



**Scientific Infra
& Private Assets**

WHITE PAPER · PRIVATE MARKETS RESEARCH

Benchmarking Private Market Performance

Finding Alpha in Private Market Funds

Most of a private fund's return comes from market exposure (beta), not manager skill. Peer-group and public-market benchmarks cannot separate the two; a Private Market Equivalent (PtME) built on asset-level private market indices can — revealing that net alpha is close to zero on average, driven mostly by sector allocation rather than investment selection.

Executive Summary

Investors in private asset funds, such as private equity and private infrastructure funds, aim to select top-performing fund managers. However, by definition, only 25% of funds can be in the top quartile, leaving most investors (Limited Partners, or LPs) with lower-performing funds. Measuring outperformance is crucial for LPs when selecting new managers or deciding whether to reinvest with existing ones. This paper explores different benchmarking methods to assess private asset fund performance using a large dataset of fund cash flow and NAV data.

1 Most fund returns come from market performance, not manager skill.

- Private equity fund managers function like active equity managers, with returns largely driven by market exposure (beta) rather than true outperformance (alpha).
- Private funds outperform public markets on average, but this does not help investors select the best managers.

2 Traditional benchmarking methods are flawed.

- Peer Group Comparisons fail to separate market-driven returns from manager skill, making manager selection unreliable.
- Public Market Equivalents (PME) use public indices, which do not reflect private market risks and returns, as benchmarks.

3 Private Market Equivalents (PtME) provide the best benchmarking approach.

- Uses private market indices to distinguish allocation alpha (sector selection) from pure alpha (manager skill).
- Findings show that most private funds generate zero net alpha after fees, confirming that manager skill is not consistently rewarded.
- Successful funds tend to outperform by choosing high-performing sectors rather than superior investment selection.

Investors cannot reliably pick top-performing managers using traditional benchmarks. PtME is the most effective method for assessing manager skill, revealing that true alpha is rare and primarily driven by sector allocation rather than investment selection.

Table of Contents

MAIN SECTIONS

I	Introduction
II	Approach
III	Private Asset Fund Dataset
IV	Peer Group Benchmarking
V	Fund Manager Indices
VI	Using Market Proxies
VII	A Private Market Equivalent (PtME)
VIII	Alpha Persistence
IX	Conclusions

APPENDICES

A	Fund Sample vs Burgiss Manager Universe
B	Impact of Stale Appraisals on Fund IRRs
C	Direct Alpha Methodology
D	Fund Manager Alpha Persistence Probability
E	Private Fund Alpha with the privateMetrics® API
F	The privateMetrics® Market Indices
G	The privateMetrics® Valuation Model

Introduction

Investors in private asset funds, like private equity or private infrastructure funds, all want to select top quartile fund managers. Yet, by definition, only 25% of funds and their managers can be in the top performance quartile in any given fund vintage. This leaves most of the limited partners (LPs) of private funds invested in lower-, if not badly, performing funds, three quarters of the time (again, by definition).

Measuring private asset fund outperformance is an important part of a complex investment decision for LPs, who need to select new managers and decide whether or not to “re-up” with existing managers on a regular basis.

This paper examines how investors may assess the outperformance of private asset funds using different types of benchmarks. We use a large sample of fund cash flow and NAV data covering both buyout and private infrastructure equity funds, and test different approaches available to LPs to benchmark private funds. Of course, benchmarks can also be important to fund managers (or General Partners, GPs) who often need to showcase their historical performance as fairly as possible to raise capital for new funds.

Our most important premise is that private asset investing does not happen in a vacuum, but in a market for private assets i.e. the market for the equity stakes of private companies. This market is very large: we estimate the Broad Market Universe (BMU) for private equities and infrastructure companies combined, in 160 countries, to represent c.USD65T of market capitalisation as of YE2024 or approximately USD120T of Enterprise Value. We further estimate the size of the Private Equities Universe (PEU), a subset of the BMU meeting certain criteria of size, profitability and activity that reflects the characteristics of the transactions made by private equity fund managers, to represent 192k companies or c.USD20T of market capitalisation and c.USD39T of enterprise value. In comparison, with approximately USD5T of AuM according to Preqin, buyout or infrastructure fund managers only hold a minority of existing private companies.

This is a key point when it comes to benchmarking: while LPs mostly access private assets through funds, private asset funds are not the private asset market, but only a slice of it. The private market into which GPs invest on their behalf is much larger and the adequate benchmark for this market is very unlikely to be limited to what private fund managers do.

As in any market, the market price of private equities is driven by supply and demand: if more investors want to buy stakes in AI companies in 2025, the market price of the average AI company must go up, and vice versa. As a result of private market price dynamics, any investor in a private equity fund is exposed to private equities market risk, just like any investor in a public equity or mutual fund is exposed to public equities market risk.

In effect, in the market for private equities, private fund managers are the equivalent of long-only active equity managers. As such, their performance should be described with the familiar combination of their market beta i.e., how exposed their portfolio is to private asset market risk, and their alpha i.e., performance achieved over (or below) that of the market.

While this framework is very familiar to any investor in public equity funds, estimating the market beta and alpha of private funds has long been challenging due to a lack of robust and representative market data and benchmarks. In this paper, we consider three approaches to benchmarking the performance of private asset funds and their managers:

1/ Peer-grouping using reported fund returns and multiple quartiles or indices of fund manager returns. This approach amounts to using an active fund manager benchmark, thereby conflating the market beta and alpha of each fund. In other words, a fund that performs well because it is exposed to a rising market is indistinguishable from one that performs equally well because it selected and managed specific investments skilfully. We find that most buyout funds beat their hurdle rate, indicating that selecting funds on the basis of an absolute return benchmark is no guarantee of selecting the best funds. We also show that the endemic paucity of reported data must lead to very low confidence in selecting the right manager on the basis of manager peer groups.

2/ Public Market Equivalents (PME) using a listed equity index as the market proxy. Conceptually, the Direct Alpha version of the PME represents significant progress on peer group data: it aims to separate a fund's beta from its alpha and addresses the robustness issue of peer group data, as a market index can achieve robustness through diversification. However, PMEs use a public equity reference, which is not representative of the risk of private equities. Indeed, the private equities universe is different from public equities, where companies tend to be larger and buyers and sellers have different investment preferences. At best, PMEs provide information about the relative benefit of investing in a given private fund instead of a cheaper listed alternative. While the average private manager outperforms the public equities market, this does not help in choosing better fund managers since they are not being compared to the relevant benchmark. As a result, investors in private asset funds cannot confidently pick a top performing manager using a PME.

3/ Private Market Equivalents (PtME), conceptually similar to PMEs but using a newly available, asset-level private market index as the benchmark. The PtME approach allows fund alpha and beta to be measured against a private market index, as well as the fund alpha to be split between two sources: "allocation alpha" obtained by selecting sector tilts different from the broad market, and "pure alpha" generated by selecting, structuring and timing investments.

Results are very similar to the well-established academic literature on active equity managers: on average, private asset funds produce zero alpha net of fees. A famous 2010 paper by Eugene Fama and Kenneth French, entitled "Luck versus Skill in the Cross-Section of Mutual Fund Returns", analyses the performance of actively managed U.S. equity mutual funds relative to the market benchmark. Their key conclusion was that mutual fund performance is distributed around the market benchmark, with little evidence that active managers, on average, can consistently outperform after accounting for costs. A similar result with the PtME confirms that Scientific Infra & Private Assets (SIPA) private market indices represent the relevant market i.e., if the market index represents the average market performance, then it is normal that about half of the investors in this market perform better than the average, while the other half does not.

We also show that most of the returns of private equities funds come from market returns, while alpha is very variable, with some funds generating high positive alpha while others underperform the market. Moreover, most of the positive alpha of private asset funds comes from making informed allocation tilts i.e., picking sectors that perform better than the broad private equities market, while net pure alpha is negative on average and close to zero before fees, but can be very positive or negative at the individual fund level.

Finally, we look at alpha persistence in private funds and find that the average manager does not generate alpha consistently. In other words, the average manager has a 50% chance of generating alpha with their next fund. However, we show that some managers are much more likely to do so than others, with a few generating alpha with 90% probability time after time.

We discuss the implications for fund benchmarking and selection in the conclusion.

Approach

Review of Benchmarking Methods in Private Markets

In this paper, we use a database of 1,000+ private funds that is representative of the private equity (buyout) and private infrastructure fund universe through which LPs have been investing over the past decades (see next section and Appendix A).

We use cash flow and fund NAV data to review different benchmarking approaches available to fund investors in private asset markets and consider to what extent LPs are more or less likely to select the best buyout or infrastructure fund managers using each approach and available data.

We first consider the Peer Grouping of fund returns and multiples quartiles, as well as indices using pooled fund manager returns. Such indices represent an average of 'long-only' private funds and not the assets that make up the market but rather a combination of market risk, cash flow risk and liquidity risk to which investors are exposed within each fund.

We then consider using listed equity market proxies in the form of Public Market Equivalents (PME), using the Direct Alpha methodology – a well-established metric of private fund outperformance relative to a market index.

Finally, we look at Private Market Equivalents (PtME), using private market indices created by SIPA for the private equities and private infrastructure markets with the Direct Alpha methodology.

These indices use asset-level prices to reflect the dynamics of the market for private equities i.e., the market risk to which private asset funds are exposed. They are built to be representative of the private equities universe (PEU) in which private fund managers invest and can also be adjusted or customised to reflect the choice of sector or geography exposures made by fund managers. These indices are registered with ESMA and as a result comply with IOSCO benchmark guidelines, which is not the case for peer group benchmarks.

The impact of the fund lifecycle

Because private market funds take several years to be fully invested, in the early years, fund investors continue to pay fees on their total commitment, while receiving return only on a part of their portfolio. This creates what is known as a “J-curve effect”: the typical pattern of a fund's net cash flow or net asset value (NAV) over its lifecycle resembles the shape of the letter "J". Therefore, in this paper we divide our data into three subsets:

- **All Funds** analysed together to describe alpha patterns over the fund lifecycle.
- **Fully-Invested funds** until the 2018 vintage to examine long-term alpha generation.
- **Still-Investing funds** of more recent vintages (from 2019) and likely still investing.

The impact of appraisals

As mentioned in the introduction, our approach consists of estimating fund alpha using reported cash flows and NAV. This begs the question of the impact of appraisals on the estimation of fund alpha since private asset funds have been shown not to update the NAV of their investments to reflect the latest state of market prices (see for example Cummings & Walz 2010, Jenkinson et al., 2013 and Brown et al., 2019).

We show in Appendix B that this effect is likely to be significant in younger funds for which the use of under- or over-valued NAVs likely distorts reported IRRs and the implied Alpha estimate. Conversely, the more mature the fund becomes, the less stale appraisals distort the IRR computation and the relevant Alpha calculation.

For this reason, we present our results first for fully invested funds and then for all funds.

The impact of fees

Fees play an important role in private markets and can be much higher than in public equity markets. The cash flow data described above is sourced net of fees and the IRR and TVPI are also computed net of fees using these cash flows and the reported NAV.

To better understand how fees impact returns and the difference between Alpha and net Alpha, we built an estimate of the average impact of management fees and carry in infrastructure and buyout funds.

We approximate this impact using the fee terms for the funds in a large sample of funds (see next section) and the average IRR of private equity and infrastructure funds, as shown in Table 1.

Note that we only consider management fee and carry as the main components of expenses in private market funds, when in practice, there can be other expenses as well that can impact the final net of fees return. Still, management fees and carry can be considered to be the primary drivers of investment costs in private funds (see Phalippou, 2020).

■ **TABLE 1 – AVERAGE FEE TERMS IN PRIVATE EQUITY AND INFRASTRUCTURE FUNDS**

METRIC	PRIVATE EQUITY FUNDS	PRIVATE INFRASTRUCTURE FUNDS
Number of Obs.	559	100
Vintage Years	2013–2024	2011–2024
Average Management Fee	1.9%	1.6%
Average Carry	20%	18.5%
Average Hurdle	8%	7.6%
Average Impact on Net Return	3.34%	1.50%

Assuming the average IRR across funds represents the annualised return of a typical fund, we define the following relationship:

$$\text{Net IRR} = \text{Gross IRR} - \text{Mgmt Fee} - \text{Carry} \times \max(0, \text{Gross IRR} - \text{Mgmt Fee} - \text{Hurdle Rate})$$

Using this relationship and the data in our sample, we estimate the average impact of fees on returns to be 1.50% in infrastructure funds and 3.34% in private equity buyout funds. The large difference between the two asset classes springs from the level of hurdle rates, which is almost similar in infrastructure and buyout funds when average realised returns are much lower in infrastructure investment as shown above.

In what follows, we compute estimates of net fund Alpha and use the average fee impact reported above to further discuss the findings.

Private Asset Fund Dataset

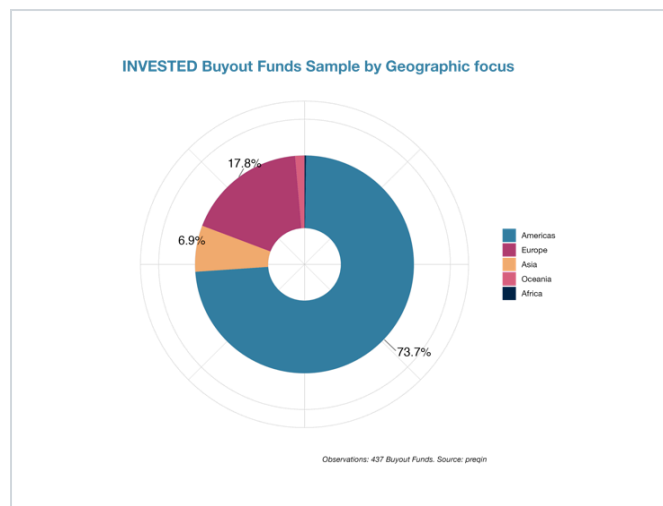
This paper uses a large and representative sample of private equity and private infrastructure funds for vintages 2013 to 2024. The data is sourced and processed from a combination of sources including Pitchbook, Preqin and hundreds of Fund Annual Reports.

Buyout fund sample

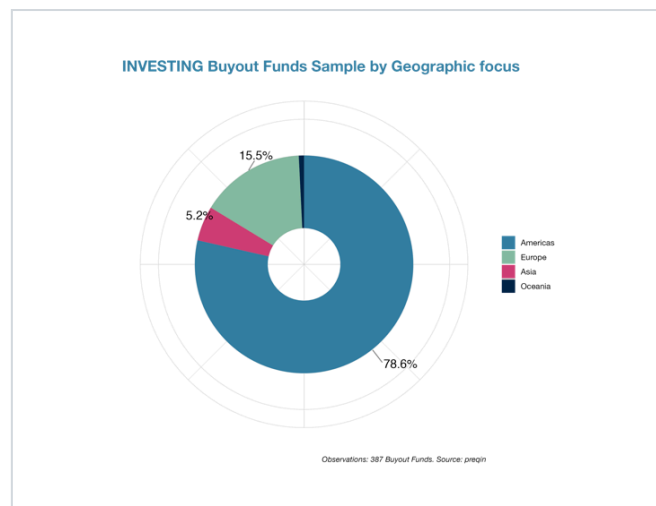
The private equity fund sample include 824 buyout funds from the 2013 to 2024 vintages with a combined Assets under Management (AuM) of \$2tn. Our sample includes funds for which a complete set of historical cash flow data could be obtained. This is approximately half the MSCI/Burgiss fund manager universe for the same vintage years (1,529 funds, \$2.7tn AuM). As shown in Appendix A, our sample of buyout funds is aligned with the MSCI universe and can be considered representative of the buyout opportunity set for LPs in the relevant period. Figure 1 shows the sample of buyout funds by investment region and sector focus for either invested (pre-2019 vintages – 1A and 1C) or still investing funds (1B and 1D).

■ **FIGURE 1 – BUYOUT FUND SAMPLE BY REGION AND SECTOR FOCUS**

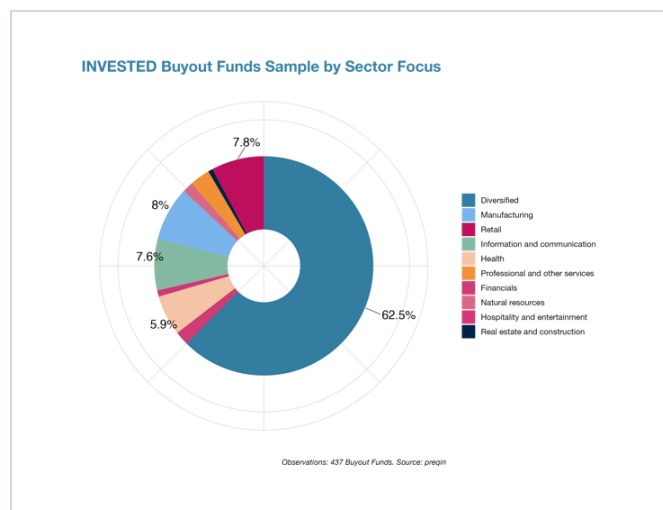
1A – INVESTED · REGION



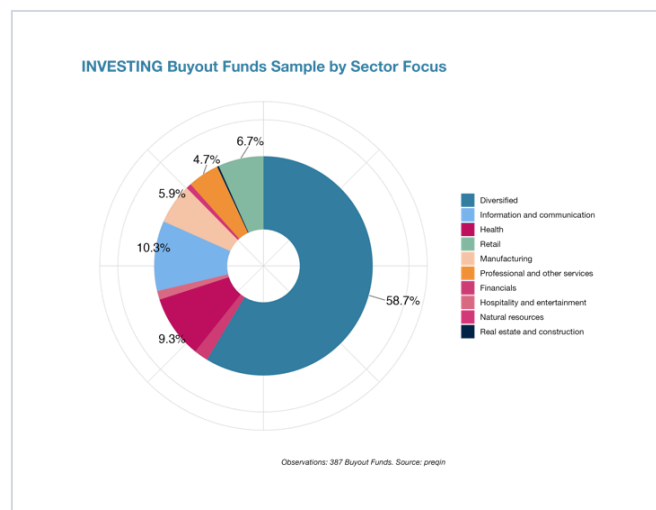
1B – STILL INVESTING · REGION



1C – INVESTED · SECTOR



1D – STILL INVESTING · SECTOR



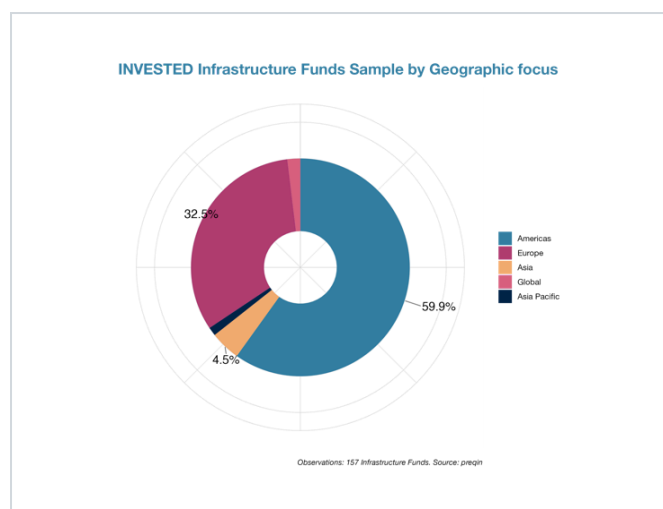
Private infrastructure fund sample

There are 263 infrastructure funds in our sample with vintages ranging from 2011 to 2023 and total AuM of \$650bn. For comparison, the MSCI Burgiss database has 297 infrastructure funds with a total size of \$696bn. We also show in Appendix A how this sample is consistent with the MSCI/Burgiss manager universe, confirming its representativity of the infrastructure fund opportunity set available to investors.

