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PAAMCO

Perspectives

Assessing Risk of Private Equity—What's the Proxy?

by Alexandra Coupe, Associate Director

Asset allocation is perhaps the most important choice facing CIOs. It involves evaluating the risk/return profile of various asset classes and is usually based on a combination of forward-looking expected returns and risk measures derived from historical data. In this context, the traditional modeling of private equity is subject to significant drawbacks. Available index data for private equity is lagged, smoothed, and understated with respect to the beta, volatility, and correlation with public equities. These drawbacks can have a significant impact on portfolio allocation decisions when a large share of a portfolio is allocated to private equity. The purpose of this paper is to evaluate alternative methods to proxy private equity investments in the context of portfolio allocation. This assessment draws on PAAMCO's experience in managing hedge fund portfolios, which may contain private equity positions.

This paper begins with an overview of private equity with an emphasis on buyout funds. The second section analyzes some of the issues with assessing risk in private equity investments. The third section reviews possible solutions for private equity risk assessment.

I. Overview of Private Equity

Traditional modeling of private equity is subject to significant drawbacks.

As the name suggests, private equity is equity in a company that is privately held and not listed. Therefore public pricing data is not available. Just as the success of hedge funds relies on managers' ability to select individual securities, private equity is a highly heterogeneous asset class in which success is driven by the ability of the managers to pick individual companies. Also similar to hedge funds, private equity funds are structured with a General Partner (GP), who is the private equity fund manager that makes the investment and operating decisions, and Limited Partners (LP), the passive investors in the fund who make no operating or investment decisions. Private equity funds have a fee structure similar to hedge funds as well, with a typical 2% management fee and 20% performance fee (also called the carried interest), usually over a hurdle (or the "preferred return" or "pref"), that is captured at the end of the investment.

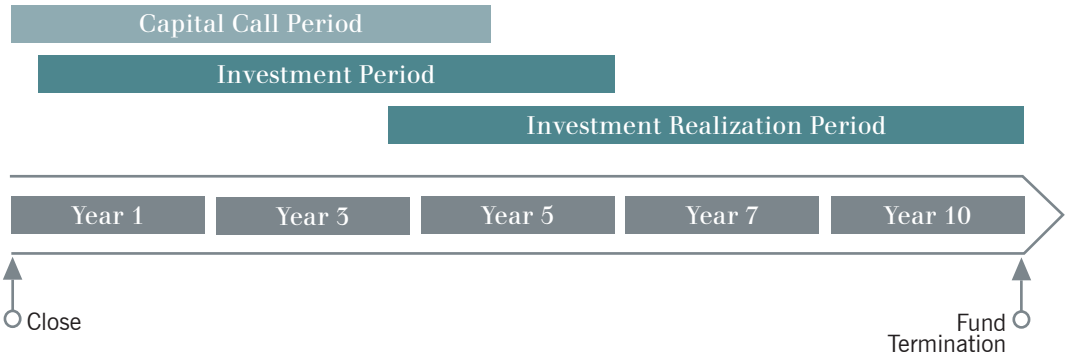
Private equity is a highly heterogeneous asset class in which success is driven by the ability of the managers to pick individual companies.

Although private equity funds and hedge funds are nominally similar in structure and fees, they are very different in terms of liquidity. Private equity funds have a predetermined life span that lasts about ten years, while hedge funds have an indeterminate life span that allows for monthly or quarterly subscriptions and withdrawals. When an LP makes a commitment to invest in a private equity fund, the commitment generally lasts for the entire life of the fund. There are secondary markets to sell LP stakes in private equity funds, but these markets are small and used infrequently.

In addition, while the investment time commitment in a private equity fund is ten years, there are varying periods of cash flows in and out of the fund, and the timing of those cash flows impacts performance (Gottschalg 2013).

When LPs sign documents committing to investment in a private equity fund, they rarely invest capital upfront. The private equity fund assembles all the commitments of capital and then closes for new investments. There can be more than one "close" if there is capacity remaining after the first close. After the fund is closed, the private equity fund will begin to "call" capital for investment. A "capital call" is a notice from the fund, or its GP, to the LPs that it is time to wire money. Once the capital flows in, the GP begins to invest the proceeds; this period of time is called the "investment period." The capital call period and investment period can overlap, and both can last for several years. It is not uncommon to expect capital call periods to last for the first three years of the life of the fund while the investment period can last for five to seven years. In the later life of the fund (i.e., years five to ten), the investments are monetized and cash is distributed back to the LPs (see Exhibit 1). This period is called the "investment realization period." Once all investments have been sold, IPO'd, or written off, the partnership agreement is terminated.

Exhibit 1
Illustration of Private Equity Funding Timeline



Source: PAAMCO

Although there are many flavors of private equity including venture capital, seed investments, angel investing, and acceleration capital, this paper focuses on the largest subcategory—buyouts. Buyouts are relevant for PAAMCO's client base given that our clients and prospects typically make large single allocations, which match the large disbursements of buyout funds. Venture capital funds tend to be smaller, requiring more relationships to meet the capacity needs of large institutions.

Generally, a single private equity fund completes the company acquisition. As can be seen in Exhibit 2 on the next page, the average size of deals is large, over $1 billion.

