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THE COMPONENTS OF PRIVATE EQUITY PERFORMANCE: IMPLICATIONS FOR PORTFOLIO CHOICE

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The Components of Private Equity Performance:

Implications for Portfolio Choice

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Abstract

We use a proprietary database of private equity returns to measure the excess return of private equity over public equity and to partition it into two components: an asset class alpha and compensation for illiquidity. Our evidence suggests that private equity managers, as a group, generate alpha by anticipating the relative performance of economic sectors. If we assume that manager-specific alpha is fully diluted across a broad universe of private equity managers, we can interpret the balance of excess return as a premium for illiquidity. This result suggests that investors can capture the asset class alpha of private equity by using liquid assets such as ETFs to match the sector weights of private equity investors. This decomposition of private equity performance has important implications for portfolio choice, which we explore in this paper.

The Components of Private Equity Performance:

Implications for Portfolio Choice

Many institutional investors allocate significant funds to private equity despite the illiquidity of this asset class and the relatively high fees charged by private equity managers. We suspect that investors are attracted to private equity for several reasons:

1. Some investors believe they can identify superior private equity funds whose performance will more than offset their illiquidity and high fees.

2. Other investors, who may not be skilled at identifying superior funds, expect private equity, as an asset class, to outperform public equity by a margin sufficient to offset its illiquidity and high fees.

3. And still others, who are not constrained by liquidity, seek to capture a premium for bearing illiquidity.

We use a proprietary database of private equity returns to measure the excess return of private equity over public equity and to partition it into two components: an asset class alpha[1] and compensation for illiquidity. Our results show that about half of the excess return of private equity comes from an asset class alpha.[2] Moreover, we demonstrate that investors can obtain the asset class alpha of private equity in the public equity market. This means that investors who are not skilled at identifying superior private equity funds should invest in this asset class only to extract an illiquidity premium.

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We organize the paper as follows: In Part I we provide a brief review of related literature. In Part II we describe the State Street Private Equity Index (SSPEI) which serves as the basis of our analysis, and we compare it to other private equity indices. In Part III we present evidence that private equity delivered an excess return net of fees relative to public equity. We also adjust the risk of private equity to offset the biases introduced by performance fees and valuation smoothing. Then we partition the excess return of private equity into an asset class alpha and an illiquidity premium. In Part IV we show how to determine the optimal allocation to private equity in light of the decomposition of its excess return. We summarize the paper in Part V.

Part I: Related Literature

Researchers have studied private equity from several perspectives that are related to our research, including its factor exposures, its premium relative to public equity, and the investment cycle of private equity.

Franzoni, Nowak, and Phalippou [2012] fitted a four-factor model to private equity returns. They found significant exposure to a liquidity factor, a market factor, and a value factor, but not to a size factor. They also found that with four factors alpha is zero and the liquidity risk premium is about 3% annually. They measured the liquidity factor as the returns of a long/short portfolio of stocks sorted according to their sensitivity to changes in market liquidity. They did not consider sector factors. Pederson, Page, and He (forthcoming in the *Financial Analysts Journal*) employed a lagged factor model to describe the performance of a

variety of alternative asset classes. They found that private equity has exposure to beta, size, value, and liquidity factors, but they did not consider sector factors.

Kaplan and Schoar [2003] evaluated the performance of private equity funds and found that their average performance net of fees was approximately equal to the return of the S&P 500 Index. However, they also found substantial dispersion in performance across private equity funds. Harris, Jenkinson, and Kaplan [2013] studied performance across types of private equity funds. They found that buyout funds outperformed public equity by about 3% per year and that venture funds outperformed public equity during the 1990s but underperformed during the 2000s.

Lerner and Schoar [2005] examined the investment cycle of private equity managers. They found that funds invested in industries with longer investment cycles impose more transfer constraints on their investors. Managers of these funds screen for investors who are less sensitive to liquidity shocks. Barrot [2013] investigated whether the contractual horizon of private equity funds influences a manager's willingness to invest in innovative companies. He found that private equity managers are more inclined to seek out innovative targets if the contractual horizon is longer. Barrot measured innovation as the rate of growth in a company's patent stock.

Our contribution is related to these three streams of literature. We estimate private equity exposure, but to economic sectors rather than factors. And of particular note, we offer evidence that private equity sector exposures are predictive of public equity performance. We

document the excess return of private equity relative to public equity, and we refine this analysis by partitioning excess return into an asset class alpha and an illiquidity premium. And we address the life cycle of private equity in our analysis of the illiquidity premium. In fact, Barrot's result supports our conjecture that lock-ups enable private equity managers to extract a premium by investing in more innovative, and hence riskier, ventures. Our final contribution is to evaluate how private equity performance affects portfolio choice from a normative perspective.

