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Market efficiency and value added by listed and unlisted U.S. institutional investor real estate portfolios.

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Executive Summary

CEM research shows that institutional investors of sufficient size tend to outperform the market over long periods of time. The ability to outperform benchmark returns stems partly from the structural advantages; investors with more scale, more actively managed assets, and more assets managed in-house tend to outperform. However, what sources of value lay at the investment level?

Here, we focus on the real estate market, demonstrating that real estate as an asset class offers the potential to add value both in listed and unlisted real estate. Average investment costs in unlisted (i.e., private) real estate exceed the gross value added generated, meaning that institutional investors, on average, underperform their benchmarks net of investment costs. By contrast, for the average listed equity REIT portfolio, nearly half of the 84 basis points of gross value added is returned to investors, providing them with 32 basis points of value added, net of all investment costs.

Highlighted in this research:

- 24-year (1998-2021) real estate net value-added distributions and statistics of U.S. institutional investor portfolios for listed equity REITs and unlisted real estate;
- Proportions of investors outperforming by year and the implied probability that investors have skill in alpha generation;
- Year-over-year net value added persistence data.

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1. Introduction

Only two factors matter for the growth in assets under management (AUM) of any portfolio: net contributions and net investment returns.

It may seem a curious fact, then, that institutional investors spend a great deal of time focused on other factors, most particularly value added (or alpha) generated by active management. It is easy to understand why institutional investors emphasize value added, the excess investment return, over a benchmark. The typical organizational structure of an institutional investor, and indeed the industry, separates the asset allocation decision from the management of assets within a specific asset class. The investors working within asset class mandates, and the managers they allocate assets to, are either trying to match the asset class benchmark (in a passive mandate) or deliver better than benchmark performance in an active (or private market) mandate.

Active management decisions are not as scalable as asset allocation decisions. So, while asset allocation may be responsible for most of the net return, active management is responsible for most of the cost incurred by institutional investors. Of the roughly 50 basis points (one basis point is 0.01 percent) of investment expenses incurred by a typical large, institutional investor, around 45 are spent trying to generate value added through active management. To the extent expenses here are a proxy for 'people' and 'effort', this proportion suggests that while asset allocation may be the most crucial decision for an investor, 90% of organizational effort is consumed with pursuing the incremental net return available via active management. It should be no surprise then that measuring success (or lack thereof) is a major focus.

If institutional investors were unable to reliably generate value added net of investment costs (i.e., net value added), the entire active management investment industry would cease to be relevant. Why pay an active manager if they cannot reliably beat their benchmark? Indeed, notable researchers have argued certain groups of investors over specific periods have not been able to generate any value added[1].

Our most recent work at CEM Benchmarking[2], using large samples of institutional investor data over long time horizons, has shown that institutional investors have generated about 67 basis points of value

[1] For two notable examples of recent research showing negative value added, see Richard M. Ennis's on benchmarking large U.S. DB pension funds in "Lies, Damn Lies and Benchmarks, An Injunction for Trustees", October 2022 or alternatively "Hogwarts Finance", December 2023, both available on SSRN, or the series of annual reviews entitled "SPIVA© U.S. Scorecard" and related research published by S&P Global.

[2] See "A Case for Scale: How the World's Largest Institutional Investors Leverage Scale to Deliver Real Outperformance" by Alexander D. Beath and Chris Flynn, February 2022, available at www.cembenchmarking.com.

added gross and 15 basis points net over the 29 years spanning 1992–2020. It is notable that, in our work, benchmarks are self-selected by investors themselves which may result in an upward bias in value added. On the other hand, if benchmarks that were easy to beat could be constructed, why would investors not simply arbitrage the benchmark?

In this work, rather than focusing on total fund value added, we focus instead on the value added in a particularly interesting asset class, real estate, for which clearly listed and unlisted (or private) analogs exist. Our prior work[3] on asset class returns for U.S. DB pension funds has shown that listed and unlisted real estate returns are highly correlated with comparable volatility, provided one accounts for the lag in reporting in private markets. Despite this similarity, listed real estate has provided higher returns than unlisted real estate over most time periods. How much of this outperformance is due to superior net value added, if any?

