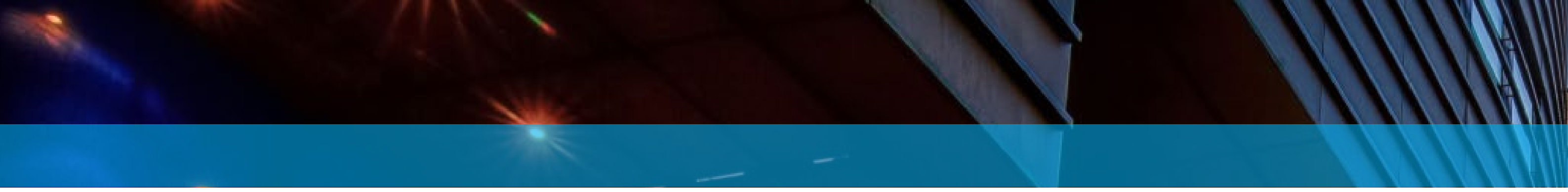
PANTHEON

in>focus

Should An Investor's Portfolio Contain Private Equity?

By Dr. Ian Roberts, Senior Research Associate

March 2015



IMPORTANT INFORMATION: Your attention is drawn to page 9 "References and Notes on Methodology" and the Important Disclosure on page 11.

Can private equity improve the risk-return profile of a portfolio of public equities?

INTRODUCTION

Though often assumed otherwise, private equity assets share many features with publicly-listed equities. The defining difference is that private equity is not traded continuously on a public capital market[1] and may not be bought or sold at will. As a result, we can only observe current market values of private equity assets when a transaction takes place between parties; and we are not able to use traditional techniques to compare the risk-return of private equity to public equities.

Aiming to circumvent these challenges, Pantheon has applied advanced techniques to examine the risk-return impact of including private equity in a portfolio of public equities. Based upon our analysis and methodology, we find that over the long run private equity assets appear to behave similarly to publicly-listed equities, but with potential significant alpha and diversification benefits. Our examination found that private equity assets may enhance an investor's risk-return profile when added to a diversified portfolio of publicly-listed equities. Based upon our historical dataset, our analysis identified the optimal allocation to private equity within our public equities portfolio (which we call our 'market portfolio'), and we calculated the portion of outperformance ('alpha') that the portfolio – which included an allocation to private equity – had the potential to generate. Please refer to note (vi) under "References and notes on methodology" on page 9 for a description of how our 'market portfolio' was derived.

DIVERSIFICATION

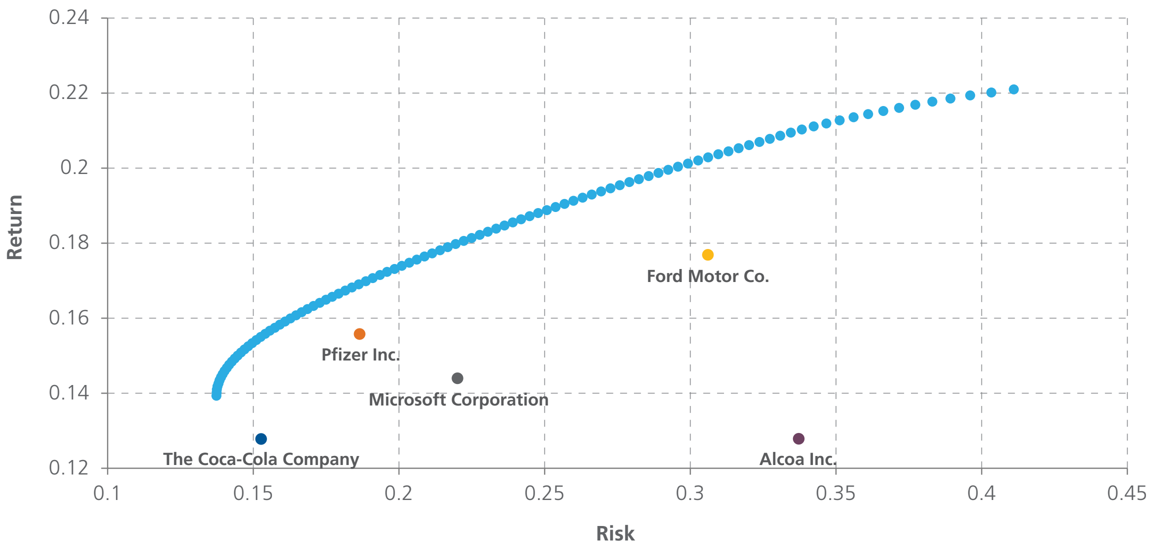
Much has been written about the benefits of portfolio diversification, and it has become common practice to hold a portfolio of assets with the objective of achieving a higher risk-adjusted return than offered by the constituent assets in isolation. Figure 1 on the following page demonstrates this graphically. Here we have taken the total returns observed through 2009-2014 on five well-known publicly-listed U.S. stocks, randomly selected, and plotted their risk-return through that period. Note that for any desired level of risk, the dataset displayed that the highest return came from a diversified portfolio of these five stocks, indicated by the blue line. This result arose because the stocks are not perfectly correlated; that is, they have correlations with each other of less than 100%. As we shall see, this is very relevant to the relationship between private equity and public equities. Please refer to note (i) under "References and notes on methodology" on page 9 for details of how the time period and these stocks were randomly selected.

