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FINANCIAL INTERMEDIATION IN PRIVATE EQUITY: HOW WELL DO FUNDS OF FUNDS PERFORM?

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ABSTRACT

This paper focuses on funds of funds (FOFs) as a form of financial intermediation in private equity (both buyout and venture capital). After accounting for fees, FOFs provide returns equal to or above public market indices for both buyout and venture capital. While FOFs focusing on buyouts outperform public markets, they underperform direct fund investment strategies in buyout. In contrast, the average performance of FOFs in venture capital is on a par with results from direct venture fund investing. This suggests that FOFs in venture capital (but not in buyouts) are able to identify and access superior performing funds.

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1. Introduction

This paper analyses funds of funds (FoFs) as a form of financial intermediation in private equity. While there is a large literature on direct fund investing in private equity, there is scant evidence on FoFs which themselves invest in these direct funds. Compared to hedge funds or publicly traded stocks, private equity investments in direct funds are illiquid, not easily scaled and have high search and monitoring costs. By pooling capital across investors, FoFs create a second level of intermediation that potentially provides specialized investment skills, diversification and lower cost services (e.g. due to economies of scale) for investors wanting exposure to private equity. Against these advantages must be weighed the additional fees charged by the FoF manager.

We benchmark FoF performance, net of their fees, against both public equity markets and strategies of direct fund investment. Our research takes advantage of detailed, fund-level cash flows and the net asset values of unrealized investments, from Burgiss on both FoFs and direct funds. The returns obtained by investors in direct funds have previously been analyzed by Harris, Jenkinson and Kaplan (2014 and 2016), but this is the first paper to consider the returns achieved by FoFs using such detailed data. We also have information on the number and type of direct funds that are included in FoFs, which enables us to understand the types of portfolios they create for their investors, and to benchmark the performance of FoF against randomly selected portfolios of direct funds. As with previous research on private equity, we distinguish between buyout and venture capital (VC) investments.

We find that FoFs – both in buyout and VC – have generated returns equal to or above those from investing in public equities over the entire sample period. Harris, Jenkinson and Kaplan (2014) find that direct funds have out-performed public markets over the same sample period, and so the extra layer of financial intermediation does not reverse this finding. As a result,

exposure to private equity through FoFs would have increased returns relative to public equities, although investors would have borne illiquidity costs associated with private equity investing. These higher returns are after accounting for fees that occur at both the FoF and direct fund level. Our measures of FoF performance are through year-end 2012 and cover FoFs that started in years 1987 through 2007.

When we compare FoFs to direct fund investing, we find significantly lower returns for FoFs that focus on buyouts or are generalist funds compared with portfolios formed by "random" direct fund investing in similar direct funds. In contrast, FoFs in VC perform roughly on a par with portfolios of direct funds, even after the additional fees. Moreover, strategies for investing in direct funds may be constrained by limits on fund access or manager selection skills. We show that VC FoFs often outperform direct investing handicapped by these limitations. In addition, given the highly-dispersed nature of direct fund returns in venture, VC FoFs create more risk reduction through diversification than is the case for buyouts. In general, our results suggest that FoFs focusing on VC provide more advantages than those investing in buyout funds.

The remainder of the paper is structured as follows. In Section 2, we discuss the role of FoFs as financial intermediaries in private equity as well as related research on the performance of direct private equity funds. In Section 3, we explain our metrics of performance and data. In Section 4, we study FoF performance, both in absolute terms and relative to investments in public equity. In Section 5, we look at the types of portfolios formed by FoFs and compare their performance to single direct funds. In Section 6, we compare FoFs to strategies of direct fund investing by forming synthetic FoFs (portfolios of direct funds) as performance benchmarks; we also examine the effects of aggregate capital flows on FoF performance. In Section 7, we consider the impact of constraints on direct fund investing, in particular the limited ability of investors to access the funds run by managers with good prior performance. In Section 8, we

provide rough estimates of the internal costs that would be necessary to justify the use of the different types of FoFs given our results. We summarize our results and discuss their implications in Section 9.

2. Financial intermediation by funds of funds in private equity

There is a large literature in economics on financial intermediaries. The explanations for intermediation typically depend on either transactions costs or information advantages.[1] Transactions costs arguments rely on the intermediary's ability to pool capital and supply lower cost services (e.g. due to economies of scale). Other explanations cite advantages that an intermediary can provide due to superior information.

In private equity, the first level of intermediation occurs with the formation of direct funds. Rather than investing directly in individual companies, investors become limited partners (LPs) in a direct private equity fund set up by a private equity manager which acts as the general partner (GP) of the fund. In turn, the "direct" fund makes the investments in companies. The GPs are the active managers of the fund's resources and supply expertise, effort and networks to make and structure investments in their portfolio companies, participate in value creation by those firms, and manage the realization of the investments. GPs supply a small part of the capital and receive management fees and a fraction of the profits ("carried interest") from the investments in the underlying companies. Though terms vary across funds, a typical fee structure is "2 and 20" –

[1] See Fang, Ivashina and Lerner (2015) for a brief overview of financial intermediation and selected references.

the GP gets an annual management fee of 2% of committed capital (usually less than 2% in the case of a large buyout fund, and sometimes more than 2% in the case of a small VC fund) and receives 20% of the gains when the fund exits its investments.[2]

LP investments in direct funds are illiquid, relatively undiversified, not easily scaled, and have high search and monitoring costs.[3] Given the costs and frictions in direct fund investment, FoFs provide a second level of intermediation. GPs set up a FoF to provide specialized expertise and services for investing in direct funds.[4] The end investor becomes an LP in the FoF, which in turn is an LP in direct funds. Most FoFs are "primary" and make capital commitments to direct funds when those funds are raising capital.[5] In contrast, "secondary" FoFs provide liquidity to LPs by purchasing their existing interests in one or more direct funds. In this paper we focus on primary FoFs.

To provide valuable intermediation, a FoF must create a profile of return and risk that is better than investors can otherwise achieve. Potential advantages offered by a FoF must, however, be weighed against their extra layer of fees. Mirroring fee structures for direct funds, FoFs charge annual management fees on capital and often take a carried interest. Surveys suggest that FoFs charge management fees of around 1% (or less) annually with a carried interest of 5%.[6] As a

[2] In practice, the definition of management fees and carried interest involves several complications. For instance, the management fee is typically levied on committed (not invested) capital during the "investment period" and then remaining invested capital thereafter. And carried interest may not be paid unless a minimum hurdle rate (such as an internal rate of return of 8%) is exceeded. For more information on the economics of private equity funds see Metrick and Yasuda (2010) and Robinson and Sensoy (2013).

[3] In light of these issues, the U. S. government restricts private equity fund investments to qualified investors who meet wealth thresholds and are deemed able to bear the risks and illiquidity of the asset class.

[4] The firm that creates a FoF (e.g. HarbourVest Partners, LLC) is typically a registered investment adviser under the Investment Advisers Act of 1940.

[5] Some primary FoFs will also participate in co-investment opportunities offered by GPs, which incur much lower (or zero) management fees and carried interest, thereby offsetting some of the costs of using a FoF.

[6] Based on surveys of FoFs, Dow Jones (2010) report a median (mean) management fee of 1% (.94%). About two-thirds of all FoFs charged management fees in the range of 76 to 100 basis points and about three-fourths scale down the fee in the later years of the fund. For primary FoFs, the median (mean) carried interest

comparison, Fang, Ivashina and Lerner (2015) report that large institutional investors, who can take advantage of economies of scale in-house, have annual costs of investing in direct funds of about 0.11% of committed capital.

In 1979, Adams Street Partners established the first private equity FoF for institutional investors. Thirty years later, FoFs accounted for about 12% of the capital raised by private equity funds during the decade ending 2009.[7] While each FoF is different, three benefits are frequently cited by LPs.

The first potential benefit is cost-effective diversification. Unlike investing in public equity, investors cannot purchase low cost, well-diversified portfolios across the private equity asset class or its sub-components. Moreover, direct funds often have substantial minimum investment levels (often $5 million for an institutional client) as well as limitations on the maximum investment by any LP. Some institutional portfolios are too small to provide cost effective diversification across direct funds, including across company life cycles, sectors, vintage years and geography. Such an investor might use a FoF to effectively "scale up" and participate in more and larger funds than would be possible with its investment base alone. Conversely, a larger investor can use a FoF to "scale down" its allocation to invest across a variety of direct funds in smaller pieces than it would normally consider. Primary FoFs make capital commitments to a number of direct funds spanning a number of vintage years. As part of

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is 5% (5.2%) and four-fifths had carried interest of less than 10%. Secondary FoFs, on average, charged slightly higher carried interest with a median (mean) of 6% (6.9%). For the vast majority of FoFs, carried interest is subject to a preferred return, most often in the range of 8%; that is the GP does not participate in profits until after the preferred return is earned. Dow Jones conducted this survey for a number of years but has not continued the publication after 2010. Informal evidence suggests that fees and carried interest have fallen on FoF in recent years (after the end of our sample period).

[7] These figures come from Harris, Jenkinson and Stucke (2010) based on Preqin fundraising data. The 12% figure includes both primary and secondary FoFs. For each year in that decade, FoFs accounted for over 10% of capital raised. Since 2009, FoF fundraising has fallen to a lower percentage. For instance, Preqin (2013) reports FoF fundraising at 8% in 2010, 7% in 2011 and 6% in 2012.

providing these diversification services, the FoF may be able to take advantage of economies of scale in areas such as fund administration and liquidity management.

A second service provided by FoFs is fund selection and monitoring. Some investors (e.g. smaller institutions or those unable to provide competitive compensation) may find it cost prohibitive, or impossible, to employ the necessary expertise and people to perform the required due diligence and to make informed decisions on direct funds. FoFs serve as an intermediary to provide the expertise that can be particularly important when dealing in geographies, industries or sectors in which the investor has limited or no experience.

A third potential advantage of FoFs is the ability to gain access into otherwise unattainable investments. The conventional wisdom for investors in direct private equity funds is to invest in partnerships that have performed well in the past – so-called top quartile funds. This conventional wisdom is based on the belief that performance in private equity persists across direct funds for the same partnership. Top-performing GPs may choose to limit direct fund size rather than raise fees, and established FoFs may have privileged access as a result of investing in earlier funds. Similarly, some investors are offered co-investment opportunities to invest additional funds directly into particular portfolio companies, typically with no fees or carried interest charged (see Fang, Ivashina and Lerner, 2015, and Braun, Jenkinson and Schemmerl, 2017). FoFs may – due to their relationships with the GPs and experience in executing such investments – be offered more such opportunities.

A survey of LP investors (Preqin, 2014) finds that the most cited reason for investing in private equity FoFs is diversification (63% of respondents). Other factors noted by respondents are manager expertise (37%), access to specific markets (34%), lack of resources (32%), access to specific funds (26%), size of portfolio (16%) and lack of experience (13%). Clearly, these

cited reasons are not mutually exclusive, but match closely the three main potential roles we identify for FoFs.