Another motivation for studying the value added in real estate is our work[4] on market efficiency in U.S. equity markets where we have found that actively managed large cap. U.S. equity portfolios are highly efficient, producing a *gross* value added of -0.02 percent, whereas small cap. U.S. equity portfolios are inefficient, having produced a *net* value added of 0.53 percent. Here, we show that efficiency depends on implementation style for real estate portfolios. Listed portfolios in the form of publicly traded real estate investment trusts (REITs) show marginally positive net value added of 0.32 percent, whereas unlisted real estate portfolios show significantly negative net value added of -0.68 percent.

The relative efficiency of listed and unlisted real estate portfolios is further clarified once we switch focus from the average net value added and look instead at the fraction of portfolios with positive net value added. In the case of listed real estate, 604 of 1,092 (or 55 percent) of portfolios have beaten their benchmark, a highly significant figure that implies with a 99.98 percent probability that listed real estate managers as a group can reliably beat the market. By contrast, in the case of unlisted real estate, 1,292 of 2,928 portfolios outperform (or 44 percent), which implies a 0.00 percent probability that unlisted real estate managers as a group can reliably beat the market.

The data we present here on the relative performance of listed and unlisted real estate is not unusual. The status of academic research on the topic was recently summarized by the Pension Real Estate Association (PREA) in their 2023 fall quarterly point of view: “Academics Question the Value of Private Real Estate Funds: What’s an Investor to Do?”. Independent studies consistently find underperformance of unlisted real estate, either via methods such as direct alpha[5] (i.e., a public market equivalent benchmark of IRR against the S&P 500), or via comparison to leverage adjusted private real estate indices[6] provided by NCREIF, the primary source of industry benchmarks in the U.S.

Furthermore, we present the same analysis on market efficiency in unlisted real estate for a variety of investment implementation styles, that is whether investment is made by direct ownership of property,

[3] See “Asset Allocation and Fund Performance of Defined Benefit Pension Funds in the United States, 1998-2021”, Alexander D. Beath and Chris Flynn, October 2023, available at www.cembenchmarking.com.
[4] See “Market Efficiency: Value Added by Large Cap. and Small Cap. U.S. Equity Portfolios”, Alexander D. Beath and Chris Flynn, November 2019, available at www.cembenchmarking.com.
[5] See “Persistently Poor Performance in Private Equity Real Estate”, Da Li and Timothy Riddough, May 2023, available on SSRN.
[6] See “Another Look at Private Real Estate Returns by Strategy”, Mitchell Bollinger and Joseph Pagliari, August 2019, Journal of Portfolio Management.

through a core fund, through an opportunistic private-equity style fund, or via fund of fund. We find that:

1. Direct ownership of real estate has generated positive value added, like listed real estate, and has outperformed other styles (i.e., core funds, opportunistic funds, and fund-of-funds).
2. Core funds and fund-of-funds real estate have generated negative net value added, on average, and far fewer than 50 percent of portfolios show positive value added.
3. Opportunistic funds have been breakeven on a net value added basis, and almost 50 percent of portfolios have shown positive net value added.

Finally, we present data on the persistence of performance in listed and unlisted real estate. An oft repeated claim by owners of unlisted real estate is that performance displays persistence: by choosing top quartile managers who display persistently high performance, unlisted real estate can outperform listed real estate even if, on average, listed real estate outperforms unlisted real estate. Our data shows that persistence in listed real estate is almost entirely non-existent. Unlisted real estate, by contrast, does indeed display persistency year-over-year, with top quartile managers more likely to remain top quartile than would be expected were performance random. However, the same is true of bottom quartile managers. Ultimately, while unlisted real estate shows persistency, the most likely cause of persistency is the well-known smoothing of appraised returns since, on average, unlisted real estate portfolios as a whole underperform.

