide some insights regarding performance, it does not necessarily provide a measure of market's expectation of returns that would be earned in the long term through investments in PE funds. Even ignoring the issues associated with properly measuring ex-post performance in the context of private equity, historical performance may have been biased by unexpectedly good outcomes during the sample periods used in earlier studies. For example, PE funds that invested in start-up companies may have unexpectedly benefited from the Internet boom and the generally stellar performance of Internet stocks that is probably unique to the 1990s. Therefore, because such unexpectedly good outcomes dominated the sample period in many studies, it is unlikely that the ex-post returns provide unbiased estimates of expected returns.

The unique advantage of our approach is that we observe the amount of money raised by the FoFs and LPEs as well as the market value of these vehicles after the initial public offering. The difference between the market value and the amount of capital used to invest in PE represents the net present value (NPV) of the underlying investment in PE. We determine the expected abnormal return for PE based on this NPV.

A. An Analysis of Funds of Funds

A.1 Methodology

Index. These entities are usually holding companies for separate operating companies that do not compensate their managers using the typical PE management fee structure.

While the theoretical basis for our methodology is straightforward, there are a few practical issues that need to be addressed in the context of FoFs. First, FoFs charge fees for managing the capital they raise. These fees are in addition to the fees charged by the unlisted private equity funds, and therefore, the market capitalization of a FoF reflects the present value of cash flows net of the second layer of fees. Consequently, the market value of the underlying portfolio of PE funds held by a FoF is the sum of the market capitalization based on the listed shares of the FoF and the present value of fees owed to the manager of the FoF.

Figure 1 illustrates our approach. FoFs invest the amount they raise at the IPO (after issuance costs) in unlisted PE funds. This is the book value of the initial investment in PE. The unobserved market value of this investment in unlisted PE funds consists of two components. The first component is the market value of FoF equity, i.e. the aggregate value of the investors' shares, and the second component is the present value of FoF fees. The difference between the total market value of the investments in unlisted PE funds and the book value of these funds is the net present value of the underlying portfolio of unlisted PE funds. If the market expects positive abnormal returns from PE investments then the total market value is greater than the book value, as Panel A illustrates. However, if the market expects PE investments to earn negative abnormal returns then the total market value is less than the book value, as Panel B illustrates. Holding all else constant, the magnitude of this net present value reflects the magnitude of the expected abnormal return for underlying PE funds in the long run.

The computation of the market value of the traded shares is straightforward based on the price and number of shares outstanding. The calculation of the present value of FoF fees, however, is less straightforward since claims to these fees are not traded. We use two approaches to compute the present value of FoF fees and extract market expectation of abnormal returns for PE investments. In the first approach, we use a theoretical model to derive analytic formulas for the present value of the FoF fees as a function of the market value of traded shares and the fee structure. This model uses simplifying assumptions about the fee structure for analytic tractability. However, we show that we can use the results of this model and observed FoF discounts to determine upper and lower bounds on the magnitude of abnormal returns that the market expects PE

funds to earn. In the second approach, we use Monte Carlo simulations to compute the present value of FoF fees based on the actual fee structure of each FoF because these fee structures are not analytically tractable. We estimate the market's expectation of the abnormal return for PE funds using our simulation results and the average FoF discount observed for our sample.

A.2 Discounts for FoFs

The market value and book value of equity for each FoF are key inputs for determining market's expectation of abnormal returns for investments in PE. We get the most accurate measure of the amount that FoFs actually invest in PE funds at the time of the IPO for each FoF since the amount available for investment is raised in cash at that time. Therefore, in much of our analysis we will focus on valuation in the months immediately following the IPO.

We first examine the relation between the market price and post-IPO book value or the net asset value (NAV) of each FoF. Specifically, we examine the FoF discount at time t , defined as:

$$D_t = 1 - \frac{\text{Price}_t}{\text{NAV}_t}. \quad (1)$$

We obtain price and NAV data from Datastream and Bloomberg. The NAV until the first financial statement after IPO is based on the value of funds raised at IPO. Since, at this time, the NAV accurately reflects the amount of capital raised for investment, we largely avoid any problems due to self-reported NAV data from the underlying funds. As we progress through time, some of the investments are assigned intermediate valuations and these new values affect the NAVs reported by the underlying PE funds. However, in the early stages of a FoF's life, the NAV for each PE fund is likely to be close to the dollar value of FoF investments since very few assets are revalued quickly.

Table 4 presents the average discount for FoFs each month during the first 12 months in event time after the IPO. Although FoFs are usually issued at a premium (to cover issuance costs), they trade at an average discount of approximately 6% three months after the IPO. The average discount gradually increases to approximately 12% by month 10 and fluctuates around this level for the remainder of the year. The evolution of

the average FoF discount in our sample follows a similar path to the average discount for closed-end mutual funds in the US that invest in publicly traded stocks and bonds. These closed-end funds are issued at a premium, but they eventually trade at a discount. Both Weiss (1989) and Peavy (1990) report that the average closed-end mutual fund discount stabilizes at about 10% to 12% after six months following the IPO. Since both FoFs and closed-end mutual funds trade at substantial discounts, these funds are not expected to add sufficient value to justify their fees. Essentially, the average discount for FoFs implies that any value created by the expected abnormal returns of the underlying portfolio of unlisted PE funds is not sufficient to offset the additional layer of fees charged by FoFs. To provide a more precise estimate of the market's expectation about the performance of the underlying portfolio, we must take into account the present value of FoF fees in addition to the market value of FoF equity.

Since that evidence in Table 4 suggests that FoFs underperform immediately following the IPO, it is likely that the IPO price does not initially reflect the true value of the underlying PE funds net of FoF fees. The results in Table 4 show that the discount stabilizes towards the end of the first year. Indeed, additional tests indicate that we do not find any abnormal returns after this initial period. The stability of the average discount and the lack of subsequent abnormal returns indicates, that the market capitalization one year after the IPO is a relatively unbiased measure of the true value of FoF equity. Therefore, we use the evidence that the average FoF discount is about 12% after one year to estimate the market's expectation of abnormal returns.

A.3 Bounds on Expected Abnormal Returns

In this subsection we analytically determine the present value of FoF fees as a function of the parameters for a simplified fee structure, market's expectation of abnormal returns, and other factors. These analytic results provide upper and lower bounds on the market's expectation of abnormal returns for the underlying portfolio of PE investments. As shown below, the distance between these bounds is fairly narrow and this range excludes many empirical estimates presented in the literature.

Usually, FoF fees have a fixed component and an incentive component. The fixed component, or the base management fee, is specified as a fixed percentage of NAV of the

FoF. The incentive component is specified as a fixed percentage of profits that earned by the FoF. Several funds also apply a hurdle rate, and the incentive fee is a percentage of the profits that exceed the profit level determined by the hurdle rate. Often, the incentive fees are payable only if the NAV exceeds a high watermark, which is the highest NAV that the FoF had previously reached. However, for the model analytically tractable, we make some simplifying assumptions about the fee structure in this subsection. We assume that the fee structure comprises only a fixed fee and an incentive fee and that there is no hurdle rate or high watermark.

Our model is specified as follows. Let NAV_t be the net asset value at time t and let λ be the base management fee expressed as a fraction of NAV_t . Let $R_{u,t}$ be the return of the underlying PE fund portfolio held by the FoF (gross of FoF fees but net of fees paid to the GPs of the underlying funds). We assume that $\{R_{u,t}\}$ is independently and identically distributed. Let π be the proportional incentive fee, which is computed as a fraction of the return after the base management fee is paid. Similarly, let θ be the proportional reinvestment rate (retention ratio), which is also computed as a fraction of the return after the base management fee is paid. By construction, each FoF makes the following distributions at time $t+1$:

$$\begin{aligned}
\text{Base Management Fee} &= \lambda NAV_t \\
\text{Incentive Fee} &= \pi NAV_t (R_{u,t+1} - \lambda) \\
\text{Distribution to FoF Shareholders} &= (1 - \theta - \pi) NAV_t (R_{u,t+1} - \lambda) \\
\text{Retained Earnings} &= \theta NAV_t (R_{u,t+1} - \lambda).
\end{aligned} \tag{2}$$

To ensure that investors receive positive distributions on average, the sum of the retention ratio (θ) and the proportional incentive fee (π) must be less than unity. Consequently, the retention ratio has a range from zero to $1 - \pi$ and the payout ratio ($1 - \theta$) has a range from π to unity. In this context, the payout ratio is the proportion of $NAV_t (R_{u,t+1} - \lambda)$ that is distributed to investors or paid to the manager as the incentive fee. Given these distributions, the evolution of the net asset value is:

$$NAV_{t+1} = \left(1 + \theta (R_{u,t+1} - \lambda)\right) NAV_t. \tag{3}$$

In general, the base management fee inherits some of the underlying fund risk as long as the fund retains a portion of its earnings for reinvestment. However, if all earnings are paid out as distributions to managers and shareholders, i.e. if $\theta = 0$, then the base management fee is riskless.

In addition to the simplifying features of the fee structure that we discussed earlier, the distribution we specify above also deviates from the actual fee structure if $(R_{u,t+1} - \lambda) < 0$. Implicitly, this specification assumes that the FoF manager pays the fund if the fund return is lower than λ . However, FoF managers do not make such payments in practice. Instead, the high watermark reduces subsequent incentive compensation by the amount corresponding to any return shortfall. While our model is analytically appealing, it changes the timing of cash flows to managers and understates the value of the incentive fee to the managers due to the time value of money. Therefore, we relax this assumption in our simulation analysis (see III.A.4) to address any potential issues due to this bias.

