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 exchange traded funds of funds that invest in unlisted private equity funds. Our results indicate that the market expects unlisted private equity funds to earn abnormal returns of about one to two percent. We also find that the market expects listed private equity funds to earn zero to marginally negative abnormal returns net of 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 positively correlated with GDP growth and negatively correlated with the credit spread. Finally, we find that market returns of exchange 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

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 successes of some large PE funds led to a rapid growth of this asset class. Capital commitment to private equity in the U.S. has grown rapidly from around $20 billion in 1990 to over $496 billion in 2007.

Although PE has experienced rapid growth, the risk and return profile of this asset class is not well understood. Many news stories in the media suggest that PE investments yield higher returns than traditional asset classes.[1] A recent news release by Thomson Financial and the National Venture Capital Association announced that Thomson Reuters' US Private Equity Performance Index (PEPI)[2] "across all horizons outperformed public market indices, NASDAQ and the S&P 500, through 9/30/2008." For example, for the 20-year period ending in September 2008, PEPI earned annualized return of 15.4 percent after fees, which is more than twice the return of 7.5 percent earned by S&P 500.

A number of academic papers also report superior returns for private equity investments. Ljungqvist and Richardson (2003) find that private equity investments outperformed the S&P 500 by six to eight percent, and Kaplan and Schoar (2005), Cochrane (2005), Peng (2003) and others also find that private equity funds outperform the S&P 500. However, all these papers use data that suffer from potential selection bias. For example, Kaplan and Shoar (2005) use Venture Economics (VE) data. These data are compiled mainly based on self-reported data provided by large private equity investors, and it does not contain data from investors who choose not to report their investments to Venture Economics (VE). It is quite likely that investors who do not have good experiences with their PE investments exit those investments or choose not to report their

[1] See Phalippou and Gottschalg (2009) for examples of several news articles that report high expectations for returns from PE investments. For example, 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."

[2] See http://www.nvca.org/pdf/Q3_08_VC_Performance_Release.pdf. The Private Equity Performance Index (PEPI) is computed based on "quarterly statistics from Thomson Reuters' Private Equity Performance Database analyzing cash flows and returns for more than 1,900 US venture capital and private equity partnerships with a capitalization of $828 billion. Sources are financial documents and schedules from Limited Partner investors and General Partners."

performance, and hence it is likely that funds that performed poorly never made it to the VE database. Additionally, the estimated performance of PE funds using VE data depends critically on the valuation of non-exited investments at the end of the sample period. For instance, Kaplan and Schoar use funds' self-reported values of such non-exited investments and find that the value-weighted performance of PE funds exceeds S&P 500 return by about five percent per year. 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 three to six percent per year.

Ljungqvist and Richardson (2003) attempt to circumvent these biases by using PE investment data provided by "one of the largest institutional investors in private equity in the U.S." While this database circumvents some of the biases in earlier studies, it is subject to a selection bias as well. The success of this institutional investor in its PE investments likely influenced its decision to provide access to its data. Moreover, this investor likely became one of the largest investors in PE because of its early successes in PE investments either because of its own skills or luck. Without data from a random sample of PE investors, it is difficult to generalize the experience of one successful PE investor to the general class of PE investments.

Cochrane (2005) uses a statistical model to take into account the effect of selection bias. He finds that venture capital investments generated average alpha of 32 percent per year after his bias adjustment. While Cochrane's analysis provides interesting insights, the reliability of his estimates depend critically on the validity of his statistical assumptions. In contrast, Quigley, Hwang and Woodward (2005) apply a different statistical approach to account for potential selection bias and report that the average alpha for venture capital investments is not different from zero.

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 is publicly traded fund of funds (FoFs) that invest in private equity funds. Funds of funds accounted for 14% of global commitments made to private equity funds in 2006 according to Preqin, a research and consultancy firm focusing on alternative asset

classes.[3] FoFs that invest in unlisted PE funds are traded on many exchanges outside the US, including the London Stock exchange and exchanges in Continental Europe. Since we observe market prices for these FoFs, we can determine the risk and return profile of the underlying PE funds from market prices. Also, since we use a comprehensive dataset of listed FoFs, our database is free from selection bias.

Our approach provides an estimate of markets' ex-ante expected returns from PE investments. In contrast, the extant literature examines ex-post performances of unlisted PE funds. 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 performances of PE funds in various datasets, based on different sets of assumptions. However, both investors and practitioners are interested in understanding what they can expect to earn in the long run through PE investments. Our approach allows us to extract market's expectation of future returns from market prices.

The intuition behind our approach is straightforward. The listed FoFs in our sample are structured as closed-end funds. The relation between market prices of these FoFs with the amount they invest in unlisted PE funds provides a measure of the value added by the underlying PE funds. However, FoFs charge an extra layer of management fees and performance fees. A comparison of the gross values of FoFs including the present value of their fees and the market value of their equity with the amounts that these FoFs invest in unlisted PE funds enables us to determine whether the market expects PE funds to earn abnormal returns in the long run.

We also examine the risk and returns of publicly traded funds that invest in private equity. We refer to these funds a listed private equity (LPE). LPEs are similar to unlisted PE funds in several respects. The managers of LPEs are compensated through management fees and performance fees similar to unlisted PE funds.[4] The LPEs also invest in private equity. These LPEs have the same opportunity sets as PE funds, to the

[3] See http://en.wikipedia.org/wiki/Private_equity.

[4] From Gompers and Lerner (1999) and Kaplan and Shoar (2005) find that the compensation scheme for PE funds are relatively homogeneous with most funds using fee structure of 1.5–2.5% annual management fee and a 20% performance fees.

extent that excess returns may be available to skilled investors who specialize in PE investments.

However, there are several organizational differences between LPEs and unlisted PE funds that may lead to differences in values that they are able to capture. For example, Jensen (2007) argues that 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 PE funds have finite lives, they are committed to returning to their investors when they float funds in the future. Therefore, their reputational concerns provide them with an added incentive to perform. Since LPEs have an indefinite life, they are relatively insulated from such concerns. If any value that PE funds are able to add comes from the inherent incentives due to their organizational structure, then they would add more value than LPEs. Therefore, the return that the market expects LPEs to earn provides a lower bound on the returns unlisted PE funds would provide their LPs.

The dataset we use has several advantages. First, it is free from selection bias. As Cochrane (2005) notes "overcoming selection bias is the central hurdle" in evaluating the performance of PE investments. Moreover, we determine the value of investments from market prices and we do not rely on self reported data for valuation. Therefore, we are able to circumvent critical shortcomings of self reported data used in extant studies.

We are also able to determine the risk characteristics of PE investment since we have market prices available for all of the listed private equity vehicles in our database. The extant literature attempts to estimate the risk characteristics of PE investments based on their cash payouts to investors and based on the valuations of these investments when they raise follow-up capital. Because it is difficult to determine the market values of all investments made by PE funds based on cash payouts or additional financing rounds for some of their investments, additional assumptions are necessary to determine the risk of these investments. The estimates of systematic risk in the extant literature seem to depend significantly on these assumptions. For example, the estimates of beta range from about 0.5 in Quigley et al. (2005) to 4.66 in Peng (2001).

In related work, Martin and Petty (1983) and Brophy and Guthner (1988) use a samples of 11 and 12 listed venture capital funds, respectively, to examine their risk and ex-post returns over about a five-year period. Bilo et al. (2005) examine the risk and

return characteristics of a larger sample of listed private equity. Although these studies use market prices of listed private equity investments, they also suffer from a selection bias since they require all firms in their samples to survive their entire sample period.

We find that the net present value of unlisted PE funds that the FoFs invest in is about ten to 20 percent of the original investment. This result indicates that the market expects unlisted PE funds to earn long run abnormal returns of one to two percent, net of their fees. Earlier studies document abnormal returns for unlisted PE funds that range from -6 percent (e.g Phalippou and Gottschalg, 2009) to +32 percent (Cochrane, 2005). While these estimates are based on particular datasets used in the respective studies and additional assumptions, 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 any proposition that the market expects negative abnormal returns, or positive abnormal returns in excess of about five percent in the long run are inconsistent with the market prices that we observe.

Both listed and unlisted private equity funds that FoFs invest in 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.