2. The CEM database and research synopsis

At CEM Benchmarking, we have been benchmarking the value proposition (e.g., returns, risks, investment costs) of large, global institutional investors since 1992. Our clients for the most part are Defined Benefit (DB) pension funds, asset managers for large pools of DB assets, buffer funds for sovereign state pension systems, or sovereign wealth funds. One reason for working with us is to compare and learn from the largest, best in class institutional investors. At the end of 2021 there was over $14 trillion (USD) of assets in the database, and over 1,100 distinct institutional investors from 20+ countries around the globe[7] have provided data to CEM Benchmarking at one time or another.

We have analyzed total-fund value added in several white papers, most recently[8] in "A Case for Scale: How large institutional investors leverage scale to deliver real outperformance". While most of the total-fund, one-year net value added distribution is caused by the vagaries and gyrations of markets rather than skill, larger, more active, and more internalized institutional investors have small but persistent advantages that ultimately results in a positive average net value added. The three major drivers of net value added and their impacts are:

1. Portfolios that are actively managed outperform those that are passively managed by 0.22%;
2. Portfolios that are internally managed outperform those that are outsourced by 0.19%;
3. For each 10-fold increase in assets under management, net value added improves by 0.20%.

[7] A typical year sees 300+ institutional investors from 12+ countries.
[8] See "A Case for Scale: How the world's largest institutional investors leverage scale to deliver real outperformance", Alexander D. Beath and Chris Flynn, February 2022, available at www.cembenchmarking.com.

The first factor causes an increase in investment costs that is compensated with an even better return, whereas the second and third factor benefit institutional investors by lowering the cost of investing.

Despite this research effort we rarely make data available on value added within asset classes. One notable example[9] was a white paper published in 2019 showing that while actively managed U.S. large cap. equity portfolios were almost entirely efficient, producing -0.02% value added gross of investment costs, U.S. small cap. equity portfolios were highly inefficient, with large institutional investors harvesting more than 0.50% of value added net of investment costs, on average. The range of outcomes in value added, is however, wide, but top quartile investors are more than capable of adding value even in the absence of persistence, although the question of persistence was not addressed.

Gross value added by institutional real estate portfolios: An overview.

We show here for the first time, detailed 24-year (1998 – 2021) value added distributions of the real estate portfolios held by large institutional investors in the U.S. reported to CEM Benchmarking, excluding passive listed real estate portfolios which, by definition, do not add value. Like our results in small cap. U.S. equities, we find that real estate gross of investment costs is highly inefficient. (U.S. large cap. stocks appear to be the exception in their displayed efficiency gross of investment costs, not the rule.)

Indeed, actively managed listed real estate – mainly listed equity REIT portfolios outsourced to third-party external managers – outperformed self-reported benchmarks gross of investment costs by 0.84% per year, on average (more than three standard errors from zero). Similarly, unlisted real estate – mainly portfolios of externally managed core real estate with a growing externally managed private equity LP-style opportunistic real estate component – outperformed self-reported benchmarks gross of investment costs by 1.01% per year, on average (more than five standard errors from zero).

These results, with the precision offered by thousands of portfolio/year observations, provide strong evidence that the market for both listed and unlisted real estate is highly inefficient, with the opportunity to outperform for very large, sophisticated institutional investors. The fraction of portfolios outperforming provides a further layer of evidence. Gross of investment costs, if outperformance were but a coin flip, the fact that we observe nearly 63% (listed) and 62% (unlisted) real estate portfolios outperforming their benchmark would require an extraordinary explanation. A simple appeal to binomial statistics shows that the probability that real estate portfolio managers display real investment skill in their ability to outperform their benchmarks *gross of costs* is almost entirely certain.