Part II: State Street Private Equity Index

In 2005 State Street Corporation constructed a private equity index (SSPEI) to evaluate the performance of actively managed private equity portfolios, and they have since updated this index quarterly. Currently, the index is derived from the data of 2,273 global private equity partnerships with funds distributed across various strategies, vintage years, and geographic regions. This index represents approximately $2 trillion of total capital commitments, which constitutes more than half of the private equity market.

State Street's clients are large institutional investors, such as public and private pension funds, endowment funds, foundations, sovereign wealth funds, and family offices, who invest as Limited Partners (LPs) in private equity funds. The SSPEI is based on the cash flows of these LPs, which State Street observes in its role as custodian and reconciles with General Partner (GP) notifications. In order to approximate the full funds' cash flows, the individual LPs' shares of cash flows are grossed up to the total partnership level based on the LP's commitment

percentage for each particular fund, and they are then aggregated to produce index results. State Street computes a variety of performance metrics from this index, including an internal rate of return (IRR), which complies with GIPS standards and is the basis of our analysis. The IRR calculation is based on daily cash-on-cash returns, modified for the residual value of the partnership's equity. The pooled return is calculated by summing all cash flows and NAVs together. This cash flow series is then used to create an investment-weighted return. All returns are net of fees, expenses, and carried interest. The index is updated every quarter, approximately 100 days after quarter end. Year-end results may not be available until 120 days after quarter end due to delays associated with annual audits.

The SSPEI has two potential biases. The funds included in the SSPEI represent only State Street clients. Moreover, the sample of funds shifts over time toward better performing funds. That said the SSPEI has several important advantages. It contains a greater number of funds than other private equity indices. It also includes more observations from currently active funds. The SSPEI is not survey based, and therefore does not rely on voluntary reporting by the GPs. As custodian, State Street has an accurate account of the amounts and timing of all cash flows related to each LP's investments. Finally, State Street is an independent, third-party service provider; therefore, it is not conflicted because it does not act as an investment advisor or placement agent for the funds. Exhibit 1 provides a comparison of the major private equity indices.

Exhibit 1: A Comparison of Private Equity Indices

		State Street Private Equity Index	Thomson Venture Economics Private Equity Index	Cambridge Associates U.S. Private Equity Index
Data	Source	LP transactions and valuations provided to custodian	Voluntary, survey-based reporting by GPs	Comination of voluntary, survey-based reporting by GPs and data provided by LP consulting clients
	Coverage*	2,273 unique private equity partnerships representing $2 trillion in capital commitments from vintage years 1980 to present	2,043 unique private equity partnerships representing $1.34 trillion in capital commitments from vintage years 1969 to present	2,521 unique private equity partnerships from vintage years 1981 to present
	Timing	Transaction data collected daily; index published quarterly with a 105-day lag (120 for Q4)**	Survey data collected quarterly; index published quarterly with a 110-day lag (130 for Q4)	Transaction and survey data collected quarterly; index published quarterly with a 110-day lag (130 for Q4)**
Methodology	IRR Calculation	Internal rate of return; cash flows are aggregated daily	Internal rate of return; cash flows are aggregated monthly	Internal rate of return; cash flows are aggregated quarterly

* Coverage statistics as of January 2014.

** These firms also provide preliminary estimates of performance after 90 days.

Exhibit 2 shows the types of funds included in State Street's database, as well as the regional distribution and the IRR associated with these categories.

Exhibit 2: Fund Type, Region, and IRR

		Number of Funds	Commitment ($ billions)	Internal Rate of Return
Coverage by Fund Type	Leveraged Buyout	1,051	1,484	13.0%
	Venture Capital	896	303	10.5%
	Other (Mezzanine/Distressed)	325	304	11.6%
	Total	**2,273**	**2,091**	**12.4%**
Coverage by Region	U.S.	1,762	1,548	12.6%
	Europe	283	380	13.7%
	Rest of World	228	163	6.0%
	Total	**2,273**	**2,091**	**12.4%**

Exhibit 3 provides a detailed description of the cash flows that are used to generate the IRRs.