The remainder of this paper is organized as follows: Section II describes the sample. Section III provides estimates of market's ex-ante expected returns for PE investments by unlisted PE funds and listed PE funds. Section IV examines the risk characteristics of the funds and Section V examines the sensitivity of PE investments to macroeconomic conditions. Section VI examines the ability of FoF and LPE returns to predict future changes in unlisted PE funds' self reported book values and Section VII concludes.

II. Sample

A. PE Fund of Funds

Unlisted PE funds are typically organized as limited partnerships. Outside investors have partnership interest in the funds as limited partners (LPs), and fund managers as general partners (GPs). PE fund of funds (FOFs) are intermediaries that raise funds from investors and invest in these PE funds as limited partners. In the US, only large institutions and qualified wealthy investors who meet certain minimum wealth and income criteria are allowed to invest in unlisted PE funds.

Many other countries, however, do not similar restrictions. Therefore, although the PE funds typically impose minimum thresholds for LP investments, small investors in Europe can invest in unlisted PE funds through FoFs. Some of these FoFs are listed on European and Australian stock exchanges and they are actively traded.

We first identified FOFs from SDC platinum database. In addition, we also obtained a list of FOFs from the Dow Jones Private Equity Funds-of-Funds database. We then augmented these data with the list of stocks that are components of 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 then matched the names with the universe of traded stocks on Datastream.

For the list of FoFs from these sources, we obtained annual reports from company websites and from industry sources over the 1994 to 2008 sample period. We then went through each annual report to identify FoFs that invest at least 50% of their assets in PE funds. Our final sample contains 26 FoFs over the sample period. Table 1a and 1b present descriptive statistics for this sample.

< INSERT TABLE 1a ABOUT HERE >

Ten FoFs in our sample are listed in London, 14 are listed in continental Europe and two are listed in Australia. The FoFs range in market cap from $14 million to $5.6 billion over our sample period. The average market capitalization of FoFs during our

sample period is $314 million and the median is $214 million. Twenty of the 26 FoFs indicate that their main focus is on buyout PE funds.

< INSERT TABLE 1b ABOUT HERE >

Although these FoFs are traded outside the US, 11 of them focus on investments in North America. The FoF investments include investments in funds raised by well-known groups such as Blackstone, Carlyle, KKR, and 3i Group. The aggregate ownership by large investors, which is defined as investors with ownership of more than 3% of the shares outstanding, is about 47% on average per FoF.

B. Listed Private Equity Funds

Our primary source for listed private equity funds is SDC platinum database. The managers of LPEs classified as "funds" in the SDC data are compensated through management fees, as in the case unlisted PE funds.[5] Table 2 presents the descriptive statistics for the sample of LPEs. There are a total of 129 LPEs in our sample. Ninety-two of these funds are listed in the London Stock Exchange and 16 are listed on US exchanges. The distribution of stage focus is much more diverse across LPEs than across FoFs. Forty-one of the LPEs have a balanced focus, while 25 focus on early stage companies and 13 focus on buyouts.

< INSERT TABLE 2 ABOUT HERE >

The LPEs also have a wide range of industry focus including biotechnology, technology and telecommunications. Seventy-eight of the LPEs focus on investments in Europe, while only 17 focus on investments in North America.

[5] To check for completeness of the SDC database, we examined a sample of stocks that were not classified in the SDC database as "funds" but were included as components of LPE indices such as the S&P Listed Private Equity Index. We examined the annual reports of these companies. In all instances, we found that stocks not classified in the SDC database as "funds" were actually holding companies of multiple business units that were separate operating companies. None of these excluded companies compensated their

III. Do PE Investments add value?

The first issue that we address is whether PE funds add value. 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.

Ex-post return is the sum of ex-ante expected return and 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 ex-post realized return is the only feasible route to estimate expected returns.

While ex-post return provides useful insights into past performance, it may not necessarily provide a measure of market's expectation of returns that can be earned of over the long term through investments in PE funds. Even ignoring the issue of selection bias, past performance may have been biased by unexpectedly good outcomes. 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 are likely unique to the nineties. Moreover, it is possible that with increased competition in the PE sector, PE funds may find it hard to replicate successes of the past in future periods.

A. An Analysis of Funds of Funds (FOFs)

A.1 Methodology

The unique advantage with our FoF data is that we observe both the amount of money that they raise and the market value of the FoFs. The difference between the market value of the Fofs and the amount of funds that FoFs invest in unlisted PE funds represent the net present value of the underlying unlisted PE fund investments. If this net present value is positive, then the market expects the underlying PE funds to earn abnormal returns.

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managers through a management fee structure as did the companies classified as "funds" in the SDC database.

The magnitude of the net present value also provides a measure of the magnitude of abnormal returns that the market expects the underlying PE funds to earn in the long run.

While the economic basis for our methodology is straightforward, there are a number of practical issues that we need to address. First, the FoFs charge their own fees for managing the funds they raise. These fees are paid out of earnings from their investments, but the market capitalization of the equity shares in the FoFs reflects only the present values of after-fee cash flows. Therefore, the value of funds invested by the FoFs in PE funds is the sum of the present value of FOF fees and the market capitalization of the traded shares of FoFs. We use the FoF fee structure to compute the present value of FoF fees.

The computation of the market value of traded shares is straightforward since we have data on prices and number of shares outstanding. However, we should be careful in determining the appropriate time to compare market values with the amount of funds invested by the FoFs in PE funds. We get the most accurate measure of the amount of FoFs actual investment with PE funds at the time of the initial public offerings (IPOs) of the FoFs since the amount invested is raised in cash at that time. Therefore, in much of our analysis we will focus on valuation in the months immediately after the IPO.

A.2. Market Value of Equity in FoFs

This section examines the market value of FoFs around their IPOs relative to the amount they invest in PE funds. At the time of IPO, FoF stocks are issued at a premium to post-IPO net asset value (NAV) since issuance costs are paid out of IPO proceeds. FOFs in our sample are closed-end funds that focus on PE investments. Peavy (1990) documents that closed-end funds in the US that invest in bonds and listed stocks are issued at a premium, but their prices on average fall by about 15% over the first 100 days after their IPOs and they eventually trade at a discount to NAV.

The first part of this section examines the post-IPO performance of FOFs. We define FoF discounts as:

$$\text{Discount}_t = 1 - \frac{\text{Price}_t}{\text{Nav}_t}.$$

We obtain prices and NAV data from Datastream. The NAV until the first financial statement after IPO is based on the value of funds raised at IPO. Since the NAV at this time accurately reflects the amount invested in underlying PEs, we avoid any problems with self-reported NAVs of the underlying funds. As we progress through time, however, some of the investments get marked to NAV reported by the underlying PEs. However, in the early stages of a FoF's life, NAV is likely to be close to the dollar value of FoF investments since very few assets are marked up or down at that stage.

Table 3 presents the average discounts for FoFs over the first 12 months after their IPOs. Although the FoFs are issued at a premium, they trade at a discount of about 4% one month after the IPO. The average discount gradually increases to 12.43% by month 6, and it fluctuates around 15% over the rest of the year.

< INSERT TABLE 3 ABOUT HERE >

The FoF discounts are larger than the 10% discount that Weiss (1989) reports for domestic stock funds in the US. The larger discount likely reflects the effect of the fees charged by the FoFs. The fact that FoFs trade at a discount indicates that they do not add sufficient value to justify their fees. Moreover, our finding indicates that any extra value that the underlying PEs generate through their investments are not sufficient to cover the average fees that the FoFs charge. However, as we discussed earlier, to understand whether the market expects the underlying PE funds to earn abnormal returns, we should consider the present value of FoF fees as well, in addition to the market value of equity in FoFs.

A.3. Present Value of FoF Fees – A Simple Model

We first consider a model with simplifying assumptions to analytically determine the value of FoF fees. This model provides the basic intuition. The next subsection determines the present value of FoF fees based on the actual structure of their fees using a simulation approach.

