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Private Equity Performance: What Do We Know?

ROBERT S. HARRIS, TIM JENKINSON, and STEVEN N. KAPLAN*

ABSTRACT

We study the performance of nearly 1,400 U.S. buyout and venture capital funds using a new data set from Burgiss. We find better buyout fund performance than previously documented—performance has consistently exceeded that of public markets. Outperformance versus the S&P 500 averages 20% to 27% over a fund's life and more than 3% annually. Venture capital funds outperformed public equities in the 1990s, but underperformed in the 2000s. Our conclusions are robust to various indices and risk controls. Performance in Cambridge Associates and Preqin is qualitatively similar to that in Burgiss, but is lower in Venture Economics.

DESPITE THE LARGE INCREASE in investments in private equity (PE) funds and the accompanying academic and practitioner scrutiny, the historical performance of PE remains uncertain, if not controversial. The uncertainty has been driven by the uneven disclosure of PE returns and questions about the quality of data available for research. While several commercial enterprises collect performance data, they do not obtain information for all funds; they often do not disclose, or even collect, fund cash flows; and the source of the data is sometimes obscure, resulting in concerns about sample biases. Furthermore, some data are only periodically made available to academic researchers.

In this paper, we use a new research-quality data set of PE fund-level cash flows from Burgiss. We refer to PE as the asset class that includes buyout funds and venture capital (VC) funds. We analyze the two types of funds separately. The data set has a number of attractive features that we describe in detail later. A key attribute is that the data are derived entirely from *institutional investors* (the limited partners or LPs) for whom Burgiss's systems provide record-keeping and performance monitoring services. This feature results in

*Harris is with University of Virginia, Darden School of Business; Jenkinson is with Said Business School, University of Oxford, and CEPR; and Kaplan is with University of Chicago Booth School of Business and NBER. This research has been supported by the UAI Foundation and the Center for Research in Security Prices. Rui Cui provided able research assistance. We thank Burgiss for supplying data. Kaplan has consulted to buyout and venture capital general partners and limited partners. He also has invested in private and public equities. We thank James Bachman, Robert Bartlett, Cam Harvey (the Editor), Stuart Lucas, David Robinson, two anonymous referees, the Associate Editor and seminar participants at Chicago Booth, Harvard Business School, the JOIM Conference at Stanford Business School, NBER Corporate Finance, the New York Federal Reserve, the University of North Carolina Private Equity Conference, and the University of Penn Law School ILE Corporate Roundtable for helpful comments.

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detailed, verified, and cross-checked investment histories for nearly 1,400 PE funds derived from the holdings of over 200 institutional investors.

Using these data, we reassess the performance of PE funds both in absolute terms and relative to public markets. Our results are markedly more positive for buyout funds than previously documented with commercial data sets. Analyzing the cash flow data from Burgiss, we find that average U.S. buyout fund returns have exceeded those of public markets for most vintages since 1984. The public market equivalent (PME) method of Kaplan and Schoar (2005), which compares how much a PE fund investor actually earned net of fees to what the investor would have earned in an equivalent investment in the public market, shows that outperformance versus the S&P 500 averages 20% to 27% over the life of the fund and more than 3% per year.

Buyout fund outperformance remains similar in magnitude using other benchmarks, such as the Nasdaq and the (small-cap) Russell 2000, and is lower, but also positive, measured against the (small-cap) Russell 2000 value index and Fama-French size deciles. These results are consistent with those in Robinson and Sensoy (2011a) and Ljungqvist and Richardson (2003), who use data from a single large LP who, they argue, invested much like an index fund, particularly for buyout funds.

Average VC fund returns in the United States, on the other hand, outperformed public equities in the 1990s but have underperformed public equities in the most recent decade.

Although we cannot directly estimate the systematic risk of the underlying portfolio companies, our results, for both buyouts and VC funds, are qualitatively similar when we assume higher levels of systematic risk.

We also examine whether fund performance is linked to capital—both the aggregate amount of capital flowing into PE and the capital committed to a particular fund. We find that both absolute performance and performance relative to public markets are negatively related to aggregate capital commitments for both buyout and VC funds. This result is consistent with and extends the results in Kaplan and Stromberg (2009). This result is also consistent with those in Robinson and Sensoy (2011a) except that they do not find a negative relation between capital commitments and buyout fund PMEs.

We find no significant relation between performance and fund size for buyout funds. For VC funds, we find that funds in the bottom quartile of fund size underperform. Controlling for vintage year, top size quartile funds have the best performance although they do not differ significantly from funds in the second and third size quartiles.[1]

We also compare the Burgiss evidence to that derived from the other leading commercial data sets, namely, Cambridge Associates, Preqin, and Venture

[1] One other relationship of interest concerns performance persistence across funds of the same general partner, as analyzed by Kaplan and Shoar (2005). In this sample of Burgiss data, we do not have access to fund sequence numbers. Using a later sample of Burgiss data, Harris et al. (2013) explore persistence.

Economics (part of Thomson Reuters).[2] Our results show that PE performance in the Cambridge Associates and Preqin samples is qualitatively similar to the performance in the Burgiss data. Consistent with Stucke's (2011) finding of a downward bias, performance is lower in the Venture Economics data, particularly for buyout funds.

We make these comparisons even though we do not have access to the underlying cash flows in the other three data sets. Our approach is to combine summary-level data from the other leading commercial sources—Cambridge Associates, Preqin, and Venture Economics—with patterns we find in the Burgiss data for which we do have complete cash flow information. Harnessing fund-level cash flows from Burgiss, we study the relationship between market-adjusted performance (PME) and absolute performance measures—the internal rate of return (IRR) and multiple of invested capital. We find that, within a given vintage year, PMEs are reliably predicted by a fund's multiple of invested capital and IRR. Regression results show that multiples and IRRs explain at least 93% of the variation in PMEs in more than 90% of vintage years. Although both add explanatory power, the multiple of invested capital provides more explanatory power than the IRR overall and in most vintage years. This suggests that multiples of invested capital are preferable to IRRs as summary measures of PE performance.

Using the strong statistical relationship between PMEs, multiples, and IRRs found in the Burgiss data, we estimate the average market-adjusted performance implicit in the other commercial databases. We apply the regression coefficients to the vintage year multiples of invested capital and IRRs from Cambridge Associates, Preqin, and Venture Economics to estimate vintage year PMEs for the funds in those databases. This procedure requires only the vintage year multiples and IRRs from the other databases, even if the underlying fund cash flows are not available to us or even to the commercial source.

As with the Burgiss data, we estimate that buyout funds outperform public markets in the 1990s and 2000s in the three other commercial databases. We estimate that the funds in Cambridge Associates and Preqin, like those in Burgiss, outperform the S&P 500 in the average vintage year by at least 20% over the life of the fund. Although the PMEs are lower in the (likely downwardly biased) Venture Economics database, the PMEs still imply that the average PE fund outperformed the S&P 500 by more than 10% over the life of the fund. For VC funds, the PME results are generally consistent across all four databases although, again, slightly lower in the Venture Economics data.

Overall, our findings strongly suggest that buyout funds have outperformed the public equity markets net of fees over most of our sample period. To invalidate that conclusion, all three reliable commercial data sets would have to be subject to a similar and large positive selection bias despite very different data collection and reporting methods. We view this as highly unlikely.

[2] Harris, Jenkinson, and Stucke (2010) and Cornelius (2011) also present performance data from different commercial data sets, but do not use cash flow data for individual funds. Lerner, Schoar, and Wongsunwai (2007) use Preqin data.

Instead, we view the similar results as more consistent with the conclusion that all three databases provide unbiased estimates of the overall performance of PE.

Because PE investments are illiquid, it is perhaps not surprising that they yield investors some premium relative to investing in public markets. As well as the relatively illiquid nature of PE investments, there is also uncertainty regarding how much to commit to PE funds to achieve a target portfolio allocation. This is due to the uncertain time profile of capital calls and realizations. Consequently, "commitment risk" exists when investing in PE. This contrasts with investing in public markets where there is no distinction between capital committed and invested, and trading is continuous. The cost of illiquidity or commitment is likely to vary across investors, and remains an important area for research.[3]

Several prior papers study PE returns. Kaplan and Schoar (2005) examine the returns to buyout and VC funds using fund cash flow data from Venture Economics. While their focus is return persistence across funds of the general partner (GP), they report that buyout fund investors earn slightly less than the public market. VC funds slightly underperform public markets on an equal-weighted basis, but outperform on a capital-weighted basis. Using a slightly updated version of the Kaplan and Schoar (2005) data set, Phalippou and Gottschalg (2009) obtain qualitatively similar results and reach a similar but somewhat more negative conclusion for buyout funds. They assume that any remaining investments held by funds for which Venture Economics reports no cash flows after 10 years have no value (rather than the net asset value applied by Kaplan and Schoar (2005)).

Stucke (2011), however, identifies a significant problem with the Venture Economics data: he presents strong evidence that many funds stopped being updated around 2001 and yet were retained in the database. For these funds, no additional cash flows were recorded and net asset values (NAVs) were simply rolled forward each quarter. As a result, fund-level IRRs in the Venture Economics sample decline with the passage of time and multiples of invested capital remain constant rather than increasing. This is consistent with the findings of Harris, Jenkinson, and Stucke (2010) that returns based on the Venture Economics sample are consistently lower than those for other commercial providers for most vintage years. We confirm this result. This serious bias in the Venture Economics performance data suggests that the results in Kaplan and Schoar (2005) and Phalippou and Gottschalg (2009) understate fund returns, particularly for buyout funds.

[3] The size of the commitment risk premium is likely to depend upon the ability (or willingness) of the investor to diversify its holdings across vintage years and, within vintage years, between funds. Given that many funds have minimum investment levels, this in turn would depend upon the overall size of the portfolio being managed. Furthermore, the cost of deviating from an "optimal" portfolio allocation, and the impact of cash flow uncertainty, will vary across investors. Hence, it is likely that risk premia will vary significantly across investors. Note that such risks could be mitigated, to some extent, by secondary transactions to sell commitments to PE funds. However, the development of such trading is still in its infancy.

Furthermore, these papers focus on funds that were close to being fully liquidated at the time the data were made available to researchers, and so only funds that started investing (the so-called "vintage year") before 1995 are included.[4] Subsequent years have seen a huge increase in the number and size of PE funds. Whereas around $148 billion was raised by U.S. buyout and VC funds from 1980 to 1995, $668 billion was raised for 1996 to 2004 vintage funds. These sums were further eclipsed by the boom period of 2005 to 2008 when $794 billion was raised by PE funds over just four vintage years.[5] The samples in the earlier papers offer no evidence on more recent performance from PE investing.

More recently, Robinson and Sensoy (2011a) study the returns earned by a large bank LP in buyout and VC funds. Their results are qualitatively similar to ours, albeit somewhat lower for VC funds. Higson and Stucke (2012) study buyout fund performance using cash flow data from Cambridge Associates. They obtain qualitatively similar results to ours. They do not study VC funds. The Higson and Stucke study also provides an "out-of-sample" test of our methods to estimate PMEs implied by a data set even without access to the underlying cash flow data. Applying our regression results (that were estimated and circulated before the Higson and Stucke article) to the summary data in Higson and Stucke, our PME estimates closely approximate the PMEs that Higson and Stucke calculate using actual cash flow data. This provides strong support for our PME estimation methodology. Phalippou (2012) estimates PMEs as of 2011 for a subset of funds from the Preqin data set that have cash flows. (He also includes very recent 2009 and 2010 vintages that are immature and have lower PMEs). He obtains qualitatively similar PMEs to ours using the S&P 500. He obtains PMEs of roughly 1.0 using a very small cap-value index.

The paper proceeds as follows. In the next section, we discuss the important features of the Burgiss data. Section II contains our main performance results. In Section III, we analyze whether performance is related to aggregate fundraising and fund size. Section IV explores the relationship between our preferred PME performance measure and the absolute performance measures most often used in practice, and we estimate the PMEs that would be found if one had detailed cash flow data from the other leading data sets. Section V concludes.

I. Data

This is the first paper to take advantage of data from Burgiss so we explain it in some detail. According to Burgiss, the data set "is sourced exclusively from LPs and includes their complete transactional and valuation history between themselves and their primary fund investments." The data include all funds

[4] The main results of Phalippou and Gottschalg (2009) use funds with a vintage year of 1993 or earlier, although they also report results for the same sample—up to the 1995 vintage—as employed by Kaplan and Schoar (2005).

[5] These figures are estimates from Private Equity Analyst. For details, see the Internet Appendix available in the online version of the article on the *Journal of Finance* website.

and cash flows from the LPs that provide the data. This is the first advantage of the Burgiss data: in order to compute performance relative to public markets, which we view as the most relevant metric, timed cash flow data are required. Few commercial providers have such detailed data, although they often have large samples of self-reported IRRs and investment multiples. (See Harris, Jenkinson, and Stucke (2010) for a summary of the main commercial databases.)

The second important advantage of the Burgiss data set is that it derives from over 200 investment programs that represent over $1 trillion in committed capital. The LPs comprise a wide array of institutions; over two-thirds have PE commitments in excess of $100 million. Of these, about 60% are pension funds (a mix of public and corporate) and over 20% are endowments or foundations. This broad range of investors differentiates this paper from others that source similar high-quality cash flow data from single investors (e.g., Ljungqvist and Richardson (2003) and Robinson and Sensoy (2011a, 2011b)).

The identities of the underlying investors are not made available to us, and so we cannot formally test how representative the LPs (and their chosen GPs) are. It is possible that the LPs in the Burgiss sample have had better-than-average experience with PE, which is why they use Burgiss and allow Burgiss to aggregate their results. The results that follow using the other commercial databases, however, lead us to doubt that this is the case.

A third important feature of the Burgiss data is that LPs use the Burgiss systems for record-keeping and fund investment monitoring. Such "check book" data—recording the exact cash outflows made by the LPs to the GPs as well as the distributions from the GPs back to the LPs—have a number of unique advantages for research purposes. The fact that the data are sourced from the back-office systems used by the LPs for reporting and fund accounting, and, importantly, are cross-checked across investors in the same fund, results in a level of data integrity and completeness that cannot be achieved by surveys, voluntary reporting, or (largely) involuntary reporting using Freedom of Information (FOIA) requests—the method primarily employed by Preqin. Furthermore, when data are sourced at least in part from GPs (as with Cambridge Associates,[6] Preqin, and Venture Economics), it is possible for a GP to strategically stop reporting. The Burgiss data also are up-to-date—given the need for quarterly reporting by most investors—and so there are no problems resulting from a lack of updating as there can be with other commercial databases.

Finally, we have Burgiss's detailed data for nearly 1,400 U.S. funds. Table I reports the sample distribution by vintage year,[7] and compares our coverage

[6] Cambridge Associates provides investment advice to LPs and, as a result, obtains its data from LPs as well as from GPs who have raised or are trying to raise capital. This may introduce a bias toward GPs who are raising new funds and therefore may have performed well. Our results, however, suggest that this is not the case.

[7] Vintage years are defined in various ways by data providers. Burgiss classifies a vintage year as the year in which a fund first draws capital from its LPs.

Table I

Number of Funds in Private Equity Data Sets

This table shows the number of funds in the various PE data sets for which performance data are available by vintage year (as defined by each source). Preqin has summary performance information (IRR and investment multiples) for the number of funds shown; it only has cash flow information, which is required for computing PME measures of performance, for a subset of these funds. Panel A focuses on buyout funds, and Panel B on VC funds, using the classifications provided by the suppliers or authors. Only funds with a North American geographical focus are included.

Panel A: Buyout Funds

Vintage	Burgiss	Venture Economics	Preqin	Cambridge Associates	Kaplan-Schoar	Robinson-Sensoy
1984	2	7	6		6	
1985	1	7	3		12	
1986	5	10	9	8	16	1
1987	7	25	7	9	22	8
1988	7	17	14	14	21	14
1989	8	24	10	15	22	16
1990	2	9	14	5	14	7
1991	4	5	8	11	6	2
1992	5	15	17	12	17	4
1993	11	21	18	22	11	9
1994	13	26	24	17	6	24
1995	17	23	22	28	7	24
1996	9	23	24	33		41
1997	30	40	35	44		40
1998	38	53	50	51		59
1999	28	38	43	49		59
2000	39	46	67	65		68
2001	26	27	25	18		26
2002	21	15	28	29		5
2003	13	13	29	32		8
2004	46	17	35	58		3
2005	57	20	63	73		2
2006	67	26	60	64		8
2007	74	22	65	67		6
2008	68	14	53	52		12
Total	598	543	729	776	160	446
Total 2000–08	411	200	425	458		
Total 1990–99	157	253	255	272	61	269
Total 1984–89	30	90	49	46	99	39

Panel B: Venture Capital Funds

1984	18	63	17	32	57	6
1985	20	46	23	25	37	5
1986	12	41	19	30	36	3
1987	17	64	21	34	63	6
1988	16	44	24	26	42	9
1989	18	50	38	37	45	10
1990	13	21	20	16	20	1
1991	6	18	12	17	11	

(*Continued*)

Table I—*Continued*

Panel B: Venture Capital Funds

Vintage	Burgiss	Venture Economics	Preqin	Cambridge Associates	Kaplan-Schoar	Robinson-Sensoy
1992	17	27	22	23	18	4
1993	13	41	32	37	45	5
1994	20	36	31	42	49	7
1995	18	49	29	34	43	13
1996	20	36	35	40		13
1997	33	64	54	73		19
1998	46	78	59	81		36
1999	65	107	78	112		40
2000	80	122	115	156		55
2001	48	59	66	52		18
2002	18	20	47	32		7
2003	25	17	37	35		
2004	32	22	51	64		
2005	48	20	58	58		1
2006	62	37	77	69		
2007	65	18	71	52		2
2008	45	14	57	55		
Total	775	1,114	1,093	1,232	466	260
Total 2000–08	423	329	579	573		
Total 1990–99	251	477	372	475	186	138
Total 1984–89	101	308	142	184	280	39

with that of other commercial and proprietary databases.[8] We distinguish between buyout funds and VC funds, and focus on funds formed between 1984 (the first year with meaningful numbers of funds in the data) and 2008. Our sample comprises 598 buyout funds and 775 VC funds. In comparison, Robinson and Sensoy (2011a) have information on 446 buyout funds and 260 VC funds. The earlier Kaplan and Schoar (2005) study uses Venture Economics cash flow data, and focuses on vintage years up to 1995. Although Preqin has summary performance data (reported IRRs and money multiples) for a larger number of funds, it has cash flow data for only a subset of funds.[9] This is sourced mainly from public investors subject to the Freedom of Information Act.[10] Until recently, Cambridge Associates, who have more funds than any other provider,

[8] In the Internet Appendix, we compare the databases on the basis of the size of the funds for which performance data are available, both in absolute terms and relative to an estimate of the total size of the market.

[9] The Preqin numbers also overstate U.S. buyout funds because they include some funds raised by U.S. GPs in dollars that are earmarked for investment outside the United States. The Burgiss data do not include such funds.