Exhibit 3: Private Equity Cash Flows Included in Internal Rate of Return Calculation

Direction of Cash Flow	Type of Cash Flow	Description
Contribution	Capital Call	Capital call for investment or working capital
	Management Fee Inside	Capital call for periodic management fees inside of commitment, net of any waivers or offsets
	Management Fee Outside	Capital call for management fees outside of commitment
	Subsequent Close Interest Expense	Interest or other fee paid by the LP to other LPs for joining the partnership late or in a subsequent round closing
	Partnership Expenses Inside of Commitment	Capital call for all partnership expenses, organizational costs, legal expenses and other expenses that are insde of commitment
	Other Expenses Outside	Capital call for all other expenses or organizational costs that are outside of commitment
	Temporary Return of Capital	Represents a distribution to LPs from GP due to previously called capital which goes unused. Recallable for future investements.
	Deemed GP Contribution	Call from LPs, on behalf of GP's share of a capital call (typically serves as an offset to future management fees)
Distribution	Return of Capital - Cash	Return of invested capital from the full or partial sale of an underlying holding
	Realized Gain (Loss) - Cash	Realized gain (or loss) on the sale of an investment
	Return of Capital - Stock	Cost basis of a stock distribution
	Realized Gain (Loss) - Stock	Realized gain (or loss) from a stock distribution
	Recallable Distribution	Distribution (return of capital, gain or otherwise) that is subject to recall for future investment
	Clawback	Return of excess carry distributed to GP, as defined by the waterfall calculation in the LPA
	Dividends	Dividend Income earned from underlying holdings
	Interest Income	Interest Income earned from underlying holdings

Part III: Excess Return of Private Equity and Its Components

We use the SSPEI to measure the excess return of private equity and to partition it into two components: an asset class alpha and a premium for illiquidity. We assume that any manager-

specific alpha beyond the asset class alpha washes out across our universe of more than 2,000

partnerships. We conjecture that private equity managers collectively produce an asset class

alpha because they anticipate the relative performance of economic sectors, for which we offer

two explanations. First, many private equity funds, such as venture capital funds, focus on

emerging segments of the economy where innovation is likely to be concentrated. Private

equity managers are the first investors to be exposed to these innovations, as entrepreneurs

seek early funding. As these innovations take hold, many of these companies go public and

attract additional funding. Moreover, existing public companies in the same sectors may

benefit by extension as investors observe these successful ventures and channel even more

funds into these segments of the economy. These private equity funds, therefore, have first

mover advantage.[3] Other private equity funds, such as buyout funds, focus on

underperforming segments of the economy. Companies in these segments may be oversold

and thus likely to outperform in the future. It may therefore be the case that private equity

managers anticipate outperformance, whereas public investors respond to outperformance.[4]

We model the illiquidity premium offered by private equity as the residual of asset class

alpha. Although we do not estimate it directly, we suspect it exists for two reasons. Privately

held firms are less encumbered by disclosure requirements, which might otherwise discourage

them from accepting beneficial short-term risks. And private equity funds have lock-up

provisions, which insulate them from potential withdrawals should they experience transitory

losses in pursuit of greater long-term gains. These features grant private equity managers more

flexibility to exploit long-term investment opportunities.[5]

Our explanation of private equity alpha and the illiquidity premium does not exclude

other accounts, and it is only a conjecture. We are open to alternative views. Nonetheless, our

focus is not to rationalize private equity alpha and the illiquidity premium, but rather to

document and measure them.   We base our analysis on a subset of the SSPEI that includes only

U.S. funds.[6] Henceforth, our use of the acronym SSPEI refers to the U.S. subset of that index.

Exhibit 4 shows the cumulative return of the SSPEI alongside the cumulative return of

the capitalization-weighted MSCI USA.[7]

Exhibit 4: Cumulative Return of U.S. SSPEI and MSCI USA (6/30/96 – 9/30/13)
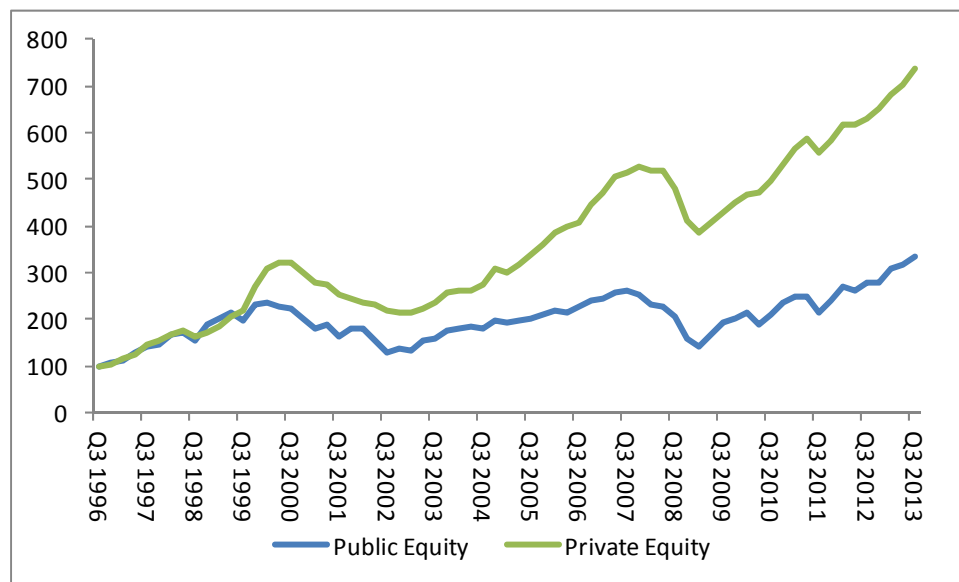
Exhibit 4 reveals that U.S. private equity as an asset class produced a higher return than