According to the capital asset pricing model (CAPM), there are two common measures used when building a diversified portfolio:

Total risk-return. This calculates which assets have the highest expected returns per unit of risk using Sharpe ratio analysis. What follows from this approach is that a value-weighted portfolio of all assets will offer the highest risk-adjusted return[ii]. This portfolio is the 'market portfolio'.

[1] Other important differences include corporate governance, capital discipline, principal-agent issues with publicly listed stocks, liquidity risk and premia with private equity, and cash flow management.

Figure 1: The power of diversification



THE POWER OF DIVERSIFICATION

The y-axis shows the average return (annualized), and the x-axis shows the standard deviation of returns (annualized). For any chosen level of risk in this dataset the portfolio offering the highest return was composed of a mixture of the five available stocks rather than any single constituent in isolation. These portfolios are indicated by the blue line. The diversification benefits arose because the correlations between these stocks were less than 100%. The sample correlations calculated using historical total returns data range between 35% and 53%.

Systematic risk-return. This approach considers the alpha (outperformance) potential and beta (market exposure) of an asset in order to evaluate its risk-return profile[iii].

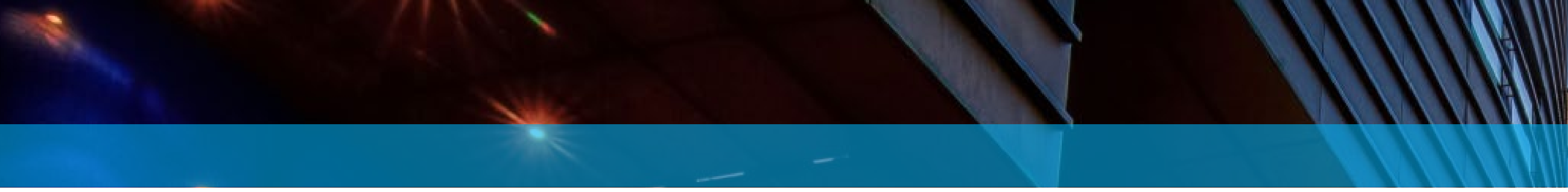
When we came to examine the diversification benefits of the private equity asset class, we therefore calculated measures for the total risk-return and the systematic risk-return, using private equity performance measures that are comparable to the return on public equities. However this was not possible to do using traditional techniques. Why was this not possible?

PRIVATE EQUITY AND STALE PRICING

Why is it that, although we receive quarterly net asset valuations (NAV) for private equity assets, we cannot simply use these to calculate their return?

There are two reasons, indeed two specific features unique to private equity assets, that explain this.

1. An accounting standard change introduced in 2007 required private equity assets to be valued at a 'fair market price', that is, to reflect an estimate of the potential transaction value of a private equity asset. Before this date private equity assets were frequently held at cost.
2. These fair market prices, represented by a quarterly NAV, don't in fact represent an up-to-the-minute valuation. Typically it can take more than a quarter for market conditions to be reflected in reported NAVs. This characteristic results in what is known as 'stale pricing'.



