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A Bottom-Up Approach to the Risk-Adjusted Performance of the Buyout Fund Market

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We use the Burgiss dataset to study private equity buyout fund performance. Our findings on performance before risk adjustments are consistent with those in the literature and indicate significant outperformance of buyout fund investments. Using a bottom-up approach, we identify the systematic risks of underlying companies in buyout funds to inform an appropriate risk-adjusted benchmark, which we determine to be a levered size- and sector-adjusted public index. After making these risk adjustments, we find no significant outperformance of buyout fund investments versus the public market equivalent on a dollar-weighted basis. We contend that even without significant risk-adjusted outperformance, buyout funds can play a valuable role in institutional investors' portfolios.

Using the CEM Benchmarking database on pension fund investments, Andonov, Kok, and Eichholtz (2013) showed that private equity is, after real estate, the most significant alternative asset class for pension funds. Doeswijk, Lam, and Swinkels (2014) confirmed that at the end of 2012, private equity represented 3.6% of the global multi-asset market portfolio, with US$3.3 trillion.

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Despite the economic importance of private equity—with buyout funds representing a large proportion (40%)[1]—and the abundant empirical literature, there is a huge debate, with significant divergence, on its risk-adjusted performance.

In one of the most prominent studies for both practitioners and academics,[2] Harris, Jenkinson, and Kaplan (HJK 2014, p. 1851) concluded that the performance of US buyout funds 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." They documented that their results are robust to various indexes (size, value), risk controls (leverage), and datasets.[3] In contrast, Phalippou (2014) pointed out that the choice of benchmark is critical. Using a Preqin dataset instead of the higher-quality, proprietary Burgiss dataset, he showed that the average buyout fund return is similar to that of small-cap indexes. Further, he concluded that "if the benchmark is changed to small and value indices, and is levered up, the average buyout fund underperforms by 3.1% p.a." (Phalippou 2014, p. 189). A better understanding of the appropriate risk-adjusted benchmark for measuring the opportunity cost of an investment in buyout funds is critical to measuring their performance. A clearer answer to the question of the relative performance of buyout funds up to now is also crucial to guiding asset owners' strategic asset allocation.

In our study, we strove to bridge the gap between HJK (2014) and Phalippou (2014) and to reach a clearer conclusion about the risk-adjusted performance of the US buyout fund market. To facilitate the comparison, we used (1) the same data source as HJK (updated data from Burgiss—752 versus 598 funds formed between 1986 and 2008 with cash flows until Q1 2015), whereas Phalippou used aggregate Preqin data, and (2) a common methodology. Using a public market equivalent (PME) performance metric, we first examined the performance of each vintage. We then assessed the relative performance of the buyout fund market vis-à-vis the chosen public benchmark using the average PME across vintages. We explored three suggestions made by Higson and Stucke (2012) and Phalippou (2014) in their concluding remarks. First, we focused on the weighting scheme of vintages because, as Phalippou (2014, p. 215) pointed out, "It…remains unclear how one should weight different vintage years." Second, we took advantage of sufficiently rich, publicly available data to inform the risk characteristics of the underlying buyout companies. Third, we used these appropriate risk adjustments to construct an appropriate benchmark, which was necessary to reach a more definitive conclusion about the performance of US buyout funds; as Higson and Stucke (2012, pp. 25–26) observed, "Hard conclusions about whether or not the US buyout industry has created alpha for its investors require further research on the appropriate benchmark."

Our study adds to the literature on the risk-adjusted performance of the buyout fund market in three ways. First, we argue that a value-weighted (VW) PME across vintages or a pooled PME, instead of the equally weighted (EW) PMEs used in HJK (2014) and Phalippou (2014), is more in line with a dollar-weighted performance metric. Because capital deployed in buyout fund investments varies significantly by vintage, the VW PME and the pooled PME more accurately reflect the historical relative performance of the US buyout fund market and the aggregate returns of investors in this market.

Second, we conducted a thorough bottom-up analysis of the risk characteristics of underlying companies in buyout funds. Using comprehensive buyout transaction datasets, we compared risk characteristics of buyout transactions with their public counterparts. Higson and Stucke (2012) and Phalippou (2014) rightly identified company size as an important risk characteristic in buyout transactions. We first obtained detailed data on the size characteristics of portfolio companies in buyout funds. Following common practices in risk management, we then compared their sector composition and leverage level with those of the constituents of public equity indexes.

Third, we used this detailed bottom-up analysis to inform our construction of an appropriate and representative risk-adjusted benchmark (linear combination of public indexes), taking into account the risk characteristics in combination instead of one by one. We then examined how buyout funds have performed relative to a levered size- and sector-adjusted public index consistent with their risk profile.

■ *Discussion of findings.* With the S&P 500 Index as a benchmark and an EW PME across vintages, our results are in line with those of Higson and Stucke (2012), HJK (2014), and Phalippou (2014). We found that US buyout funds have outperformed the S&P 500 by 22%, on average, over the life of the funds. We also found that the underlying companies that buyout funds invest in have, on average, smaller market capitalizations than their public counterparts. Their sector composition is materially different (e.g., significantly overweight and underweight, respectively, in the Consumer Discretionary and Financials sectors), and their leverage is significantly higher than that of public companies in the same sector. When we used a risk-adjusted benchmark fairly representing the size, sector composition, and leverage of portfolio companies in buyout funds, the outperformance was reduced by more than half (an average EW PME of 1.10 versus 1.22). Finally, when we used either a VW PME or a pooled PME in tandem with a risk-adjusted benchmark, we found no evidence of outperformance by the US buyout fund market.

Methodology

The methodology that we followed in our study is in line with Higson and Stucke (2012), Robinson and Sensoy (2013), HJK (2014), and Phalippou (2014). It focuses on a specific performance metric, PME, and emphasizes a dollar-weighting scheme to better reflect realized returns to investors in the US buyout fund market. However, two other methodologies have been used in recent literature: (1) one-step regressions using contemporaneous and lagged risk factors to estimate risk loadings (summed coefficients) and abnormal performance[4] and (2) estimation of discount rates of private equity returns from cash flows accruing to limited partners.[5] The findings resulting from these two methodologies diverge significantly. One-step regressions have found evidence that the market beta tends to be lower than 1, that there is a small size tilt, and that buyout funds outperform public equities on a risk-adjusted basis. In contrast, when discount rates are estimated from cash flows in a net present value (NPV) framework, the market beta is significantly higher than 1, coefficients on value and liquidity factors are positive, and buyout funds tend to underperform public equities on a risk-adjusted basis.