Let α be the abnormal return that the market expects the underlying portfolio of PE funds to earn. The expected return for the underlying PE portfolio is determined by the cost of capital according to the CAPM plus this expected abnormal return:⁹

$$E_t [R_u - R_f] = \alpha + \beta_u (E_t [R_m] - R_f), \quad (4)$$

where β_u is the underlying fund beta, $E_t [R_m]$ is the expected return on the market, and R_f is the riskfree rate.¹⁰ We assume that all of these moments are constant for convenience.

The parameters of the model must satisfy two technical conditions. First, $\alpha - \lambda + R_f > 0$ to guarantee that the expectation of the risk-adjusted distribution to investors is positive, i.e., the cash flows that investors receive have positive economic

⁹ Since PE funds invest at privately negotiated prices and may also implement operational changes, the expected return for these investments can deviate from CAPM depending on the level of managerial skill.

¹⁰ Note that the return earned by the underlying portfolio is defined in this context using the quantity of money invested in the PE funds and not the market value of the underlying portfolio. The market value of the portfolio of underlying PE investments would incorporate the effect of any anticipated outperformance, and hence, in an efficient market the expected abnormal returns based on the market value of the underlying PE portfolio would be zero.

value, and consequently, the price of the asset is strictly positive.¹¹ Second, $R_f - \theta(\alpha - \lambda + R_f) > 0$ to guarantee that the transversality condition is satisfied, i.e., the value of the equity stake is finite because the risk-adjusted distributions do not grow faster than the riskfree rate.

We assume that the valuation of each claim to the cash flows of the FoF is consistent with the CAPM. Essentially, the present value of distributions to investors and the present value of the management fees from the perspective of investors are both determined by participants in an efficient market governed by the CAPM. While it is possible to generalize this setting to incorporate additional risk factors, it is still the case that directly holding unlisted private equity partnerships may lead to greater exposure to liquidity risk compared to holding the same private equity partnerships through a traded FoF. Therefore, the following analysis provides an upper bound on the value of investing in unlisted PE funds from the perspective of participants with substantial private equity allocations such as pension funds and university endowments. The present value of the distributions to investors, also known as FoF equity, is:

$$V_{e,t} = E_t \left[\sum_{s=1}^{\infty} \frac{(1 - \theta - \pi)(R_{t+s} - \lambda)NAV_{t+s-1}}{(1 + E_t[R_e])^s} \right] \quad (5)$$

where $E_t[R_e]$ is the discount rate for equity. Since distributions to shareholders are made after payment of base management fees, $E_t[R_e]$ will usually be different from the discount rate for the underlying PE funds.

Proposition 1 below provides an analytic solution for the present value of distributions to investors stated in terms of the discount for the FoF as well as an expression for the endogenously determined value of $E_t[R_e]$.

Proposition 1. *The FoF discount and the associated discount rate for equity are specified by the following two equations:*

$$D_t = 1 - \frac{V_{e,t}}{NAV_t} = 1 - \frac{(1 - \theta - \pi)(\alpha - \lambda + R_f)}{R_f - \theta(\alpha - \lambda + R_f)} \quad (6)$$

¹¹ During our sample period the average base management fee is 1% and the average 20-Year Treasury Constant Maturity Rate is approximately 6%. Unless PE funds are expected to earn large negative

and

$$E_t[R_e] = R_f + \left(\frac{R_f}{\alpha - \lambda + R_f} \right) \beta_u (E_t[R_m] - R_f). \quad (7)$$

Proof: See appendix.

The first expression indicates that the FoF discount is a decreasing function of the expected abnormal return and an increasing function of both the base fee and the incentive fee. The second expression provides the discount rate for FoF equity. This expression implies that the systematic risk for the return net of fees is equal to a scaled version of the systematic risk for the underlying portfolio. Since the base management fee is a fixed proportion paid before the distribution to shareholders, this obligation is similar to a debt obligation and magnifies the risk borne by equity holders. Therefore, the base fee increases the systematic risk faced by investors holding all else constant. Interestingly, Eq. 7 indicates that the proportional reinvestment policy does not change the systematic risk of the investors' claims.

We also determine the present value of the incentive fees, $V_{i,t}$. Since the ratio of the incentive fee to the distribution to investors is $\pi/(1-\theta-\pi)$, Proposition 1 implies that $V_{i,t}$ is given by:

$$\frac{V_{i,t}}{NAV_t} = \frac{\pi(\alpha - \lambda + R_f)}{R_f - \theta(\alpha - \lambda + R_f)}. \quad (8)$$

The discount rate for the incentive fee, R_i , is equal to the discount rate for the distributions to investors. Both investors and fund managers hold claims that are equal to a fixed proportion of the distributions from the underlying portfolio of PE funds net of the base fee.

Although the model utilizes a simplified fee structure, the analytic results we derive provide upper and lower bounds on market's expectation of abnormal returns under the actual fee structures we observe in practice. First, we determine a lower bound. We proceed by addressing the following question. Given the level of FoF discount observe, what is the lowest possible level of market's expectation of abnormal returns?

abnormal returns, the condition $\alpha - \lambda + R_f > 0$ is satisfied.

As we discussed in the context of Figure 1, the difference between the NAV and the total market value of the underlying portfolio held by the FoF is positively related to the expected abnormal return. We observe the NAV and the market value of equity. The only unobservable component of total market value is the value of FoF fees. For any given NAV and market value of equity, a smaller value of FoF fees would imply a smaller expected abnormal return. Therefore, if we find a lower bound for the value of FoF fees, then we also have a lower bound for the expected abnormal return. If we assume that the incentive fee is zero, i.e. $\pi = 0$, then we have a lower bound for FoF fees. In addition, this assumption also implies that the hurdle rate and high watermark condition are irrelevant. Rearranging Equation (6) and setting $\pi = 0$, yields the following lower bound α_l :

$$\alpha_l = \lambda - R_f + R_f \left(\frac{1 - D_t}{1 - \theta D_t} \right). \quad (9)$$

We use the same intuition to find an upper bound for the expected abnormal return as well. If we find an upper bound for the value of FoF fees, then there exists a corresponding upper bound for α . The value of FoF fees without a hurdle rate will be greater than the value with a hurdle rate. Since the hurdle rate is always non-negative, the analytic present value of the incentive fee is an upper bound on the present value of the incentive fee in practice.¹² Therefore, the α in Equation (6) is itself an upper bound for the expected abnormal return because this equation was derived while ignoring the hurdle rate. Specifically, we get the following upper bound α_h by rearranging Equation (6):

$$\alpha_h = \lambda - R_f + R_f \left(\frac{1 - D_t}{1 - \pi - \theta D_t} \right). \quad (10)$$

The average FoF discount twelve months after IPO is approximately 12% and the two standard deviation confidence interval around this point estimate ranges from 5% to

¹² This discussion overlooks the mismatch between the timing of incentive fee payments in the model relative to standard practice whenever the underlying portfolio return is sufficiently low. The value of incentive component of the management fee is understated due to the time value of money because negative incentive payments in the model are delayed in the real world to offset subsequent profits. However, for plausible hurdle rates, disregarding the hurdle rate entirely more than counterbalances this understatement. Using our simulations we verify that Equation (10) does provide an upper bound on the market's expectation of management skill for the average hurdle rate in the sample.

19%. Figure 2 plots the upper and lower bounds of α when the discount equals the point estimate of 12% and for discounts of 5% and 19%. We set the risk-free rate (R_f) equal to 6% because the average 20-Year Treasury Constant Maturity is 5.74% and the average yield for AAA rated corporate bonds is 6.55% during our sample period and we set the base management fee (λ) equal to 1% based on the average base management fee reported in Table 2. To determine the upper bound we also set the incentive fee (π) equal to 10% (the average incentive fee for FoFs with an incentive fee). This value of π overstates the average incentive fee for our sample because the sample includes several FoFs that do not charge any incentive fees. Hence, it provides an upper bound compared to the average incentive fee for the full sample which includes FoFs that do not charge an incentive fee.

Since the bounds are a function of the market's expectation of the retention ratio (θ), Figure 2 presents the bounds for payout ratios ($1-\theta$) ranging from 0.25 to 1. The average payout ratio during the sample period is approximately 0.3, but this average is not necessarily the market's expectation of the ratio in the future. Because many of the funds in our sample are early in their life cycle, they naturally choose to have low payout ratios during this time period.

We plot these upper and lower bounds as a function of the payout ratio for the three different discount (valuation) levels. Figure 2 indicates that the lower bound for α is always greater than -0.25% and the upper bound is always less than 1.75%.¹³ The difference between the upper and lower bounds for the expected abnormal return, given a specific discount level and payout ratio, is less than 1%. The model produces a relatively narrow range for the market's expectation of α compared to the wide range of estimates offered in the literature. This range, however, indicates that the market considers investing as an LP in unlisted PE funds to be a positive NPV project for plausible payout ratio. Hence, reasonable assumptions rule out negative expected abnormal returns.

A.4 Expected Abnormal Returns – Simulation Results

¹³ If we set R_f equal to 4%, the analogous lower bound for α is always greater than 0.2% and the analogous upper bound is always less than 1.5%.