In the analytic model, we consider a simple situation where the base management fee is a fixed percentage of the value of the underlying portfolio selected by the fund of

funds. For each period t, the return of this underlying portfolio is R_t and we assume that $\{R_t\}$ is independently and identically distributed. Let λ be the proportion of the underlying portfolio value at the beginning of the period that is collected by the fund manager at the end of each period. By definition, the base fee, F_{t+1}, is equal to λV_t. All capital appreciation and earnings generated by the underlying portfolio is distributed to investors in their entirety every period. However, λV_t is reinvested from the underlying distribution to pay the base management fee. Thus, the distribution from the underlying portfolio is $V_t R_{t+1}$ and the distribution to investors after the reinvestment of the base management fee is $V_t(R_{t+1}-\lambda)$. This assumption guarantees that the fund of funds is of constant size, $V_t=V_{t+1}$. If the fund does not perform sufficiently well, there is call for additional capital. The timing convention used throughout this section is that the management fee, λV_t, and the cash flow to investors, $V_t(R_{t+1}-\lambda)$, are distributed; next, the residual value of the underlying portfolio after any reinvestment, V_{t+1}, is established; finally the market price, P_{t+1}, of the fund of funds is determined. After investigating the implications of the base fee, we consider the impact of an incentive fee in addition to the base fee.

The present value of the base management fee, $PV_{F,t}$, is the starting point of our analysis. Since each period's base management fee is proportional to a deterministic process, we discount these fees using the (constant) riskfree rate, R_f.

$$PV_{F,t} = \sum_{s=1}^{\infty} \frac{\lambda E_t[F_{t+s}]}{(1+R_f)^s}$$

$$PV_{F,t} = \sum_{s=1}^{\infty} \frac{\lambda V_t}{(1+R_f)^s}$$

$$PV_{F,t} = \left(\frac{\lambda}{R_f}\right) V_t$$

In the absence of any market inefficiencies, the price of the investors' claim is equal to the market value of the assets under management at the beginning of $t+1$ plus the present value of the skill of the fund of funds minus the present value of the base management fee. Let R be the constant discount rate for the cash flow from the underlying portfolio in the absence of skill and let α be the measure of per period

abnormal returns earned by the underlying PE funds. We define this measure of management skill such that $E_t[R_{t+s}-\alpha]=R$ for any s. Thus, the market value of assets under management plus the present value of skill is given by

$$E_t\left[\sum_{s=1}^{\infty}\frac{V_t\alpha}{(1+R_f)^s}+\frac{V_tE_t[R_{t+s}-\alpha]}{(1+R)^s}\right]=\left(\frac{R_f+\alpha}{R_f}\right)V_t$$

and the price of the investors' claim is equal to

$$P_t=\left(\frac{R_f+\alpha-\lambda}{R_f}\right)V_t.$$

Since the data indicate that most fund of funds trade at a substantial discount relative to the value of the underlying portfolio, this model suggests that the benefit of management skill is less than the base management fee, i.e., $\alpha<\lambda$.

What are the properties of the net-of-fee return in this setting?

$$R_{t+1}^{net\ of\ fee}=\frac{P_{t+1}+D_{t+1}-P_t}{P_t}$$

$$R_{t+1}^{net\ of\ fee}=\frac{\left(\frac{R_f+\alpha-\lambda}{R_f}\right)V_{t+1}+V_t(R_{t+1}-\lambda)-\left(\frac{R_f+\alpha-\lambda}{R_f}\right)V_t}{\left(\frac{R_f+\alpha-\lambda}{R_f}\right)V_t}$$

$$R_{t+1}^{net\ of\ fee}=\left(\frac{R_f}{R_f+\alpha-\lambda}\right)(R_{t+1}-\lambda)$$

As this expression indicates, the net-of-fee return is a scaled version of the return to the underlying portfolio minus the management fee. Since this management fee is constant each period, it is a fixed payment obligation (debt) that the investors must finance using the proceeds from the underlying fund of funds portfolio. Of course, management skill is a fixed benefit every period that may offset the obligation imposed by the management fee. If management skill is less than the base management fee, the fixed component of the management fee implicitly creates leverage from the perspective of the investors.

Next, we include an incentive fee as well as a base management fee. Let π be the fraction of the distribution after the base management fee collected by the fund of funds manager as an incentive fee. For this theoretical analysis, we ignore the hurdle rate

feature that often accompanies incentive fees. By construction, the incentive fee, I_{t+1}, is equal to $\pi\ V_t\ (R_{t+1}-\lambda)$ and the resulting distribution to shareholders is $(1-\pi)V_t\ (R_{t+1}-\lambda)$. The present value of the incentive fee is

$$PV_{I,t} = E_t\left[\sum_{s=1}^{\infty}\frac{\pi V_t(\alpha-\lambda)}{(1+R_f)^s}+\frac{\pi V_t[R_{t+s}-\alpha]}{(1+R)^s}\right]$$

$$PV_{I,t} = \pi\left(\frac{R_f+\alpha-\lambda}{R_f}\right)V_t$$

The price of the investors' claim is equal to the market value of the assets under management at the beginning of t+1 plus the present value of the skill of the fund of funds minus the present value of the base management fees and the present value of the incentive fees.

$$P_t = \left(\frac{R_f+\alpha}{R_f}\right)V_t-\left(\frac{\lambda}{R_f}\right)V_t-\pi\left(\frac{R_f+\alpha-\lambda}{R_f}\right)V_t$$

$$P_t = (1-\pi)\left(\frac{R_f+\alpha-\lambda}{R_f}\right)V_t$$

The ratio of the present value of the incentive fees to the market price is $\pi/(1-\pi)$. Both the investors and the fund manager have claims that are a fixed proportion of the underlying distribution net of the base fee. Essentially, the fund manager is entitled to the cash flows of a riskless bond through the base fee and a fixed proportion of the equity in the fund of funds through the incentive fee. The remaining equity stake in the fund of funds is held by the investors themselves.

What are the properties of the net-of-fee return in a setting with both an incentive fee and a base management fee? Because the market price and the distribution to investors are scaled by $1-\pi$ compared to the setting without an incentive fee, the net-of-fee return with this type of incentive fee is identical to the net-of-fee return in the absence of the incentive fee.

$$R_{t+1}^{net\ of\ fee} = \left(\frac{R_f}{R_f+\alpha-\lambda}\right)(R_{t+1}-\lambda)$$

A more realistic setting should include an incentive fee with a hurdle rate and more substantial reinvestment of distributions. These characteristics make it more

difficult to devise an analytically tractable model, but the basic intuition from this simple case is still useful. The base fee is less risky than an equity position in the fund of funds, the incentive fee without a hurdle rate is similar to an equity stake, and an incentive fee in conjunction with a hurdle rate is similar to a leveraged equity position in the fund of funds. In general, the appropriate discount rate for the base management fee is not the riskfree rate because the base fee in each subsequent period usually depends on the performance of the underlying portfolio through the reinvestment of stochastic proceeds. Thus, the discount rate for these fees is determined by the reinvestment policy and the systematic riskiness of the investment strategy. To analyze the present value of fees in a more realistic setting, we use a simulation designed to capture these important features.

A.4. Present Value of Fund of Fund Fees – Simulation Results

To quantify the present value of all management fees as well as the gross value of FoFs, we utilize a simulation framework with a constant discount rate. We first compute the accounting returns earned by the FoFs. We define accounting returns as the sum of FoFs earnings, FoF fees and change in NAV divided by beginning of period NAV. The average accounting return earned by the PE investments of the FoFs in our sample is 15% per year with a standard deviation of 0.2. Phalippou and. Gottschalg (2009) and others argue that NAV based returns may overstate true returns, and hence the true return may be less than 15%. In our simulation experiment, we consider a range of possible returns around the 15% estimate. The historical average payout ratio after fees in our sample is 33%, but we also consider other values for this parameter.

For each fund, we simulate the annual return on the underlying portfolio using the historical average return and standard deviation described above. This simulated return for the underlying portfolio is drawn independently and identically each year 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 one hundred years. The base fee is a fixed proportion of the underlying portfolio value at the beginning of the period that is collected by the fund manager at the end of each period. The incentive fee is the fraction of the underlying portfolio proceeds minus the base management fee above the hurdle rate. The hurdle rate is path dependent due to the

typical high watermark provision. The average payout ratio in conjunction with the fund-specific base management fee determines the distribution to investors. This distribution is a fraction of the value invested in the underlying portfolio multiplied by the return to this portfolio minus the base management fee. The proceeds after all fees and distributions are then reinvested in the underlying portfolio for the next period. We calculate the present value of each component of management fees as well as all distributions to investors using a constant discount rate. We define the present value of the distributions to investors as the simulated price. This discount rate in these calculations ranges from 0.13 to 0.17 based on the level of fund manager skill from -0.02 to 0.02. For example, if managerial skill is assumed to be 0.01 then we discount all cash flows using 0.15-0.01=0.14 each period.