Our study builds on the work of Higson and Stucke (2012), Robinson and Sensoy (2013), HJK (2014), and Phalippou (2014). Similar to HJK, we favored the PME ratio as a return metric to assess the performance of buyout funds. Unlike time-weighted return metrics, this dollar-weighted metric captures the ability of general partners (GPs) to control the timing of the investment of a closed-end buyout fund's committed capital. GPs control the timing of investments and divestments during the life of the fund, and these cash flows are irregular in terms of magnitude and sequence. Further, the PME does not depend on the intermediate net asset value (NAV) that the GPs determine and report. It is a widely accepted measure in the asset management industry and under the Global Investment Performance Standards (GIPS).

The PME compares the contributions to and distributions from a private equity investment, adjusted for the time value of money. The rate used to discount the cash flows can be thought of as the opportunity cost of the investment. Thus, a public market index return is commonly used as the discount rate in the PME ratio to represent the benchmark of the buyout investment. The PME ratio represents how many dollars need to be invested in the benchmark for each dollar in the buyout fund. As HJK (2014, p. 13) pointed out, "The PME can be viewed as a market-adjusted multiple of invested capital (net-of-fees)." The PME of vintage i with N quarters of cash flows can be stated as

$$\text{PME}_i = \frac{\sum_{t=0}^{N} \text{PV of distribution}_t}{\sum_{t=0}^{N} \text{PV of contribution}_t}. \quad (1)$$

HJK (2014, Table IV) centered their analysis on the EW PME across vintages and the sample average PMEs. Robinson and Sensoy (2013) provided the EW average and median PMEs; Phalippou (2014) used a similar approach.

We used two additional estimates of the performance of buyout funds relative to public equity markets. First, we calculated a VW PME across vintages whereby the weights are prescribed by the invested capital (converted into dollars with 1986 purchasing power using the US Consumer Price Index) in each vintage. Second, we calculated the pooled PME for the entire universe of buyout fund cash flows in the database. The pooled performance metric implicitly uses a VW scheme across funds and over time.[6]

Two reasons motivated our choosing a VW scheme. First, the EW scheme corresponds to a time-weighted metric and reduces the benefits of the dollar-weighted metric that we chose for each vintage. Second, we argue that it is more meaningful and statistically appropriate to put more weight on vintages with more invested capital. EW PMEs assume that each vintage is equally representative, with the same weight for each vintage, even if the number of funds or the amount of invested capital of the first vintages is very small compared with more recent vintages. Of the 23 vintages we analyzed, the first 12 vintages (1986–1997) represent $75 billion of inflation-adjusted invested capital and 171 buyout funds. The remaining 11 vintages (1998–2008) represent $397 billion of inflation-adjusted invested capital and 581 buyout funds. Because these 11 vintages contain information on 85% of the returns to limited partners (LPs), we argue that dollar-weighted averages, in combination with the appropriate risk adjustments, are better suited than EW averages for assessing the historical performance of buyout funds.

Although we favored the mechanics of the PME as a performance metric, the benchmark used in the PME is a critical choice that should reflect the systematic risks of buyout funds. As highlighted by Kaplan and Schoar (2005, p. 1797), "If private equity returns have a beta greater (less) than 1, PME will overstate (understate) the true risk-adjusted returns to private equity."[7] We analyzed in detail the risk characteristics of buyout funds' underlying companies in order to (1) construct a benchmark that reflects their systematic risks and (2) assess the risk-adjusted performance of buyout funds.

Risk Characteristics of Underlying Companies

In this section, we describe our data and discuss our bottom-up analysis to inform the appropriate risk adjustments to be made to public market returns regarding such factors as size, sector composition, leverage, and others.

Bottom-Up Analysis. The choice of benchmark in our PME analysis was not motivated, as in previous studies, by the sensitivity analysis of a particular risk characteristic (size or leverage). We conducted an in-depth, bottom-up analysis of comprehensive buyout transaction datasets to inform the appropriate risk adjustments to be made to public market returns. Unlike earlier researchers, we present detailed information about (1) the fraction of companies falling into the size quartiles of public indexes, (2) their sector composition relative to public indexes, and (3) their leverage relative to their public counterparts.

Data. Using data from Capital IQ, we documented the size and the sector composition of companies that buyout funds invest in. For 1993–2014, we identified 3,492 buyout transactions, of which 574 were public-to-private transactions and 2,918 were private-to-private transactions. To ascertain the leverage and the cost of leverage at the transaction's inception, we used data from Leveraged Commentary & Data (LCD). We were able to determine the leverage for over 1,400 transactions from 1997 to 2014.

Size. Most studies have confirmed that the companies buyout funds invest in are usually small. Phalippou (2014) showed that 95% of the buyout transactions in the Capital IQ database have a reported enterprise value below $1.08 billion; HJK (2014) observed that individual equity investments exceeding $2.5 billion are rare. To better understand the size characteristics of companies that buyout funds invest in, we used a bottom-up approach to compare the distributions of portfolio companies of buyout funds and publicly listed companies.

For each buyout in our Capital IQ sample, we inferred the estimated equity investment as follows: enterprise value (EV) times average equity contribution (30%, on average, according to LCD data; see the discussion on leverage).[8] We then compared the equity size distribution of buyout fund investments with the equity size distribution of constituents of the large- and small-cap public indexes (S&P 500 and S&P 600) over time. **Figure 1** shows that from 1994 to 2014, there were only 15 equity investments larger than the maximum size of the companies in the small-cap universe (S&P 600): 0.4% of the transactions. These mega-buyouts are concentrated in two years, 2006 and 2007. Excluding these mega-buyouts, the maximum equity size of the buyout investments is below the maximum size of companies in the small-cap universe. Most of the other buyout investments are very small. The median equity of the buyout investments is well below the minimum of the small-cap companies, and the average size of buyouts is well below the average size of small-cap publicly listed companies (S&P 600).

Table 1 compares the size distributions of buyout fund portfolio companies with the size distributions of the constituents of the S&P 600 (by both number of companies and percentage value of the index). The buyouts outside the small-cap universe represent, on average, 7% of the total by market value. The buyouts in the top and bottom halves of the small-cap universe represent 26% and 67% of the market, respectively. In comparison, the top and bottom halves of the S&P 600 represent, on average, 76% and 24% of the market; 90% of the fund equity investments are in the bottom decile and represent 40% of the market. To facilitate the sector analysis, we retained the S&P 600 as a size benchmark, although the bottom half of the index is likely more representative.

Sector Composition. **Figure 2** presents the average sector composition of buyout fund investments and the S&P 600 over 1994–2014. On average, buyout funds invested almost 30% of their commitments in Consumer Discretionary, which is 13% more, on average, than the weight of Consumer Discretionary in the S&P 600. In contrast, the Financials sector is significantly underweighted, as are Information Technology (IT) and Health Care.