Past research on FoFs in other alternative asset classes, such as hedge funds, often questions the value of their performance.[8] However, the higher illiquidity costs and information asymmetries in private equity relative to hedge funds may lead to higher intermediary benefits for private equity FoFs than in the hedge fund industry. To date there is scant research on FoFs in private equity.[9]

Other research on private equity suggests that factors affecting value created by FoFs as intermediaries may differ between venture capital and buyout funds, and may have changed over time as the private equity industry has developed. Lerner, Schoar and Wongsunwai (2007) study LP investments in direct funds from 1991 to 1998 and find that FoFs have relatively poor performance. At the same time, they find that endowment investors (notably educational and other nonprofit institutions) earn private equity returns superior to those of other institutional investors. They attribute this result to endowments having advantages in evaluating and gaining access to private equity funds compared to other institutional investors.

These relationships may have changed. Sensoy, Wang and Weisbach (2014) study fund investments in the 1990s and 2000s, and report that endowments do no better (in fact worse) than

[8] Brown, Goetzmann and Liang (2004) find that individual hedge funds dominate FoFs on an after-fee return or Sharpe ratio basis. Fung et al. (2008) study hedge fund FoFs over the decade 1995 to 2004 and find that the average FoF delivers alpha only in the period between October 1998 and March 2000. They do find, however, that a subset of FoFs consistently delivers alpha. Ang et al. (2008) argue that FoFs need to be compared to direct fund portfolios that would be available to investors in the absence of FoFs and conclude that hedge FoF performance justifies the extra layer of fees. However, as an illustration of the important differences between hedge funds and private equity, in studying illiquid assets Cornelius et al (2013) explicitly exclude hedge funds and limit their focus to private equity and real assets.

[9] Preqin and other industry sources provide useful reports on private equity FoFs. Gresch and von Wyss (2011) study a small sample of private equity FoFs using Preqin data but are unable to calculate PMEs. Studying IRRs and multiples of investment capital, they compare FoFs to investments in single direct funds and conclude that the low dispersion of FoF returns makes them attractive compared to direct funds of the same vintage year. They do not look at portfolios of direct funds nor do they control for vintage year differences between FoFs and the direct funds in which they invest.

other institutional investors in the later vintage years (1999-2006). The outperformance of endowments in the 1990s was largely due to greater access to top-performing VC funds. They point to the "general maturing of the industry" as a wide array of investors (in addition to endowments) have gained experience with private equity. If more institutional investors have developed the skills and relationships to pursue private equity investing, the value proposition of a FoF may appeal to fewer investors than in earlier periods. Moreover, a wide array of consultants and advisors compete with FoFs to supply services to investors.[10]

Consistent with the results in Sensoy, Wang and Weisbach (2014), recent research shows that the persistence of GP performance has weakened over time for buyout funds. Kaplan and Schoar (2005) find that direct funds in both buyout and venture capital had significant performance persistence in earlier years (before 2001). More recently, however, Harris, Jenkinson, Kaplan and Stucke (2014) find that while persistence has persisted in venture capital, it has eroded for buyout funds after 2000. Because direct buyout funds have become a larger part of private equity investments, this drop in persistence may have eroded any "access value" offered by buyout FoFs.[11]

3. Measures of performance and data

We compare FoFs to two alternative forms of investments. The first is public equities. Unlike private equity investments, public markets provide investors with liquid, cost-effective ways to create diversified portfolios. Thus, for investors without the capabilities to navigate direct fund investing, the public equity route is a potentially attractive alternative to a FoF.

[10] Recently, some providers have offered products constructed as diversified portfolios of public stocks that they claim track private equity performance. It is too early to tell how these will perform and how widely they will be used. They do, however, offer potential competition to FoFs.

[11] One caveat to the Sensoy et al. findings is that the data set they use, unlike the one we use in this paper, may not include performance results for the top performing VC partnerships in the latter part of the sample. In recent years, top VC GPs have avoided LPs who make their performance results public.

We use the public market equivalent (PME) from Kaplan and Schoar (2005), which compares an investment in a private equity fund to an equivalently timed investment in the relevant public market index. The PME calculation discounts (or invests) all cash distributions to, and any residual value of, the fund at the public market total return and divides the resulting value by the value of all cash contributions discounted (or invested) at the public market total return.[12] The PME can be viewed as a market-adjusted multiple of invested capital (net of fees). A PME of 1.30, for example, implies that at the end of the fund's life, investors ended up with 30% more than they would have if they had invested in the public markets. Sorensen and Jagannathan (2015) note that the Kaplan-Schoar PME measure provides a valid economic performance measure regardless of the risk of the underlying private equity investments.[13]

A second alternative to FoFs is to invest directly into private equity funds. Benchmarking FoFs against direct funds brings up the inevitable question of what direct fund portfolio investors could create on their own. If each investor could readily and cost-effectively navigate direct fund investing, the economic rationale for a FoF would disappear.[14] Our approach is to compare an actual FoF's PME against a distribution of PMEs for synthetic FoFs. These synthetic FoFs are formed as portfolios of randomly chosen direct funds drawn from the set of all direct funds which fit a set of investment criteria. The FoF is matched to the investment criteria using its vintage year and investment focus (e.g. buyout or venture capital). Such synthetic FoFs capture diversification benefits absent in single direct funds. As an example, we match a FoF that specializes in buyouts against synthetic FoFs from a "naïve" investment strategy of randomly picking direct funds that have the same strategy (i.e. buyout) and are spread over a number of

[12] Harris, Jenkinson and Kaplan (2014) provide more detailed discussion of PMEs and the role of residual Net Asset Values when funds are not fully liquidated.

[13] Their model assumes investors have log-utility preferences.

[14] Ang, Rhodes-Kropf and Zhao (2008) discuss the general issue and study FoFs investing in hedge funds.

vintage years. The PME of each of these synthetic FoFs is calculated resulting in a distribution of PMEs.

Because all our performance measures are net of fees, FoFs would, on average, have lower returns than direct funds unless they can create above average performance in their direct fund investments by choosing better performing funds. For a given investor, these results shed light on the tradeoff in using FoFs given the investor's capabilities and feasible alternative investment strategies.

To conduct our analysis we use data on fund-level, timed cash flows and fund valuations from Burgiss. This research-quality database was first used by Harris, Jenkinson and Kaplan (2014), and is sourced from a broad base of over 200 institutional investors, who use Burgiss' systems for audit and performance measurement. The data is cross-checked for accuracy by comparing the records of different investors in the same fund.

Our data measure performance through December 31, 2012. We restricted our study to FoFs with vintage years in 2007 and earlier. This allows five years for the FoF to make investments prior to our analysis of performance. Few commercial providers have such detailed, high-quality data, although they often have large samples of self-reported IRRs and investment multiples.[15]

There are 294 primary FoFs for which Burgiss assign a vintage year of 2007 and earlier.[16] Burgiss categorizes private equity FoFs as buyout, venture capital or generalist.[17] The generalist

[15] Harris, Jenkinson and Kaplan (2014) provide a more detailed discussion of the advantages of Burgiss data, the nature of other data sets and how the data sets compare. That research's conclusions lead us to doubt that Burgiss data have an overall positive or negative bias in terms of performance.

[16] Burgiss classifies a vintage year as the year in which a fund first draws capital from its LPs. Burgiss also provides the geographic focus of the fund, Of the 294 funds, 222 focus on North America with most of the rest focusing on Europe.

[17] Burgiss produced a new private capital classification system in 2016, with equity FoF being classified as venture capital, expansion capital or generalist. Previously, buyouts had been included in a slightly broader 'corporate finance' category, which included some debt-equity hybrid investments (such as mezzanine and distressed debt). In this paper, we use the current classification.

category has a mix of corporate finance and venture capital. As we report later, one interesting finding is that FoFs tend to provide diversification not only across funds within a particular investment class, but often diversify across classes as well. For instance, some FoFs that predominately invest in buyout funds also include some VC fund investments.

As part of our comparison of FoF performance, we also use cash flows for the direct funds in the Burgiss database (through vintage year 2012). We state all cash flows in US dollars. Our data do not contain the names of the FoFs or the underlying direct funds. While we cannot link a FoF to the specific direct funds in which it invests, we have some information on portfolio composition through year-end 2012 for a subset of our FoF sample. These holdings data include the count and weight (percent of committed capital) of the underlying direct funds in each of the FoFs by vintage year and sub-asset class.

4. Fund of fund absolute performance and performance relative to public markets

Table 1 compares Burgiss data to a FoF sample drawn from Preqin, an alternative commercial data source. While Preqin has summary performance data for a larger number FoFs, it does not have cash-flow data needed to compute PMEs for more than a modest subset.[18] As a result, Table 1 reports two metrics widely used by funds and investors to gauge absolute performance. The first measure is the LP's annualized internal rate of return (IRR) based on fund contributions and distributions. The distributions include the estimated value of any unrealized investments (or residual value) as of the last reporting date. The second measure is the multiple of invested capital (MOIC), also referred to as the ratio of total value to paid in capital (TVPI). The

[18] Preqin's data is largely derived from Freedom of Information Act requests, where investors provide information on cash invested, realizations and net asset values on a quarterly basis. It is, therefore, a quarterly aggregation of the cash flows, rather than the individual, timed cash-flows in the Burgiss data. Preqin reports the first fund of funds in vintage year of 1979 but typically has only one observation per vintage year until the late 1980s and hits double digits only in 1997.

multiple's numerator is the sum of all fund distributions and the value of unrealized investments. The denominator is the sum of all fund contributions by LPs. Given the relatively short history of the FoF industry, it is only in the late 1990s that individual vintage years have more than a few observations. This makes it impossible to provide reliable vintage year averages for earlier years. The first vintage year that has coverage in the Burgiss data is 1987, but 1997 is the first year with more than three observations.

Table 1 shows that the absolute performance measures are similar across the two samples. For FoFs with vintage years 1997-2007, the sample average IRR is 6.7% for the Burgiss sample and 7.2% for Preqin. Sample average TVPIs for this period are also similar for the two groupings, respectively 1.31 and 1.27. Medians and averages of vintage year figures confirm the similarity across samples. Thus across our sample period, Table 1 shows our set of FoFs from Burgiss have performance consistent with that of the larger Preqin sample for which detailed cash flow data are not available. A notable feature in Table 1 is the high absolute performance in the early days of the FoF industry: IRRs and money multiples are much higher for funds started prior to 1997.

Of more interest than these absolute return measures is performance relative to pubic markets. Figure 1 plots the overall distribution of PMEs for FoFs using the Burgiss sample.[19] Panel A shows that FoFs have outperformed the broad market average as measured by the S&P 500. Across all FoFs in the Burgiss sample, the average PME using the S&P 500 is 1.13 which is significantly above one (p-value < 0.01). The median PME is 1.08. Panel B charts PMEs against the Russell 2000, an index for smaller publicly traded firms which is sometimes used by LPs as a benchmark. PMEs against the Russell 2000 are generally lower than those using the S&P 500 but

[19] We cannot compute PMEs for the Preqin sample since detailed cash flow data are unavailable. Given the similar absolute performance measures by vintage year shown in Table 1 for the Preqin and Burgiss samples, we would expect the Preqin sample to have PMEs very similar to those shown in Figure 1. Harris, Kaplan and Jenkinson (2014) show the close empirical relationship between absolute measures of performance and PMEs.

remain above 1.0 on average. Across all funds of funds, the average is 1.04 (statistically greater than 1.0 at the 0.08 level). The median is 1.0.