[10] Preqin's data are largely derived from quarterly FOIA requests, where investors provide information on cash invested, realizations, and net asset values on a quarterly basis. They are therefore a quarterly aggregation of the cash flows, rather than individual, timed cash flows as in the Burgiss data. Furthermore, Preqin may be missing some high-performing funds that refuse to accept public pension funds as investors precisely because they are subject to FOIA requests.

had not made their data—which *are* based on cash flows—available to researchers. However, since the first version of this paper circulated, Higson and Stucke (2012) report results for U.S. buyout funds based on these data. They do not analyze VC funds. As we report later in Section IV, their results are similar to ours, and in line with the PMEs that we estimate for Cambridge Associates from our regression model. This provides support for our method for estimating PMEs using the more generally available IRRs and money multiples.

While we believe the Burgiss data are of higher quality than those used in previous work, it is important to note some weaknesses. In terms of U.S. buyout funds, the coverage is excellent since 2000, but includes relatively few funds before 1993. Consequently, Higson and Stucke (2012) have a more even, and larger, coverage of U.S. buyout funds, but they do not analyze VC funds. Robinson and Sensoy (2011a) have greater buyout fund coverage through 2001 (their single investor participated in more U.S. buyout funds than the entire samples of each of the other data providers in the late 1990s), but this collapses after 2001. It appears that their investor effectively wound down their PE investment program at this point, and so their data miss the large growth of the buyout industry from 2001 to 2008. For VC funds, the Burgiss sample is less extensive in the early years than Venture Economics (and hence Kaplan and Schoar (2005)), but the coverage increases significantly over the sample period.

In summary, the strengths of the Burgiss data set are its detailed cash flows for both VC and buyout funds, the fact that it is sourced exclusively from investors, the broad base of over 200 institutional investors who contribute data, the fact that the data are used for control (audit and performance measurement) purposes, its quality (being cross-checked when LPs invest in the same fund), and the good coverage of funds (particularly in more recent years).

II. PE Performance

A. Performance Measures: IRR and Investment Multiples

PE performance can be measured in various ways. The most widely used metrics among funds and investors are the fund IRR and the investment multiple (also referred to as the multiple of invested capital). The former measures the LP's annualized IRR based on fund contributions and distributions, net of fees and profit shares (also known as carried interest) paid to the GP. Until all the investments in the fund are realized, and the cash returned to the investors, the IRR calculation includes the estimated value of any unrealized investments (the residual net asset value, or NAV) as of the last reporting date as a final "cash flow." The investment multiple compares the sum of all fund contributions by investors to the sum of all fund distributions and the value of unrealized investments, again net of fees and carried interest.

The proportion of invested capital that has been realized in the Burgiss data is presented in Table II for the median fund in each vintage year. For buyout

Table II

Private Equity Fund Internal Rates of Return and Investment Multiples

This table shows average internal rates of return (IRR) and investment multiples by vintage year on the individual funds using the Burgiss data. Investment multiples are the ratio of total value to paid-in capital (TVPI). Total value is the sum of the cash returned to investors and the remaining NAV as estimated by the PE fund manager. Given the limited life of the funds, for the early vintage funds the vast majority of the investments have been realized, whereas the opposite is true for the later vintages, for which the reported IRRs and multiples relate mainly to NAVs, with little cash having been returned to investors. Weighted averages use the capital committed for each fund as a proportion of the total commitments for each vintage year. Panel A focuses on buyout funds, and Panel B on VC funds, as classified by Burgiss. Only funds with a North American geographical focus are included.

	Panel A: Buyout Funds								Panel B: Venture Capital Funds							
			Internal Rate of Return			Investment Multiple					Internal Rate of Return			Investment Multiple		
Vintage Year	Funds	Median % Realized	Average	Median	Weighted Average	Average	Median	Weighted Average	Funds	Median % Realized	Average	Median	Weighted Average	Average	Median	Weighted Average
1984	2	100.0	10.6	10.6	15.8	2.44	2.44	3.28	18	100.0	8.2	6.9	7.9	1.78	1.71	1.73
1985	1	100.0	13.7	13.7	13.7	2.66	2.66	2.66	20	100.0	5.5	8.7	7.1	1.96	1.81	1.93
1986	5	100.0	13.6	16.8	16.0	2.40	2.36	3.27	12	100.0	9.0	9.3	9.4	1.83	1.93	1.82
1987	7	100.0	17.3	16.2	15.3	2.93	2.55	2.58	17	100.0	15.8	16.7	20.2	2.70	2.35	2.77
1988	7	100.0	14.4	10.1	18.4	2.03	1.74	2.32	16	100.0	17.9	21.6	24.4	2.45	2.55	2.88
1989	8	100.0	20.6	22.4	21.1	2.55	2.69	2.75	18	100.0	20.5	15.3	25.7	2.92	2.41	3.09
1990	2	97.8	31.9	31.9	52.9	3.03	3.03	3.37	13	100.0	25.3	21.7	29.5	2.96	2.48	3.30
1991	4	100.0	25.7	24.9	27.8	2.45	2.54	2.54	6	100.0	28.1	24.4	28.5	3.11	2.70	2.92
1992	5	100.0	11.2	10.7	15.0	1.68	1.41	1.88	17	100.0	21.0	14.2	24.8	2.69	2.07	2.72
1993	11	100.0	31.0	19.1	26.0	2.62	2.07	2.48	13	100.0	47.1	40.9	51.9	6.65	3.28	6.34
1994	13	100.0	29.6	25.7	34.5	2.73	2.18	3.29	20	100.0	41.7	31.8	41.4	5.27	3.05	6.58
1995	17	99.5	20.9	10.5	16.9	2.08	1.51	1.82	18	100.0	49.2	28.9	46.4	3.64	2.50	3.55
1996	9	100.0	6.0	5.7	2.4	1.46	1.30	1.17	20	98.3	64.5	25.2	76.7	5.92	2.06	6.33
1997	30	98.3	8.6	5.5	8.8	1.42	1.28	1.50	33	97.6	65.9	26.3	76.1	3.03	1.87	3.28
1998	38	96.9	6.4	8.0	3.6	1.42	1.39	1.28	46	97.1	16.3	−1.2	15.5	1.55	0.93	1.60
1999	28	89.9	3.3	4.3	4.8	1.31	1.21	1.40	65	85.0	−7.4	−5.6	−4.5	0.81	0.73	0.94
2000	39	62.2	12.7	11.9	14.3	2.66	1.58	1.75	80	66.7	−2.7	−2.1	−1.3	0.91	0.88	0.97
2001	26	57.5	13.7	14.6	15.1	1.58	1.72	1.67	48	60.5	−1.7	−2.4	−0.7	0.97	0.87	1.01
2002	21	44.9	16.1	16.4	18.4	1.72	1.79	1.84	18	55.0	−1.1	−0.2	0.6	1.01	0.99	1.07
2003	13	29.4	19.5	16.2	22.5	1.98	1.75	1.80	25	41.7	−2.1	0.1	0.9	0.99	1.00	1.11
2004	46	18.1	12.8	11.7	15.4	1.53	1.50	1.64	32	23.9	−1.5	−1.0	0.3	1.01	0.97	1.07
2005	57	9.7	6.8	7.6	7.1	1.26	1.25	1.27	48	17.3	2.2	0.5	3.3	1.37	1.02	1.31
2006	67	10.8	2.6	1.2	0.5	1.08	1.03	1.02	62	16.0	−1.3	−2.4	0.6	1.01	0.95	1.04
2007	74	1.9	3.7	6.2	4.4	1.11	1.12	1.09	65	3.0	1.7	2.6	3.2	1.06	1.06	1.09
2008	68	6.3	3.2	2.8	1.5	1.07	1.04	1.04	45	13.0	−2.8	−1.6	−4.5	0.99	0.98	0.97
Average	598	72.9	14.2	13.0	15.7	1.97	1.81	2.03	775	85.8	16.8	11.1	19.3	2.34	1.73	2.46
Average 2000s	411	26.8	10.1	9.8	11.0	1.55	1.42	1.46	423	33.0	−1.0	−0.7	0.3	1.03	0.97	1.07
Average 1990s	157	98.2	17.5	14.6	19.3	2.02	1.79	2.07	251	97.8	35.2	20.7	38.6	3.56	2.17	3.76
Average 1980s	30	100.0	15.0	14.9	16.7	2.50	2.41	2.81	101	100.0	12.8	13.1	15.8	2.27	2.13	2.37

funds unrealized investments never exceed 3% of invested capital for the median fund in pre-1999 vintages and are only 10% of invested capital for the median 1999 fund. The pre-2000 vintages, therefore, represent largely realized funds. The proportion of realized investments naturally falls for the later vintages, to less than 20% for vintages after 2003. Similar patterns apply to the VC funds. The residual value (NAV) assumptions therefore become increasingly important for more recent vintages.

Assumptions about NAVs have generated controversy in the literature and merit discussion. As we do, Kaplan and Schoar (2005) use the stated NAVs in their analysis of Venture Economics data. Phalippou and Gottschalg (2009) question the NAVs based on patterns in the Venture Economics data and, in their primary analysis, assume that, for funds beyond their tenth year with no cash flow activity, NAVs are zero. Stucke (2011) convincingly demonstrates that Venture Economics did not update cash flows and NAVs for many funds. As a consequence, calculations using Venture Economics data understate returns for many funds even if the stated NAVs are used. Therefore, the Phalippou and Gottschalg (2009) assumption that NAVs are zero is clearly (with hindsight) inappropriate and understates performance even more.

Although caution is warranted before including residual values in returns calculations, we benefit from two differences not available to the authors of the earlier papers. First, the Burgiss figures for both distributions and NAVs are up-to-date because the data are sourced directly from LPs, are subject to extensive cross-checking, and are part of the Burgiss systems used for the LPs' monitoring and record-keeping. Second, since the end of 2008, the Financial Accounting Standards Board (FASB) has required PE firms to value their assets at fair value every quarter, rather than permitting them to value the assets at cost until an explicit valuation change.[11] This likely has had the effect of making estimated unrealized values closer to true market values than in the past, particularly for buyout funds.

Furthermore, recent evidence from Brown, Gredil, and Kaplan (2013) and Jenkinson, Sousa, and Stucke (2013) finds that, on average, residual values have historically been conservative estimates of the ultimate cash returned to investors. The estimates in this paper for funds that are not fully realized may therefore be conservative.

Table II shows the average IRRs and investment multiples derived from the Burgiss data, separately for buyout funds and VC funds.[12] The mean, median, and weighted-average (where the weights are capital commitments) figures are shown for each vintage year, as well as averages for the 1980s, 1990s, and 2000s. We find considerable variation in average performance across vintage years, with cycles that appear to lead economic booms and busts. This is due

[11] This was formalized in the Statement of Accounting Standards 157, known as FAS157, relating to topic 820 on Fair Value Measurement. FAS 157 was first proposed in September 2006 and required as of December 15, 2008.

[12] In the Internet Appendix, we compare our results with IRRs and investment multiples obtained using alternative averaging techniques and different data sources.

to the convention of classifying funds by vintage year, the year of the fund's first investment in a company. Most funds have a five- or six-year investment period, and so deploy most of their capital in the few years after their designated vintage year.

For buyout funds, the IRR has averaged around 14% per annum, and the average investment multiple has been about two. Average performance peaked in the mid-1990s, but was also high for vintage years in the early 2000s. Buyout funds that started investing just before the financial crisis have, on average, lower IRRs and investment multiples close to one.

For VC funds, the pattern of performance over time is more variable. IRRs and investment multiples were extremely high for vintage years in the mid-1990s. For instance, the (weighted-average) IRR for 1996 vintage funds was around 76%, and the investment multiple was over six. However, post-1998 and after the demise of the dot-com boom, the fortunes of VC investors reversed. The vintages with the largest amounts of VC fundraising, 1999 and 2000, have returned negative IRRs and investment multiples well below one. The generally lower average returns for VC have persisted in the 2000s.

B. Does PE Outperform Public Markets?

Although most practitioners have historically focused on IRRs and investment multiples, one of the key questions regarding PE is how returns compare with those to public equity. To perform such a comparison requires timed cash flows that many data providers either do not have or do not make available to researchers. Such cash flows are one of the key strengths of the Burgiss data.

Comparisons with public markets can be performed in various ways. We focus on Kaplan and Schoar's (2005) PME, which compares an investment in a PE fund to an equivalently timed investment in the relevant public market. The PME calculation discounts (or invests) all cash distributions and residual value to 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. The PME can be viewed as a market-adjusted multiple of invested capital (net of fees). A PME of 1.20, for example, implies that, at the end of the fund's life, investors ended up with 20% more than they would have if they had invested in the public markets.

We also report (but do not present) an annualized excess return measure using the Long-Nickels methodology in Kocis et al. (2009). This method calculates the annualized IRR that a fund investor would have earned if it had invested the same amounts at the same time in the S&P 500 or relevant index. The annualized excess return is the difference between the fund's actual IRR and the annualized S&P 500 IRR. This excess return measure is generally positive when the PME is greater than one and negative when the PME is less than one. We do not focus on the Long-Nickels measure because it has the mathematical peculiarity that, for a small number of funds with particularly good performance, it is not possible to calculate a return on an S&P 500 equivalent investment.

Like Kaplan and Schoar (2005), we use the S&P 500 index to proxy for the public market. This is arguably an appropriate standard of comparison for institutional investors. More formally, Sorensen and Jagannathan (2013) show that the PME and its use of a value-weighted stock market index have a strong theoretical underpinning. The PME is equivalent to using the stochastic discount factor of the log utility investor to value risky cash flows.

There are additional empirical justifications for this assumption, particularly for buyout funds. In their study of publicly traded funds-of-funds that invest in unlisted PE funds, Jegadeesh, Kraussl, and Pollet (2009) find that publicly traded funds-of-funds have a market beta of 1.0. Driessen, Lin, and Phalippou (2012) report a beta of 1.3 for buyout funds, but a higher beta of 2.7 for venture funds. Axelson, Sorensen, and Stromberg (2013), however, report a beta of greater than two for individual buyout fund investments gross of fees. That estimate, however, overstates fund betas net of fees because the total fees, particularly the carried interest, have a negative beta.

Later in this section, we report on the sensitivity of PMEs to alternative benchmark indices (such as Nasdaq, growth, or size-focused indices, which are sometimes used by LPs and partially control for differences in risk) as well as to different beta assumptions.

Table III presents average PMEs by vintage year. Buyout funds consistently outperform the S&P 500. The average of the weighted-average vintage PMEs is 1.27; the average of the averages is 1.22; and the average of the medians is 1.16. All of these significantly exceed 1.0. The weighted-average, average, and median PMEs also exceed 1.0 in all three decades. The weighted average and the average buyout PMEs each exceed 1.0 for 20 of 25 vintages from 1984 to 2008; even the median PME exceeds 1.0 for 19 of 25 vintages. Three of the six vintage years with a median below 1.0—1984, 1985, and 1992—have five or fewer funds. In vintage years with at least 10 funds, the median PME is below 1.0 in only 2 of 15 years. And, ignoring vintage years, the average fund in the entire sample has an average PME of 1.20 and a median PME of 1.11.

We also calculate the Long-Nickels annualized excess return measure (from Kocis et al. (2009)). The average fund in the sample has a return that is 6.6% greater than if it had been invested in the S&P 500, while the median is 3.4%. The capital-weighted average excess return is 3.7% while the median is 3.0%. We could not calculate an S&P 500 equivalent for 22 funds. These funds have an average PME of 2.0. If we assume these funds have an excess return of 10% (top quartile) and include them, the averages increase by 0.10% and the medians increase by 0.40%.

The average PME of 1.20 and an average annual excess return of roughly 4% suggest that the typical duration of a buyout fund is on the order of 5 years, a duration lower than the typical fund's legal life of 10 to 13 years. This is true because committed capital is drawn down over a five-year investment period (rather than all at the beginning of the fund) and capital is returned through company sales and IPOs over the life of the fund.

These results strongly suggest that the buyout funds have significantly outperformed public markets—by at least 20% over the life of the fund, or at least

Table III
Private Equity Fund Public Market Equivalent Ratios

This table shows the average PME ratios by vintage year, comparing PE returns to equivalent-timed investments in the S&P 500 using the Burgiss data. Vintage years are defined by the date of the first investment by a fund. Weighted averages use the capital committed to the funds as weights. Only funds with a North American geographical focus are included.

	Panel A: Buyout Fund PMEs				Panel B: Venture Capital Fund PMEs			
Vintage Year	Funds	Average	Median	Weighted Average	Funds	Average	Median	Weighted Average
1984	2	0.87	0.87	1.09	18	0.70	0.63	0.69
1985	1	0.91	0.91	0.91	20	0.71	0.70	0.73
1986	5	1.00	1.11	1.11	12	0.75	0.73	0.80
1987	7	1.25	1.21	1.20	17	1.18	1.09	1.29
1988	7	0.98	0.80	1.13	16	1.18	1.31	1.44
1989	8	1.26	1.28	1.22	18	1.34	0.95	1.52
1990	2	1.57	1.57	2.34	13	1.50	1.18	1.66
1991	4	1.23	1.23	1.32	6	1.37	1.26	1.35
1992	5	0.79	0.87	0.89	17	1.27	0.94	1.34
1993	11	1.35	1.11	1.24	13	2.79	1.54	2.74
1994	13	1.48	1.34	1.75	20	2.40	1.43	2.86
1995	17	1.34	1.00	1.20	18	2.16	1.48	2.09
1996	9	1.13	1.01	0.90	20	3.79	1.75	4.17
1997	30	1.23	1.16	1.30	33	2.43	1.45	2.65
1998	38	1.35	1.32	1.21	46	1.43	0.93	1.48
1999	28	1.19	1.06	1.27	65	0.76	0.65	0.90
2000	39	1.42	1.39	1.47	80	0.79	0.77	0.85
2001	26	1.31	1.43	1.38	48	0.80	0.71	0.84
2002	21	1.42	1.47	1.53	18	0.82	0.79	0.88
2003	13	1.75	1.56	1.58	25	0.88	0.90	0.99
2004	46	1.40	1.35	1.51	32	0.90	0.85	0.96
2005	57	1.20	1.19	1.23	48	1.27	0.95	1.23
2006	67	1.03	0.97	0.99	62	0.93	0.85	0.97
2007	74	1.03	1.03	1.02	65	0.97	0.96	0.99
2008	68	0.91	0.88	0.90	45	0.84	0.81	0.84
Average	598	1.22	1.16	1.27	775	1.36	1.02	1.45
Average 2000s	411	1.27	1.25	1.29	423	0.91	0.84	0.95
Average 1990s	157	1.27	1.17	1.34	251	1.99	1.26	2.12
Average 1980s	30	1.04	1.03	1.11	101	0.98	0.90	1.08

3.7% per year—for a long period of time. Not only have top quartile funds outperformed the S&P 500, but so have average and median funds. Figure 1 illustrates that these results imply significantly better performance for buyout funds than those found in earlier research by Kaplan and Schoar (2005) and Phalippou and Gotschalgh (2009) (although the results are largely consistent with the performance realized by the single investor of Robinson and Sensoy (2011a)).