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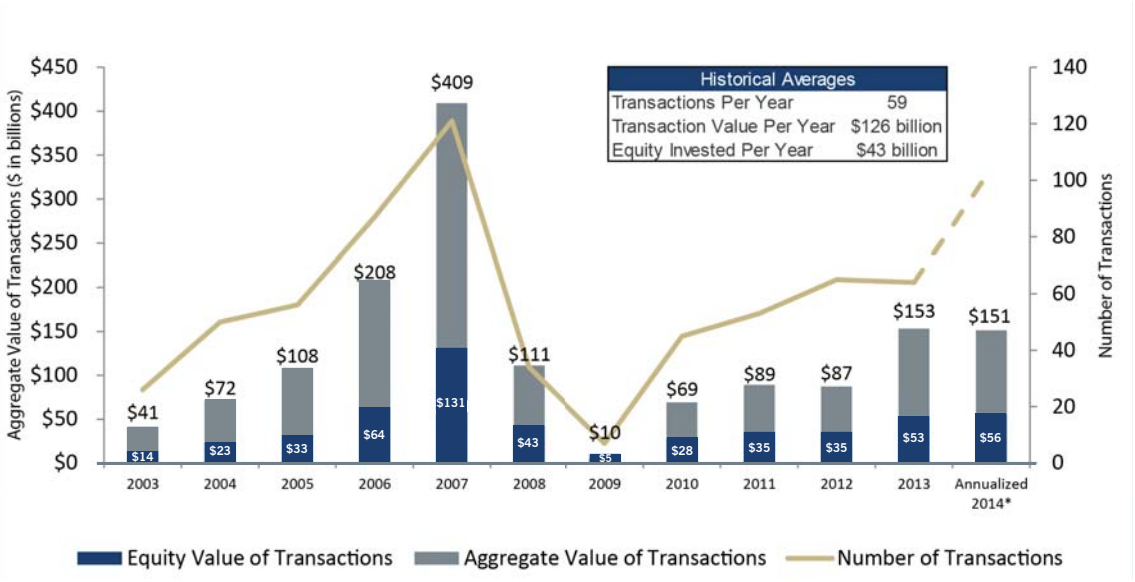
Exhibit 2
Leveraged Buyout (LBO) Activity



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014*
Transactions	26	50	56	87	121	34	7	45	53	65	64	104
Average TEV/Deal: (in billions)	$1.6	$1.4	$1.9	$2.4	$3.4	$3.3	$1.4	$1.5	$1.7	$1.3	$2.4**	$1.5

**Q1 2014 Annualized*
***Excluding Heinz and Dell: $1.6*
Source: S&P Capital IQ Leveraged Buyout Review, as of March 31, 2014. Represents U.S. LBOs with transaction sizes of $500 million or greater.

Private equity sponsors aim to create value in buyout funds in three different ways, or combinations thereof: 1) Improvement of operations; 2) Financial restructuring; and 3) Multiple expansion.

Private equity sponsors aim to create value in buyout funds in three different ways, or combinations thereof:

1. Improvement of operations: Better management, cost cutting, improved synergies and even additional accretive acquisitions can improve the underlying company's cash flow profile. Leverage in the company decreases as the value of the assets increases as a result of the better cash flow.
2. Financial restructuring: This involves selling off assets (hopefully at attractive valuations) to pay down debt or provide distributions to the LPs. This is generally a riskier strategy as leverage can be substantial, requiring meaningful sales of assets at attractive valuations.
3. Multiple expansion: In times of market dislocation, private equity funds aim to pick up cheap companies trading at low valuations and sell them later as multiples increase. The long time horizon for a fund combined with looser valuation requirements for private equity relieves the GP and the underlying company from much of the mark-to-market volatility of public counterparts.

These characteristics and strategies of buyout funds have implications for assessing their risk profile. First, the underlying companies tend to have a lower beta to the S&P 500, but the use of leverage elevates both the beta and the volatility profile. Second, leverage should generally, but not always, decrease over time. As a result, we would generally expect the volatility profile of a buyout private equity position to be highest in the initial stages, but then decrease over time. However, this expected volatility profile is counter to what is seen in most data series.[1] Third, at a fund level, diversification should provide some benefit as the median buyout fund holds 12 investments (Metrick and Yasuda 2010), so the expected volatility should be somewhere between that of an individual equity and a diversified index. Lastly, the impact of fees on volatility is meaningful and provides a volatility (and beta) dampening impact. Axelson, Sorensen, and Stromberg (2014) find that when constructing private equity IRRs from underlying deal-level data, beta estimates decline from 1.8 gross of fees to 1.3 net of management fees and carried interest. "It appears that subtracting the GP's management fees and carried interest reduces the estimated beta by around 0.5."

Venture capital (VC) funds comprise the other largest sector of the private equity industry. VC invests in early-stage companies, typically within the technology or healthcare sectors. At the earliest stages, VC-targeted companies may not even have revenues, so there is rarely any debt or leverage. Funding is provided with a one-to-two year horizon to see if the company can survive, and the failure rate is substantial with about half of VC investments in start-up companies failing (Woodward 2004). VC funds tend to be smaller with an average size of about $300 million (Exhibit 3). As such, private equity portfolios of large institutional investors are more likely to be slanted towards buyout funds. Therefore, VC funds should have a risk assessment that is different and reflects the industry bias and high failure rate, but those issues are left for future research.

We would generally expect the volatility profile of a buyout private equity position to be highest in the initial stages, but then decrease over time.

[1] Since private equity positions are not actively traded, the valuation is typically model-based (such as a discounted cash flow model) and the value is only reported quarterly. However, once a company is listed through an Initial Public Offering (IPO), the price will change daily as the shares are more actively traded. Looking at the standard deviation of the reported values, we typically see lower volatility in the earlier years followed by higher volatility as more information becomes public and the shares start to trade on a daily basis.

Exhibit 3
Fund Statistics of Buyout and Venture Capital (VC) Funds

Venture Capital Fund Characteristics (94 funds)				
	25%	median	75%	mean
Size (mm)	$100	$225	$394	$322
# of past funds	0	1	3	1.78
Firm age (years)	0	3	8	4.69
# of partners	3	4	6	4.81
# of professionals	7	9	13	11.49
# of investments	15	20	30	24.24

Buyout Firm Characteristics (144 funds)				
	25%	median	75%	mean
Size (mm)	$297	$600	$1,500	$1,238
First fund dummy				0.27
# of past funds	0	1	3	1.80
Firm age (years)	0	6	11	6.44
# of partners	3	5	7	6.10
# of professionals	9	13	24	20.33
# of investments	9.75	12	16.67	14.76

Source: Metrick and Yasuda 2010, The Economics of Private Equity Funds.

