Private Equity Performance: A Survey

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Abstract

We survey the literature on private equity performance, focusing on venture capital and buyout funds rather than on portfolio companies. We describe recent findings on performance measures, average fund returns, risk adjustments, cyclicality and liquidity, persistence, interim returns and self-reported net asset values, the performance of different types of investors in funds, and the links between management contracts and fund returns. Buyout funds have outperformed the S&P 500 net of fees on average by approximately 20% over the life of the fund. Venture capital funds raised in the 1990s outperformed the S&P 500, whereas those raised in the 2000s underperformed. The results are consistent across a number of data sets and papers. Before the 2000s, buyout and venture capital fund performance showed strong evidence of persistence. Since 2000, buyout fund persistence has declined, whereas venture capital fund persistence has remained equally strong.

1. INTRODUCTION

Capital committed to private equity (PE) funds worldwide has risen substantially in the past decade. For example, PE funds obtained commitments for more than $460 billion in 2013, a 12-fold increase over the $38 billion committed in 1995 (see MacArthur et al. 2014). In this article, we survey the literature on the performance of the two major types of PE funds: buyout (BO) and venture capital (VC). We focus on funds rather than on the companies in which the funds invest (portfolio companies). Consequently, we omit important literatures on the selection, financing, monitoring, exiting, and performance of PE portfolio companies as well as associated contracting issues. Kaplan & Stromberg (2009), Metrick & Yasuda (2011), and Da Rin, Hellmann & Puri (2013) provide useful surveys including these and other topics.

This article is also motivated by the large increase in the PE fund performance literature in the past several years. On the empirical side, the emergence of new data sets of cash flows between general and limited partners (GPs and LPs, respectively) has enabled researchers to examine fund performance in the post–tech boom era, along with a host of related questions. On the theoretical side, progress has been made in grounding performance measures in asset pricing theory and understanding risk adjustments.

We begin in Section 2 with an overview of the structure of PE funds. Sections 3 and 4 summarize early and recent evidence on the average performance of PE funds. Section 5 discusses cyclical variation in PE returns. Section 6 considers evidence on the persistence of performance from one fund of a PE partnership to the next. Section 7 summarizes recent results on the reporting of interim performance by PE funds. Section 8 focuses on GP and LP skill. Section 9 summarizes the literature on PE fund fees and performance. Section 10 concludes.

2. THE ORGANIZATION OF PRIVATE EQUITY FUNDS: WHAT ARE PRIVATE EQUITY FUNDS?

PE funds are financial intermediaries that pool their investors' capital and make investments in portfolio companies. A defining characteristic of the PE industry is that these portfolio companies either are private or become private as part of the PE transaction, so there is no organized exchange for the company's equity. The goal of PE investing is to exit the portfolio company after increasing its equity value. PE funds include active investors who attempt to increase value through financing and other contractual structures, value-added monitoring, advice, and management staffing. These features distinguish PE funds from mutual funds and hedge funds, which include primarily passive investors. Successful exit mechanisms include acquisitions by operating companies; initial public offerings; and, in BO, acquisitions by other BO firms (known as secondary BOs).

Although VC and BO funds have a similar organizational form and compensation structure, they are distinguished by the types of investments they make and the way they finance them. BO funds generally acquire 100% of the target firm, which can be public or private, and use leverage (for a model of the use of leverage in buyout investments, see Axelson, Stromberg & Weisbach 2009). VCs take minority positions in private businesses and do not use debt financing.

Legally, PE funds are usually organized as limited liability partnerships. The fund is managed by a PE firm, such as Sequoia or KKR, which takes the GP role of the partnership. Fund investors are the LPs. These investors are typically large institutions such as endowments, pension plans, and banks. LPs retain limited liability for the actions of the partnership in exchange for delegating all management decisions to the GP.

The contracted life of the partnership is typically ten years. The year the fund begins is known as its vintage year. At the inception of the fund, LPs commit to a total investment amount (committed capital). These committed amounts are not transferred immediately to the GP, but rather are kept

by the LPs until called by the GP to fund investments and management fees (capital calls or takedowns). Investments are made during the first few years of a fund's life, with subsequent years devoted to attempts to add value and exit investments. Generally, investments are held for three to eight years before exit (Strömberg 2008, Thomson Reuters 2014). A fund's life often can be and often is extended for an additional one to three years upon mutual agreement, if more time is needed to exit investments. Unlike investors in mutual funds and hedge funds, investors in PE funds typically cannot redeem their stakes even after waiting a redemption period, because the nature of the PE investing cycle makes inopportune liquidations of portfolio companies extremely costly.

GPs are compensated with an annual management fee and a share of the profits generated by the fund, known as the carried interest or carry. The modal management fee is 2% of committed capital per year, though there is substantial variation in both the percentage fee and the basis on which it is calculated. Carried interest is almost always 20%, with variation in the value of carry driven primarily by differences in the basis and timing rules for its calculation. In addition, GPs invest their own capital in the fund, committing at least 1% of the total committed capital. Gompers & Lerner (1999), Metrick & Yasuda (2010), and Robinson & Sensoy (2013b) describe and analyze the fee structures of PE funds.

3. FUND-LEVEL PERFORMANCE MEASUREMENT

3.1. Performance Measures

The organizational form of PE, and its exemption from public disclosure requirements, complicates performance inference. A key problem is that the inherent illiquidity of the equity of PE portfolio companies means that there is no completely objective way to mark a PE fund's investments to market except when an investment is made or exited. Interim assessments of the fund's net asset value (NAV) that GPs report to LPs are necessarily subjective. Furthermore, fund NAVs do not necessarily adjust for any transaction costs the fund would bear if it actually tried to sell underlying investments.

Consequently, industry practice and most academic work have shied away from performance evaluation based on factor pricing models, which require periodic returns that lean heavily on self-reported NAVs. Instead, the practice has been to measure performance using, to the extent possible, objective cash flows between GPs and LPs. For active funds, the last observed NAV is generally assumed to be a fair measure of the true value of the fund, so it is treated as a liquidating distribution for the purposes of calculating performance. The accuracy of interim returns is discussed below.