This subsection presents the results of our simulations designed to estimate the market's expectation of the abnormal return for unlisted PE funds. These simulations incorporate the hurdle rate and the high watermark features of the typical FoF fee structure that we observe in practice. This approach also correctly accounts for the fact that incentive fees are non-negative even if the underlying portfolio earns a negative return.

Our simulation methodology requires assumptions regarding several parameter values. As above, we assume that the riskfree rate is equal to 6% based on the average 20-Year Treasury Constant Maturity rate during our sample period. Further, we assume that the market risk premium is 4% and the standard deviation of stock market returns is 15% per year. In addition, we assume that $\beta = 1$ for the underlying portfolio of PE investments and that the fund-specific standard deviation is 15% per year. We choose these parameters to be consistent with the actual values we observe in the data and we note that the results are not particularly sensitive to these parameter values.

We simulate the annual return for the underlying portfolio of unlisted PE funds for each FoF using the single factor model with an adjustment for the level of the expected abnormal return. Each component of this annual portfolio return is drawn independently and identically over time from a normal distribution. We calculate the base management fee and the incentive fee using the fund-specific base management rate, incentive rate, and hurdle rate for each particular FoF. The base fee is a fixed proportion of the underlying portfolio value at the beginning of the period and is collected by the fund manager at the end of each period. The incentive fee is the maximum of zero and the fraction of the underlying portfolio proceeds minus the base management fee that is above a level specified by the hurdle rate and high water mark. The payout ratio, in conjunction with the fund-specific base management rate, determines the distribution to investors. The lower bound of the distribution to investors is zero. Each FoF reinvests the residual after all fees and distributions, i.e. retained earnings, in the underlying portfolio for the next period. The sample path for returns is simulated for 300 years and we repeat this process 5,000 times for each fund, holding the expected abnormal return and payout ratio constant.

Using the simulated distributions, we calculate the present value of all distributions to investors using a constant discount rate. The discount rate for the

distribution to investors depends on the systematic risk of these distributions. Since we derive the relevant theoretical beta in the last section under simplifying assumptions, the theoretical beta does not reflect the true beta for these distributions because the model does not include the hurdle rate and high watermark provisions. Instead, we find the appropriate beta for these distributions using an iterative methodology. We use the betas from the analytic solution in the last subsection as the starting point. In this iterative process, we calculate the return for each period using the present value of subsequent distributions at the beginning of the current period, the present value of subsequent distributions at the beginning of the subsequent period, and the distribution at the end of the period. Then, we regress this return series on the simulated market return series. The coefficient estimate from this regression is the next iterative estimate for beta. We continue this process until the difference between consecutive iterative estimates for beta is less than 0.001, i.e., the sequence converges. Once we have the appropriate beta for the distributions to investors for a particular FoF, we calculate the relevant discount rate and the present value of these distributions for each sample path. The average of these present value calculations is used to compute the simulated FoF discount. We repeat this exercise for the expected abnormal return ranging from -3% to 3% in increments of 1% and for the payout ratio ranging from 0.25 to 1 in increments of 0.05.¹⁴

Table 5 presents the average of simulated discounts across FoFs for expected abnormal returns ranging from -2% to 2% and various levels of the payout ratio. As we would anticipate, the average FoF discount decreases as α increases because investors are willing to pay more if they expect the underlying PE funds to earn higher returns, holding all else constant. For a relatively low expected abnormal return, the discount decreases with the payout ratio. For example, if α is equal to -2%, the average discount is 59% for a payout ratio of 0.25 compared to a discount of 27% when the payout ratio is 1. Similarly, if α is equal to 0%, the average discount for a payout ratio of 0.25 is 33% compared to a discount of 11% when the payout ratio is 1. Intuitively, if abnormal performance is low relative to the fees of a FoF, the market would prefer that the FoF increase its payout ratio because reinvestment destroys value.

¹⁴ Since some FoFs have an incentive fee of 20%, the lower bound for the payout ratio to investors for these funds must be greater than 0.2 (or 20%).

Analogously, the discount increases or the premium decreases with the payout ratio for large expected abnormal returns. For example, if α is equal to 2%, the average premium is 44% (i.e., a discount of -44%) if the payout ratio is 0.25 compared to a premium of only 5% if the payout ratio is 1. This result is also intuitive. The market would prefer that each FoF decrease its payout ratio whenever abnormal performance is high relative to FoF fees because reinvestment in the underlying PE funds is a positive NPV project. Hence, the simulations indicate that low payout ratio magnifies the impact of abnormal performance relative to FoF fees.

We search for the levels of α are consistent with the observed level of the average FoF discount that we observe in Table 4. Each curve in Figure 3 plots the simulated FoF discount for a given expected abnormal return as a function of the payout ratio, i.e. each curve represents an iso- α curve. The horizontal line in Figure 3 reflects the statistical average FoF discount of 12%. Each intersection of an iso- α curve with this horizontal line is a possible combination of the expected abnormal return and the payout ratio that is consistent with market prices.

This figure indicates that there is a relatively narrow range of possible expected abnormal returns that are consistent with the observed FoF discount of 12%. First, we consider the plausibility of substantial negative expected abnormal returns. Figure 3 indicates that if the market expects the underlying PE funds to have an average abnormal return of less than -1% per year, the FoF discount would be at least 19%, or approximately two standard deviations greater than our point estimate of 12%. Hence, estimates of the expected abnormal return between -6% and -3% in Phalippou and Gottschalg (2009) are significantly smaller than the market's ex-ante expectation. Indeed, the horizontal line for a discount of 12% is below the iso- α curve for $\alpha = 0$ whenever the payout ratio is less than 0.9, and hence, the market expects positive abnormal returns from the underlying portfolio of PE funds for plausible payout ratios.

Figure 3 also implies that if α is greater than or equal to 2%, FoFs would trade at a *premium*, rather than at a discount, for any expectation of the payout ratio. Intuitively, if α equals 2%, then the abnormal returns PE funds earn are expected to more than compensate for FoF fees. In this case, the smallest possible *premium* is 4.8% (discount of -4.8%), i.e., more than four standard deviations away from the average *discount* of 12%.

Therefore, many of the large estimates of α based on ex-post performance in the literature (e.g. by Ljungqvist and Richardson (2003) and Cochrane (2005)) far exceed the level anticipated by the market during our sample period.

While Figure 3 does not extend the curves to include payout ratios lower than 0.25 due to technical restrictions imposed by the large incentive fees charged by some FoFs in our sample, analyzing such a payout ratio for funds with lower incentive fees would not change our findings. Note that iso- α curves outside the range of 0% to 1% diverge from the horizontal line as the payout ratio decreases to 0.25. This divergence pattern would continue for lower payout ratios because the impact of abnormal performance relative to fees is magnified by reinvestment. Hence, our results indicate that the market expects α to be between 0 and 1% regardless of the market's expectation of the payout ratio. If we consider a plausible payout ratio range, such as 0.3 to 0.7, a more detailed version of Figure 3 would indicate that the expected abnormal return is bounded between 0.25% and 0.75%, or approximately 0.5%.¹⁵

B. An Analysis of Listed Private Equity Funds (LPEs)

This section examines whether LPEs add value. LPEs and unlisted PE funds have similar goals since they both conduct private equity transactions. LPE managers are also compensated through base management fees and, in some cases, incentive fees. However, there exist several differences in the organizational structure that could lead to performance differences between LPEs and PEs. In particular, a LPE is a closed-end fund with an indefinite life. In fact, the typical discount in the case of closed-end fund suggests that the structure of LPEs would result in agency costs such as unduly high fees or less than optimal effort on the part of fund managers. In contrast, since PE funds have a finite life, they are committed to returning to their investors for funds they float in the future and this reputational concern provides an added incentive to perform well. Therefore, the structure of unlisted PE funds may better align incentives of GPs with LPs. Since LPEs are more likely to suffer from higher agency costs compared to their unlisted counterparts, we would expect them to underperform unlisted PE funds. Thus, the

¹⁵ We also examined the simulated discount for a range of alternative parameter values for market volatility and the risk premium. These variations do not dramatically change the pattern of our results.

expected performance of LPEs provides a lower bound on the expected performance of PE funds.

To investigate whether the market expects LPEs to earn abnormal returns, we examine the behavior of the average discount for these LPEs. As we discussed earlier, the discount based on the IPO price is likely to be a biased indicator of market expectations. We use the beginning of the first month when data are available on Datastram as the IPO date. Table 6 presents the average discount during the first 12 months in event time after the IPO. LPEs trade at a 2% premium to NAV at the end of the first month. However, the average premium declines to about 1.6% after six months. By the end of the first year after IPO, the LPEs trade at an average discount of 3.5%. The average discount is not significantly different from zero at any point in event time. These results indicate that although the IPO premium eventually disappears, the average LPE price is near its NAV. Therefore, the market expects the average abnormal return for LPEs to be indistinguishable from zero.