U.S. public equity over the 17-year period for which we have data (12.30% versus 7.10%), and

based on observed standard deviations, it did so at significantly less risk (12.53% versus

18.33%).   But the observed standard deviation of private equity understates its true risk for

two reasons. Performance fees reduce upside returns but not downside returns. Thus

standard deviations calculated net of fees understate risk. We must correct for this bias by

reverse-engineering the fee calculation to derive a volatility measure that correctly captures

downside deviations. [8] Fair-value pricing also dampens observed volatility because these prices

are anchored to prior period prices. Therefore, we need to de-smooth the private equity

returns to eliminate this bias.[9] Exhibit 5 shows the observed volatility of public equity (MSCI

USA) and private equity (SSPEI) as well as the implicit volatility of private equity after correcting

for the biases arising from performance fees and valuation smoothing.

Exhibit 5: Adjustment for Performance Fees and Valuation Smoothing

	MSCI USA	SSPEI	SPPEI Adjusted for Fees	SSPEI Adjusted for Fees and Smoothing
Annualized return	7.10%	12.30%	12.30%	12.30%
Annualized standard deviation	18.33%	12.53%	13.46%	22.68%
Return to risk ratio	0.39	0.98	0.91	0.54

It appears from Exhibit 5 that private equity is an attractive alternative to public equity

even after accounting for a realistic assessment of its risk. At this point we might conclude that

investors should choose private equity over public equity if they can match the performance of

the average private equity manager and if the excess return adequately compensates them for

the illiquidity of private equity. But such a conclusion could be misguided because, as we

conjectured earlier, part of the excess return may constitute an asset class alpha arising from

the ability of private equity managers to anticipate the relative performance of public equity

sectors. If this is the case, we should expect a public equity index whose sector weights reflect

the exposures of private equity investors to outperform a capitalization-weighted public equity index. We refer to this sector mimicking index as *pseudo private equity*.
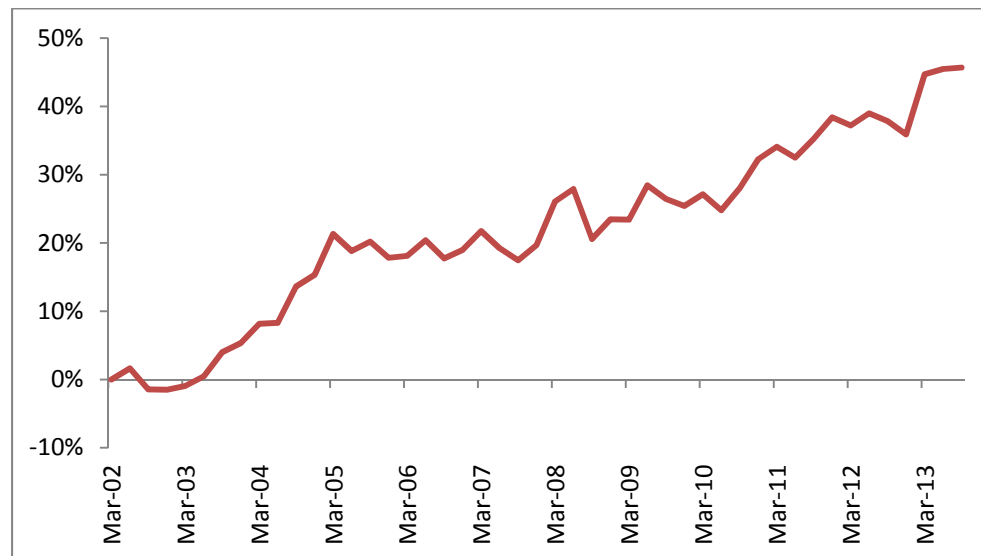
We estimate private equity sector exposures by regressing quarterly SSPEI returns, net of market returns, on quarterly public equity sector returns, net of market returns, using a step-wise regression.[10] We use rolling five-year windows and estimate a cumulative beta for each sector by taking the sum of all significant coefficients across lags, including negative coefficients. This calibration implies that, on balance, we are capturing sector exposures with a mean lag of two and one half years. We create a pseudo private equity index as follows. We standardize each coefficient by subtracting from it the mean coefficient, and then dividing this difference by the cross-sectional standard deviation of the coefficients.   Then we scale these standardized coefficients to produce active weights that sum to zero and that, when added to the sector capitalization weights, constrain aggregate short positions not to exceed 20%.[11] We report the weights of this pseudo private equity index in Exhibit 6, which shows significant variation in these weights through time. This variation suggests that the index's performance is not determined by just a few sectors.[12]