The consequence of this is that it is necessary to use advanced techniques in order to identify and measure the risk-return of private equity investments.

HOW WE APPROACHED OUR STUDY

Private equity is viewed as a relatively long-term asset class, and although there is a large and growing secondary market for private equity assets[iv], this remains true in general. Therefore, it makes sense to consider the risk and return for private equity funds over their entire lifetime, from inception to liquidation – a period that is typically at least 10 years. But to do so requires us to think 'outside the box'. First, we focused on actual cash flows for our core analysis, thereby aiming to circumvent the problem of stale pricing and changes in accounting standards.

We used data from industry data provider, Preqin, for U.S. buyout funds with vintages (fund inception dates) spanning 1992 to 2004. Accordingly, for our market portfolio we used a value-weighted index of all publicly-listed U.S. stocks. This is a much expanded universe compared to the S&P500, and although the two indices are highly correlated, our index also includes all the small and mid-cap companies that are arguably important in making a fair comparison to private equity. We refer to our index as MKT. Please refer to note (vi) under "References and notes on methodology" on page 9 for a description of how our 'market portfolio' was derived.

Throughout the study, we grouped individual private equity funds together into funds-of-funds to provide a more realistic picture of the risk-return properties of private equity, as experienced by an investor taking a diversified position across multiple private equity funds.

TOTAL RISK

For each vintage in the study we considered the distribution of portfolios of 10 private equity funds from that vintage. We did this, for each vintage, by randomly generating a sample of 2,000 combinations of 10 private equity funds that are possible using the Preqin U.S. buyout data from that vintage[vii]. This means that we equally-weight each vintage in our sample, spanning the period 1992 to 2004. Please refer to note (v) under "References and notes on methodology" on page 9 for more detail on our dataset.

It is common practice when measuring the performance of a private equity portfolio to calculate the Internal Rate of Return (IRR) or the Total Value to Paid-In (TVPI). However, we believe that neither of these measures is suitable for comparing private equity fund performance to other investments with differing cash flow patterns, such as a position in MKT.

Common private equity performance measures for comparison purposes are the public market equivalent (PME)[viii] and the Long-Nickels methodology[ix]. However neither of these measures gives a comparable rate of wealth creation for portfolios with anything between zero to 100% private equity allocation, and this is what we needed in order to map out the risk-return frontier for our analysis[x].

We needed to find a different approach that would work for our purpose and that approach is known as the Modified Internal Rate of Return (MIRR)[xi]. This measure is calculated by assuming that an investor's uncalled capital (capital that is yet to be invested in underlying portfolio companies) and distributions (resulting from sales or corporate actions) are invested in a tradable security such as T-bills or MKT. Please see "Explaining the MIRR" on page 8 for details about the MIRR calculation.

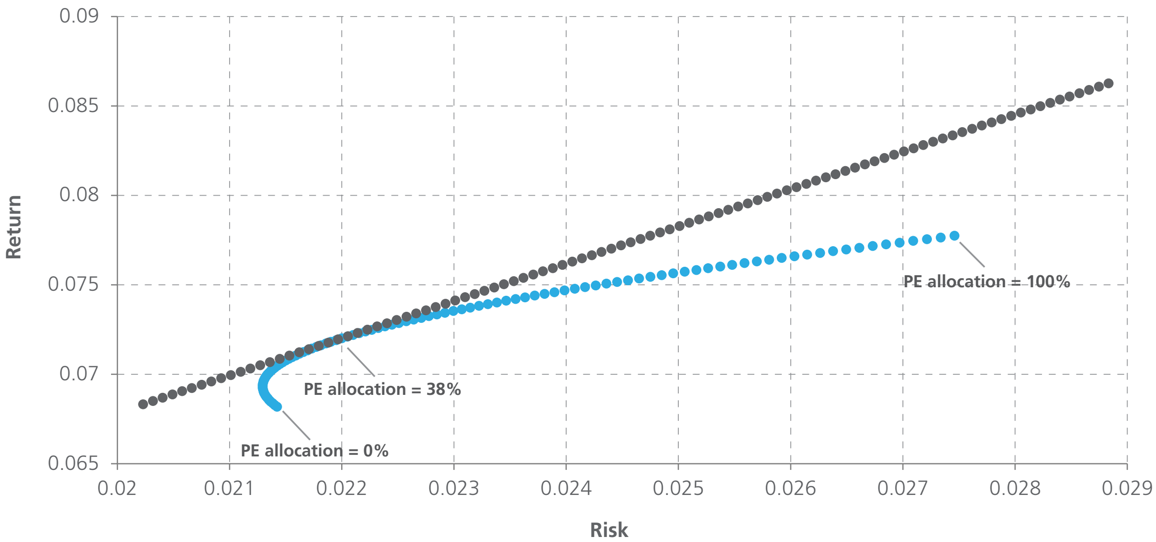
We modelled for an allocation range between zero and 100% to private equity and we used MKT as the reinvestment asset for our private equity dataset[xii]. Where zero allocation is made to private equity, the MIRR simply shows the