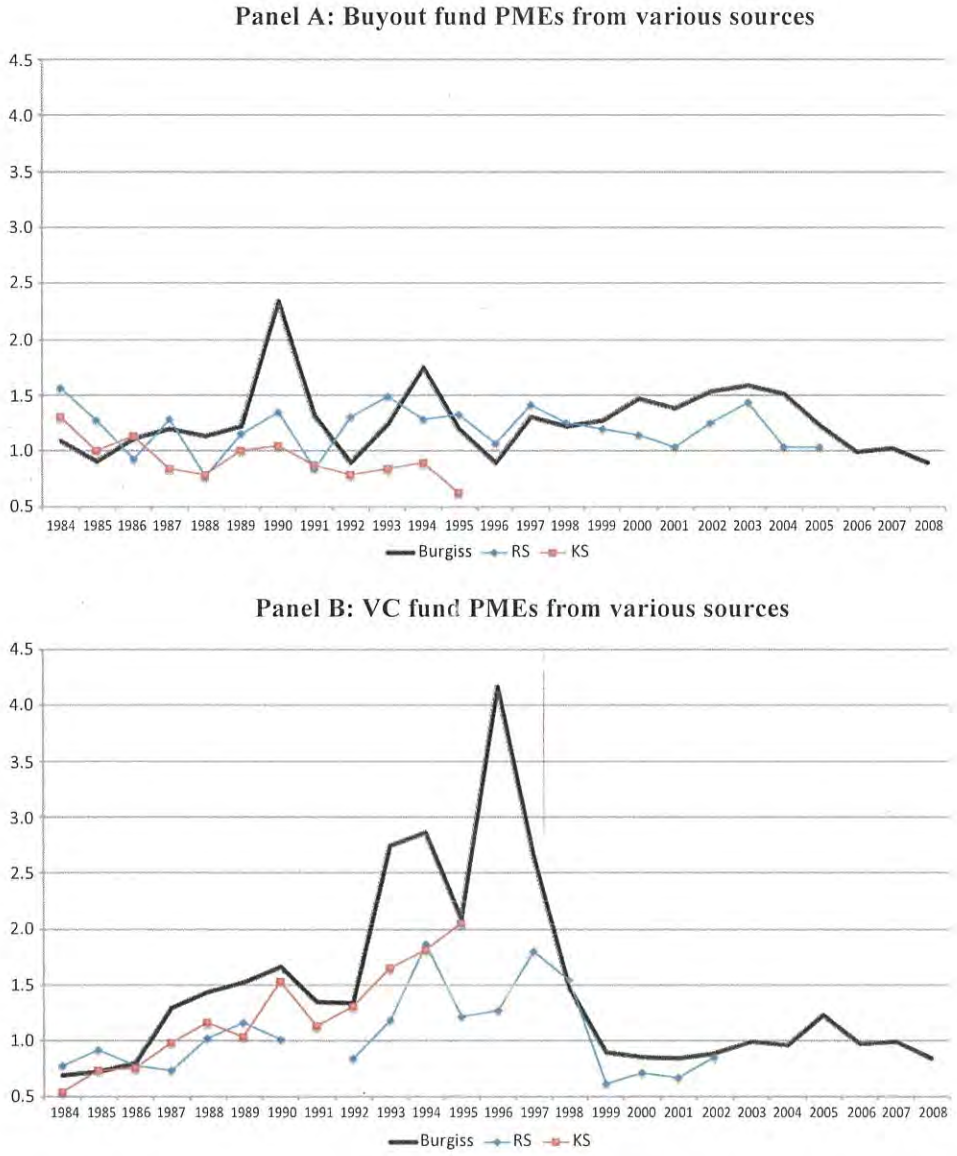

Figure 1. Buyout and VC fund PMEs. This figure shows average PMEs by vintage year, comparing PE returns to equivalently timed investments in the S&P 500. Panel A focuses on buyout funds, and Panel B on VC, using the classifications used by the suppliers or authors. Only funds with a North American geographical focus are included.

In part, the lower performance in earlier work may be due to the problems with the Venture Economics data noted earlier, although to some extent the differences also derive from using a more recent sample of funds. The

Burgiss data include a relatively large number of 1990s and 2000s vintage funds, reflecting the growth in the buyout market in recent years.

It is worth stressing again that the eventual performance for the more recent vintages will depend on the future realization of investments over the funds' remaining lives. That performance will improve if the historical J-curve pattern of PE funds—in which fund multiples increase over a fund's life—continues to hold.[13]

The performance of VC contrasts considerably with that of buyouts. Panel B of Table III shows that the PMEs for early VC vintages were less than 1.0, but then increased sharply after 1986. Weighted-average PMEs exceed 1.0 for the 1987 to 1998 vintage years, with the 1996 vintage having a weighted-average PME above 4.0.

From 1999 to 2008, the pattern reverses. Except for 2005, none of those vintages have a weighted-average or simple-average PME greater than 1.0. The 1999 to 2002 vintages are particularly low with all PMEs at or below 0.90. Overall, the results suggest that VC PMEs exceeded 1.0 for most of the 1990s by a fairly wide margin. Since 1999, they have been less than 1.0, being particularly low for 1999 to 2002 vintages. Compared to earlier research, the more negative findings for VC returns largely reflect the fact that our data include more recent funds. As can be seen from Figure 1, the returns obtained from the Burgiss data have a similar trend to those found by Kaplan and Schoar (2005), although the PMEs are somewhat higher. However, the inclusion of more recent vintages reverses the previous finding that VC funds generally outperformed public markets: this was true up to 1998, but afterwards the performance has not kept pace. Our results are consistent with the findings of the Kaufmann Foundation for its investments in VC (see Kauffman Foundation (2012)).

C. Sensitivity of PMEs to the Choice of Benchmark

So far our PME calculations are based on the S&P 500 because it is a widely used proxy for U.S. public market returns, has a natural asset pricing interpretation, and allows for direct comparison to past research. However, LPs commonly use other investable benchmarks (e.g., Nasdaq or other size-related indices) to control for what they perceive as differences in risk or other return characteristics.[14] To gauge the sensitivity of our results, Table IV reports vintage year average, average, and median PMEs using a number of different indices, each of which represents a different public market alternative for investing funds.

The first five columns of Table IV calculate PMEs with the S&P 500 and four other commonly used benchmarks. For buyout funds (Panel A), the average

[13] See Kocis et al. (2009) for a description of the J-curve. Consistent with this general time profile for fund returns, Harris et al. (2013) find higher average PMEs, particularly for post-2004 vintages, using a later sample (from December 2011) of Burgiss data.

[14] For instance, a number of LPs indicated to us that they considered the Nasdaq or, in particular, the Russell 2000 better benchmarks for VC funds as these indices capture returns to smaller firms.

Table IV

Private Equity Public Market Equivalent Ratios Using Alternative Public Market Indices

This table shows vintage-year average, average, and median PME ratios calculated with alternative market benchmarks. The Russell 3000 index is based on the largest 3,000 U.S. companies. The Russell 2000 measures the performance of small-cap stocks and is based on a 2,000 company subset of the Russell 3000. The Russell 2000 Growth and 2000 Value indices are subsets of the Russell 2000 chosen on the basis of forecasted growth rates and price-to-book ratios. We also include selected Fama-French size deciles. The final columns calculate PMEs using multiples of the S&P 500 to approximate the effect of betas of 1.5 and 2. Panel A focuses on the 598 buyout funds, and Panel B on the 775 VC funds, in the Burgiss data set.

Panel A: Buyout Funds

			Russell Indices			Fama-French				Multiple of S&P 500	
Vintage Years	S&P 500	Nasdaq	3000	2000	2000 Value	8th	6th	4th	2nd	1.5X	2X
1984	0.87	0.97	0.90	1.15	1.07	0.93	0.96	1.15	1.39	0.59	0.44
1985	0.91	0.98	0.94	1.18	1.09	0.98	0.99	1.20	1.45	0.6	0.42
1986	1.00	1.02	1.02	1.18	1.10	1.05	1.05	1.21	1.36	0.75	0.61
1987	1.25	1.2	1.27	1.43	1.32	1.31	1.30	1.49	1.59	0.95	0.75
1988	0.98	0.9	0.99	1.05	0.99	1.00	0.97	1.09	1.14	0.74	0.58
1989	1.26	1.15	1.27	1.34	1.23	1.29	1.26	1.36	1.36	0.95	0.76
1990	1.57	1.48	1.57	1.58	1.43	1.49	1.51	1.56	1.47	1.23	1.03
1991	1.23	1.15	1.25	1.40	1.31	1.35	1.32	1.39	1.35	0.95	0.77
1992	0.79	0.78	0.82	0.97	0.92	0.92	0.98	0.98	0.88	0.58	0.44
1993	1.35	1.33	1.38	1.62	1.56	1.53	1.60	1.59	1.45	1.03	0.81
1994	1.48	1.45	1.52	1.78	1.70	1.59	1.76	1.72	1.51	1.13	0.9
1995	1.34	1.3	1.35	1.5	1.43	1.33	1.54	1.48	1.25	1.13	0.99
1996	1.13	1.26	1.12	1.02	0.83	0.92	1.05	1.00	0.80	1.06	1.07
1997	1.23	1.3	1.19	1.01	0.88	0.94	1.03	0.99	0.83	1.21	1.28
1998	1.35	1.56	1.3	1.01	0.81	0.98	1.02	0.99	0.85	1.39	1.51
1999	1.19	1.36	1.15	0.92	0.74	0.91	0.88	0.89	0.84	1.2	1.28
2000	1.42	1.48	1.38	1.18	1.05	1.17	1.08	1.12	1.16	1.38	1.43
2001	1.31	1.27	1.28	1.15	1.12	1.12	1.04	1.09	1.16	1.23	1.24
2002	1.42	1.34	1.39	1.28	1.29	1.22	1.12	1.21	1.32	1.34	1.35
2003	1.75	1.66	1.72	1.63	1.66	1.54	1.39	1.54	1.71	1.75	1.87
2004	1.40	1.3	1.38	1.32	1.36	1.24	1.12	1.25	1.35	1.42	1.54
2005	1.20	1.1	1.19	1.12	1.17	1.07	0.97	1.07	1.14	1.26	1.39
2006	1.03	0.94	1.02	0.96	0.99	0.95	0.87	0.94	0.99	1.1	1.19
2007	1.03	0.95	1.02	0.94	0.97	0.95	0.90	0.94	0.96	1.07	1.13
2008	0.91	0.86	0.91	0.85	0.87	0.89	0.88	0.91	0.90	0.94	0.91
Average	1.22	1.20	1.21	1.22	1.16	1.15	1.14	1.21	1.21	1.08	1.03
Average 2000s	1.27	1.21	1.25	1.16	1.16	1.13	1.04	1.12	1.19	1.28	1.34
Average 1990s	1.27	1.30	1.27	1.28	1.16	1.20	1.27	1.26	1.12	1.09	1.01
Average 1980s	1.07	1.04	1.07	1.22	1.13	1.09	1.09	1.25	1.38	0.76	0.59
Sample average	1.20	1.17	1.18	1.11	1.07	1.07	1.04	1.09	1.09	1.18	1.21
Sample median	1.11	1.05	1.09	1.02	0.99	1.00	0.96	1.01	1.01	1.11	1.13

(*Continued*)

Table IV—*Continued*

Panel B: Venture Capital Funds											
1984	0.70	0.80	0.73	0.92	1.01	0.75	0.78	0.91	1.11	0.48	0.35
1985	0.71	0.76	0.73	0.91	0.98	0.75	0.77	0.93	1.10	0.49	0.36
1986	0.75	0.73	0.76	0.86	0.95	0.76	0.75	0.89	1.00	0.54	0.41
1987	1.18	1.10	1.18	1.32	1.42	1.20	1.18	1.36	1.48	0.85	0.66
1988	1.18	1.07	1.18	1.26	1.34	1.20	1.16	1.29	1.32	0.87	0.66
1989	1.34	1.18	1.35	1.45	1.57	1.40	1.36	1.48	1.47	0.98	0.74
1990	1.50	1.32	1.50	1.55	1.68	1.52	1.48	1.58	1.54	1.14	0.89
1991	1.37	1.23	1.40	1.64	1.75	1.55	1.61	1.66	1.53	0.98	0.74
1992	1.27	1.24	1.32	1.56	1.68	1.50	1.55	1.57	1.46	0.92	0.68
1993	2.79	2.38	2.92	3.88	3.90	3.55	3.92	3.86	3.42	1.91	1.35
1994	2.40	2.10	2.50	3.23	3.35	2.86	3.33	3.24	2.75	1.70	1.24
1995	2.16	1.89	2.21	2.59	2.67	2.33	2.67	2.58	2.25	1.71	1.40
1996	3.79	3.01	3.85	4.46	4.34	3.92	4.62	4.47	3.82	3.13	2.69
1997	2.43	2.05	2.42	2.45	2.42	2.21	2.53	2.47	2.12	2.26	2.15
1998	1.43	1.52	1.38	1.15	1.37	1.08	1.18	1.14	0.97	1.47	1.58
1999	0.76	0.89	0.73	0.57	0.72	0.56	0.54	0.55	0.52	0.81	0.92
2000	0.79	0.83	0.77	0.64	0.73	0.63	0.56	0.61	0.64	0.80	0.87
2001	0.80	0.76	0.78	0.69	0.72	0.68	0.60	0.66	0.72	0.80	0.84
2002	0.82	0.76	0.80	0.73	0.73	0.71	0.63	0.70	0.78	0.81	0.84
2003	0.88	0.82	0.87	0.82	0.80	0.80	0.71	0.80	0.88	0.91	0.98
2004	0.90	0.82	0.89	0.83	0.80	0.81	0.73	0.81	0.87	0.95	1.01
2005	1.27	1.16	1.26	1.18	1.13	1.15	1.03	1.14	1.22	1.36	1.48
2006	0.93	0.85	0.92	0.85	0.82	0.85	0.79	0.85	0.87	0.98	1.02
2007	0.97	0.89	0.95	0.88	0.86	0.91	0.86	0.91	0.92	1.02	1.04
2008	0.84	0.78	0.83	0.77	0.75	0.79	0.78	0.80	0.79	0.84	0.81
Average	1.36	1.24	1.37	1.49	1.54	1.38	1.44	1.49	1.42	1.15	1.03
Average 2000s	0.91	0.85	0.90	0.82	0.82	0.81	0.74	0.81	0.85	0.94	0.99
Average 1990s	1.99	1.76	2.02	2.31	2.39	2.11	2.34	2.31	2.04	1.60	1.36
Average 1980s	0.98	0.94	0.99	1.12	1.21	1.01	1.00	1.14	1.25	0.70	0.53
Sample average	1.20	1.12	1.19	1.21	1.25	1.14	1.17	1.21	1.17	1.10	1.07
Sample median	0.88	0.86	0.87	0.83	0.85	0.81	0.76	0.83	0.84	0.87	0.85

vintage year PMEs exceed 1.0 measured using all five benchmark indices. The PMEs are of similar magnitude (1.20 to 1.22) using the S&P500, Nasdaq, Russell 3000, and (small cap) Russell 2000 indices. The average vintage year PME is slightly lower (1.16) using the narrower Russell 2000 Value (small cap value) index. Average vintage year PMEs also are consistent over time for those four indices—they all exceed 1.0 for each of the indices in each of the three decades for which we have data.

The overall sample average PMEs also exceed 1.0 across all indices. Measured against the S&P 500, Nasdaq, and the Russell 3000 indices, sample average PMEs are between 1.17 and 1.20. They are lower using the Russell 2000 (1.11) and the Russell 2000 Value (1.07), but again still statistically greater than 1.0. The lower PMEs for the Russell 2000 Value index are driven by

PMEs below 1.0 for the late 1990s vintages and the more recent 2007 and 2008 vintages.

The next four columns of Table IV calculate PMEs using returns to Fama-French size deciles 8, 6, 4, and 2 whose firms have average market values, respectively, of roughly $6 billion, $2.5 billion, $1.2 billion, and $0.5 billion in both 2007 and 2011.[15] As with the commonly used benchmarks, the average vintage year PMEs and the sample average PMEs for buyout funds significantly exceed 1.0 for all four size indices. The PMEs are somewhat lower although still greater than 1.0 for the sixth and eighth size deciles, driven to a large extent by lower PMEs in the more recent and less fully realized 2006 to 2008 vintages. It is worth noting that it is unusual for even the largest funds to make individual equity investments exceeding $2.5 billion. In other words, deciles 8 and even 6 are larger than the corresponding deciles for most buyout funds. Firms in size deciles 4 and 2, on the other hand, are more similar in size to the firms in which most buyout funds invest.

Unlike the sample means, the sample medians are not significantly different from 1.0 for the smaller capitalization indices (Russell 2000, Russell 2000 Value, and Fama-French indices). An important question, then, is whether the mean or the median is a more appropriate measure of fund performance. If LP investors can freely choose among different funds and create a diversified portfolio of funds, then the mean is the appropriate measure of LP performance. If, instead, some LPs can distinguish in advance which funds will outperform and those funds are not available to the typical LP, then the median may be the more appropriate measure.

The results of recent work suggest that the mean is the appropriate measure for buyout funds. Harris et al. (2013) find that buyout fund persistence has declined post-2000, suggesting that it is difficult to predict which funds will outperform based on previous fund performance. Sensoy, Wang, and Weisbach (2013) do not find that any particular type of LP (including endowments) is able to access or choose better performing buyout funds, both before and after 2000. These results suggest that the typical buyout fund LP has been able to access the average buyout fund.

For venture funds (Panel B of Table IV), the patterns identified using the S&P 500 persist across the different indices. Although average vintage year PMEs exceed 1.0 across all indices, they are below 1.0 in the 2000s and well above 1.0 in the 1990s. Sample average PMEs are similar for the different indices with the lowest using the Nasdaq (1.12) and the highest using the Russell 2000 Growth index (1.25). Similarly, the average vintage year PMEs and sample average PMEs using the four Fama-French size deciles are qualitatively identical to those using the Russell 2000.

While the overall sample average performance of VC funds is greater than 1.0, the sample median is below 1.0. For VC funds, it is less clear whether the median or mean is the appropriate measure for the typical VC LP. Harris

[15] The results are qualitatively similar using the odd Fama-French size deciles. To conserve space, we do not report them in the table.

et al. (2013) find that VC fund persistence is equally strong pre- and post-2000, suggesting that it is possible to predict which funds will outperform based on previous fund performance and that the typical VC LP may not be able to access the average fund. Alternatively, Sensoy, Wang, and Weisbach (2013) do not find that any particular type of LP (including endowments) is able to access or choose better performing VC funds post-1998, suggesting that the mean is a more appropriate measure of fund performance.

Overall, Table IV shows that average PMEs across our sample are robust to a range of public market benchmarks. Size (smaller) and value benchmarks reduce the outperformance of buyout funds somewhat, but do not eliminate it. This reinforces our conclusions about PE performance from the prior section. In keeping with prior research and the Sorensen and Jagannathan (2013) asset pricing interpretation, we rely on PMEs using the S&P 500 for the remainder of our analysis.