That said, one could (and many will) appeal to the fact that benchmarks are self-chosen which could conceivably lead to bias. However, with listed real estate portfolios, benchmarks are nearly always REIT indices themselves, most commonly FTSE EPRA Nareit Developed or similar, thus having very high correlations and betas to the assets they intend to benchmark. Given this, if managers knew that their benchmark was easy to beat on a regular basis, one would have to ask why they choose not to simply lever the guaranteed alpha? For this reason, we find it unlikely that – in listed real estate markets at least – benchmarks can be gamed to ensure consistent success. Instead, we conclude that in listed

[9] See "Market Efficiency: Value Added by Large Cap. and Small Cap. U.S. Equity Portfolios", Alexander D. Beath and Chris Flynn, November 2019, available at www.cembenchmarking.com.

markets at least, real estate portfolio managers possess demonstrable skill and can generate alpha from this inefficient market, gross of cost.

Net value added by institutional real estate portfolios: An overview.

The impact of investment costs on investment performance cannot be overstated. Where actively managed listed real estate portfolios and unlisted real estate portfolios had similar gross value added over the period 1998-2021, listed real estate portfolios net value added was positive at 0.32% (more than one standard error from zero) whereas unlisted real estate net value added was -0.68%, distinctly negative. These data show that the primary separator between success and failure in real estate portfolios is cost. In the more detailed sections of this whitepaper, this is further supported by the fact that low-cost internal direct unlisted real estate displayed positive net value added as well.

The impact of investment costs on real estate portfolios is also seen in the fraction of outperforming portfolios. In the case of listed real estate, where nearly 63% of portfolios outperformed their benchmarks gross of investment costs, the fraction outperforming drops to just above 55% net of investment costs. While this may seem close to 50% (indicative of no investment skill), the large sample size gives a 99.98% confidence that observed fraction indicates real investment skill.

In the case of unlisted real estate, the impact of costs extends to the fraction of portfolios outperforming, where only 44% of portfolios outperform their benchmark net of investment costs (recall that 62% of portfolios outperform gross of investment cost). In terms of investor skill, the large sample size of 2,928 investor-year portfolios means that we can conclusively demonstrate that unlisted real estate managers, more often than not, destroy value.

That unlisted real estate managers destroy value relative to their own self-reported benchmarks indicates that indexing would be, for this real estate implementation style, a superior implementation strategy. The primary unlisted real estate benchmarks used, however, are not investible. It might be argued that the primary unlisted real estate benchmark used – NCREIF ODCE – is in fact investible via a sufficiently large, sufficiently diversified fund-of-fund.

3. Real estate benchmarks used by U.S. institutional investors (Exhibit 1)

In Exhibit 1, we show the frequency of common benchmark usage in listed (Exhibit 1A) and unlisted real estate (Exhibit 1B) portfolios during calendar 2021. Benchmarks used in listed real estate portfolios are more diverse, most of which can be classified as pure REIT benchmarks, the exception being NCREIF-ODCE (11%), a benchmark comprised of unlisted real estate. The most common are provided by FTSE; FTES EPRA Nareit Diversified (26%), FTSE Nareit All Equity (19%), or FTSE EPRA Nareit Global Real Estate (9%). More niche REIT index providers are also represented such as MSCI U.S. REIT (13%), Dow Jones U.S. Select REIT (9%) and Wilshire REIT (6%). The use of NCREIF-ODCE is indicative that some listed real estate portfolios are managed within (or under) an unlisted real estate portfolio, likely as a completion strategy.

Unlisted real estate benchmarks are, as mentioned, less diverse than listed real estate benchmarks. More than 3 out of 4 U.S. institutional investors in the CEM database with unlisted real estate portfolios benchmark using indices provided by NCREIF (either ODCE, NPI, or simply “NCREIF” without further description). We remark that NCREIFs ODCE likely makes up more than half of all unlisted real estate benchmarks and represents an industry standard (presuming more than 50% of the indices labelled

Exhibit 1A. Listed real estate benchmarks (2021)

Dedicated listed real estate portfolio benchmark descriptions are provided by CEM Benchmarking client funds. Benchmarks categorized as "other" include composite benchmarks created from equity / debt blends designed to reflect the volatility of the portfolio, and other composite constructions that cannot easily be ascribed to any particular category.