An LP's cash outflows consist of management fees and capital called for investments, whereas inflows result from cash distributions from exiting investments (net of the applicable carried interest a GP withholds from these distributions). Traditionally, industry practice has been to express fund performance in two ways: (*a*) the internal rate of return (IRR) of this cash flow stream and (*b*) the ratio of the cumulative inflows/distributions to cumulative capital outflows/calls known as the multiple of invested capital (MIC) or total value paid in capital. In both cases, the return measure is net of all fees.

Although useful, the IRR and MIC have several drawbacks. Most importantly, both the IRR and MIC are absolute, not relative, measures of performance. They do not control for movements in the overall market or any other source of risk.

Long & Nickels (1996) propose a method to market-adjust the IRR, in what has become known as the Long-Nickels public market equivalent (LN PME). Essentially, the LN PME calculates the IRR an investor would have received from investing in the relevant public equity benchmark

and compares that IRR to the IRR from the PE fund. The LN PME has the advantage that many investors think in terms of IRRs. At the same time, the LN PME has two disadvantages. First, it shares with the IRR the unattractive attribute of being unusually sensitive to investment sequencing, particularly the success of a fund's early investments. Second, the LN PME "blows up" or cannot be calculated for some funds, particularly those that are very successful and return capital quickly. Gredil, Griffiths & Stucke (2014) propose an alternative method to market-adjust the IRR. They calculate the differential return or alpha to the relevant benchmark that discounts the PE fund cash flows to a net present value of zero. This methodology of Gredil et al. is an improvement over Long & Nickels (1996) in that it is easier to calculate, is more intuitive, and has fewer instances where it cannot be calculated.

Kaplan & Schoar (2005) propose a related method to market-adjust the MIC rather than the IRR. The Kaplan-Schoar (KS) PME is calculated as the ratio of the sum of discounted distributions to the sum of discounted capital calls, where the discount rate is the total return on the relevant public equity benchmark from an arbitrary reference date to the date of the cash flow in question. Following Kaplan & Schoar (2005), the S&P 500 is usually used as the public benchmark. A fund with a KS PME (hereafter, simply PME) greater than 1 outperforms the benchmark (net of all fees); a fund with a PME less than 1 underperforms. For instance, a PME of 1.20 (0.80) means that an investor ends up with 20% more (fewer) dollars by investing in a PE fund instead of the public benchmark. The PME has the advantages that it can always be calculated and has an intuitive interpretation. One practical disadvantage for practitioners is that it provides a cumulative measure rather than an annualized return measure.

3.2. Risk Adjustments

Since Kaplan & Schoar (2005) introduced the PME, it has been the standard performance measure in the literature measuring PE returns using fund-level cash flows. A natural question is to what extent the market adjustment embedded in the PME suffices to risk-adjust fund returns. Recent theoretical work by Sorensen & Jagannathan (2013) and Korteweg & Nagel (2013) has sought to link PE performance measurement to asset pricing theory. These papers establish that the PME suffices to adjust for risks spanned by the benchmark return, regardless of the beta of PE with respect to the benchmark, under the assumption that investors have log utility.[1] However, as the authors acknowledge, investors may not have log utility,[2] and there are likely to be relevant risks not spanned by a single benchmark return.

Other strands of the PE literature have attempted to estimate the betas of PE funds with respect to public equity factor portfolios such as the factors of Fama & French (1993) and/or to account for the impact of other risks—such as illiquidity—on the required returns of PE funds (for proposals of methods to measure the betas of portfolio companies rather than funds, also see Cochrane 2005; Korteweg & Sorensen 2010; Axelson, Sorensen & Stromberg 2014). Common to these lines of research is the limitation that the proposed adjustments can be reliably estimated only for groups of funds (e.g., the industry as a whole) rather than individual funds.

Driessen, Lin & Phalippou (2012) propose that the betas of groups of funds can be estimated by finding the beta (and alpha) that minimizes the sum of squared differences between the present

[1]Technically, it is the difference between the sum of discounted distributions and the sum of discounted capital calls that provides the appropriate risk adjustment, rather than their ratio. As Korteweg & Nagel (2013) note, because of Jensen's inequality, the expectation of the ratio may differ from 1 even if the expectation of the difference is equal to zero.

[2]Log utility implies that risk aversion and the intertemporal elasticity of substitution are both equal to 1. The asset pricing literature has found these implications hard to reconcile with the equity premium and risk-free rate in the data.

value of a fund's distributions and the present value of its capital calls, where the discount rate is the realized risk-free rate plus the alpha to be estimated plus the realized excess market return times the beta to be estimated. Using this approach, they estimate that market betas are approximately 1.3 for BO funds and 2.5 for VC funds.

Ang et al. (2013) adopt an approach that is similar in spirit to that of Driessen, Lin & Phalippou (2012). However, their goal is to decompose PE returns into two components: one due to traded factors and another due to a time-varying PE premium. They estimate market betas of approximately 1.3 for BO funds and 1.6 for VC funds.

Jegadeesh, Kraussl & Pollet (2012) take a different approach based on the observable market prices of publicly traded funds-of-PE funds. If the market is efficient, then the beta of a fund-of-funds, estimable using standard methods, will closely track the beta of the underlying untraded PE funds. They find an average BO beta of close to 1. Sorensen, Wang & Yang (2014) use a model of PE investing in incomplete markets to quantify the premium investors' demand for the illiquidity of PE portfolio companies. They find that the required break-even PME is approximately 1.2, which roughly equals the average PME of BO funds found in recent empirical work.

Robinson & Sensoy (2013a) examine the cyclical and diversifiable variation in GP–LP cash flows, arguing that cash flow variation is the salient source of risk for PE LPs. They find a strong cyclical component of both capital calls and distributions, with distributions more cyclical than calls. They also find that most cash flow variation is diversifiable.