Exhibit 6: Pseudo Private Equity Sector Weights (1/15/02 – 10/15/13)
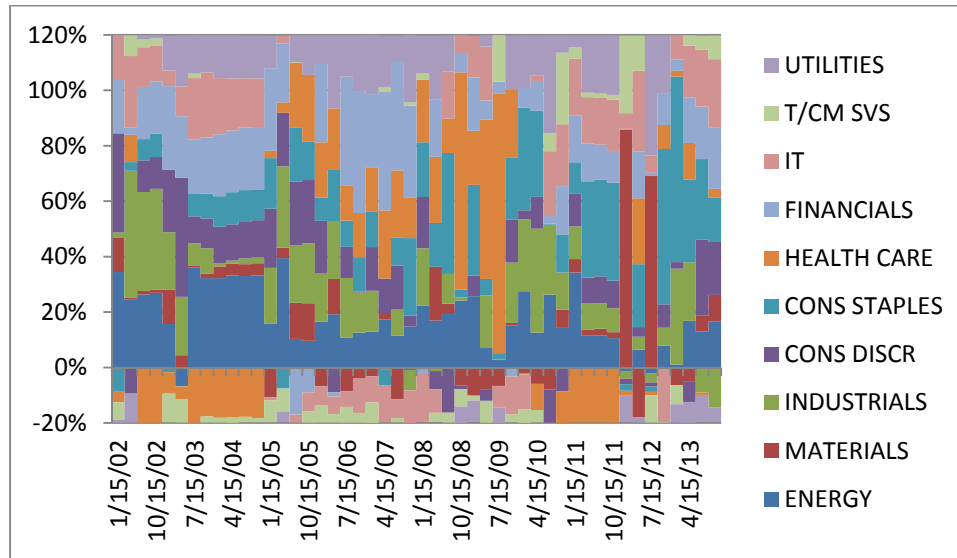
Next, we compute the cumulative return of this pseudo private equity index, assuming quarterly rebalancing, and compare it to the cumulative return of the capitalization-weighted MSCI USA.[13] The pseudo private equity index produced an annualized cumulative return of 7.63% compared to 5.60% for the MSCI USA, for an annualized excess return of 2.03%. Moreover, it outperformed public equity in 8 out of 12 years.

Exhibit 7: Cumulative Excess Return of Pseudo Private Equity Index (3/31/02-9/30/13)

The predictive power of private equity sector exposures is also evident from the differences in subsequent public equity sector excess returns depending on whether their regression coefficients were significantly negative, insignificant, or significantly positive.

Significance	Next-Quarter Excess Return (Annualized)
Significant and negative	-0.07%
Not significant	1.81%
Significant and positive	5.10%

The excess returns do not sum to zero because we did not account for the sector weights in this analysis. The weighted-average excess return in a given quarter is 0%.

Next we examine the decay rate of the private equity sector information by postponing rebalancing for intervals ranging from one quarter to four years. We find that private equity sector exposures were informative for several years beyond the mean estimation lag of two and one half years, although there was substantial decay in performance with rebalancing delays beyond one year. [14]

Exhibit 8: Pseudo Private Equity Excess Return with Delayed Rebalancing
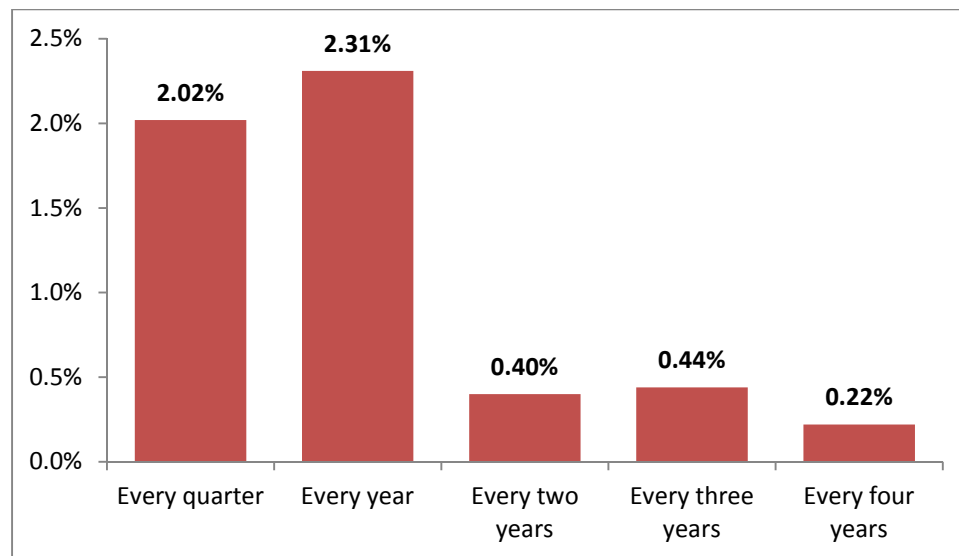
These results support our conjecture that the implicit (and perhaps unintended) sector choices of private equity managers predict the subsequent performance of public equity sectors with a substantial lead time, which is consistent with the notion of a J curve investment cycle.