geometric mean return achieved on a lump-sum investment in MKT spanning the lifetime of the comparison private equity assets.

For each portfolio of 10 private equity funds we therefore had an observation of its MIRR, as well as an observation of the MIRR for MKT. Using this data we are able to estimate the covariance(xiii) and so map out the risk-return frontier. Please see Figure 2. The blue line indicates the risk-return achieved for the allocation ranges between zero to 100% to private equity. Portfolio theory then told us that on a risk-adjusted basis the optimal allocation to equities was given by what's known as the tangency portfolio(xiv), which in this case involved a 38% allocation to a portfolio of 10 private equity funds.

To consider why this result occurred, note that a portfolio of private equity funds (marked as the point "PE allocation = 100%" in Figure 2) would have offered a higher expected return than MKT (marked as the point "PE allocation = 0%" in Figure 2). At the same time it also entailed a higher dispersion in outcomes, as indicated by its higher risk level. To see this note that the 100% private equity portfolio is further to the right than the 0% private equity portfolio. All of this reflects established portfolio theory that the higher your risk position the higher your expected returns. However since the correlation between private equity and public equities was only 70.1%(xv), this suggested that private equity can provide significant diversification benefits when included in a portfolio of public equities, and that including

Figure 2: The optimal private equity allocation identified by our study



THE OPTIMAL PRIVATE EQUITY ALLOCATION IDENTIFIED BY OUR STUDY

The y-axis shows the average return (MIRR), and the x-axis shows the standard deviation in return (MIRR), for a range of portfolios with private equity allocations from 0% to 100%. Based upon our historical dataset, the portfolio of risky assets with the highest risk-return allocates 38% to private equity. This is known as the optimal portfolio of risky assets. The dashed grey line plots the risk-return of a portfolio composed of mixtures of T-bills and the optimal portfolio of risky assets. Classic portfolio theory tells us that regardless of your risk preferences, it is optimal to hold one of the portfolios indicated by this dashed grey line.

private equity in a portfolio of public equities can raise risk-adjusted returns.

The result of this risk-return analysis, (known as mean-variance analysis) suggests that, based upon our historical dataset, it was optimal to allocate 38% of the portfolio of risky assets as a commitment to private equity, where uncalled and distributions are invested in MKT.

Although there is a large and rapidly growing secondary market for private equity fund shares, private equity is relatively illiquid compared to public equities, and in order to make a fair comparison we believe one must apply a correction to the analysis. Adjusting for the reality of imperfect liquidity (i.e. the private equity investor can't sell his positions at will) would have reduced the optimal allocation to private equity to 23.6%[xvi]. For an investor with no liquidity constraints, our analysis suggests that the higher allocation of 38% would have been optimal.

SYSTEMATIC RISK

As discussed earlier, another important way of assessing the marginal benefit of adding private equity to a portfolio of public equities is by considering its alpha and beta.