There is clearly more work to be done to fully understand the sources and magnitudes of the risks facing PE investors. Attempting to do so is a fertile area for future research. Currently, the PME is the state-of-the-art measure of fund-level performance. It also has the practical advantages of being extremely easy to calculate, implement, and explain. In what follows, we summarize what is known about the average, time series, and cross section of PE fund performance, focusing on the PME.

4. AVERAGE PRIVATE EQUITY FUND PERFORMANCE

4.1. Early Evidence

Three roughly contemporaneous papers (Ljungqvist & Richardson 2002, Kaplan & Schoar 2005, Jones & Rhodes-Kropf 2003) written in the early to mid-2000s are the first contributions to our understanding of fund-level PE performance. Despite their different samples and methodologies, these studies reach similar conclusions about average performance. Ljungqvist & Richardson (2002) study the returns to investments by one large LP in 19 VC funds and 54 BO funds raised between 1981 and 1993. They estimate that the funds in their sample outperform the equity market and have positive alphas. They do not calculate PMEs.

Kaplan & Schoar (2005) use a data set obtained from Venture Economics (VE) consisting of 577 VC funds and 169 BO funds of vintage years 1980–1995. The cash flow data are quarterly and extend to the end of 2001. Using these data, Kaplan & Schoar (2005) report an equal-weighted average PME of 0.96 for VC funds and 0.97 for BO funds. The size (committed capital)-weighted average PME is 1.21 for VC funds and 0.93 for BO funds. They find higher BO PMEs in the 1980s, reconciling their results with those of Ljungqvist & Richardson (2002), whose sample is mostly from that period. Kaplan & Schoar (2005) conclude that overall PE returns are roughly equal to the S&P 500, but the largest VC funds outperform.

Jones & Rhodes-Kropf (2003) use the same VE data set, but a different methodology that focuses on quarterly returns using GP estimates of NAV. They estimate alphas of approximately

5% per year for VC funds and close to zero for BO funds. However, a drawback of the VE data is that it is based on voluntary self-disclosures by GPs and LPs.

Phalippou & Gottschalg (2009) use the same VE data but with cash flows extended to the end of 2003 and argue that the self-reported NAVs of funds that are at least ten years old are likely to be significantly overstated and should be interpreted as "living dead" investments that, although not yet liquidated, are essentially worthless. As a result, Phalippou & Gottschalg (2009) recommend that ending NAVs be written down to zero rather than treated as correct. With this adjustment to the methodology of Kaplan & Schoar (2005), Phalippou & Gottschalg (2009) find that the average PME decreases from 0.99 to 0.92. They conclude that PE underperforms the S&P 500 net of fees and that adjusting for risk reveals even greater underperformance.

4.2. Recent Evidence

Recently, researchers have gained access to new sources of data that help reconcile the opposing conclusions of prior work. Using these data, researchers also have updated performance statistics to reflect funds raised after the mid-1990s, a period that includes the tech boom and crash and the BO boom of the mid-2000s. Stucke (2011) conducts an analysis of the VE data used in prior work. Focusing on BO funds, he notices that for a significant number of funds in the VE database the last observations consist of a sequence of repeating identical NAVs with no cash flows. Because disclosure to VE is voluntary, Stucke (2011) conjectures that this pattern is due to these funds ceasing to be updated in the database. As noted above, Kaplan & Schoar (2005) assume those NAVs are the correct values, whereas Phalippou & Gottschalg (2009) assume they equal zero.

Stucke (2011) obtains the true cash flows and NAVs for a large portion of these funds from actual LPs in the funds. He finds that the actual NAVs are greater than the reported NAVs and substantially greater than zero. As a result, an average fund's actual performance is better than that obtained by assuming the final reported NAV in the VE is the true value, to say nothing of writing it down to zero. Stucke (2011) estimates that with correct data the size-weighted BO average PME of 0.93 found by Kaplan & Schoar (2005) changes to 1.10, indicating significant outperformance, rather than underperformance, relative to the S&P 500. Stucke (2011) concludes that the estimates by Kaplan & Schoar (2005) and by Phalippou & Gottschalg (2009) of BO performance are downward biased because of flaws in the underlying data. He further adds that BO funds likely outperformed the S&P 500 during the previous authors' sample period.

A parallel development has been the emergence of new cash flow data sets to extend what is known about PE performance beyond the sample periods covered by the earlier literature. Robinson & Sensoy (2013a) use a proprietary data set of GP–LP cash flows for 295 VC and 542 BO funds that comprise the entire investment history of a single large LP. The data span vintage years 1984–2009, with cash flows extending to the second quarter of 2010. Unlike the VE data used in prior research, this data set is free from reporting biases because it consists of the actual cash flows received and paid out by the LP.

Robinson & Sensoy (2013a) also argue that the LP data source largely invested like an index fund in BO funds, so the data are unlikely to be subject to selection bias with one exception. For VC funds, they note that the data are unlikely to include the top-performing VCs of the 1990s, access to which was largely limited to one class of LP, endowments (see Lerner, Schoar & Wongsunwai (2007). Robinson & Sensoy (2013a) report an equal-weighted average PME of 1.19 for BO funds and 1.06 for VC funds.

Harris, Jenkinson & Kaplan (2014) use cash flow data for 775 VC and 598 BO funds obtained from Burgiss (henceforth, the Burgiss data). The data span vintage years 1984–2008, with cash flows extending to the first quarter of 2011. The Burgiss data are derived entirely from LPs for

whom Burgiss's systems provide record-keeping and performance-monitoring services, resulting in investment histories that are free from any reporting bias. Harris et al. (2014) argue that the PE funds also are unlikely to be subject to selection bias. They report an equal-weighted average PME of 1.22 for BO funds and 1.36 for VC funds.