Table 2 segments the PMEs by vintage year. The average PME using the S&P 500 is one or above in each vintage year shown. Median figures display a similar pattern of outperformance. PMEs are especially high in the early years, with an average PME of 1.49 in the 1997 vintage and 1.59 for earlier years. PMEs using the Russell 2000 are, since 1996, lower (especially for the 1998 and 1999 vintage years for which the average PME is below 0.90) and, like those using the S&P 500, display strong outperformance in the early vintage years.

It is worth mentioning that the top quartile of FoFs have PMEs (relative to the S&P 500) above 1.0 in every vintage year. As with investing directly, this suggests that it would be desirable to be able to choose and access top performing FoFs, particularly if that performance persists.

Earlier research (Harris, Jenkinson and Kaplan, 2014) documents that direct VC funds performed exceptionally well for vintages in the 1990s, but then saw a dramatic drop. Table 3 segments our FoF sample into three categories: buyout, generalist and VC. Due to the limited number of observations in some years, we aggregate over vintage-year groupings. Using the S&P 500, Panel A of Table 3 shows that all three FoF categories have mean PMEs significantly above one. Moreover, Table 3 echoes the findings for direct VC funds that show dramatic shifts in venture performance over time.

For VC FoFs, Panel A reports a mean PME of 1.16 over the entire sample (significantly different from one at the 0.02 level). The performance is exceptionally strong for the vintages prior to 1998 with a mean (median) PME of 2.02 (2.00). This drops off dramatically thereafter: for the next four vintages (1998-2001) the average PME is below 0.90. Such trends reflect FoF investments in direct funds from a number of vintage years after the FoF's launch. Panel A also

shows that the median PME for venture FoFs is 1.01, well below the mean. This gap reflects the variability of returns in VC investing—a topic to which we return later.

Panel A also displays that buyout FoFs have outperformed the S&P 500. The mean PME for buyout FoFs is 1.14 over the sample period (significantly different from one at the 0.01 level); the median is 1.11. Buyout FoF mean and median PMEs are consistently above 1.0 over the sample period, but less so at the end of the sample period (from 2004 onward). This pattern echoes the findings that direct buyout funds show PMEs well above 1.0 before 2006, but close to 1.0 since 2006 (see Harris, Jenkinson and Kaplan (2014 and 2016)). Generalist FoFs (which invest in both venture and buyout) have a mean PME of 1.10 (significantly different from one at the 0.01 level) against the S&P 500 and a time pattern of results closer to buyout than to venture. The median PME figure for generalists is 1.09.

Panel B of Table 3 replicates Panel A using the Russell 2000 as a benchmark. Consistent with the overall sample results shown earlier, PMEs against the Russell 2000 are lower for the sample: means of 1.04 for buyouts, 0.98 for generalist and 1.12 for venture. Only the mean PME for buyouts is still significantly different from one (at 0.02 level). Median PME values are also lower in Panel B.

Overall, Figure 1, Table 2 and Table 3 indicate that, historically, FoFs have provided returns above those of the S&P 500. FoFs have also, on average, had returns equal or above the Russell 2000 though the margin of outperformance is narrower. This outperformance is after fees since all performance measures are based on the net-of-fee cash flows to LPs. In addition, Table 2 shows that the high absolute performance in the early years of the industry (IRRs and MOICs in Table 1) also corresponds to higher performance relative to public markets.

A more complete analysis of FoF benefits to investors requires comparison of FoF and direct fund performance, which we turn to in the next section. It does appear, however, that on average, FoFs have historically provided returns higher than those in public markets.

5. Funds of funds and direct fund investing

As a first step in comparing FoFs and direct funds, Table 4 presents simple regressions to investigate performance differences between FoFs and single direct funds. Fund performance, using data from both individual FoFs and individual direct funds, is regressed against a zero-one dummy variable which equals 1 for a FoF and 0 for a direct fund. All regressions incorporate vintage year fixed effects.

Panel A measures performance relative to the S&P 500. Regression I includes all FoFs and direct funds. The coefficient, equal to -0.07, significant at the 0.05 level, indicates that the average PME for FoFs is almost 7% less than the comparable PME for direct funds. Regressions II through IV segment the sample. Regression II includes only buyout funds (both FoF and direct) and hence compares funds investing in this sub-asset class. Regression III includes only VC funds while regression IV includes generalist FoFs and all direct funds. FoFs who are generalists (regression IV) or specialize in buyouts (regression II) have significantly lower PMEs than direct funds – 11% to 12% less. In contrast, VC FoFs (regression III) have PMEs that are not statistically different from those achieved by direct VC fund investing.[20] The results in Panel B for the Russell 2000 are nearly identical, both qualitatively and quantitatively.

The differences in Table 4 across FoF categories are striking. They suggest that VC FoFs perform quite differently from FoFs in other areas of private equity. Yet Table 4 compares single

[20] Regressions, not shown, find that PMEs for FoFs focusing outside North America were not significantly different from the rest of the sample.

FoFs to single direct funds. This approach fails to capture the main reasons, as noted earlier, many LPs say they invest in FoFs – namely diversification.

The diversification benefits delivered by FoFs depend on the nature of the underlying variability in direct fund performance. To illustrate, Figure 2 plots the distribution of PMEs (against the S&P 500) for our sample of direct funds. Across direct buyout funds, Panel A shows a standard deviation of 0.55. For direct VC funds, Panel B shows a more dispersed distribution with a standard deviation of 1.78. The higher standard deviation for VC reflects higher variation across funds in the same vintage year as well as more variation over time in performance. Panel B also displays a pronounced gap of 0.37 between mean and median PMEs. Direct VC funds thus have much more dispersed performance with the mean boosted upwards by the spectacular performance of very successful funds. In contrast, the spread between mean and median PMEs for direct buyout funds (Panel A) is only 0.08. The contrast between Panels A and B suggests a more important role for FoFs in venture capital to diversify across direct funds and vintage years, and, potentially, to gain access to the top-performing direct funds.

FoFs diversify across funds and show, as expected, smaller dispersion in performance than single direct funds. Moreover, the reduction in dispersion is much more pronounced in venture than in buyout. Across our sample of venture FoFs, the standard deviation of PMEs against the S&P 500 is 0.57, about one-third of the comparable value (1.78) for direct VC funds; and for venture FoFs the gap between mean and median PME is 0.15, less than half the gap for direct VC funds. For buyout FoFs, the standard deviation of PMEs is 0.24, about half the value (0.55) for direct buyout funds; and the gap between the mean and median is 0.03 compared to 0.08 for direct buyout funds. Overall the figures show, not surprisingly given the higher underlying variability in direct venture fund performance, that venture FoFs have higher dispersion in

performance than FoFs focusing on buyout. That said, venture FoFs appear to provide larger risk reduction benefits relative to single funds than do FoFs focusing on buyout.

The natural benchmarks for FoFs are portfolios of direct funds, not single direct funds. What types of portfolios do FoF managers create for their LPs? To address this question, we use detailed information on portfolio composition, which is available for a subset of our sample. The first block of columns in Table 5 summarizes results for all 190 FoFs for which we have portfolio information. The columns show patterns of diversification across funds and vintage years. The mean (median) number of direct funds held is 25.6 (22.5). Moreover, FoFs commit, on average, 18.6% of their capital to direct funds in their first year (i.e. their vintage year).[21] The average for year 2 is 32.9%. By the end of year 3, on average almost 80% of the capital is committed, and by year 4 over 90%.

The subsequent columns in Table 5 report the results for the FoF categories. FoFs focusing on buyouts tend to hold fewer funds that do generalists or VC FoFs. This appears consistent with higher benefits of diversification in venture because of the underlying variability of returns. There are similar patterns of vintage year diversification across buyout, generalist and VC FoFs.

As would be expected, buyout FoFs commit the vast majority of their capital to direct buyout funds: 87.2% of capital for the median fund. Many buyout FOFs have meaningful allocations to direct funds investing in mezzanine, distressed debt and special situations; the mean allocation of 16.6% is quite close to the 75th percentile value of 17.6%. Furthermore, a minority of FoFs with a buyout focus have a smattering of investment in real assets and venture capital.

[21] Sometimes primary FOF make commitments to direct funds that are in later rounds of closing their fund. In this instance, the FOF will have a position in a direct fund from a prior vintage year. In our sample these were small figures, typically well less than 10 % of the FOF. In the figure for year 1 reported in Table 1 we have accumulated all direct funds in that or prior vintage years.

FoFs classified as generalists have, as expected, more broadly diversified portfolios in terms of sub-asset classes. On average, about 55% of generalists' portfolios are allocated to buyout, 35% to various stages of VC and the remainder is spread across real assets, mezzanine, distressed debt, special situations and other. As with buyout FoFs, there is variation across generalists' portfolios: a fourth of these FoFs have buyout exposures of 65.4% or above and a fourth have exposures no larger than 45.4%. Similarly, there is variation in how the generalists deploy capital not allocated to buyout.

FoFs classified as VC invest, on average, over 85% of their capital in direct VC funds, with about half of that (40.3%) in early stage direct funds. Direct VC funds pursuing a balanced approach (i.e. investments across different stages) represent 37.8% of the FoFs' capital, on average, while late stage direct venture funds make up less than 10% of capital. Since "balanced" direct funds have a mix of early and late stage, our figures suggest that over half of capital, on average, is in early stage VC.

While VC FoFs, as expected, place most of their capital in venture, Table 5 shows a potential "style drift" towards buyout for some FoF managers. Over three quarters of all venture FoFs have some capital in buyout, the average allocation is 15.2%, and over a fourth have buyout allocations above 20%. We say potential because it is always possible that some funds pursue strategies that are a mix of venture and buyout. Funds that invest in growth equity – like Oak Investment Partners and Summit Partners – are particularly difficult to classify. While a VC FoF may consider such funds as venture, it is possible that Burgiss classifies them as buyout.[22]

Behind the average figures, FoFs vary in the number of direct funds they hold and the speed with which they deploy capital. Looking at the first block of columns in Table 5, about a fourth

[22] We replicated Table 5 for FoFs started prior to 2000 and again for those started after 2000. For both subsets, patterns of holdings were similar to those reported in Table 5.

of FoFs have 15 or fewer direct funds, another fourth of the sample have over 32 funds. Apparently, some FoFs focus on a relatively small set of funds that they expect to be high performing. Other FoFs appear to behave more like index funds, spreading their capital across a large number of direct funds (occasionally over 50). In terms of capital deployment, one fourth of FoFs have commitments to year 1 of 5.7% or less; and another one fourth have commitments to year 1 of 24.5% or higher. For vintage years 5 and onwards, the median value for commitments is only 2% but some FOFs are still in an investment mode as shown by 75th percentile value of 12.2% (aggregated over all the vintage years beginning with year 5).

In summary, portfolios created by FoFs hold, on average, 20 to 30 direct funds and commit the vast majority of their capital to four vintage years. While general categorizations of FoFs (e.g. buyout, generalists or venture capital) are useful, they do not always capture style differences in terms of the portfolios FoFs actually form.