For each vintage in our sample, we formed a fund-of-funds portfolio composed of U.S. buyouts from the Preqin dataset. We then applied a technique that estimates the alpha and beta that are required to give the fund-of-funds a net present value of zero[xvii]. This method is analogous to the procedure for estimating the IRR of a sequence of cash flows, and allows us to avoid any stale pricing issues.

We estimate a beta of 1.05, or put another way, confirm that, based upon our dataset and period under observation, there was a relation of approximately one-to-one between private equity and MKT returns. This makes sense - private equity is, after all, substantially similar to public equities. Private and public equity occupy the same position in the capital structure, and consequently the supply and demand for private equity assets is broadly influenced by the same macroeconomics as affects public equities. In particular, entry and exit opportunities are highly likely to be related to public market valuations.

The picture is completed by the economically and statistically significant alpha estimate of 3.16% (annualized), which is estimated via the same technique as described in the previous paragraph and is based upon the same historical dataset as referenced earlier. This alpha could be attributable to operational skill, compensation for illiquidity, or a combination of both.

What all of this suggests is that private equity fund commitments can provide an investor with a similar exposure to the risk and return offered by MKT, but with the added benefit of something that cannot be achieved simply by taking a leveraged position in the MKT - alpha. That alpha of 3.16% suggests that private equity can add value to a portfolio of public equities, by providing access to a potential extra annualized return of 3.16% that cannot be obtained using publicly-traded equities. This alpha implies a spread of 3.16% between private equity and public equities.

This historical analysis of systematic risk and returns therefore results in a similar conclusion to the previous section: inclusion of private equity assets may enhance the risk-return profile of a portfolio of public equities.

CONCLUSION

It is common to hear of the benefits that may accrue from holding a diversified portfolio of investments. However, given the particular profile of private equity and its valuation features, there has been no obvious way to pinpoint the diversification benefits from adding private equity to a portfolio of publicly-listed equities. On the one hand, private equity might be expected to behave much like public equities, but on the other hand private equity deals can sometimes be more leveraged, and might benefit from operational skill and any extra returns that might arise as compensation for illiquidity (i.e. the limitations of being able to sell private equity at will).

This study applied advanced techniques to examine the risk-return of private equity versus publicly-listed equities. The results appear to confirm the inherent similarities between private equity and public equities, but they also suggest that a private equity allocation can offer significant alpha and diversification benefits when added to a portfolio of public equities. These risk-return comparisons demonstrate that the classic portfolio theory regarding the benefits of portfolio diversification can also apply to private equity.

OUR KEY FINDINGS

Private equity behaved similarly to public equities over the long run but with alpha:

> We estimated a beta of 1.05 between private equity and public equities. This suggests that on average the potential transaction value of private equity investments moved in-step with public market returns.

> Based upon our historical dataset, private equity added value to a portfolio of public equities via an annualized alpha of 3.16%.

> This alpha suggests that, during the period under observation, private equity provided access to an extra annualized return of 3.16% each year on average that could not have been obtained using publicly-traded equities.

Private equity can provide diversification benefits to a portfolio of public equities:

> Private equity can offer higher returns and higher total risk than an index of public equities.

> This follows the classic maxim of financial markets: the more risk you take the higher your expected returns.

> However because the correlation between private equity and public equities was 70.1% (based upon our dataset), private equity provided diversification benefits when included in a portfolio.

> Analysis therefore indicates that adding private equity to a portfolio of public equities may raise risk-adjusted returns.

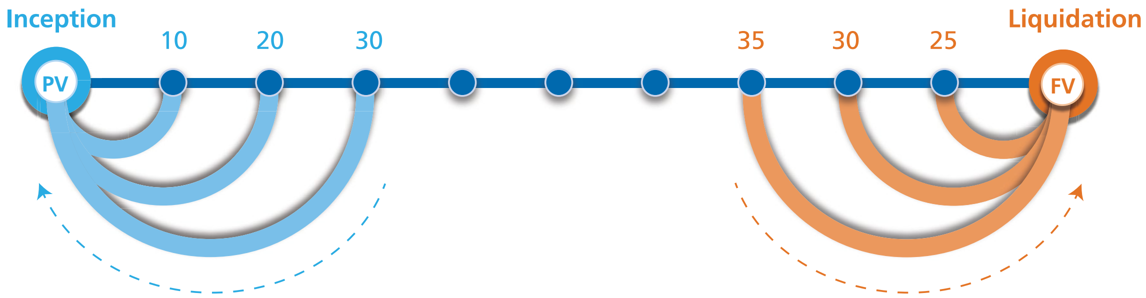
> Mean-variance analysis suggests that the optimal portfolio of risky assets should have included a 23.6% commitment to a diversified portfolio of private equity funds. This calculation included a penalty for private equity due to its relative illiquidity compared to public equities.