Harris et al. (2014) use the strong statistical relationship among PMEs, multiples, and IRRs in the Burgiss data to estimate the average market-adjusted performance implicit in other commercial databases. They apply the regression coefficients from the Burgiss data to the vintage year multiples of invested capital and IRRs from Cambridge Associates, Preqin, and VE to estimate vintage year PMEs for the funds in those databases. The estimates from Cambridge Associates and Preqin are economically similar to those from Burgiss. Consistent with the downward bias identified by Stucke (2011), the estimates for VE are lower than those for the other three databases. Notably, following this research, VE decided to discontinue its data series and replace it with data from Cambridge Associates.

In subsequent work, Higson & Stucke (2014) assemble a large data set of 1,169 BO funds with vintage years 1980–2008 with GP–LP cash flows extending to the second quarter of 2010. Their BO sample is approximately twice as large as those used in prior work by Robinson & Sensoy (2013a) and Harris et al. (2014). They do not examine VC funds. Approximately half their data comes from Cambridge Associates, with the majority of the remainder from CalPERS. Using these data, the authors report an equal-weighted average BO PME of 1.22. Their actual results are very similar to the estimates in Harris et al. (2014) for the Cambridge Associates data.

Robinson & Sensoy (2013a), Harris et al. (2014), and Higson & Stucke (2014) all conclude that BO funds have historically outperformed the S&P 500 net of fees. Each conducts robustness exercises, concluding that performance estimates are only somewhat affected by using benchmark indexes other than the S&P 500 or by levering the S&P 500 benchmark return to account for reasonable levels of beta greater than 1. In contrast, Phalippou (2014) argues that certain choices of benchmark index have important effects on performance inference. He uses a sample of 392 BO funds for which GP–LP cash flows through mid-2011 are available from the commercial data provider Preqin. Using these data, Phalippou (2014) finds an average S&P 500 PME of 1.20, in agreement with prior work. He argues, however, that a more appropriate benchmark index would focus on small-cap stocks, in particular small-cap value stocks. Using the Dimensional Fund Advisors (DFA) microcap mutual fund and the Fama–French small-cap value index as benchmarks in place of the S&P 500, Phalippou (2014) finds that average BO PME declines to 1.04 and 0.96, respectively. With these and other adjustments, Phalippou (2014) concludes that BO funds underperform relevant benchmarks. An important criticism of this conclusion is that it is unlikely that LPs can invest appreciable amounts in the alternative benchmarks Phalippou considers. In particular, the DFA microcap mutual fund had less than $4 billion in assets in 2011, appreciably less than 1% of outstanding investments in BO funds.

4.3. Summary

Until around 2010, Kaplan & Schoar (2005) and Phalippou & Gottschalg (2009) were the most commonly cited papers for statistics on average PE fund performance. New evidence from Stucke (2011) has shown that the prior authors' statistics for BO funds are biased downward even during their sample period owing to flaws in the underlying data. Researchers should therefore use caution when citing these results.

Evidence from new sources of GP–LP cash flow data, extending through 2011, indicates that BO funds have outperformed the S&P 500 net of fees on average by approximately 20% over the life of a fund. Despite their different data sources, Robinson & Sensoy (2013a), Harris et al.

(2014), Higson & Stucke (2014), and Phalippou (2014) all find virtually identical average BO PMEs using the S&P 500 as the benchmark, suggesting that each of these data sets is reasonably representative of the universe of BO funds. Even though the evidence overwhelmingly supports BO outperformance relative to the S&P 500, the correct benchmark can be debated: For example, as noted above, Korteweg & Nagel (2013) and Sorensen & Jagannathan (2013) provide theoretical justification for using a market portfolio such as the S&P 500 as the appropriate benchmark, and spell out the necessary assumptions.

Because fees in PE funds are on the order of 3% to 4% per year (see Kaplan & Rauh 2010, Metrick & Yasuda 2010), evidence also strongly suggests that BO funds outperform the S&P 500 and all other reasonable benchmarks gross of fees. On the VC side, the picture is mixed. Both Robinson & Sensoy (2013a) and Harris et al. (2014) find that VC funds raised in the 1990s outperformed the S&P 500, whereas those raised in the 2000s underperformed.

5. PERFORMANCE OVER TIME

There is ample evidence that private and public equity waves move together (see Gompers & Lerner 2000, Gompers et al. 2008, Kaplan & Stromberg 2009). When public equity valuations are high, so too are commitments to PE funds and entry of new funds (Kaplan & Schoar 2005). As Kaplan & Stromberg (2009) document, such episodes tend to be followed by low absolute returns to PE funds.[3] One interpretation of this finding is that it reflects irrational exuberance on the part of LPs and opportunistic behavior on the part of GPs. Another, more innocuous interpretation is that cyclical variation in returns is to be expected given the equity-like nature of PE investments. A natural question is whether the cyclicality of PE returns continues to hold in a market-adjusted sense using the PME as the performance measure.

Table 1 shows value-weighted average IRR, MIC, and PME by vintage year for BO funds. The statistics are taken from Robinson & Sensoy (2013a), Harris et al. (2014), and Higson & Stucke (2014). **Table 2** shows the analogous statistics for VC funds from Robinson & Sensoy (2013a) and Harris et al. (2014). The procyclicality of absolute returns, especially for VC funds, is evident in the table. The PME displays less cyclicality, especially for BO funds.

Robinson & Sensoy (2013a) and Harris et al. (2014) conduct formal tests relating ex post realized fund MICs and PMEs to the total capital committed to all PE funds in the same vintage years. Like Kaplan & Stromberg (2009), these authors find that MICs are strongly negatively related to PE fundraising quantities, especially for VC funds. However, the economic magnitude of the relation is smaller when looking at PMEs. The relation is significant in Harris et al. (2014), but not in Robinson & Sensoy (2013a). Overall, the evidence suggests that a great deal of the aggregate fluctuations in PE returns over time is due to common shocks affecting public and private equities.