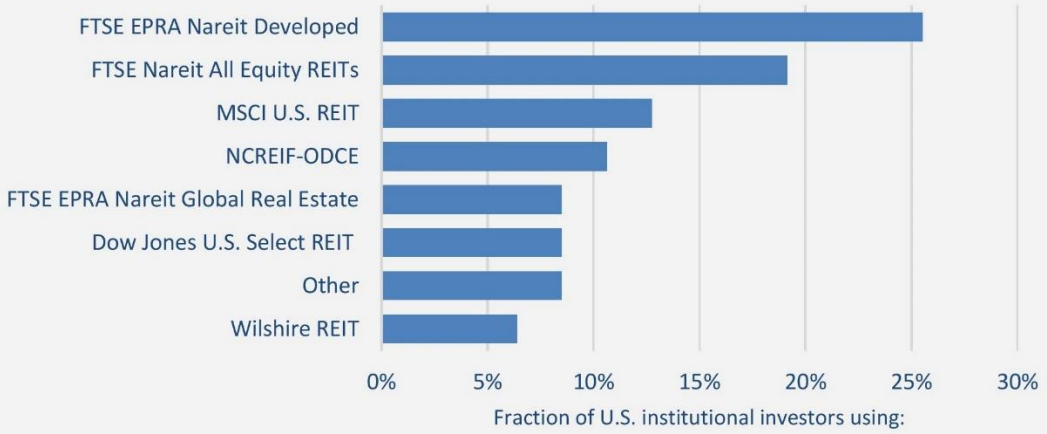
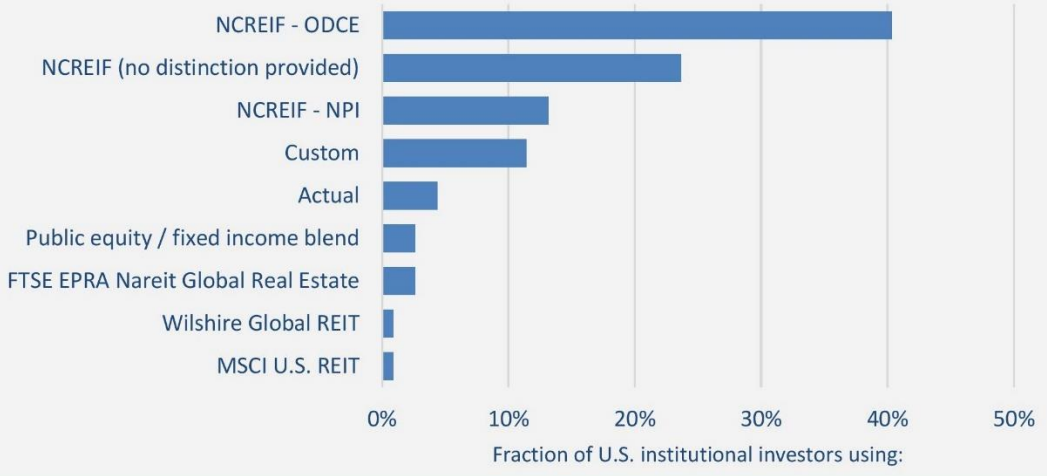


Exhibit 1B. Unlisted real estate benchmarks (2021)

Unlisted real estate portfolio benchmark descriptions are provided by CEM Benchmarking client funds. Benchmarks categorized as "custom" benchmarks are composite benchmarks comprised of several components in order to capture sector / regional / leverage factors in the portfolio that cannot be easily categorized into any particular category. Benchmarks described as "actual" lack a benchmark (or, equivalently, are neutralized to have no value added) and are excluded from the analysis. Benchmarks categorized as "public equity / fixed income" include composite benchmarks created from equity / debt blends designed to reflect the volatility of the portfolio.