II. Issues with Assessing Risk in Private Equity Investments

Although there is a vast literature on private equity funds, there is very little consensus on their risk and return profiles.

Private equity can be thought of as public equity liberated from the obligation to mark-to-market.[2] Although there is a vast literature on private equity funds, there is very little consensus on their risk and return profiles due to a number of factors. Harris (2014) provides an excellent overview of the issues with private equity data. These include: (1) the scarcity of information and quality of data, (2) the time lag of actually receiving funds from an initial investment (fund life is typically ten years with an investment effective duration of five years), (3) smoothed valuation and reporting (quarterly), and (4) the role of fees and treatment of residual interests.

As a result of these issues, beta and alpha estimates for private equity vary quite a bit (see Exhibit 4). Therefore, assessing risk in private equity is a mix of art, based on an understanding of the asset class and the specific investments and strategies pursued by an investor, and science, which gleans some information from the public equity component of private equity (i.e., proxying).

[2] Valuation has become more disciplined for private equity investments because of changes in the accounting rules imposed by SFAS 157 (or ASC 820) and subsequently, the SEC launch of a late 2011 informal inquiry into the private equity industry. While prior to the release of ASC 820, private equity firms were allowed to value investments based on cost, they now need to use fair value. The most important assumption for private equity valuation is the assumed exit price and the soundness of the assumptions used to estimate that exit price.

Exhibit 4
Summary of Beta Findings in Academic Literature

Buyout Funds

Beta	Annual Alpha	Data Source	Paper	Year	Method
2.20	1.0%	Private large general partner networks	Buchner: The Alpha and Beta of Private Equity Investments	2014	Single factor (S&P 500), cash-flow based, gross of fees
2.20 - 2.40	8.3% - 8.6%	1 Large fund of funds	Axelson, Sorensen, Stromberg: Alpha and Beta of Buyout Deals: A Jump CAPM for Long Term Illiquid Investments	2013	Single factor (S&P 500), cash-flow based, gross of fees
1.33	-2.0%	Preqin	Ang, Chen, Goetzmann, Phalippou: Estimating private equity returns from limited partner cash flows	2013	4 factor Pastor and Stambaugh model, cash-flow based, gross of fees
1.30	0.0%	Center for Private Equity Research (CEPRES)	Franzoni, Nowak, Phalippou: Private equity performance and liquidity risk	2012	4 factor Pastor and Stambaugh model, cash-flow based, gross of fees
0.94	1.6%	Thompson Venture Economics	Driessen, Lin, Phalippou: New Method to estimate risk and return of non-traded assets from cash flows: The case of private equity funds	2011	3 factor Fama French model, cash-flow based
1.00*	-3.0%	Thompson Venture Economics	Phalippou, Gottschalg: The Performance of Private Equity Funds	2009	*Single factor, profitability index (beta is assumed to be 1), net of fees
1.00*	-0.1%	Publicly-listed private equity FoFs, Listed Private Equity Funds	Jegadeesh: Risk and Expected Returns of Private Equity Investments	2009	*Single factor, publicly traded funds (range of betas, but none statistically different from 1), alphas slightly negative
0.41	N/A	Thompson Venture Economics	Kaplan, Schoar: Private Equity Performance: Returns, Persistence, and Capital Flows	2005	Single factor (S&P 500)
0.86	2.0%	Thompson Venture Economics	Woodward: Measuring Risk and Performance for Private Equity	2004	Lagged betas and recalculation
0.66	0.7%	Thompson Venture Economics	Jones, Rhodes-Kropf: The Price of Diversifiable Risk in Venture Capital and Private Equity	2003	Single factor (S&P 500), GP estimates of NAV
1.08	N/A	1 Large LP	Ljungqvist, Richardson: The Cash Flow, Return, and Risk Characteristics of Private Equity	2003	Single factor (S&P 500)

Venture Capital Funds

Beta	Annual Alpha	Data Source	Paper	Year	Method
2.60	3.5%	Private large general partner networks	Buchner: The Alpha and Beta of Private Equity Investments	2014	Single factor (S&P 500), cash-flow based
2.57	-8.3%	Thompson Venture Economics	Driessen, Lin, Phalippou: New Method to estimate risk and return of non-traded assets from cash flows: The case of private equity funds	2008	3 factor Fama French model, cash-flow based
2.06	-1.2%	Cambridge Associates	Woodward: Measuring Risk and Performance for Private Equity	2004	Lagged betas and recalculation

Source: Referenced papers, PAAMCO

As mentioned, the lack of data accessibility creates a challenge in assessing the risk of private equity investments. First, data on private equity are sparse, highly confidential, and difficult to obtain for research purposes. Second, returns are typically reported only quarterly, which requires a long time series of data (i.e., five to six years) in order to evaluate the asset class. Third, as with hedge fund indices, there are various biases in index data such as selection bias, hindsight bias, and backfill bias. Some indices gather information from GPs, others from LPs and GPs, and still others use the Freedom of Information Act (FOIA) to obtain information from the GPs and investors. Lastly, there is significant debate about the use of residuals in indices. Since private equity investments are illiquid, a fund's remaining investment in a company may exist for a period of years with no change in the valuation (similar to a hedge fund residual). If indices include residual investments, this has the impact of

adding 0% returns quarter after quarter which can both bias the return estimates (typically down) and dampen the volatility of the overall return stream. The Burgiss[3] data is generally considered to be the best since it is based on actual accounting cash flows from the LPs and the data can be crosschecked and verified across multiple LPs and GPs. Cambridge Associates has the largest database of reporting funds and is perhaps the most widely used given the availability of data to the public. Similar to Burgiss, Cambridge Associates' private equity indices are constructed from the underlying cash flows and Net Asset Value (NAV) provided by the GPs. While performance results show that Cambridge Associates and Preqin are qualitatively similar to the Burgiss data, Preqin data is primarily constructed through Freedom of Information Act (FOIA) requests, making it difficult to verify the reported numbers. Venture Economics is currently considered the least robust database due to its inclusion of funds that stopped reporting and its practice of rolling forward the last reported NAVs every quarter (Harris 2014). While Burgiss data may be the best data source, it is also not public, so Cambridge Associates indices are used for analytical purposes in this paper.