We used the sector composition of buyout investments to construct a size- and sector-adjusted public index. Assuming that the stylized sector composition of buyouts was constant over time, we constructed a size- and sector-adjusted index to reflect this average long-term sector allocation. We acknowledge that this representation does not capture the time-varying sector composition of the buyout industry. Some sectors have been in and out of favor over time—for example, in 2014, 29% of buyout capital was in IT, compared with the average IT sector concentration of 14%; and in 2009, 1% of buyout capital was in bank transactions, compared with the average Financials sector concentration of 5%.

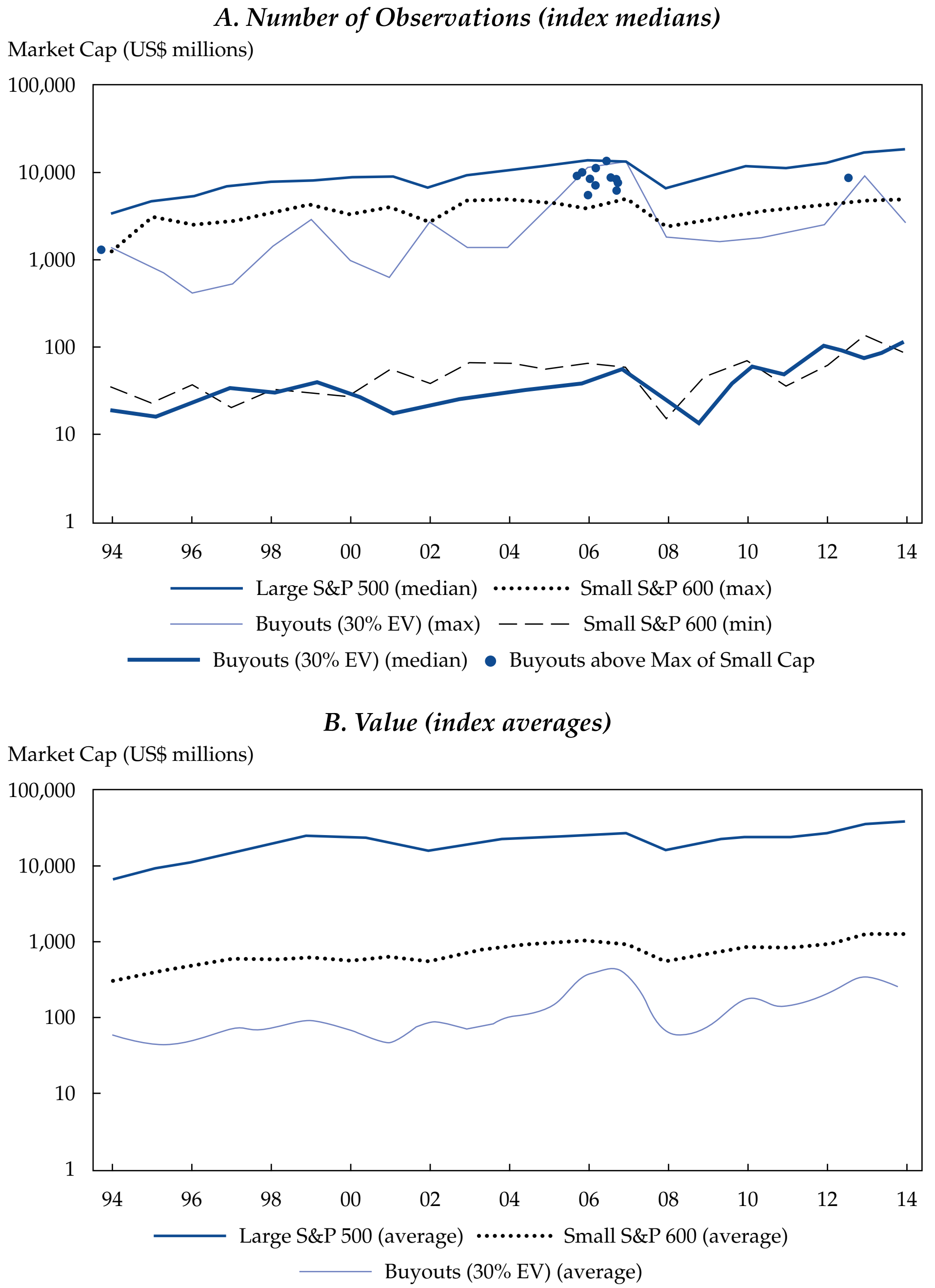
Leverage. Axelson, Jenkinson, Strömberg, and Weisbach (2013) and Acharya, Gottschalg, Hahn, and Kehoe (2013) observed an average debt-to-enterprise value of around 70% at the buyout transaction's inception. In comparison, the same ratio is approximately 35% for comparable publicly listed companies. Acharya et al. (2013) documented an average debt-to-enterprise value of 44% at exit, a level consistent with the results of Cao and Lerner (2009) for reverse leveraged buyouts (LBOs); they found that the leverage remained elevated after the public offering (47% for reverse LBOs versus 28% for non-buyout-backed IPOs).

We corroborated that at inception, buyout transactions have consistently been levered at higher levels than their public counterparts, independent of industry and time period. The average net debt to enterprise value (ND/EV) at inception has been approximately 65% (see **Figure 3**).

Leverage at exit is more difficult to estimate. According to the Preqin "2015 Global Private Equity and Venture Capital Report," trade sales (private-to-strategic transactions), in terms of number of observations, represent the favored exit route, followed by sale to GPs (private-to-private or secondary transactions) and buyout-backed IPOs (private-to-public transactions). However, buyout-backed IPOs represent slightly more than one-third of the value over the last 14 years (PitchBook 2014). The average ND/EV of the IPO exits is approximately 45%, similar to the ratio reported by Cao and Lerner (2009). In the absence of a better estimate, we assumed a 45% ND/EV at exit for all buyout transactions. Assuming a linear interpolation[9] between average leverage at inception (65%) and average leverage at exit (45%), we estimated the average leverage over the life of the buyout investment to be approximately 55%.

Figure 4 shows the evolution of the leverage ratio of buyout transactions at inception, as well as the average leverage of the public size- and sector-adjusted index, whose leverage is consistently lower than that of buyouts. We also report the average cost of debt for buyout transactions (S&P/LSTA US Leveraged Loan Index yield) and their public counterparts (Barclays US Corporate Investment Grade Index yield). To

Figure 1. Size Distributions of Buyout Companies and Publicly Listed Companies, 1994–2014



Notes: For public equity, size is measured as the Ln (natural logarithm) of market cap. For buyouts, size is measured as the Ln of estimated equity. In Panel A, Large S&P 500 (median) represents the median market cap of constituents of the S&P 500. Small S&P 600 (max) and Small S&P 600 (min) represent the maximum and minimum market caps of the small-cap companies. Buyouts (30% EV) (max) and Buyouts (30% EV) (median) represent the maximum and median estimated equity of buyouts. Buyouts above the maximum of the small-cap companies (blue dots) represent the estimated equity of the mega-buyouts. In Panel B, Large S&P 500 (average) and Small S&P 600 (average) represent the average market caps of the constituents of the S&P 500 and S&P 600, respectively. Buyouts (30% EV) (average) represent the average estimated equity of buyouts, assuming a typical *pro forma* equity contribution of 30%.