6. PERFORMANCE PERSISTENCE

Kaplan & Schoar (2005) were the first to document performance persistence in PE. They show that the performance (PME or IRR) of a given fund is positively associated with the performance of the next fund raised by the same PE firm. They find persistence for both BO and VC funds. In contrast, there is little evidence of persistence in mutual fund performance (Carhart 1997, Fama

[3]Ljungqvist, Richardson & Wolfenzon (2007) find that BO fund managers accelerate investments and portfolio company investments perform better when market conditions improve. Axelson et al. (2013) show that the use of leverage in BO investments increases and subsequent performance suffers when credit markets loosen.

Table 1 Buyout fund performance over time: value-weighted averages by vintage year

Vintage year	IRR			MIC			PME		
	Robinson & Sensoy (2013a)	Harris, Jenkinson & Kaplan (2014)	Higson & Stucke (2014)	Robinson & Sensoy (2013a)	Harris, Jenkinson & Kaplan (2014)	Higson & Stucke (2014)	Robinson & Sensoy (2013a)	Harris, Jenkinson & Kaplan (2014)	Higson & Stucke (2014)
1980	—	—	30.9	—	—	5.87	—	—	1.88
1981	—	—	33.6	—	—	4.67	—	—	2.02
1982	—	—	38.7	—	—	3.24	—	—	1.67
1983	—	—	20.2	—	—	2.46	—	—	1.1
1984	38	15.8	23.6	3.23	3.28	3.92	1.56	1.09	1.38
1985	24	13.7	24.2	2.62	2.66	2.39	1.27	0.91	1.35
1986	13	16	20.1	2.05	3.27	3.2	0.93	1.11	1.28
1987	20	15.3	11.7	2.66	2.58	1.92	1.28	1.2	0.89
1988	9	18.4	14.1	1.57	2.32	1.82	0.77	1.13	0.95
1989	20	21.1	20.4	2.42	2.75	2.53	1.15	1.22	1.25
1990	28	52.9	20.4	2.64	3.37	2.26	1.35	2.34	1.09
1991	16	27.8	29.5	1.92	2.54	2.68	0.84	1.32	1.41
1992	37	15	26.5	2.3	1.88	2.64	1.31	0.89	1.27
1993	44	26	22.7	2.74	2.48	2.09	1.49	1.24	1.14
1994	28	34.5	29.8	2.14	3.29	2.57	1.28	1.75	1.43
1995	18	16.9	18.9	2.09	1.82	1.88	1.33	1.2	1.26
1996	9	2.4	5.8	1.43	1.17	1.3	1.07	0.9	1
1997	13	8.8	9.7	1.67	1.5	1.55	1.41	1.3	1.37
1998	6	3.6	4.7	1.39	1.28	1.26	1.25	1.21	1.2
1999	−3	4.8	8.5	1.36	1.4	1.41	1.2	1.27	1.28
2000	6	14.3	15.3	1.31	1.75	1.72	1.14	1.47	1.48
2001	4	15.1	19.8	1.26	1.67	1.79	1.03	1.38	1.55
2002	27	18.4	21.1	1.53	1.84	1.8	1.25	1.53	1.55
2003	50	22.5	22.1	1.6	1.8	1.71	1.43	1.58	1.59
2004	17	15.4	13.3	1.23	1.64	1.45	1.04	1.51	1.41
2005	14	7.1	7.4	1.19	1.27	1.23	1.04	1.23	1.28
2006	—	0.5	−1	—	1.02	0.98	—	0.99	1.07
2007	—	4.4	−1.7	—	1.09	0.97	—	1.02	1
2008	—	1.5	0.2	—	1.04	1.01	—	0.9	0.96

Statistics are taken from Robinson & Sensoy (2013a); Harris, Jenkinson & Kaplan (2014); and Higson & Stucke (2014). Dashes (—) mark cells that are not applicable. Abbreviations: IRR, internal rate of return (in percent); MIC, multiple of invested capital (also known as the total value paid in capital); PME, public market equivalent (calculated following Kaplan & Schoar 2005).

& French 2010), and the evidence is mixed in hedge funds (Ammann, Huber & Schmid 2010; Jagannathan, Malakhov & Novikov 2010).

From a theoretical perspective, performance persistence in delegated asset management is puzzling. In Berk & Green (2004), investor capital flows competitively, and managers capture the returns to their skill by growing the size of their funds or increasing fees as a percentage of fund size. This mechanism eliminates persistence in the net-of-fee returns to investors even when managers are skilled.

Table 2 Venture capital fund performance over time: value-weighted averages by vintage year

Vintage year	IRR		MIC		PME	
	Robinson & Sensoy (2013a)	Harris, Jenkinson & Kaplan (2014)	Robinson & Sensoy (2013a)	Harris, Jenkinson & Kaplan (2014)	Robinson & Sensoy (2013a)	Harris, Jenkinson & Kaplan (2014)
1984	10	7.9	1.48	1.73	0.78	0.69
1985	12	7.1	2.05	1.93	0.92	0.73
1986	−10	9.4	1.4	1.82	0.78	0.8
1987	6	20.2	1.78	2.77	0.73	1.29
1988	15	24.4	1.8	2.88	1.02	1.44
1989	18	25.7	2.13	3.09	1.17	1.52
1990	15	29.5	1.43	3.3	1.01	1.66
1991	—	28.5	—	2.92	—	1.35
1992	6	24.8	1.27	2.72	0.84	1.34
1993	36	51.9	1.96	6.34	1.19	2.74
1994	52	41.4	3.31	6.58	1.87	2.86
1995	21	46.4	1.89	3.55	1.22	2.09
1996	27	76.7	1.99	6.33	1.27	4.17
1997	42	76.1	2.26	3.28	1.8	2.65
1998	30	15.5	1.67	1.6	1.54	1.48
1999	−27	−4.5	0.64	0.94	0.61	0.9
2000	−11	−1.3	0.83	0.97	0.71	0.85
2001	−22	−0.7	0.82	1.01	0.67	0.84
2002	3	0.6	1.05	1.07	0.85	0.88
2003	—	0.9	—	1.11	—	0.99
2004	—	0.3	—	1.07	—	0.96
2005	−6	3.3	0.93	1.31	0.8	1.23
2006	—	0.6	—	1.04	—	0.97
2007	—	3.2	—	1.09	—	0.99
2008	—	−4.5	—	0.97	—	0.84

Statistics are taken from Robinson & Sensoy (2013a) and Harris, Jenkinson & Kaplan (2014). Dashes (—) mark cells that are not applicable. Abbreviations: IRR, internal rate of return (in percent); MIC, multiple of invested capital (also known as the total value paid in capital); PME, public market equivalent (calculated following Kaplan & Schoar 2005).