While fair-value reporting moves the valuation of private equity investments closer to the "true" value, the scarcity of relevant information to evaluate private equity positions and the numerous methods to determine fair value continue to result in an understated volatility profile for private equity.

The time horizon of private equity investing also creates challenges with interpreting return data. The legal structure of a private equity fund's life is typically eight to ten years, and the true success of an investment isn't known until the fund is wound down. Nonetheless, investors still expect a status update on their investment, thus creating the need for quarterly performance results. Historically, private equity funds could hold investments at cost which resulted in a very smooth return series that far understated the risk. For example, assume a private equity fund has an NAV of $100 based on the cost of acquiring properties. The market for the following two months is +10% and -5%. The PE fund NAV will not reflect that volatility, but rather remain static at $100. With cost basis accounting, the volatility could be flat until there is a market realizing event.

The implementation of accounting rule SFAS 157 (also referred to as ASC 820) in 2007 requires fair value reporting of the investments, which should increase return volatility. Even so, valuations are largely model-based (i.e., a discounted cash flow analysis) and so will likely still exhibit a smooth pattern. For example, a discounted cash flow analysis is one acceptable method of determining fair value for an illiquid investment. In these examples, the quarterly NAV will change mostly due to a set of cash flow payments rolling off. Since the model remains static except with timing moving forward one period, a high degree of autocorrelation that continues to understate volatility is created. Other model-based methods such as comparable sales would also continue to understate volatility due to the infrequency of relevant deals. While fair value reporting moves the valuation of private equity investments closer to the "true" value, the scarcity of relevant information to evaluate private equity positions and the numerous methods to determine fair value continue to result in an understated volatility profile for private equity.

In addition, LPs minimally scrutinize whether GPs determine "true" NAV value because LPs do not typically transact at that value. This is in contrast to hedge fund managers for whom an accurate estimate of the monthly NAV is important because investors may invest or redeem at that value. As a result, hedge funds are subject to heavy scrutiny and even outside pricing verification to establish an accurate NAV. Private equity fund investors are locked for the duration of the life of the fund, so the quarterly NAV value does little else than serve as a reporting value. The degree of scrutiny is much lower and there is rarely an outside or objective pricing review of the securities (and even if there were, the GP would have a substantial information advantage).

[3] Burgiss is a global provider of investment decision support tools for the private capital market. They offer tools for a variety of portfolio monitoring and performance measurement functions.

Investors view private equity returns in two different ways. One way is to evaluate returns by fund vintage year, a method mostly used for benchmarking purposes to determine if a fund is outperforming its peers. The other way is by quarterly index releases for the asset class that combine vintage years to report a quarterly return series. This index data is built upon a vast array of assumptions, mostly because recent vintages will report quarterly return series with only a fraction of the investments realized. For example, in Exhibit 5 below from Harris (2014), we see that in the final eight years of analysis, just over a quarter of the funds have investments that have been realized with capital returned to investors. This means that the return profile is biased heavily by the GP valuation assumptions for company performance rather than actual cash proceeds realized.

Exhibit 5
Historical IRRs and Investment Multiples for Private Equity Returns

Buyout Funds								
			Internal Rate of Return			Investment Multiple		
Vintage Year	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
1985	1	100.0	13.7	13.7	13.7	2.66	2.66	2.66
1986	5	100.0	13.6	16.8	16.0	2.40	2.36	3.27
1987	7	100.0	17.3	16.2	15.3	2.93	2.55	2.58
1988	7	100.0	14.4	10.1	18.4	2.03	1.74	2.32
1989	8	100.0	20.6	22.4	21.1	2.55	2.69	2.75
1990	2	97.8	31.9	31.9	52.9	3.03	3.03	3.37
1991	4	100.0	24.7	24.9	27.8	2.45	2.54	2.54
1992	5	100.0	11.2	10.7	15.0	1.68	1.41	1.88
1993	11	100.0	31.0	19.1	26.0	2.62	2.07	2.48
1994	13	100.0	29.6	24.7	34.5	2.73	2.18	3.29
1995	17	99.5	20.9	10.5	16.9	2.08	1.51	1.82
1996	9	100.0	6.0	5.7	2.4	1.46	1.30	1.17
1997	30	98.3	8.6	5.5	8.8	1.42	1.28	1.50
1998	38	96.9	6.4	8.0	3.6	1.42	1.39	1.28
1999	28	89.9	3.3	4.3	4.8	1.31	1.21	1.40
2000	39	62.2	12.7	11.9	14.3	2.66	1.58	1.75
2001	26	57.5	13.7	14.6	15.1	1.57	1.72	1.67
2002	21	44.9	16.1	16.4	18.4	1.72	1.79	1.84
2003	13	29.4	19.5	16.2	22.5	1.98	1.75	1.80
2004	46	18.1	12.8	11.7	15.4	1.53	1.50	1.64
2005	57	9.7	6.8	7.6	7.1	1.26	1.25	1.27
2006	67	10.8	2.6	1.2	0.5	1.08	1.03	1.02
2007	74	1.9	3.7	6.2	4.4	1.11	1.12	1.09
2008	68	6.3	3.2	2.8	1.5	1.07	1.04	1.04
Average	598	72.9	14.2	13.0	15.7	1.97	1.81	2.03
Average 1980s	30	100.0	15.0	14.9	16.7	2.50	2.41	2.81
Average 1990s	157	98.2	17.5	14.6	19.3	2.02	1.79	2.07
Average 2000s	411	26.8	10.1	9.8	11.0	1.55	1.42	1.46

Source: Harris et al., (2014)

Fees can have a volatility dampening effect thereby skewing beta and volatility estimates downward.