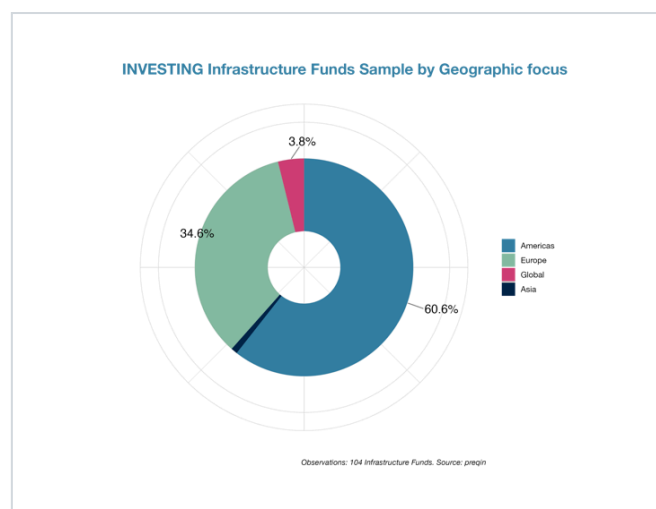
Figure 2 shows the proportion of funds by investment region and sector focus for fully invested (2A, 2C) and still investing funds (2B, 2D).

■ **FIGURE 2 – PRIVATE INFRASTRUCTURE FUNDS SAMPLE BY REGION AND SECTOR**

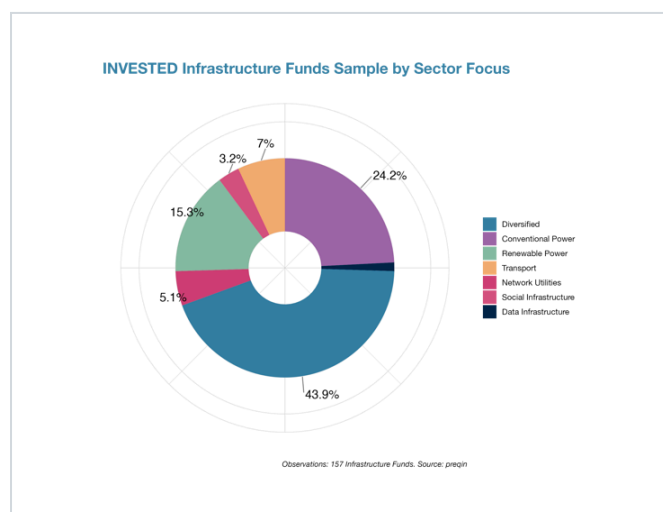
2A – INVESTED · REGION



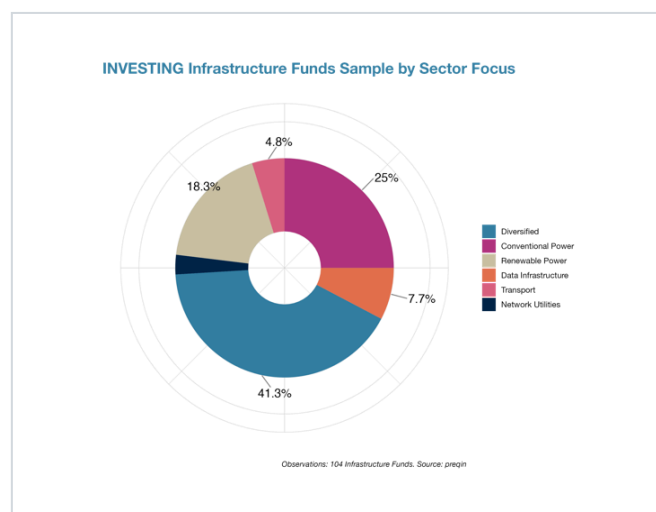
2B – STILL INVESTING · REGION



2C – INVESTED · SECTOR



2D – STILL INVESTING · SECTOR



With both types of funds, we see that the fully-invested and still-investing funds (post 2019 vintage) represent fairly similar exposures to different markets and sectors or combination of sectors.

The two samples include a majority of funds focused on North America, as well as a majority of “diversified” strategies i.e., investing across multiple sectors. The proportion of other sector-specific strategies, while different in the two cohorts of funds, remains comparable.

Thus, any large difference between the two generations of funds is unlikely to be driven by shifts in the sector or geographic focus on the funds.

Fund Performance

We use the funds’ reported cash flows and NAV to compute an IRR and TVPI, thus ensuring consistent comparisons between funds. As shown in Tables 2 and 3 (also Figure 3), buyout funds have a mean (median) net IRR of 14.4% (13.7%) and a mean and median net TVPI of 1.3x, while infrastructure funds have a mean (median) net IRR of 6.3% (6.9%) and mean (median) TVPI of 1.2x (1.1x).

The net IRR IQR or inter-quartile range is 2,728 basis points for buyout funds (1,782bps for infrastructure). The IQR of the net TVPI is 0.6x (0.4x for infrastructure). Clearly, the dispersion of returns is very large, albeit less so for infrastructure funds. This is likely with private asset funds that are mostly concentrated in a few assets.

The buyout fund sample contains 437 fully-invested funds (2013-2019 vintages) and 387 still-investing funds from vintages younger than 2019 (Table 2). As expected, older vintages achieve higher IRRs on average but also include a wide range of values from very negative to very high returns, on par with the range of values found in still-investing funds.

The infrastructure fund sample contains 157 fully-invested funds (2011-2019 vintages) and 104 still-investing funds (Table 3). Here, the median IRR of younger funds is higher than that of older vintages, suggesting that the market in which younger infrastructure funds invest has changed over time. We know that the sectors and geographies of the two fund cohorts are not very different (see above). This is because expected returns have increased in infrastructure markets since 2019 (see infraMetrics). Clearly, this makes comparisons between cohorts difficult without taking into account the impact of the market on returns.

■ TABLE 2 – PRIVATE EQUITY FUND IRR STATISTICS

METRIC	ALL	FULLY INV.	STILL INV.
Number of Obs.	824	437	387
Min Net IRR	-60.3%	-52.5%	-60.3%
Mean (median) IRR	14.4% (13.7)	16% (14.7)	12.6% (11.7)
Max Net IRR	169%	144%	169%
Min Net TVPI	0.08x	0.09x	0.08x
Mean (median) TVPI	1.34x (1.25)	1.52x (1.44)	1.14x (1.11)
Max Net TVPI	5.08x	5.08x	3.59x
Positive Net IRR	73.7%	81.5%	64.9%
Net IRR > 8%	61.2%	66.4%	55.3%
Net IRR > 6%	65.1%	70.9%	58.7%

■ TABLE 3 – PRIVATE INFRASTRUCTURE FUND IRR STATISTICS

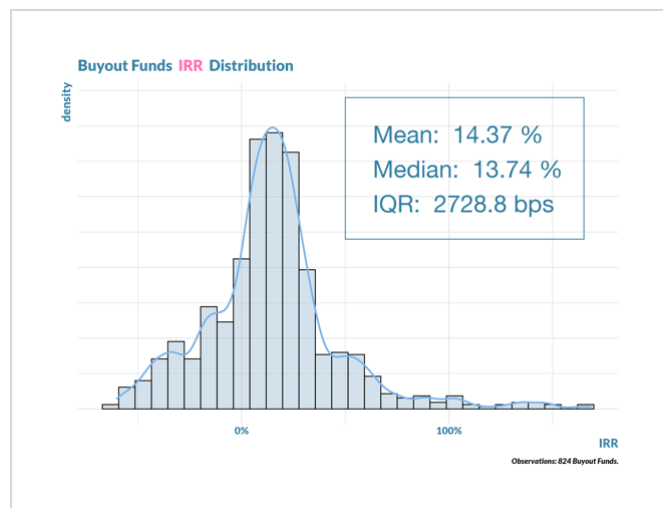
METRIC	ALL	FULLY INV.	STILL INV.
Number of Obs.	261	157	104
Min Net IRR	-62.7%	-61.7%	-62.7%
Mean (median) IRR	6.34% (6.9)	6.81% (6.1)	5.63% (8.8)
Max Net IRR	144%	144%	115%
Min Net TVPI	0.04x	0.3x	0.04x
Mean (median) TVPI	1.17x (1.13)	1.23x (1.19)	1.06x (1.09)
Max Net TVPI	2.83x	2.83x	2.49x
Positive Net IRR	68.4%	72.0%	63.2%
Net IRR > 8%	48.3%	44.6%	53.8%
Net IRR > 6%	52.5%	50.3%	55.7%

Source: privateMetrics, infraMetrics. Net IRR and TVPI computed from reported cash flows and NAV.

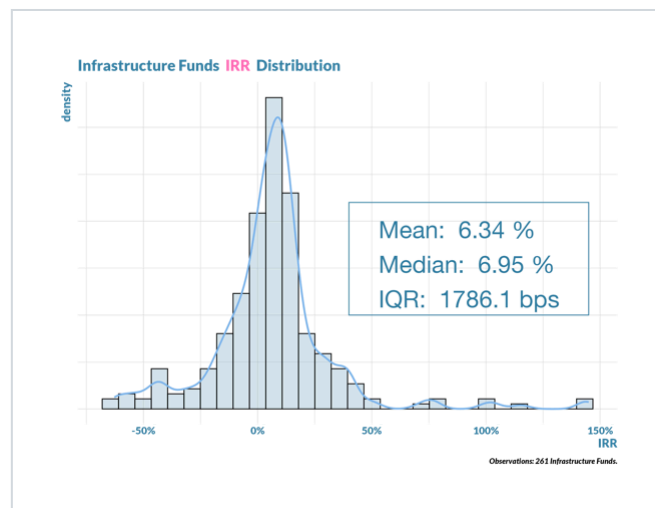
Table 2 and 3 also show that 81.5% fully-invested funds in the buyout sample have a positive net IRR (72% for infrastructure), 66.4% have an IRR higher than 8% (44.6% for infrastructure), and 71% higher than 6% (50.5% for infrastructure). Thus, the majority of fully-invested and even of still-investing funds show positive performance in absolute terms and half or more have achieved returns higher than their hurdle rate.

■ FIGURE 3 – BUYOUT AND INFRASTRUCTURE FUND IRR DISTRIBUTION (ALL VINTAGES)

BUYOUT FUNDS



INFRASTRUCTURE FUNDS



At this stage, we can make the following remarks when it comes to benchmarking the performance of private asset funds:

- **Usefulness of absolute return benchmarks:** The ability of funds to beat their hurdle rate or a typical absolute return benchmark is not very useful to select the best managers: half or more of the funds achieve this level of return even after being fully-invested but investors cannot know how much risk was taken to clear this hurdle.
- Comparing recent fund performance to historical data without taking into account the state of the market at the time of older vintages could lead to misleading comparisons. For instance, more recent and still-investing infrastructure funds exhibit higher returns than older, fully invested vintages. Is it because expected broad market infrastructure returns have increased or because infrastructure fund managers have moved up the risk spectrum?
- **Robustness:** The very wide dispersion of performance metrics suggests that a lot of data is needed to estimate quartile rankings in a robust manner (we return to this below).

Next, we consider how investors can use different benchmarks to try and answer such questions. In particular, we consider how likely they are to pick the best funds when using each benchmarking approach.

Peer Group Benchmarking

Peer-grouping consists of comparing the performance of an individual fund or manager with a sample of fund data grouped by asset class (e.g., buyout or infrastructure), geographic focus, vintage year or sector specialisation. This approach raises two key questions:

- **Conceptually:** By aggregating fund-level data, peer grouping conflates the impact of market risk on performance (the beta of the fund) with the added value of the manager (the alpha they create through their investment choices). A fund peer group is a long-only, active (private) equities manager benchmark, but not a market benchmark.
- **Empirically:** In principle, the absence of distinct measures of fund beta and manager alpha could be addressed through the construction of representative and robust peer groups. Unfortunately, as we demonstrate below, this is virtually impossible to achieve in private markets due to an endemic lack of data. Even if all private transaction price data was available, there would still not be enough data to build robust and representative peer-group benchmarks.

Next, we consider the different ways in which peer-grouping is likely to lead to misleading conclusions when it comes to selecting the best funds.

Peer group data is biased

Peer-grouping is so common in private fund investing that it is often referred to as “benchmarking” by data vendors, despite the fact that such approaches have little to do with a market benchmark.

Indeed, a good market benchmark should be relevant, unambiguous, specified in advance and include a curated list of constituents determined by an index administrator to ensure that the index is representative of the price dynamics of the market of interest at all times.

Instead, pooling fund manager data creates numerous biases:

- **Selection Biases:** Fund managers exercise discretion over whether, when, and how they report performance to industry databases. They may report only after achieving favourable returns, creating a dataset skewed toward successful outcomes (see Agarwal et al., 2010). Research also shows that underperforming or liquidated funds are also less likely to report.
- **Survivorship Biases:** manager datasets typically include only “surviving” funds that remain active or have successfully exited, while failed funds are excluded, inflating performance metrics.
- **Valuation Biases:** Reported fund NAVs are often stale and backward-looking, resulting in NAV undervaluation in rising markets and vice-versa. Research has shown that fund managers also overstate valuations to attract additional capital for follow-on funds (Cummings & Walz 2010; Jenkinson et al. 2013; Brown et al. 2019; Gompers & Lerner 1999).

As a result, peer group “benchmarks” are more than likely to be very noisy and potentially misleading for fund selection purposes.

Quartile rankings are not robust

The most common peer grouping approach is “quartile ranking”, which aims to identify top-performing funds based on their reported Internal Rate of Return (IRR) or Total Value to Paid-In (TVPI) compared to a sample of historical fund data. The top 25% of funds or managers are then typically considered to be outperformers relative to their peers.

Beyond the biases in the data described above, there is a more fundamental problem of robustness when peer grouping private market funds: there is not enough data to begin with to build robust quartile ranks.

For example, if we try to rank the performance of GI Partners Fund IV: a US Tech Buyout fund of 2013 vintage with a size of \$2 billion and an IRR of 15.57%. An accurate ranking should rest on peer group data that takes into account the fund's characteristics, such as vintage year, strategy, geography, and size. Table 4 shows a peer group strictly matching these criteria – US-based buyout funds from the 2013 vintage, larger than \$1 billion, and focused on the technology sector – but comprises only 6 datapoints. In this narrowly defined peer group, GI Partners Fund IV ranks in the top quartile.

■ **TABLE 4 – QUARTILE RANKINGS FOR GI PARTNERS FUND IV**

PEER GROUP	Q1	Q2	Q3	NO. FUNDS	QUARTILE RANK
US PE Funds, vintage 2013	23.5%	15.1%	10.1%	89	2
Global PE Tech Funds, vintage 2013	29.5%	15.6%	10.7%	36	3
US PE Buyout Tech Funds, 2013 > \$1bn	15.3%	14.1%	10.1%	6	1

Six data points, however, are too small a sample when estimating a mean value, let alone quartiles. To achieve some robustness, the peer group definition must be relaxed to include a broader set of funds, but does so at the expense of relevance. Under broader definitions yielding 36 and 89 observations, the quartile rank of GI Partners Fund IV is 3rd against “US PE Funds 2013” and 2nd against “Global PE Tech funds 2013.”

In these conditions, what are investors to do? Can they consider this fund to be top quartile using six datapoints or not against a more robust but less representative peer group?

Using quartile rankings is not that different from gambling

The lack of raw market data is an endemic issue for investors in private markets: at the global level there are millions of private companies they could invest in (1.2M+ in the privateMetrics universe) but c.5,000 buyout funds are invested in a much smaller subset of c.50,000 portfolio companies. Globally, the number of buyout transactions is c.4,000 to c.6,000 annually. Taking strategy, geography, size and other factors into account, the likelihood of creating a representative peer group benchmark that also includes enough data to be robust is very low.

Thus, because of an endemic lack of transaction data, peer group benchmarks almost never provide investors with a good representation of fund performance. As a result, most uses of quartile ranks are highly uncertain and can be compared to gambling with aggressive odds.

Indeed, investors can take one of two alternative approaches when building quartile benchmarks: either maximise the sample size at the expense of relevance or try to build a representative peer group at the expense of robustness. First, we consider all buyout funds of all types and geographies for the 2011-2016 vintages i.e. funds that are either completed or winding down. This yields a broad sample of 280 buyout funds, which can be considered robust. Table 5 shows the IRR boundaries of the sample and the corresponding 95% confidence intervals.