6. Comparing funds of funds to strategies of direct fund investing

To compare FoFs to direct fund investing, we create synthetic FoFs (portfolios of direct funds) as performance benchmarks. These synthetic portfolios are comprised of randomly selected funds that satisfy a specified investment policy for a sub-asset strategy (e.g. buyout or VC) and diversify across a number of funds and vintage years. As an example, a "naïve" benchmark strategy for a FoF in buyout could be investing only in direct buyout funds and spreading that investment over four vintage years to create portfolios of 20 direct buyout funds (5 direct funds per vintage year beginning with the vintage year of the FoF). We create 10,000 synthetic FoFs that fit that strategy, resulting in a distribution of PMEs for these synthetic portfolios. We start

with this type of naïve strategy and later adjust it based on characteristics of FoF portfolios (Table 5) or limitations on investment opportunities.[23]

6.1 FoF performance relative to naïve benchmarks

Figure 3 illustrates a "naïve" benchmark distribution created for an individual FoF classified as buyout and having a 2005 vintage year. The synthetic portfolios contain 20 direct buyout funds spread over vintage years 2005-2008. Figure 3 shows that the mean PME for that benchmark strategy was 1.16. If an actual FoF had a PME of 1.18, this would imply an excess PME of .02 (1.18-1.16). That same PME would fall in the 60th percentile of performance. We repeat this process for each FoF in the sample to get a distribution of excess performance measures.

Figure 4 shows the distribution of excess PMEs comparing FoFs to the naïve direct investing strategy. Buyout FoFs are matched against portfolios of direct buyout funds, VC FoFs against direct venture funds and generalists against a mix of buyout (60%) and venture (40%). Panel A of Table 6 summarizes the results (using the S&P 500 as the benchmark index). For all FoFs, the mean excess PME is -0.06, which is significantly negative at the 1% level. Both buyout and generalist FoFs also have significantly negative average PMEs of -0.06 and -0.10 respectively. In contrast, the mean excess PME for venture FoFs is +0.02 and is not significantly different from zero.

Percentile values across the groupings reveal the same patterns through a different, but interesting, lens. The average buyout FoF would have been in the 32nd percentile of the synthetic

[23] Our data do not enable us to match a FoF with the exact direct funds in which it invests. We do, however, have information on the profiles of the portfolios of direct funds formed (e.g. number of funds). We did simulations both with and without replacement. The two approaches provided almost identical results in terms of performance benchmarks and lead to the same conclusions about FoF performance. We report results with replacement. As expected, the synthetic portfolios have much lower dispersion than single direct funds and the gap between mean and median performance is drastically reduced. For instance, for the "naïve" buyout (venture) strategy, the gap between mean and median PME is typically less than 0.01 (0.10) in a vintage year and the vintage year average for the gap is 0.01 (0.049).

funds. The average generalist FoF did not fare much better, being in the 35th percentile. However, the average VC FoF would have been in the 49th percentile of synthetic funds, suggesting that managers of VC FoF, on average, largely "earn their fees" by their choice of, and access to, the direct funds. The percentile figures also provide insight on the benefits of diversification created by VC FoFs compared to single direct funds. If we benchmark single direct VC funds (not FoFs) against the naïve synthetic portfolios, the mean ranking is the 39th percentile—well below the 49th percentile value for VC FoFs. Buyout direct funds, on the other hand, have a mean rank of the 50th percentile against a naïve strategy—well above the comparable figures for buyout and generalists FoFs. These differences in patterns for VC and buyout FoFs show the large importance of diversification in venture investing where outsized returns on some investments play a key role.

6.2 FoF performance relative to informed benchmarks

Panel B of Table 6 mirrors Panel A, but takes advantage of our holdings data to "inform" the direct fund benchmark with a mix of sub-asset classes and number of funds reflecting average portfolios that FoFs actually create. FoFs with a buyout focus are benchmarked against a blend of 20 direct funds, buyout (80%) and other corporate finance (mezzanine, special situations and distressed debt) funds (20%). For FoFs classified as VC, we benchmark against 28 direct funds, 80% venture and 20% buyout. In the case of generalist FoFs we weight buyout at 60% and VC at 40% across 28 funds. The excess PME performance results in Panel B are essentially the same as those in Panel A. VC FoFs perform on a par with direct fund investing but buyout and generalists FoFs perform significantly worse than the direct fund strategy[24]. If we use the Russell 2000 as the

[24] There is some downward shift in the percentile ranking of VC FoFs. This is because adding buyout funds in the informed strategy reduces the dispersion of the synthetic fund distributions against which VC FoFs are benchmarked.

benchmark portfolio, the Excess PME for VC FoFs are hardly affected at all, but for buyout and generalist FoFs the Excess PME is usually worse by about 0.01 – 0.02, and the percentile positions fall from the low 40s to the high 30s. These results are also available in an internet appendix, Table IA1). The general patterns observed in Table 6 are the same if we calculate excess PME relative to the median, rather than mean, returns (see appendix Table IA2).[25]

For the 190 FoFs for which we have holdings information (summarized in Table 5), we create even more refined benchmarks using FoF-specific (rather than average) figures on number of funds and allocations across vintage years and sub-asset classes. We form synthetic FoFs assuming an investor can mimic an individual FoF's allocation strategy but selects direct funds randomly. These "FoF-level" benchmarks arguably provide a stronger test of FoF fund selection skills since they assume that an investor can match a FoF's abilities at vintage year diversification and sub-asset allocation. Table 7 shows that across all FoFs, the mean excess PME is -0.05 and significantly negative, against these benchmarks. As in earlier tables, however, there are differences across FoF categories. Venture FoFs provide returns on a par with the benchmarks, providing a mean (median) excess PME of -0.02 (0.00), not significantly different

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This is true for every vintage year and is expected since the performance of buyout funds is not as variable as it is for VC funds. The poorer performing VC FoFs thus drop in their percentile scores. In contrast, the percentile rankings of the stellar performing individual VC FoFs do not shift appreciably since they were already very high and cannot go much higher. The net result is that the average percentile ranking of VC FoFs is lower against the informed distribution, even though the mean excess PME is virtually unchanged.

[25] We also performed a number of further analyses. First, we examined whether the results have changed over time. We repeated the analysis in Table 6 separately for FoFs formed in or prior to 2000 and those formed afterwards. For both periods, buyout FoFs, generalist FoFs and FoFs overall had negative excess PMEs. VC FoFs had a small positive excess PME in the earlier years and zero thereafter, but the difference is not significant. Overall, the sub-period results echo the conclusions for the entire period. Second, we tested for significant links between a FOF's excess PMEs (using the benchmarks in Table 6) and other details of how it structured its portfolio. We examined the number of direct funds, speed of deploying capital across vintage years and a FoF's degree of specialization across sub-asset class (e.g. whether a buyout FoF specialized in buyout or had some allocation to mezzanine). Both regressions and partitions (quartiles) of the data failed to reveal any significant patterns. Results are available upon request.

from zero. Generalist funds have significantly negative performance relative to the benchmarks. While performance results for buyout FOFs are negative, there are mixed results in terms of statistical significance: the mean excess PME is not significantly different from zero but the average percentile value is significantly below 0.50. In summary Table 7 echoes earlier findings: on average, generalist and buyout FoFs underperform direct investing strategies, but venture FoFs do not.

6.3 Do FoFs add value by timing their investments?

We next examine whether FoFs pursue a timing strategy by overweighting "good" vintage years of direct funds. Prior research shows that performance is higher (lower) for direct funds that start in periods of smaller (greater) aggregate capital flows into private equity, and that this effect is more pronounced in venture capital than in buyout. A contrarian timing strategy might take advantage of this pattern.

We use aggregate capital flows as indicators of the likely quality of vintage year performance. Following prior research (see Harris, Jenkinson and Kaplan (2014, 2016)), we measure fund flows into the industry based on capital committed to U.S. funds – segmented into VC and non-venture (primarily buyout). We use annual estimates from Private Equity Analyst for the current and previous vintage years. This sum provides an (imperfect) estimate of the amount of capital available to fund deals.[26] To compare these capital flows over a long period of time, we deflate the two-year capital commitments by the total value of the U.S. stock market (CRSP total market index) at the beginning of the vintage year. We assign vintage years into quartiles based on those

[26] Another method would be to estimate the "dry powder" – capital committed that has not been invested – for buyouts and VC separately, by year back to the mid-1990s. However, such estimates are only available for recent years.

flows. Due to the inverse relationship between flows and performance, our top (fourth) quartile expected performance years are ones with the lowest capital flows.

To measure vintage year timing, we estimate the amount by which FoFs over- or under-weight vintage years compared to a "standard" allocation. To illustrate, suppose a FoF started in 1998 and had a policy to commit equal amounts of capital across four years; the standard allocation would be 25% per year. If the FoF actually allocated 30% in vintage year 1999 (year two for the FOF), then that year would be over-weighted by 5% (30%-25%= 5%). These weights sum to zero over the life of the FoF. We apply these weights to our measure of vintage year quality. Continuing our example, suppose that 1999 was a good vintage year for direct fund performance (which we designate as 4 reflecting fourth quartile). The product of the over-weighting and vintage year quality (0.2 = 0.05 x 4) measures the positive effect of over-weighting that good year. Summing over all vintage years for the FoF we get a summary measure of timing ability. The measure is expected to be zero if the FoF has no timing ability and will be positive (negative) if the FoF systematically over-weights (under-weights) the better vintage years during its life.

To implement the approach, we use the average from Table 5 to estimate "standard" vintage year allocations by FoF category. The actual allocations are those of the individual FoF thus restricting our analysis to the 190 FOFs for which we have holdings data. In our calculations, we apply venture flows to characterize year quality for VC FoFs and the non-venture flows for buyout and generalist FoFs.

For venture FoFs, the mean value of timing is -0.04, which is not significantly different from zero at the 10% level (p-value is 0.30). The median is also -0.04. This suggests that venture FoFs do not benefit from timing skills, relative to the standard allocation. Similar results are found for generalists FoF, which have a statistically insignificant mean (median) value of 0.02 (0.00). In contrast, for buyout FoFs the mean value of timing is -0.11, which is significantly different from

zero at the 1% level. The median is -0.07. This suggests that, on average, buyout FoFs are actually hurt by their timing.[27]

Given the difficulty of estimating an expected allocation to a vintage year, we do not draw strong conclusions from this analysis. The analysis, however, does not find any evidence of superior timing abilities among FoF managers. If anything, they suggest FoF managers focusing on buyout are, on average, prone to overweight high volume direct fund years, which contributes to their under-performance of synthetic benchmark portfolios.

6.4 Is performance related to aggregate capital flows into private equity?

Prior research has found that increased aggregate capital commitments to direct buyout and VC funds are related to subsequent performance, especially for VC funds. In essence, large infusions of capital into private equity challenge the ability of direct funds to create value for their investors. In this section we examine how FoF performance is affected by capital flows. In addition to examining the scale of capital flows into private equity, we study the proportion of capital raised by FoFs, which may affect FoFs' ability to select and gain access to high performing direct funds. For instance, if the pool of talented FoF managers is limited, increases in FoF fund raising may lead to performance declines. We limit the analysis to vintage years from 1993 onwards when our data have more substantial coverage of FoFs.