The fee structure of private equity investments is somewhat unique and adds to the challenges of assessing risk. Fees are paid on the committed capital as opposed to the invested capital, which is the practice for hedge funds. In addition, the fees are high: 2% management fee and 20% performance fee earned at the realization of the investment, and various transaction and monitoring fees. Index data, like Cambridge Associates, typically report net of fee data, but the fees can have a volatility dampening effect thereby skewing beta and volatility estimates downward. Although the management fee has zero beta for private equity since it is based on the committed capital and therefore remains constant, the performance fee has a meaningful impact on beta estimates which we can estimate as 20% carried interest multiplied by the gross of fees beta. This volatility and beta dampening effect occurs because the performance fee accrual reduces returns as the expected deal value increases (typically in rising equity markets), while the reversal of the performance fee accrual increases returns as the expected deal value decreases (typically in falling equity markets).

III. Approaches to Assess Private Equity Risk

Multiple approaches can be used to assess risk more appropriately for private equity, including: 1) using statistical processes to de-smooth the reported return streams; 2) using proxies from publicly-listed private equity companies; or 3) using publicly-listed industry or size (or both) index proxies.

The expanding body of academic literature recognizes that private equity has a beta and volatility profile higher than that suggested by the smooth quarterly returns of major index providers. Multiple approaches can be used to assess risk more appropriately for private equity, including: 1) using statistical processes to de-smooth the reported return streams; 2) using proxies from publicly-listed private equity companies; or 3) using publicly-listed industry or size (or both) index proxies. This section examines each of these approaches in turn.

(1) De-smoothing returns

A large portion of academic literature attempts to calculate the beta, volatility, and alpha estimates of private equity funds by using the reported return streams and applying statistical techniques to de-smooth the returns. One of these methods is illustrated in Jorion (2012) which uses the autocorrelation coefficient to construct an adjusted return series. To illustrate, we examine the Cambridge Associates private equity returns from March 2005 to September 2014. For this illustration, we used a one period autocorrelation coefficient, although arguably the autocorrelation impact could extend for up to four or five periods.

Exhibit 6 compares the properties of the S&P 500 Total Return Index, the raw Cambridge Associates return series, and the de-smoothed Cambridge Associates series. We can see that the volatility increases meaningfully from 9.6% to 16.6% for the de-smoothed series. This is a 72% increase in the volatility measure alone. Similarly, the Sharpe ratio, which provides a measure of risk-adjusted return, plummets below 1 due to the increase in volatility. Lastly, the S&P 500 beta of private equity also meaningfully increases as the diversifying properties of private equity were overstated due to the lagged and smoothed return series. These findings are in line with what has been published.

Exhibit 6
Impact of De-smoothing Private Equity Returns

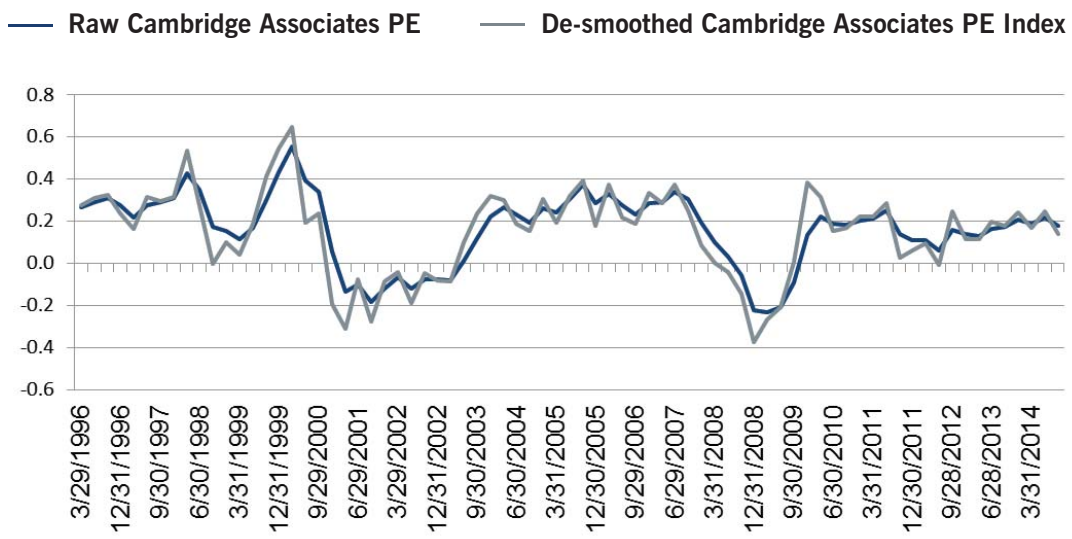
	S&P 500	CA Private Equity	Adjusted CA PE Returns
Return	8.51%	13.65%	13.78%
Volatility	16.45%	9.64%	16.63%
Sharpe ratio	0.517	1.416	0.829
Autocorrelation coefficient	0.247	0.487	0.020
Beta to S&P	1.00	0.46	0.74

Source: Cambridge Associates, PAAMCO

As we can see in Exhibit 7 below, the de-smoothing series generally tracks the return pattern of the original but with greater volatility, which seems more realistic. As a result, for the purpose of this paper, the de-smoothed return series will be treated as the "true" return series, against which we compare proxies using public market-based substitutes.