For each particular skill level and fund of funds, we conduct 10,000 simulations and average the simulated output for each fund. Next, we scale the present value of each component of simulated fees by the simulated price and then average this value across all funds. The top panel of Table 4 reports the baseline results for a payout ratio of 0.33. The third row of the table indicates that the present value of total management fees is a remarkably stable fraction of the price for differing levels of managerial skill. The present value of the incentive fee is approximately 40% of the present value of total fees. This result should not be particularly surprising because the average hurdle rate is about 0.08 according to Table 1b and the average return on the underlying assets is 0.15 by assumption. Thus, the average difference between performance and hurdle rate is 0.07. Of course, if the difference between the return to the underlying portfolio and the hurdle rate is less than zero, then incentive fee is zero. So, a lower bound expected incentive fee is 0.7% of the value of the underlying portfolio. Since the base management fee is 1.5% of the value of the underlying portfolio, 30% (0.7/2.2=0.31) is a lower bound for the percentage of the present value of total fees that is attributed to the incentive fee.

< INSERT TABLE 4 ABOUT HERE >

For the baseline specification (payout ratio of 0.33), the present value of all fees is approximately 38% of market price. In the bottom panel of Table 4, we repeat our

simulations using a variety of payout ratios. The simulations indicate that the present value of fees relative to share price depends quite critically on the assumption regarding the payout ratio, ranging from 12% of price for a payout ratio of 1, to 64% of price for a payout ratio of 0.2. The present value of fees relative to price is monotonically declining in the payout ratio because reinvestment increases both the base fee and the incentive fee in subsequent periods.

We find that the ratio of value of FoF fees to market value of equity is not sensitive to the level of managerial skill, conditional on the payout ratio. Intuitively, when skill increases, the present value of fees increases but so does the market value of equity. The net effect is that the ratio is roughly constant across skill levels.

A.5. Value of FoFs Gross of FoF Fees

This section examines whether the PE investments are ex-ante expected to earn abnormal returns, gross of FoF fees. We use our estimates of the present value of FoF fees from the simulation experiment. As we report in Table 3, the market value of FoF shares relative to their NAV varies over time. At the time of their IPOs, FoF shares are issued at a premium over NAV to cover issuance costs. Therefore, IPO investors expected their investments in FoFs to add value even after the net of FoF fees.

However, the IPO price may reflect biased expectations since FoFs decline in value for the first six months. Why investors participate in FoF IPOs when in almost all instances they experience a loss soon after is puzzle. Weiss (1989) and Peavy (1990) consider several explanations for this puzzle in the context of closed-end fund that invest in traded stocks, but this issue is not the focus of this paper.

Predictable underperformance of FoF IPOs indicates that the IPO price does not reflect the true value of the underlying PE investments net of FoF fees. The results in Table 3 indicate that the market values, relative to the NAV stabilize after about six months. In fact, in later tests, we do not find any abnormal returns after the initial period, which suggests that the price after six months is reliable measure of true market value of traded shares. Therefore, we use the market value six-months after IPO to compute gross values.

Given an average discount six months after IPO of 0.125 in Table 3, our simulations indicate that the average gross value (value before management fees) of such funds as a percentage of net asset value should be approximately 1.2, i.e., (1-0.125)*(1.385). In Table 5 we analyze this issue in considerable detail. We compute the gross value as a fraction of NAV for each fund as the sum of the price divided by NAV six months after IPO multiplied by the one plus the ratio of the average simulated present value of fees to the average price. Then, we average this quantity across funds. For the baseline specification (payout ratio of 0.33), we find that the gross value relative to net asset value is 1.21. If market expectations are rational, i.e. the price is an accurate reflection of expected cash flows and risk, then average discount and the simulated present value of fees indicate that underlying portfolio will outperform the relevant risk model, but not sufficiently to offset the fees of the average FoF under the baseline assumptions. If the skill level was sufficiently high, then the shares would trade at a premium rather than a discount relative to NAV because the present value of skill would more than offset the present value of fees. If the payout ratio is equal to 1, then the simulations in Table 5 indicate that average gross value is only slightly less than one. For even the most conservative valuation of fees as a fraction of price, the results are not consistent with substantial value destruction by the underlying private equity funds selected by the FoFs.

< INSERT TABLE 5 ABOUT HERE >

We note that discounting the base fee using the expected return of the underlying portfolio of fund of funds (adjusted for skill) is likely to produce a downward bias in the present value of total fees because the base fee is less risky than the return to the underlying portfolio. This bias is partially offset by the fact that the incentive fee is a leveraged claim to the underlying portfolio, and hence, should be discounted using a higher rate of return. On net, since the base fee is the dominant component of fees in any case, the ratio of the present value of total fees to price probably biased downwards. Thus, these results provide a lower bound for the presence of managerial skill.

B. Results in Perspective

This subsection puts our findings in perspective with the results in extant literature. The extant literature examines the ex-post performance of unlisted PE funds and finds a wide range of performance parameters. For example, Phalippou and Gottschalg (2009) provide estimates of abnormal returns for unlisted PE funds ranging from −6% to −3%. In contrast, Cochrane (2005) finds that the PE funds in his sample earn average abnormal returns of 32%. The findings in these papers provide interesting insights into the past performance of fund in their respective datasets based on different set of assumptions. However, an important unanswered question that is of interest to both investors and practitioners is whether these estimates provide reliable measures of long run returns that investors can expect in the future.

This subsection uses the market prices of the exchange traded FoFs in our sample to examine whether the findings in prior studies are plausible estimates for the market's ex-ante expectation for long run returns from PE funds. To provide a setting for our analysis, we assume a simple constant growth model. We will show that the constant growth framework provides upper or lower bounds for Tobin's *q*- ratios under various assumptions about abnormal returns.

Suppose the required rate of returns for PE investments is *k*, and that the unlisted PE funds are expected to earn a return equal to *ROE* on their investments. These funds earn positive abnormal returns if $k < ROE$ and negative abnormal returns if $k > ROE$. Although the PEs that the FoFs invest in have finite life, the FoFs themselves have indefinite life. Therefore, they reinvest any capital repayment or earnings from their original PE investments in other PE funds, which also earn the same ROE as the old funds. Suppose the FoFs retain a fraction *b* of the earnings and pays out the balance to their shareholders.

With these assumptions, the gross value of the FoFs can be determined using the Gordon growth model that is described in most textbooks on investments (for example, see Bodie, Kane and Marcus, 2008). The *q*-ratio for FoFs is given by:

$$q_{fof} \equiv \frac{\text{Market Price}}{\text{Book Value}} = \frac{(1-b)\times ROE}{k - b\times ROE}.$$

We will further assume that the FoF pays out all earnings as dividend (*i.e. b = 0*), which provides an upper or lower bounds for Tobin's q under different assumptions about abnormal returns. Under this assumption,

$$q_{fof} = \frac{ROE}{k}, \quad for\ b = 0.$$

Suppose *ROE* > *k*. As an extreme example, consider the estimate of 32% abnormal return in Cochrane (2005). As we later show, the FoFs have an average beta close to 1. We therefore assume that *k* equals the expected return on the market. For ease of exposition we assume that *k* = *.1* or 10%.[6]

If the underlying PEs earn abnormal returns of 32% then their ROE equals 42%. With these assumptions, $q_{fof} = \frac{.42}{.1} = 4.2.$ The *q*-ratio of 4.2 implied by this estimate is far greater than the *q*-ratios we observe in practice. We assumed in our example that *b* = 0 but in practice *b* is much larger than 0. However, when *ROE* > *k*, it is easy to see from the generalized equation that the *q*-ratio will be greater than 4.2 that we computed above. In other words, the *q*-ratio with *b* = 0 provides a lower bound in this case. Therefore, the estimate of 32% abnormal returns is much larger than market's ex-ante expectation. The estimates of 5% to 8% abnormal returns in Kaplan and Schoar (2005) and Gompers and Lerner (1997) would imply a lower bound of 1.5 to 1.8 for *q*-ratios, which are much larger than the *q*-ratio of about 1.1 to 1.2 (based on the gross value of FoFs) that we find in the data.