> Our analysis suggests that for investors with no liquidity constraints, the optimal allocation to private equity would have been 38%.

EXPLAINING THE MIRR

The IRR is only valid as a comparison in the event that the IRR is also available elsewhere for the investment of uncalled and the reinvestment of distributions. Use of the IRR could lead to unrealistic flattery of private equity fund performance. Meanwhile, the TVPI assumes that uncalled capital and distributions are not reinvested at all, which is an unrealistic penalization of private equity fund performance. Therefore we used what is known as the Modified Internal Rate of Return (MIRR)[xviii]. This measure is calculated by assuming that the LP's uncalled capital and distributions are invested in a tradable security such as T-bills or MKT. We then discount all commitments back to the time of the fund inception, using the return observed on this security. We denoted this the present value (PV) of commitments. Similarly we then compound all the distributions forward to the time of fund liquidation, again using the return observed on the reinvestment security. This was denoted as the future value (FV) of distributions. The MIRR is the annualized geometric mean return that compounds PV to equal FV. The MIRR was more accurate because it gave us a comparable rate of wealth creation for portfolios with anything between a zero to 100% private equity allocation, and does not suffer from issues with stale pricing[xix]. Note that in the event of a zero private equity allocation, the MIRR is just the geometric mean return achieved on a lump-sum investment in MKT spanning the lifetime of the comparison private equity assets.

Figure 3: MIRR explained



MIRR EXPLAINED

Capital calls (blue) are discounted back to inception using the return observed on the reinvestment security, and then summed to give the present value (PV). Distributions (orange) are compounded forward to the time of liquidation using the return observed on the reinvestment security, and then summed to give the forward value (FV). This gave us the present value of the calls and the forward value of the distributions, where the time value of money is given by the return observed on the reinvestment security. The MIRR is then the annualized geometric mean return that compounds PV to give FV.

For more information, please contact:

Dr. Ian Roberts
Senior Research Associate

Phone: +44 20 7484 6200
Email: ian.roberts@pantheon.com

REFERENCES AND NOTES ON METHODOLOGY

(i) The stocks (as well as the period) were selected randomly from a database of currently listed U.S. stocks. The requirements being (a) to select multiple U.S. stocks in order to be able to examine the correlation between them; and (b) selecting a multi-year period over which to do so. Whilst the time period under observation might have modified the specific conclusions for the particular subset of stocks chosen, the main result – that imperfectly correlated stocks can generate benefits from portfolio diversification – would have remain unchanged regardless of the time period (and indeed the stocks themselves) selected, as long as all five stocks were not perfectly correlated. Therefore, neither the specific stocks selected, nor the time period chosen, are central to our argument, and together represent only one possible example from many.

(ii) This comes from the Capital Asset Pricing Model. Any assets that do not have an appealing risk-adjusted return are demanded less by investors, lowering their price and increasing their risk-adjusted return. The result is that in equilibrium all assets form part of the 'market portfolio'.

(iii) Alpha is the average return an investor receives without bearing any exposure to the risk in the market portfolio (i.e. systematic risk), and beta captures the exposure to the risk in the market portfolio. Using these risk-return measures follows from the analysis of total risk-return. If the market portfolio is the default investment choice, then it makes sense to measure the value-add of an investment according to what returns the investor achieves that are not available from exposure to the risk in the market portfolio. Similarly, it makes sense to measure the risk in an investment according to how much extra exposure to the market portfolio is entailed in that investment.

(iv) Secondary market volumes rose from $25bn in 2011 to $42bn in 2014 according to Cogent Partners, Secondary Market Trends & Outlook, January 2015.