Why do PE fund managers not fully capture the returns to their skill in this way? Hochberg, Ljungqvist & Vissing-Jorgensen (2014) propose an explanation based on an information friction. In their model, the LPs of a given fund learn soft information about the GP's skill that outsiders do not, in particular the ability to discern whether a particular return was largely due to skill or luck. When it is time for the GP to raise another fund, existing LPs use their information advantage to hold up the GP; if existing LPs decline to reinvest, outsiders will infer that GP skill must be low and also refuse to invest. This mechanism inhibits the competitive supply of capital and allows existing LPs to achieve better terms than they would otherwise. Using IRR information for a large sample of VC funds raised between 1980 and 2002, the authors confirm the persistence of VC returns and present evidence supportive of their model mechanism.

Since Kaplan & Schoar (2005), the literature has generally shown that performance persistence in PE has continued but diminished somewhat. Robinson & Sensoy (2013a) show performance

persistence in their sample. Chung (2012) uses a sample of funds from Preqin with vintage years up to 2000 and concludes that performance persistence does not continue beyond one fund ahead and is partly driven by common economic shocks to funds that overlap in time.

Harris et al. (2014) conduct the most comprehensive analysis of fund-level performance persistence in PE. Using the Burgiss data through 2011, they confirm previous findings on persistence in pre-2000 funds. There is persistence for BO funds and, particularly, for VC funds.

After 2000, they find little evidence of persistence for BO funds, except at the lower end of the performance distribution. When funds are sorted by the quartile of performance of their previous funds, performance of current funds is statistically indistinguishable regardless of quartile. Regression results confirm the absence of persistence after 2000 except for funds in the lower end of the performance distribution.

In contrast, for VC funds, they find that performance remains as persistent after 2000 as before 2000. Partnerships whose previous VC funds are below the median for their vintage year subsequently tend to be below median and have returns below those of the public markets (S&P 500). Partnerships in the top two quartiles tend to stay above the median, and their returns exceed those of the public markets. Harris et al. (2014) and Ghai, Kehoe & Pinkus (2014) obtain qualitatively similar results using Preqin data through 2013.

Performance persistence has also been documented at finer levels of detail than the PE fund. Ewens & Rhodes-Kropf (2015) use a novel data set of information on individual venture capitalists within a VC firm (VC partners). They show that performance persists at the partner level; a VC partner who makes an investment that goes on to be successful is more likely to make additional successful investments. Braun, Jenkinson & Stoff (2014) use a large data set of BO portfolio company investments to show that performance persists within a BO firm across successive groupings of investments without regard to the fund in which investment occurs. Consistent with other evidence that persistence has declined over time, they find little evidence of persistence in investments made since the late 1990s.

Overall, the diminished persistence results for BOs are broadly consistent with Berk & Green (2004). Over time, investor capital flows competitively and managers capture the returns to their skill, in this case by growing the size of their funds. In contrast, the continued persistence results for VC are not consistent with the model by Berk & Green (2004). Instead, they require an alternative explanation such as that of Hochberg, Ljungqvist & Vissing-Jorgensen (2014).

7. INTERIM RETURNS

The advent of new cash flow data has spawned a stream of research analyzing the accuracy of GPs' self-reported NAVs over the life of a fund. The question is important for at least two reasons. First, calculation of interim fund returns (whether IRR, MIC, or PME) necessarily involves taking a stand on the fair value of unrealized investments, i.e., a fund's NAV. As noted in Section 3, common practice in the literature has been to treat last-observed NAVs as a liquidating distribution for the purpose of computing performance for funds that are not yet liquidated at the end of a researcher's sample period. The validity of this practice is ultimately an empirical matter. Second, PE firms typically manage multiple funds at once and seek to raise a new fund every three to five years. At that time, the performance of the immediate-past fund has not yet been fully realized. Gompers (1996) shows that funds strategically time their exits to improve their fundraising chances. Chung et al. (2012) show that GPs' fundraising incentives are of the same order of magnitude as the incentives provided by carried interest in the current fund. Given the importance of raising new funds, it is natural to question whether GPs inflate NAVs strategically around fundraising periods in an attempt to make to-date performance look as good as possible.

Several recent papers address these issues. Jenkinson, Sousa & Stucke (2013) use quarterly NAVs and cash flows for a complete history of the 761 PE funds in which CalPERS invested. The data span vintage years 1990–2012 and extend to the end of the first quarter of 2012. Using these data, they find fairly widespread evidence of NAV manipulation. They find that NAVs are usually conservative, in that they understate future distributions, and smoothed, in that they respond less than one for one to changes in public market valuations. At the same time, they find that valuations spike around likely fundraising times and in the fourth quarter of the year, when returns are particularly salient.

Brown, Gredil & Kaplan (2014) use the Burgiss data to focus on reported NAVs around times fundraising occurs or is likely to occur. They find some evidence that GPs of poorly performing funds attempt to game NAVs in an effort to raise another fund. This pattern is, however, concentrated among firms that fail to raise a new fund, suggesting that LPs see through such attempts at manipulation.

Specifically, Brown, Gredil & Kaplan (2014) find that, among firms that fail to raise a new fund, reported to-date performance using NAVs around the likely time of fundraising is significantly higher than the ultimate realized performance of the funds. This pattern is not present for other groups of funds. Finally, they present evidence that top-performing funds are conservative when it comes to reporting NAVs and interpret this result as consistent with an incentive to be conservative to lessen the odds of later being accused of manipulation. Overall, Brown, Gredil & Kaplan (2014) conclude that NAV manipulation is much less widespread than noted by Jenkinson, Sousa & Stucke (2013) and attribute the different results to differences in methodology.