Now consider the case where *ROE* < *k*. For example, Phalippou and Gottschalg (2009) report that unlisted PE funds underperform by at least 3%. If this estimate is consistent with market's expectation of long run performance of PE funds, then for *b* = 0, the *q*-ratio would be .7. When *ROE* < *k*, if *b* were larger, then the generalized equation implies that the *q*-ratio would be smaller. Therefore, the assumption that *b* = 0 provides an upper bound for the *q*-ratio. Our results show that the price to NAV ratio, even if we were to exclude the present value of fees, is about .85. Therefore, estimates of -3%

[6] Dimson, Marsh and Staunton (2002) find global equity risk premium is 5.4. Fama and French (2002) find that equity risk premium is between 2.55% and 4.32%. The average bond yield during our sample period is 5.24%. Therefore 10% expected rate of return is roughly equal to the expected rate return on the world market, but at the higher end of Fama and French estimates. The results of the analysis in this section, however, are not sensitive to risk premium assumptions within the range of estimates in Fama and French.

underperformance or lower do not capture market's expectation about future ROE for underlying portfolio of unlisted PE funds.

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

This section examines whether LPEs add value. LPEs and PE funds have similar operational focus since they both invest in private equity. LPE managers are also compensated through management fees and at least in some cases, with incentive fees. However, there are several differences in the organizational structure that could lead to performance differences between LPEs and PEs. Since LPEs are closed end funds with indefinite life they do not have the same reputational concerns as PE funds. In fact, the typical discount in the case of closed-end fund suggests that the organizational 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, several papers have argued that PE funds' incentive structure aligns their interests with that of limited partners. Also, since PE funds have finite life, they are committed to returning to their investors for funds they float in the future and reputational concerns provide them with an added incentive to perform. Therefore, the organizational structure of PE funds may incentivize them to add more value than that of LPEs.

Since LPEs likely suffer from higher agency costs, we would expect them to underperform PE funds. Since they both operate in the same PE space, but LPEs have higher agency costs, the expected performance of LPEs provides a lower bound on the expected performance of PE funds. The difference between the expected performances of LPEs and PEs would provide a quantitative measure of the agency costs.

To investigate whether the market expects LPEs to earn abnormal returns, we examine the *q*-ratios of these LPEs soon after their IPOs. As we discussed earlier, q-ratio based on the IPO price is likely to be a biased indicator of market expectations. Therefore, we first examine the pattern of LPE discount in event time after IPOs. We use the beginning of the first month when data are available on Datastram as the IPO date.

< INSERT TABLE 6 ABOUT HERE >

Table 6 presents the discount over the first 12 months after IPOs. LPEs on average trade at a 4% premium to NAV at the end of their first month. However, the premium declines to about 1.7% by the end of six months. By the end of 12 months after IPO, the LPEs trade at a discount of 1.74%. These results indicate that although the IPO premium disappears by the end of 12 months, LPE price is close to its NAV. Therefore, the market expects LPEs to earn zero abnormal returns.

IV. Risk Characteristics of FoFs and LPEs

The extant 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 Quigley 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, the difficulty arises from the fact that these studies estimate betas from investment cash flows rather than from market values. As result, the beta estimates depend on the underlying assumptions.

The difficulty in estimating the risk of PE funds in turn makes it hard to reliably evaluate the performance of PE funds. For example, Phalippou and Gottschalg's (2009) analysis show that the measured performance is quite sensitive to reasonable changes in assumptions about beta. In their sample, the abnormal returns for PE funds changes from -3% per year when they assume beta equals one, to -6% per year when they assume an "industry/size-matched cost-of-capital."

This section examines the systematic risk of FoFs and LPEs. Since we have market prices, we are able to estimate multiple dimensions of risk using traditional time series regressions. This section present systematic risk measured with respect single factor and multifactor models. In addition, we also present the sensitivity of FoF and LPE performances to macroeconomic risks.

A. FoF and LPE Indices

To examine the systematic risk of PE investments, we construct value-weighted indices of FoFs and LPEs. We use all available stocks at the beginning of each month to construct the indices. We obtain returns data from Datastream.

< INSERT FIGURE 1 ABOUT HERE >

Figure 1 plots the cumulative returns for the FoF index, and the LPE index over the January 1994 to December 2008 sample period. We also present the cumulative returns of S&P 500 index and the MSCI world index over this sample period for comparison. Also, the figure presents the cumulative returns for the PEPI index computed by Thomson Reuters. The PEPI index is computed by Thomson Reuters based on the returns on more than 1,900 U.S. venture capital and private equity partnerships in its database.

B. Market Risk and Fama-French Factor Risks

We examine systematic risk in the context of CAPM and the Fama-French and Carhart four factor models. Since our FoF and LPE samples comprise international funds, the appropriate proxy we use MSCI world index as the 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:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,m}(R_{m,t} - R_{f,t}) + \varepsilon_{i,t},$$

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

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 risk-free rate. $SMB, HML,$ and MOM are the size, book-to-market and momentum factor portfolios. We obtain factor portfolio returns from French's website. French constructs these three factors with only US stocks. Given the international composition of fund portfolios, we would ideally like to use international factors but we are constrained to use US factors because we do not have international factor data. Nevertheless, since the US market is a significant 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.

< INSERT TABLE 7 ABOUT HERE >

Table 7 presents the regression estimates and corresponding Newey-West standard errors with six lags. Betas with respect to the MSCI World index for the FoFs and LPEs are .93 and .84, and with respect to the S&P 500 index are .80 and .71, respectively. The R^2s are also larger with respect to the MSCI index. Since the underlying funds have international exposures, both FoF and LPEs have higher sensitivity to the MSCI World index, and the MSCI index has a larger explanatory power than the S&P 500 index.

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 .44 and .54 for the FoF and LPE indices respectively, and both these estimates are significantly greater than zero. Therefore, both FoFs and LPEs behave more like small firms than large firms. This finding is intuitive since many of the PE investments are made in firms that are smaller than a typical listed firm.

< INSERT TABLE 8 ABOUT HERE >

The beta with respect to HML is .35 for FoFs and .39 for LPEs. Although these point estimates are not significantly different, HML beta is not significantly different from zero for FoFs but it is significant for LPEs. Therefore, both FoFs and LPEs are more sensitive to value firms than growth firms. One possible explanation for this finding is that these funds 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 four factor models betas for separately for funds with buyout focus and VC focus. We found that buyout funds HML beta was significantly positive but VC fund HML beta estimate was not significantly different from zero. Therefore, even VC funds on average are not sensitive to the growth factor.

Overall, we find that the risk profiles of FoFs and LPEs are quite similar. The betas with respect to various risk factors are not statistically different for these two categories of funds. Although the geographic composition of the FoFs and LPEs are different, the similarities indicate that their risk structures are not particularly different.

As we discussed earlier, private PE funds and LPEs differ in their organizational structure because LPEs have indefinite life while PE funds have finite life and they are likely to be more sensitive to reputational concerns because they are constrained to periodically go back to the market to raise funds for future operations. Our earlier findings indicate that PE funds add more value than LPEs, which is likely due to this organizational difference. However, this difference between PE funds and LPEs need not necessarily affect their risk exposure since they operate in the same space.

Our analysis of the implications of the FoF fee structure showed that FoF equity may be viewed as a levered claim on the underlying PE funds because the base management fee is equivalent to debt contract. Therefore, the market beta of FoF equity provides an upper bound for the market beta of the underlying portfolio of PE funds.

Conceptually, we could "unlever" the FoF betas based on our analysis in Section III. The practical impact of accounting for the implicit leverage effect due to the base management fee on betas, however, may not be as large. For example, Kaplan and Stein (1990) find that the even when firms increase the debt in their capital structure from about 25% of their capital to about 81% the change in equity betas is "surprisingly small." Therefore, the true betas of the underlying PE funds may be closer to the FoF equity betas than what is suggested by the leverage effect due to base management fee.