Table 1. Size Distributions of Buyout Target Companies and S&P 600 Companies, 1994–2014

	Distribution of the No. of Companies		Distribution of the Value of Companies	
Size Group	Buyouts	S&P 600 (small cap)	Buyouts	S&P 600 (small cap)
Large cap	0.03%	—	1%	—
Mid cap	0.26	—	6	—
Small cap, top half	2	50%	26	76%
Small cap, bottom half	97	50	67	24
Small cap, bottom 10%	90	10	40	2

Note: Buyout sizes are measured as 30% EV.

generate the levered size- and sector-adjusted return time series, we first estimated the unlevered return time series and then re-levered the return with the appropriate leverage and cost of the debt.[10]

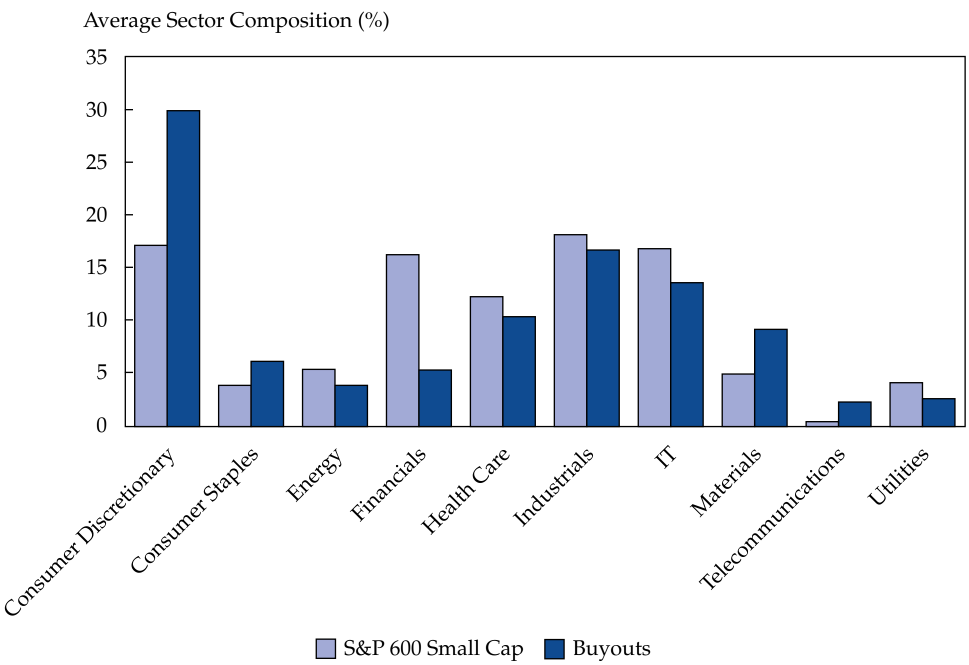
Other Factors. Because buyout fund portfolio companies are expected to have large free cash flows (Jensen 1986), we also examined whether they are more *value* in nature. We concluded that the underlying companies of buyout funds are approximately value neutral.[11] Therefore, we made no adjustment for value in the benchmark. Liquidity could have been another candidate: Franzoni, Nowak, and Phalippou (2012) and Ang, Chen, Goetzmann, and Phalippou (2013) all found a significantly positive loading on the Pástor and Stambaugh (2003) liquidity risk factor. We did not address this issue because liquidity in this framework is not an easily available stock characteristic compared with size, sector, leverage, and value. Rather, it is defined as the sensitivity (covariance) to an aggregate level of market liquidity.[12]

Risk-Adjusted Performance

In this section, we describe the private equity data, construct risk-adjusted public benchmarks to replicate the opportunity cost of buyout funds, and compare our PME results with those of Higson and Stucke (2012), Robinson and Sensoy (2013), HJK (2014), and Phalippou (2014).

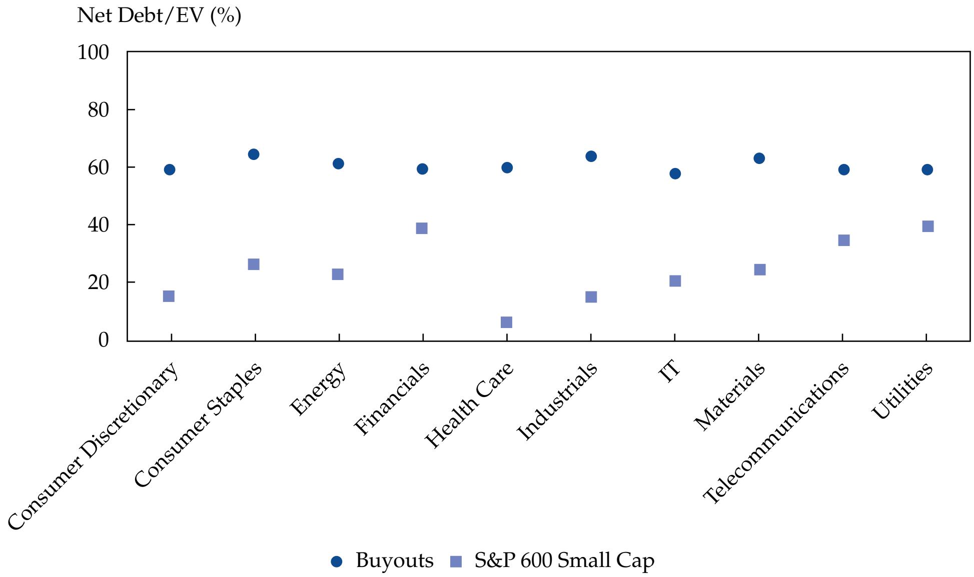
HJK (2014) explained the Burgiss data in detail.[13] The HJK sample comprised 598 buyout funds formed between 1984 and 2008. Our sample comprised 752

Figure 2. Average Sector Compositions of Buyout Companies and S&P 600 Companies, 1994–2014