■ **TABLE 5 – IRR QUARTILE BOUNDARIES AND CONFIDENCE INTERVALS, 2011–2016 VINTAGES, 280 BUYOUT FUNDS**

	IRR	95% CONFIDENCE INTERVAL
Top quartile boundary	24.9%	[21.9%, 27.7%]
Q3/Q2 quartile boundary	14.7%	[12.0%, 16.7%]
Bottom quartile boundary	3.4%	[1.8%, 5.9%]

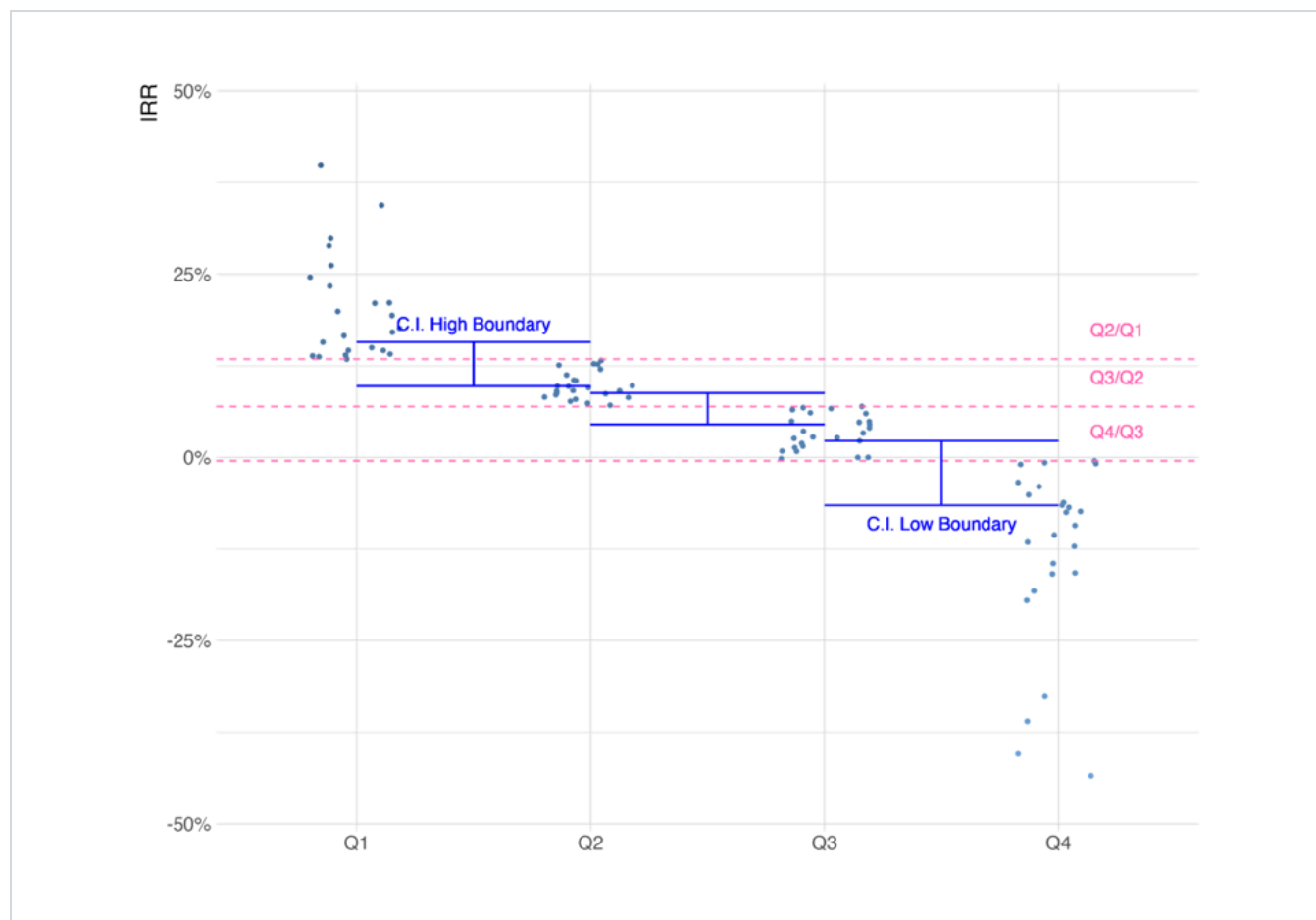
The confidence intervals are very important because investors observe only a sample of fund data; they cannot be certain of the exact value of the quartile boundary. Consider the top quartile: any fund with an IRR above 24.9%. However, some observations fall within the confidence interval, i.e., we cannot be sure that they are above or below the quartile limit. Even with a large sample of 280 fund IRRs, about 20% of the data cannot be classified as belonging to a specific quartile with certainty.

Table 6 shows the proportion of observations that are classified in each quartile but also fall within the range of the quartile boundary confidence interval. With such a large sample the betting odds remain excellent. Still, it is a gamble to consider 20% of the best ranked funds as top quartile when they may not be. The main problem is that such a broad peer group is not very useful: it includes all buyout funds in all sectors and geographies across multiple vintages.

■ **TABLE 6 – IRR QUARTILE CONFIDENCE INTERVAL, 2011–2016 VINTAGES, 280 BUYOUT FUNDS**

	WITHIN BOUNDARY CI	OUTSIDE BOUNDARY CI	BETTING ODDS
Top quartile data	20%	80%	1:4
Second quartile data	25.7%	74.3%	1:3
Third quartile data	20%	80%	1:4
Fourth quartile data	20%	80%	1:4

■ **FIGURE 5 – IRR DISTRIBUTION BY QUARTILE & QUARTILE CONFIDENCE INTERVALS – 2011–2016, 280 GLOBAL BUYOUT FUNDS**

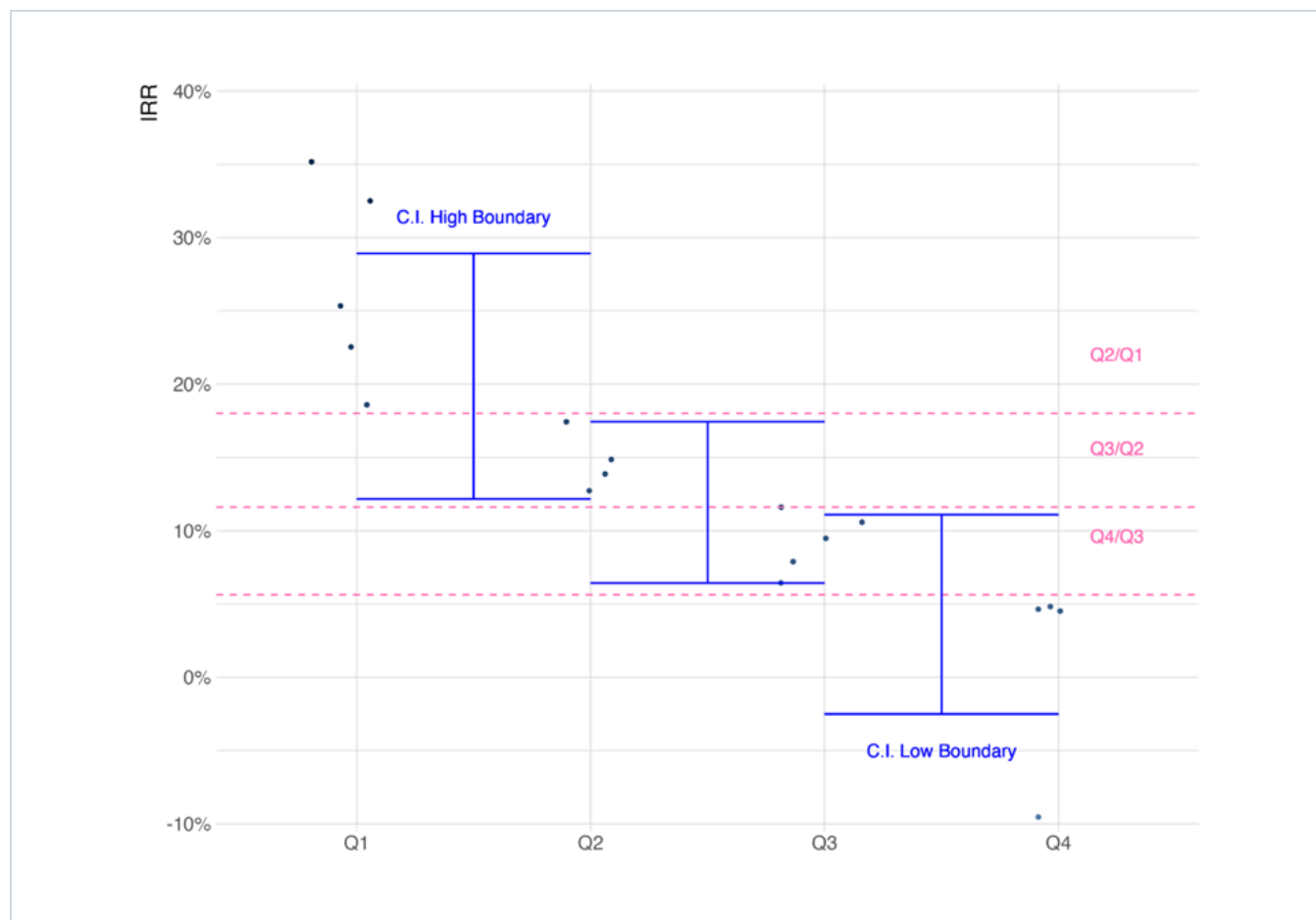


Next, we consider a narrower and much more relevant set of peers for the same 2013 US Buyout Tech Fund and restrict the sample to the relevant sector (Tech) and vintages (2012-2016). This yields a peer group of 19 funds. The gain in relevance is so costly in terms of robustness that it turns the entire benchmarking exercise into a very aggressive gamble. At 3:2 chances of picking a true top quartile fund, this is not how a ‘prudent person’ should run institutional money. Figure 6 confirms how unlikely investors are to get it right with 19 datapoints: the confidence intervals are now so large that almost all the data sits within them. The quartiles have become completely meaningless.

■ **TABLE 7 – IRR QUARTILE CONFIDENCE INTERVAL, 2012–2016 VINTAGES, 19 TECH BUYOUT FUNDS**

	WITHIN BOUNDARY CI	OUTSIDE BOUNDARY CI	BETTING ODDS
Top quartile data	60%	40%	3:2
Second quartile data	100%	0%	N/A
Third quartile data	80%	20%	4:1
Fourth quartile data	60%	40%	3:2

■ FIGURE 6 – IRR DISTRIBUTION BY QUARTILE & QUARTILE CONFIDENCE INTERVALS – 2012–2015, 19 TECH BUYOUT FUNDS



Because the relevant peer group data is rarely robust, investors take significant risk of misclassifying funds as top quartile: the more specific the peer group, the less data, the larger the chance of making the wrong call. It should be noted that weak or irrelevant peer group benchmarks are also unfair to many managers who either get compared to a handful of other funds without any robustness, or against a larger sample that includes very different investment strategies.

Fund Manager Indices

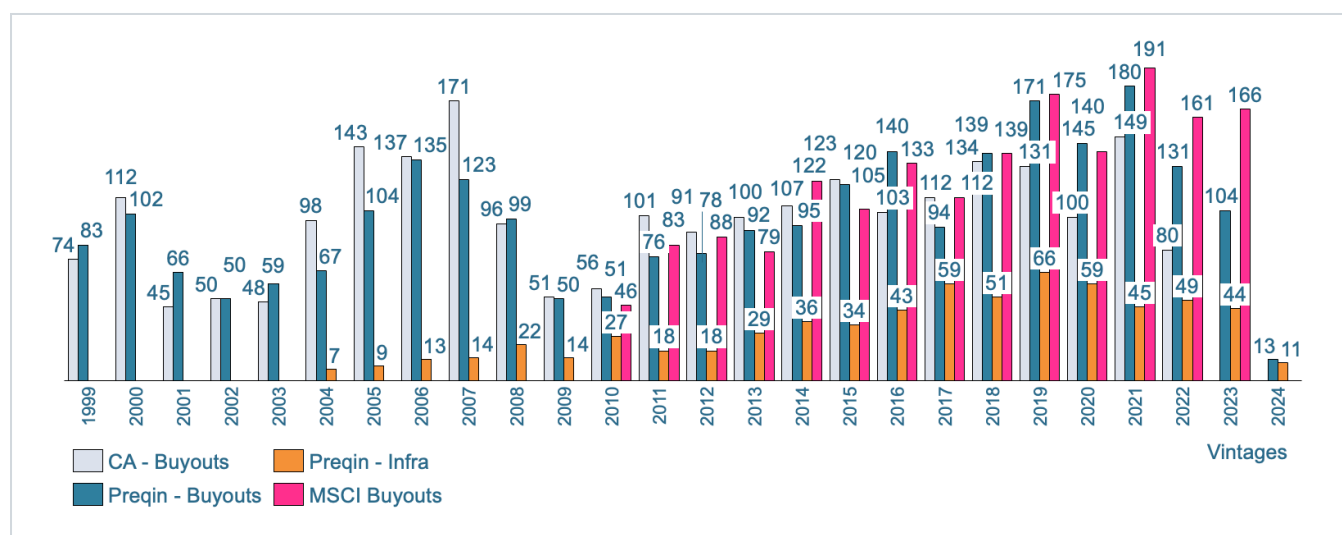
Beyond quartiles, another example of peer group benchmarks are fund manager indices: combining fund data to calculate a performance index. Again, such benchmarks have both conceptual and empirical issues.

Conceptually, they are still long-only active manager benchmarks instead of market benchmarks and thus continue to conflate a fund's market beta and its manager's alpha. Unfortunately, as is the case with performance quartiles, empirical limitations make these manager indices useless in practice. With too few data points, they capture a limited set of market segments and present significant performance and risk biases.

Too few and changing observations

Fund manager benchmarks fail to meet the standards of a market index: their composition is neither fixed nor transparent. As illustrated in Figure 7, the number of fund observations used in benchmarking is both limited and highly variable over time. The sharp fluctuations confirm that funds are constantly added or omitted in any given year, raising concerns about the representativeness of the dataset.

■ **FIGURE 7 – NUMBER OF INDIVIDUAL BUYOUT FUNDS IN FUND MANAGER BENCHMARKS (LATEST AVAILABLE JAN 2025)**



Sources: MSCI Private i, Preqin Pro, Cambridge Associates.

Too few strategies

As a result of observing a fluctuating cast of funds, it is not possible to create indices for specific strategies, which is what would be needed for benchmarks to be relevant and representative. Table 8 shows the number of off-the-shelf private manager indices available from different vendors and compares them with the number of market benchmarks created within the SIPA privateMetrics platform using individually priced constituents from a much larger dataset.

■ **TABLE 8 – NUMBER OF OFF-THE-SHELF PRIVATE MARKET INDICES AVAILABLE**

		MSCI/BURGISS	CA	PREQIN	PRIVATEMETRICS
Unique Geographies	Buyouts	6	2	4	100+
	Infrastructure	3	N/A	4	25
Unique Strategies	Buyouts	N/A	N/A	5	200+
	Infrastructure	N/A	N/A	1	30+

Sources: MSCI Private i, Preqin Pro, Cambridge Associates, privateMetrics.

Biased metrics

Private fund manager benchmarks report either Pooled IRRs or Modified Dietz returns, neither of which is likely to represent performance fairly. Pooled IRR indices (Cambridge Associates) present numerous issues: due to the inherent non-additivity of IRRs, pooled IRRs do not accurately reflect the average performance of the underlying funds (CFA Institute, 2022); they are highly sensitive to the timing of cash flows; and they often represent "since inception" returns. For example, pooling KKR's funds from 1976-1998 yields an IRR of 26.1%, while including funds from 1999-2024 reduces the IRR to 16.1%; pooling all funds from 1976-2023 raises it again to 25.5% (KKR, 2025).

The Modified Dietz method (MSCI, Preqin) is an improvement, but all these indices face a fundamental issue: the reliance on appraisals. Beginning and end-of-period NAVs are the result of appraisals that lag real market performance and tend to be "smooth". Table 9 and Figure 8 show the return, risk and performance of three fund manager indices and provide a comparison with the privateMetrics market indices.

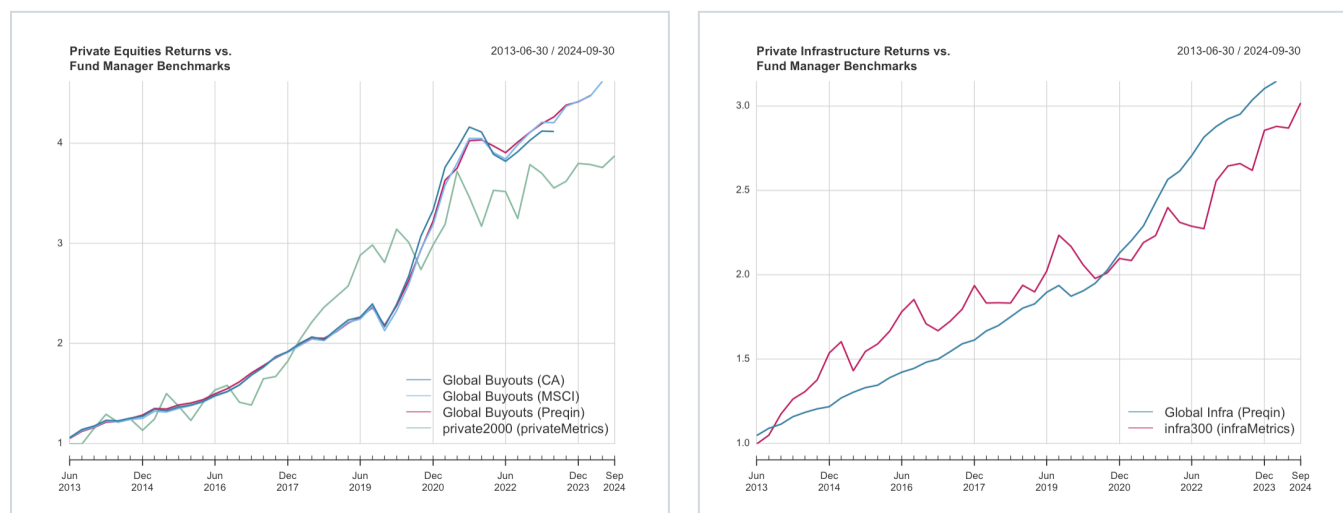
- The returns of the fund manager benchmarks are very high when compared to the market returns (private2000 and infra300), suggesting reporting and survivorship bias.
- The risk of the fund manager benchmarks is very low and implies very high Sharpe Ratios that are not realistic. In comparison, private market indices have attractive but realistic Sharpe ratios.
- Appraisals lead to NAVs being typically under-estimated in periods of market growth (2013 to 2019) and over-estimated following periods of market contraction or shock, such as the 2020-22 period.

■ **TABLE 9 – NET 10Y RETURNS AND RISK OF MANAGER INDICES AND PRIVATEMETRICS MARKET INDICES**

	CA: BUYOUTS ¹	MSCI BUYOUTS ²	PREQIN BUYOUTS ³	PREQIN INFRA ³	PRIVATE2000 ³	INFRA300 ⁴
Annualised Return	14.80%	14.60%	14.60%	11%	11.90%	10.1%
Annualised Std Dev	9%	8.10%	7.20%	3.10%	17.20%	10.4%
Sharpe (Rf=1%)	1.526	1.654	1.871	3.215	0.631	0.866

¹ Pooled net IRR. ² net Pooled Dietz. ³ privateMetrics, net total returns. ⁴ infraMetrics, net total returns – see fee assumptions in paper.