IV. Risk Characteristics of Private Equity

This section analyzes the risk characteristics of private equity based on the performance of FoFs and LPEs determined by market prices. The existing literature provides a wide range of estimates for systematic risk of PE investments. For example, the estimates of beta range from about 0.5 in Hwang et al. (2005) to 4.66 in Peng (2001). This wide range illustrates the difficulty in estimating betas for these investments. To a large extent, this difficulty arises from the fact that existing estimates for systematic risk utilize realized cash flows rather than market prices. In turn, the imprecise estimation of the risk of unlisted PE funds precludes the reliable evaluation of the performance of PE funds. For example, Phalippou and Gottschalg (2009) show that measured performance is quite sensitive to reasonable changes in assumptions about beta. In this analysis, the abnormal returns for PE funds changes from -3% per year when they assume beta is equal to one, to -6% per year when they assume an “industry/size-matched cost-of-capital.” Since we have market prices, we are able to reliably estimate multiple dimensions of exposure to systematic risk using traditional time series regressions and value-weighted indices of FoF and LPE performance. We measure systematic risk using both single factor and

multifactor models. In addition, we also analyze the sensitivity of FoF and LPE performances to macroeconomic risks. Understanding the systematic risk characteristics of private equity is critically important for the asset allocation decisions of large institutional investors, including pension funds and endowments.

A. Market Risk and Fama-French Factor Risks

We examine systematic risk in the context of the CAPM and the Fama-French (1993) and Carhart (1997) four-factor model. Since both the FoF and LPE samples contain international PE investments, we use the MSCI world index as the appropriate proxy for the market factor. We also examine the systematic risk with respect to the S&P 500 index to examine the sensitivity of our indices to US markets. We fit the following time series regressions to estimate systematic risk:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,m}(R_{m,t} - R_{f,t}) + \beta_{i,smb}SMB_t + \beta_{i,hml}HML_t + \beta_{i,mom}MOM_t + \varepsilon_{i,t}, \quad (11)$$

where $R_{i,t}$ is the fund index return and $R_{f,t}$ is the risk-free rate. We use one-month U.S. Treasury Bill rate as the risk-free rate. In some specifications, we also include the size, book-to-market and momentum factors, labeled SMB , HML , and MOM , respectively. We use factor returns from Kenneth French's website. We note that these three factors are constructed only using stocks listed in the US. Nevertheless, since the US equity market is the largest part of any world portfolio, the sensitivity of the fund indices to the US factors will shed important insights into the nature of PE risk.

Table 7 presents the regression estimates and corresponding Newey-West standard errors with six lags. The systematic risk estimates for FoFs and LPEs based on the MSCI World index are 0.82 and 1.08, and based on the S&P 500 index are 0.70 and 0.98, respectively. Since the underlying funds have international exposures, both FoF and LPEs have higher sensitivity to the MSCI World index and the MSCI index has greater explanatory power than the S&P 500 index. We note that a small difference between the expected abnormal return for unlisted PE funds and the performance of LPEs is unlikely to generate significant differences in the systematic risk exposures for these two groups because both sets of PE vehicles seek similar investment opportunities.

Table 8 presents the regression estimates for the four-factor model. With the MSCI index as the market factor, the betas with respect to the SMB factor are 0.49 and 0.47 for the FoF and LPE indices respectively, and both these estimates are significantly greater than zero. Therefore, the performance of both FoFs and LPEs behaves more like small stocks than large stocks. This finding is intuitive since most PE funds invest in firms that are smaller than the average listed firm. The factor loading with respect to HML is 0.35 for FoFs and 0.27 for LPEs. Although these point estimates are not significantly different from each other, HML beta is not significantly different from zero for FoFs but it is marginally significant for LPEs. There is suggestive evidence that both FoFs and LPEs are slightly more sensitive to value stocks than growth stocks. One possible explanation for this finding is that LPEs have significant investments in buyouts and targets of buyouts are perhaps more likely to be value firms than growth firms. In unreported results, we examined the betas from a four-factor model separately for funds with buyout focus and venture capital focus. We find that the HML coefficient estimate for buyout funds is significantly positive but the HML coefficient estimate for VC funds is not significantly different from zero. Apparently, even the average VC fund is not sensitive to the growth factor. Overall, we find that the risk profiles of FoFs and LPEs are quite similar. The magnitudes for each systematic risk factor are not statistically different for these two categories of PE investments in spite of any variation in the geographic composition or average stage focus across the two groups.

Our analytic results in Proposition 1 show that FoF equity is viewed as a levered claim on the underlying portfolio of funds because the base management fee is equivalent to debt contract. Consequently, the market beta of FoF equity provides an upper bound for the market beta of the underlying portfolio of PE funds whenever the expected abnormal return is less than the average base management fee. Conceptually, we could “unlever” these FoF factor loadings based on our analysis in Section III. The practical implication of adjusting for the implicit leverage effect due to the base management fee, however, may not large. First, since the estimate of the expected abnormal return, α , is only slightly less than the average base management fee, λ , Proposition 1 indicates that the systematic risk of the FoF equity index based on market prices should be similar to the systematic risk of the corresponding portfolio of underlying PE funds. Second,

Kaplan and Stein (1990) find that even when the average firm increases its debt ratio from about 25% to about 81%, the change in the estimate of systematic risk is “surprisingly small.” Therefore, the true systematic risk of the underlying PE funds may be closer to the systematic risk of the FoF equity index than what is suggested by the leverage effect due to the base management fee.

In earlier work, Kaplan and Schoar (2005) acknowledge the difficulty in estimating beta because of “the lack of true market values for fund investments until the investments are exited” and assume that beta is equal to equals one. Phalippou and Gottschalg (2009), however, conjecture that “the assumption of a beta as 1 is likely to overstate relative performance” and they use an industry/size-matched cost-of-capital benchmark. Our findings indicate that the estimates of systematic risk for FoFs and LPEs are not significantly different from one. Hence, the assumption by Kaplan and Schoar (2005) appears to be quite reasonable.

B. Ex-post Abnormal Performance

The estimates of the constant term for these regressions can be interpreted as the average abnormal return surprise for PE investments during the sample period compared to the ex ante expected abnormal return. These coefficient estimates for FoFs and LPEs are not significantly different from zero in either the CAPM or four-factor benchmark. The findings indicate that these vehicles performed as expected on average, conditional on the realizations of the risk factors. During this sample period, the market was not surprised ex-post by the performance of this asset class. Thus, the discount one year after the IPO does not appear to be biased by any systematic error in the expectations of market participants. We would like to reiterate that these estimated coefficients should not be used as a measure of whether or not PE investments themselves earn abnormal returns. In an efficient market, the participants would anticipate any potential ability of PE funds to earn abnormal returns above their cost of capital, and this ability will be reflected in market prices. Therefore, the returns based on market prices earned by PE funds would only compensate investors for systematic risk.

C. PE Performance and the Macroeconomic Environment

This section examines the relation between fund performance and macroeconomic activity. We use GDP growth and the credit spread to capture macroeconomic activity.

GDP growth would have a positive impact on fund performance after controlling for contemporaneous market returns if macroeconomic risks have a greater effect on early stage firms than on more mature firms that form a large part of the market index. Substantial GDP growth could potentially allow PE funds to profitably exit some underlying investments via IPO and lead to better performance for PE funds. However, economic growth could also result in greater competition between PE funds. For instance, Gompers and Lerner (2000) find that valuation of investment opportunities increases during periods of expansion, and hence, the increased competition that comes with economic growth may have a negative impact on fund performance. Kaplan and Schoar (2005) report that funds raised during periods of increased competition tend to underperform funds raised during other periods, and find support for hypothesis that performance suffers whenever money chases deals. The net effect of the positive impact of economic growth and the negative impact of increased competition on the covariance between economic growth and performance is determined by the relative impact of these two offsetting forces.

The credit spread is another measure of macroeconomic conditions. As Fama (1990) argues, a widening spread generally signals deteriorating business conditions, which would make it more difficult for PE funds to exit underlying investments via IPO. Moreover, a high credit spread implies a high cost of raising new risky debt, and hence, it would likely have an adverse impact on the performance of PE funds attempting to finance new transactions involving substantial leverage. Therefore, we expect a negative relation between the performance of PE funds and the credit spread.

We obtain data for GDP growth and the credit spread from the Federal Reserve Economic Data (FRED) website. Table 9 reports the estimates for the following equation:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,m} (R_{m,t} - R_{f,t}) + \delta_{i,GDP} \Delta GDP_t + \delta_{i,credit} Credit Spread_t + \varepsilon_{i,t} \quad (12)$$

where $R_{m,t}$ is the return for the MSCI world index, ΔGDP is percentage real GDP growth, and credit spread is the difference between the yield on BAA and AAA rated corporate bonds. For ease of interpretation, we standardize both ΔGDP and $Credit Spread$ by demeaning both variables and dividing by their respective standard deviations. Therefore,

the slope coefficient for each variable may be interpreted as the change in performance associated with an increase of one standard deviation in the variable of interest.¹⁶

We find that GDP growth is positively related to returns for both FoFs and LPEs, although the estimate is not statistically significant for the LPE performance index. A one standard deviation change in GDP growth is associated with a 2.3% increase in the excess return of the FoF index. Our results indicate that the increase in the value of the existing investments of unlisted PE funds more than offset the negative impact of potentially increased competition on returns from future investments. We also find that the credit spread is negatively related to FoF and LPE returns, after controlling for market returns as well as GDP growth. Essentially, restrictive credit conditions reduce the performance of private equity. This result is also consistent with the possibility that the performance of private equity depends significantly on credit risk.