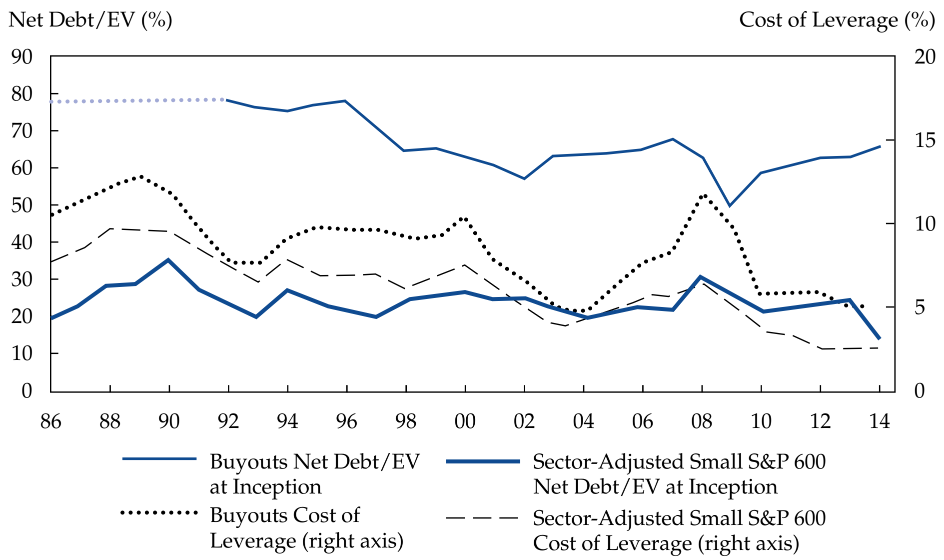
Sources: Capital IQ (average sector composition of buyout investments for 1994–2014); Worldscope (average sector composition of the S&P 600 for 1994–2014).

Figure 3. Average Leverage by Sector in the Buyout Industry and in Small-Cap Public Equities, 1997–2014



Notes: We obtained data on the leverage of US buyout investments at inception from LCD. Because LCD does not provide leverage information on buyouts according to the Global Industry Classification Standard (GICS), we mapped the LCD classification onto GICS. We measured the S&P 600 leverage as net debt to ensure comparability with buyout investments.

Figure 4. Leverage and Cost of Leverage for Buyout Companies and Sector-Adjusted S&P 600 Companies, 1986–2013



Notes: Using data from LCD, we measured the ND/EV of buyout investments at inception. LCD does not provide pre-1992 leverage data; we backfilled the data to 1986, assuming that the leverage was the same then as in 1992 (dotted line). For the sector-adjusted S&P 600, we measured ND/EV from Worldscope data. We proxied the cost of leverage for buyout investments by the yield of the S&P/LSTA US Leveraged Loan Index, obtained from LCD starting in 1999. For 1992–1999, we used the yield of the US Credit Suisse Leveraged Loan Index. For 1986–1992, we used as a proxy Barclays BB/B Bond Index minus the average credit spread to the S&P/LSTA US Leveraged Loan Index over 1999–2012. The cost of leverage for public equity is proxied by the yield of the Barclays US Corporate Investment Grade Index.

funds formed between 1986 and 2008. We used aggregate cash flows from Burgiss by vintage, not by fund level, as did HJK (2014). For each vintage, **Table 2** presents the total amount of inflation-adjusted invested capital, the number of funds, the vintage life in years (11 years, on average), and the vintage duration in years (average duration of 4.5 years).[14] The last column in Table 2 reports the value of the residual NAV for each vintage; though minimal for the first vintages, it is significant for the later vintages.

S&P 500–Adjusted Performance. To facilitate the comparison with Higson and Stucke (2012, Table VI), Robinson and Sensoy (2013, Table 2), and HJK (2014, Table III), we present in **Table 3** the PMEs for each US buyout vintage from 1986 to 2008, as well as the EW and VW PMEs, the pooled PMEs, and the implied annualized excess performance. Our EW PME of 1.22 is equal to that of HJK (their EW PME was 1.22 when equally weighted across vintages and over time and 1.27 when value weighted by commitments in each vintage and equally weighted across vintages).[15] Robinson and Sensoy (2013) obtained similar results—an average PME of 1.18 for liquidated funds. Using a representative dataset covering 1980–2008 and about 85% of capital invested in US buyout funds, Higson and Stucke (2012) found a similar PME of 1.22 for aggregated cash flows. Our VW PME and pooled PME are slightly lower, at 1.17 and 1.16, respectively. Higson and Stucke (2012) reported a cap-weighted PME of 1.23.

Table 2. Summary Statistics for US Buyout Funds by Vintage Year

Vintage	Invested Capital ($ billions; inflation adjusted)	No. of Funds	Vintage Life (years)	Vintage Duration (years)	Residual NAV (% of invested capital)
1986	3.1	7	14.8	6.1	0
1987	9.7	10	17.0	4.3	0
1988	3.9	11	15.0	4.2	0
1989	4.2	10	18.7	4.5	0
1990	0.6	4	16.4	4.2	0
1991	1.6	6	19.0	3.9	0
1992	3.2	11	12.8	3.3	0
1993	3.8	10	17.2	3.9	0
1994	8.4	22	15.5	4.3	0
1995	12.1	26	15.0	4.3	0
1996	5.2	20	15.3	4.5	5
1997	19.5	34	15.5	4.9	0
1998	30.9	52	14.9	4.5	2
1999	22.9	39	14.6	4.4	3
2000	43.9	63	14.2	3.8	7
2001	17.5	31	13.8	3.9	14
2002	8.9	23	12.6	4.0	16
2003	12.5	20	11.7	4.0	29
2004	23.9	52	10.6	4.2	29
2005	40.2	71	9.7	4.7	35
2006	68.9	79	8.7	4.6	55
2007	77.5	89	7.7	3.7	65
2008	50.0	62	6.7	3.2	62
2009	8.7	21	5.9	3.3	83
2010	18.4	34	4.7	3.4	96
2011	22.0	43	3.7	3.1	100
2012	33.2	56	2.8	2.4	85
2013	34.5	49	1.7	2.1	94
2014	44.2	74	0.7	0.9	92
Total, 1986–2008	472.3	752			
Total, 1986–2014	633.3	906			
EW average, 1986–2008			15.6	4.5	14
VW average, 1986–2008			11.2	4.5	32

Source: Burgiss (July 2015).

Table 3. Buyout Funds' PMEs and Implied Annualized Excess Returns with Alternative Public Market Indexes