■ **FIGURE 8 – NET PERFORMANCE OF MANAGER INDICES AND PRIVATE2000 MARKET INDEX**



What about unsmoothing fund manager indices?

Investors sometimes choose to unsmooth the returns of the fund manager benchmarks using approaches such as autoregressive filtering (Geltner, 1993), the equity volatility method (Fisher, Geltner & Webb, 1994) or the market states method (Chaplin, 1997). However, unsmoothing can lead to completely different results depending on the choice of technique as illustrated in Table 10. For example, the level of risk almost doubles when Geltner 1-lag is used and quadruples with Geltner 2-lags.

■ **TABLE 10 – RISK-RETURN PROFILES FOR SMOOTHED AND GELTNER 1-LAG / 2-LAG UNSMOOTHED INDICES**

INDEX	10-YEAR TOTAL RETURN	10-YEAR VOLATILITY	10-YEAR SHARPE (RF=1%)
Smoothed Preqin PE Index	14.08%	7.39%	1.77
Unsmoothed PE (Geltner 1-Lag)	13.07%	14.23%	0.84
Unsmoothed PE (Geltner 2-Lags)	7.17%	31.94%	0.18

If the risk calculations depend on the choice of unsmoothing method rather than the actual risk of the asset class, investors might as well pick any number they prefer. In other words, fund manager indices are unusable to measure risk in private markets.

Who uses fund manager indices anyway?

With quartile rankings, investors have to make an impossible choice between robustness and representativity; given the nature of private market data, they cannot have both. With fund manager indices they have neither: these indices are both empirically weak and not representative of the state of the market. In effect, and unlike quartile rankings which are common, we are not aware of many uses of such fund manager indices amongst investors in private equities and private infrastructure.

Using Market Proxies

The idea of using a market benchmark to assess the performance of funds is a powerful improvement on the peer grouping of fund managers, which is almost always statistically weak and rarely representative. A market index is a portfolio. As such, it should remove the two sources of bias investors suffer from when looking at peer groups:

- A market index shows the risk and performance of the market for underlying assets and can therefore be used to distinguish the impact of the market on fund performance from that of managers and their own choices and value-add.
- A market index relies on a construction methodology to create a weighted average of a representative set of assets. Such a portfolio is almost always more robust than a peer group dataset built from ad hoc data contributed by a changing cast of managers.

From Ranking Quartiles to Ranking Alpha

A simple way to use a market benchmark to decompose the performance of private funds is the Direct Alpha approach of Gredil et al. (2023) by which a fund IRR can be written as:

$$\text{Fund IRR} = \text{Market Return} + \text{Total Fund Alpha}$$

The Direct Alpha calculations are described in Appendix C. The alpha of each manager can be broken down into multiple sources. Broadly, these fall into three categories: asset allocation (strategic bets on market segments such as sector and geographic focus), asset selection (choosing specific investments and timing distributions), and structuration (adjusting leverage or reducing market risk). Using a broad market benchmark to measure Total Fund Alpha in combination with a strategy-specific benchmark, it is straightforward to split Total Fund Alpha into two components: Asset Allocation Alpha and Pure Alpha. The difference between Total Fund Alpha and Pure Alpha is the Allocation Alpha:

$$\text{Allocation Alpha} = \text{Total Fund Alpha} - \text{Pure Alpha}$$

The total fund net IRR is then written:

$$\text{Fund net IRR} = \text{Market Return} + \text{Asset Allocation Alpha} + \text{Pure Alpha} - \text{Fees}$$

$$\text{Fund net IRR} = \text{Market Return} + \text{Asset Allocation Alpha} + \text{Net Pure Alpha}$$

Asset Allocation Alpha represents the portion of returns attributable to the fund manager's choice of market segment or style exposures (sectoral, geographic or factor tilts). **Net Pure Alpha** isolates the value added by the manager's investment selection and structuring skills, which includes timing of distributions, leverage decisions, and exit strategies, after fees.

How Equivalent is the Public Market?

Market equivalents are not new and since Kaplan and Schoar's 2005 paper, Public Market Equivalents or PME's have become a frequent alternative to peer groups. Unfortunately, a public market equivalent does not answer the question of what drives private fund managers' performance. A public equity index may be unambiguous, measurable, reflective of current investment options and specified in advance, but it is not the relevant benchmark.

The choice of public market index also introduces another level of noise and may be considered opportunistic. Phalippou (2024) discusses the fact that the S&P 500 was a common benchmark in the pre-2008 period, when its low returns favoured PME results. In more recent periods, indices such as MSCI, Russell 2000, and Russell 3000 have been employed instead.

Crucially, none of these indices can convincingly be linked to the investment universe available to private market investors. Figure 10 shows the GICS sector comparison between the Russell 2000 Index and the fund universe tracked by Cambridge Associates (CA). The Information Technology sector holds the highest weight in the CA Universe, accounting for 36%, while in the Russell 2000, it ranks fifth, with a weight of 14%.

■ FIGURE 10 – COMPARISON BETWEEN RUSSELL 2000 AND CAMBRIDGE ASSOCIATES BY SECTOR

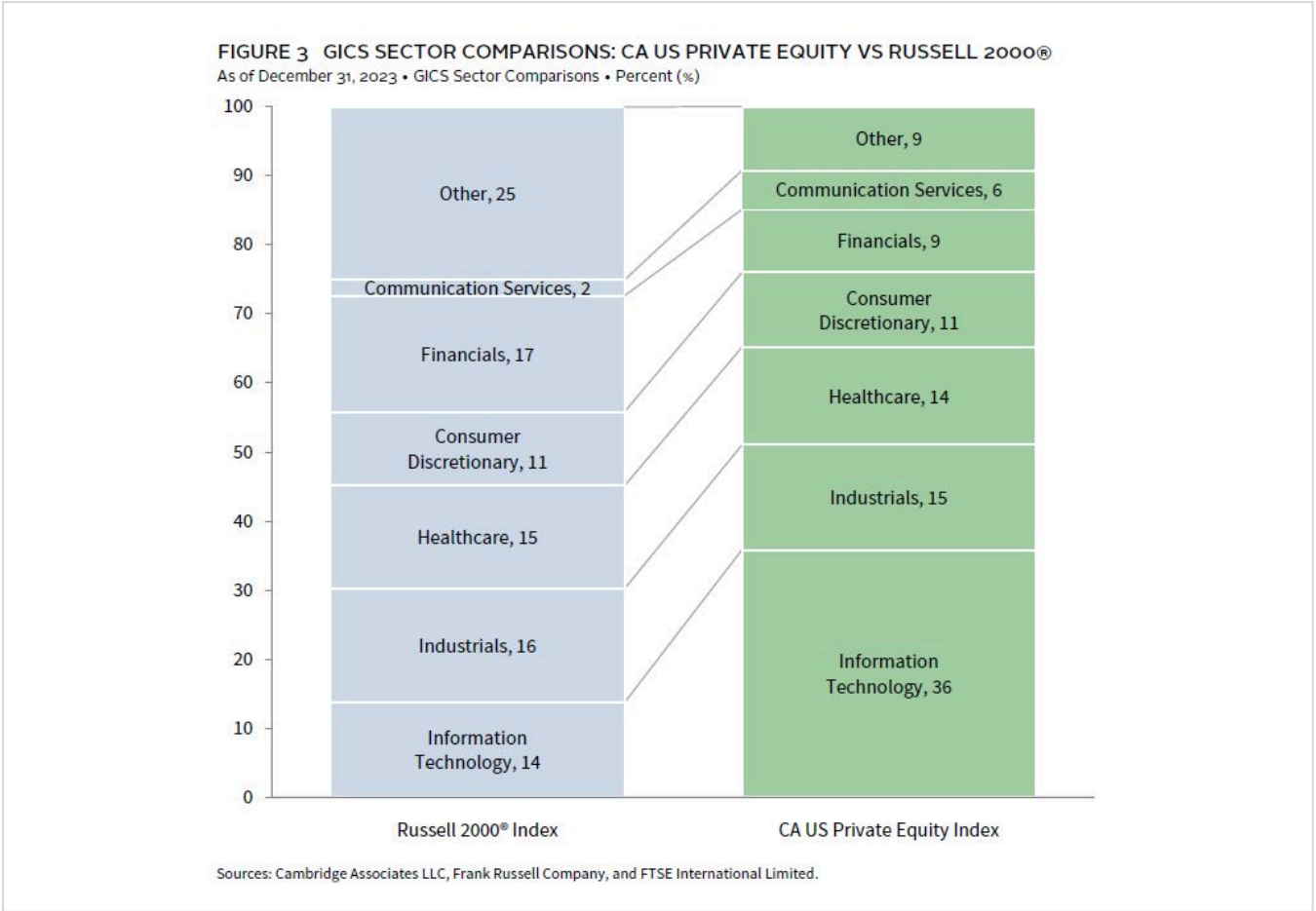
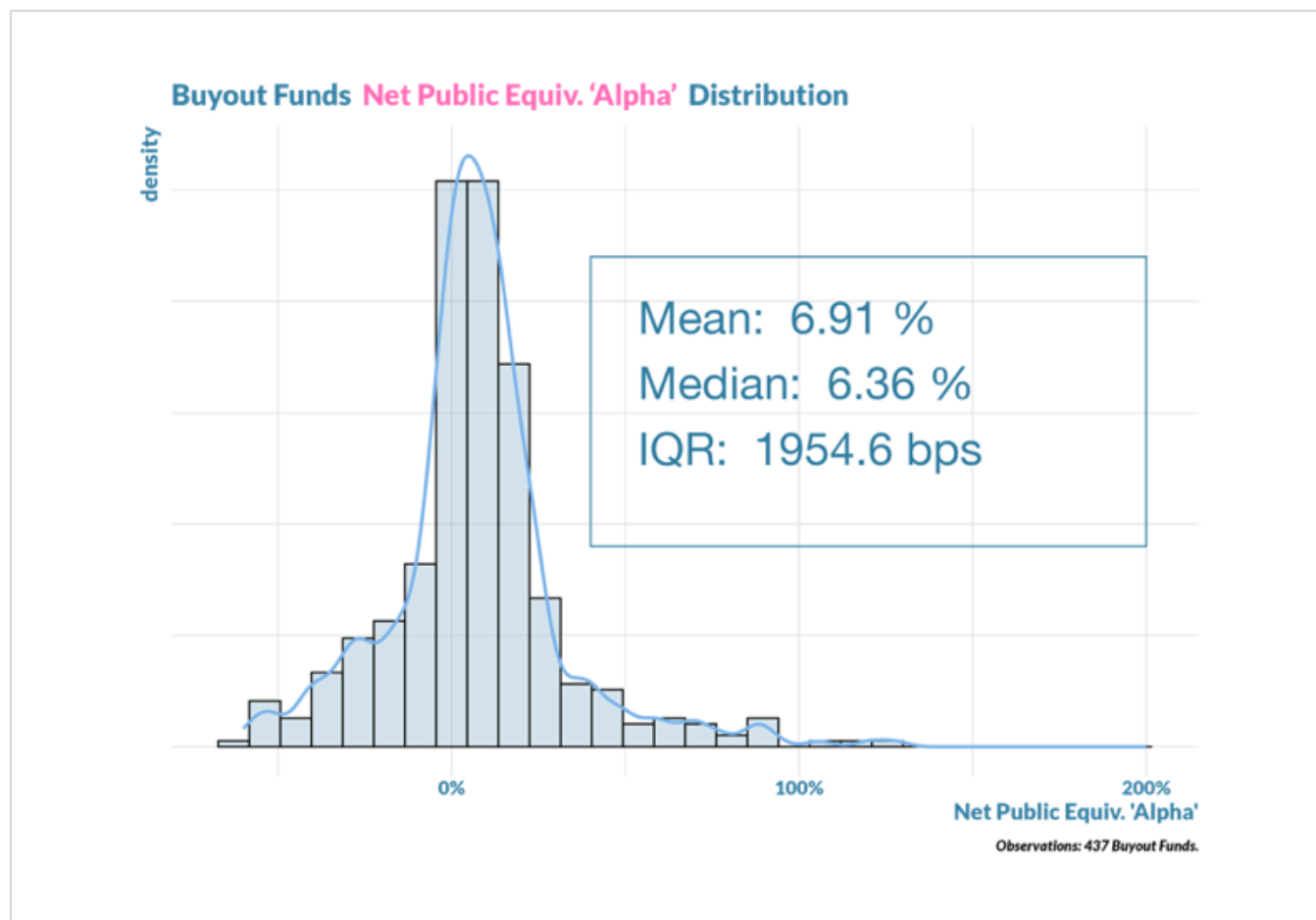


Figure 11 shows the distribution of net Total Fund Alpha of our fully invested buyout fund sample when benchmarked against the Russell 2000 index using the Direct Alpha method. On average, 68% of fully invested buyout funds exhibit a positive net “alpha”, with a median of 6.9%. Adding our average fee estimate, that is an average gross alpha of c.10.5%.

■ FIGURE 11 — PUBLIC MARKET EQUIVALENT DIRECT ALPHA WITH RUSSELL 2000 AS BENCHMARK — FULLY INVESTED FUNDS



A comparison with public markets can be useful to understand the potential upside of investing in private market funds over a passive public market strategy. But this is an average: 32% of fully invested buyout funds exhibit negative net Total Fund Alpha against the Russell 2000. The PME does not provide information about the risks taken by the fund manager and whether returns come from the fund's exposure to the private assets market (beta) or the manager's alpha. With this PME, if investors select a manager randomly in our buyout fund sample, they face approximately 1:2 odds of underperforming a Russell 2000 ETF.

A Private Market Equivalent (PtME)

A private market equivalent is built using the same approach as a Direct Alpha PME but switching the public market index for a more relevant private market index.

Indices of choice

We use the privateMetrics indices and benchmarks because they are specifically designed to capture changes in market conditions. The two market indices we use are the private2000® and infra300® indices. Both are registered with the European Securities and Market Authority (ESMA) as market benchmarks, indicating that they follow rigorous index construction standards and governance and comply with IOSCO guidelines. Updated monthly and using a fixed list of constituents managed by a dedicated Index Committee, these indices reflect market dynamics accurately and consistently (see Table 11). infraMetrics also allows custom benchmarks reflecting the strategy of a fund to be built, used to capture the strategy of the funds and distinguish between asset allocation and pure alpha.

■ **TABLE 11 – SUMMARY DESCRIPTION OF THE PRIVATE2000 AND INFRA300 MARKET INDICES**

	CONSTITUENTS	PRIVATEMETRICS UNIVERSE	MARKET CAP	10-Y RETURN	SHARPE
private2000®	2,000 in 30 countries	Private Equities (1M, in 150 countries)	USD2.1T	15%	0.70
infra300®	300 in 20 countries	Private Infrastructure (9,000 in 25 countries)	USD323bn	8.6%	0.72

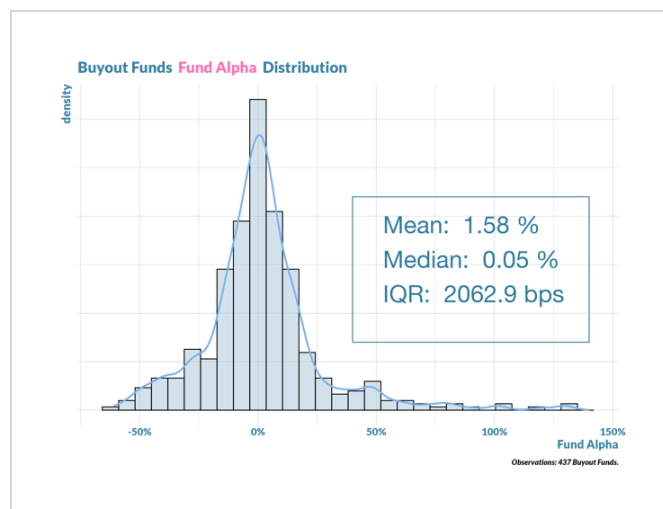
Fully-invested funds: Long-term alpha

Next, we use these two market indices to measure the alpha of the fully-invested funds in our sample. Figure 12a shows that when using the private2000 index to compute the PtME of buyout funds, the median net alpha is 0.05% (mean: 1.58%). In other words, the median net alpha is not different from zero. As shown in Figure 12b, the contribution of the market return to average fund returns is 14.4%, which is not different from the aggregate IRR of the same sample of buyout funds.

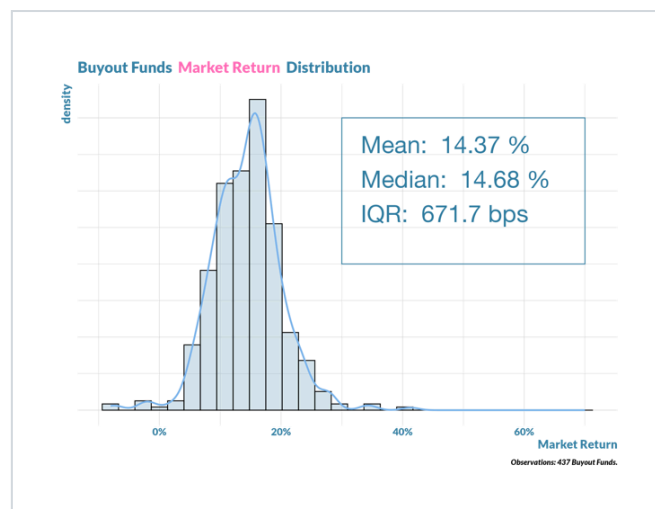
- On average, we find close to zero net alpha in private asset funds when benchmarked against the relevant private market index. Approximately half the funds exhibit positive net alpha.
- This result also implies that the private2000 index is indeed the relevant market benchmark for private equities: it accurately represents the average market performance.
- Market performance (market risk) is the main driver of fund performance.
- Gross of fees, using the average fee estimate described earlier, the average fund alpha is about 3.5%. Buyout funds thus tend to generate positive gross alpha, but in line with other findings in the finance literature the average outperformance is consumed by the average level of management fees.