Barber & Yasuda (2013) obtain results that are consistent with both previous papers. They first show that the performance of a GP's current fund relative to its vintage year affects a GP's ability to raise a subsequent fund. They also find that a GP's time of subsequent fundraising coincides with peak current fund performance (relative to its vintage year). Following fundraising, they find that the size and frequency of markdowns increase. Effects are present for both BO and VC funds and are stronger for smaller and younger GPs who have greater incentives to report strong interim performance. Investigating risk-shifting incentives associated with interim performance, Crain (2014) also finds that strong interim performers increase the risk of their subsequent portfolio company investments.

Overall, the evidence suggests that some GPs, particularly smaller, younger, and more poorly performing ones, are aggressive in reporting their NAVs when they are fundraising. It is not clear whether LPs are fooled by such aggressive reporting. In nonfundraising periods, the evidence suggests that GPs tend to be conservative in their reporting of NAVs. This suggests that the performance studies cited above provide reliable measures of performance and, if anything, understate that performance.

8. SKILL OF GENERAL AND LIMITED PARTNERS

8.1. General Partner Skill

A natural question, especially given the evidence on performance persistence in PE, is the extent to which GPs have skill and how reliably skill can be identified from the data. Indeed, the extent to which skill or luck is responsible for manager performance is a key issue in many areas of economics and finance. Hochberg, Ljungqvist & Vissing-Jorgensen (2014) observe that approximately two-thirds of VC funds in their data went out of business during their sample period, suggesting that LPs came to believe that their GPs lacked skill.

Korteweg & Sorensen (2013) use a variance decomposition model to attempt to disentangle skill from luck in a sample of 842 VC funds and 562 BO funds with vintage years 1969–2001. Although confirming the standard persistence results in the literature, they point out that the traditional AR(1) regression model of persistence, in which the performance of a partnership's *N*th fund is regressed on the performance of its immediately prior fund, implies that all PE firms converge in the limit to the same distribution, which precludes long-run differences in outcomes across firms. They propose a model of PE performance that does not share this drawback. In their model, fund performance is driven by firm fixed effects, reflecting long-term persistence or skill, as well as two types of shocks: one specific to the PE firm and time period and the other purely idiosyncratic.

Estimating their model using the IRR as the performance measure, Korteweg & Sorensen (2013) conclude that there is a large amount of long-term persistence (differences in skill) across PE firms and that skilled PE firms outperform by 7–8% annually. They emphasize, however, that it is difficult for LPs to capitalize on these differences in real time. PE performance is noisy, and identifying skilled GPs from past performance alone is fraught with error.

Ewens & Rhodes-Kropf (2015) attempt to disentangle GP skill at the level of a firm from that of individual partners. In a fixed effects framework in which identification is based on partners who switch firms, they find evidence that at least some GP skill in VC operates at the level of individual partners.

8.2. Limited Partner Skill

The skill versus luck question is also present in the performance of LPs. A key question for institutional investors is whether some investors, or classes of investors, earn higher returns because they are better than others at selecting or accessing investments. Lerner, Schoar & Wongsunwai (2007) hypothesize that, because of their relative complexity and opacity, PE investments are an area in which differences in LP investment abilities are particularly likely to exist. Using a sample of 838 BO and VC funds raised between 1991 and 1998 invested by 352 LPs, totaling 4,618 LP investments, Lerner, Schoar & Wongsunwai (2007) find that the performance (measured by IRR) of funds in which endowments invest is statistically and economically greater than the performance of funds in which other classes of institutions invest, including public and corporate pension funds, investment advisors, insurance companies, banks, and others. Exploring the sources of this outperformance, the authors propose that a way to evaluate LP skill is to measure the quality of their reinvestment decisions. Because LPs in a fund generally have the option of reinvesting in a partnership's next fund, focusing on reinvestment decisions holds constant LPs' access to the funds. They show that the funds in which endowments reinvest perform better than those in which endowments choose not to reinvest. On the basis of this and other tests, Lerner, Schoar & Wongsunwai (2007) conclude that their results are at least partially driven by endowments' superior skill at selecting funds that will perform well.

Sensoy, Wang & Weisbach (2014) update and extend this analysis to funds raised between 1999 and 2006. Using a sample of 14,380 investments by 1,852 LPs in 1,250 BO and VC funds raised between 1991 and 2006, they likewise find that endowments outperform when investing in funds raised between 1991 and 1998 and that reinvestment decisions for these endowments are better than those of other LP types. However, they also find in this period that the funds in which endowments declined to reinvest perform better than those in which other LP types do reinvest. With this and other tests, these authors conclude that endowment LPs had access to a superior pool of investment opportunities in the 1991–1998 period, particularly among VC funds.

In a more recent sample of funds raised between 1999 and 2006, Sensoy, Wang & Weisbach (2014) find no evidence that endowments outperform other LP types or display any superior skill at selecting GPs.[4] They conclude that the disappearing endowment advantage is consistent with other secular trends in the industry, particularly the decline in VC performance since the late 1990s and the decline in performance persistence in BO firms. At the same time, using the method of Harris, Jenkinson & Kaplan (2014) to estimate PMEs from information on IRR, MIC, and vintage year, Sensoy, Wang & Weisbach (2014) conclude that PE investments from all LP types outperform the S&P 500 on average in both the 1991–1998 and the 1999–2006 periods.

This does not mean, however, that LP investments are necessarily always made with an eye toward maximizing returns. Hochberg & Rauh (2013) conduct a study of public pension plan investments by local, in-state VC GPs. They find that such investments underperform those made by out-of-state GPs, suggesting that government investors may favor local GPs at the expense of pension plan participants.