To measure aggregate fund flows into private equity, as described in the prior section of the paper, we use capital commitments from Private Equity Analyst (PEA) for the current and previous vintage years, scaled by the total value of the stock market. PEA data allow us to

[27] We repeated this analysis assuming a standard allocation of spreading capital equally over four years. The results are very similar and conclusions unchanged. We also repeated the analysis using two alternative definitions of year quality. One was the actual percentage value of the capital flows, not grouped into vintage year quartiles. The other was vintage year quartiles based on the mean PME of direct funds from that vintage year (i.e. the actual ex-post average performance for venture and non-venture separately). In each instance, the results are similar and the conclusions about timing unchanged.

identify aggregate capital flows according to a venture/non-venture classification. Since the latter is dominated by flows into buyout funds, the analysis in this section focusses on two categories (venture and buyout) separately.

Over the 1993-2007 period, the two-year total capital commitments to venture funds average 0.32% (median of 0.27%) of the stock market value. The two-year capital commitments to buyout funds are higher with an average of 0.85% (median of 0.80%). There are quite different patterns in venture and buyout. For instance, venture capital commitments peaked in vintages 2000 and 2001 at about 0.7% and plummeted thereafter. Buyout capital commitments, on the other hand, peaked at over 2% in the vintage year 2007.

We also estimate the size of capital flowing through FoFs relative to aggregate capital flows. Again, we do this separately for venture and buyout, using data from PEA and Burgiss[28]. The relative size of capital flowing through FoFs also differs between venture and buyouts. In venture, FoFs account for an average of 17.63% (median of 17.35%) of the capital for venture investing. In contrast, FoFs play a smaller role in buyouts: the average is 9.86% (median of 10.72%). Again, the two groupings also show different patterns over time. For instance, in venture capital the ratio peaked at over 30% in the 2006 and 2007 vintages. For buyouts, the peak was in 1999 and 2000 at over 15%[29].

Table 8 produces estimates of the impact of capital flows on our estimates of excess PMEs. Separately for VC and buyouts, we regress the average annual excess PME on total capital

[28] Since PEA does not report subcategories of FoF capital, we estimated the amounts going to venture and buyouts using percentages derived from Burgiss data. We applied the percentage split to the PEA figure on total capital raised by FoFs to create dollar estimates of funds raised by FoFs targeted at direct funds in venture and buyouts. Finally, these dollar figures are compared to PEA total commitments (not just those from FoFs). The ratio of two year sums (current and previous vintage years) provides an estimate of the proportion of the capital for investment in a sector (venture or buyout) that comes from FoFs. Note that while we have estimates of annual total capital commitments we do not have FoF specific data on fund size.

[29] For the 1993-2007 period, the time series correlation between the two metrics of capital flows (i.e., the size of flows relative to the stock market and the proportion of capital represented by FoFs) is essentially zero for venture (correlation of 0.03) and is 0.25 for non-venture.

commitments and on the percent of capital going through FoFs. We test for the sensitivity of results using two different time periods to define capital flow variables. The first uses the variables explained earlier for the FoF's vintage year. To reflect FoF investments over a number of vintages, the second measure takes a four-year average beginning with the FoF's vintage year. In general, while we find a negative coefficient on total capital committed, echoing findings from earlier research (e.g. Kaplan and Schoar (2005), Harris, Jenkinson and Kaplan (2014, 2016)), the coefficients are not statistically significant. We also find that the proportion of capital, for VC and buyouts separately, raised by FoFs has a negative impact on FoF performance, but only for one of the VC models is the effect statistically significant.

Overall, then, the results in Table 8 do not uncover strong, statistically significant patterns in the effects of capital flows on how FoFs perform compared to direct funds. Given the aggregate time-series nature of our analysis, the limited history of the FoF industry and the inherent measurement difficulties, perhaps it is not surprising that no strong patterns emerge.

7. Limitations on direct fund investing

The direct fund investing strategies in the prior section assumed that an investor could randomly select any direct fund that satisfied a selected vintage year and sub-asset class profile. In practice, however, the ability to identify top performing funds and, more importantly, the ability to gain access to some of them, is inherently difficult and may be limited (as illustrated by research on performance persistence: Kaplan and Schoar (2005), Korteweg and Sorensen (2017) and Harris, Jenkinson, Kaplan and Stucke (2014)). These constraints are likely to be particularly relevant for smaller investors or those who have little or no experience of investing in private equity, for whom employing a FoF manager is the obvious alternative to building an internal capability and constructing a portfolio of direct fund investments.

FoFs often cite improved fund access and selection as important sources of value to their investors. Such features may be especially valuable in venture capital where the distribution of fund returns is highly dispersed (see Figure 3) and where it is likely that access to top funds is more restricted. To illustrate the importance of having top-performing funds in a portfolio, we create synthetic FoFs, as before, but impose limitations on the set of direct funds to be used. We then compare FoFs to these new benchmarks. We consider four hypothetical scenarios in which either the synthetic FoF does not have access to a fund or has a reduced chance of being in the fund (either due to access or selection skill).

Panel A of Table 9 excludes the single top performing (as measured by PME) direct buyout fund in each vintage year and the single top-performing venture fund for the vintage year. The results are striking. While buyout and generalist FoFs still underperform, venture capital FoFs now show an average positive excess PME of 0.10 (significant at the 5% level). This positive performance attests to the outsized effects on returns in venture capital from a small number of very successful funds. Panel B excludes the top deciles of buyout and venture funds for each vintage year and shows that, overall, FoFs outperform this handicapped direct investing—an average excess PME of 0.07 (significant at the 1% level). This is driven by the performance of venture capital FoFs which have an average excess PME of 0.20 which places the average venture FoF in the top quartile of the constrained synthetic FOF distribution.

Panels C and D of Table 9 do not eliminate any direct funds but simply change the probability of investing in a high performing fund. In Panel C, the probability that a synthetic FoF invests in a top-decile fund is reduced to half that of being in other funds. Panel D halves the probability for the entire top quartile of direct funds. In both panels, venture FoFs outperform direct fund

investing while buyout and generalist FoFs do not. In Panel D, the excess PME for venture FoFs is 0.15, which is significant at the 1% level.[30]

Clearly the strategies presented in Table 9 are hypothetical and some require perfect knowledge of what funds will be top performers. They do illustrate, however, that differences in fund access and selection skills can have a dramatic impact on the relative merits of FoFs and direct fund investing, especially in venture capital. Since the probability of new investors gaining access to top-performing VC funds is extremely low, these constrained benchmarks are particularly relevant and strengthen the case for employing an additional layer of intermediation.

8. The implicit costs of FoFs

In this section, we use our results on PMEs to provide rough estimates of the amount of internal costs related to direct investing that would be necessary to justify the use of the different types of FoFs.

As shown in Section 5, our findings indicate that VC FoFs earn their fees (compared to direct investing) under the assumption that investors in direct funds can randomly access the pools of VC funds. VC FoFs more than earn their fees if investors in direct funds are restricted in their access to top performing funds (as illustrated by the positive excess PMEs in Table 9).

In contrast, buyout and generalist do not earn their fees if investors in direct funds can randomly access the relevant pool of funds. Our estimates in Table 6 indicate that buyout and generalist FoFs generate excess PMEs of -0.05 and -0.10, respectively. We can obtain a rough estimate of the annual internal costs (or fees) that would lower a PME by those amounts.

[30] All the synthetic fund strategies matched against FOFs in Table 9 have mean PMEs above unity across vintage years. For instance, for Panel D the mean (median) value of the synthetic fund PME for buyout is 1.13(1.11), for generalist is 1.16(1.10) and for venture is 1.12 (1.02).

To do this we create a hypothetical portfolio that results from direct investing and calculate two PMEs: one without any internal costs and one adjusted downward for internal costs. We then see what amount of internal costs would result in a difference of -.05 (or -.10) in the two PME figures. The resulting cost figure thus has the same PME impact on the investor as investing in a FoF with an excess PME of -.05 (or -.10). We make the following assumptions: (1) the internal investor invests an equal amount in direct funds in each of the first four years; (2) each direct fund invests an equal amount in companies in each of the fund's first four years; (3) investments in companies are outstanding for five years; (4) internal costs are the same each year; and (5) internal costs reduce the numerator of the PME calculation. The resulting synthetic fund life, therefore, is thirteen years. We implicitly assume that the internal investor can pay enough to recruit suitable staff to implement this strategy and can randomly access the relevant pool of funds.

An excess PME of -0.05 over the thirteen-year life of the synthetic FoF would correspond to an expense (internal cost) of roughly 0.38% per year if the public markets were flat over the life of the fund. If the public markets appreciate, then the expenses needed to lower the PME by 0.05 would be higher because they are effectively discounted by the public market return. Under the assumption that public markets appreciate by 8% per year, similar to the appreciation since 2000, this would correspond to an expense of 0.47% per year. At 0.38% (0.47%) per year, an investor could afford to spend $380 ($470) thousand per $100 million invested in private equity to create a direct capability instead of investing in buyout FoFs.

Similarly, an excess PME of -0.10 over the thirteen-year life of the synthetic FoF would correspond to an expense of 0.77% per year if the stock market were flat. If the public markets appreciate by 8% per year, this would correspond to 0.94% per year. At 0.77% (0.94%) per year,

an investor could afford to spend $770 ($940) thousand per $100 million invested in private equity to create a direct capability instead of investing in generalist FoFs.

Because creating an internal or direct investing capability has a large fixed cost component, the attractiveness of doing so likely increases with the scale of an investor's commitment to the private equity asset class. Moreover, smaller investors may be unable to invest in a sufficient number of direct funds to create diversification benefits.

9. Conclusions

In this paper, we benchmark FoF performance (net of all management and performance fees) against both public equity markets and strategies of direct fund investment. Our research takes advantage of detailed, fund-level cash flows from Burgiss on both FoFs and direct funds. We also provide information on the types of portfolios that FoFs form. Our measures of FoF performance are through year-end 2012 and cover FoFs that were raised between 1987 through 2007.

We find that FoFs provide returns equal to or above those from investing in public equities. Thus, exposure to private equity through FoFs would have increased realized returns relative to public equities for investors. This is true even after accounting for fees that occur at both the FoF and direct fund level. This result reflects the general out-performance, relative to public equities, of buyout funds throughout the sample period, and by VC funds in much of the sample period except for the Internet bust.

In comparison to portfolios of direct funds, we find that overall – across all types of private equity – FoFs have lower returns than do portfolios of direct funds. This lower performance is significantly different from zero for FoFs that focus on buyouts or are generalist. In contrast, FoFs in VC perform roughly on a par with portfolios formed by "random" direct fund investing even after fees. Moreover, strategies for investing in direct funds may be constrained by limits on fund access or manager selection skills. We show that FoFs in venture capital often out-perform direct investing handicapped by these limitations – which are likely to be particularly relevant to investors without a long track record of investing in successful VC funds. Given that such funds typically limit access to new investors, some established VC FoF managers are able to provide their investors access to top-performing funds. Therefore, the evidence suggests that VC FoF managers are more likely, through fund selection or access, to overcome their additional

layer of fees than are buyout FoFs. In addition, our analysis suggests that VC FoFs create more risk reduction through diversification than is true in buyout.