Exhibit 7
Comparison of Smoothed vs. De-smoothed Private Equity Returns

Rolling Annual (4th Quarter) Returns (1Q95-3Q14)



Source: Cambridge Associates, PAAMCO

PE indices have a number of different biases that can skew the return estimates, most notably incomplete information and a selection bias.

(2) Publicly-listed private equity companies
As noted previously, PE indices have a number of different biases that can skew the return estimates, most notably incomplete information and a selection bias. For example, with the exception of Burgiss, most PE indices are not based on fund-level cash flow data. Since the timing of capital calls and distributions can impact IRRs, the cash flow-based data is important for deriving accurate returns. Also, selection bias is large as many indices are based on voluntary reporting either by the GPs or the LPs. These data sets can be skewed upwards by those LPs having a good experience from their private equity investments or by GPs ramping up marketing efforts on the heels of a successful fund. Lastly, some data sets such as Preqin lean more heavily on FOIA requests. These databases could exclude large successful funds that avoid taking institutional assets specifically to avoid FOIA requests.

Evaluating the performance of publicly-listed private equity funds or funds of hedge funds seeks to eliminate these biases, and the academic research finds that using listed private equity funds provides similar beta and alpha expectations as de-smoothing methods (Jegadeesh, Kraussl, and Pollet 2009). Listed private equity as a proxy provides a similar framework to using funds of hedge funds returns to evaluate hedge fund returns.

Exhibit 8
Listed Private Equity Funds in S&P Listed Private Equity Index
As of September 30,2015

Top 10 Constituents by Index Weight

Constituent	Symbol	Sector*
Brookfield Asset Management Inc	BAM.A	Financials
Partners Group Hldg	PGHN	Financials
Blackstone Group LP The	BX	Financials
3I Group	III	Financials
KKR & Co	KKR	Financials
Eurazeo	RF	Financials
Ares Capital Corp	ARCC	Financials
Wendel	MF	Financials
American Capital Ld	ACAS	Financials
Intermediate Capital Group	ICP	Financials

**Based on GICS sectors*
Source: Standard & Poors

Listed private equity as a proxy provides a similar framework to using funds of hedge funds returns to evaluate hedge fund returns.

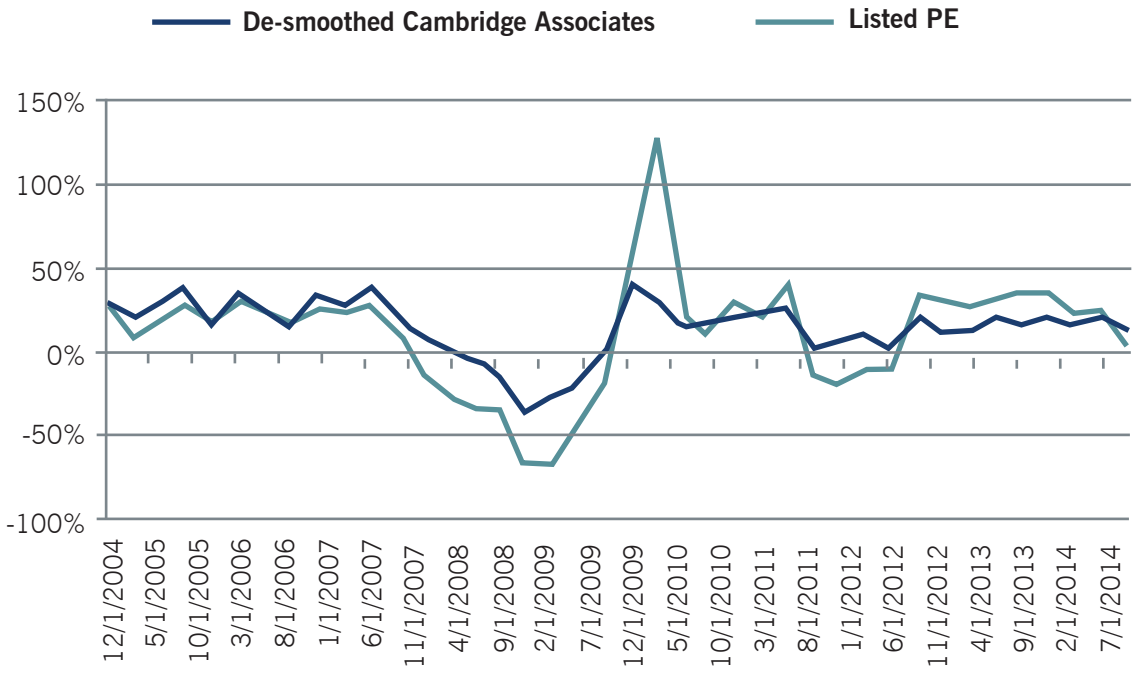
The use of publicly-listed private equity funds takes a large step towards using public market pricing to establish the "true" return streams for private equity, but it is also a flawed measure. Most notably, the market prices of listed private equity companies are more likely to represent a claim on private equity fees, not the companies themselves. While growth in fees (particularly the more stable management fee) is related to growth in assets which in turn can be a proxy for growth of the underlying companies, it does not provide a direct link to understanding the volatility profile of a private equity fund of companies. The claim on fees can also induce a leverage effect, as incentive fees typically account for 20% of gross returns instead of the 80% going to LP investors.