In earlier work, Kaplan and Shoar (2005) acknowledge the difficulty in estimating betas because of "the lack of true market values for fund investments until the investments are exited" and assume that beta equal one. Phalippou and Gottschalg (2009), however, conjecture that "the assumption of a beta as 1 is likely to overstate relative performance" and the use an industry/size-matched cost-of-capital benchmark. However, our findings indicate that the betas for FoFs and LPEs are not significantly different from one.

C. Alphas

The alphas for FoFs and LPEs are on average not different from zero both with CAPM and four-factor benchmark. These results indicate that these funds on average performed as expected, conditional on the realizations of the risk factors. Essentially, the market was not surprised ex-post by the performance of this asset class. We would like to caution that the estimated alphas should not be used as a measure of whether or not PE investments themselves are able to earn abnormal returns. In an efficient market, the market would anticipate any potential ability of PEs to earn abnormal returns above their cost of capital, and this ability will be reflected in market prices. Therefore, the market price-based returns earned by PEs reflect the compensation for investment risk.

V. FoF and LPE Performance and Economic Environment

This section examines the relation between fund performance and macroeconomic activity. We use US GDP growth and credit spread to capture macroeconomic activity and we fit the following regression:

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

where ΔGDP is percentage real GDP growth and $Credit\ Spread$ Credit spread is the difference between the yield on BAA and AAA rate corporate bonds.[7] For ease of interpretation, we standardize both ΔGDP and $Credit\ Spread$ by demeaning them and dividing them by their respective standard deviation. Therefore, the slope coefficients denote fund returns for one standard deviation change in these variables. We use MSCI world index as the market portfolio in the results we report.[8]

GDP growth would have a positive impact on fund performance after controlling for contemporaneous market returns is macroeconomic risk have a greater effect on early stage firms than on large cap firms that form a large part of the market index. Healthy GDP growth could potentially allow private firms to access capital markets and go public, which would have a positive impact on PE investments.

However, economic growth also could attract greater competition. For instance, Gompers and Lerner (2000) find that valuation becomes richer and hence the increased competition that comes with economic growth may have a negative impact on fund

[7] We obtain these data from the St. Louis Fed website.
[8] We found similar results when we use the S&P 500 index as the market portfolio.

performance. Kaplan and Schoar (2005) report that funds started when there is increased competition tend to underperform other funds, and find support for hypothesis that performance suffers when money chases deals. The net effect of the positive impact of economic growth and the negative impact of increased competition on the cost of future investments depends on which of these effects dominate.

Credit spread also provides a measure of the economic environment. Koopman, Kräussl, Lucas, and Monteiro (2009), among others, show that credit spread is countercyclical. As Fama (1990) argues, widening spread generally signals deteriorating business conditions, which would make it difficult times for private firms to go public. Moreover, widening credit spread also increases the cost of raising new debt and hence it would likely have an adverse impact on the performance of private firms. Therefore, we expect a negative relation between the performance of PE funds and credit spread.

< INSERT TABLE 9 ABOUT HERE >

Table 9 reports the estimates of Regression (4). We find that GDP growth is positively related to returns for both FoFs and LPEs. One standard deviation change in GDP growth leads to 2.04% and 1.29% increase in excess returns for FoFs and LPEs respectively. Out results indicate that the increase in the value of existing investments of PE funds more than offset the negative impact of potentially increased competition on returns from future investments.

We also find that credit spreads are negatively related to FoF and LPE returns, after controlling for market returns and also after accounting for GDP growth. FoFs are more sensitive to credit spreads than LPE and the difference in the slope coefficients is significant at the five percent level. One possible explanation for this difference is that because the PE funds that underlie FoF investments may be hurt more by deteriorating capital markets because of their finite life. The LPEs may not have the same urgency to liquidate their investments in unfavorable market conditions as PE funds because of their indefinite life.

VI. PEPI and Fund indices – Lead-lag relation

Practitioners and industry sources such as the National Venture Capital Association use Private Equity Performance Index (PEPI) to measure the performance of PE funds. Thomson Reuters computes PEPI based on cash flows from the PE funds in the Thomson database, based on self-reported book values of these funds. As Phalippou and Gottschalg (2009) and others have noted self-reported book values tend to be overstated.

Any bias aside, self-reported book values may not reflect changes in their market values 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, PEPI would not reflect true changes in the value of PE investments in a timely manner since book values are used to compute PEPI.

In contrast to PEPI, we compute the FoF and LPE indices using market prices. Since market prices reflect fundamental values in a timely manner, these indices should be able to predict changes in PEPI under the partial adjustment hypothesis. To examine whether FoFs and LPE indices can predict future changes in book values that underlie PEPI, we examine the relation between PEPI returns and contemporaneous and lagged values of MSCI World index returns and fund index returns.

Table 10 reports the regression results. Since PEPI is published quarterly, we fit the regressions with quarterly returns. The slope coefficient in univariate regression with MSCI as the independent variable is .39, which is statistically significant. This slope coefficient is significantly smaller that of the FoF beta, which may be due to the fact that PEPI is computed using data from PE funds that largely invest in US companies, while the FoFs invest in international PE funds. Partial adjustment of book values used in the computation of PEPI will also 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.

< INSERT TABLE 10 ABOUT HERE >

To test the delayed adjustment hypothesis, we include both the contemporaneous and lagged MSCI World returns in the regression specification. In addition, we also add contemporaneous and lagged returns on the FoF index as additional explanatory

variables. Since FoF returns reflect changes in the value that are unique to the PE sector, lagged FoF returns should 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 at .09 and .11 respectively, both statistically significant. Therefore, both lagged MSCI World and FoF index returns 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 although the FoF index returns in much noisier since it is constructed with only 26 FoFs. We found similar results when we used LPE index returns in the place of FoF index returns. These results support the delayed adjustment hypothesis.

VII. Conclusion

We estimate the risk and expected returns on private equity investments based on the market prices of exchange traded funds of funds that invest in unlisted private equity funds, and based on market prices of listed private equity funds. Our results indicate that the market expects unlisted private equity funds to earn abnormal returns of about one to two percent. We also find that the market expects listed private equity to earn zero to marginally negative abnormal returns net of fees.

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.

We find that the net present value of unlisted PE funds that the FoFs invest in is about ten to 20 percent of the original investment. This result indicated that the market expect the unlisted PE funds to earn long run abnormal returns of one to two percent, net of their fees. Earlier studies document abnormal returns for unlisted PE funds that range from -6% (e.g Phalippou and Gottschalg, 2009) to +32% (Cochrane, 2005). While these estimates are based on the dataset used in the respective studies and additional assumptions, 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 any proposition that the market expects negative abnormal returns, or positive abnormal returns in excess of about four percent in the long run are inconsistent with the market prices that we observe.

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Table 1. Sample Statistics – Funds of Funds

Notes: This table presents sample statistics for our sample of twenty-six private equity funds of funds (FoFs). The sample period is 1994 to 2008.