D. Sensitivity of PMEs to Beta or Systematic Risk

As mentioned above, Sorensen and Jagannathan (2013) provide strong economic justification for our PME analyses, particularly the assumption that one can discount at the market return (like that of the S&P 500) without making assumptions about systematic risk (or betas). The relatively stable and positive pattern of PMEs for buyout funds that we find over the 1980s, 1990s, and 2000s—periods of very different market returns—suggests this assumption is reasonable.

Nevertheless, to further consider the effect of this assumption, we approximate assuming betas of 1.5 and 2.0 by estimating PMEs assuming that an alternative investment earned, respectively, 1.5 times and 2.0 times the return on the S&P 500.

For buyout funds, we find that the average fund has a PME of 1.20, 1.18, and 1.20 assuming public market returns of, respectively, 1.0, 1.5, and 2.0 times the S&P 500. The median PMEs are 1.12, 1.11, and 1.13, respectively. The PMEs are similarly insensitive to the public market return assumption for 1990s and 2000s vintages. The one set of vintages where beta seems to matter is the 1980s—a period of particularly high leverage and a rising stock market. Overall, we conclude that systematic risk does not explain our PME results for buyout funds, particularly since 1990.

Interestingly, the patterns are potentially consistent with a change in the nature of the buyout industry and how GPs add value to their portfolio companies. In the 1980s, GPs relied more heavily on leverage and financial engineering, while since then GPs appear to have relied less heavily on leverage and more heavily on operational engineering (and the accompanying operational improvements).[16]

For VC funds, we find that the average fund has a PME of 1.21, 1.10, and 1.07 assuming public market returns of, respectively, 1.0, 1.5, and 2.0 times

[16] Kaplan and Stromberg (2009) provide a discussion of this history.

the S&P 500. The medians are closer at 0.90, 0.87, and 0.85. At the vintage year level, the results vary little in the 2000s, but average PMEs vary somewhat more—between 1.40 and 1.77—for the 1990s vintages depending on the assumed systematic risk. Our basic conclusions are unchanged regardless of our assumption about beta—VC funds outperformed in the 1990s and underperformed in the 2000s.

III. PE Performance, Capital Flows, and Fund Size

In this section, we reexamine two possible determinants of PE performance that have been studied in prior research—the relation of performance to aggregate PE capital commitments (or fund flows) and the relation of PE performance to fund size. Kaplan and Schoar (2005), Kaplan and Stromberg (2009), and Robinson and Sensoy (2011a) all find some evidence that increased aggregate capital commitments to buyout and VC funds are related to subsequent performance. At the fund level, Kaplan and Schoar (2005) find a concave relation between performance and fund size for VC funds, but not for buyout funds. Robinson and Sensoy (22011a) find that PMEs for both buyout and VC funds are modestly concave in the log of fund size. We undertake a similar, but slightly different, analysis using the Burgiss data.

A. Capital Flows

To measure fund flows into the industry, we take capital committed to U.S. buyout and VC funds using annual estimates from Private Equity Analyst for the current and previous vintage years.[17] This sum provides an (imperfect) estimate of the amount of capital available to fund deals.[18] 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 at the beginning of the vintage year. In a typical year, the two-year capital commitments to buyout funds average 0.76% (median of 0.70%) of the stock market value. The two-year capital commitments to VC funds average 0.27% (median of 0.23%). We then regress weighted-average vintage year performance—as measured by PME, as well as IRR and investment multiple—on aggregate capital flows, separately for buyouts and VC funds. The results are qualitatively and statistically similar using unweighted average performance. We limit the analysis to vintage years from 1993 onwards, the point at which Burgiss begins to have more substantial fund coverage.

Table V shows that buyout fund performance is significantly negatively related to capital commitments. Absolute performance measures—IRRs and investment multiples—are negatively related to capital commitments. When

[17] These estimates from Private Equity Analyst are reported in the Internet Appendix.

[18] Ideally, we would use an estimate of 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.

Table V
The Relationship between Aggregate Flows into Private Equity and Performance

This table reports regressions where the dependent variable is fund performance—as measured by IRR, investment multiple, or PME—and the explanatory variable is an estimate of capital flows into PE. We measure capital flows by summing the capital commitments (as estimated by Private Equity Analyst; see the Internet Appendix) in the current and previous vintage years, and then take the ratio of this sum to the aggregate U.S. stock market value at the start of the current vintage year. This provides a measure of the amount of capital available to fund PE deals. The performance measures are weighted averages, where the weights are the proportion of capital committed in each vintage year to the total capital committed over the vintages included in the regression. Given the small sample sizes in early vintages, only vintage years from 1993 onwards are included. See Tables II and III for explanations of the performance measures. Separate regressions are estimated for buyout funds and VC funds. Standard errors are reported in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	Buyout Funds			VC Funds		
Dependent Variable:	PME	IRR	Multiple	PME	IRR	Multiple
Capital Commitments to	−31.7***	−12.23***	−71.9***	−278.9**	−75.0*	−625.8**
Total Stock Market Value	[9.9]	[3.97]	[23.9]	[128.6]	[37.9]	[268.8]
Constant	1.58	0.24	2.30	2.48	0.43	4.39
	[0.10]	[0.04]	[0.25]	[0.47]	[0.14]	[0.98]
N	16	16	16	16	16	16
R^2	0.42	0.40	0.39	0.25	0.22	0.28

capital commitments increase from the bottom quartile of years (0.42%) to the top quartile of years (0.87%), IRRs decline by more than 5% per year while multiples decline by around 0.45. We also find that PMEs are negatively related to capital commitments. The regression coefficients imply that PMEs decline by 0.14 when capital flows move from the bottom to top quartile. Overall, these results suggest that an influx of capital into buyout funds is associated with lower subsequent performance. Our findings are consistent with and extend the results in Kaplan and Stromberg (2009). Our results are also consistent with Robinson and Sensoy's (2011a) findings using absolute performance measures (IRR and multiples), although they do not find a negative relation between buyout PMEs and capital commitments.

Table V also shows a negative relation between capital commitments and performance for VC funds. The regression coefficients imply that, when capital flows move from the bottom to top quartile, IRRs decline by 9% per year, multiples decline by 0.75, and PMEs decline by 0.33. These results are broadly consistent with Kaplan and Stromberg (2009) and Robinson and Sensoy (2011a) and add support to the finding that an influx of capital into VC funds is associated with lower subsequent performance.

B. Fund Size

Most practitioners are concerned with how performance varies with fund size. Over time, fund sizes have, on average, increased for both buyout and VC

Table VI
The Relationship between Private Equity Fund Size and Performance

This table examines whether fund size affects performance. In Panel A, funds are classified into size quartiles by decade. The cutoff points for each quartile, by decade, are reported. The performance—as measured by PME—is then analyzed for these size quartiles. Buyout funds and VC funds are considered separately. Panel B reports regressions where the dependent variable is PME, and the explanatory variables are fund size quartiles (calculated as above) and, for some regressions, vintage year dummies. Standard errors are reported in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A: Average Performance by Fund Size Quartile

	Buyout Funds				Venture Capital Funds			
	Bottom Quartile	Median	Top Quartile	Mean	Bottom Quartile	Median	Top Quartile	Mean
	Size Cutoffs ($ Millions)							
1980s	85	215	425	390	34	55	90	77
1990s	200	485	998	782	81	137	250	191
2000s	284	700	1,530	1,420	137	278	475	358
	PME							
Small Funds	0.80	1.02	1.37	1.16	0.57	0.78	1.08	1.03
2nd Size Quartile	0.90	1.16	1.49	1.23	0.61	0.90	1.24	1.25
3rd Size Quartile	0.93	1.14	1.40	1.21	0.69	0.96	1.30	1.34
Large Funds	0.91	1.14	1.43	1.19	0.70	0.90	1.14	1.18

Panel B: Regressions of PME on Fund Size Quartiles

Dependent variable: PME	Buyout Funds		Venture Capital Funds	
2nd size quartile	0.065	0.039	0.219	0.138
	[0.059]	[0.057]	[0.149]	[0.140]
3rd size quartile	0.042	0.059	0.314**	0.318**
	[0.059]	[0.057]	[0.150]	[0.141]
4th (highest) size quartile	0.027	0.031	0.149	0.349**
	[0.059]	[0.057]	[0.150]	[0.145]
Vintage year dummies	No	Yes	No	Yes
Funds	598	598	775	775
R^2	0.00	0.15	0.01	0.21

funds. This is apparent in Panel A of Table VI, where we classify funds into size quartiles by decade. Buyout fund sizes have increased from an average size of $390 million in the 1980s to $782 million in the 1990s to $1.4 billion in the 2000s. VC fund sizes also increased from an average of $77 million to $191 million to $358 million. Similar increases have occurred over time for each fund size quartile.

Panel A also reports PMEs by size quartile, across the entire sample, for buyout and VC funds. Although not controlling for any vintage year effects,

these average returns by size quartile do not demonstrate a strong correlation between fund size and performance. The only noticeable relationship is that the smallest quartiles of both buyout and VC funds tend to have lower performance.

To investigate this further, Panel B reports fund-level regressions of PME on fund size quartiles (by decade). When vintage year dummies are not included, the regressions have little explanatory power, as might be expected given the important time-series trends in returns reported earlier. When controlling for vintage years, there remains no significant relationship between fund size and returns for buyout funds. These results are consistent with the findings of Lopez-de-Silanes, Phalippou, and Gottschalg (2014), who find no relationship between buyout fund size and returns, but find evidence of diseconomies of scale related to the number of simultaneous deals being undertaken for buyout funds. Our findings are also consistent with the earlier results of Kaplan and Schoar (2005).

For VC funds, however, we find a strong positive relation between size and performance. Once we control for vintage year effects, funds in the smallest quartile underperform other funds and significantly so compared to the third and fourth size quartiles.

Our conclusions about the effects of fund size are not sensitive to our size classifications. We find qualitatively similar results when we classify funds by their size quartile in a particular vintage year.

IV. Relation of Absolute and Relative Performance Measures

The cash flow-level data we employ in this paper allow us to explore an additional question: how PMEs are related to the absolute performance measures—IRRs and investment multiples—provided by most commercial data sources. This analysis has two primary motivations. First, if there is a robust relationship between PMEs, IRRs, and investment multiples in the Burgiss data, we can use this relationship to estimate the PMEs that would be obtained were the required cash flow data available. Since absolute performance measures are often the only metrics available from data providers (as well as from some LPs and GPs), this approach provides a way to assess the extent to which conclusions on PE performance depend on the data sample being studied. Second, our analysis can shed light on the debate among practitioners as to whether IRRs or multiples provide more accurate indicators of market-adjusted performance.

A. PME and Absolute Performance Measures

We start by reporting regressions of PMEs on IRRs and multiples in Table VII. We report standard errors both unclustered and clustered by vintage years. Clustering by vintage years increases standard errors, but all coefficients of interest remain strongly statistically significant. As before, we focus on vintages starting with 1993 because from that year onward all VC vintages and all

Table VII
The Relationship between PME, IRR, and Multiples

This table reports fund-level regressions where PME is the dependent variable. Given the small sample sizes in early vintages, only vintage years from 1993 onwards are included. Ordinary standard errors are reported in brackets, and standard errors clustered by vintage year are in curly brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively, using standard errors clustered by vintage.

	Buyout Funds			VC Funds		
IRR	2.52***		0.43	3.47***		1.21***
	[0.07]		[0.07]	[0.11]		[0.07]
	{0.43}		{0.25}	{0.55}		{0.25}
Multiple		0.71***	0.62***		0.56***	0.44***
		[0.01]	[0.02]		[0.01]	[0.01]
		{0.06}	{0.10}		{0.07}	{0.07}
Vintage Year Dummies	Y	Y	Y	Y	Y	Y
N	557	557	557	638	638	638
R^2	0.75	0.92	0.92	0.71	0.91	0.94

but one vintage for buyout funds have at least 10 observations. Results using the full sample are similar and are presented in the Internet Appendix.

Columns 1 to 3 of Table VII report regressions, each with vintage year dummies, of buyout fund PMEs on IRRs, on multiples, and on both IRRs and multiples. Buyout fund PMEs are strongly related to IRRs and multiples. IRRs and vintage years alone explain 75% of the variation in PMEs. Multiples and vintage years alone explain 92% of the variation. And IRRs, multiples, and vintage years also explain 92% of the variation in PMEs. In other words, it is possible to predict a buyout fund's PME with a great degree of reliability knowing a fund's IRR, multiple, and vintage year. IRRs explain less of the variation than multiples and add little incremental explanatory power. Columns 4 to 6 repeat the regressions for VC funds with similar findings.

We also run the regressions by vintage year, to allow the regression relationship to change over time, and find that there is not a single vintage year in which IRRs and multiples explain less than 86% of the variation in PMEs. In all but three of the 32 vintage year cohorts, IRRs and multiples explain at least 93% of the variation in PMEs. As with the combined regressions in Table VII, multiples typically provide greater explanatory power for PMEs than do IRRs. These results are presented in the Internet Appendix.

These results have two implications for understanding performance. First, the consistent findings for both buyout and VC funds suggest that multiples are more robust indicators of fund performance relative to public markets than are IRRs (controlling for vintage year). Second, each 0.10 increase in a multiple (equal to 10% of invested capital) is associated with an increase in PME of 0.071 for buyout funds and 0.056 for VC funds. If the funds have an effective duration of about five years and we use the estimated impact on PME, a 0.10 increase in

multiple translates into roughly an additional 110 to 140 basis points per year relative to public markets.

B. Estimating PMEs from Other Data Sources

Having found a strong relationship between PME, IRR, and investment multiples in the Burgiss data, we take advantage of this relationship to estimate the PMEs that are implicit in other commercial data sources. Our approach uses the regression results from the Burgiss cash flow data to translate vintage year IRRs and investment multiples into PMEs even when the underlying cash flow data are not available. We would expect any selection biases affecting a given sample to show up in the IRRs and investment multiples as well as PMEs, all of which are interconnected.

For our analysis, we use the regression coefficients by vintage year reported in the Internet Appendix and apply these to the IRRs and investment multiples reported by Cambridge Associates, Preqin, and Venture Economics as of March 2011, the same date for which we have the Burgiss data. We note that, in some of the earlier vintage years, the number of observations in the regressions is small so there is more potential for estimation error. With these caveats in mind, Table VIII presents the estimated PMEs for the other main PE data samples, along with the actual PMEs from the Burgiss data and those found by Robinson and Sensoy (2011a).

Panel A of Table VIII reports the PME estimates for buyouts. These results are also presented graphically in Figure 2. The estimates imply that the weighted-average PMEs and average PMEs for buyout funds of 1990s and 2000s vintages exceed 1.0 for all three commercial databases just as they do for the Burgiss data. The average PMEs are slightly higher in the Preqin data than in Burgiss and slightly lower for Cambridge Associates. The Venture Economics estimates, although greater than 1.0, are markedly lower than those from the other three commercial data sets, consistent with the downward bias uncovered in Stucke (2011). The very similar overall results obtained using samples from Burgiss, Cambridge Associates, and Preqin, despite each source's different collection processes, suggest these samples provide unbiased estimates of overall buyout performance.

Panel B of Table VIII repeats our analysis for VC funds. The results are consistent across all four commercial data sets. VC funds outperformed public markets substantially until the late 1990s. The performance is stronger in the Burgiss data than in the others and lowest in Venture Economics. In contrast to the strong VC performance in earlier vintages, from the 1999 vintage year onwards VC funds have generally underperformed public markets in all four commercial data sets. The average vintage year PMEs are similar across all four commercial data sets.

The results in Higson and Stucke (2012) provide an opportunity to conduct an out-of-sample test of our approach because their paper appeared subsequent to our analysis. They analyze fund-level cash flow data for a sample of buyout funds, most of which come from Cambridge Associates. (They do not analyze

Table VIII

Actual PMEs and Implied PMEs

This table reports, by vintage year, average actual PMEs for Burgiss and Robinson-Sensoy and implied PMEs for Venture Economics, Preqin, and Cambridge Associates. The implied PMEs use the results of vintage year regressions of PMEs on IRRs and multiples from Burgiss data (reported in the Internet Appendix). Weighted averages use as weights fund capital commitments, as a proportion of total commitments for funds reporting performance data, in each vintage. Capital commitments at the fund level are not reported by Cambridge Associates

Panel A: Buyout Funds

	Weighted Average				Unweighted Average			
			Implied PME			Implied PME		
Vintage	Actual PME Burgiss	Actual PME Robinson-Sensoy	Venture Economics	Preqin	Actual PME Burgiss	Venture Economics	Preqin	Cambridge Associates
1984	1.09	1.56			0.87			
1985	0.91	1.27			0.91			
1986	1.11	0.93			1.00			
1987	1.20	1.28			1.25			
1988	1.13	0.77			0.98			
1989	1.22	1.15			1.26			
1990	2.34	1.35			1.57			
1991	1.32	0.84			1.23			
1992	0.89	1.31			0.79			
1993	1.24	1.49	1.07	1.16	1.35	1.02	1.17	1.06
1994	1.75	1.28	0.91	1.14	1.48	0.91	1.10	0.89
1995	1.20	1.33	1.00	1.16	1.34	1.04	1.23	1.26
1996	0.90	1.07	1.08	1.27	1.13	1.15	1.56	1.19
1997	1.30	1.41	1.23	1.22	1.23	1.03	1.25	1.21
1998	1.21	1.25	1.04	1.18	1.35	1.21	1.37	1.61
1999	1.27	1.20	1.42	1.30	1.19	1.23	1.31	1.56
2000	1.47	1.14	1.31	1.52	1.42	1.25	1.55	1.41
2001	1.38	1.03	1.15	1.78	1.31	1.16	1.62	1.65
2002	1.53	1.25	1.25	1.43	1.42	1.15	1.30	1.45
2003	1.58	1.43	1.46	1.71	1.75	1.21	1.43	1.38
2004	1.51	1.04	1.31	1.42	1.40	1.28	1.39	1.33
2005	1.23	1.04	1.04	1.16	1.20	1.07	1.21	1.20
2006	0.99		0.89	1.02	1.03	0.98	1.05	1.12
2007	1.02		0.98	1.00	1.03	1.06	1.08	1.03
2008	0.90		0.87	0.92	0.91	0.93	0.95	0.88
Average 2000s	1.29	1.16	1.14	1.33	1.27	1.12	1.29	1.27
Average 1993–99	1.27	1.29	1.11	1.21	1.30	1.08	1.29	1.25

(*Continued*)

Table VIII—*Continued*

Panel B: Venture Capital Funds

	Weighted Average				Unweighted Average			
			Implied PME			Implied PME		
Vintage	Actual PME Burgiss	Actual PME Robinson-Sensoy	Venture Economics	Preqin	Actual PME Burgiss	Venture Economics	Preqin	Cambridge Associates
1984	0.69	0.78			0.70			
1985	0.73	0.92			0.71			
1986	0.80	0.78			0.75			
1987	1.29	0.73			1.18			
1988	1.44	1.02			1.18			
1989	1.52	1.17			1.34			
1990	1.66	1.01			1.50			
1991	1.35				1.37			
1992	1.34	0.84			1.27			
1993	2.74	1.19	1.51	1.76	2.79	1.30	1.70	1.58
1994	2.86	1.87	2.18	3.14	2.40	1.53	2.08	1.80
1995	2.09	1.22	2.47	3.52	2.16	2.24	2.82	2.97
1996	4.17	1.27	3.21	1.75	3.79	3.25	2.44	3.09
1997	2.65	1.8	1.92	2.28	2.43	2.01	2.09	2.04
1998	1.48	1.54	1.61	1.64	1.43	1.55	1.58	1.40
1999	0.90	0.61	0.69	0.81	0.76	0.79	0.87	0.88
2000	0.85	0.71	0.92	0.90	0.79	0.82	0.98	0.78
2001	0.84	0.67	1.00	0.99	0.80	0.92	0.89	0.90
2002	0.88	0.85	0.80	0.91	0.82	0.81	0.80	0.87
2003	0.99		1.03	0.95	0.88	1.00	0.90	0.96
2004	0.96		0.97	1.06	0.90	0.94	1.07	1.19
2005	1.23	0.8	1.07	1.03	1.27	1.05	0.96	0.98
2006	0.97		0.93	0.97	0.93	0.86	0.94	0.95
2007	0.99		0.93	0.96	0.97	0.96	1.04	1.12
2008	0.84		0.85	0.89	0.84	0.78	0.84	0.90
Average 2000s	0.95		0.94	0.96	0.91	0.90	0.94	0.96
Average 1993–99	2.41	1.36	1.94	2.13	2.25	1.81	1.94	1.96

VC funds.) Higson and Stucke report sample average values for PMEs, IRRs, and multiples by vintage year that they calculate from the cash flow data.