■ **FIGURE 12 – PE FUNDS DIRECT ALPHA PTME AND MARKET RETURN USING PRIVATE2000 INDEX – FULLY-INVESTED FUNDS**

12A – NET ALPHA DISTRIBUTION



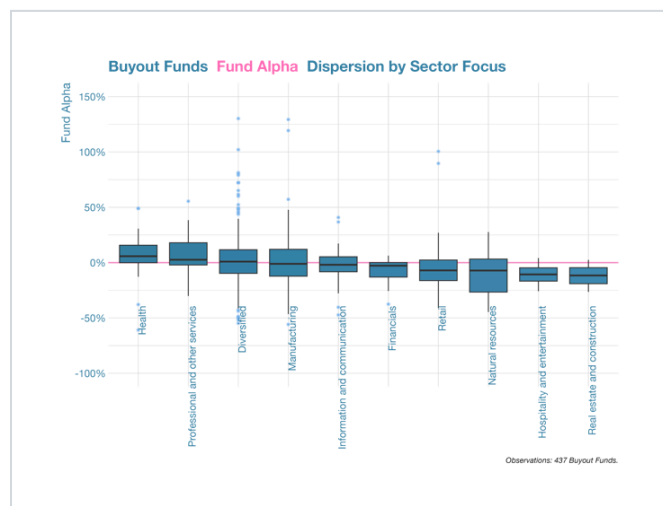
12B – SOURCES OF RETURN



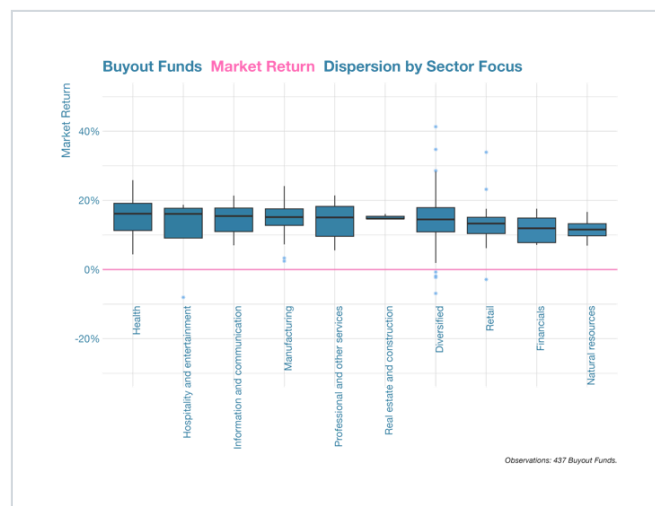
Looking at the alpha of buyout funds by strategy, Figure 13a shows that only a few sector-focused strategies such as Health and Professional Services achieve positive alpha on average once the private2000 is the market benchmark. Again, the market return is the main driver of returns on average (Figure 13b). Nevertheless, the dispersion of fund alpha is significant and some sector-focused funds achieve high positive alpha, especially in the manufacturing and retail strategies.

■ **FIGURE 13 – PE FUNDS DIRECT ALPHA PTME AND MARKET RETURN BY SECTOR FOCUS – INVESTED FUNDS**

13A – ALPHA BY SECTOR



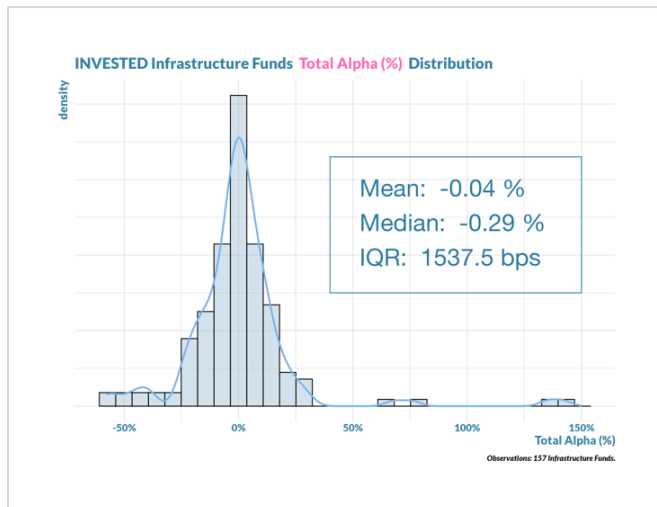
13B – MARKET RETURN BY SECTOR



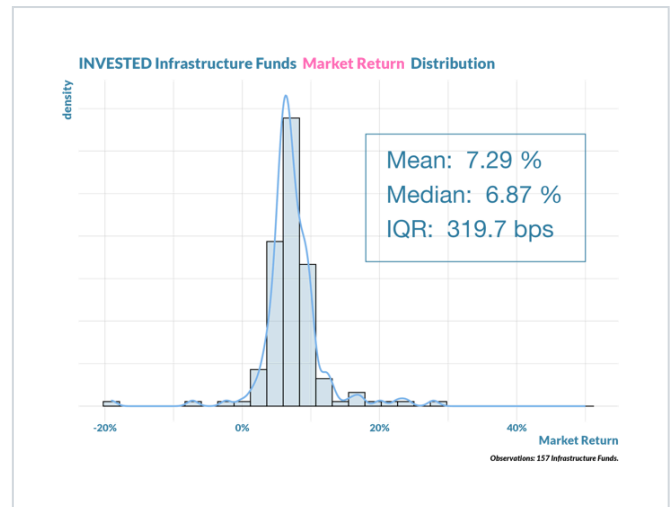
Turning to infrastructure funds we find similar results: using the infra300 index as the market benchmark, Figure 14a shows that the median net alpha is -0.29% (mean: -0.04%), which corresponds to circa 1.2% gross alpha, on average. Figure 14b shows that most of the average return of infrastructure funds comes from market risk, at c.7%.

FIGURE 14 – INFRASTRUCTURE FUNDS DIRECT ALPHA PTME AND MARKET RETURN USING INFRA300 INDEX – FULLY INVESTED FUNDS ONLY

14A – NET ALPHA DISTRIBUTION



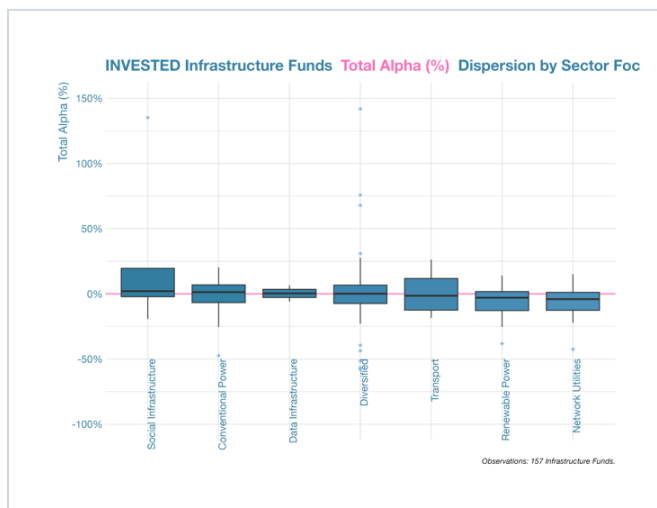
14B – SOURCES OF RETURN



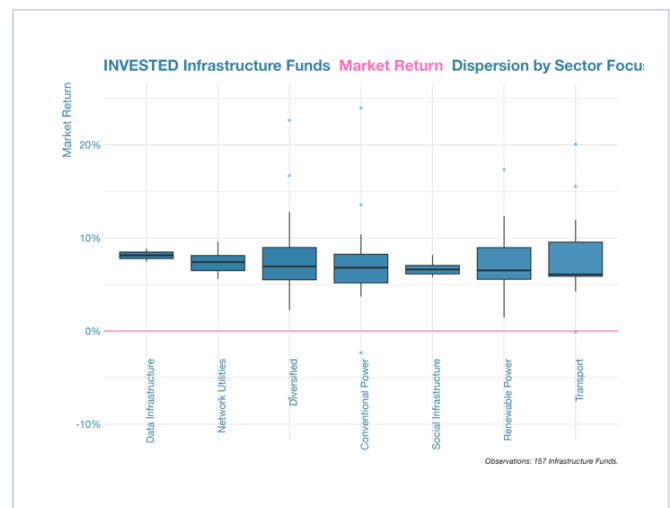
At the fund strategy level, Figure 15a shows that only funds focused on Social Infrastructure achieved positive alpha on average, while other sectors have a zero median or negative net alpha and almost all average returns by strategy can be explained by exposure to market risk. We note that Alpha dispersion is lower than with buyout funds. To summarise, for both private equity and private infrastructure funds, we find approximately zero net alpha on average when benchmarked against a representative private market index, consistent with previous findings in the academic literature (Jensen 1968; Fama & French 2010).

FIGURE 15 – INFRASTRUCTURE FUNDS DIRECT ALPHA PTME AND MARKET RETURN BY SECTOR FOCUS

15A – ALPHA BY SECTOR



15B – MARKET RETURN BY SECTOR



Breaking down fund alpha

For each fund in the sample, we use the privateMetrics custom benchmark tool to build a benchmark reflecting the geography and sector focus of the fund. The Asset Allocation alpha is then the difference between the Total Fund Alpha derived against the broad market index, and the Pure Alpha derived against the strategy-adjusted benchmark.

■ **TABLE 12 – SOURCES OF ALPHA IN BUYOUT AND INFRASTRUCTURE FUNDS – FULLY INVESTED FUNDS**

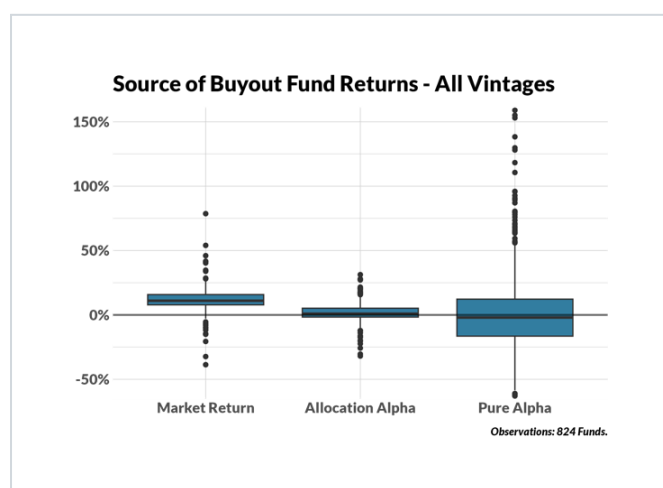
	ALPHA SOURCE	MEAN	MEDIAN	IQR
Buyouts	Asset Allocation Alpha	3.82%	3.92%	639bps
	Net Pure Alpha	-2.54%	-4.04%	2069bps
	Pure Alpha (fees 3.4%pa)	0.86%	-0.64%	N/A
Infrastructure	Asset Allocation Alpha	6.22%	6.7%	902bps
	Net Pure Alpha	-6.26%	-5.97%	1333bps
	Pure Alpha (fees 1.5%pa)	-4.76%	-4.47%	N/A

For buyout funds the median Asset Allocation Alpha is 3.92%, indicating that fund managers generate value over and above the market by making sector specific bets. This value add is however completely offset on average by a median Net Pure Alpha of -4.04%. Since we estimated average fees in buyout funds to be c.3.4%, adding this back to net Pure Alpha suggests an average gross pure Alpha of -0.64%. Thus, in this sample of 800+ buyout funds, the average manager does not produce any Alpha. However, the IQR of net Pure Alpha is 2,069bps, indicating a very wide dispersion: many fund managers are still able to pick and structure superior investments and generate high Alpha.

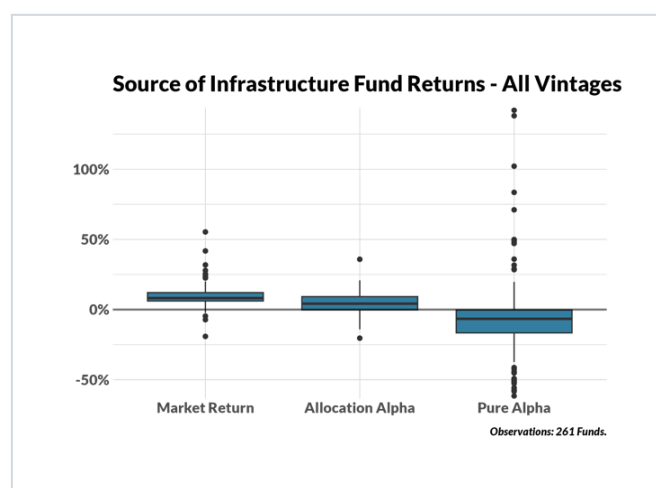
Infrastructure funds exhibit a median Asset Allocation Alpha of 6.3% and a median net Pure Alpha of -6.26% (-4.76% before fees). The average infrastructure fund manager generates returns primarily through broad market exposure and selecting sectors expected to outperform (e.g. Data infrastructure and Renewables), but this only partly offsets a large and negative average Pure Alpha. This can be interpreted as partly driven by the nature of infrastructure companies, many of which are akin to a fully amortising bond with risky cash flows – operational improvements are necessarily limited (you do not “turn around” a toll road).

■ **FIGURE 16 – SOURCES OF RETURNS IN BUYOUT AND INFRASTRUCTURE FUNDS**

16A – BUYOUT



16B – INFRASTRUCTURE

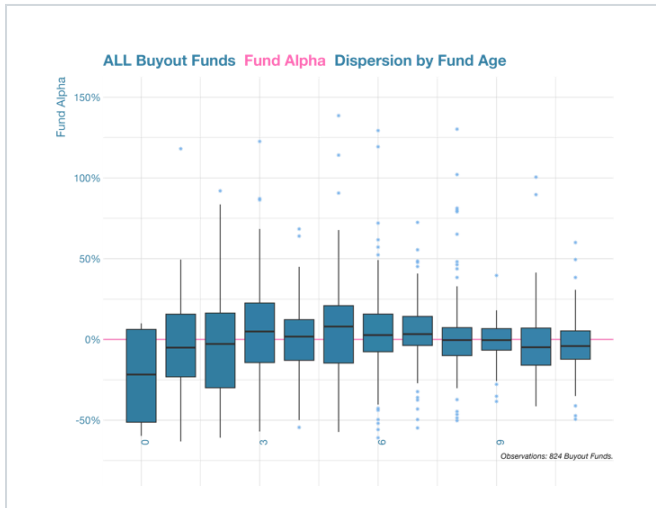


Full sample: Alpha through the fund lifecycle

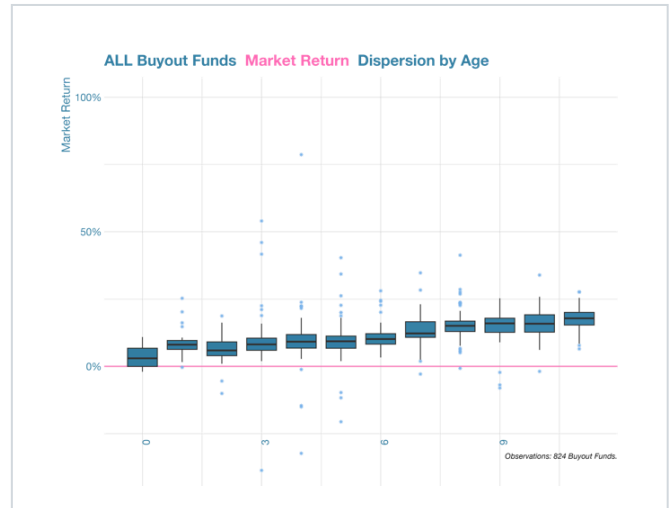
In this section, we include more recent (still-investing) vintages to better understand the role of the fund lifecycle. Figure 17 shows the dispersion of buyout fund performance by age, focusing on fund alpha (17a) and market returns (17b). The impact of the fund lifecycle is clearly visible, with early vintages starting in negative alpha territory and improving over time, albeit not delivering above-zero alpha in the long run, on average. Meanwhile, the market return compounds over time and corresponds to the majority of fund returns.

■ **FIGURE 17 – ALPHA AND MARKET RETURN IN BUYOUT FUNDS BY FUND AGE – ALL VINTAGES**

17A – FUND ALPHA

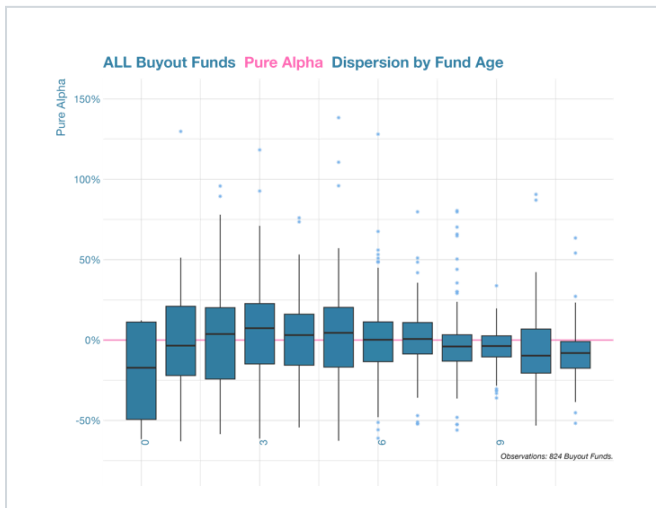


17B – MARKET RETURN



■ **FIGURE 18 – SOURCE OF ALPHA IN BUYOUT FUNDS BY FUND AGE – ALL VINTAGES**

18A – PURE ALPHA



18B – ALLOCATION ALPHA

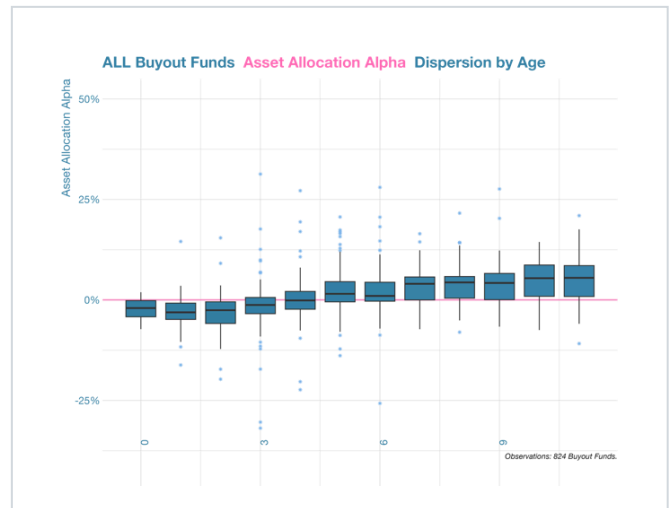
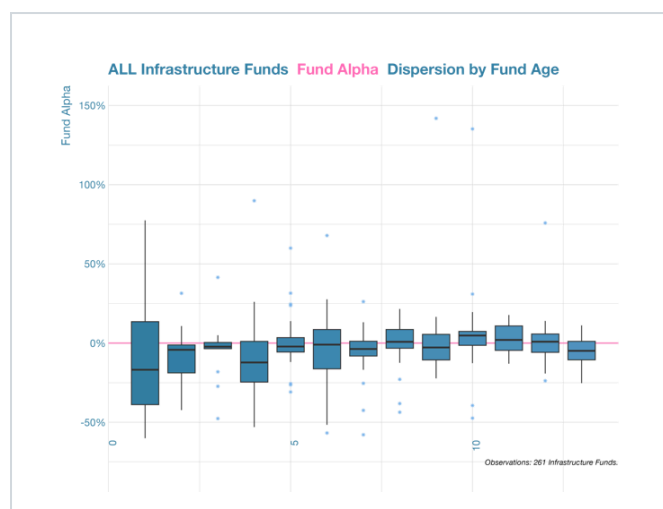


Figure 18 shows the sources of alpha in buyout funds by vintage year. The impact of the j-curve is clearly visible but does not change the bigger picture: average Pure Alpha trends towards zero in the long run but with huge dispersion between funds, while Asset Allocation Alpha increases over time and increasingly offsets the lack of Pure Alpha in the average fund. Figures 19 and 20 make the same point about infrastructure funds, which have been active in a market that has radically changed over the past decade.