(v) The dataset commences in 1992 as there were too few usable U.S. buyout funds in the Preqin data prior to 1992. We cut the dataset off after 2004 to ensure we had at least 10 years of performance data to measure. For the 2004 vintage we therefore had 10 years of private equity cash flow data, i.e. our last observations were from 2014. We focused on U.S. buyouts as this was the Preqin subset with the largest amount of available data, and allowed for a more direct comparison to our U.S.-focused public market portfolio.

We started with the 1992 vintage, and then randomly selected 10 U.S. buyout funds with replacement, equally weighting each of them. We calculated the MIRR of this PE portfolio and the corresponding MIRR of MKT over the same period. We then repeated this process 2000 times so as to have 2000 of pairs of observations of the performance on PE and MKT, for the vintage 1992. The commitment period of each fund-of-funds ("FOF") is 1-year, the number of FOF is 2000 and we equally weighted each commitment to the 10 funds. We then repeated this for each vintage (1993, 2004).

For the public indices we used the CRSP value-weighted index and the MIRR calculation, assuming a lump sum commitment coinciding with the inception of the FOF, and a lump sum distribution coinciding with the liquidation of the FOF. In this circumstance the MIRR figure is equivalent to the geometric mean return on the CRSP value-weighted index for the time period spanning the inception and liquidation of the FOF.

(vi) We used the Centre for Research in Security Price's (CRSP) value-weighted index of all publicly listed U.S. stocks, because we believe it to be a good public market comparator for the U.S. buyout-focused private equity data we used in our analysis. The value-weighted index is a value-weighted portfolio built each calendar period using all issues listed on the selected exchanges with available shares outstanding and valid prices in the current and previous periods, excluding American Depositary receipts. Issues are weighted by their market capitalization at the end of the previous period.

(vii) For each vintage we looked at the sample of funds and randomly selected 10 funds with replacement to result in one re-sample. We then did this 2000 times for each vintage, so as to obtain 2000 re-sampled portfolios of 10 funds for each vintage. A program written using Matlab was used to implement this resampling exercise.

(viii) Kaplan and Schoar (2005).

(ix) Kocis et al (2009).

(x) To consider this, note that both the PME and Long-Nickels methodology involve comparing a portfolio of private equity funds to a strategy that invests in the benchmark in synchronization with the cash flows of the private equity portfolio. However, for a zero allocation to private equity the rate of wealth creation accruing to the investor is unrelated to the cash flows of the portfolio of private equity funds.

(xi) Franzoni et al (2012, Journal of Finance).

(xii) Note that changing the choice of reinvestment asset will influence the result. For example, we repeated this study using T-bills and unsurprisingly found that the portfolio of 10 private equity funds has lower risk and lower returns. However such a portfolio would be an unusual investment assuming one believes that MKT is the next best thing to private equity. As a result, it would be an unfair penalization of the private equity portfolio to assume that T-bills are used for reinvestment, as any sensible private equity strategy would arguably involve reinvesting in subsequent private equity funds, if not MKT. In terms of systematic risk, we estimated a lower beta (0.49) and lower alpha (20 bps annually) when using T-bills for reinvestment.

(xiii) This estimate takes care to correct for autocorrelation issues. This issue and the findings of the study more broadly are explained in greater detail in a forthcoming technical white paper. Please contact Pantheon directly if you would like a copy of the technical version of this paper.

(xiv) The tangency portfolio is the optimal combination of risky assets, and mixtures of the tangency portfolio and the risk-free asset will maximize return at each level of risk.

(xv) A portfolio's beta is equal to the covariance between the portfolio returns and MKT returns, divided by the variance of the MKT returns. Rearranging this algebraically, the correlation can be expressed as the beta multiplied by the ratio of the standard deviation of MKT returns to the standard deviation of the portfolio returns. So even though our beta is approximately one, the relatively higher standard deviation of private equity vs. the MKT lowers the correlation. In practice we estimate the correlation by first estimating the covariance and then scaling by the standard deviations. We take care to correct for autocorrelation issues. This issue and the findings of the study more broadly are explained in greater detail in a forthcoming technical white paper. Please contact Pantheon directly if you would like a copy of the technical version of this paper.