To gauge how well our regression approach works, we use average IRRs and multiples for each vintage year to estimate the vintage year PMEs we would predict, paralleling our analysis in Table VIII. Our estimates come very close to the mark. The mean (median) predicted vintage year PME is 1.23 (1.25) from 1993 to 2008. For this same time interval, the PMEs directly calculated by Higson and Stucke from the fund cash flows have a mean (median) vintage year value of 1.27 (1.26). Looking at differences in individual vintage years,

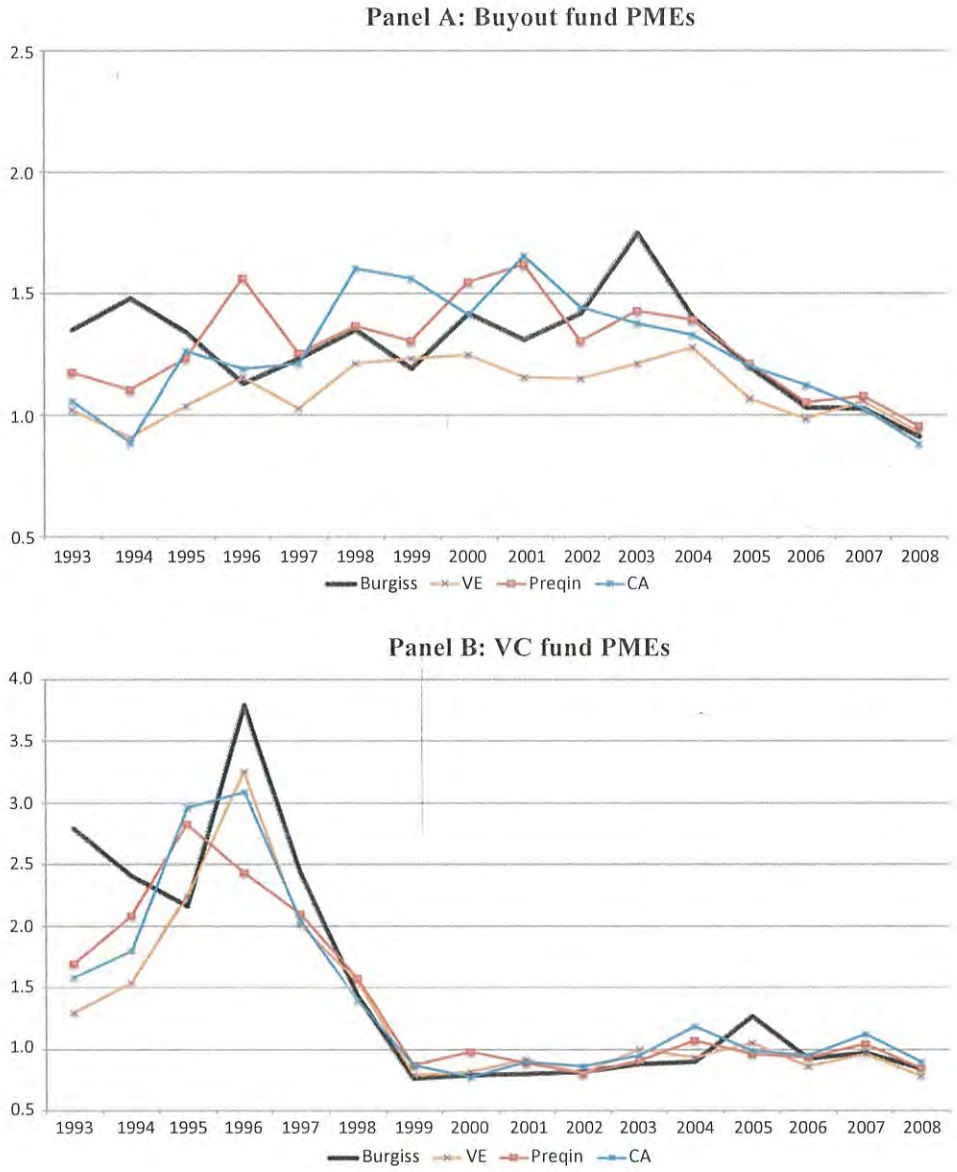

Figure 2. Actual and estimated PMEs. This figure shows, by vintage year, average PME ratios from different commercial data sets. PMEs for Burgiss are calculated using underlying cash flow data for funds. PMEs for Venture Economics, Preqin, and Cambridge Associates are the PMEs implied using regression results as reported in Table VIII. Panel A focuses on buyout funds, and Panel B on VC, using the classifications used by the suppliers or authors. Only funds with a North American geographical focus are included.

the mean (median) difference is –0.04 (–0.04) with a standard error of 0.05. The mean (median) absolute vintage year difference is 0.05 (0.05). Thus, our procedure provides estimates that closely track the actual sample PMEs that could have been calculated with cash flow data.

C. Conclusions about Performance

Overall, the PME results across the different data sets reinforce the earlier conclusions about PE performance. Buyout funds have consistently outperformed public markets for some time. Such outperformance holds despite the different selection criteria and data-gathering methods used in the various data sets. Confirmation of this claim must await the emergence of a complete buyout fund data set. Nevertheless, for this conclusion to turn out to be incorrect, the four commercial data sets (as well as Robinson and Sensoy (2011a)) with different selection criteria would all have to have substantial positive selection bias. The PME results from different data sets also confirm the earlier findings on VC funds. While VC performance was strong in earlier vintages, from the 1999 vintage year onwards VC funds have generally underperformed public markets.

V. Conclusions

Our research highlights the importance of high-quality data for understanding PE and the returns it provides to investors. Some existing papers in the academic literature are based upon data whose reliability has recently been questioned. Most previously published papers also focus on funds raised up until the mid- or late-1990s. The enormous growth in investor allocations to PE funds since the late 1990s has created a need for a reevaluation of PE performance. This paper is the first to take advantage of a new research-quality cash flow data set from Burgiss, using data as of March 2011. We believe the results in our paper have several implications.

First, it seems likely that buyout funds have outperformed public markets, particularly the S&P 500, net of fees and carried interest, in the 1980s, 1990s, and 2000s. Our estimates imply that each dollar invested in the average fund returned at least 20% more than a dollar invested in the S&P 500. This works out to an outperformance of at least 3% per year. The conclusion that there has been outperformance is relatively insensitive to assumptions about benchmark indices and systematic risk. For the more recent and less fully realized vintage funds, however, eventual performance will depend on the ultimate realization of their remaining investments. Our results (and those we estimate from the other commercial data sets) imply that buyout funds outperformed public markets much more substantially gross of fees. Nailing down the sources of this outperformance seems a fruitful subject for future research.

Second, VC funds outperformed public markets substantially until the late 1990s, but have underperformed since. Extant research focuses on the earlier vintage years and inevitably obtains more positive results. Since 2000, the

average VC fund has underperformed public markets by about 5% over the life of the fund. Although disappointing, this underperformance is less dramatic than the more commonly quoted absolute return measures. Again, the qualitative conclusions do not appear sensitive to assumptions about systematic risk.

Third, vintage year performance for buyout and VC funds decreases with the amount of aggregate capital committed to the relevant asset class, particularly for absolute performance, but also for performance relative to public markets. This suggests that a contrarian investment strategy in these asset classes would have been successful in the past. The magnitudes of these relations have been greater for VC funds. Why these patterns have persisted is something of a puzzle and an interesting topic for future research.

Fourth, within a given vintage year, PMEs are reliably related to the more generally available absolute performance measures—IRRs and investment multiples. For both buyout and VC funds, IRRs and investment multiples explain at least 90% of the variation of PMEs in most vintage years, with investment multiples explaining substantially more of the variation than IRRs. As a result, researchers and practitioners can use our models to estimate PMEs without having the underlying fund cash flows.

Fifth, the Burgiss, Cambridge Associates, and Preqin data sets yield qualitatively and quantitatively similar performance results. There is little reason to believe that the Burgiss and Preqin data sets, in particular, suffer from performance selection biases in the same direction. Accordingly, we think this suggests that the three data sets are unbiased and therefore suitable for academic research and practitioner use. At the same time, consistent with Stucke (2011), we find that performance, particularly for buyout funds, is markedly lower in the Venture Economics data. This confirms that academic research and practitioners should be cautious in relying on Venture Economics data.

Finally, although it is natural to benchmark PE returns against public markets, investing in a portfolio of PE funds across vintage years inevitably involves uncertainties and potential costs related to the long-term commitment of capital, uncertainty of cash flows and the liquidity of holdings that differ from those in public markets. While the average outperformance of PE we find is large, further research is required to calibrate the extent of the premia investors require to bear these risks.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Appendix S1: Internet Appendix

How Do Private Equity Investments Perform Compared to Public Equity?

ROBERT S. HARRIS, TIM JENKINSON, and STEVEN N. KAPLAN*

ABSTRACT

The merits of investing in private versus public equity have generated considerable debate, often fueled by concerns about data quality. In this paper, we use cash flow data derived from the holdings of almost 300 institutional investors to study over 1,800 North American buyout and venture capital funds. Average buyout fund returns for all but one vintage years before 2006 have exceeded those from public markets; averaging about 3% to 4% annually. Post-2005 vintages have been roughly equal to public markets. We find similar performance results for a sample of almost 300 European buyout funds. Venture capital performance has varied substantially over time. North American venture funds from the 1990s substantially outperformed public equities; those from the early 2000s have underperformed; and recent vintage years have seen a modest rebound. The variation in venture performance is significantly linked to capital flows: performance is lower for funds started when there are large aggregate inflows of capital to the sector. We also examine the variation in performance of funds started in the same year. We find marked differences between venture and buyout leading to a much more pronounced impact of accessing high performing funds in venture investing.

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* Harris is the C. Stewart Professor at the University of Virginia, Darden School of Business, HarrisR@darden.virginia.edu. Jenkinson is Professor of Finance at the Said Business School, University of Oxford, and a research associate with CEPR, tim.jenkinson@sbs.ox.ac.uk. Kaplan is the Neubauer Family Professor of Entrepreneurship and Finance at the University of Chicago, Booth School of Business, and a research associate with NBER, skaplan@uchicago.edu. This research has been supported by the UAI Foundation as part of the Private Equity Research Consortium. Wendy Hu provided excellent research assistance. We thank Burgiss for supplying data. We thank an anonymous referee for helpful comments. Portions of this paper present updates to empirical work in Harris, Jenkinson and Kaplan, Journal of Finance, 2014 and we adapt portions of that article in our presentation here. Kaplan has consulted to buyout and venture capital general partners and limited partners. He also has invested in private and public equities. Jenkinson has consulted to limited partners, and has held board positions in private equity backed portfolio companies and in a fund investing in private equity. He also has invested in private and public equities. Harris has invested in private and public equities and has held a board position for funds investing in public equities.

Despite the large increase in investments in private equity funds, the historical performance of private equity (PE) remains a subject of considerable debate. Fueling that debate has been the difficulty of obtaining high quality data for research. Private equity is called "private" for a reason. There is no requirement for those running private equity funds—the General Partners, or GPs—to make their data available. Of course, they provide this data to their current and potential investors—the Limited Partners in their funds, or LPs—but normally under confidentiality agreements that prevent sharing the data. And even if one obtains comprehensive data, measuring returns to illiquid private assets is a complicated task. It thus comes as no surprise that assessments of private equity performance are not easy.

In this paper, we examine private equity performance of over 2000 funds through June 2014. Our data are high-quality fund level cash flows sourced by Burgiss from almost 300 private equity fund investors. We focus on comparing two ways investors can have residual equity claims on companies: limited partner stakes in a private equity fund or ownership of publicly traded stocks.[1] Despite the real differences between the two forms of ownership (including liquidity and control over cash flow timing), portfolio managers increasingly see them as alternative routes to equity exposure rather than as separate asset classes.

Our new data allow us to update and extend prior research in light of dramatic shifts in public and private markets in recent years. Public equities have surged since the financial crisis, with many market indices up 50% or more. And private equity funds suffered large write-downs during the crisis but these were largely reversed in the following years. Fundraising stalled during 2009-2010 but has since returned strongly. In an earlier study (Harris, Kaplan and Jenkinson (2014)) we focused on North American private equity funds using returns through March 2011.

[1] Harris, Jenkinson and Kaplan (2014) discus prior research on private equity performance. Cornelius (2011) provides an overview of issues related to illiquid assets such as limited partner interests in private equity funds.

In this paper we update and extend this earlier analysis, adding more North American funds, several hundred European funds, and with updated cash flows and asset values that reflect the significant movements in markets in the last few years. As well as providing a comparison of private equity and public equity performance, we also use this larger data set to examine the role of high performing ("top quartile") funds in determining investment results.

Many of our new findings echo those from earlier research despite the dramatic market shifts of the last few years. Buyout fund returns have exceeded those from public markets in almost all vintage years before 2006. Since 2006, buyout fund performance has been roughly equal to those of public markets. Venture capital (VC) funds started in the 1990s substantially outperformed public equities; however, those started since 2000 have generally underperformed.

The new results uncover a performance rebound for VC funds raised in recent years. This is consistent with a large decline in dollars going into venture capital during the 2000s. We show that for both venture and buyout, fund returns tend to be higher (lower) when smaller (larger) infusions of capital come into that sector. The magnitudes of these relations have been greater for VC funds and may reflect more constraints on the VC industry's ability to expand in value-creating ways, especially as the cost of many technologies has fallen, thereby reducing the demand for capital. The inverse relationship between fund performance and aggregate capital committed to that sector suggests that a contrarian investment strategy would have been successful in the past. This apparent boom-bust cycle merits future research.

We also explore differences in performance across funds started in the same year. The performance gap between top (first) and bottom (fourth) quartile funds is much more pronounced in venture than in buyout, as would be expected. Moreover, compared to buyout, the highs are much higher in venture and the lows lower. In buyout, even third quartile funds have returns comparable to public markets. In venture, having some top quartile funds in the portfolio is much

more important for successful investing, and so our results highlight that LP selection skills and fund access are much more critical in venture capital than in buyout.

We find that average buyout performance appears quite similar between Europe and North America. On both continents, buyout funds have historically outperformed public market returns and by similar magnitudes. Our sample of European venture funds is limited which precludes strong conclusions. It appears, however, that venture investing in Europe has been less successful than in North America, and has been below that of European public equities. In contrast, buyout investing seems to provide similar average performance in both continents—suggesting a more globalized market for buyout.

Some may find it unsurprising that PE funds have historically provided investors a premium relative to investing in public markets. After all, PE investments are relatively illiquid and LPs bear "commitment risk" reflecting the uncertain timing of capital calls and distributions, which are under the control of the GP. This contrasts with investing in public markets where there is no distinction between capital committed and invested, and trading is continuous. The costs of illiquidity and commitment likely vary across investors. For some, the average return premium we find for buyout funds (3% to 4% per year over public markets) may well seem attractive; for others who face higher illiquidity costs it may not. On the other hand, the fact that post-2005 buyout vintages have not outperformed public markets leaves open the possibility that the illiquidity premium has declined and / or competition among buyout investors has driven returns down. An important area for research is understanding how to trade off the costs (e.g. illiquidity and commitment risk) against the potential benefits (e.g. a return premium) inherent in private versus public equity investing.

In the next section, we discuss our data and metrics of performance. Section II contains our main performance results on North American funds. In Section III, we analyze European

funds. Section IV investigates whether performance is related to aggregate fundraising. Section V concludes.

I. Data and Measures of Performance

A. Data

We use PE fund-level cash flows from Burgiss as of June 2014. Burgiss provides investment decision support tools for the private capital market. Through these tools, and with authorization from its clients, Burgiss accumulates various data on private capital markets, including the Burgiss Manager Universe – a set of detailed, verified and cross-checked histories for almost 6,000 funds with a total capitalization of almost $4 trillion as of June 2014. According to Burgiss, this dataset "is representative of actual investor experience because it is sourced exclusively from limited partners and includes their complete transactional and valuation history between themselves and their primary fund investments." As a result we have "check book" data – recording the exact cash outflows made by the LPs to the general partners (GPs) as well as the distributions from the GPs back to the LPs for all of the private equity investments. All the returns we report are net of management fees and carried interest payments received by the GPs. The data are sourced entirely from nearly 300 institutional investors that represent approximately $0.75 trillion in committed capital. The LPs comprise a wide array of institutions: nearly one-third is represented by small institutional investors, defined by Burgiss as having private capital commitments of less than $100 million, and of the remaining two-thirds, about 60% are pension funds (a mix of public and corporate) and over 20% are endowments or foundations.

The first academic paper to use the Burgiss data was Harris, Jenkinson and Kaplan (2014). In that paper we discuss its advantages and compare it to other leading commercial data

sets. As part of their data confidentiality policy, Burgiss does not disclose the identities of the underlying investors or funds, and so we cannot formally test how representative the LPs (and their chosen GPs) are. Our earlier results comparing different commercial databases, lead us to doubt that Burgiss data have an overall positive or negative bias in terms of performance.[2]

We study funds formed between 1984 (the first year with meaningful numbers of funds in the data) and 2010. In total we have data for over 1,800 North American funds: 781 buyout funds and 1,085 VC funds. We also have information on over 300 European funds which we analyze separately. In comparison, our earlier study (Harris, Jenkinson and Kaplan (2014)) used Burgiss data on 598 buyout funds and 775 VC funds, all focusing on North America.