V. PEPI and Fund Indices

Practitioners frequently use the Private Equity Performance Index (PEPI) for venture capital funds and buyout funds to measure the performance of PE industry. Thomson Reuters computes PEPI based on the self-reported cash flows and net asset value data from PE funds in the Thomson database. Setting aside any directional biases, self-reported book values may not reflect market valuation changes in a timely manner. For instance, book values reported by funds may only partially adjust to changes in their true value. Under this partial adjustment hypothesis, the PEPI does not reflect the actual changes in the value of PE investments in a timely manner since smoothed book values are used to compute the PEPI. In contrast to the PEPI, we compute the index for FoFs using market prices. Since market prices should reflect fundamental values in a timely manner, under the partial adjustment hypothesis, these indices should be able to predict changes in PEPI. To examine whether the FoF index can predict future changes in book values embedded in the PEPI, we examine the relation between the PEPI return and

¹⁶ We find similar results when we use the S&P 500 index as the market portfolio. In addition, IPO volume is not significantly related to the performance of the FoF index or the LPE index after controlling for GDP growth and the credit spread and the inclusion of IPO volume does not qualitatively change the estimates for the other regressors.

contemporaneous and lagged values of MSCI World index return as well as the FoF index return.

Table 10 reports the regression results for a variety of specifications. Since PEPI is published quarterly, we also use quarterly versions of each explanatory variable. The slope coefficient from the univariate regression of PEPI on the MSCI World index is statistically significant. However, the estimated coefficient of 0.45 for the systematic risk is considerably smaller than the analogous estimates of systematic risk of 0.82 and 1.08 for FoFs and LPEs, respectively. Partial adjustment of book values used in the computation of PEPI will result in a smaller slope coefficient because the slope coefficient estimate for contemporaneous returns will understate the true sensitivity of PE funds to the stock market.¹⁷

To further test the partial adjustment hypothesis, we incorporate the contemporaneous and lagged MSCI World returns in the regression specification as well as the contemporaneous and lagged return for the FoF index in a variety of different specifications. Since FoF returns reflect changes in the value that are unique to the PE sector, lagged FoF returns should be able to incrementally predict PEPI returns under the delayed adjustment hypothesis. The results in column 6 of Table 10 indicate that the slope coefficients on lagged MSCI World and FoF index returns are 0.07 and 0.10, respectively, and both statistically significant. Therefore, both lagged MSCI World index and the lagged FoF index are useful in predicting PEPI returns. In fact, the predictive power of lagged FoF index return is at least as strong as that of lagged MSCI World index returns even though the FoF index return is much noisier since it is constructed with only 24 FoFs. Since the results remain largely unchanged even when the lagged performance of the PEPI index is included, these results are not largely due to the autocorrelation of the dependent variable. The findings support the partial adjustment hypothesis and imply that the FoF index provides crucial information about the performance of the unlisted PE industry.¹⁸

¹⁷ Since we use the MSCI World index as the measure of public equity performance, it is possible that the relatively low systematic risk estimate for PEPI due to the fact that it is computed using data from PE funds that largely invest in US companies compared to the market-based measures which include more substantial international investments.

VI. Conclusion

We estimate the risk and expected returns for PE investments using the market prices of FoFs that invest in unlisted private equity funds. We also examine the risk and expected returns of LPEs. Our results indicate that the market expects unlisted private equity funds to earn abnormal returns of approximately 0.5%. We also find that the market expects LPEs to earn an abnormal return that is statistically indistinguishable from zero after fees. Earlier studies find ex-post estimates of abnormal returns for PE funds that range from -6% to 32%. Our results indicate that the market does not expect PE funds to earn such extreme abnormal returns in the long run. In fact, we show that the market does not expect negative abnormal returns or positive abnormal returns in excess of 2% in the long run.

Both listed and unlisted private equity funds have betas close to one and they have positive betas on Fama-French SMB factor. Private equity fund returns exhibit positive correlation with GDP growth and negative correlation with credit spread. Finally, we find that market returns of listed fund of funds and listed private equity predict future changes in self-reported book values of unlisted private equity funds.

¹⁸ In unreported regressions we find similar results using LPE index in the place of FoF index.

A. Appendix

We assume that the CAPM determines the market value of each claim. The value of the base management fee, $V_{b,t}$, is the starting point of our analysis. Each period's base management fee is proportional to a stochastic process because a portion of the proceeds is reinvested. Hence, the appropriate discount rate, $E_t[R_b]$, depends on the retention ratio and the systematic risk of the underlying portfolio:

$$V_{b,t} = E_t \left[\sum_{s=1}^{\infty} \frac{\lambda NAV_{t+s-1}}{(1 + E_t[R_b])^s} \right]. \quad (\text{A1})$$

The present value of the fixed fees is proportional to the amount invested in the underlying portfolio, i.e. $V_{b,t} = \delta NAV_t$. We find the discount rate, $E_t[R_b]$, as well as the proportionality constant, δ , starting from the following equation:

$$\delta NAV_t = E_t \left[\frac{\lambda NAV_t + \delta NAV_{t+1}}{1 + E_t[R_b]} \right]. \quad (\text{A2})$$

We use the evolution of net asset value and rearrange this equation:

$$\delta = E_t \left[\frac{\lambda + \delta(1 + \theta(R_{u,t+1} - \lambda))}{1 + E_t[R_b]} \right]. \quad (\text{A3})$$

Substituting the expected return for the underlying portfolio and rearranging again yields an expression for $E_t[R_b]$ in terms of:

$$E_t[R_b] = \frac{\lambda}{\delta} + \theta(\alpha - \lambda + R_f + \beta_u(E_t[R_m] - R_f)). \quad (\text{A4})$$

Similarly, we write the actual return, $R_{b,t+1}$:

$$R_{b,t+1} = \frac{\lambda}{\delta} + \theta(\alpha - \lambda + R_f + \beta_u(R_{m,t+1} - R_f) + \varepsilon_{u,t+1}). \quad (\text{A5})$$

The systematic risk of the base fee, β_b , is equal to $\theta\beta_u$. Hence, the CAPM indicates

$$E_t[R_b] = \frac{\lambda}{\delta} + \theta(\alpha - \lambda + R_f + \beta_u(E_t[R_m] - R_f)) = R_f + \theta\beta_u(E_t[R_m] - R_f). \quad (\text{A6})$$

The expected return is the riskfree rate plus an adjustment for the systematic riskiness of the fees based on reinvestment. In the absence of any reinvestment, the discount rate is R_f .

We rearrange to solve for δ as a function of the parameters:

$$\delta = \frac{\lambda}{R_f - \theta(\alpha - \lambda + R_f)}. \quad (\text{A7})$$

Therefore, the present value of the base management fee relative to net asset value and the associated discount rate are given by the following two equations:

$$\frac{V_{b,t}}{NAV_t} = \frac{\lambda}{R_f - \theta(\alpha - \lambda + R_f)} \quad (\text{A8})$$

and

$$E_t[R_b] = R_f + \theta\beta_u (E_t[R_m] - R_f). \quad (\text{A9})$$

In the absence of any market inefficiencies, the price of the investors' claim P_t is equal to the present value of the distributions to investors, $V_{e,t}$:

$$V_{e,t} = E_t \left[\sum_{s=1}^{\infty} \frac{(1-\theta-\pi)(R_{t+s} - \lambda)NAV_{t+s-1}}{(1 + E_t[R_e])^s} \right]. \quad (\text{A10})$$

Analogously, the present value of the distributions to investors is proportional to the amount invested in the underlying portfolio, i.e. $V_{e,t} = \eta NAV_t$. We find the discount rate, $E_t[R_e]$, as well as the proportionality constant, η , starting from the following equation:

$$\eta NAV_t = E_t \left[\frac{\lambda NAV_t + \delta NAV_{t+1}}{1 + E_t[R_e]} \right]. \quad (\text{A11})$$

Again, we use the evolution equation for net asset value and rearrange:

$$\eta = E_t \left[\frac{(1-\theta-\pi)(R_{u,t+1} - \lambda) + \eta(1 + \theta(R_{u,t+1} - \lambda))}{1 + E_t[R_e]} \right]. \quad (\text{A12})$$

Substituting the expected return for the underlying portfolio and rearranging again yields an expression for $E_t[R_e]$ in terms of η .

$$E_t[R_e] = \left(\frac{1-\theta-\pi}{\eta} + \theta \right) (\alpha - \lambda + R_f + \beta_u (E_t[R_m] - R_f)) \quad (\text{A13})$$

Similarly, we write the actual return, $R_{e,t+1}$:

$$R_{e,t+1} = \left(\frac{1-\theta-\pi}{\eta} + \theta \right) (\alpha - \lambda + R_f + \beta_u (R_{m,t+1} - R_f) + \varepsilon_{u,t+1}). \quad (\text{A14})$$

The systematic risk of the base fee, β_b , is equal to $((1-\theta-\pi/\eta) + \theta)\beta_u$. Hence, the CAPM indicates

$$\left(\frac{1-\theta-\pi}{\eta} + \theta \right) (\alpha - \lambda + R_f + \beta_u (E_t[R_m] - R_f)) = R_f + \left(\frac{1-\theta-\pi}{\eta} + \theta \right) \beta_u (E_t[R_m] - R_f). \quad (\text{A15})$$

We rearrange to solve for η as a function of the parameters:

$$\eta = \frac{(1-\theta-\pi)(\alpha - \lambda + R_f)}{R_f - \theta(\alpha - \lambda + R_f)}. \quad (\text{A16})$$

Therefore, the present value of the distributions to investors relative to net asset value and the associated discount rate are given by the following two equations:

$$\frac{V_{e,t}}{NAV_t} = 1 - \frac{(1-\theta-\pi)(\alpha - \lambda + R_f)}{R_f - \theta(\alpha - \lambda + R_f)} \quad (\text{A17}), \text{ and}$$

$$E_t[R_e] = R_f + \left(\frac{R_f}{\alpha - \lambda + R_f} \right) \beta_u (E_t[R_m] - R_f). \quad (\text{A18})$$

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Table 1. Sample Statistics – Funds of Funds

Notes: This table presents sample statistics for our sample of twenty-four private equity funds of funds (FoFs). The characteristics of each FoF are from the first available annual report or Datastream one year after the initial public offering (IPO). The sample period of IPOs for FoFs is from 1994 to 2008.