	Unadjusted S&P 500		Size-Adjusted S&P 600		Levered Size- and Leverage-Adjusted S&P 600		Levered Size-, Sector-, and Leverage-Adjusted S&P 600 with Buyout Sector Weights	
Vintage	PME	Excess Return	PME	Excess Return	PME	Excess Return	PME	Excess Return
1986	1.33	4.8%	1.47	6.3%	1.28	4.5%	1.41	5.8%
1987	0.90	–2.4	0.91	–2.2	0.81	–5.4	0.87	–3.2
1988	1.04	0.9	1.03	0.6	0.90	–2.4	0.94	–1.5
1989	1.31	6.3	1.35	6.6	1.20	4.1	1.27	5.2
1990	1.14	3.2	1.16	3.7	1.05	1.2	1.11	2.6
1991	1.47	10.4	1.63	12.9	1.48	10.6	1.61	12.4
1992	1.09	2.5	1.23	6.4	1.06	1.7	1.23	6.4
1993	1.04	1.0	1.16	4.2	1.04	1.0	1.15	4.0
1994	1.46	9.1	1.59	13.5	1.45	10.7	1.63	14.4
1995	1.23	4.9	1.18	4.7	1.12	3.3	1.21	5.5
1996	1.03	0.7	0.93	–1.9	0.91	–2.9	0.96	–1.3
1997	1.32	5.8	0.96	–0.9	0.89	–2.7	0.92	–1.9
1998	1.21	4.3	0.80	–5.0	0.73	–7.0	0.74	–6.8
1999	1.23	4.8	0.87	–3.1	0.79	–5.2	0.79	–5.1
2000	1.37	8.7	1.14	3.4	1.05	1.2	1.04	1.1
2001	1.45	9.9	1.27	6.4	1.18	4.5	1.18	4.5
2002	1.44	9.6	1.31	7.0	1.24	5.4	1.23	5.3
2003	1.54	11.5	1.42	9.4	1.37	8.5	1.35	8.3
2004	1.34	7.2	1.26	5.8	1.25	5.9	1.22	5.3
2005	1.22	4.4	1.13	2.6	1.14	2.9	1.07	1.6
2006	1.01	0.3	0.93	–1.4	0.88	–2.5	0.84	–3.5
2007	0.99	–0.2	0.93	–1.4	0.83	–3.6	0.80	–4.3
2008	0.99	–0.2	0.95	–0.9	0.84	–3.4	0.82	–3.9
EW average, 1986–2008	1.22*	4.66*	1.16*	3.34*	1.08	1.51	1.10	2.10
VW average, 1986–2008	1.17*	3.51*	1.04	0.82	0.97	–0.86	0.96	–1.35
Pooled universe, 1986–2008	1.16	3.32	1.06	1.21	0.98	–0.38	0.98	–0.42

Notes: US leveraged buyout fund performance is based on Burgiss cash flow data and is net of fees. The value-weighted average is based on the inflation-adjusted amount of invested capital in each vintage. The test of the null hypothesis for the value-weighted PME is based on the standard error of PMEs over time (value weighted); for the pooled universe PME, we provide only a scalar.

*Significant at the 5% level.

Size-Adjusted Performance. Our EW PME decreases slightly, from 1.22 to 1.16. This result is in line with HJK (2014), who reported a very small decrease in EW PMEs for the Fama–French size deciles 4 and 2—similar in size to the companies that most buyout funds invest in. However, their sample average EW PME decreased more significantly, from 1.20 to 1.09. Robinson and Sensoy (2013) reported a similar decrease—from 1.18 to 1.10—using the Fama–French size tercile index whether the fund was self-described as a small-cap, mid-cap, or large-cap buyout fund. Phalippou (2014, p. 191) found that "the average buyout fund return is similar to that of (similar sized) listed equity."

The average PME drops materially when using a VW scheme instead of an EW scheme. Our VW PME goes from 1.16 to 1.04, and the implied annualized excess return decreases by 75%—from 3.34% to 0.82%. The PME and excess return are not significantly different from 1 and 0, respectively. We observed the same pattern for the pooled universe PME. This result is consistent with Higson and Stucke (2012), who used the S&P 600 as a public proxy for size and showed that for liquidated funds (1980–2000), the average excess internal rate of return (IRR) went from 4.5% to 1.25% (–72%), whereas for the full sample, the excess IRR went from 5.44% to 1.84% (–66%).

Size- and Leverage-Adjusted Performance. With the leverage-adjusted S&P 600 as a benchmark, both the EW and the VW PMEs are not significantly different from 1. The EW PME ratio goes from 1.16 to 1.08; the VW PME ratio decreases, from 1.04 to 0.97. The results for the pooled universe PME are similar (a decrease, from 1.06 to 0.98).[16] Size and leverage are the key systematic risks to control for when comparing buyout fund returns and public market returns. Assuming that an institutional investor could have invested equally in each vintage over 1986–2008, it would have outperformed a size- and leverage-adjusted public benchmark by 1.51% a year (not significant). This outperformance, however, is not representative of the typical investor in the US buyout fund market, whose commitment schedule and capital calls are sensitive to business cycles and market conditions (see Robinson and Sensoy 2013). VW or pooled PMEs better capture the performance of the buyout fund market relative to public equity markets. Using these more relevant performance metrics, we found no evidence of significant risk-adjusted outperformance of the US buyout market over 1986–2008.

Size-, Leverage-, and Sector-Adjusted Performance. Adjusting the leverage-adjusted S&P 600 for sector has no material impact on PMEs. Our EW PME increases slightly, from 1.08 to 1.10. The VW PME with the levered size- and sector-adjusted index as a benchmark goes from 0.97 to 0.96.

Sensitivity Analysis. To assess the robustness of our results, we examined their sensitivity to the residual NAVs and the poor coverage of the Burgiss dataset for the first vintages. The VW PME is 1.00 (0.95) when residual NAVs[17] are 20% higher (lower) and is not significant in either case. When the vintage weights are scaled up by the additional funds reported in Higson and Stucke (2012), the VW PME of 0.97 is not significantly different from 1.[18]

Because our data contained cash flows until Q1 2015 and we selected the 2008 vintage as the last vintage for which to calculate performance (similar to HJK 2014), we expected less of the J-curve effect to be present in our data compared with HJK (2014). One could expect higher PMEs for these vintages (2005–2008) because they have had more time to realize the returns of their initial investments and outperform the public market. However, we found no evidence of higher PMEs with our refreshed data, reinforcing our view that US buyout funds have not outperformed their risk-adjusted benchmark.

Table 4 includes additional vintages (2009–2014). It shows that the more recent vintages have PME ratios mostly below 1.00 and that the PMEs for the full sample period (1986–2014) are, as expected, consistently lower than those for the main sample period (1986–2008). **Figure 5** illustrates the VW and EW PMEs by vintage over 1986–2014, with both unadjusted and risk-adjusted benchmarks as well as the invested capital.

We believe that the cause of VW PME underperformance relative to EW PME is largely driven by increasing market efficiency. Segmenting our data into two time periods, we can see that the size of the buyout fund market has increased almost sixfold in the second half of the data compared with the first half.