B. Performance Measures

PE performance can be measured in various ways. The metrics most widely used by funds and investors are the fund IRR and the investment multiple (also referred to as the multiple of invested capital). The former measures the LP's annualized IRR based on fund contributions and distributions, net of fees and profit shares (also known as carried interest) paid to the GP. Until all the investments in the fund are realized, and the cash returned to the investors, the IRR calculation includes the estimated value of any unrealized investments (the residual net asset value, or NAV) as of the last reporting date as a final "cash flow." The investment multiple compares the sum of all fund contributions by investors to the sum of all fund distributions and the value of unrealized investments, again net of fees and carried interest.

Neither of these two metrics provides a direct way to assess how PE returns compare with those to public equity. We focus on Kaplan and Schoar's (2005) PME, which directly compares

[2] We compare the Burgiss, Cambridge Associates and Preqin data sets. The article introduces a regression approach to estimate performance measures for latter two data sets even in the absence of fund-level cash flow information.

an investment in a PE fund to an equivalently-timed investment in the relevant public market. The PME calculation discounts (or invests) all cash distributions and residual value to 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. The PME can be viewed as a market-adjusted multiple of invested capital (net of fees). A PME of 1.20, for example, implies that at the end of the fund's life, investors ended up with 20% more than they would have if they had invested in the public markets.

In calculating PMEs, we initially use the S&P 500 index to proxy for the public market. This is arguably an appropriate standard of comparison for institutional investors. More formally, Sorensen and Jagannathan (2013) show that the PME and its use of a value-weighted stock market index have a strong theoretical underpinning. The PME is equivalent to using the stochastic discount factor of the log utility investor to value risky cash flows.

There are additional empirical justifications for this assumption, particularly for buyout funds. In their study of publicly-traded funds-of-funds that invest in unlisted PE funds, Jegadeesh, Kraussl, and Pollet (2009) find that publicly traded funds-of-funds have a market beta of 1.0. Driessen, Lin, and Phalippou (2012) report a beta of 1.3 for buyout funds, but a higher beta of 2.7 for venture funds. Axelson, Sorensen and Stromberg (2013), however, report a beta of greater than two for individual buyout fund investments gross of fees. That estimate, however, overstates fund betas net of fees because the total fees, particularly the carried interest, have a negative beta.

Later in the paper, we report on the sensitivity of PMEs to alternative benchmark indices (such as growth, or size-focused indices, which are sometimes used by LPs and partially control for differences in risk) as well as to different beta assumptions.

To provide an annualized measure we also calculate an excess return using the direct alpha methodology of Gredil, Griffiths and Stucke (2014).[3] The direct alpha approach sets up a PME calculation and then solves for an excess return (the direct alpha, over and above the index) that forces the PME to be equal to one. This excess return measure is positive when the PME against the benchmark is greater than one and negative when the PME is less than one. While a useful measure, direct alpha shares some of the drawbacks of any internal rate of return calculation.

II. PE Performance

A. IRR and Investment Multiples

Table I displays both IRRs and investment multiples for our sample of North American funds. The table also shows what proportion of total value (realized distributions plus remaining value) has been realized for the median fund in each vintage year. For buyout funds the percent realized value is 100% for the median fund in pre-1999 vintages and over 90% for the median fund in the 1999-2001 vintages. The pre-2002 vintages, therefore, represent largely realized funds. The proportion of realized investments naturally falls for the later vintages, and drops below 25% for the 2010 vintage. Similar patterns apply to the VC funds although the more recent vintage VC funds have a smaller fraction of value realized than do buyout funds-reflecting a longer lag between investment and realization in VC. The residual value (NAV) assumptions therefore become increasingly important for more recent vintages.

Table I here

[3] Gredil, Griffiths and Stucke (2014) discuss the specifics of the direct alpha method as well as alternative approaches to assessing private equity relative to public market returns. Kocis et al. (2009) discuss difficulties in interpreting internal rates of return

Assumptions about NAVs have generated controversy in past research. As discussed in Harris, Jenkinson and Kaplan (2014), some claim that NAVs are biased upward while more recent research suggests that, on average, residual values have historically been conservative estimates of the ultimate cash returned to investors. Although caution is always warranted before including residual values in return calculations, two factors help mitigate any tendency for reported NAVs to be systematically biased in predicting future realizations. First, the Burgiss figures for both distributions and NAVs are up-to-date because the data are sourced directly from LPs, are subject to extensive cross-checking, and are part of the Burgiss systems used for the LPs' monitoring and record-keeping. Second, since the end of 2008, the Financial Accounting Standards Board (FASB) has required PE firms to value their assets at fair value every quarter, rather than permitting them to value the assets at cost until an explicit valuation change.[4] This likely has had the effect of making estimated unrealized values closer to true market values than in the past, particularly for buyout funds.

Table I shows the average IRRs and investment multiples, separately for buyout funds and VC funds. The mean, median, and weighted-average (where the weights are capital commitments) figures are shown for each vintage year, as well as averages for the 1980s, 1990s, and 2000s. We find considerable variation in average performance across vintage years, with cycles that appear to lead economic booms and busts. This is due to the convention of classifying funds by vintage year, which is defined as the year of the fund's *first* capital call. Most funds have a five- or 6-year investment period, and so deploy most of their capital in the few years after their designated vintage year.

[4] This was formalized in the Statement of Accounting Standards 157, known as FAS157, relating to topic 820 on Fair Value Measurement. FAS 157 was first proposed in September 2006 and required as of December 15, 2008.

For buyout funds, the average of the mean vintage year IRRs is 15.7%, and the average investment multiple is 2.02. Capital Weighted averages are a bit higher. Over the entire sample of buyout funds, the average IRR is lower at 12.4% reflecting the increased number of funds after the early vintages. Average performance peaked in the early-1990s, and then rebounded though to a lower level for vintage years in the early 2000s. Buyout funds that started investing just before the financial crisis have, on average, lower IRRs and investment multiples.

For VC funds, the pattern of performance over time is more variable. IRRs and investment multiples were extremely high for vintage years in the mid-1990s. For instance, the (weighted-average) IRR for 1996 vintage funds was around 81%, and the investment multiple was over six. However, post-1998 and after the demise of the dot-com boom, the fortunes of VC investors reversed. The vintages with the largest amounts of VC fundraising, 1999 and 2000, have returned negative IRRs. The generally lower average returns for VC persisted through the mid-2000s but have shown a rebound to double digit returns in the last few vintages.

B. Does PE Outperform Public Markets?

Neither the IRR nor investment multiple offers a direct comparison to public markets as does PME. Initially we examine performance against the broad equity market as measured by the SP500. Table II presents average PMEs by vintage year for North American funds. Buyout funds consistently outperform the S&P 500. The average of the weighted-average vintage PMEs is 1.25; the average of the averages is 1.20; and the average of the medians is 1.14. All of these significantly exceed 1.0. The weighted-average, average, and median PMEs also exceed 1.0 in all three decades. The weighted average buyout PME exceeds 1.0 for 25 of the 27 vintages from 1984 to 2010; the average for 23 and even the median PME exceeds 1.0 for 19 of 27 vintages. And, ignoring vintage years, the average fund in the entire sample has an average PME of 1.18

and a median PME of 1.09. These results are qualitatively identical to the earlier results in Harris, Jenkinson and Kaplan (2014).

Table II here

We also calculate the direct alpha for each fund to measure the annualized excess return over and above the S&P 500. The average direct alpha for the buyout sample is 3.07%, while the median is 2.40%. The capital-weighted average excess return is 3.16%. We also calculated direct alpha pooling all the cash flows over all funds. The resulting 4.72% reflects the excess return on a private equity portfolio comprised of all 781 buyout funds. The average PME of about 1.20 and an average annual excess return of roughly 3 to 4% suggest that the typical duration of a buyout fund is on the order of five years, a duration lower than the typical fund's legal life of 10 to 13 years. This reflects the reality that committed capital is drawn down over a five-year investment period (rather than all at the beginning of the fund) and capital is returned through company sales and IPOs over the life of the fund.

These results strongly suggest that North American buyout funds have significantly outperformed public markets – by 20% over the life of the fund, or at least 3% per year – for a long period of time. Not only have top quartile funds outperformed the S&P 500, but so have average and median funds.

At the same time, the performance of more recent vintages – post-2005 – have roughly equaled, not exceeded, the performance of public markets. It is worth noting that those more recent vintage funds are not fully realized. Their eventual performance will depend on the future realization of investments over the funds' remaining lives. That performance will improve if the historical J-curve pattern of private equity funds – in which fund multiples increase over a fund's

life – continues to hold.[5] Alternatively, that performance will not improve if competition among buyout funds has reduced the premium for illiquidity.

The performance of North American VC contrasts considerably with that of buyouts. Panel B of Table II shows that the PMEs for early VC vintages were less than 1.0, but then increased sharply after 1986. Weighted-average PMEs exceed 1.0 for the 1987 to 1998 vintage years, with the 1996 vintage having a weighted-average PME above 4.0.

From 1999 to 2006, the pattern reverses. Except for 2003 and 2004, none of those vintages have a weighted-average or simple-average PME greater than 1.0. The 1999 to 2002 vintages are particularly low with all PMEs at or below 0.91. Interestingly, VC performance has rebounded somewhat after the 2006 vintage. While not at the high levels of the 1990s, weighted average PMEs are above one for each of the vintage years 2007 through 2010.

We also note that the gap between average (mean) and median performance is much more pronounced in venture than in buyout. This was especially the case when venture was performing well in the 1990s and reflects the highly variable nature of investing in early stage companies, a few of which have spectacular success.

We also calculate direct alpha as a measure of the annualized excess return over and above the S&P 500. For the entire venture sample, the average direct alpha is 2.07 %, the median is -2.93% and the capital-weighted average is 0.47%. For sub-periods of vintages, however, the figures are markedly different, mirroring the patterns in venture fund PMEs. Venture fund direct alphas average double digits in the 1990s, fall off precipitously beginning in 1999 and have a negative average in the 2000s.

[5] See Kocis et al. (2009) for a description of the J-curve.

Overall, our findings suggest that North American venture funds delivered returns higher than those from public markets for most of the 1990s, and by a fairly wide margin. Beginning in 1999, venture performance dropped dramatically and returns underperformed public markets for years. In the most recent vintages, venture performance shows signs of a rebound, though not to the level of the 1990s. Later we examine whether this change in performance is linked to capital flows into venture capital funds.

C. *Sensitivity of PMEs to the Choice of Benchmark*

So far our PME calculations are based on the S&P 500 because it is a widely used proxy for U.S. public market returns, has a natural asset pricing interpretation, and allows for direct comparison to past research. However, LPs commonly use other investable benchmarks (e.g., Russell 2000 or other size-related indices) to control for what they perceive as differences in risk or other return characteristics. To gauge the sensitivity of our results, Table III reports vintage year average, average, and median PMEs using a number of different indices, each of which represents a different public market alternative for investing funds.

The first four columns of Table III calculate PMEs with the S&P 500 and three other commonly used benchmarks. For buyout funds (Panel A), the average vintage year PMEs exceed 1.0 measured using all four benchmark indices. The PMEs are of similar magnitude (1.20 to 1.23) using the S&P 500, Russell 3000, and (small cap) Russell 2000 indices. The average vintage year PME is slightly lower (1.17) using the narrower Russell 2000 Value (small cap value) index. Average vintage year PMEs also are consistent over time – they all exceed 1.0 for each of the indices in each of the three decades for which we have data.

Table III here

The overall sample average PMEs also exceed 1.0 across all indices. Measured against the S&P 500 and the Russell 3000 indices, sample average PMEs are 1.18 and 1.16. They are lower using the Russell 2000 (1.11) and the Russell 2000 Value (1.08), but again still statistically greater than 1.0. The lower PMEs for the Russell 2000 Value index are driven by PMEs below 1.0 for the late 1990s vintages and the more recent 2009 and 2010 vintages. We also calculated direct alphas against each benchmark. Paralleling the reported PMEs, the sample average alpha is higher against the S&P 500 (3.07%) and Russell 3000 (2.7%) than against the Russell 2000 (1.71%) and 2000 value (1.15%). Direct alphas from pooled data are higher than the simple sample averages and aligned in the same fashion; similar against the S&P 500 (4.72%) and Russell 3000 (4.60%) and lower for the Russell 2000 (4.04%) and Russell 2000 value (2.86%).

The sample median PMEs are also significantly different from 1.0 except against the Russell 2000 Value. An important question is whether the mean or the median is a more appropriate measure of fund performance. If LP investors can freely choose among different funds and create a diversified portfolio of funds, then the mean is the appropriate standard. If, instead, some LPs can distinguish in advance which funds will outperform and those funds are not available to the typical LP, then the median may be the more appropriate measure.

Recent research suggests that the mean is the more appropriate measure for buyout funds. Harris, Jenkinson, Kaplan and Stucke (2014) find that buyout fund persistence has declined post-2000, suggesting that it is difficult to predict which funds will outperform based on previous fund performance. Furthermore, in their study of the performance of LPs, Sensoy, Wang, and Weisbach (2013) do not find that any particular type of investor is able to choose, and access, better performing buyout funds.

For venture funds (Panel B of Table III), the patterns identified using the S&P 500 also persist across the different indices. Although average vintage year PMEs exceed 1.0 across all

indices, they are below 1.0 in the 2000s and well above 1.0 in the 1990s. Sample average PMEs are similar for the different indices with the lowest using the S&P 500 and Russell 3000 (both 1.23) and the highest using the Russell 2000 Growth index (1.30).

While the overall sample average performance of VC funds is greater than 1.0, the sample median is below 1.0. For VC funds, it is less clear whether the median or mean is the appropriate measure for the typical LP. Harris, Jenkinson, Kaplan and Stucke (2014) find that VC fund persistence is equally strong before and after 2000. This suggests that it is possible to predict which VC funds will outperform based on previous fund performance. If the typical LP cannot get into such high-performing funds it may not be able to achieve average (mean) returns. Alternatively, Sensoy, Wang, and Weisbach (2013) do not find that any particular type of LP (including endowments) is able to access or choose better performing VC funds after 1998 which suggests that the mean is a more appropriate benchmark.

Overall, Table III shows that average PMEs across our sample are robust to a range of public market benchmarks. Size (smaller) and value benchmarks reduce the outperformance of buyout funds somewhat, but do not eliminate it. This reinforces our prior conclusions about PE performance.

D. Sensitivity of PMEs to Beta or Systematic Risk

As Sorensen and Jagannathan (2013)) show, there is a strong asset pricing justification for using PMEs calculated using the market return (like that of the S&P 500) without making assumptions about systematic risk (or betas). The relatively stable and positive pattern of PMEs for buyout funds that we find over the 1980s, 1990s, and 2000s – periods of very different market returns – suggests this assumption is reasonable.

Nevertheless, to further investigate the sensitivity of our conclusions, we estimate PMEs with discount rates that approximate assumed betas of 1.5 and 2.0. These higher betas are created by investment strategies that combine the S&P 500 (beta of 1.0) with borrowing. For instance, to proxy the public market return from a beta of 1.5, we take 1.5 times the return on the S&P 500 minus the interest cost involved in borrowing to leverage the index.[6] The PMEs for different beta assumptions are reported in the last two column of Table III.

For buyout funds, we find that the average fund has a PME of 1.18, 1.20, and 1.30 assuming public market returns that are levered to betas of, respectively, 1.0, 1.5, and 2.0 respectively. The median PMEs are 1.09, 1.07, and 1.12, respectively. The slightly higher PMEs for higher beta assumptions reflect times when the S&P 500 was flat or negative so that levering the market portfolio to create a higher beta would lead to lower returns than the index itself. This effect is especially noticeable for the vintages in the late 1990s that have very high PMEs using a beta of 2.0. Overall, given the similarities of average PMEs across the different beta assumptions, we conclude that systematic risk does not explain our PME results for buyout funds.

For VC funds, we find that the average fund has a PME of 1.23, 1.21, and 1.27 assuming betas of 1.0, 1.5, and 2.0. The medians are also close at 0.87, 0.85, and 0.89. Our basic conclusions are unchanged regardless of our assumption about beta – VC funds outperformed in the 1990s and underperformed in the early 2000s. The apparent recovery of VC in recent vintage years is less pronounced, however, if one uses a higher beta.

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[6] Specifically, the 1.5 beta return would be calculated as 1.5 times the S&P 500 return minus .5 times the interest rate. The interest costs comes from incurring $50 of borrowing to add to each $100 supplied. In line with an approximate duration of investments in a private equity fund, we use a five year interest rate. We form a daily index linking the 1.5 beta return series and use it to calculate PMEs. For the interest rate we use the yield to maturity on five year U.S. treasury bonds which would ignore any credit spread. Adding a credit spread would reduce the 1.5 beta return and hence may make our benchmark slightly higher than actually achievable.

Overall, our analysis shows our main conclusion are robust to an array of assumptions about market indices and beta. In keeping with these results, prior research, and the Sorensen and Jagannathan (2013) asset pricing interpretation, we rely on PMEs using a broad market index for the remainder of our analysis.

E. Selection Bias?

In our analysis, we have assumed that the Burgiss data provide an unbiased measure of PE performance. In fact, it is possible that the LPs who provide data to Burgiss are above average and, overall, invest in above average funds. If this were true, the Burgiss data would overstate PE performance. In Harris, Jenkinson and Kaplan (2014), we acknowledged that we could not be certain there was no bias, but we concluded that such a bias was highly unlikely. We so concluded and still come to the same conclusion for two primary reasons.

If the data were biased, Burgiss should overstate performance. However, Harris, Jenkinson and Kaplan (2014) find that the Burgiss performance results are qualitatively and quantitatively similar to those in Preqin and Cambridge Associates. Subsequently, we confirmed that the Burgiss performance data are qualitatively and quantitatively similar to those in Pitchbook. Preqin, Cambridge Associates and Pitchbook are the primary competitors to Burgiss. Importantly, both the Preqin and Pitchbook databases rely largely on Freedom of Information Act requests from public pension investors. That is, public pension investors have to report performance (IRRs and MOICs) for all of the funds in which they invest. Particularly for buyout funds, public pension investors invest in virtually all of the large buyout funds. Accordingly, it is highly unlikely that Preqin's buyout results are biased. Preqin's buyout results – both averages and capitalization-weighted averages – are slightly higher, but qualitatively and quantitatively similar to those in Burgiss. Accordingly, we view a bias in the Burgiss data as highly unlikely.

Instead, we view the similar results as more consistent with the conclusion that all four databases provide unbiased estimates of the overall performance of private equity.

It also is worth pointing out that for a bias to exist, the following would need to be true: (1) there would have to be a group of institutional investors who invested in the worst PE funds, had poor performance, no longer invest in PE funds and do not use Burgiss to measure their fund performance; (2) no other institutional investors who do use Burgiss invested in those same PE funds, so the poorly performing PE funds do not show up in the data set.

This seems highly unlikely, particularly for buyout funds. Sensoy et al. (2014) find that LPs have found it difficult to consistently pick outperforming funds, particularly in buyout. Harris, Jenkinson, Kaplan, and Stucke (2014) find that persistence of buyout GPs has declined substantially post-2000. As a result, it is difficult for LPs to consistently pick winners or losers. So, it is almost certain that even the most successful institutional investors invest in many poorly performing PE funds. Even if Burgiss were biased towards more successful institutional investors, the Burgiss data set likely would not have any bias towards more successful PE funds.