In addition, the largest listed private equity companies do substantially more than just private equity. If we evaluate the S&P Listed Private Equity Index as a proxy (see Exhibit 8 on the previous page), the largest weights (e.g., Blackstone, Brookfield, KKR) have other business lines in addition to private equity, such as hedge funds and real estate. Lastly, as seen in Exhibit 9 below, the volatility profile of listed private equity companies seems to be too large, as compared to the de-smoothed Cambridge Associate returns. This methodology is also not ideal for assessing the risk in private equity because the risk and return profile of these companies is driven by factors other than the risk in a private equity investment itself and because the volatility of this proxy appears to overstate the true risk of the asset class.

The largest listed private equity companies do substantially more than just private equity.

Exhibit 9
Listed Private Equity Returns

Rolling Annual (4th Quarter) Returns (4Q03-3Q14)

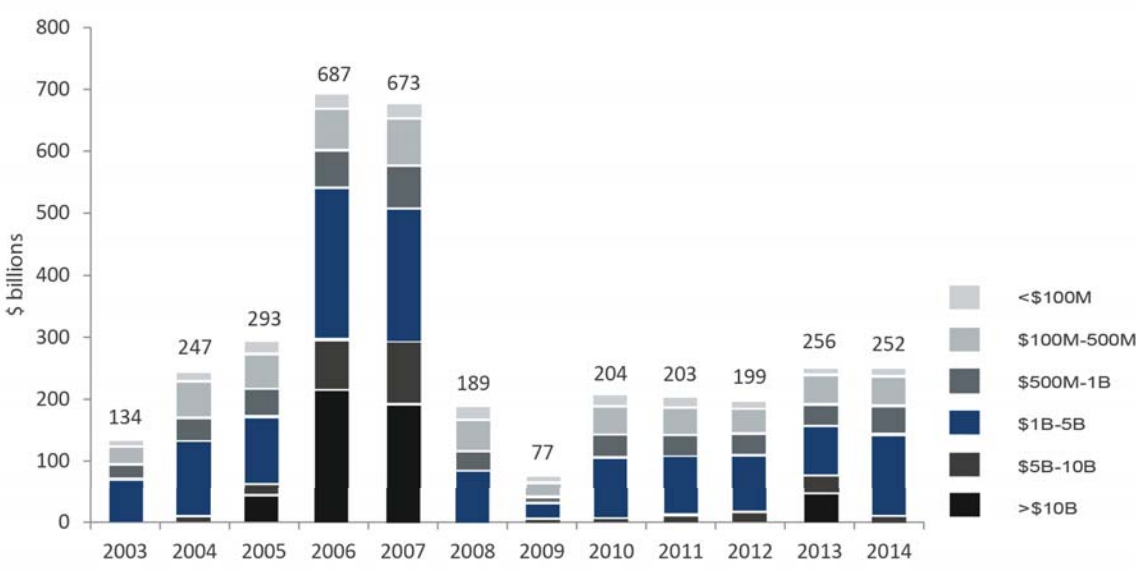


Source: S&P, Cambridge Associates, PAAMCO

(3) Industry and size ETF proxies
Mapping private equity allocations to industry and size sector ETFs provides a basic intuition for how private equities perform. After all, for buyout funds, these are companies that typically were publicly listed before the private equity company took them private and that will be publicly listed (or acquired by a publicly listed company) as the private equity fund winds down. Per the Bain 2015 Global Private Equity Report, when referring to the number of private equity IPOs, "the new IPOs also understate in other ways the importance of public equity markets as an exit venue for private equity." Using industry proxies is also the basis for the MSCI Barra factor model for private equity.

If we proceed with industry and size index proxies, the question of which proxies are appropriate remains. The bulk of global buyout deal value is in the $1-$5 billion range, which corresponds to midcap companies (see Exhibit 10).

Exhibit 10
Global Buyout Deal Value by Size



Source: Dealogic, PAAMCO

Similarly to hedge fund investors, private equity investors look for dislocations such as the financial crisis that began in 2008 or the energy sell-off beginning in 2H 2014 as opportunities to deploy capital.

Similarly to hedge fund investors, private equity investors look for dislocations such as the financial crisis that began in 2008 or the energy sell-off beginning in 2H 2014 as opportunities to deploy capital. However, we know some general characteristics of industry exposures given the types of companies buyout funds seek—generally those with strong cash flows, low beta, and an ability to improve operations or revenues through financial restructuring. Exhibit 11 illustrates that in any given year the industry exposures fluctuate. We see that the largest concentrations are relatively stable in industries such as technology, industrials, services, and transportation.