Our next task is to differentiate the asset class alpha from an illiquidity premium. We first scale the returns of public equity and pseudo private equity so that they are risk equivalent to the return of private equity. We carry out this transformation by multiplying the public equity and pseudo private equity returns by the ratios of private equity volatility to the respective volatilities of public equity and pseudo private equity. We then subtract the risk-equivalent return of public equity from the risk-equivalent return of our pseudo private equity index to estimate the asset class alpha, and we subtract alpha from the excess return of private equity to estimate the illiquidity premium.

Exhibit 9: Disentangling the Private Equity Excess Return (3/31/02 – 9/30/13)

	Public Equity	Pseudo Private Equity*	Private Equity
Return	5.60%	7.63%	10.45%
Risk	17.83%	16.72%	17.13%
Return-to-risk ratio	0.31	0.46	0.61
Return rescaled to PE risk level	5.38%	7.81%	10.45%
Premium versus public equity	0.00%	2.43%	5.06%
Private equity asset class alpha			2.43%
Private equity illiquidity premium			2.63%
Total PE premium			5.06%

* Pseduo private equity is net of round-trip transaction costs of 20 basis points. Turnover is approximately 200% per annum.

The risk equivalent returns of public equity and pseudo private equity are 5.38% and 7.81% respectively; hence the asset class alpha equals 2.43% (7.81% - 5.38%). Because the total excess return of private equity is 5.06% (risk adjusted), the illiquidity premium equals 2.63%

(5.06% - 2.43%). This particular decomposition of private equity excess return depends, in part, on the fact that we constrained short exposures not to exceed 20% of the portfolio. If we did not constrain leverage, the pseudo private equity index would have produced a risk-equivalent alpha of 3.57% net of trading costs, resulting in an illiquidity premium of 1.49%.

Thus far we have focused on private equity performance relative to the MSCI USA, which includes the largest capitalization companies summing to 80% of the U.S. equity market. One might argue that, because privately held companies are relatively small on average, we should conduct our analysis based on an index of smaller capitalization companies. We do not believe the choice of the public equity index is an issue for the purpose of capturing the asset class alpha, because investors can extract the pseudo private equity alpha by netting out the MSCI USA, irrespective of the size of private equity companies. Some may argue, however, that the choice of the public equity index is relevant for the purpose of distilling the illiquidity premium from the private equity excess return. We disagree as we will soon explain, but nonetheless, we repeat the entire analysis using the S&P 600 Index as our public equity benchmark. This index includes the smallest 600 companies of the U.S. equity market and does not overlap with the MSCI USA. This analysis reveals that the risk-equivalent excess return of private equity relative to small capitalization public equity is 2.80% of which 1.50% constitutes an asset class alpha, leaving 1.30% as an illiquidity premium. Given this result, it may be tempting to argue that the illiquidity premium we distilled from the excess return of private equity over large capitalization public equity partly reflects a small capitalization premium. This may be the case, but because small companies are relatively expensive to trade and therefore

partly illiquid, we choose to interpret the premium of small companies as a component of the illiquidity premium. We believe it is preferable to estimate the illiquidity premium of private equity based on a highly liquid index rather than an index that itself is partly illiquid. [15]

This decomposition of the private equity excess return into an asset class alpha and an illiquidity premium has significant implications for the optimal allocation to private equity, which we next explore. We base the remainder of our analysis on the results using the MSCI USA as the benchmark for the reasons we have just cited.

Part IV: The Optimal Allocation to Private Equity

In this section we determine the optimal allocation to private equity in light of our decomposition of its excess return into an asset class alpha and an illiquidity premium. We assume the investor has the option to allocate to four asset classes: fixed income, public equity, pseudo private equity, and private equity.[16] Our intent is to show how the optimal allocation to private equity shifts as we introduce liquidity and pseudo private equity into the portfolio construction process.