9. FEES AND PERFORMANCE

An old question is whether delegated asset managers earn their fees in the sense of generating risk-adjusted gross returns sufficient to cover investor costs, including fees. Closely related is the question of whether asset managers with higher fees underperform those who charge less for their services. Robinson & Sensoy (2013b) address these questions using the first data set available to researchers containing information on both GP–LP contractual terms at the fund level and fund cash flow performance. The contractual terms in this data set include management fee percentage and basis, carried interest percentage, and GP ownership in the fund.

Using the PME as the primary performance measure, Robinson & Sensoy (2013b) find no evidence that funds with higher management fees or carried interest underperform other funds. They also find no link between fund performance and GP ownership in the fund. These findings are hard to reconcile with the views that high GP fees are unjustified by performance, that low GP ownership implies insufficient GP interest in the outcome of the fund, or that LPs fail to understand the implications of the contracts they sign or are otherwise unable to bargain effectively with GPs. Instead, Robinson & Sensoy (2013b) argue that their findings are consistent with at least one feature that would be expected of an optimal contracting outcome between sophisticated parties: Higher-skilled GPs earn their higher fees by delivering superior gross-of-fee performance.

Robinson & Sensoy (2013b) nevertheless find evidence of GP–LP agency problems in distribution behavior around carried interest waterfalls and the presence of "living dead" investments. Although Jensen & Meckling (1976) note that even optimal contracting does not imply the elimination of all agency problems, the optimality of GP–LP contracts and the extent of persistent agency issues in a GP–LP relationship are likely to be topics of continued debate and fruitful areas for future research.

Fang, Ivashina & Lerner (2013) offer another approach examining fees and performance in PE. They analyze the performance of direct PE investments by institutional LPs, consisting of both coinvestments alongside traditional funds and solo direct investments. Despite the fact that such investments are made at substantial fee discounts relative to the traditional fund structure, Fang, Ivashina & Lerner (2013) find that they do not outperform traditional funds net of fees. If anything, direct investments underperform, suggesting that lower fees are associated with lower

[4]Da Rin & Phalippou (2013) report survey evidence that endowments do not use different investment procedures than do other LP types. Instead, more sophisticated policies and procedures are associated with larger LPs.

performance gross of fees. Overall, the result that higher fees do not result in lower performance is consistent across Robinson & Sensoy (2013b) and Fang, Ivashina & Lerner (2013).

10. SUMMARY

In this article, we survey the results of recent empirical work on PE fund performance as well as progress in the theoretical understanding of different performance measures and risk adjustments. Evidence from new sources of GP–LP cash flow data, extending through 2011, indicates that BO funds have outperformed the S&P 500 net of fees on average by approximately 20% over the life of the fund. The results are consistent across a number of data sets (Burgiss, Cambridge Associates, Preqin, and large LP types), suggesting that each of these data sets is reasonably representative of the universe of BO funds. Even though evidence overwhelmingly supports BO outperformance relative to the S&P 500, the correct benchmark can be debated. Because fees in PE funds are on the order of 3% to 4% per year, results also strongly suggest that BO funds outperform the S&P 500 and all other benchmarks gross of fees.

It is an open question whether BO outperformance net of fees can persist in the future. The outperformance has been minimal for funds raised from 2006 to 2008, a period in which the number of funds raised and capital commitments were at historically high levels. Capital commitments have also continued at high levels over the past several years. It is possible that the competitive pressures described in Berk & Green (2004) will eliminate outperformance going forward.

On the VC side, the picture is mixed. VC funds raised in the 1990s outperformed the S&P 500, whereas those raised in the 2000s underperformed. Again, more recent vintages have performed roughly in line with the S&P 500 net of fees. These findings are consistent with the arguments in Berk & Green (2004) for the asset class as a whole.

For both BO and VC funds, absolute returns are significantly negatively related to capital committed to the asset class. Public market returns also are negatively related to capital committed, suggesting that capital committed to PE increases when realized market returns are high and expected market returns are low. BO and VC fund PMEs also are negatively related to capital committed, but relations are weaker than with absolute returns.

Before the 2000s, the performance of both BO and VC funds showed strong evidence of persistence. Since 2000, the persistence of BO funds appears to have declined, if not disappeared, except for poorly performing funds, the so-called bottom quartile. VC fund persistence, however, remains equally and remarkably strong post 2000.

Several recent papers have studied the reporting of interim performance by PE funds. Overall, evidence suggests that some GPs, particularly smaller, younger, and more poorly performing ones, are aggressive in reporting their NAVs when they are fundraising. It is unclear whether LPs are fooled by aggressive reporting. In nonfundraising periods, the evidence indicates that GPs tend to be conservative in their reporting of NAVs. This suggests that the performance studies cited above provide reliable measures of performance and, if anything, understate that performance.

As with recent evidence on persistence, recent evidence on LP skill suggests that competition and entry have likely altered relationships that appeared to hold in earlier periods. In particular, in funds raised between 1999 and 2006, endowments do not appear to outperform other LP types in their PE investments or to possess superior skill at selecting GPs. Finally, recent work on fees can best be described as finding that GPs earn their fees. Higher-fee funds do not underperform their lower-fee counterparts net of fee, and low-fee LP investments such as coinvestments and solo direct investments do not outperform traditional funds.

One lens for interpreting this work overall is the extent to which asset growth, competition, and learning along the lines of Berk & Green (2004) have affected PE performance over time. For

average performance, these forces did not reduce BO fund performance through 2005 vintages, but they may have done so for post-2005 BO funds and arguably have led to VC fund returns of recent vintages roughly equal to the overall market. Similarly, these forces appear to have reduced the extent of persistence for BO funds. They also appear to have eliminated the advantage of endowments as LPs. Interestingly, competitive forces have not eliminated the advantages and persistence of top-performing VC funds.

DISCLOSURE STATEMENT

Kaplan has consulted to buyout and venture capital general partners and limited partners. He has also invested in private and public equities. Sensoy is not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

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