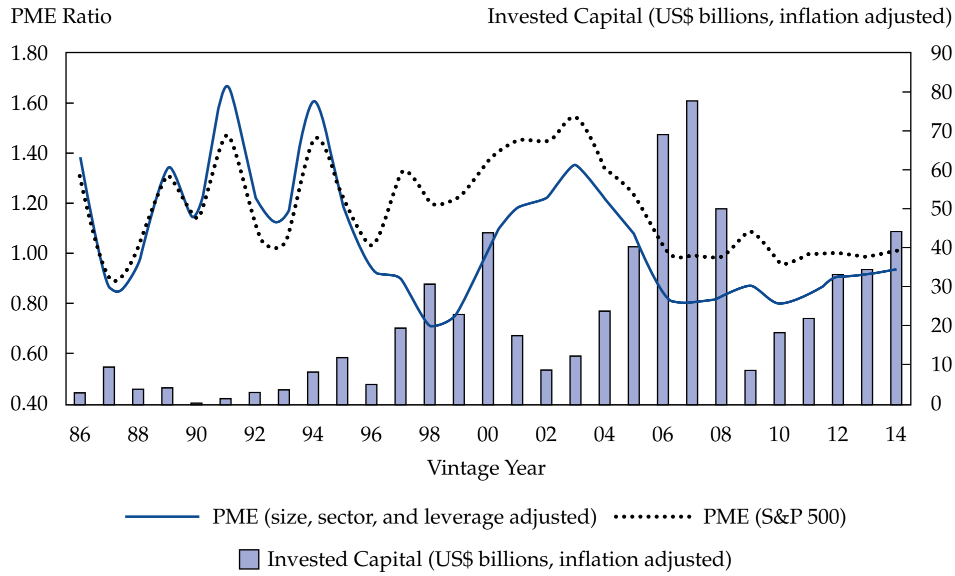
Table 4. Sensitivity of Buyout Funds' PMEs and Implied Annualized Excess Returns to Inclusion of Recent Vintage Years

	Unadjusted S&P 500		Size-Adjusted S&P 600		Levered Size- and Leverage-Adjusted S&P 600		Levered Size-, Sector-, and Leverage-Adjusted S&P 600 with Buyout Sector Weights	
Vintage	PME	Excess Return	PME	Excess Return	PME	Excess Return	PME	Excess Return
2009	1.08	1.8%	1.05	1.0%	0.90	–2.4%	0.87	–3.0%
2010	0.96	–0.8	0.95	–1.2	0.83	–4.1	0.80	–4.8
2011	0.99	–0.1	0.98	–0.4	0.86	–3.2	0.84	–3.9
2012	1.00	0.1	0.99	–0.1	0.92	–1.9	0.90	–2.2
2013	0.98	–0.3	0.98	–0.4	0.93	–1.6	0.92	–1.9
2014	1.00	0.0	0.98	–0.4	0.94	–1.3	0.93	–1.5
EW average, 1986–2014	1.18**	3.72**	1.12	2.59	1.04	0.77	1.06	1.16
VW average, 1986–2014	1.12	2.62	1.03	0.59	0.96	–0.97	0.94	–1.38
Pooled universe, 1986–2014	1.14	3.00	1.05	1.09	0.97	–0.73	0.98	–0.31

Note: See notes to Tables 1 and 3.

**Significant at the 5% level.

Figure 5. PMEs by Vintage and Invested Capital, 1986–2014



The growth in both the number of buyout funds and the average fund size has made the buyout fund market more competitive. We believe that the increasing amount of capital available for buyout funds is outpacing the increasing number of investment opportunities and is thus driving the difference between the VW and EW PMEs across our study period.

Conclusion

After adjusting for appropriate risks, we found no outperformance of buyout funds vis-à-vis their public market equivalents on a dollar-weighted basis. Using cash flows from the Burgiss dataset, we started by examining the risk-adjusted performance of US buyout funds over 1986–2014. Consistent with HJK (2014), we found that buyout funds have historically outperformed the S&P 500: The average EW PME across vintages is 1.22. Following Phalippou (2014), we documented the systematic risks of underlying companies in buyout funds to determine an appropriate risk-adjusted benchmark. Using a bottom-up approach, we found that target companies of buyout funds are small cap and have significantly more leverage than their public counterparts and a different sector composition than the broad public indexes. We then constructed a levered size- and sector-adjusted benchmark to better reflect the return and risk dynamics of buyout funds. From a practitioner's perspective, the resulting benchmark could be used as a starting point to represent the return and risk inputs (volatility and correlation) in a strategic asset allocation process. Once we appropriately controlled for these risk characteristics, the outperformance of US buyout funds was reduced by more than half—with the EW PME going from 1.22 to 1.10. However, we argue that a VW PME across vintages is a more appropriate performance metric than the EW PME because it more accurately reflects the aggregate return experience of investors in the buyout fund market. The VW PME is not significantly different from 1.

Despite these findings, we believe that buyout funds serve a valuable role in an institutional investor's portfolio. First, they provide small-cap equity exposure (Phalippou 2014) and broaden the opportunity set available to public equity investors—an important portfolio addition, especially where small-cap equity markets are thinner, as is the case outside the United States. Second, the ability to select outperforming managers is valuable. Owing to higher cross-sectional dispersion of returns in buyout funds relative to public equities, buyout funds present a more attractive opportunity for exercising manager selection compared with public equities. Third, our findings concerning EW PMEs and VW PMEs indicate that institutional investors would benefit from investing equal amounts per vintage year. Although investors should aim for time diversification, this goal is challenging. It requires strict investor discipline throughout market cycles and a flexible asset allocation model. Finally, buyout funds also grant access to direct private investments. Large institutional investors make direct investments, which—with appropriate security selection, portfolio construction, and fee/carry structuring—lead to higher overall private equity returns.