F. Fund Quartiles in Buyout and Venture Investing

A common practice in private equity is to place funds into quartiles based on performance relative to other funds started in the same vintage year. The top quartile label gets special attention, especially since past research has found that the funds raised by the best performing GPs tend to outperform their peers with some consistency over time—and in a way that even the best mutual funds and hedge funds clearly have not. As a result, GPs aim to market new funds based on "top quartile results" from their existing funds. LPs often select funds based on top quartile results. More recent research suggests performance persistence may have declined in

recent years especially for buyout funds (see Harris, Jenkinson, Kaplan and Stucke (2014) and the references therein). Our data allow us examine how important having positions in top quartile funds is for overall investment performance.

Table IV here

Table IV reports PMEs by quartile. In each vintage year, we use PMEs to group funds into quartiles and report the average PME for that quartile. Averages weighted by capital commitments (not reported) yield similar patterns. We begin with the 1994 vintage since that allows meaningful numbers of funds in each quartile grouping.

For buyout funds, Panel A shows that over the 1994-2010 period, top (1^{st}) quartile funds have average PMEs over two and a half times those of the bottom (4^{th}) quartile. The vintage year average for the 1^{st} quartile is 1.79 and 0.66 for the 4^{th} quartile. The averages across all individual funds for vintages back to 1984 are shown in Panel A's bottom row and lead to a similar conclusion. The gap between the top and bottom quartiles narrows in more recent vintages. This narrowing may well result from recent funds being largely unrealized (shown in Table II earlier) so ultimate outcomes are not yet known. While bottom quartile PMEs in buyout are well below one, third quartile buyout funds have returns roughly on par with the S&P 500; the average of the vintage year averages for 1994-2010 is 1.01 and the average across all funds back to 1984 is 1.00. Second quartile buyout funds have PMEs well above 1, averaging 1.29.

Compared to buyout, venture funds display a much wider gap between top and bottom quartile performance. This is to be expected given the nature of investing in young versus mature companies. As shown in Panel B, the top VC quartile PME averages 3.29 over the vintage years 1994-2010 and is over seven times the bottom quartile average of 0.45. As was true for buyouts, the gap between bottom and top quartile in venture narrows in recent vintages of funds whose

investments are largely unrealized. Unlike buyout, third quartile venture funds have PMEs well below one except during the boom venture years of the 1990s. In addition, the gap between second and top quartile venture funds is pronounced, especially in the 1990s when some funds saw spectacular successes. Over the entire period, top quartile venture funds have PMEs that average well over two times those of the second quartile. For vintages in the mid-1990s the gaps are even larger.

Comparing Panels A and B, the quartile results reflect the much more dispersed outcomes of venture investing compared to buyout. The bottom quartile of venture (average vintage year PME of 0.45) is lower than the bottom buyout quartile (average of .66). At the other end of the spectrum, the top quartile of venture (average vintage year PME of 3.29) has appreciably higher performance than the top buyout quartile (average vintage year of 1.79). Even in the 2000s when venture had years of sub-par average performance, the top quartile of venture often matched or exceeded the top buyout quartile.

The results in Table IV highlight that fund selection and access are more important (and likely more difficult) in venture than in buyout. To illustrate the impact of top quartile funds for investment performance we compare two polar scenarios over vintage years 1994-2010. In the first scenario, we assume an LP's investments were representative of all venture funds (i.e. equally invested in all four quartiles). In the second scenario, we assume the LP did not select or have access to any top quartile venture funds (i.e., invested in only the remaining three quartiles). Using the data in Table IV, the first scenario provides a vintage year average PME of 1.46; the second provides a PME of 0.85.[7] The result of missing top quartile venture funds is a dramatic

[7] For the first scenario we weight each of the four quartile average PMEs equally-reflecting a hypothetical portfolio spread equally across the quartiles. For the second, we give one-third weight to each of quartiles 2 to 4 and no weight to quartile 1. The averages across all four quartiles are essentially the same as the average performance shown in

drop in PME to a level that provides returns well below those of public equities. In contrast, the impact of top funds is much smaller in buyout. Applying the same polar scenarios to buyout, if a buyout investor missed out on all top quartile funds the average PME would be 0.99. This represents a drop from 1.19 if all four quartiles are included but is still almost on a par with public equities.

Of course, these illustrations are extremes. In practice, the issue is not complete exclusion from top quartile funds but rather a reduced probability of being in those relative to other funds. For instance, if we adjust our prior example for venture so that an investor's allocation to top quartile was only 12.5% (half of the random 25%, but not zero) the implied PME is 1.15 rather than 0.85. This is still a substantial drop from the PME with equal investment across quartiles. Our calculations illustrate the substantive differences in the importance of top performing funds in venture versus buyout. In practice, individual LPs likely have different skills and access to funds. Our illustrations show that such differential abilities are much more important in venture than buyout. The challenge, of course, is identifying likely fund performance at the fund's launch in time for investment decisions.

III. Comparison of European and North American Funds

In the early years of private equity, the vast majority of investment focused on North America. While the industry has become more global, most research still focuses on North American funds given their larger numbers and longer history. Burgiss data enable us to analyze a sample of 282 European buyout funds. These start with the 1994 vintage when meaningful numbers of observations are available. Table V reports PMEs for these funds calculated in two ways. The

Table II over the same set of vintages. There are minor differences due to rounding. Harris, Jenkinson and Stucke (2012) discuss some of the issues practitioners face in allocating funds to quartiles when they use IRRs and multiples that come from different sources.

first converts all cash flows to US dollars and then uses the S&P 500 as an index, paralleling our analysis of North American funds. The second uses cash flows in Euros and the MSCI Europe as the benchmark. The last columns of the table show our earlier North American results for comparison.

Table V here

While European buyout coverage is limited in the early vintages, it is significantly larger by the 2000s. Over all vintage years (1994-2010), the European buyout sample of 282 has about 40% as many funds as our North American sample.

Over the entire time period, the average of the vintage year mean PMEs is 1.27 against the S&P 500 and 1.21 against the MSCI. The average of the capital-weighted average is 1.32 against the S&P 500 and 1.28 against the MSCI Europe. Thus, European buyout funds have also outperformed public markets over the time span of our sample. Moreover, over the entire period, estimates of the size of this outperformance are very similar whether we calculate PMEs in dollars versus the S&P 500 or in Euros versus the MSCI Europe.[8]

A striking finding in Table V is that the European buyout funds have had performance very similar to that delivered by their North American counterparts. This is especially true in the 2000s when average PMEs are almost identical for the two continents. The 1990s vintages of European funds have higher PMEs than do European funds from the 2000s. Moreover, in the 1990s European PMEs are higher than those for North America. We urge caution, however, in

[8] There is also highly significant correlation across time. For European funds with vintages 1994-2010, the simple correlation between the vintage year average PME (S&P 500) and vintage year average PME (MSCI Europe) is 0.93. The corresponding correlation for weighted average PMEs is 0.88.

interpreting these time trends given the small number of observations in the early years of our European sample.

Overall, European buyout funds show similar performance to those in North America, especially in the 2000s.[9] On both continents, buyout funds have, on average, provided higher returns than have public equities.

Unfortunately, we do not have enough European venture funds for detailed analysis across vintages. Our sample of 87 European venture funds has very limited coverage in many vintages since 1994 –double digit coverage in only three vintage years and five or fewer funds in more than half of the vintages. As a consequence, we provide only high level averages shown in Table VI.

Table VI here

Unlike European buyout funds, European venture funds do not outperform public equities over the sample period. Using the S&P 500 as a benchmark, the average of the vintage year average PMEs is 0.95 over the full sample period; the corresponding figure for capital weighted averages is 1.05. PMEs in Euros against the MSCI Europe provide almost identical averages. PMEs are appreciably lower across vintages from the 2000s.

Moreover, European venture funds appear to perform worse than their North America counterparts. In the 2000s European funds have an average PME of 0.80 compared to 0.97 for North American funds. The gap is even more pronounced in the 1990s when North American venture funds had exceptional performance leading to an average PME of 2.42, During the

[9] The correlation over time is also very high: for instance, the correlation between the weighted average PMEs by vintage year for European funds and the equivalent for North American funds is 0.95 (whether using the S&P 500 for each, or the MSCI Europe).

1990s, the European average is 1.29 which, though above one, falls far short of the North American results.

In summary, average buyout performance appears quite similar between Europe and North America. On both continents, buyout funds have historically outperformed public market returns and by similar magnitudes. In contrast, venture performance in Europe has not been on a par with that in North American and has not outperformed public equities. Given the small size of our European venture sample, especially in the 1990s, strong conclusions on venture await further research with more data. Our findings do suggest, however, that venture investing has been more successful in North America than Europe. Buyout investing seems to provide similar average performance in both continents—suggesting a more globalized market for buyout.

IV. PE Performance and Capital Flows

As shown earlier, VC funds have displayed dramatic shifts in performance over time. In this section we examine this issue in more detail. Prior research has found that increased aggregate capital commitments (or fund flows) to buyout and VC funds are related to subsequent performance, especially for VC funds. In essence, large infusions of capital into private equity may challenge the ability of funds to create value for their investors.

To examine this issue with our data we follow prior research (see Harris, Jenkinson and Kaplan (2014) for past studies) and measure fund flows into the industry using capital committed to U.S. buyout and VC funds. We use annual estimates for capital commitments 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.[10] To compare these capital flows over a

[10] Ideally we would use an estimate of 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.

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 limit the analysis to vintage years from 1993 onwards when our data have more substantial fund coverage. In a typical year, the two-year capital commitments to buyout funds average 0.99% (median of 0.77%) of the stock market value. The two-year capital commitments to VC funds average 0.31% (median of 0.28%). There are quite different patterns in buyout and VC. For instance, buyout capital commitments peaked at over 2% in the vintage years 2007 through 2009. VC, on the other hand, peaked in vintages 2000 and 2001 at about 0.7% and plummeted thereafter.

We regress weighted-average vintage year performance, as measured by PME returns, IRRs and investment multiples, on aggregate capital flows. The results are qualitatively and statistically similar using unweighted average performance. Table VII shows that buyout fund performance is negatively related to capital commitments and significantly so for PMEs and investment multiples. When capital commitments increase from the bottom quartile of years (0.66%) to the top quartile of years (1.01%), multiples decline by around 0.11. The regression coefficients imply that PMEs decline by 0.075 when capital flows move from the bottom to top quartile. Overall, these results suggest that an influx of capital into buyout funds is associated with lower subsequent performance. The impacts, however, are not as large as found in prior research (see Harris, Jenkinson and Kaplan (2014)).

Table VII here

For VC funds, Table VII shows a significant negative relation between capital commitments and performance for all three measures of performance. The regression coefficients imply that when capital flows move from the bottom to top quartile, IRRs decline by 10% per year, multiples decline by 0.83, and PMEs decline by 0.39. These results are much more

pronounced than those for buyout and show larger impacts (though in the same direction) than found in earlier research (e.g. see Harris, Jenkinson and Kaplan (2014) and research cited there). The roller coaster ride of VC performance in the last two decades seems highly related to the sector's difficulties in absorbing large amounts of capital.

V. Conclusions

The enormous growth in investor allocations to private equity funds since the late 1990s has created a need for a reevaluation of how these funds have performed. This paper measures buyout and venture capital fund performance through mid-2014 taking advantage of high-quality cash flow data from Burgiss. Some key conclusions emerge.

First, it seems likely that buyout funds have outperformed public markets, particularly the S&P 500, net of fees and carried interest, in the 1980s, 1990s, and 2000s. Our estimates imply that each dollar invested in the average buyout fund returned at least 20% more than a dollar invested in the S&P 500. This works out to an outperformance of at least 3% per year. The conclusion that there has been outperformance is relatively insensitive to assumptions about benchmark indices and systematic risk. For the more recent and less fully realized post-2005 vintage funds, however, performance has been roughly equal to public markets. Eventual performance will depend on the ultimate realization of their remaining investments. Our results imply that buyout funds outperformed public markets more substantially gross of fees including the post-2005 vintages. Nailing down the sources of this outperformance seems a fruitful subject for future research.

Second, venture capital funds outperformed public markets substantially until the vintages of the late 1990s, but then had a period of underperformance. Only in the last few vintage years, has VC performance appeared to rebound though not to the heady levels of the early 1990s.

Although VC returns were disappointing for periods, this relative underperformance is less dramatic than the more commonly quoted absolute return measures (internal rates of return and investment multiples). Much prior research focuses on the earlier vintage years and inevitably obtains more positive results. Again, the qualitative conclusions do not appear sensitive to assumptions about systematic risk.

Third, the performance gap between top and bottom quartile funds in the same vintage year is much more pronounced in venture than in buyout. Moreover, compared to buyout, the highs are much higher in venture and the lows lower. In buyout, even third quartile funds have returns comparable to public markets. In venture, having some top quartile funds in the portfolio is much more important for successful investing. Our results highlight that LP selection skills and fund access are much more critical in venture capital than in buyout.

Fourth, average buyout performance appears similar between Europe and North America. On both continents, buyout funds have historically outperformed public market returns and by similar magnitudes. In contrast, venture performance in Europe has not been on a par with that in North American and has not outperformed public equities. While firm conclusions on venture await further research with more data, our findings are consistent with venture investing being more successful in North America than in Europe to date. Buyout investing seems to provide similar average performance in both continents—suggesting a more globalized market.

Fifth, vintage year performance for buyout and venture funds decreases with the amount of aggregate capital committed to that class of funds. This suggests that a contrarian investment strategy in these asset classes would have been successful in the past. The magnitudes of these relations have been greater for venture funds. Why these patterns have persisted is something of a puzzle and an interesting topic for future research.

Some may find it unsurprising that buyout funds have historically provided investors a premium relative to investing in public markets. After all, private equity investments are relatively illiquid, and investor commitments to funds face uncertain timing of capital calls and distributions that are under the control of the GP. This contrasts with investing in public markets where there is no distinction between capital committed and invested, and trading is continuous. The costs of illiquidity and commitment risk likely vary across investors. For some, the average return premium we find for buyout funds (3% to 4% per year) may well seem attractive. For those facing higher illiquidity costs it may not. On the other hand, the fact that post-2005 buyout vintages have not outperformed public markets leaves open the possibility that the illiquidity premium has declined and / or competition among buyout investors has driven returns down. An important area for future research is to understand the forces that operate here and how to trade off the costs (e.g. illiquidity and commitment risk) against the potential benefits (e.g. a return premium) inherent in private versus public equity investing.

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Table I

North American Private Equity Fund Internal Rates of Return and Investment Multiples

This table shows average internal rates of return (IRR) and investment multiples by vintage year on the individual funds using the Burgiss data. Investment multiples are the ratio of total value to paid-in capital (TVPI). Total value is the sum of the cash returned to investors and the remaining NAV as estimated by the PE fund manager. Given the limited life of the funds, for the early vintage funds the vast majority of the investments have been realized, whereas the opposite is true for the later vintages, for which the reported IRRs and multiples relate mainly to NAVs, with little cash having been returned to investors. Weighted averages use the capital committed for each fund as a proportion of the total commitments for each vintage year. Panel A focuses on buyout funds, and Panel B on VC funds, as classified by Burgiss. Only funds with a North American geographical focus are included. Averages are across vintage years and then separately across individual funds.

	Panel A: Buyout Funds								Panel B: Venture Capital Funds							
			Internal Rate of Return			Investment Multiple					Internal Rate of Return			Investment Multiple		
Vintage year	Funds	% Realised	Average	Median	Weighted average	Average	Median	Weighted average	Funds	% Realised	Average	Median	Weighted average	Average	Median	Weighted average
1984	4	100.0	15.5	14.9	24.8	2.87	2.85	4.09	24	100.0	7.3	6.3	7.7	1.69	1.57	1.71
1985	3	100.0	28.0	15.7	36.9	2.42	2.42	2.39	24	100.0	5.5	8.0	7.7	1.97	1.73	2.05
1986	7	100.0	14.2	16.8	16.8	3.36	2.36	4.47	18	100.0	10.7	8.6	8.7	2.14	1.78	1.76
1987	10	100.0	17.1	15.1	15.0	2.97	2.28	2.28	30	100.0	12.7	13.9	15.5	2.37	2.04	2.41
1988	10	100.0	13.3	11.2	16.5	1.96	1.70	2.24	26	100.0	13.4	11.6	20.5	2.12	1.94	2.65
1989	9	100.0	26.4	27.3	24.8	2.88	3.23	2.85	28	100.0	16.3	14.4	20.3	2.49	2.03	2.80
1990	4	100.0	20.6	17.1	19.1	2.89	2.87	2.72	17	100.0	20.6	20.4	26.2	2.63	2.24	3.10
1991	5	100.0	36.8	37.5	33.2	3.65	2.97	3.48	8	100.0	21.3	18.1	23.7	2.55	2.14	2.57
1992	11	100.0	16.6	18.8	26.4	1.91	1.88	2.20	19	100.0	22.4	13.4	27.4	2.64	1.78	2.75
1993	10	100.0	21.2	18.3	21.4	2.23	1.94	2.29	21	100.0	45.2	38.6	47.3	5.21	3.11	4.98
1994	20	100.0	20.9	19.6	28.2	2.09	1.72	2.65	23	100.0	37.6	31.0	50.9	4.92	2.91	7.83
1995	23	100.0	18.3	10.5	15.8	1.88	1.49	1.74	28	100.0	57.0	27.7	58.9	5.40	2.53	5.55
1996	18	100.0	10.4	8.0	9.1	1.51	1.36	1.40	23	100.0	67.8	44.9	80.8	5.92	3.21	6.51
1997	31	100.0	3.9	3.5	7.1	1.26	1.24	1.47	42	100.0	60.1	22.6	65.9	3.56	1.76	3.33
1998	46	100.0	6.0	8.3	4.7	1.47	1.45	1.38	58	99.7	15.2	0.7	16.0	1.86	1.04	1.93
1999	34	98.4	3.6	7.4	3.5	1.32	1.48	1.29	88	92.5	-2.1	-2.5	-3.1	0.94	0.82	0.99
2000	60	96.4	12.8	13.2	15.3	1.75	1.73	1.86	109	85.0	-2.0	-2.0	-0.7	0.97	0.87	1.01
2001	31	93.1	19.5	17.3	19.2	1.81	1.91	1.97	58	81.7	2.3	3.1	2.1	1.40	1.18	1.31
2002	23	85.6	16.1	14.9	18.8	1.86	1.85	1.97	21	70.4	0.1	1.8	1.5	1.09	1.11	1.12
2003	23	83.4	16.4	13.6	21.2	2.05	1.76	2.00	30	64.9	1.2	1.4	3.7	1.30	1.08	1.54
2004	50	72.6	12.5	11.9	15.3	1.67	1.65	1.84	49	44.9	3.8	1.8	5.1	1.72	1.12	1.75
2005	66	63.9	10.8	9.5	9.8	1.67	1.53	1.63	59	37.3	4.0	3.4	4.7	1.48	1.18	1.39
2006	80	50.4	7.8	8.2	7.4	1.41	1.48	1.42	70	25.3	3.3	5.0	5.9	1.30	1.27	1.40
2007	86	42.8	10.4	10.4	10.5	1.44	1.40	1.43	84	29.0	10.0	9.9	11.8	1.56	1.41	1.65
2008	64	31.7	13.9	13.7	15.8	1.45	1.43	1.52	58	23.4	10.2	11.7	11.0	1.69	1.38	1.67
2009	19	25.9	15.8	14.1	18.2	1.42	1.38	1.52	33	24.8	15.8	15.4	18.7	1.52	1.39	1.62
2010	34	14.8	15.5	13.9	15.5	1.30	1.29	1.29	37	9.9	22.5	19.7	22.3	1.64	1.45	1.64
Average*	781	83.7	15.7	14.5	17.4	2.02	1.88	2.13	1,085	77.4	17.9	12.9	20.8	2.37	1.71	2.56
Average 2000s	*502*	*64.6*	*13.6*	*12.7*	*15.2*	*1.65*	*1.61*	*1.72*	*571*	*48.7*	*4.9*	*5.2*	*6.4*	*1.40*	*1.20*	*1.44*
Average 1990s	*202*	*99.8*	*15.8*	*14.9*	*16.9*	*2.02*	*1.84*	*2.06*	*327*	*99.2*	*34.5*	*21.5*	*39.4*	*3.56*	*2.15*	*3.96*
Average 1980s	*43*	*100.0*	*19.1*	*16.8*	*22.5*	*2.74*	*2.47*	*3.05*	*150*	*100.0*	*11.0*	*10.5*	*13.4*	*2.13*	*1.85*	*2.23*
All funds*	781	78.6	12.4	11.2	12.4	1.66	1.51	1.61	1,085	85.7	13.0	6.4	10.2	1.97	1.34	1.66

** average except for number of funds*

Table II
Private Equity Fund Public Market Equivalent Ratios

This table shows the average PME ratios by vintage year, comparing PE returns to equivalent-timed investments in the S&P 500 using the Burgiss data. Vintage years are defined by the date of the first investment by a fund. Weighted averages use the capital committed to the funds as weights. Only funds with a North American geographical focus are included.