FIGURE 19 – ALPHA AND MARKET RETURN IN INFRASTRUCTURE FUNDS BY VINTAGE

19A – FUND ALPHA



19B – MARKET RETURN

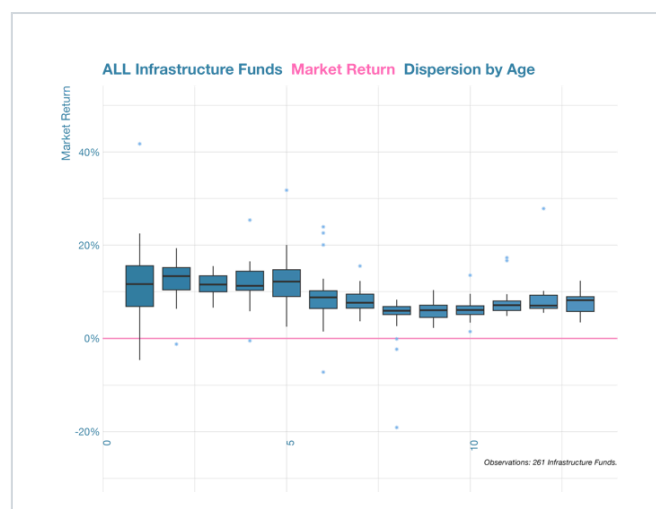
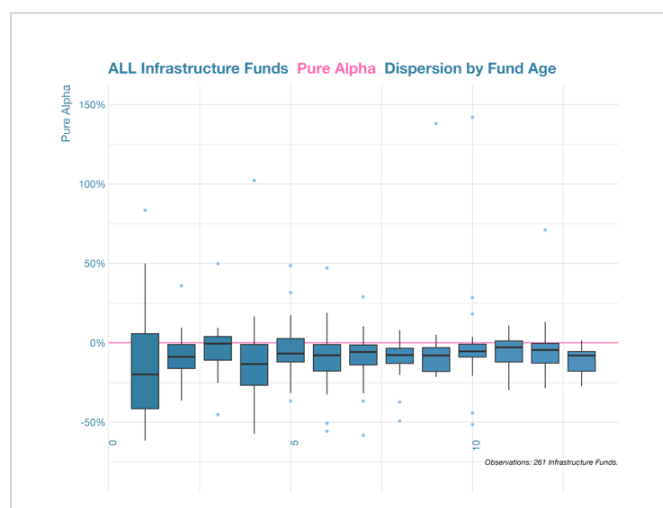
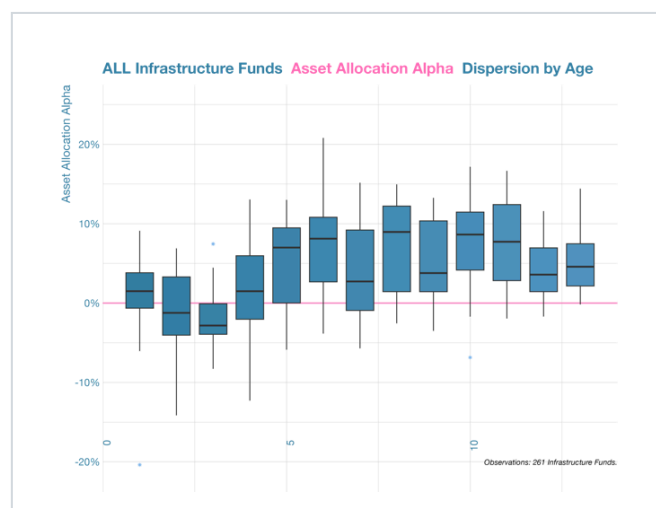


FIGURE 20 – SOURCE OF ALPHA IN INFRASTRUCTURE FUNDS BY VINTAGE

20A – PURE ALPHA



20B – ALLOCATION ALPHA

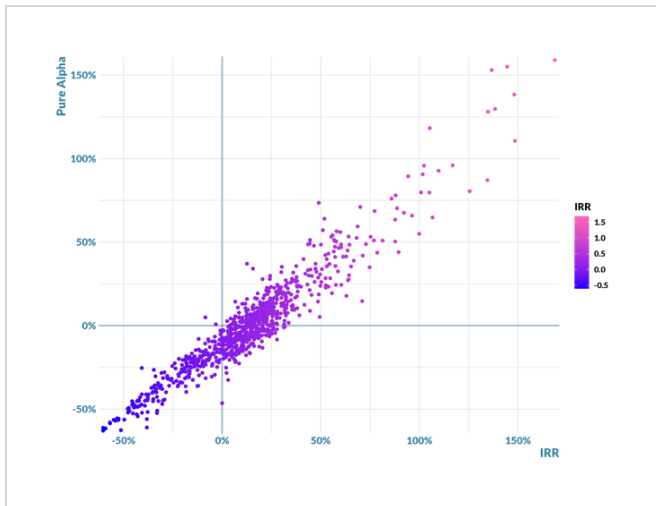


Fund Alpha, Market Return and Fund IRR

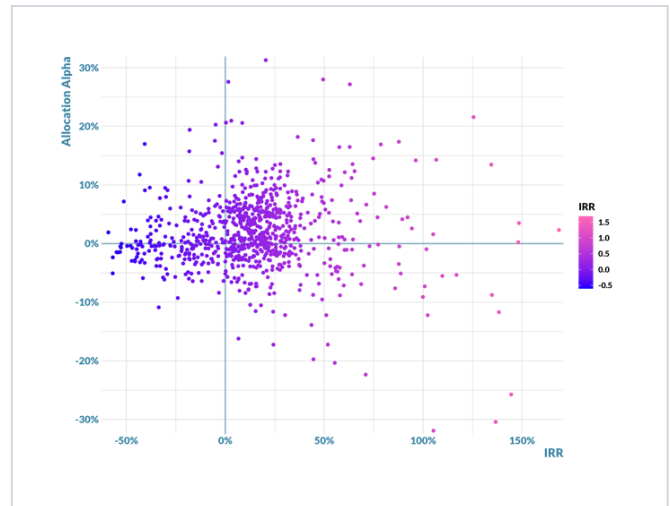
Figure 21 illustrates these relationships for buyout funds. 21a shows that Pure Alpha is highly predictive of the fund IRR but also that a number of funds have positive IRR but negative alpha. Asset Allocation Alpha (21b) is not related to IRR. Figure 21c shows that higher Pure Alpha tends to come with higher market exposure: those managers creating high positive Pure Alpha also have to take market risk to access such opportunities. Figure 21d shows that Allocation Alpha and the market return are not related.

FIGURE 21 — PURE ALPHA AND ALLOCATION ALPHA — BUYOUT FUNDS, ALL VINTAGES

21A — PURE ALPHA VS FUND IRR



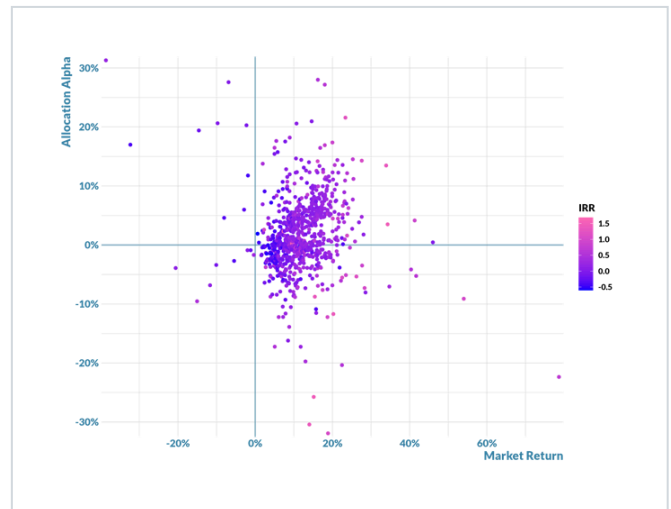
21B — ALLOCATION ALPHA VS FUND IRR



21C — PURE ALPHA VS MARKET RETURN



21D — ALLOCATION ALPHA VS MARKET RETURN



Using a Private Market Equivalent works!

We have seen that peer grouping lacks robustness, that PME lacks representativity and therefore that using them to select funds is akin to making investment decisions with a blindfold on. In contrast, the private market equivalent (PtME) provides a robust and granular understanding of the performance of private asset funds relative to the market. Next, we look at the persistence of fund alpha on average across all funds and at the manager level.

Alpha persistence

A key question for investors in private funds is to know whether past performance is likely or not to be repeated. Even if the selection of a fund and manager can be made in a robust and representative manner using a PtME, it remains based on backward-looking data. A manager that exhibits high positive alpha in the past may be highly skilled but she may also have just been lucky.

The notion of persistence implies that top-performing managers are more likely to generate strong returns in subsequent funds. A number of studies have assessed this relationship (Kaplan & Schoar, 2005; Harris, Jenkinson, & Kaplan, 2014). The evidence is mixed. Given the data robustness issues highlighted earlier when ranking funds by IRR using contributed fund data, the lack of conclusive research results may not be a surprise. In this section, we use the PtME total alpha to estimate the “alpha persistence” of buyout funds for a sample of 80+ managers for which we have evidence for multiple funds.

Average manager alpha persistence

Transition Matrices

We first compute the positive alpha transition probability of each manager with one lag (Table 13) and two lags (Table 14). Table 13 suggests that there is limited performance persistence: while there is a slightly higher probability for positive alpha funds to remain successful, nearly half (46%) transition to negative alpha in the next period. Table 14 suggests asymmetrical persistence, where underperformance is more likely to persist than outperformance – the 63% probability of continued negative alpha implies that poorly performing fund managers are significantly less likely to reverse trajectory.

■ **TABLE 13 – ALPHA PERSISTENCE, ≥ ONE PRIOR FUND**

FUND (T-1)	POS. ALPHA (T)	NEG. ALPHA (T)
Positive Alpha	54%	46%
Negative Alpha	53%	47%

■ **TABLE 14 – ALPHA PERSISTENCE, ≥ TWO PRIOR FUNDS**

(T-2) / (T-1)	POS. ALPHA (T)	NEG. ALPHA (T)
Positive / Positive	51%	49%
Negative / Negative	37%	63%

Regression Analysis

Next, we use regression analysis on a sample of 259 buyout fund managers with two funds in their track record. The dependent variable is alpha of the fund at time t, and the explanatory variables include market return at time t, the alpha of the previous fund (t-1) and fund size at time t (log scale):

$$\text{Alpha}_t \sim \text{Market Return}_t + \text{Alpha}_{t-1} + \log(\text{Size}_t)$$

■ **TABLE 15 – REGRESSION OF ALPHA AGAINST MARKET RETURN, PRIOR ALPHA AND FUND SIZE**

	ESTIMATE	STD. ERROR	T-VALUE	PR(> T)	SIGNIF.
Alpha (t-1)	0.112472	0.060782	1.85	0.06540	.
Market Return	1.928218	0.251259	7.674	0.00000	***
Size_log	-0.022918	0.003787	-6.052	0.00000	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1. R²: 0.198.

- The previous fund alpha is barely significant (t-value < 2): it cannot be considered highly statistically significant above the 10% confidence level.
- Market returns are a large and very significant driver of positive fund alpha.
- Fund size has a large negative impact, indicating diminishing returns to scale in private equity.

We can also conduct a similar analysis on the two individual components, Pure Alpha and Allocation Alpha (Tables 16 and 17). We now find some evidence of conditional persistence: when a manager generates positive Pure Alpha or positive Allocation Alpha with their previous fund, they do tend to generate positive Pure or Allocation Alpha with their next fund. This suggests that while the average manager may not exhibit persistent alpha, some managers do.

■ **TABLE 16 – PURE ALPHA REGRESSION**

	ESTIMATE	T	SIGNIF.
Pure Alpha (t-1)	0.169292	2.803	**
Market Return	1.843381	7.035	***
Size_log	-0.022135	-5.603	***

R^2 : 0.184.

■ **TABLE 17 – ALLOCATION ALPHA REGRESSION**

	ESTIMATE	T	SIGNIF.
Alloc. Alpha (t-1)	0.3006542	5.431	***
Market Return	0.0640209	1.224	
Size_log	-0.0010479	-1.327	

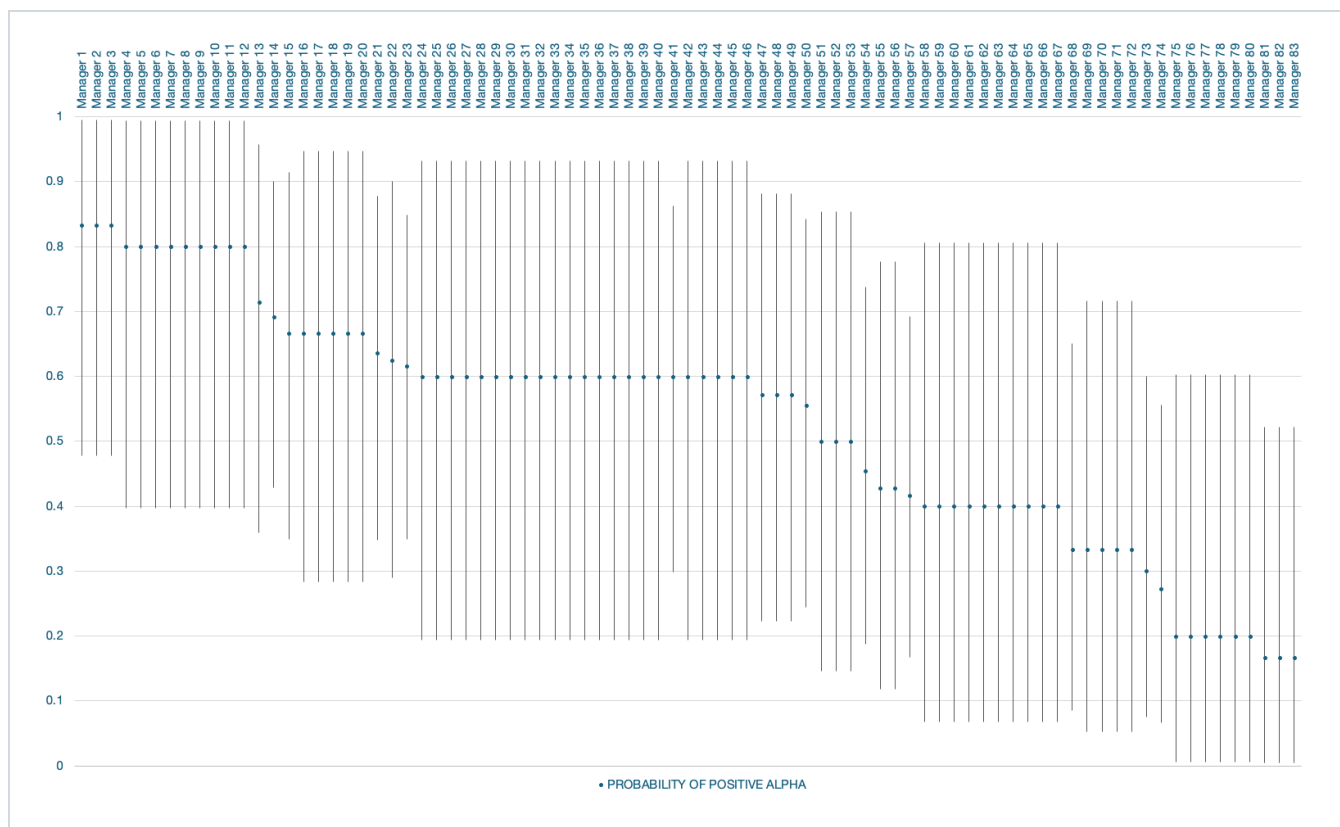
R^2 : 0.115.

Individual manager alpha persistence

Since there is evidence that some managers do deliver positive alpha persistently but that on average it is not the case, we apply a simple Bayesian approach: the probability for a given fund manager of delivering positive alpha with any given fund is modelled as a beta distribution. The informed prior for this value is 0.5 – the equivalent of a Beta(2,2) distribution which has a mean of 0.5. We then observe realisations of alpha in each manager's funds, and update the parameters accordingly (see Appendix D). The more funds we observe, the more precise our estimate becomes, so we also compute a confidence interval.

Figure 22 shows the manager-level probability of delivering positive alpha and its confidence interval. Clearly some managers are very likely to deliver positive alpha, with close to 90% probability of doing so, while others have lower and some very low probability. These results confirm that while the average manager is not an alpha manager, some managers are and are very likely to deliver alpha fund after fund.

FIGURE 22 – ALPHA PERSISTENCE OF BUYOUT FUND MANAGERS – PROBABILITY OF GENERATING ALPHA AND 95% CONFIDENCE INTERVAL



Source: privateMetrics.

Conclusions

The pitfalls of benchmarking private asset funds

In this paper, we have reviewed four ways to benchmark private asset funds: peer grouping performance metrics, fund manager indices, public market equivalents (PMEs) and private market equivalent (PtME). We have shown that peer grouping is flawed for a fundamental reason: the amount of raw data available in private markets is such that peer groups are either not robust, to the point that using them to select managers is equivalent to a very aggressive gamble, or not informative because they must combine many different styles, risk profiles and vintages to become robust.