Panel A: Exchange							
	Total	%	% USD	Active	%	Dead	%
US	0	0.0%	0.0%	0	0.0%	0	0.0%
Europe	14	53.9%	68.9%	14	53.9%	0	0.0%
London	10	38.5%	30.9%	10	38.5%	0	0.0%
Australia	2	7.7%	0.3%	1	3.9%	1	3.8%
Total	26	100%	100%	25	96.2%	1	3.8%
Panel B: Size							
	Total	%	% USD	Active	%	Dead	%
<20m	0	0.0%	0.0%	0	0.0%	0	0.0%
20m - 100m	7	26.9%	2.9%	6	23.1%	1	3.8%
100m - 500m	12	46.2%	31.3%	12	46.2%	0	0.0%
500m - 1000m	3	11.5%	17.4%	3	11.5%	0	0.0%
1000m – 2500m	3	11.5%	30.7%	3	11.5%	0	0.0%
>2500m	1	3.9%	17.7%	1	3.9%	0	0.0%
Total	26	100%	100%	25	96.2%	1	3.8%
Panel C: Stage Focus							
	Total	%	% USD	Active	%	Dead	%
Early-Stage	2	7.7%	2.3%	2	7.7%	0	0.0%
Expansion	2	7.7%	2.2%	2	7.7%	0	0.0%
Balanced	0	0.0%	0.0%	0	0.0%	0	0.0%
Buyout	20	76.9%	87.7%	19	73.1%	1	3.8%
Other PE	2	7.7%	7.8%	2	7.7%	0	0.0%
Total	26	100%	100%	25	96.2%	1	3.8%
Panel D: Industry Focus							
	Total	%	% USD	Active	%	Dead	%
Biotechnology	0	0.0%	0.0%	0	0.0%	0	0.0%
Consumer	17	65.4%	78.5%	16	61.5%	1	3.8%
Diversified	4	15.4%	3.0%	4	15.4%	0	0.0%
Financials	0	0.0%	0.0%	0	0.0%	0	0.0%
Industrials	4	15.4%	17.7%	4	15.4%	0	0.0%
Technology	1	3.9%	0.8%	1	3.9%	0	0.0%
Telecommunication	0	0.0%	0.0%	0	0.0%	0	0.0%
Total	26	100%	100%	25	96.2%	1	3.8%
Panel E: Geographical Focus							
	Total	%	% USD	Active	%	Dead	%
North America	11	42.3%	68.6%	11	42.3%	0	0.0%
Europe	11	42.3%	29.2%	11	42.3%	0	0.0%
Rest of the World	4	15.4%	2.3%	3	11.5%	1	3.8%
Total	26	100.0%	100.0%	25	96.2%	1	3.8%

Table 1b: Descriptive Statistics – Funds of Funds

Notes: This table reports descriptive statistics for twenty-six funds of funds (FoFs) for the period 1994 to 2008. The first column for every variable shows the median while the second shows the average. Market capitalization is in USD million.

	Median	**Average**
Market Capitalization	203.8	312.4
Management Fee	1.50%	1.40%
Incentive Fee	10.00%	10.73%
Hurdle rate	8.00%	9.54%
Institutional Ownership	46.59%	47.15%

Table 2. Sample Statistics – Listed Private Equity Funds

Notes: This table presents the sample statistics for our sample of 129 listed private equity funds (LPEs). The sample period is 1994 to 2008.

Panel A: Exchange							
	Total	%	% USD	Active	%	Dead	%
US	16	12.4%	59.3%	16	12.4%	0	0.0%
Europe	7	5.4%	0.9%	5	3.9%	2	1.6%
London	92	71.3%	32.7%	81	62.8%	11	8.5%
Rest of the World	14	10.9%	7.1%	9	7.0%	5	3.9%
Total	129	100.0%	100.0%	111	86.1%	18	14.0%
Panel B: Size							
	Total	%	% USD	Active	%	Dead	%
<20m	28	21.7%	1.3%	22	17.1%	6	4.7%
20m - 100m	67	51.9%	11.2%	57	44.2%	10	7.8%
100m - 500m	26	20.2%	31.2%	25	19.4%	1	0.8%
500m - 1000m	5	3.9%	11.6%	4	3.1%	1	0.8%
1000m - 2500	0	0.0%	0.0%	0	0.0%	0	0.0%
>2500m	3	2.3%	44.7%	3	2.3%	0	0.0%
Total	129	100.0%	100.0%	111	86.1%	18	14.0%
Panel C: Stage Focus							
	Total	%	% USD	Active	%	Dead	%
Early-Stage	25	19.4%	4.7%	18	14.0%	7	5.4%
Expansion	34	26.4%	26.0%	30	23.3%	4	3.1%
Balanced	44	34.1%	13.8%	40	31.0%	4	3.1%
Buyout	13	10.1%	13.4%	11	8.5%	2	1.6%
Other PE	13	10.1%	42.1%	12	9.3%	1	0.8%
Total	129	100.0%	100.0%	111	86.1%	18	14.0%
Panel D: Industry Focus							
	Total	%	% USD	Active	%	Dead	%
Biotechnology	16	12.4%	18.7%	15	11.6%	1	0.8%
Consumer	12	9.3%	39.3%	10	7.8%	2	1.6%
Diversified	47	36.5%	23.9%	42	32.6%	5	3.9%
Financials	2	1.6%	0.5%	1	0.8%	1	0.8%
Industrials	16	12.4%	13.0%	15	11.6%	1	0.8%
Technology	25	19.4%	3.4%	21	16.3%	4	3.1%
Telecommunication	11	8.5%	1.4%	7	5.4%	4	3.1%
Total	129	100.0%	100.0%	111	86.1%	18	14.0%
Panel E: Geographical Focus							
	Total	%	% USD	Active	%	Dead	%
North America	17	13.2%	46.0%	17	13.2%	0	0.0%
Europe	78	60.5%	21.4%	68	52.7%	10	7.8%
Rest of the World	34	26.4%	32.6%	26	20.2%	8	6.2%
Total	129	100.0%	100.0%	111	86.1%	18	14.0%

Table 3. 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.

$$\text{Discount} = 1 - \frac{\text{Price}}{\text{Net Asset Value}}.$$

Δd is the change in discount relative to previous event month. Event month 1 is the first month after the initial public offering; event month 2 is the second month, and so on.

Event Month	Average Discount	Average Δd	*t*-stat Avg. Δd
1	0.0378		
2	0.0657	0.0279	2.64
3	0.0824	0.0167	1.05
4	0.1019	0.0195	1.22
5	0.1149	0.0130	0.55
6	0.1243	0.0094	1.36
7	0.1382	0.0139	1.19
8	0.1410	0.0028	0.44
9	0.1591	0.0181	2.02
10	0.1551	-0.0039	-0.58
11	0.1574	0.0022	0.20
12	0.1498	-0.0076	-0.80

Table 4. Simulations for the Present Value of the Management Fees for Funds of Funds

Notes: The expected return in the absence of any fund of funds fees is 0.15 per year. The discount rate for all cash flows from this underlying portfolio is 0.15 minus management skill. For each fund the simulations use the fund-specific base management fee, incentive fee, and hurdle rate. We report the average for present value of fees and the standard deviation (in parentheses) for the present value of fees across the twenty-six fund of funds. The present value of (each component of) fees for each fund is itself an average from 10,000 fund-specific return simulations. The simulation methodology is discussed in greater detail in the text.

Average Present Value of the Components of Simulated Fees as a Fraction of Simulated Price (Payout Ratio = 0.33)

Present Value of Fees	**Management Skill**				
	-2%	**-1%**	**0**	**1%**	**2%**
Management Fee	0.2359	0.2320	0.2212	0.2238	0.2253
	(0.0932)	(0.0941)	(0.0901)	(0.0905)	(0.0899)
Incentive Fee	0.1571	0.1592	0.1645	0.1607	0.1574
	(0.1460)	(0.1465)	(0.1498)	(0.1468)	(0.1456)
Total Fee	0.3930	0.3912	0.3856	0.3844	0.3827
	(0.2140)	(0.2149)	(0.2111)	(0.2113)	(0.2098)

Average Present Value of Total Simulated Fees as a Fraction of Simulated Price

Payout Ratio	**Management Skill**				
	-2%	**-1%**	**0**	**1%**	**2%**
0.20	0.6422	0.6386	0.6358	0.6342	0.6340
	(0.3522)	(0.3497)	(0.3479)	(0.3475)	(0.3487)
0.33	0.3930	0.3912	0.3856	0.3844	0.3827
	(0.2140)	(0.2149)	(0.2111)	(0.2113)	(0.2098)
0.50	0.2597	0.2597	0.2584	0.2574	0.2564
	(0.1422)	(0.1420)	(0.1419)	(0.1409)	(0.1399)
0.66	0.1958	0.1948	0.1941	0.1935	0.1932
	(0.1089)	(0.1068)	(0.1071)	(0.1057)	(0.1049)
1	0.1284	0.1283	0.1287	0.1294	0.1302
	(0.0709)	(0.0695)	(0.0701)	(0.0709)	(0.0716)

Table 5. Simulations for the Gross Value of Funds of Funds

Notes: The expected return in the absence of any fund of funds fees is 0.15 per year. The discount rate for all cash flows from this underlying portfolio is 0.15 minus management skill. For each fund the simulations use the fund-specific base management fee, incentive fee, and hurdle rate. We report the average for value added as a fraction of NAV and the analogous standard deviation (in parentheses) across the twenty-six fund of funds. We calculate value added for each fund as the sum of the average ratio of traded price to NAV six months after the IPO of fund of funds (actual data) plus the average simulated present value of total fees to NAV. These calculations are based on the present value of (each component of) fees for each fund which is itself an average from 10,000 fund-specific return simulations. The simulation methodology is discussed in greater detail in the text.