Our results suggest that for non-VC FoFs, both the amount of money committed to FoF managers and the fees charged by them might come under pressure. Indeed, according to Private Equity Analyst, commitments to FoFs have represented only 5% of total commitments to buyout and VC funds from 2013 to 2016 compared to over 10% between 2000 and 2007. And, although direct evidence on the fees and profit shares charged by FoF managers is hard to obtain, discussions with industry practitioners suggests that these, too, have been on a downward trend in recent years.

Our results also are broadly consistent with recent research on the persistence of GP performance. Harris, Jenkinson, Kaplan and Stucke (2014) find that the performance of direct venture funds has been persistent over time while performance persistence of direct buyout funds has attenuated in recent years. Our finding that FoFs focusing on buyouts underperform direct fund investing (likely because of the additional FoF fees) suggests that buyout FoFs as a group are unable to choose direct funds that will outperform. This, in turn, is consistent with a lack of persistence in buyout funds.

In contrast, the result that venture FoFs perform as well as the average direct venture fund (despite the additional FOF fees) is consistent with the ability of some venture FoFs to choose and gain access to direct venture funds that will outperform. This is consistent with persistence in VC returns. However, disentangling the extent to which FoF managers can add value as a result of superior access to managers that LPs would find it difficult to invest in directly, or whether FoFs add value by choosing between (generally) available managers, remains an important topic for future research.

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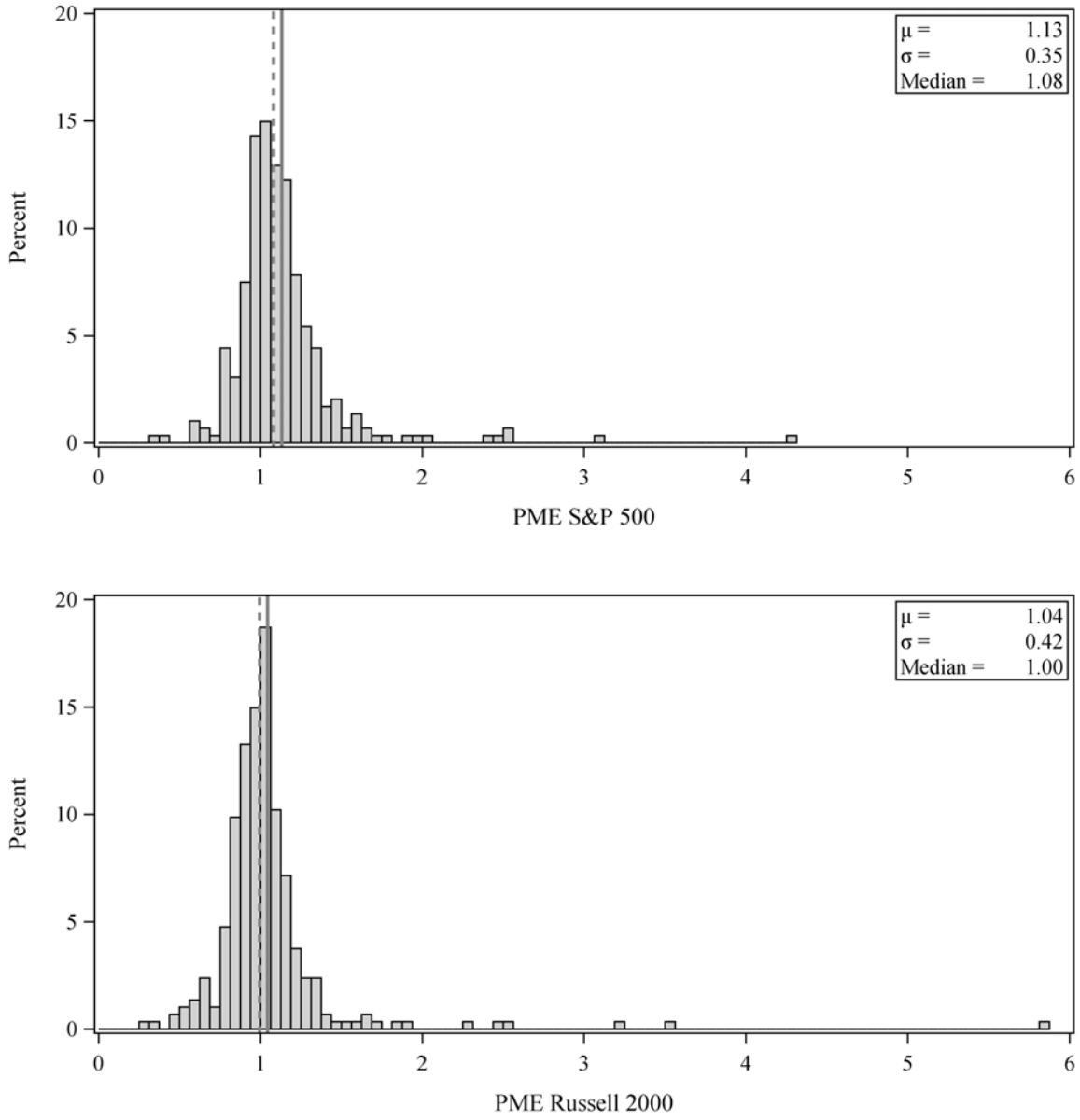

Figure 1. This figure plots the histogram of the Public Market Equivalents (PMEs) for the 294 funds of funds in our sample. The sample covers the period 1987 to 2007. The top panel reports the PMEs using the S&P 500 as the benchmark portfolio. The bottom panel reports the PMEs using the Russell 2000 as the benchmark portfolio. The solid (dashed) vertical line in each panel denotes the sample mean (median).

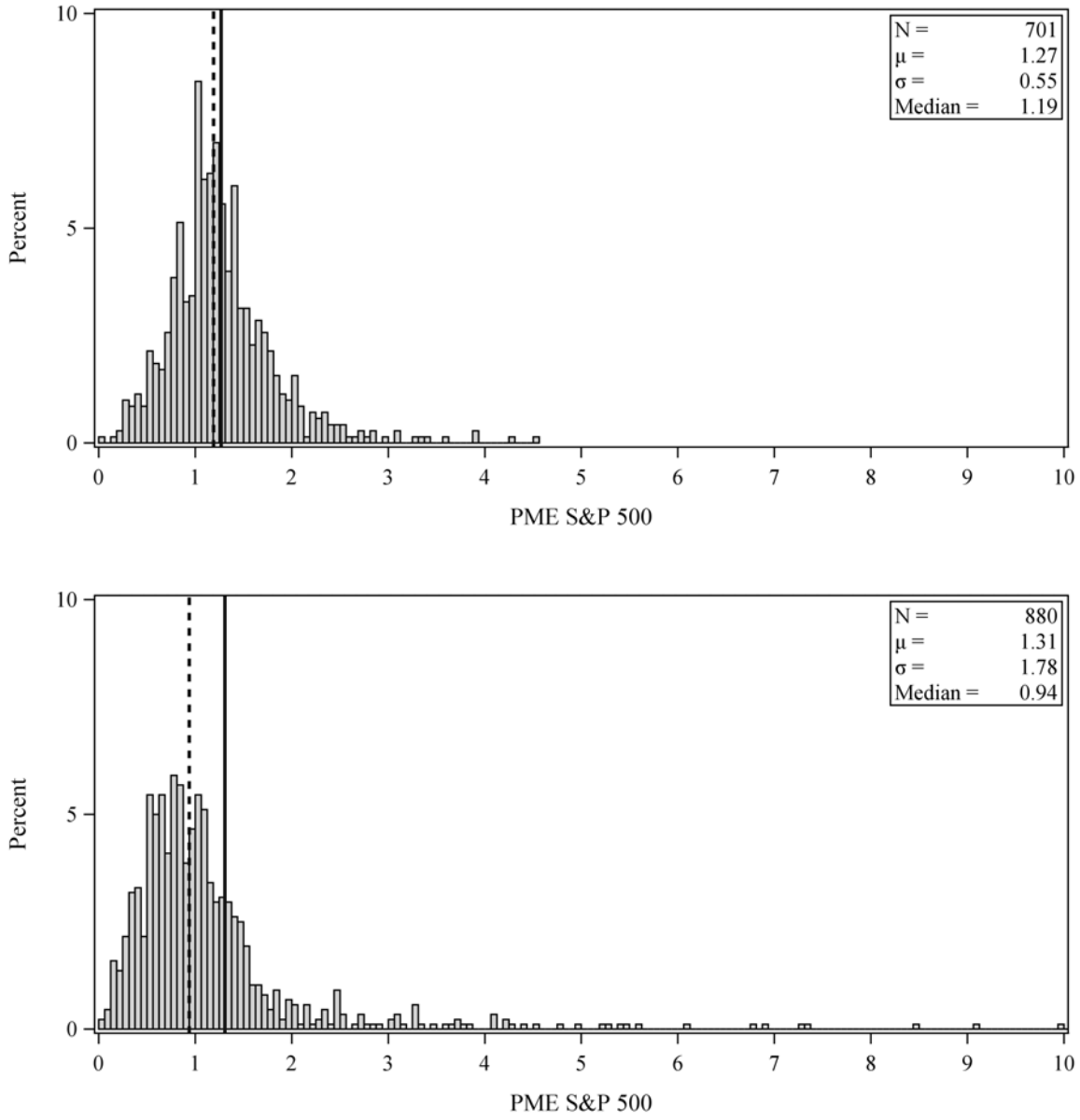

Figure 2. This figure plots the histogram of the Public Market Equivalents (PMEs) relative to the S&P 500 for the direct funds in our sample. The sample covers the period 1987 to 2007. The top panel reports the PMEs for buyout funds. The bottom panel reports the PMEs for venture capital funds. The solid (dashed) vertical line in each panel denotes the sample mean (median).

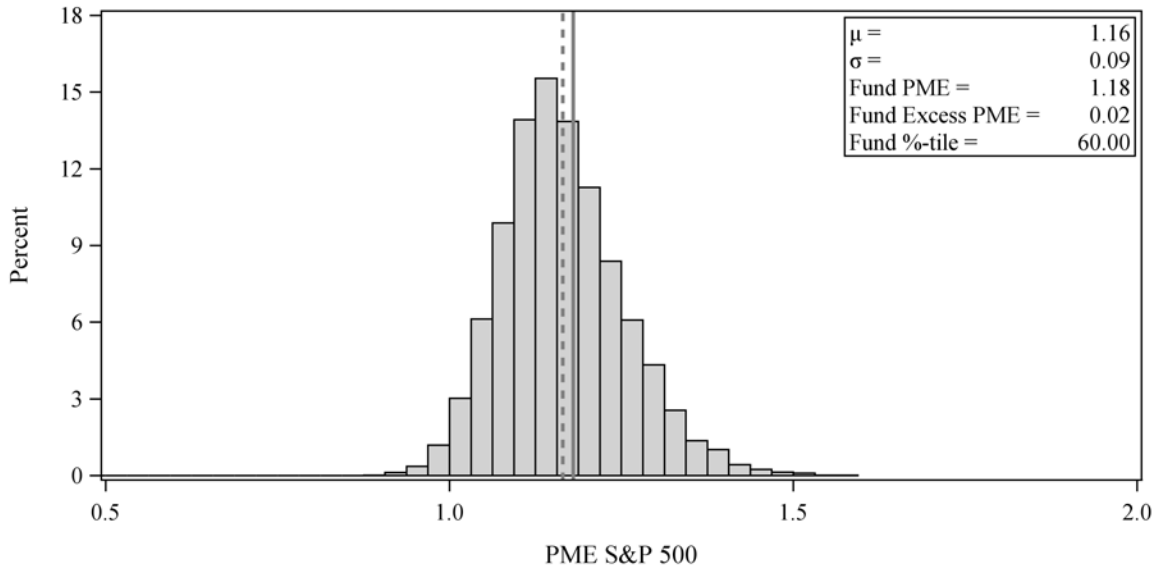

Figure 3. This figure plots the histogram of S&P 500 PMEs for the synthetic naive buyout funds of funds for vintage year 2005. These synthetic portfolios are formed by the procedure outlined in the text. The dashed vertical line denotes the sample mean. The solid vertical line denotes the PME for an example fund of funds in our sample.