We have also shown that fund manager benchmarks are even worse: achieving neither robustness nor granularity and displaying very biased results. Such benchmarks also conflate a fund's exposure to market risk (its beta) and the added-value of the fund manager (alpha), making manager selection on the basis of performance more dependent on market trends than on individual manager skills. The serious and prudent way to address these issues is to rely on a market index that can be used to separate the impact of market risk on fund returns from that of the manager. However, using the market equivalent approach with the wrong index, such as a public equity index, is not conducive to more informed manager selection.

A better way: PtME and alpha persistence

- When used to compute the alpha of private funds, the privateMetrics market indices give an average net alpha of zero, which is aligned with all previous academic research on active fund managers and makes the most sense as a genuine market benchmark: only half of market participants can beat the market average, by definition.
- The PtME approach provides investors with a clear understanding of the sources of fund return: which part is attributable to market risk and which to manager skills (or luck).
- Measuring manager alpha on an ongoing basis allows alpha persistence — whether a manager really is skilled or just lucky — to be estimated. Some managers clearly are more skilled than others.

Characteristics of a good private market benchmark

Finance 101 defines a good benchmark as being unambiguous, investable, measurable, appropriate, reflective of current investment options and specified in advance. But unlike for public market indices, the investability criterion is not straightforward in private markets. By definition, private assets such as private equity and infrastructure are not continuously available for purchase or sale. Consequently, private market benchmarks cannot be expected to represent a directly tradable basket of assets, but instead must serve as a reference portfolio, reflecting the characteristics, risk exposures, and performance trends of the investable universe.

This disqualifies peer group benchmarks, which do not meet any of these criteria. It also disqualifies PMEs which are not reflective of current investment options in private markets. The infra300 and private2000 indices and other benchmarks available via the privateMetrics platform do, however, meet all the relevant criteria. These indices are calculated by calibrating an asset pricing model with the latest market transactions each month.

Lessons learned

- **Private assets trade in a market like any other financial security**, and private asset funds trade in and out of this market, like any other active equity manager. Private fund managers only hold a fraction of the market for private assets.
- **Private markets are risky.** Market prices change continuously as a result of supply and demand, macro-economic conditions and investor preferences. High returns are available, especially when trades are executed by the most skilled managers, but typically involve significant market and idiosyncratic risk.
- **Private asset beta matters.** Private investment performance results from exposure to private market risk (beta) and investment selection, management and timing (alpha). Alpha typically comes with taking significant market risk.
- **Only some private fund managers outperform the market (about half the time).** We find strong evidence that some private fund managers generate high alpha, but only half generate positive alpha and on average private fund alpha is close to zero. Also, (average) fees offset most of the (average) alpha.

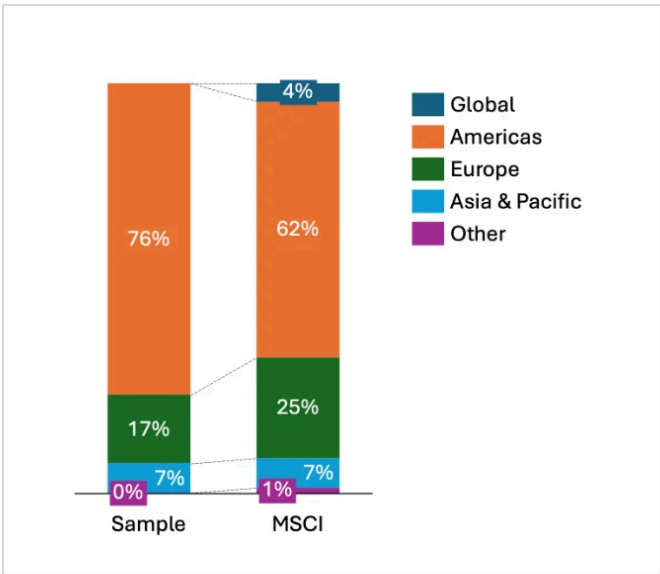
Recognising this does not mean giving up on investing in private markets — on the contrary. It means investing with eyes open and therefore in line with an investor's fiduciary responsibility. Using a private market benchmark, investors can select the best managers, managers can truly showcase their skills, and plan members can fully receive the benefits of investing in private markets.

Appendix A: Fund Sample vs. Burgiss Manager Universe

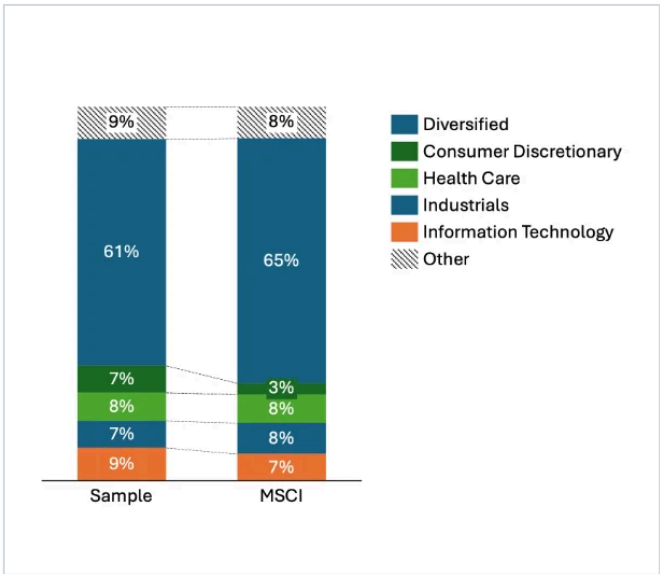
To assess the representativeness of our results, we compare the data used in this paper with the MSCI/Burgiss manager universe, which is typically considered to represent the universe of funds available to most LPs. The buyout fund sample includes 824 buyout funds from the 2013 to 2024 vintages with a combined AuM of \$2tn – about half of the MSCI/Burgiss fund manager universe for the same vintage years (1,529 funds, \$2.7tn AuM). Figure 23 shows that both datasets are aligned, with the majority of funds concentrated in the Americas, and over 60% following a diversified multi-industry strategy.

■ FIGURE 23 – BUYOUT FUNDS SAMPLE VS MSCI FUND UNIVERSE BY GEOGRAPHY AND INDUSTRY FOCUS

BY GEOGRAPHY

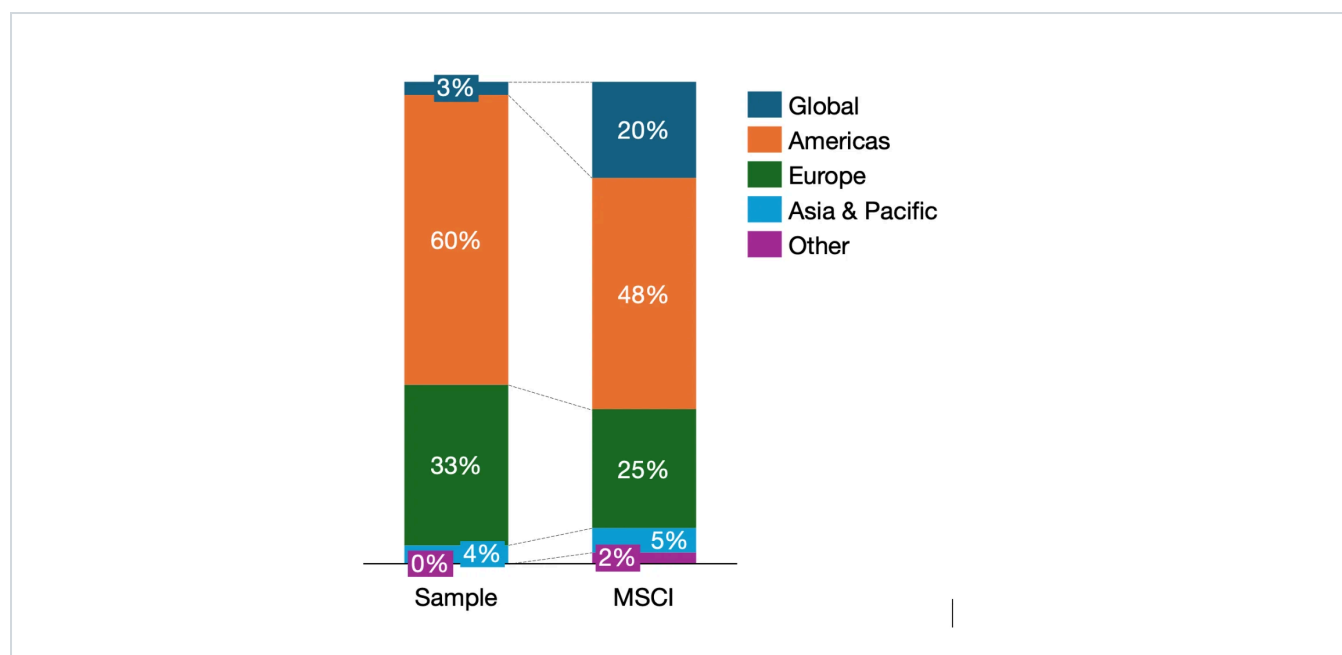


BY INDUSTRY FOCUS



The 263 infrastructure funds from 2011 to 2024 in our sample represent a total AuM of \$650bn and are in line with the MSCI fund universe (297 infrastructure funds, \$696bn). Figure 24 shows that both datasets include Europe- and Asia-focused funds. The Americas region, while the largest in both datasets, is partially offset by a higher representation of global funds in the MSCI dataset.

■ FIGURE 24 – INFRASTRUCTURE FUNDS SAMPLE VS MSCI MANAGER UNIVERSE



Appendix B: Impact of Stale Appraisals on Fund IRRs

In this example, we show the impact of stale appraisals on reported Fund IRR at different moments in the fund lifecycle. We assume a simple fund with ten years of cash flows including an initial \$100 capital call. Knowing the full fund life data, we get an IRR of 14.8% (see Table A1). This is the benchmark we use to illustrate the impact of stale NAVs.

Next, we consider the case when the IRR is reported in year 4 based on existing cashflows and the reported NAV. If we use the full-life IRR (14.8%) to discount the future cash flows, we get a NAV of \$151 and fund IRR in year 4 of 14.8%, which is correct. However, if the fund manager overestimates the NAV of its assets using a lower discount rate of 12.8%, we compute a fund NAV of \$161 and a fund IRR of 17.1%, or 238 basis points higher than the true IRR.

However, the mechanical effect of stale NAVs on reported IRR dissipates over time: computing the fund NAV in year 8 with a lower discount rate, the difference with the correct IRR is now very small (16bps). It follows that estimating alpha based on the cash flows and NAVs of mature funds should be seldom impacted by stale NAVs. However, in younger funds, this effect can be significant.

■ **TABLE A1 – ILLUSTRATIVE CASH FLOW AND APPRAISALS IMPACT ON REPORTED FUND IRR**

DISC RATE	IRR	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
FULL FUND LIFE											
	14.8%	-100	0	0	0	20	20	100	30	0	80
EARLY FUND LIFE: NAV COMPUTED IN YEAR 4 (Y4 = CF + NAV)											
14.8%	14.8%	-100	0	0	151						
12.8%	17.1%	-100	0	0	161						
IRR Diff										238 bps	
LATE FUND LIFE: NAV COMPUTED IN YEAR 8 (Y8 = CF + NAV)											
14.8%	14.8%	-100	0	0	0	20	20	100	91		
12.8%	14.9%	-100	0	0	0	20	20	100	93		
IRR Diff										16 bps	

Appendix C: Direct Alpha Methodology

Compound the fund cash flows by the return of the private market index from the date of the cash flow to the calculation date. Then calculate the internal rate of return of the adjusted cash flows, which is the Private Market Equivalent. Inputs required: fund's historical cash flows and NAV, and the private market index.

Step 1 – Adjust the cash flows. Each cash flow is compounded forward by the index return from time t to the calculation date T :

$$C^*_t = C_t \cdot \frac{V_b^T}{V_b^t}$$

where C_t is the cash flow at time t (positive for distributions, negative for contributions), V_b^T is the value of the private market index on the calculation date T , V_b^t is the value of the index at time t , and C^*_t is the adjusted fund cash flow.

Step 2 – Solve for the rate α linking the adjusted cash flows and the residual value:

$$\sum_{t=0}^T \frac{C^*_t}{(1+\alpha)^t} + \frac{NAV}{(1+\alpha)^T} = 0$$

α is the Direct Alpha rate (analogous to IRR). A Private Market Equivalent greater/lower than 0 indicates that the fund has outperformed or underperformed the private market index.

Appendix D: Fund Manager Alpha Persistence Probability

We model the probability of delivering alpha in a given fund for a given manager using a Beta-Binomial model to update the belief about the probability of success (θ) as new data is observed.

Step 1 — Define the prior. Since we initially assume a 50/50 chance for success and failure, a reasonable choice for the prior is a Beta distribution. Beta(2,2) has a mean of 0.5 and gives slightly more weight to values near 0.5.

$$\theta \sim \text{Beta}(\alpha, \beta)$$

Step 2 — Likelihood function. If we observe S successes and F failures, the likelihood is:

$$P(S, F \mid \theta) = \theta^S (1 - \theta)^F$$

Step 3 — Compute the posterior. Since the Beta distribution is conjugate to the Binomial likelihood, the posterior remains a Beta distribution:

$$\theta \mid S, F \sim \text{Beta}(\alpha + S, \beta + F)$$

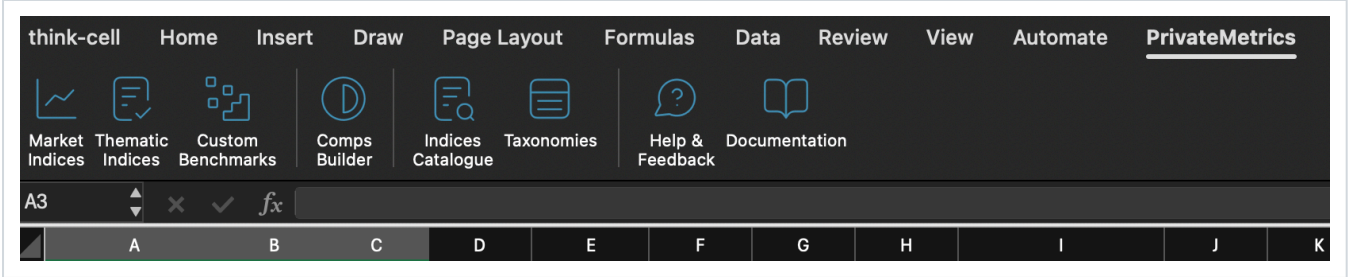
Step 4 — Estimate the probability of success. The mean of the posterior Beta distribution is:

$$E[\theta \mid S, F] = \frac{\alpha + S}{\alpha + S + \beta + F}$$

Step 5 — Credible intervals. A 95% confidence interval is given by the inverse CDF of the Beta distribution at the 2.5% and 97.5% levels: $[\text{Beta}^{-1}(0.025, \alpha+S, \beta+F), \text{Beta}^{-1}(0.975, \alpha+S, \beta+F)]$. The more a manager delivers positive alpha funds, the higher the probability of delivering another success with the follow-up fund.

Appendix E: Private Fund Alpha with the privateMetrics® API

The privateMetrics API enables a seamless and customised implementation of the Direct Alpha approach to make a quantitative assessment of a fund’s performance. Our detailed use case provides an Excel template with calculations.



Selecting a Market Index

The investor defines a market index benchmark that represents the broad market in which the fund is active. A typical choice is the private2000: representing the largest 2,000 private companies in the 30 most active markets for PE investors. Subsets include the privateUS, privateEurope and privateAPAC indices. The Direct Alpha calculated against this index estimates the market return and the total alpha each fund generated above that market return.

■ EXCEL ADD-IN TASK PANE USED TO SELECT AND DOWNLOAD PRIVATEMETRICS MARKET INDEX DATA

The image displays two screenshots of the PrivateMetrics Excel add-in task pane, illustrating the process of selecting and downloading market index data.

Left Screenshot: Market Indices Selection

- The task pane is titled "PrivateMetrics" and "Market Indices".
- Under "Select from the following", the "Index" dropdown is open, showing a list of indices.
- The selected index is "private2000, EW LCL".
- Other indices in the list include: privateEurope, CW USD; private2000, EW AUD; private2000, EW CAD; private2000, EW EUR; private2000, EW GBP; private2000, EW JPY; private2000, CW AUD; private2000, CW EUR; private2000, CW CAD; and private2000, CW JPY.

Right Screenshot: Market Indices Details

- The task pane is titled "PrivateMetrics" and "Market Indices".
- Under "Select from the following", the "Index" dropdown is set to "private2000, EW LCL".
- A link "See Index details" is visible.
- The "Metric" dropdown is open, showing a list of metrics.
- The selected metric is "Index Price".
- Other metrics in the list include: Ev To Sales; Price To Earnings; MoM Total Returns; Cumulative Total Returns; Annualised Total Returns; Volatility; Sharpe Ratio; VaR 97.5%; VaR 99.5%; and Max Drawdown.

Select a representative fund benchmark

To isolate the drivers of alpha (Allocation vs Pure Alpha) a customised strategy benchmark can be created that represents the choice of market segments (sectors and geographies) of the investments made by each fund. The custom benchmark is built from a base index universe, like the private2000, specifying allocations by PECCS pillars and geography. With up to 20 constraints possible, users can easily mirror the allocations of the fund under consideration.

EXCEL ADD-IN FUNCTIONS TO CREATE A CUSTOM BENCHMARK FROM THE PRIVATEMETRICS DATABASE

Excel

File

Edit

View

Insert

Format

Tools

Data

Window

Help

AutoSave

Excel add-in 78052419-ae6c-4238-8d0b-6646e790e9e0

Home

Insert

Draw

Page Layout

Formulas

Data

Review

View

Automate

Developer

PrivateMetrics

Cut

Copy

Format

Aptos Narrow (Bod... 12

FUND CASH FLOW AND NAV DATA USED TO CALCULATE THE ALPHA OF INDIVIDUAL FUNDS

	A	B	C	D	E	F
1						
2	USER INPUTS					
3						
4						
5	Period	Manager	Fund	Contribution	Distribution	NAV
6	30/09/2023	Manager 1	Fund 1	4,673.38	5,427.29	1,079.96
7	30/06/2023	Manager 1	Fund 1	4,683.84	5,381.77	1,062.11
8	31/03/2023	Manager 1	Fund 1	4,714.87	5,877.62	1,098.40
9	31/12/2022	Manager 1	Fund 1	4,714.87	5,852.39	1,127.31
10	30/09/2022	Manager 1	Fund 1	4,703.59	5,681.32	1,217.09
11	30/06/2022	Manager 1	Fund 1	4,699.38	5,676.63	1,240.59
12	31/03/2022	Manager 2	Fund 2	4,699.38	4,240.84	2,709.93
13	31/12/2021	Manager 2	Fund 2	4,692.54	3,529.04	3,325.56
14	30/09/2021	Manager 2	Fund 2	4,665.34	3,274.43	3,369.62
15	30/06/2021	Manager 2	Fund 2	4,659.73	3,089.35	3,578.39
16	31/03/2021	Manager 2	Fund 2	4,634.51	2,106.08	4,090.16
17	31/12/2020	Manager 2	Fund 2	4,645.71	2,502.33	3,870.38
18	30/09/2020	Manager 2	Fund 2	4,618.60	2,500.46	3,410.38

Alpha calculations

Using the market index, custom fund benchmark, and the fund cash flows data, the privateMetrics Alpha Tracking template performs all the calculations and produces the results for the fund: Total Alpha, Market Return, Allocation Alpha and Pure Alpha. The “RESULTS” tab shows the total alpha of each fund and manager against the specified market index, and breaks down the return into market return (beta) and sources of alpha: allocation and pure components.