Exhibit 11
Global Buyout Deal Value by Industry

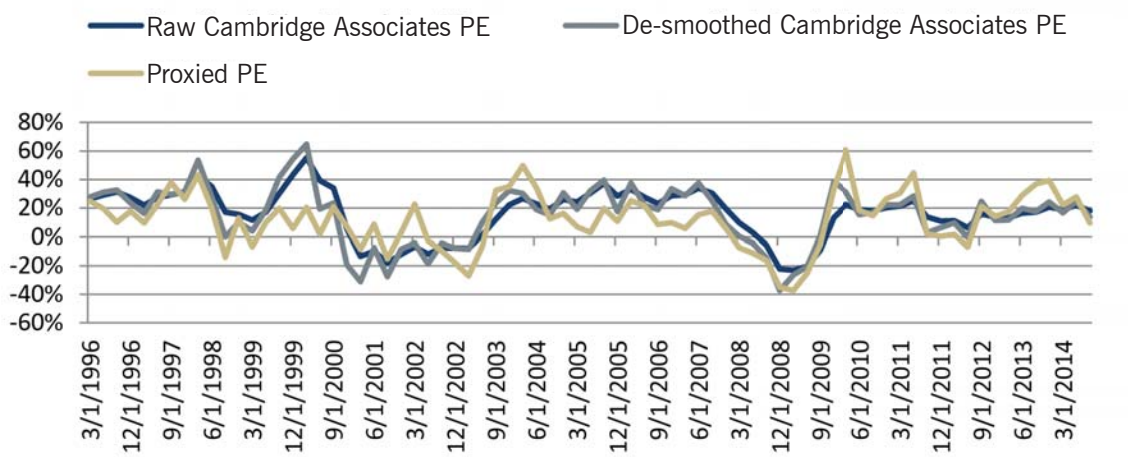
Year	Finance	Food	Health	High-tech	Industrial	Natural Resources	Retail	Services	Transport
1990	1%	16%	9%	10%	21%	0%	6%	31%	7%
1991	6%	12%	2%	15%	14%	4%	5%	36%	6%
1992	5%	11%	1%	9%	39%	14%	1%	15%	5%
1993	24%	25%	6%	6%	21%	1%	3%	8%	6%
1994	4%	5%	2%	28%	19%	8%	13%	9%	12%
1995	7%	4%	9%	5%	24%	4%	12%	21%	14%
1996	15%	1%	7%	9%	27%	4%	4%	19%	14%
1997	9%	7%	20%	13%	17%	3%	10%	17%	5%
1998	7%	9%	4%	8%	26%	4%	7%	29%	5%
1999	7%	4%	7%	17%	27%	3%	2%	26%	6%
2000	3%	15%	6%	20%	28%	5%	3%	9%	13%
2001	3%	4%	15%	12%	28%	6%	3%	22%	6%
2002	7%	13%	11%	2%	22%	3%	3%	16%	23%
2003	4%	7%	3%	29%	19%	3%	8%	15%	12%
2004	4%	1%	10%	8%	33%	3%	13%	12%	15%
2005	12%	3%	10%	16%	32%	5%	3%	14%	6%
2006	1%	5%	7%	25%	17%	6%	6%	24%	9%
2007	3%	0%	5%	6%	28%	5%	12%	32%	9%
2008	1%	5%	7%	25%	17%	6%	6%	24%	9%
2009	1%	5%	7%	25%	17%	6%	6%	24%	9%
Average	**6%**	**8%**	**7%**	**14%**	**24%**	**5%**	**6%**	**20%**	**10%**

Source: HEC Buyout Dataset
Gottschalg et al., 2013

If we take the average weight allocated to these subindustries from 1990-2009 and use the S&P 400 Midcap Index sectors to create a proxy, we obtain a risk and return profile that can be compared to both the raw and de-smoothed Cambridge Associates times series (see Exhibit 12).

Exhibit 12
Comparison of Public Proxied Private Equity Returns

Rolling Annual (4th Quarter) Returns (1Q96-1Q14)



Source: Cambridge Associates, PAAMCO

Exhibit 13
Summary Statistics of PE Proxy Alternatives

	Since 1Q 2004				
	Raw Cambridge Associates PE	De-smoothed Cambridge Associates PE	Proxied PE	S&P 500	Listed PE
Return	14.6%	13.9%	11.1%	8.7%	11.2%
Volatility	9.9%	18.4%	19.9%	15.8%	32.3%
Sharpe Ratio	1.5	0.8	0.6	0.6	0.3
Autocorrelation Coefficient	38.5%	-16.8%	12.3%	21.9%	19.7%
Beta to S&P 500	0.5	0.8	1.2	1.0	1.8
N=	43	43	43	43	43
Lehman (3Q08-1Q09)	-24.0%	-29.5%	-39.1%	-36.4%	-64.1%
Fall '11 (3Q11-4Q11)	1.1%	1.8%	-6.5%	-2.1%	-18.7%

Source: Cambridge Associates, Bloomberg, PAAMCO

As shown in Exhibit 13, this industry/index proxy has a risk profile that most closely approximates the de-smoothed private equity index. The volatility is similar, albeit slightly higher. The beta is higher, in large part due to higher correlation with the market.

Thus, using an industry-based and size-based index proxy appears to be a good fit for approximating the risk profile of private equity positions. This implementation, however, can still be improved upon. Like hedge funds, private equity funds are actively managed and opportunistic. This can result in industry weights for a particular vintage that look very different from the average weight used in our proxy. In practice, the industry weights can be adjusted to reflect the opportunity set or the known details of a particular investor's portfolio.

Indeed, PAAMCO goes through a systematic process of mapping the private equity positions in our clients' portfolios using publicly traded proxies. Our risk management team consults with our portfolio management team to determine the best proxy, usually a single stock in the same industry with the same size, or an industry index. Sometimes an adjustment is made for leverage. An industry index obviously understates the risk at the level of the individual position, but we believe this effect washes out at the portfolio level.

Using an industry-based and size-based index proxy appears to be a good fit for approximating the risk profile of private equity positions.

IV. Conclusion

Proxies based on industry and size appear to provide the closest match to de-smoothed private equity index returns and hence offer a practical and useful approximation to risk measurement for private equity.

Private equity is a growing asset class for institutional investors, yet its risk characteristics are largely elusive. These difficulties emanate from the lack of liquidity in private equity markets, smooth NAV valuation processes, and sparse, flawed data sets. In addition, the success of a private equity investment is not truly known until the investment is realized and exited, typically ten years after the initial capital commitment. The timing of cash flows and the equity market conditions upon exit of investment (i.e., the multiple for the underlying companies) are meaningful drivers of the IRR.

Most academic research centered on determining the beta and alpha of PE funds tended to use lagged betas or statistical techniques to de-smooth reported return series. While this is helpful ex-post to assess the pattern of the risk profile, it is not helpful in conducting the forward-looking analysis needed to make asset allocation decisions, nor is it helpful in understanding the risk drivers of the allocation. Other academic research uses public market proxies, such as listed private equity funds. However, listed private equity funds exhibit much higher volatility as their returns represent a different and leveraged claim on the underlying assets. Overall, proxies based on industry and size appear to provide the closest match to de-smoothed private equity index returns and hence offer a practical and useful approximation to risk measurement for private equity.

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