We carry out our analysis by applying a variant of mean-variance analysis that was introduced by Kinlaw, Kritzman, and Turkington [2013]. Their framework treats liquidity as a shadow allocation, depending on how investors deploy liquidity. If an investor deploys liquidity to raise a portfolio's expected utility beyond what one would expect by holding constant the portfolio's composition, then a shadow asset is attached to the assets within the portfolio that can be traded to capture this benefit.[17] If instead liquidity is deployed to preserve the

portfolio's expected utility, then a shadow liability is attached to those assets that are not

tradable and thus prevent the investor from preserving the portfolio's original expected

utility.[18] This novel approach for incorporating liquidity into portfolio choice has the virtue of

converting liquidity into units of return and risk, as shown in Exhibit 10.[19]

Exhibit 10: Liquidity Benefits and Illiquidity Penalties

	Return (bps)	Risk (bps)	Attached to:
Benefits			
Market timing	40	80	Liquid assets
Total shadow asset	**40**	**80**	**Liquid assets**
Penalties			
Sub-optimality cost from asset drift	46	0	Illiquid assets
Sub-optimality cost from capital calls	3	0	Illiquid assets
Borrowing cost from capital calls	20	16	Illiquid assets
Total shadow liability	**69**	**16**	**Illiquid assets**

Next we combine our assumptions for the shadow asset and liability with our views for

the explicit assets of the portfolio.[20]

Exhibit 11: Expected Returns, Standard Deviations, and Correlations

Asset Class	Expected Return	Standard Deviation	Correlations					
			Public Equity	Fixed Income	Private Equity	Pseudo Private Equity	Shadow Asset	Shadow Liability
Public Equity	8.50	15.00	1.00					
Fixed Income	4.00	8.00	0.00	1.00				
Private Equity	12.17	22.68	0.73	0.00	1.00			
Pseudo Private Equity	10.33	16.72	0.96	0.00	0.70	1.00		
Shadow Asset	**0.40**	**0.80**	**0.00**	**0.00**	**0.00**	**0.00**	**1.00**	
Shadow Liability	**-0.69**	**0.16**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00

The decomposition of the private equity excess return into an asset class alpha and an illiquidity premium should have the following three consequences:

1. It should reduce the attraction of private equity relative to pseudo private equity because, although they both deliver the asset class alpha, pseudo private equity delivers it without the encumbrance of illiquidity.

2. It should reduce the attraction of public equity relative to pseudo private equity because with equal liquidity pseudo private equity offers an asset class alpha.

3. It should diminish the attraction of private equity relative to all liquid asset classes because it reveals a smaller illiquidity premium with which to offset the benefits of liquidity.

These expectations are confirmed in Exhibit 12, which shows how the optimal allocations to these asset classes change as we first ignore liquidity and asset class alpha, then consider liquidity but treat the entire private equity excess return as an illiquidity premium, and then recognize that the private equity excess return comprises an asset class alpha as well as an illiquidity premium.[21]

Exhibit 12: Optimal Portfolio Weights Adjusted for Liquidity and Asset Class Alpha
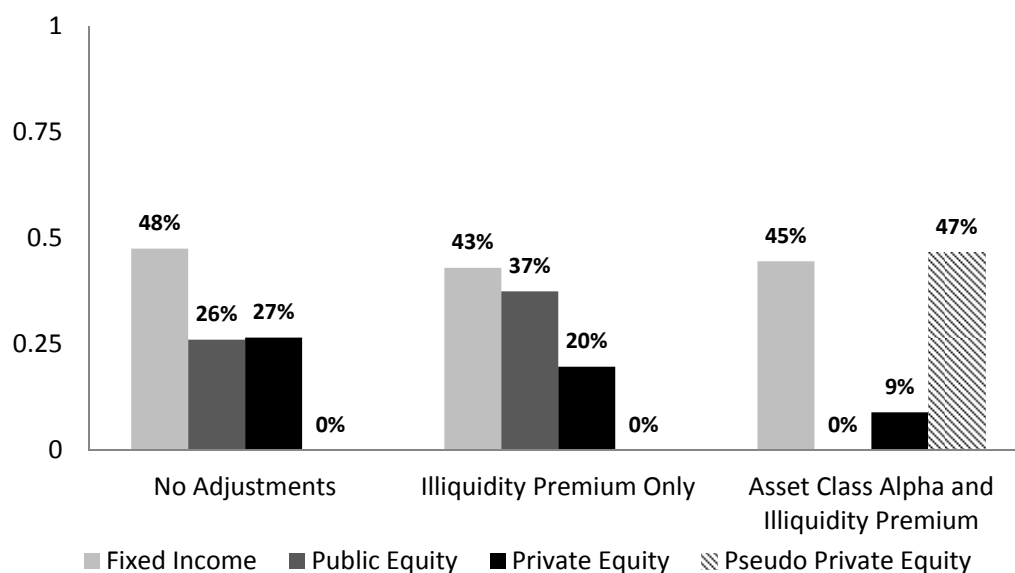
The specific allocations in our analysis depend on our assumptions for expected returns, standard deviations, and correlations. Nonetheless, we are very confident that the ordinal shifts we observe in this analysis would prevail for any set of return and risk assumptions that are grounded in theory and informed by history.