Vintage year	Panel A: Buyout Fund PMEs				Panel B: Venture Capital Fund PMEs			
	Funds	Average	Median	Weighted average	Funds	Average	Median	Weighted average
1984	4	1.01	0.98	1.41	24	0.66	0.57	0.67
1985	3	1.14	1.00	1.25	24	0.68	0.62	0.72
1986	7	1.17	1.11	1.36	18	0.89	0.71	0.78
1987	10	1.24	1.04	1.09	30	1.00	0.92	1.08
1988	10	0.93	0.81	1.07	26	0.97	0.85	1.29
1989	9	1.49	1.61	1.35	28	1.14	0.89	1.36
1990	4	1.19	1.07	1.18	17	1.31	1.10	1.52
1991	5	1.82	1.65	1.63	8	1.13	1.04	1.20
1992	11	1.01	0.99	1.13	19	1.24	0.84	1.35
1993	10	1.11	0.97	1.13	21	2.33	1.45	2.28
1994	20	1.19	1.09	1.46	23	2.24	1.40	3.42
1995	23	1.24	1.01	1.17	28	3.07	1.49	3.14
1996	18	1.13	1.13	1.05	23	3.86	2.16	4.34
1997	31	1.09	1.03	1.27	42	2.86	1.43	2.68
1998	46	1.38	1.40	1.31	58	1.66	0.99	1.74
1999	34	1.15	1.21	1.13	88	0.83	0.67	0.89
2000	60	1.44	1.38	1.48	109	0.75	0.66	0.78
2001	31	1.42	1.49	1.48	58	0.97	0.83	0.91
2002	23	1.38	1.34	1.51	21	0.76	0.76	0.79
2003	23	1.57	1.40	1.55	30	0.92	0.81	1.09
2004	50	1.29	1.29	1.45	49	1.18	0.75	1.23
2005	66	1.25	1.12	1.26	59	1.07	0.80	0.98
2006	80	1.01	1.03	1.02	70	0.87	0.80	0.95
2007	86	1.01	0.97	0.99	84	1.03	0.93	1.08
2008	64	0.97	0.96	1.03	58	1.06	0.85	1.05
2009	19	0.96	0.92	1.01	33	0.99	0.95	1.05
2010	34	0.91	0.90	0.93	37	1.13	1.00	1.13
Average*	781	1.20	1.14	1.25	1,085	1.35	0.97	1.46
Average 2000s	*502*	*1.23*	*1.19*	*1.28*	*571*	*0.96*	*0.81*	*0.99*
Average 1990s	*202*	*1.23*	*1.16*	*1.25*	*327*	*2.05*	*1.26*	*2.26*
Average 1980s	*43*	*1.16*	*1.09*	*1.25*	*150*	*0.89*	*0.76*	*0.98*
All funds*	781	1.18	1.09	1.17	1,085	1.23	0.87	1.13

** average except for number of funds*

Table III
Private Equity Public Market Equivalent Ratios Using Alternative Public Market Indices

This table shows vintage-year average, average, and median PME ratios calculated with alternative market benchmarks. The Russell 3000 index is based on the largest 3,000 U. S. companies. The Russell 2000 measures the performance of small-cap stocks and is based on a 2,000 company subset of the Russell 3000. The Russell 2000 Growth and 2000 Value indices are subsets of the Russell 2000 chosen on the basis of forecasted growth rates and price-to-book ratios. The final columns calculate PMEs using a levered S&P 500 to approximate the effect of betas of 1.5 and 2. Panel A focuses on the 781 buyout funds, and Panel B on the 1085 VC funds, which have a North American focus and are in the Burgiss data set.

Panel A: Buyout Funds

		Russell indices			Beta (levered S&P 500)	
Vintage years	S&P 500	3000	2000	2000 value	1.5	2
1984	1.01	1.05	1.35	1.24	0.98	1.01
1985	1.14	1.19	1.39	1.32	1.10	1.10
1986	1.17	1.23	1.55	1.37	1.13	1.17
1987	1.24	1.26	1.41	1.30	1.17	1.14
1988	0.93	0.93	1.00	0.94	0.86	0.82
1989	1.49	1.49	1.56	1.44	1.38	1.31
1990	1.19	1.21	1.33	1.20	1.07	0.99
1991	1.82	1.85	2.06	1.91	1.65	1.54
1992	1.01	1.03	1.19	1.15	0.90	0.82
1993	1.11	1.13	1.33	1.26	1.00	0.94
1994	1.19	1.21	1.39	1.31	1.13	1.14
1995	1.24	1.25	1.35	1.25	1.26	1.37
1996	1.13	1.12	1.08	0.99	1.26	1.50
1997	1.09	1.04	0.86	0.72	1.30	1.66
1998	1.38	1.32	1.03	0.83	1.65	2.06
1999	1.15	1.11	0.90	0.74	1.32	1.58
2000	1.44	1.40	1.20	1.07	1.58	1.84
2001	1.42	1.38	1.27	1.24	1.47	1.59
2002	1.38	1.35	1.27	1.28	1.43	1.57
2003	1.57	1.54	1.47	1.50	1.68	1.93
2004	1.29	1.27	1.24	1.29	1.36	1.54
2005	1.25	1.24	1.20	1.27	1.30	1.43
2006	1.01	1.00	0.98	1.03	1.00	1.05
2007	1.01	1.00	0.97	1.01	0.95	0.91
2008	0.97	0.96	0.94	0.97	0.85	0.76
2009	0.96	0.96	0.95	0.96	0.82	0.72
2010	0.91	0.90	0.90	0.92	0.79	0.69
Average	1.20	1.20	1.23	1.17	1.20	1.27
Average 2000s	*1.23*	1.21	1.15	1.16	1.25	1.33
Average 1990s	*1.23*	1.23	1.25	1.14	1.25	1.36
Average 1980s	*1.16*	1.19	1.38	1.27	1.10	1.09
Sample average	1.18	1.16	1.11	1.08	1.20	1.30
Sample median	1.09	1.08	1.03	1.01	1.07	1.12

Panel B: Venture Capital Funds

		Russell indices			Multiple of S&P 500	
Vintage years	S&P 500	3000	2000	2000 growth	1.5X	2X
1984	0.66	0.69	0.88	0.94	0.65	0.67
1985	0.68	0.71	0.88	0.96	0.66	0.68
1986	0.89	0.92	1.09	1.17	0.88	0.92
1987	1.00	1.01	1.12	1.19	0.95	0.94
1988	0.97	0.97	1.05	1.13	0.90	0.85
1989	1.14	1.15	1.23	1.34	1.04	0.97
1990	1.31	1.31	1.36	1.49	1.18	1.09
1991	1.13	1.15	1.37	1.46	0.97	0.86
1992	1.24	1.28	1.51	1.64	1.07	0.95
1993	2.33	2.42	3.12	3.18	1.95	1.69
1994	2.24	2.32	3.00	3.11	1.91	1.70
1995	3.07	3.14	3.84	3.81	2.75	2.58
1996	3.86	3.91	4.50	4.40	3.68	3.69
1997	2.86	2.84	2.89	2.84	2.95	3.19
1998	1.66	1.60	1.39	1.57	1.90	2.32
1999	0.83	0.79	0.63	0.79	1.00	1.31
2000	0.75	0.72	0.61	0.70	0.85	1.03
2001	0.97	0.93	0.84	0.86	1.03	1.17
2002	0.76	0.74	0.69	0.69	0.79	0.89
2003	0.92	0.90	0.87	0.85	0.95	1.05
2004	1.18	1.16	1.13	1.08	1.19	1.29
2005	1.07	1.05	1.02	0.98	1.08	1.17
2006	0.87	0.85	0.83	0.79	0.81	0.79
2007	1.03	1.01	0.98	0.95	0.92	0.86
2008	1.06	1.05	1.03	1.00	0.90	0.79
2009	0.99	0.98	0.97	0.95	0.83	0.72
2010	1.13	1.13	1.13	1.12	0.97	0.84
Average	1.35	1.36	1.48	1.52	1.29	1.30
Average 2000s	*0.96*	0.94	0.90	0.88	0.94	0.98
Average 1990s	*2.05*	2.08	2.36	2.43	1.94	1.94
Average 1980s	*0.89*	0.91	1.04	1.12	0.85	0.84
Sample average	1.23	1.23	1.26	1.30	1.21	1.27
Sample median	0.87	0.86	0.84	0.87	0.85	0.89

Table IV
Private Equity Fund Public Market Equivalent Ratios by Performance Quartile

This table shows the average PME ratios by vintage year, comparing PE returns to equivalent-timed investments in the S&P 500. In each vintage year, a fund is assigned to a quartile based on its PME relative to others in that year. Figures reported are the average PME across funds in that quartile. We start with 1994 when there are meaningful numbers of funds in each quartile group. Averages of vintage year averages are shown after the last vintage year. The final row of numbers report averages over all invidual funds in all vintage years 1984-2010 for our full sample. Only funds with a North American geographical focus are included.

Vintage year	Panel A: Buyout Funds, Average PME per Quartile					Panel B: Venture Capital Funds, Average PME per Quartile				
	Funds	Bottom (4th) Quartile	3rd Quartile	2nd Quartile	Top (1st) Quartile	Funds	Bottom (4th) Quartile	3rd Quartile	2nd Quartile	Top (1st) Quartile
1994	20	0.67	0.93	1.31	1.87	23	0.37	0.88	1.92	5.49
1995	23	0.58	0.88	1.27	2.11	28	0.68	1.19	2.12	8.27
1996	18	0.40	0.85	1.26	1.89	23	0.73	1.55	2.61	10.03
1997	31	0.55	0.93	1.17	1.62	42	0.59	1.19	2.16	7.24
1998	46	0.63	1.14	1.55	2.14	58	0.40	0.80	1.23	4.09
1999	34	0.44	0.90	1.37	1.84	88	0.23	0.53	0.81	1.74
2000	60	0.70	1.26	1.57	2.23	109	0.31	0.57	0.82	1.28
2001	31	0.76	1.23	1.57	2.02	58	0.35	0.66	0.98	1.83
2002	23	0.79	1.18	1.60	1.87	21	0.37	0.62	0.86	1.12
2003	23	0.93	1.23	1.43	2.58	30	0.29	0.68	0.94	1.70
2004	50	0.74	1.14	1.34	1.91	49	0.43	0.62	0.91	2.62
2005	66	0.77	1.04	1.29	1.89	59	0.33	0.66	0.99	2.23
2006	80	0.61	0.95	1.10	1.39	70	0.36	0.67	0.91	1.50
2007	86	0.66	0.92	1.05	1.41	84	0.56	0.85	1.08	1.61
2008	64	0.69	0.89	1.03	1.28	58	0.42	0.78	0.98	2.02
2009	19	0.72	0.88	0.97	1.23	33	0.59	0.87	1.01	1.41
2010	34	0.63	0.84	0.95	1.19	37	0.66	0.94	1.13	1.73
Average*	708	0.66	1.01	1.29	1.79	870	0.45	0.83	1.26	3.29
Average 2000-10	536	0.73	1.05	1.27	1.73	608	0.42	0.72	0.96	1.73
Average 1994-99	172	0.54	0.94	1.32	1.91	262	0.50	1.02	1.81	6.14
Average across all funds in vintages 1984-2010	781	0.66	1.00	1.26	1.75	1085	0.41	0.76	1.12	2.58

** average except for number of funds*

Table V

Private Equity Fund Public Market Equivalent Ratios for North American and European Buyout Funds

This table shows the average PME ratios by vintage year, comparing PE returns to equivalent-timed investments in a market index. Weighted averages use the capital committed to the funds as weights. Funds with a North American geographical focus are benchmarked against the S&P 500. Funds with a European focus are benchmarked in US $ against the S&P 500 and in Euros against the MSCI Europe index. Averages across a span of vintage years are averages of the values for each vintage year.

	European Funds							*North American Funds*			
	US$, S&P 500 benchmark				Euros, MSCI Europe benchmark			US$, S&P 500 benchmark			
Vintage year	Funds	Average	Median	Weighted average	Average	Median	Weighted average	Funds	Average	Median	Weighted average
1994	7	1.19	1.12	1.70	1.38	1.31	1.98	20	1.19	1.09	1.46
1995	2	0.69	0.69	0.61	0.71	0.71	0.63	23	1.24	1.01	1.17
1996	5	1.25	1.21	1.28	1.16	1.19	1.29	18	1.13	1.13	1.05
1997	8	2.05	1.71	1.69	1.84	1.48	1.55	31	1.09	1.03	1.27
1998	12	1.90	1.80	1.89	1.59	1.48	1.59	46	1.38	1.40	1.31
1999	9	1.40	1.57	1.74	1.13	1.35	1.38	34	1.15	1.21	1.13
2000	19	1.83	1.61	1.81	1.45	1.31	1.46	60	1.44	1.38	1.48
2001	13	1.75	1.65	1.67	1.40	1.41	1.37	31	1.42	1.49	1.48
2002	11	1.72	1.55	1.70	1.46	1.34	1.39	23	1.38	1.34	1.51
2003	13	1.44	1.48	1.60	1.32	1.36	1.46	23	1.57	1.40	1.55
2004	17	1.09	0.98	1.26	1.12	1.07	1.29	50	1.29	1.29	1.45
2005	27	1.10	1.02	1.17	1.22	1.23	1.30	66	1.25	1.12	1.26
2006	42	0.91	0.78	0.90	1.08	0.92	1.11	80	1.01	1.03	1.02
2007	43	0.81	0.85	0.87	0.96	1.03	1.05	86	1.01	0.97	0.99
2008	33	0.86	0.88	0.93	0.99	1.01	1.07	64	0.97	0.96	1.03
2009	14	0.85	0.82	0.88	0.97	0.91	1.00	19	0.96	0.92	1.01
2010	7	0.76	0.71	0.77	0.83	0.76	0.83	34	0.91	0.90	0.93
Average*	282	1.27	1.20	1.32	1.21	1.17	1.28	708	1.20	1.16	1.24
Average 2000-10	*239*	*1.19*	*1.12*	*1.23*	*1.16*	*1.12*	*1.21*	*536*	*1.20*	*1.16*	*1.25*
Average 1994-99	*43*	*1.41*	*1.35*	*1.48*	*1.30*	*1.25*	*1.40*	*172*	*1.20*	*1.15*	*1.23*

** average except for number of funds*

Table VI

Private Equity Fund Public Market Equivalent Ratios for North American and European Venture Funds

This table shows PMEs which compare PE returns to equivalent-timed investments in a market index. Weighted averages use the capital committed to the funds as weights. Funds with a North American geographical focus are benchmarked against the SP500. Funds with a European focus are benchmarked in US $ against the S&P 500 and in Euros against the MSCI Europe index. Averages across a span of vintage years are average of the vintage year values.

Vintage years	*European Funds*							*North American Funds*			
		US$, S&P 500 benchmark			EUROs, MSCI Europe benchmark				US$, SP500 benchmark		
	Funds	Average	Median	Weighted average	Average	Median	Weighted average	Funds	Average	Median	Weighted average
Average 1994-2010*	87	0.95	0.94	1.05	0.96	0.94	1.07	870	1.48	1.02	1.60
Average 2000-10	*69*	*0.80*	*0.77*	*0.88*	*0.83*	*0.81*	*0.92*	*608*	*0.97*	*0.83*	*1.00*
Average 1994-99	*18*	*1.29*	*1.29*	*1.43*	*1.24*	*1.21*	*1.38*	*262*	*2.42*	*1.36*	*2.70*

** averages except for number of funds*

Table VII
The Relationship Between Aggregate Flows into Private Equity and Performance

This table reports regressions where the dependent variable is fund performance – as measured by IRR, investment multiple, or PME – and the explanatory variable is an estimate of capital flows into PE. We measure capital flows by summing the capital commitments as estimated by Private Equity Analyst in the current and previous vintage years, and then take the ratio of this sum to the aggregate U.S. stock market value at the start of the current vintage year. This provides a measure of the amount of capital available to fund PE deals. The performance measures are weighted averages, where the weights are the proportion of capital committed in each vintage year to the total capital committed over the vintages included in the regression. Only funds with a North American Focus are included. Given the small sample sizes in early vintages, only vintage years from 1993 onwards are included. Separate regressions are estimated for buyout funds and VC funds. Standard errors are reported in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	Buyout Funds			VC Funds		
Dependent variable:	PME	IRR	Multiple	PME	IRR	Multiple
Capital Commitments to Total Stock Market Value	-21.67**	-2.38	-31.85**	-297.55**	-77.55**	-635.51**
	[7.91]	[2.92]	[14.89]	[135.65]	[32.51]	[259.98]
Constant	1.45***	0.17***	2.02***	2.57***	0.47***	4.61***
	[0.09]	[0.03]	[0.17]	[0.48]	[0.12]	[0.92]
N	18	18	18	18	18	18
R-squared	0.32	0.04	0.22	0.23	0.26	0.27