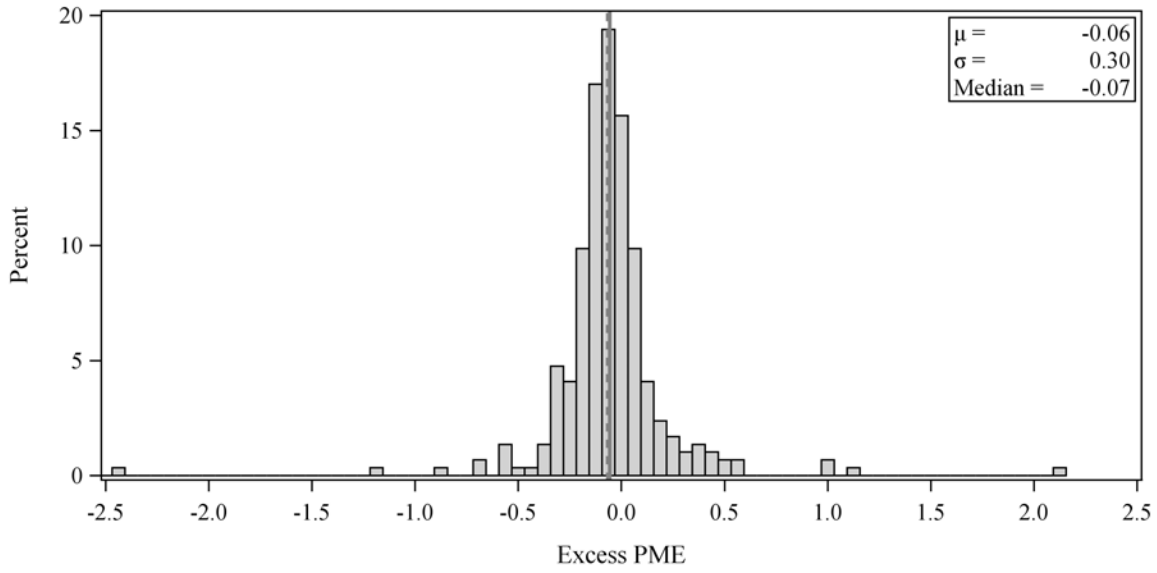

Figure 4. This figure plots the histogram of the Excess PME for the 294 funds of funds in our sample. Excess PME is measured relative to the synthetic naive funds of funds. These synthetic portfolios are formed by the procedure outlined in the text. The sample covers the period 1987 to 2007. The solid (dashed) vertical line denotes the sample mean (median).

Table 1

This table presents average and median internal rates of return (IRR) and investment multiples (total value to paid in, TVPI) for all funds of funds (FoFs) in the Burgiss database and in Preqin. IRR and TVPI numbers are as of December 2012.

	Number of FoFs		IRR Average		IRR Median		TVPI Average		TVPI Median	
Vintage	Burgiss	Preqin	Burgiss	Preqin	Burgiss	Preqin	Burgiss	Preqin	Burgiss	Preqin
1996 and earlier	14	44	25.4	28.7	15.6	24.5	3.02	2.48	2.27	2.48
1997	8	11	22.5	14.6	10.7	6.9	1.76	1.36	1.60	1.36
1998	17	18	4.2	6.2	5.7	6.1	1.27	1.38	1.35	1.38
1999	18	29	4.4	4.0	4.0	3.6	1.26	1.24	1.27	1.24
2000	25	35	6.7	7.2	5.4	6.5	1.45	1.33	1.36	1.33
2001	14	47	10.4	9.4	10.8	9.7	1.56	1.54	1.63	1.54
2002	9	25	9.9	10.6	10.3	9.6	1.50	1.55	1.47	1.55
2003	23	35	9.6	8.4	9.6	8.0	1.45	1.43	1.49	1.43
2004	25	45	5.5	7.7	6.0	6.7	1.28	1.34	1.28	1.34
2005	35	70	5.0	7.0	5.3	5.5	1.24	1.24	1.24	1.24
2006	60	82	5.5	5.6	5.3	5.2	1.23	1.19	1.21	1.19
2007	46	102	5.9	6.0	6.2	6.2	1.19	1.18	1.18	1.18
1987-2007	294	543	7.6	9.1	6.2	6.8	1.39	1.28	1.27	1.28
1997-2007	280	499	6.7	7.2	6.0	6.4	1.31	1.27	1.26	1.27
Vintage year average 97-07			8.1	7.9	7.2	6.7	1.38	1.34	1.37	1.34

Table 2

This table presents average and median PME (public market equivalent) figures based on the S&P 500 and the Russell 2000 total return indices for all funds of funds (FoFs) in the Burgiss database.

	Number	PME S&P 500				PME Russell 2000			
Vintage Year	of FoFs	P25	Average	Median	P75	P25	Average	Median	P75
1996 and earlier	14	0.90	1.59	1.11	2.01	0.96	1.85	1.04	2.49
1997	8	0.79	1.49	1.34	1.74	0.65	1.31	0.99	1.44
1998	17	1.02	1.11	1.22	1.30	0.77	0.86	0.92	1.03
1999	18	1.00	1.08	1.09	1.23	0.76	0.86	0.85	1.00
2000	25	0.93	1.17	1.11	1.20	0.82	0.98	0.93	1.04
2001	14	0.99	1.26	1.25	1.46	0.92	1.13	1.11	1.31
2002	9	1.17	1.22	1.20	1.26	1.08	1.12	1.10	1.16
2003	23	1.10	1.22	1.24	1.30	1.02	1.14	1.16	1.22
2004	25	0.97	1.10	1.11	1.19	0.91	1.04	1.05	1.12
2005	35	1.04	1.07	1.07	1.13	0.96	1.00	1.01	1.06
2006	60	0.96	1.05	1.03	1.11	0.89	0.99	0.98	1.05
2007	46	0.95	1.00	0.98	1.05	0.89	0.94	0.94	0.99
1987-2007	294	0.97	1.13	1.08	1.22	0.89	1.04	1.00	1.09
1997-2007	280	0.97	1.11	1.08	1.20	0.89	1.00	0.99	1.09
Vintage year average 97-07		0.99	1.16	1.15	1.27	0.88	1.03	1.00	1.13

Table 3

This table presents average (Avg) and median (Med) of PMEs for buyout, generalist, and venture capital funds of funds in Burgiss. Panel A reports PMEs relative to the S&P 500 and Panel B reports PMEs relative to the Russell 2000.

Panel A: PME S&P 500

	Buyout Focus			Generalist Focus			VC Focus			All FoFs		
Vintage Yea	N	Avg	Med	N	Avg	Med	N	Avg	Med	N	Avg	Med
≤ 1997	4	1.38	1.42	8	1.06	0.93	10	2.02	2.00	22	1.55	1.26
1998/99	11	1.20	1.23	18	1.11	1.15	6	0.88	0.81	35	1.1	1.16
2000/01	16	1.46	1.39	13	1.16	1.13	10	0.85	0.84	39	1.2	1.13
2002/03	15	1.25	1.24	9	1.22	1.20	8	1.17	1.16	32	1.22	1.23
2004/05	26	1.08	1.10	16	1.07	1.07	18	1.09	1.13	60	1.08	1.1
2006/07	63	1.04	1.03	23	1.03	0.99	20	1.01	0.99	106	1.03	1.01
1987-2007	135	1.14	1.11	87	1.10	1.10	72	1.16	1.01	294	1.13	1.08
1997-2007	132	1.14	1.11	83	1.09	1.10	65	1.07	0.99	280	1.11	1.08

Panel B: PME Russell 2000

	Buyout Focus			Generalist Focus			VC Focus			All FoFs		
Vintage Yea	N	Avg	Med	N	Avg	Med	N	Avg	Med	N	Avg	Med
≤ 1997	4	1.32	1.24	8	1.03	0.84	10	2.29	2.09	22	1.66	1.11
1998/99	11	0.92	0.99	18	0.88	0.87	6	0.69	0.62	35	0.86	0.86
2000/01	16	1.24	1.25	13	1.00	0.97	10	0.74	0.74	39	1.03	0.97
2002/03	15	1.16	1.17	9	1.12	1.10	8	1.10	1.08	32	1.14	1.16
2004/05	26	1.02	1.02	16	1.01	1.01	18	1.03	1.05	60	1.02	1.03
2006/07	63	0.97	0.95	23	0.97	0.94	20	0.96	0.94	106	0.97	0.95
1987-2007	135	1.04	1.02	87	0.98	0.98	72	1.12	0.95	294	1.04	1.00
1997-2007	132	1.04	1.02	83	0.97	0.98	65	0.98	0.94	280	1.00	0.99

Table 4

This table reports regression results where the dependent variable measures the PME (public market equivalent) of a fund relative to the S&P 500 (Panel A) and the Russell 2000 (Panel B). The sample includes both direct funds and funds of funds for the period 1987-2007. The sample includes 294 funds of funds (135 buyout, 87 generalist, and 72 venture capital) and 1,828 direct funds (880 venture capital and 948 non-venture (primarily buyout)). Fund of Funds is a binary variable equal to 1.0 when the fund is a fund of funds and equal to 0.0, otherwise. Column I includes all funds, Column II includes funds classified as buyout, Column III includes funds classified as venture capital, and Column IV includes funds classified as generalist. Vintage year effects are fixed. *, **, *** denotes significance at the 10, 5 and 1 percent levels, respectively.

Panel A: PME using S&P 500

	All Funds of Funds	Buyout Focus	VC focus	Generalist
Intercept	1.35***	1.22***	1.49***	1.34***
Fund of Funds	-0.07**	-0.11***	-0.01	-0.12***
Observations	2,122	1,083	952	1,915
R-Squared	0.06	0.09	0.14	0.05
Adj. R-Squared	0.05	0.07	0.12	0.04

Panel B: PME using Russell 2000

	All Funds of Funds	Buyout Focus	VC focus	Generalist
Intercept	1.40***	1.19***	1.61***	1.39***
Fund of Funds	-0.06*	-0.10***	-0.002	-0.13***
Observations	2,122	1,083	952	1,915
R-Squared	0.08	0.07	0.17	0.08
Adj. R-Squared	0.07	0.05	0.15	0.07

Table 5

This table gives information on the portfolio composition of funds of funds. It presents the patterns of investments into primary direct funds by funds of funds in the Burgiss database for which detailed information on the underlying portfolio is available. We distinguish fund investments across the vintage year of direct funds (i.e., a fund of funds' investment year) and sub-asset class. The sample covers the period 1987 to 2007. Figures represent the percentage of a fund of fund's capital committed to primary direct funds for the lower quartile (P25), average (mean), median, and upper quartile (P75). Mezz/DD/SS includes mezzanine, distressed debt and special situations as identified by Burgiss.