Panel A: Exchange							
	N	%	% USD	Active	%	Dead	%
US	0	0.0%	0.0%	0	0.0%	0	0.0%
Europe	13	54.2%	62.9%	13	54.2%	0	0.0%
London	9	37.5%	35.8%	9	37.5%	0	0.0%
Australia	2	8.3%	1.3%	1	4.2%	1	4.2%
Total	24	100%	100%	23	95.8%	1	4.2%
Panel B: Size (Average size over the period 1994 to 2008)							
	N	%	% USD	Active	%	Dead	%
<20m	2	8.3%	5.8%	2	8.3%	0	0.0%
20m - 100m	5	20.8%	4.2%	4	16.7%	1	4.2%
100m - 500m	11	45.8%	43.5%	11	45.8%	0	0.0%
500m - 1000m	4	16.7%	23.2%	4	16.7%	0	0.0%
1000m – 2500m	2	8.3%	23.3%	2	8.3%	0	0.0%
>2500m	0	0.0%	0.0%	0	0.0%	0	0.0%
Total	24	100%	100%	23	95.8%	1	4.2%
Panel C: Stage Focus							
	Total	%	% USD	Active	%	Dead	%
Early-Stage	3	12.5%	2.9%	2	8.3%	1	4.2%
Expansion	3	12.5%	7.2%	3	12.5%	0	0.0%
Balanced	0	0.0%	0.0%	0	0.0%	0	0.0%
Buyout	15	62.5%	76.6%	15	62.5%	0	4.2%
Other PE	3	12.5%	13.4%	3	12.5%	0	0.0%
Total	24	100%	100%	23	95.8%	1	4.2%
Panel D: Geographical Focus							
	N	%	% USD	Active	%	Dead	%
North America	10	41.7%	58.8%	10	41.7%	0	0.0%
Europe	9	37.5%	28.9%	9	37.5%	0	0.0%
Rest of the World	5	20.8%	12.3%	4	16.7%	1	4.2%
Total	24	100.0%	100.0%	23	95.8%	1	4.2%

Table 2: Descriptive Statistics – Funds of Funds

Notes: This table reports descriptive statistics for 24 funds of funds (FoFs) in our sample. The components of the fee structure for each fund are from the prospectus for the IPO of the fund and confirmed by the first available annual report. The other fund characteristics are from the first available annual report or Datastream one year after the IPO. The first column for every variable shows the median while the second shows the average. Market capitalization is the number of shares outstanding multiplied by price per share in millions of USD. The base management fee is specified as a fixed percentage of the assets managed by the FoF. The incentive fee is specified as a percentage of profits or excess profits above the hurdle rate that FoFs earn. The hurdle rate is the minimum return that must be earned before the proportional incentive fee begins to accrue. Institutional ownership is the percentage of outstanding shares for each FoF held by institutional investors. Underlying PE Funds is the number of distinct unlisted PE funds held by the FoF.

	Median	Average
Market Capitalization	187.5	385.6
Base Management Fee	1.00%	1.00%
Incentive Fee	8.75%	6.88%
Hurdle rate	7.75%	6.41%
Underlying PE Funds	19	55

Table 3. Sample Statistics – Listed Private Equity Funds

Notes: This table presents the sample statistics for our sample of 155 listed private equity funds (LPEs). The characteristics of each LPE are from the first available annual report or Datastream one year after the IPO. The sample period of IPOs for LPEs is from 1994 to 2008.

Panel A: Exchange							
	N	%	% USD	Active	%	Dead	%
US	9	5.8%	26.0%	9	5.8%	0	0.0%
Europe	22	14.2%	11.3%	12	7.7%	10	6.5%
London	109	70.3%	59.1%	96	61.9%	13	8.4%
Rest of the World	15	9.7%	3.6%	9	5.8%	6	3.9%
Total	155	100.0%	100.0%	126	81.3%	29	18.7%
Panel B: Size							
	N	%	% USD	Active	%	Dead	%
<20m	42	27.1%	3.4%	32	20.7%	10	6.5%
20m - 100m	85	54.8%	25.6%	72	46.5%	13	8.4%
100m - 500m	19	12.3%	32.2%	15	9.7%	4	2.6%
500m - 1000m	6	3.9%	11.5%	4	2.6%	2	1.3%
1000m – 2500	1	0.7%	4.5%	1	0.7%	0	0.0%
>2500m	2	1.3%	22.8%	2	1.3%	0	0.0%
Total	155	100.0%	100.0%	126	81.3%	29	18.7%
Panel C: Stage Focus							
	N	%	% USD	Active	%	Dead	%
Early-Stage	31	20.0%	19.6%	23	14.8%	8	5.2%
Expansion	38	24.5%	10.1%	33	21.3%	5	3.2%
Balanced	49	31.6%	24.2%	41	26.5%	8	5.2%
Buyout	16	10.3%	16.5%	11	7.1%	5	3.2%
Other PE	21	13.6%	29.6%	18	11.6%	3	1.9%
Total	155	100.0%	100.0%	126	81.3%	29	18.7%
Panel D: Geographical Focus							
	N	%	% USD	Active	%	Dead	%
North America	19	12.3%	36.5%	18	11.6%	1	0.7%
Europe	99	63.9%	39.6%	81	52.3%	18	11.6%
Rest of the World	28	18.1%	13.3%	18	11.6%	10	6.5%
NA	9	5.8%	10.6%	9	5.85	0	0.0%
Total	155	100.0%	100.0%	126	81.3%	29	18.7%

Table 4. FoF Discount in Event Time

Notes: This table reports the average fund discounts in event time for exchange-traded funds of funds (FoFs) that invest in unlisted private equity funds. We calculate the discount for each fund as unity minus the price of the fund divided by the NAV of the fund. Both price and NAV information is from Datastream and augmented by Bloomberg. Event month 1 is the first month after the IPO; event month 2 is the second month, and so on.

Event Month	Average Discount	Standard Error	<i>t</i>-statistic
1	1.07%	2.02%	0.53
2	2.98%	2.14%	1.40
3	5.70%	2.04%	2.79
4	6.62%	2.16%	3.06
5	6.89%	2.45%	2.81
6	7.32%	2.48%	2.95
7	8.60%	2.71%	3.17
8	9.48%	2.61%	3.63
9	10.76%	2.77%	3.89
10	11.61%	2.90%	4.00
11	12.01%	3.51%	3.42
12	11.76%	3.61%	3.26

Table 5. Simulated FoF Discount

Notes: This table reports the average (across funds) of the simulated FoF discount for each particular combination of the payout ratio and the expected abnormal return. We calculate the discount for each fund as unity minus the average simulated present value of all distributions to investors divided by the initial NAV of the fund. We compute the relevant present value of FoF equity separately for each FoF using the fund-specific fee structure. These calculations are based on 5,000 fund-specific performance simulations. The simulation methodology is discussed in greater detail in the text. The expected abnormal return (α) is the market's expectation of the abnormal return for the underlying portfolio of PE investments. The payout ratio is the fraction of a fund's earnings that is paid out to equity holders.

Payout Ratio (1-θ)	Expected Abnormal Return (α)				
	-2%	-1%	0	1%	2%
0.25	59.39%	48.79%	33.35%	7.11%	-43.77%
0.50	41.11%	31.85%	20.21%	5.90%	-12.50%
0.75	31.69%	23.48%	14.68%	4.27%	-7.29%
1	25.62%	18.69%	11.46%	3.61%	-4.83%

Table 6: LPE Discount in Event Time

Notes: This table reports the average discount in event time for listed private equity funds (LPE). We calculate the discount for each fund as unity minus the price of the fund divided by the NAV of the fund. Both price and NAV information is from Datastream and augmented by Bloomberg. Event month 1 is the first month after the IPO; event month 2 is the second month, and so on.

Event Month	Average Discount	Standard Error	<i>t</i>-statistic
1	-2.16%	1.80%	-1.20
2	-2.21%	1.96%	-1.13
3	-1.31%	2.14%	-0.61
4	-0.81%	2.12%	-0.38
5	0.46%	2.41%	0.19
6	1.57%	2.25%	0.70
7	0.68%	2.54%	0.27
8	1.13%	2.43%	0.46
9	4.45%	2.40%	1.85
10	3.63%	2.34%	1.55
11	2.68%	2.36%	1.14
12	3.50%	2.38%	1.47

Table 7. The Performance of Private Equity (CAPM)

Notes: This table reports market model regression estimates for value weighted FoF and LPE indices. We use MSCI World or S&P 500 indices as market proxies. One-month Treasury bill rate is the riskfree rate. The dependent variables are excess returns on the indices reported in the column headings. The standard errors are based on the Newey-West estimator with 6 lags (in parentheses). The sample period is from January 1994 to December 2008.