Part V: Summary

We use a proprietary database of private equity returns to measure the excess return of private equity relative to public equity covering a period of approximately 17 years. We then partition this excess return into two components: an asset class alpha and an illiquidity premium.

We conjecture that private equity managers as a group generate alpha because entrepreneurs first seek to fund their innovations privately and as these innovations take hold,

public investors follow. Hence, private equity managers have first mover advantage.

Alternatively or additionally, private equity managers may be skilled at identifying oversold

assets, which therefore have a relatively high expected return. We also conjecture that private

equity managers earn an illiquidity premium because they are less burdened by disclosure

requirements and because the lock-up periods they impose on their investors afford them

greater flexibility to seek long-term investment opportunities.

Our empirical analysis offers persuasive evidence that the sector weights of private

equity funds do indeed predict the subsequent performance of public equity sectors within

both large and small capitalization universes. This means that investors can capture this asset

class alpha using sector ETFs to match the sector weights of private equity funds without

incurring the encumbrance of illiquidity. We refer to this strategy as pseudo private equity.

We then show how this decomposition of the private equity excess return into an asset

class alpha and an illiquidity premium affects the optimal composition of a portfolio. Private

equity loses appeal relative to pseudo private equity because pseudo private equity delivers the

asset class alpha without subjecting the investor to illiquidity. And public equity becomes less

attractive relative to pseudo private equity because it does not offer an asset class alpha.

Finally, private equity becomes less attractive relative to all liquid asset classes, because it is

now seen to offer a smaller premium to compensate for its illiquidity.[22]

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[1] Throughout this paper we use the word alpha to mean a model-free, volatility-adjusted return in excess of an illiquidity premium. We do not use a factor-based asset pricing model because these models assume that assets are easily tradable, which is not the case for private equity. Hence, its return is more likely to be proportional to its total risk than its systematic risk.

[2] This specific attribution depends, in part, on the risk we assume investors are willing to accept in pursuit of alpha.

[3] This conjecture does not necessarily imply that private equity managers are particularly clever. They may be the unwitting beneficiaries of smart innovators who seek private funding.

[4] This rationale may apply to industries and factors as well. We focus on sectors because it is easy to invest in them at low cost by using sector ETFs.

[5] One might argue that private equity managers generate incremental alpha by restructuring companies, including replacement of management. We argue that this restructuring is enabled by lock-ups; hence, we characterize the incremental return from restructuring as part of the illiquidity premium.

[6] We focus on U.S. private equity funds because investors could capture the asset class alpha inexpensively in this market using sector ETFs. Furthermore, U.S. funds account for the preponderance of the private equity marketplace as well as 74% of our private equity database by capital commitments.

[7] The SSPEI includes venture capital, buyout, and distressed debt funds within the U.S. Its returns are dollar-weighted (IRR) within quarters and time-weighted across quarters. Net of fees, the SSPEI returned 12.3% annually compared to 7.1% for the MSCI USA, resulting in an annualized excess return of 5.2%.

[8] Specifically, we convert net-of-fee returns to gross-of-fee returns by adding back a base fee (2% annualized) and a performance fee (20% in excess of a 7.5% hurdle rate) using the model of Kinlaw, et al [2013].

[9] We de-smooth returns using the simple first-order autoregressive model of Kinlaw, et al [2013]. More sophisticated algorithms that optimize the number of lags produce similar results. See, for example, Neumaier and Schneider [2001].

[10] We include contemporaneous returns plus three lags in our regression. We require a sector to have an initial p-value of 10% or less to be included in our model. To be excluded, we require a sector to have a p-value of 15% or more. We net out market returns to improve the reliability of our results, given the arbitrariness of step-wise sequencing.

[11] We allow a small amount of leverage because sector underweights are informative and because this small degree of leverage is tolerable for most institutional investors.

[12] Castellaneta [2014] offers additional evidence that the sources of private equity performance vary across sectors.

[13] We account for publication lag in this back test. The SSPEI as of December 31 is not available until one quarter plus 15 days later. Our first regression is performed on January 15, 2002 using the SSPEI data through September 30, 2001. Note that there are two parts to this lag: the first is the data collection lag, which is "hard" and lasts one quarter (90 days). The second is the calculation lag, which is 15 days. We include round-trip transaction costs of 20 basis points given that this strategy could be implemented with sector ETFs.

[14] Again we constrain aggregate short positions not to exceed 20%.