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Notes

1. See Preqin Ltd. (2015); in its "2015 Global Private Equity and Venture Capital Report," Preqin documented private equity assets under management by fund type as of June 2014, with buyout funds accounting for US$1 trillion.
2. The results from Harris, Jenkinson, and Kaplan (2014) are reported on the Private Equity Growth Capital Council (PEGCC) website: http://www.pegcc.org/newsroom/newsletters/academics-and-private-equity-professionals-discuss-private-equity-performance/reports.
3. HJK (2014) obtained similar results with (1) four other commonly used benchmarks: the NASDAQ, Russell 3000, (small-cap) Russell 2000, and (small-cap value) Russell 2000 Value indexes—lower public market equivalents (PMEs) for the last two indexes; (2) four Fama–French size deciles—lower PMEs for smaller-size deciles, similar in size to the companies in which most buyout funds invest; and (3) multiples of the S&P 500 Index to approximate the effect of betas of 1.5 and 2.0. The results based on the Burgiss dataset are also qualitatively similar when using Cambridge Associates and Preqin datasets.
4. See Barber and Wang (2013); Ewens, Jones, and Rhodes-Kropf (2013); Fan, Fleming, and Warren (2013); Pedersen, Page, and He (2014).
5. Ang, Chen, Goetzmann, and Phalippou (2013) used a net present value (NPV) framework in which the NPV equation for all limited partner cash flows is assumed to be zero in expected value both over time and across funds. The estimation procedure can be interpreted as finding the set of discount rates that produce the smallest errors in the fund-level NPV equations. This approach is highly parameterized. See also Driessen, Lin, and Phalippou (2012) and Franzoni, Nowak, and Phalippou (2012).
6. Higson and Stucke (2012) used a cap-weighted average whereby vintage weights are based on invested capital or the number of funds.
7. Kaplan and Schoar (2005) introduced this metric under the intuition that it is valid when the beta is equal to 1. Sorensen and Jagannathan (2015, p. 48) outlined conditions under which the PME measure does not require a beta of 1, showing that "the PME is calculated without explicitly relying on the risk of the investment (such as its beta), and the PME is valid regardless of this risk. It does not require different treatments of cash flows associated with capital calls and distributions, despite their different properties." Korteweg and Nagel (forthcoming 2016) also proposed a generalized PME approach, one based on stochastic discount factors and a generalized method of moments.
8. We retained this metric because it reflects the equity investments in buyout target companies. The sum of these equity investments represents the size of the buyout market publicized by different data providers. Other authors have used enterprise value to measure the size of buyout target companies and compare it with the enterprise value (net of cash) of public companies. Although that is a measure of the size, it does not correspond to the exposure of private equity investors.
9. A linear interpolation between the entry and exit leverage levels would overstate the amount of principal paid on the debt each year, resulting in understated average leverage. Thus, we also estimated the average leverage of a portfolio of buyouts over the life of the buyouts, using a debt amortization schedule of the average buyout. Using this method, which mimics a truer debt paydown schedule and more closely mirrors average leverage, we found that the capital-weighted average ND/EV of a portfolio of buyouts is 60% over the life of the buyouts. This higher (by 5 pps) level of leverage relative to the simple average leverage of 55% results in very little impact on our performance results.
10. We first calculated the unlevered return time series: $k_{U,t} = \left(k_{L,t}^{SSA} + k_{D,t}^{SSA} \times L_t^{SSA} \times \pi\right) / \left(1 + L_t^{SSA} \times \pi\right)$, where $k_{L,t}^{SSA}$ is the levered return at time t of the size- and sector-adjusted index (SSA), $k_{D,t}^{SSA}$ is the return on investment-grade credit at time t, L_t^{SSA} is the net-debt-to-equity ratio of public counterparts, and $\pi = 1 -$ taxes, where taxes are assumed to be 30%. We then calculated the buyout return: $k_t^{BO} = k_{U,t} + \left(k_{U,t} - k_{D,t}^{BO}\right) \times L_t^{BO} \times \pi$, where $k_{D,t}^{BO}$ is the loan index return at time t and L_t^{BO} is the net-debt-to-equity ratio in buyout transactions, assumed to be 55% over the life of the buyouts. We used a return approach rather than a cost-of-debt (yield) approach to account for the positive correlation between loans and equity. Therefore, the buyout beta is equal to $\beta^{BO} = \beta_U\left(1 + L^{BO} \times \pi\right) - \beta_D^{BO} \times L^{BO} \times \pi$ and is lower than the first term because the beta of loan relative to equity $\left(\beta_D^{BO}\right)$ is positive (around 0.3). Details about data sources are provided in Figure 4.
11. It is more difficult to determine measures of value for portfolio companies. We used two different samples. First, we analyzed public-to-private transactions whose price-to-book-equity ratio (P/B) was available (12% of the deals and 22% of the capital deployed) and found that the average P/B 90 days before the announcement was 2.1×. In comparison, the average P/B of the size- and sector-adjusted comparable public counterparts was 2.6×. Second, we examined both public-to-private and private-to-private transactions whose EV/EBITDA was available (24% of the deals and 72% of the capital deployed) and found that the average EV/EBITDA was 11.8× versus 12.9× for the risk-adjusted benchmark. Concluding that the public-to-private and private-to-private transactions we examined were value neutral, we did not adjust the benchmark for any value tilt. In contrast, using the "implied equity value to book value" of 537 observations at transaction announcement, Phalippou (2014) concluded that portfolio companies are value companies.
12. In addition to liquidity risk, a commitment risk (see HJK 2014) is associated with the uncertainty of cash flows and deviations from target allocations. Ang, Papanikolaou, and Westerfield (2014) showed that the compensation for bearing illiquidity risk or for the inability to rebalance can be substantial. Sorensen, Wang, and Yang (2014) proposed an asset allocation model for a typical institutional investor. The model captures the main institutional features of private equity—notably, the difficulty of rebalancing and the resulting liquidity risks. They showed that institutional investors may need breakeven PMEs significantly higher than 1.
13. The Burgiss dataset is sourced exclusively from a wide array of 200 LPs (limited partners) and is representative of the buyout industry, covering US$1 trillion. Data used for reporting and performance measurement are checked across investors in the same fund. The coverage is excellent from 2000 on but less so before. Higson and Stucke (2012) had a much wider coverage (1980–2000).
14. A typical buyout fund calls capital over multiple years. We calculated the net duration of the buyout fund vintages as the Macaulay duration of the distributions minus the Macaulay duration of the contributions. We used the duration of buyout fund vintages to calculate an annualized return from the PME ratio. The implied annualized excess performance is $\mathrm{PME}^{1/d} - 1$, where d is the weighted average vintage duration. For more recent vintages (2009–2014), we used the average duration of 4.5 (years) to infer annualized excess returns.
15. We began our coverage in 1986, not in 1984 as HJK (2014) did. Their sample had 154 fewer funds than ours, a relatively slight difference.
16. Although not shown in Table 3, we also tested PMEs using leverage-adjusted S&P 500 returns and found that both the value-weighted and the equally weighted PMEs are

significantly higher than 1.00, in line with the results of HJK (2014). Although the 1.5 multiple of the S&P 500 used by HJK had no material impact on their sample average PME ratio, their equally weighted average PME across vintages went from 1.22 to 1.08 (still significantly higher than 1). This result is also consistent with Robinson and Sensoy (2013), who used a levered PME to show that beta increases from 1 on have diminishing effects on levered PME. They demonstrated that the relationship between PME and beta is convex. Most of the effect occurs between 0 and 1. From 1 to 1.5, the impact is marginal. After 1.5, the impact is almost null.

17. In our analysis, we assumed that the residual NAVs are representative of fair market values (reinforced by FASB Statement No. 157, effective as of the end of 2007). We observed two different types of residual NAVs: (1) the "living dead investments NAVs" (see Phalippou and Gottschalg 2009), which occur late in vintages (12+ years) and are likely to be overstated, and (2) the "J-curve NAVs," which occur early in vintages, may not reflect the upside realized in the underlying portfolio, and are likely to be understated.
18. Some may argue that the coverage of the first vintages is lower than that of the most recent vintages. We analyzed the robustness of our results by scaling up the committed/invested capital by a factor that we defined as the ratio of the number of funds in the most comprehensive database (Higson and Stucke 2012, Table III) to the number of funds in the Burgiss dataset. For the sake of brevity, these results are not reported here but are available from the authors upon request.

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