(xvi) This adjustment from 38% to 23.6% is guided by academic research. In particular, a standard calibration of Ang et al (2013)'s model suggests that an allocation to an illiquid risky asset should be 62% of what it would be in a setting where it did not suffer from illiquidity risk. This issue and the findings of the study more broadly are explained in greater detail in a forthcoming technical white paper. Please contact Pantheon directly if you would like a copy of the technical version of this paper.

(xvii) Driessen et al (2012, Journal of Financial and Quantitative Analysis).

(xviii) Franzoni et al (2012, Journal of Finance).

(xix) It also allows for the investment opportunity of uncalled capital; reinvestment of distributions; does not assume that an investor who is not invested in a GP's fund is able to observe when the GP is making calls or distributions; and offers well-behaved quantities.

IMPORTANT DISCLOSURE

This publication has been prepared solely for use by sophisticated investors / professional clients in the U.S. and U.K. only for illustration, educational and or discussion purposes. It does not constitute independent research and under no circumstances should this publication or the information contained in it be used or considered as an offer, inducement, invitation, solicitation or recommendation to buy or sell any security or financial instrument or service or to pursue any investment product or strategy or otherwise engage in any investment activity or as an expression of an opinion as to the present or future value or price of any security or financial instrument. Nothing contained in this publication is intended to constitute legal, tax, securities or investment advice. Nothing contained in this publication is intended to be published or made available in any jurisdiction where to do so would result in a breach of any applicable law or regulation.

In all jurisdictions other than the U.S. this document is issued by Pantheon Ventures (UK) LLP (“Pantheon UK”), which is authorised and regulated by the Financial Conduct Authority (FCA) in the United Kingdom. Pantheon UK’s registration number is OC352463 and its registered address is Norfolk House, 31. St. James’s Square, London, SW1Y 4JR. In the U.S., this document is issued by Pantheon Ventures (US) LP which is registered as an investment advisor with the U.S. Securities and Exchange Commission (“Pantheon US” and together with Pantheon UK “Pantheon”).

Past performance is not a guide to the future. Market and exchange rate movements may cause the capital value of investments, and the income from them, to go down as well as up and the investor may not get back the amount originally invested.

This publication may include “forward-looking statements”. All projections, forecasts or related statements or expressions of opinion are forward-looking statements. Although Pantheon believes that the expectations reflected in such forward-looking statements are reasonable, it can give no assurance that such expectations will prove to be correct, and such forward-looking statements should not be regarded as a guarantee, prediction or definitive statement of fact or probability.

The historical data set and conclusions here are purely illustrative, and representative only of a small sample of possible scenarios. The conclusions applicable to this data are based on the back tested performance of randomly selected investments over the time period indicated. “Back testing” is a process of objectively simulating historical investment returns by applying a set of rules for buying and selling fund shares backward in time, testing those rules, and hypothetically investing in the shares that are chosen. Back testing is designed to allow investors to understand and evaluate certain strategies by seeing how they would have performed hypothetically during certain time periods.

It is possible that the markets will perform better or worse than shown via this study, the actual results of an investor who invests in the manner this study highlighted can be better or worse than concluded here, and an investor may lose money by investing in this way. Although the information contained herein has been obtained from sources believed to be reliable, its accuracy and completeness cannot be guaranteed. While back testing results reflect the rigorous application of the data selected, back tested results have certain limitations and should not be considered indicative of future results.

Pantheon has taken reasonable care to ensure that the information contained in this document is accurate at the date of publication. However, no warranty or guarantee (express or implied) is given by Pantheon as to the accuracy of the information in this document, and to the extent permitted by applicable law, Pantheon specifically disclaims any liability for errors, inaccuracies or omissions in this document and for any loss or damage resulting from its use. Unless stated otherwise, any opinions expressed herein are current as of the date hereof and are subject to change at any time. Unless stated otherwise all views expressed herein represent Pantheon’s opinion.

PVL 6249

PANTHEON

London > San Francisco > Hong Kong > New York > Seoul > Bogotá

www.pantheon.com