	FoF	FoF	LPE	LPE
Intercept	-0.0027 (0.0057)	-0.0033 (0.0064)	-0.0010 (0.0034)	-0.0019 (0.0042)
MSCI World	0.8227*** (0.2063)		1.0793*** (0.1218)	
S&P 500		0.7083*** (0.2227)		0.9830*** (0.1529)
R^2	0.2946	0.2278	0.5731	0.4958
Observations	180	180	180	180

- * - Significant at the 10% level.
- ** - Significant at the 5% level.
- *** - Significant at the 1% level.

Table 8. The Performance of Private Equity (4-Factor Model)

Notes: This table reports the four-factor model estimates for value-weighted FoF and LPE indices. We use MSCI World or S&P 500 indices as market proxies. One-month treasury rate is the riskfree rate. SMB and HML Fama-French size and book-to-market factors, respectively, and UMD is momentum factor. The dependent variables are excess returns on the indices reported in the column headings. The standard errors are based on the Newey-West estimator with 6 lags (in parentheses). The sample period is from January 1994 to December 2008.

	FoF	FoF	LPE	LPE
Intercept	-0.0049 (0.0067)	-0.0062 (0.0076)	-0.0019 (0.0038)	-0.0038 (0.0046)
MSCI World	0.8758*** (0.2410)		1.0836*** (0.1284)	
S&P 500		0.8137*** (0.2636)		1.0446*** (0.1614)
SMB	0.4873*** (0.1437)	0.5813*** (0.1612)	0.4693*** (0.0837)	0.5908*** (0.0972)
HML	0.3455 (0.2201)	0.3789 (0.2461)	0.2745* (0.1574)	0.3365* (0.1748)
MOM	0.0222 (0.1054)	0.0457 (0.1170)	-0.0847* (0.0501)	-0.0452 (0.0576)
R^2	0.3636	0.3224	0.6443	0.6032
Observations	180	180	180	180

* - Significant at the 10% level.
 ** - Significant at the 5% level.
 *** - Significant at the 1% level.

Table 9. The Impact of the Macroeconomic Environment on the Performance of Private Equity

Notes: This table reports the estimates of a regression of excess returns on value-weighted FoF and LPE indices on MSCI world index, GDP growth and credit spread. One month Treasury bill rate is the riskfree rate. Both GDP growth and the credit spread are de-meanned and scaled by their standard deviations. The dependent variables are excess returns on the indices reported in the column headings. The standard errors are based on the Newey-West estimator with 6 lags (in parentheses). The sample period is from January 1994 to December 2008.

Dependent Variable: LPE Index Excess Return

	FoF	FoF	FoF	LPE	LPE	LPE
Intercept	-0.0024 (0.0043)	-0.0023 (0.0047)	-0.0023 (0.0042)	-0.0008 (0.0027)	-0.0007 (0.0028)	-0.0007 (0.0026)
MSCI World	0.6783*** (0.1155)	0.6318*** (0.1127)	0.6058*** (0.0974)	1.0058*** (0.0837)	0.9482*** (0.0880)	0.9420*** (0.0858)
GDP growth	0.0232** (0.0085)		0.0134*** (0.0050)	0.0118 (0.0072)		0.0032 (0.0040)
Credit spread		-0.0255*** (0.0068)	-0.0178*** (0.0065)		-0.0175*** (0.0049)	-0.0157*** (0.0049)
R^2	0.4180	0.4380	0.4661	0.6092	0.6495	0.6514
Observations	180	180	180	180	180	180

* - Significant at the 10% level.
 ** - Significant at the 5% level.
 *** - Significant at the 1% level.

Table 10. Lead-Lag Relation for the Private Equity Performance Index (PEPI) with the FoF and MSCI World Indices

Notes: This table examines the lead-lag relation between the performance for the PEPI in the United States and the returns for the FoF and MSCI World indices. The dependent variable is the quarterly return on PEPI for the United States, reported by Thomson Reuters and the National Venture Capital Association (NVCA) from Q1 of 1994 until Q4 of 2008. MSCI World is the return to the MSCI World index. The FoFs is the value-weight return on the index of listed funds of funds that invest in unlisted private equity funds. The standard errors are based on the Newey-West estimator with 6 lags (in parentheses).

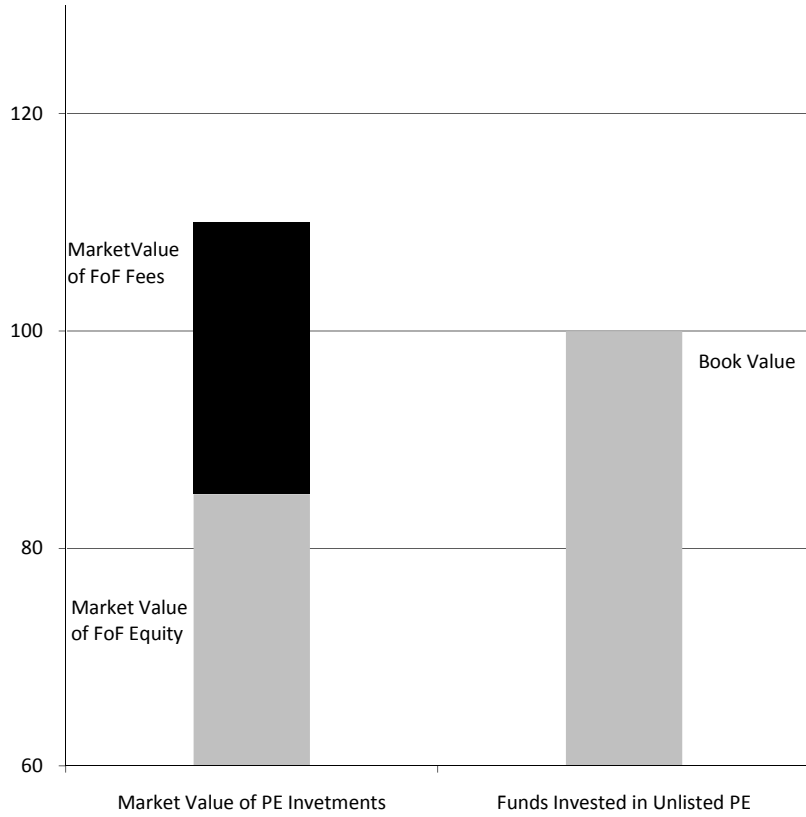
Dependent Variable: Private Equity Performance Index (PEPI) Return

	1	2	3	4	5	6	7
Intercept	0.0121** (0.0059)	0.0162** (0.0067)	0.0128** (0.0050)	0.0141** (0.0066)	0.0096** (0.0046)	0.0083** (0.0038)	0.0055 (0.0038)
MSCI World	0.4532*** (0.0703)		0.1345*** (0.0246)		0.3438*** (0.0398)	0.3628*** (0.0391)	0.3574*** (0.0420)
MSCI World (Lag)						0.1049* (0.0597)	0.0471 (0.0590)
FoFs		0.2508*** (0.0324)	0.3061*** (0.0420)	0.2294*** (0.0288)	0.0910*** (0.0211)	0.0691*** (0.0256)	0.0609** (0.0285)
FoFs (Lag)				0.0958** (0.0389)	0.1309*** (0.0326)	0.0976*** (0.0365)	0.0770** (0.0356)
PEPI Return (Lag)							0.2047* (0.1220)
R^2	0.5665	0.4999	0.6527	0.5449	0.7314	0.7473	0.7605
Observations	60	60	60	59	59	59	59

* - Significant at the 10% level.
 ** - Significant at the 5% level.
 *** - Significant at the 1% level.

Figure 1. The Expected Abnormal Return and Market Value vs. Book Value of PE Investments