Gross Value as a Fraction of NAV

Payout Ratio	**Management Skill**				
	-2%	**-1%**	**0**	**1%**	**2%**
0.20	1.4332	1.4299	1.4274	1.4262	1.4261
	(0.4527)	(0.4494)	(0.4478)	(0.4480)	(0.4498)
0.33	1.2136	1.2120	1.2071	1.2060	1.2046
	(0.3218)	(0.3215)	(0.3184)	(0.3182)	(0.3173)
0.50	1.0963	1.0962	1.0951	1.0942	1.0933
	(0.2578)	(0.2567)	(0.2567)	(0.2561)	(0.2555)
0.66	1.0401	1.0389	1.0384	1.0378	1.0375
	(0.2302)	(0.2269)	(0.2272)	(0.2266)	(0.2261)
1	0.9805	0.9804	0.9807	0.9815	0.9822
	(0.1996)	(0.1985)	(0.1992)	(0.2000)	(0.2009)

Table 6: LPE Discount in Event Time

Notes: This table reports the average discounts in event time for listed private equity funds.

$$\text{Discount} = 1 - \frac{\text{Price}}{\text{Net Asset Value}}.$$

Δd is the change in discount relative to previous event month. Event month 1 is the first month after the initial public offering; event month 2 is the second month, and so on.

Event Month	Average Discount	Average Δd	*t*-stat Avg. Δd
1	-0.0408		
2	-0.0448	-0.0042	-0.53
3	-0.0331	0.0117	2.25
4	-0.0376	0.0000	0.00
5	-0.0266	0.0085	1.51
6	-0.0188	0.0047	0.77
7	-0.0170	-0.0006	-0.10
8	-0.0152	0.0064	1.23
9	0.0154	0.0307	2.08
10	-0.0004	-0.0090	-0.96
11	0.0096	0.0100	1.72
12	0.0174	0.0090	1.12

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	0.0002	-0.0005	-0.0017	-0.0023
	(0.0051)	(0.0058)	(0.0035)	(0.0042)
MSCI World	0.9227***		0.8384***	
	(0.1956)		(0.1827)	
S&P 500		0.7999***		0.7071***
		(0.2128)		(0.2026)
R^2	0.3881	0.3043	0.3843	0.2851
Observations	180	180	180	180

*** - 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 FOFs 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	-0.0023	-0.0038	-0.0045	-0.0058
	(0.0060)	(0.0068)	(0.0041)	(0.0048)
MSCI World	0.9943***		0.9093***	
	(0.2272)		(0.1924)	
S&P 500		0.9244***		0.8338***
		(0.2498)		(0.2173)
SMB	0.4354***	0.5421***	0.5389***	0.6349***
	(0.1344)	(0.1532)	(0.1463)	(0.1648)
HML	0.3529	0.3912	0.3949*	0.4236*
	(0.2192)	(0.2470)	(0.2221)	(0.2426)
MOM	0.0609	0.0876	0.0543	0.0756
	(0.0786)	(0.0895)	(0.0566)	(0.0540)
R^2	0.4507	0.3954	0.4937	0.4299
Observations	180	180	180	180

* - Significant at the 10% 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 FoFs 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-meaned 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	0.0004	0.0006	0.0006	-0.0012	-0.0015	-0.0015
	(0.0037)	(0.0038)	(0.0034)	(0.0028)	(0.0028)	(0.0027)
MSCI World	0.7961***	0.7270***	0.7101***	0.7587***	0.7152***	0.7045***
	(0.1142)	(0.1066)	(0.0972)	(0.1335)	(0.1163)	(0.1152)
GDP growth	0.0204**		0.0087*	0.0129**		0.0055*
	(0.0079)		(0.0045)	(0.0050)		(0.0029)
Credit spread		-0.0261***	-0.0212***		-0.0166***	-0.0133***
		(0.0049)	(0.0051)		(0.0041)	(0.0040)
R^2	0.4874	0.5458	0.5583	0.4318	0.4594	0.4654
Observations	180	180	180	180	180	180

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

Table 10. Relation between returns on Private Equity Performance Index (PEPI), FoF, LPE and MSCI World indices

Notes: This table examines the lead-lag relation returns on PEPI and FoF, LPE and MSCI World indices. The dependent variable is the quarterly return on PEPI, reported by Thomson Reuters and the National Venture Capital Association (NVCA) from Q1 of 1994 until Q3 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**
Intercept	0.0153**	0.0149**	0.0137**	0.0122*	0.0093*	0.0088**
	(0.0062)	(0.0062)	(0.0054)	(0.0062)	(0.0048)	(0.0045)
MSCI World	0.3863***		0.2677***		0.3355***	0.3480***
	(0.0469)		(0.0444)		(0.0407)	(0.0350)
MSCI World (Lag)						0.0867*
						(0.0526)
LPE FoFs		0.2593***	0.1268***	0.2381***	0.0596**	0.0476**
		(0.0244)	(0.0270)	(0.0235)	(0.0249)	(0.0217)
LPE FoFs (Lag)				0.0925**	0.1450***	0.1071***
				(0.0408)	(0.0316)	(0.0355)
R^2	0.4879	0.4152	0.5414	0.4604	0.6439	0.6565
Observations	59	59	59	58	58	58

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

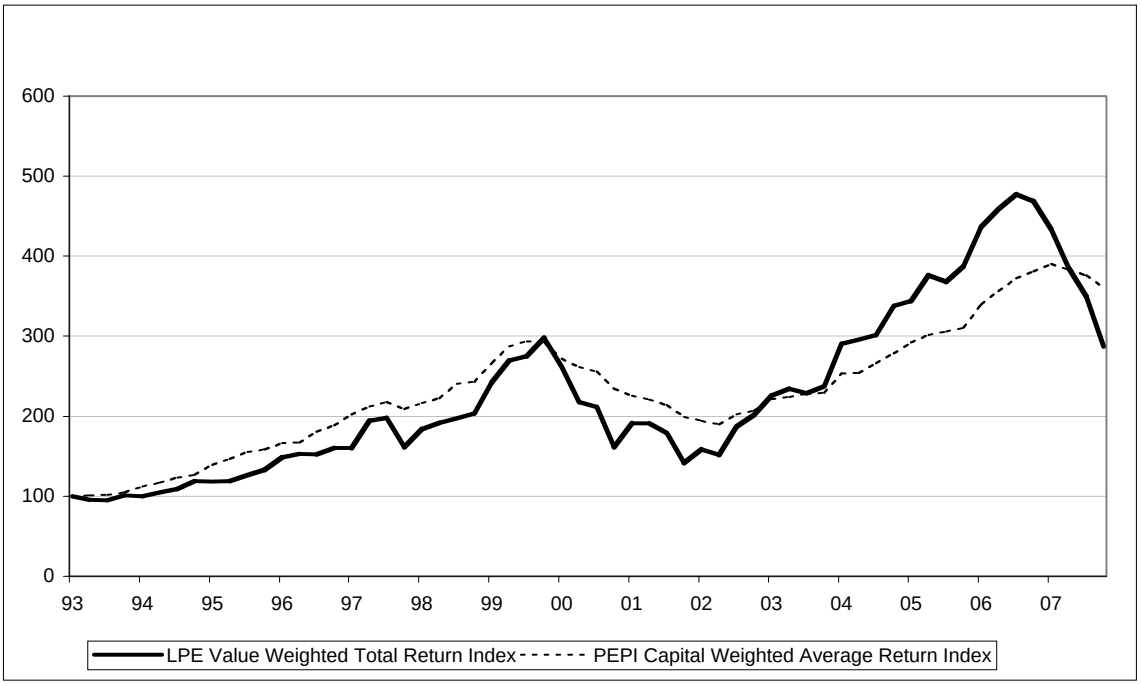

Figure 1. Cumulative Returns on Listed Private Equity Index (LPE) and Private Equity Performance Index (PEPI), 1994 -2008