	All Funds of Funds (n=190)				Buyout (n=83)				Generalist (n=54)				Venture Capital (n=53)			
	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75
Number of Funds	15.0	25.6	22.5	32.0	14.0	21.4	19.0	28.0	16.0	30.2	26.0	35.0	18.0	27.6	26.0	35.0
Year 1	5.7	18.6	13.2	24.5	6.0	18.5	13.3	24.5	5.3	19.9	14.2	25.9	5.4	17.5	9.6	22.7
Year 2	19.0	32.9	31.2	44.8	18.4	32.1	32.0	43.8	20.6	35.9	34.5	48.1	19.0	31.1	27.7	42.4
Year 3	12.6	26.7	27.0	37.8	12.9	27.2	26.8	36.8	6.6	22.4	24.3	33.8	17.9	30.1	31.4	41.3
Year 4	--	12.1	8.8	19.8	--	11.5	8.1	18.4	--	13.0	11.5	22.7	0.4	12.0	8.3	21.8
Year 5+	--	9.8	2.0	12.2	--	10.7	1.9	14.6	--	8.9	4.3	12.2	--	9.2	1.4	11.1
Buyout	20.8	52.3	54.7	84.4	76.5	76.2	87.2	94.3	45.4	55.1	54.7	65.4	3.1	12.1	8.9	21.0
Mezz/DD/SS	--	8.7	0.5	7.7	--	16.6	4.9	17.6	--	5.1	4.1	7.7	--	0.1	--	--
Real Assets	--	1.1	--	--	--	1.0	--	--	--	1.9	--	3.7	--	0.3	--	--
VC Early	--	16.9	9.4	30.2	--	1.7	--	3.4	5.4	17.4	15.1	26.9	27.9	40.3	41.2	49.1
VC Balanced	--	15.7	9.7	25.7	--	2.1	--	3.4	8.9	14.7	14.2	20.3	29.7	37.8	37.9	46.0
VC Late	--	3.8	0.3	5.8	--	0.8	--	--	--	2.9	1.7	5.2	3.6	9.4	7.4	13.7
Other	--	1.5	--	--	--	1.5	--	--	--	3.0	--	--	--	--	--	--

Table 6

This table reports summary statistics for performance metrics of Funds of Funds PMEs relative to Synthetic Funds of Funds PMEs. The benchmark portfolio for the calculation of PME is the S&P 500. Excess PME is the difference in the Fund of Funds PME and the mean PME of the Synthetic Funds of Funds in the same strategy and vintage year. Percentile PME is the percentile of the Fund of Funds PME in the distribution of Synthetic Funds of Funds PMEs in the same strategy and vintage year. Panel A constructs synthetic funds of funds based on the naive strategy outlined in the text. Panel B constructs synthetic funds of funds based on the informed strategy outlined in the text. For the averages, we report the significance of the test of the hypothesis that Excess PME equals 0.0 and Percentile PME equals 50.0. *, **, *** denotes significance at the 10, 5 and 1 percent levels, respectively.

Panel A: Naïve Synthetic Funds of Funds

	All Funds of Funds (n=294)				Buyout (n=135)				Generalist (n=87)				Venture Capital (n=72)			
	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75
Excess PME	-0.15	-0.06***	-0.07	0.03	-0.16	-0.06***	-0.08	0.01	-0.16	-0.10***	-0.09	0.02	-0.08	0.02	-0.03	0.06
Percentile PME	6	37***	27	69	3	32***	14	58	6	35***	26	63	22	49	49	74

Panel B: Informed Synthetic Funds of Funds

	All Funds of Funds (n=294)				Buyout (n=135)				Generalist (n=87)				Venture Capital (n=72)			
	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75
Excess PME	-0.16	-0.05***	-0.06	0.03	-0.15	-0.05***	-0.07	0.02	-0.17	-0.10***	-0.09	0.03	-0.13	0.01	-0.04	0.04
Percentile PME	4	35***	19	67	3	34***	17	60	3	32***	17	67	9	42*	41	73

Table 7

This table analyses performance of funds of funds where we have detailed holdings data. It reports summary statistics for performance metrics of Funds of Funds PMEs relative to Synthetic Funds of Funds PMEs. The benchmark portfolio for the calculation of PME is the S&P 500. Excess PME is the difference in the Fund of Funds PME and the mean PME of the Synthetic Funds of Funds in the same strategy and vintage year. Percentile PME is the percentile of the Fund of Funds PME in the distribution of Synthetic Funds of Funds PMEs in the same strategy and vintage year. Synthetic funds of funds are constructed using the Fund of Fund-level benchmarking strategy outlined in the text. For the averages, we report the significance of the test of the hypothesis that Excess PME equals 0.0 and Percentile PME equals 50.0. *, **, *** denotes significance at the 10, 5 and 1 percent levels, respectively.

	All Funds of Funds (n=190)				Buyout (n=83)				Generalist (n=54)				Venture Capital (n=53)			
	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75
Excess PME	-0.12	-0.05***	-0.03	0.04	-0.11	-0.01	-0.03	0.03	-0.20	-0.12***	-0.06	0.03	-0.12	-0.02	0.00	0.09
Percentile PME	15	43***	39	67	17	42**	37	66	10	38***	28	63	21	48	57	72

Table 8

This table analyses the effect of aggregate capital flows into private equity on FoF returns. The table reports regression results where the dependent variable measures PMEs of FoF relative to synthetic FoF. The benchmark portfolio for the calculation is the S&P 500. Excess PME is the difference between the FoF PME and the mean PME of the synthetic FoF in the same strategy and vintage year. Excess PMEs are then averaged by vintage year. *Total Funds Raised/Stock Market Capitalization* is calculated by summing the capital commitments to all private equity funds, separately for venture and buyouts (as estimated by Private Equity Analyst) in the current and previous vintage years, and then taking the ratio of this sum to the aggregate U.S. stock market value at the start of the current vintage year. Percent of Funds Raised by FoFs is calculated by summing the capital commitments to FoFs (as estimate by Private Equity Analyst) in the current and previous vintage years and dividing by the sum of capital commitments to all private equity funds (as estimated by Private Equity Analyst) in the current and previous vintage years. *, **, *** denote significance at the 10, 5, and 1 percent levels respectively.

Panel A: Buyout Funds						
	Single Year Flows			4-yr average flows		
	I	II	III	IV	V	VI
Intercept	0.04	0.33	0.40	0.00	0.29	0.52
Total Funds Raised/Stock Market Capitalisation	-7.48		-7.8	-2.76		-14.77
Percent of Funds Raised by FoFs		-2.98	-2.97		-2.46	-3.05
Number of observations	14	13	13	14	13	13
R-squared	0.01	0.40	0.42	0.00	0.10	0.17
Adjusted R-squared	-0.07	0.35	0.30	-0.08	0.01	0.00
Panel B: Venture Capital Funds						
	Single Year Flows			4-yr average flows		
	I	II	III	IV	V	VI
Intercept	0.10	0.36*	0.74**	0.05	0.36	0.78**
Total Funds Raised/Stock Market Capitalisation	-20.77		-72.91	-3.95		-68.04
Percent of Funds Raised by FoFs		-1.32	-1.95***		-1.21	-2.03
Number of observations	17	12	12	17	12	12
R-squared	0.00	0.14	0.42	0.00	0.10	0.18
Adjusted R-squared	-0.06	0.05	0.30	-0.07	0.01	0.00

Table 9

This table analyzes the fund of funds performance relative to constrained direct investing. It reports summary statistics for performance metrics of Funds of Funds PMEs relative to Synthetic Funds of Funds PMEs. The benchmark portfolio for the calculation of PME is the S&P 500. Excess PME is the difference in the Fund of Funds PME and the mean PME of the Synthetic Funds of Funds in the same strategy and vintage year. Percentile PME is the percentile of the Fund of Funds PME in the distribution of Synthetic Funds of Funds PMEs in the same strategy and vintage year. Panel A constructs synthetic funds of funds based on the naive strategy outlined in the text excluding the direct fund with the highest PME in each strategy-vintage year pair. Panel B constructs synthetic funds of funds based on the naive strategy outlined in the text excluding the direct funds in the top decile of PME in each strategy-vintage year pair. Panel C constructs synthetic funds of funds based on the naive strategy outlined in the text with the direct funds in the top decile of PME in each strategy-vintage year pair half as likely to be selected into the synthetic fund of funds as direct funds not in the top decile. Panel D constructs synthetic funds of funds based on the naive strategy outlined in the text with the direct funds in the top quartile of PME in each strategy-vintage year pair half as likely to be selected into the synthetic fund of funds as direct funds not in the top quartile. For the averages, we report the significance of the test of the hypothesis that Excess PME equals 0.0 and Percentile PME equals 50.0. *, **, *** denotes significance at the 10, 5 and 1 percent levels, respectively.

Panel A: Excluding Top Performing Direct Fund

	All Funds of Funds (n=294)				Buyout (n=135)				Generalist (n=87)				Venture Capital (n=72)			
	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75
Excess PME	-0.11	0.00	-0.03	0.07	-0.12	-0.03*	-0.05	0.04	-0.12	-0.05*	-0.04	0.08	-0.05	0.10*	0.03	0.13
Percentile PME	8	44***	37	82	4	37***	20	72	8	42**	36	81	30	59**	66	90

Panel B: Excluding Top Decile of Direct Funds

	All Funds of Funds (n=294)				Buyout (n=135)				Generalist (n=87)				Venture Capital (n=72)			
	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75
Excess PME	-0.04	0.07***	0.04	0.15	-0.06	0.03*	0.00	0.10	-0.05	0.03	0.04	0.15	0.02	0.20***	0.09	0.24
Percentile PME	23	60***	70	98	14	53	49	96	23	58*	66	98	60	76***	91	99

Table 9 (continued)

Panel C: Reweighted Top Decile of Direct Fund

	All Funds of Funds (n=294)				Buyout (n=135)				Generalist (n=87)				Venture Capital (n=72)			
	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75
Excess PME	-0.09	0.00	-0.02	0.09	-0.11	-0.02	-0.04	0.05	-0.10	-0.04	-0.04	0.08	-0.04	0.10*	0.03	0.13
Percentile PME	11	47	44	83	6	41***	27	78	11	45	43	82	37	61***	67	88

Panel D: Reweighted Top Quartile of Direct Fund

	All Funds of Funds (n=294)				Buyout (n=135)				Generalist (n=87)				Venture Capital (n=72)			
	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75	P25	Avg	Med	P75
Excess PME	-0.07	0.04**	0.01	0.11	-0.09	0.01	-0.02	0.07	-0.08	0.00	-0.01	0.11	-0.01	0.15***	0.07	0.17
Percentile PME	21	54**	59	88	12	48	39	85	21	53	57	86	53	69***	79	89