Panel A: Expected Abnormal Return > 0



Panel B: Expected Abnormal Return < 0

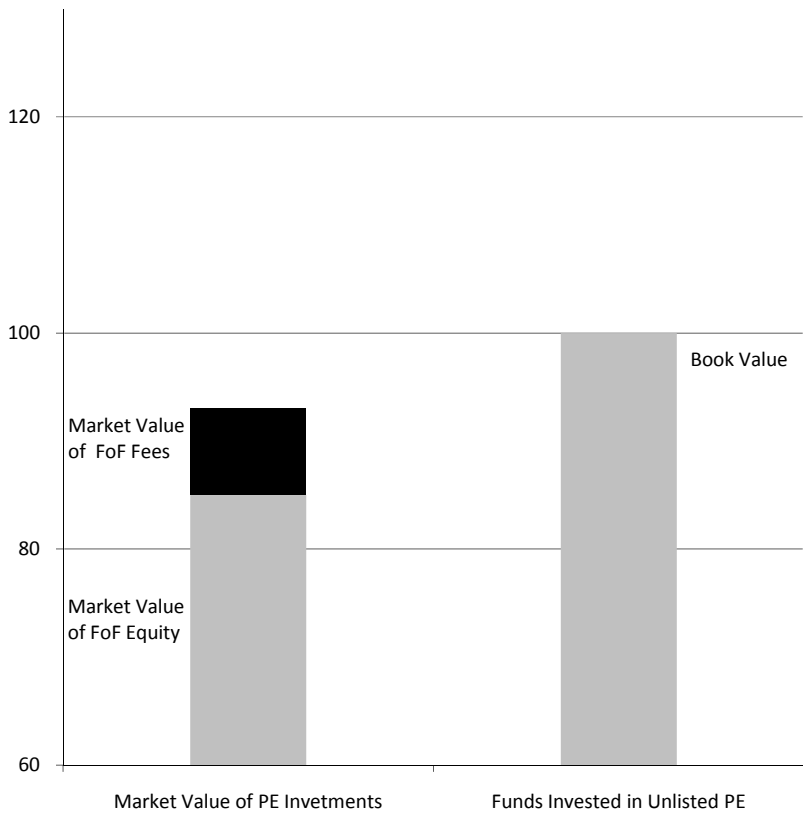
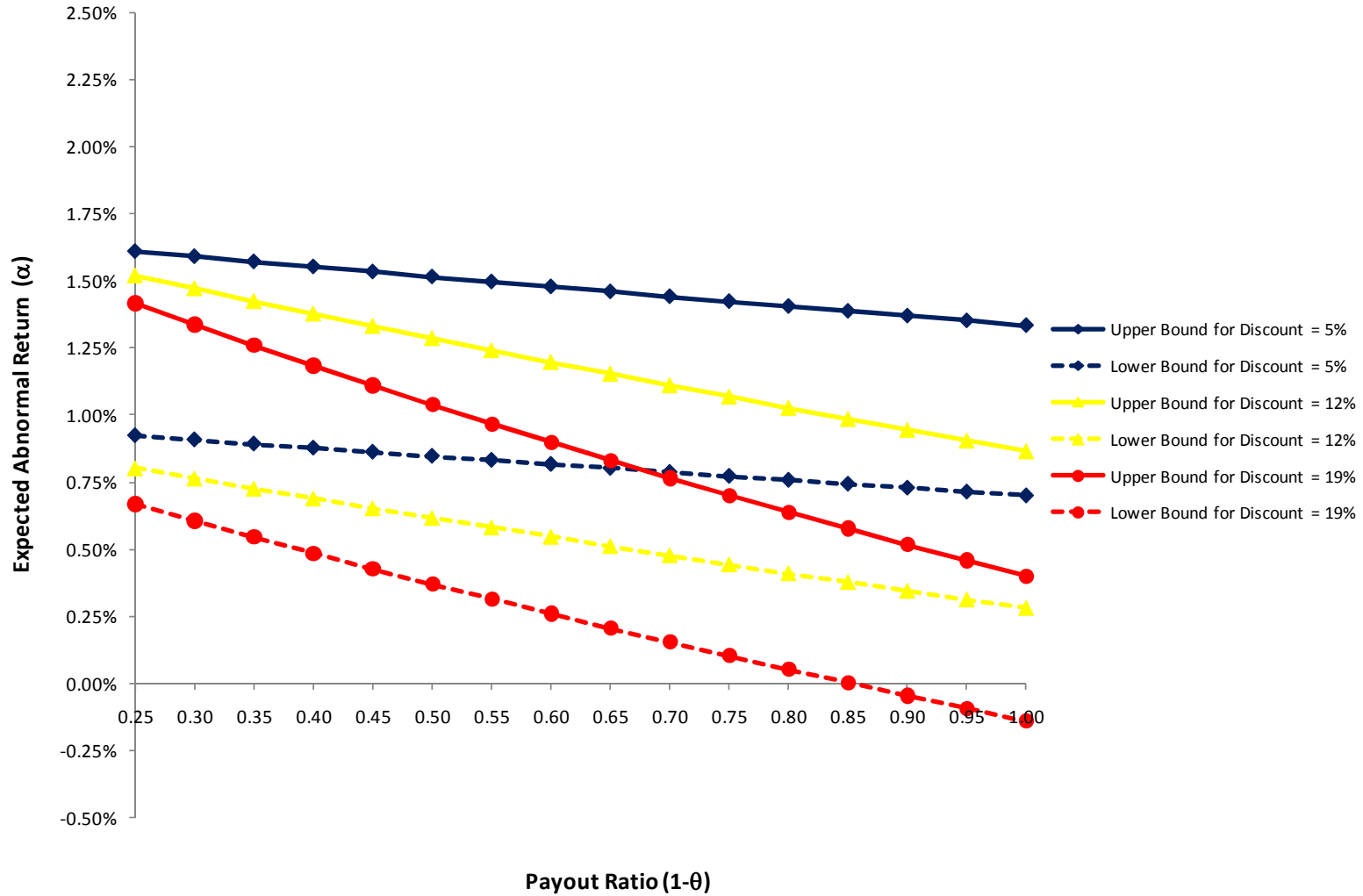
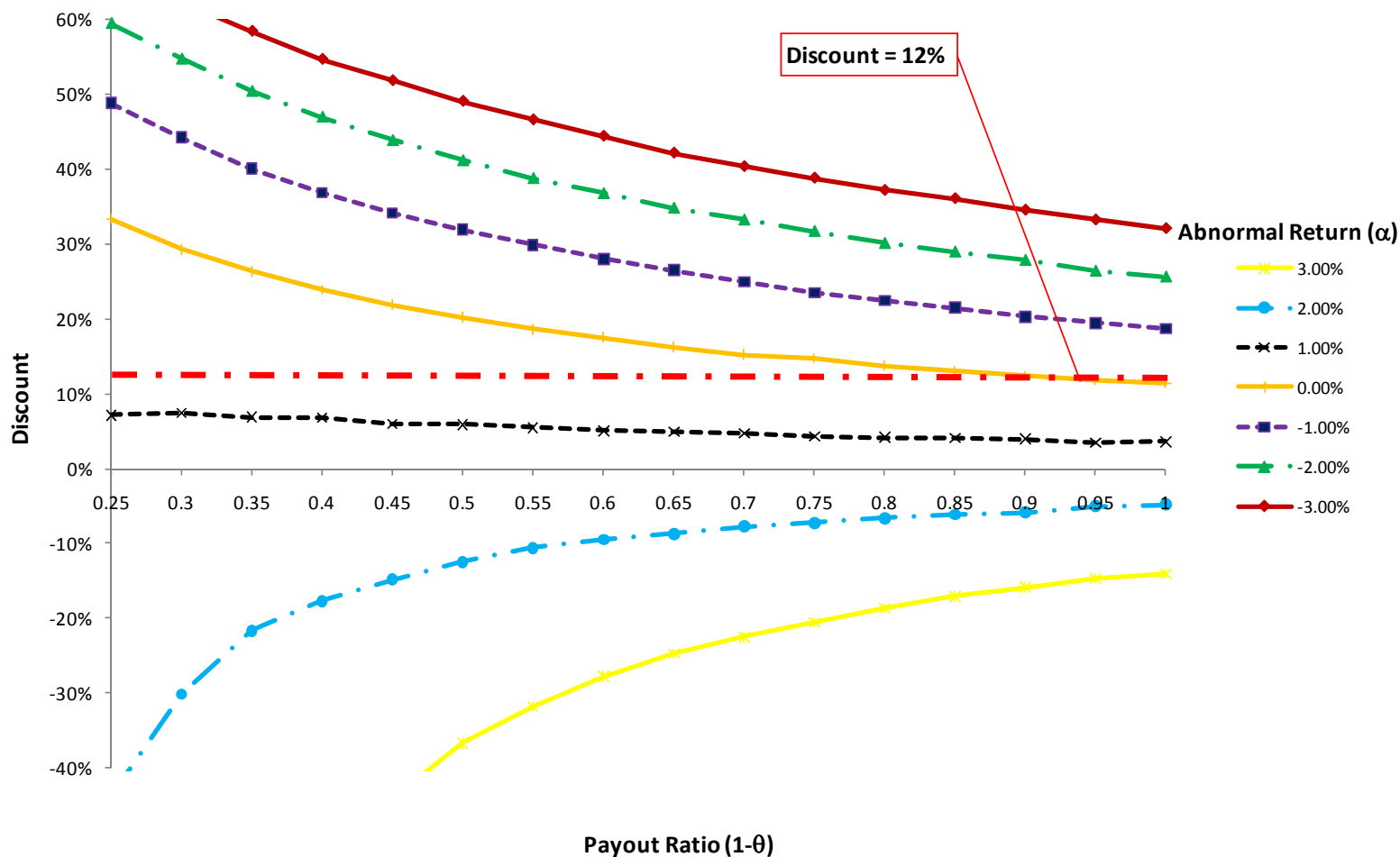


Figure 2. Upper and Lower Bounds for the Expected Abnormal Return



Notes: This figure presents the upper and lower bounds for the expected abnormal return (α) for three different levels of the FoF discount: 5%, 12%, and 19%. These three levels reflect the point estimate and the end points of the 95% confidence interval for the average FoF discount twelve months after the initial public offering (see Table 3). The bounds for the expected abnormal return are determined by equations (9) and (10) in Section III.A.3 using a base management fee of 1% and an incentive fee of 10%.

Figure 3. Simulated Relation for the Discount and the Expected Abnormal Return



Notes: This figure presents the simulated relation between the average (across funds) FoF discount and payout ratio for different levels of the expected abnormal return (α). The line labeled “Discount = 12%” plots the average discount observed in the sample one year after the IPO for the FoFs. We calculate the discount for each fund as unity minus the average simulated present value of all distributions to investors divided by the initial NAV of the fund. The expected abnormal return is the market’s expectation of the abnormal return for the underlying portfolio of PE investments. The simulation methodology is discussed in greater detail in the text.