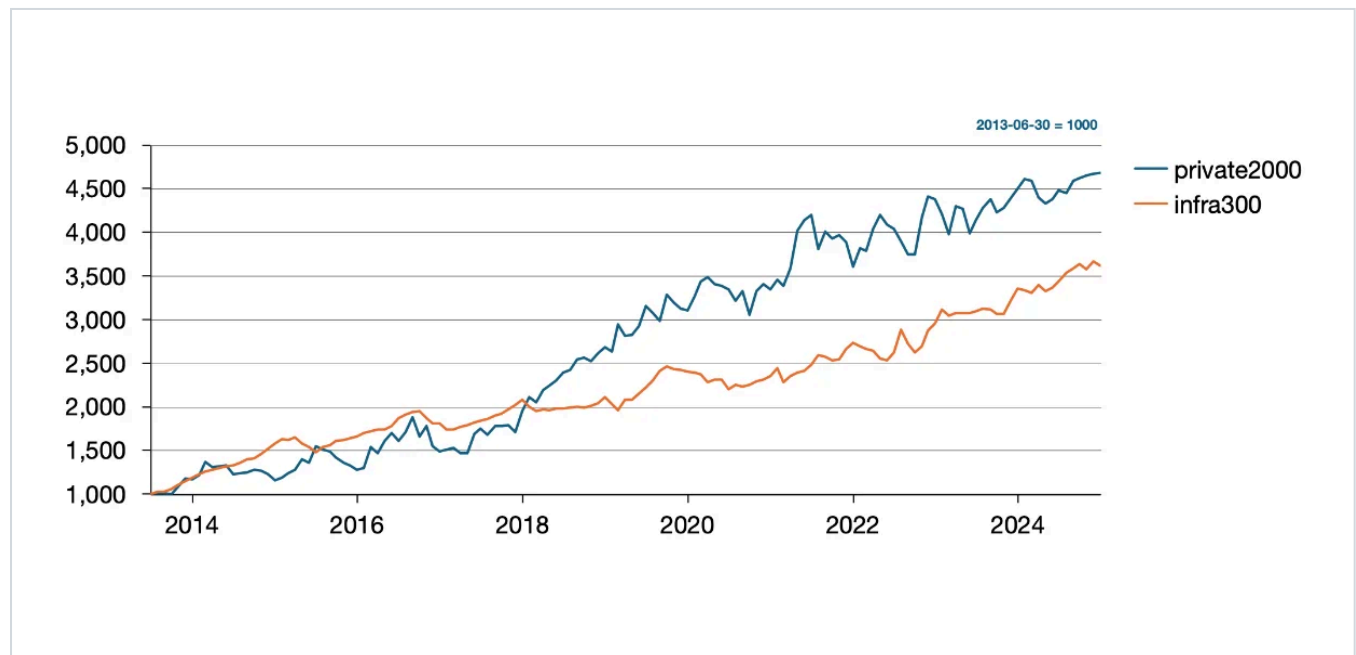
PRIVATEMETRICS ALPHA TRACKING TEMPLATE RESULTS

		Fund 1	Fund 2
Fund IRR		17.64%	21.37%
Fund TVPI		1.39	1.46
Public Equity Benchmark			
	Beta	11.63%	10.64%
	Alpha	6.01%	10.72%
Private Market Benchmark			
	Beta	18.25%	16.55%
	Alpha	-0.61%	4.81%
	Alpha - Allocation Tilt	0.12%	1.20%
	Alpha - Investment Selection	-0.73%	3.61%

Appendix F: The privateMetrics® Market Indices

The private2000 index comprises the top 2,000 companies by size representing the largest investable universe across 30 key countries attractive to private equity investors. The Infra300 index comprises 300 infrastructure companies worldwide and is designed to track the different TICCS® segments of the unlisted infrastructure reference universe. Figure 29 and Table 18 show the historical performance and risk-return summary of these market indices as of 31 December 2024. Both indices demonstrate a strong risk-return profile, with private2000 delivering higher long-term returns (14.98% over 10 years) alongside greater volatility, while infra300 offers stable returns (8.65% over 10 years) with lower risk.

■ FIGURE 29 – PRIVATEMETRICS MARKET INDICES HISTORICAL PERFORMANCE



■ TABLE 18 – PERFORMANCE SUMMARY OF PRIVATEMETRICS MARKET INDICES

INDEX	3M RETURN	2024 RETURN	5Y ANN. RETURN	10Y ANN. RETURN	5Y ANN. VOL.	10Y ANN. VOL.
private2000	1.38%	4.13%	8.58%	14.98%	15.15%	18.77%
infra300	-0.53%	7.85%	8.57%	8.65%	10.23%	10.24%

Appendix G: The privateMetrics® Valuation Model

Our approach to the valuation of private companies is designed to maximise the available transaction and financial data in private markets and provide a standardised and systematic manner to update prices with every observed transaction.

First, we construct a multi-factor model of prices using a sample of observed transactions over time which can infer the unbiased and precise factor prices that investors pay for different characteristics of a private asset. Although every transaction is idiosyncratic or unique, in a large sample of transactions, the individual errors in each transaction price can be diversified away to discern the price attributable to each factor.

Second, with the estimated factor prices, it would then be possible to price unlisted private companies whose information is available, irrespective of whether they are traded or not. Our approach's novelty is calibrating the model to newly observed transactions obtaining the factor price evolution over time, which allows us to update the valuation for all tracked unlisted private companies.

Common risk factors

The privateMetrics asset pricing model uses five key risk factors:

- **Size:** Larger companies may be more complex, have higher transaction costs, and be less liquid, all of which can make them trade at a lower valuation per \$ of revenue.
- **Growth:** Companies that can grow faster can be more sought after, making them more valuable.
- **Leverage:** Leverage can make a company riskier, but there is also a signalling effect, as companies with stable cash flows can support higher leverage.
- **Profits:** More profitable companies have more predictable (less risky) future payouts and hence attract a lower risk premium.
- **Maturity:** Younger companies have fewer track records and face higher information uncertainty; maturity negatively affects valuation.
- **Country risk:** Investors may require a high return when investing in a high-risk country, thus depressing the current valuation.

■ **TABLE G1 – KEY FACTORS, THEIR EFFECT ON VALUATION & THE ECONOMIC RATIONALE**

FACTOR	DEFINITION (PROXY)	EFFECT ON PRICE	ECONOMIC RATIONALE	REFERENCES
Size	Revenues	▼ Negative	Larger firms are more illiquid and trade a lower price	Fama & French (1993)
Growth	Change in Revenues	▲ Positive	Companies with higher revenue growth trade at a higher price	Fama & French (1992), Petkova & Zhang (2005)
Leverage	Total debt / Revenues	▲ Positive	Companies that can borrow more have a lower cost of capital and a higher value	Gomes & Schmid (2010), George & Hwang (2010)
Profits	Ebitda Margin	▲ Positive	Companies that have higher profits have a higher value	Novy-Marx (2013), Hou et al. (2015)
Maturity	Years since incorporation	▼ Negative	Companies that are mature exhibit less growth potential and trade at a lower price	Jiang et al. (2005)
Country Risk	Term Spread	▼ Negative	Companies in high-risk countries face more uncertain prospects	Chen & Tsang (2013)

Source: calculated using over 10k deals from PitchBook, CapitalIQ, Factset, and other primary sources between 1999-2022.

Model set up

The privateMetrics asset pricing model uses the Price-to-Sales ratio of observable transactions (the entry price multiple) as the modelled variable. The model is estimated as the linear sum of the product of factor exposures and factor prices:

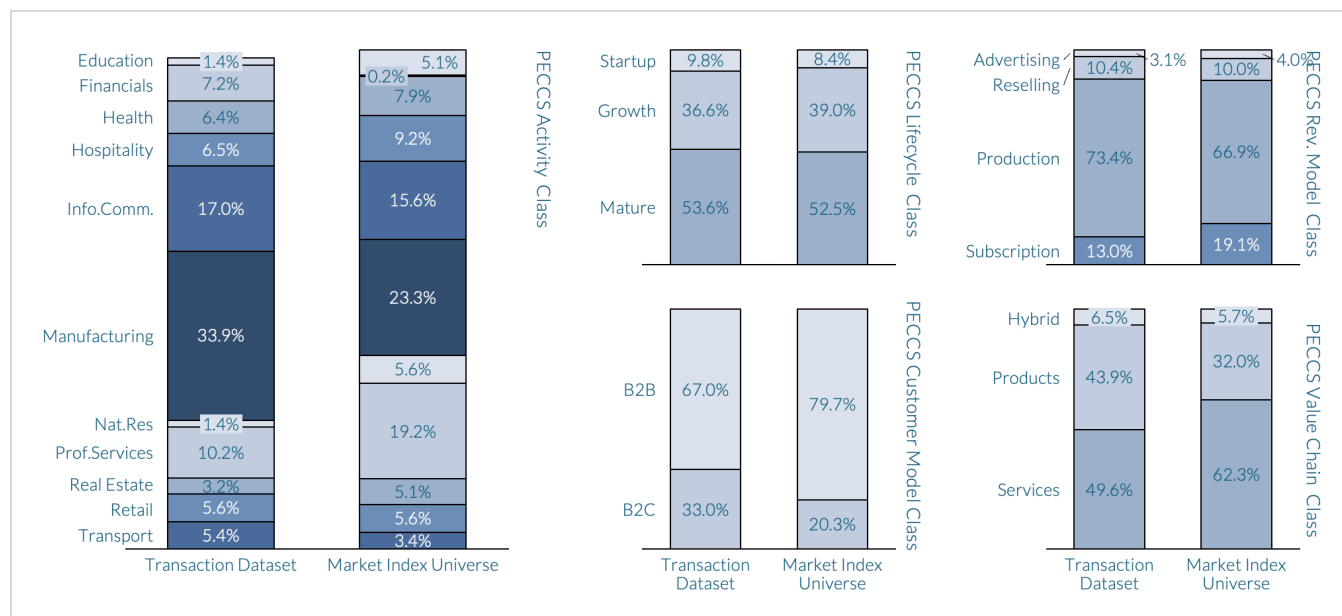
$$\frac{P}{S} = \alpha + \sum_{k=2}^K \beta_k \lambda_k + \varepsilon$$

Following standard asset pricing notation, the factor exposure or factor loading is called a beta (β), and the factor premium is called a lambda (λ) for the k factors in the model. α is the intercept and ε is the noise or idiosyncratic part of the valuation.

Model calibration

The privateMetrics model uses a carefully curated dataset of more than 10k+ unlisted private company investments going back two decades. We calibrate this model using new observations monthly to update its estimation of the price of risk of each factor through a dynamic estimation (using a Kalman filter), which retains the memory of past λ s while allowing the new transaction to influence the relationship. More details are available in our online documentation and Selvam and Whittaker (2024).

■ **FIGURE G1 – PRIVATEMETRICS TRANSACTION DATASET COMPARED TO THE INDEX UNIVERSE BY PECCS PILLAR & CLASS**



How precise are the predictions across PECCS® pillars?

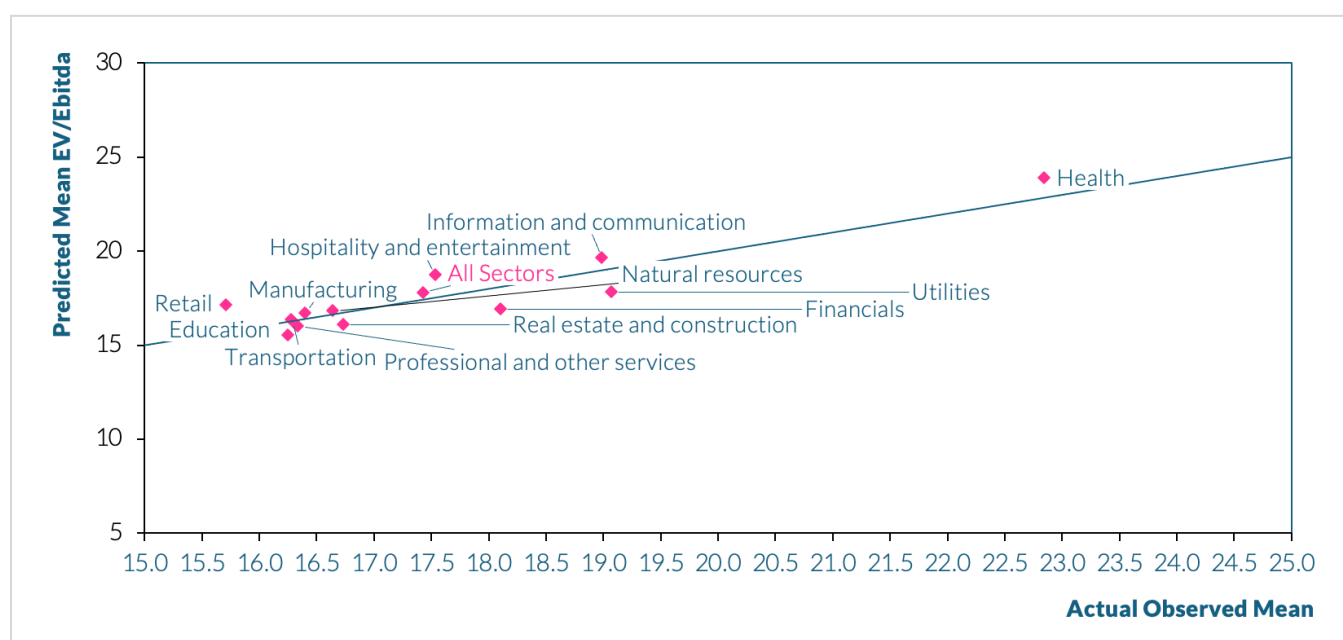
To examine how closely the predicted valuations track the raw modelled valuations in transactions, we compute the average estimation errors of the full sample and by classes within each PECCS® pillar. All the errors are within $\pm 10\%$, reassuring that the model predictions on average even within each segment of PECCS® are reasonable. We also compute a predicted EV/EBITDA and compare it to transaction-implied ratios; Figure G3 presents the average predicted and observed EV/EBITDA by PECCS® activity classes, finding the predictions very close to the observed values.

■ **TABLE G2 – AVERAGE ESTIMATION ERRORS ACROSS PECCS® CLASSES**

PECCS ACTIVITY	MEAN EST. ERROR	PECCS CLASS	MEAN EST. ERROR
Education and public	0.9%	LIFECYCLE PHASE	
Financials	1.8%	Startup	0.1%
Health	2.6%	Growth	-1.7%
Hospitality and entertainment	-1.1%	Mature	2.8%
Information and communication	-4.4%	REVENUE MODEL	
Manufacturing	2.5%	Advertising	1.2%
Natural resources	9.4%	Reselling	4.6%
Professional and other services	3.3%	Production	2.9%
Real estate and construction	1.9%	Subscription	-6.9%
Retail	0.5%	CUSTOMER MODEL	
Transportation	7.2%	B2B	1.5%
Full Sample	1.1%	B2C	0.9%
		VALUE CHAIN	
		Hybrid	0.6%
		Products	1.1%
		Services	3.4%

Source: Calculated using over 10k deals from Pitchbook, CapitalIQ, Factset, and other sources between 1999-2022.

■ **FIGURE G3 – PREDICTED VERSUS ACTUAL EV/EBITDA RATIOS BY PECCS® ACTIVITY CLASSES**



Source: PitchBook, CapitalIQ, Factset, and other sources between 1999-2022.

Contact Information

LONDON OFFICE

100 Wood Street,
London EC2V 7AN
United Kingdom
+44 (0) 207 566 5445

SINGAPORE OFFICE

One George Street
#15-02
Singapore 049145
+65 66538575

Email: sales@sipametrics.com · Web: www.sipametrics.com

Disclaimer

The information contained in this document (the "Information") has been prepared by Scientific Infra & Private Assets, a PEI Group company, solely for informational purposes. It does not constitute a recommendation to participate in any particular investment strategy and should not be considered investment advice or an offer to sell or buy any securities.

All Information provided by Scientific Infra & Private Assets is impersonal and not tailored to the needs of any person, entity, or group of persons. The Information shall not be used for any unlawful or unauthorized purposes and is provided on an "as is" basis. Although Scientific Infra & Private Assets obtains information from sources it considers reliable, neither Scientific Infra & Private Assets nor any other PEI Group entities involved in compiling, computing, or creating the Information (collectively, the "SIPA Parties") guarantees the accuracy or completeness of the Information.

None of the SIPA Parties makes any representation or warranty, express or implied, as to the results to be obtained from the use of the Information. The user assumes the entire risk of any use made of this Information. The SIPA Parties hereby expressly disclaim all implied warranties (including, without limitation, warranties of accuracy, completeness, timeliness, merchantability, or fitness for a particular purpose). In no event shall any SIPA Party have any liability for any direct, indirect, special, punitive, consequential, or any other damages (including lost profits), even if notified of the possibility of such damages.

All Scientific Infra & Private Assets indices and data are the exclusive property of Scientific Infra & Private Assets. Past performance is not an indication or guarantee of future results. Hypothetical or back-tested results are achieved via retroactive application of a simulation model and have inherent limitations. Scientific Infra & Private Assets maintains and calculates indices but does not manage actual assets. Index returns do not reflect the payment of sales charges or fees, which would reduce actual performance.

The Information may be used to create internal charts and reports. Limited extracts may be distributed infrequently and in a non-systematic manner. The Information may not be used in connection with the marketing or promotion of any financial instrument or investment product that makes explicit reference to any trademarks licensed to Scientific Infra & Private Assets or the PEI Group without a separate license agreement. The Information may not be used to verify or correct data from other sources.