"NCREIF" without further distinction as to the type are ODCE). The use of NCREIFs NPI is in some sense odd; unlisted real estate portfolios all use leverage to some degree while NPI is a "pure property" index with all the effects of leverage removed (CEM Benchmarking clients report returns of unlisted real estate portfolios including leverage, like any other asset class, with the exception being where leverage is applied at the total portfolio level). Leverage mismatches between portfolio and benchmarks result in

high value added in years where returns exceed the cost of leverage and vice-versa, an effect that is clearly visible in the net value added data presented in the following section.

4. Listed and unlisted real estate value added distributions (Exhibits 2 and 3)

Detailed active management performance statistics are shown in Exhibits 2 and 3 for listed and unlisted real estate. Each Exhibit shows the same statistics, so a description of one suffices to describe them all, aside from the obvious fact that the data are different. Each of the Exhibits consists of 3 parts; part A displays a summary of the 24 years of annual value added data, part B displays statistics on each of the 24 individual years of value added data; and part C displays statistics on each of the 24 individual years of net return data which are used to calculate part A and part B.

Exhibits 2A/3A – Value added statistics.

Exhibits 2A/3A show value added data over the entire sample period, 1998-2021. 1998 is chosen as the starting year since that is the first year for which listed equity REIT data is available. Data in Exhibits 2A/3A is aggregated across years. The left-hand side of the Exhibits 2A/3A shows:

1. Asset class characteristics such as the number of observations, assets under management, the average fraction of portfolios managed actively, the average fraction of portfolios managed internally, and the average annualized compound return.
2. Performance summaries gross of investment management expenses, including the gross average annualized compound return, the proportion of portfolio/year observations outperforming the benchmark gross of investment expenses, and the odds that the observed data is consistent with investor skill gross of investment expenses[10] (i.e., odds actual gross probability of outperforming benchmark (POB) > 50%).
3. Performance summaries net of investment management expenses, including the net average annualized compound return, the proportion of portfolio/year observations outperforming the benchmark net of investment expenses, and the odds that the observed data is consistent with investor skill net of investment expenses (i.e., odds actual net POB > 50%).

The right-hand side of Exhibits 2A/3A shows:

[10] We include the derived statistic 'Odds actual POB > 50%' because the simple observation that (say) 60% of portfolios beat their benchmark is not necessarily indicative of skill on account of the finite sample size. As a simple example, flipping a coin four times and observing heads on 3 occasions does not imply that the coin is biased whereas flipping a coin 400 times and observing heads on 300 occasions almost certainly does mean that the coin is biased. Here, 'odds actual gross POB > 50%' refers to the probability that the underlying (and un-observed) probability of outperforming benchmark (POB) is in fact greater than 50%. An 'odds of actual gross/net POB > 50%' > 99% means that investors displayed skill with a 99% probability, and an 'odds of actual gross/net POB > 50' of 1% means that investors displayed a lack of skill with a 99% probability, with the understanding that skill here means an ability to outperform a self-reported benchmark.

1. A histogram of value added net of investment expenses aggregated across years[11], along with statistics describing the distribution. Statistics include the average, the standard deviation, the skewness, the standard error, counts (raw count, count with net value added > 0, proportion outperforming benchmark, and odds proportion outperforming benchmark > 50%, and percentiles.
2. Persistence of net value added summary statistics showing the fractions of portfolios with consecutive year data within quartile 1 through 4 in one year and within quartile 1 through 4 in the following year. Note that, because not all portfolio data have consecutive year data, the sum of columns/rows does not identically add to 25% (as they would were the dataset not sparse). The data is further aggregated into above/below median for a simple demonstration of portfolio persistence which appears in a statistically higher/lower fraction appearing than one would assume given a random distribution of value added.

Exhibits 2B/3B – Net value added statistics by year.

Exhibits 2B/3B show net value added statistics by year, together with a plot of the average net value added and error bars showing plus/minus one standard error for listed and unlisted real estate, respectively. Statistics shown by year are identical to that shown over the entire period in Exhibits 2A/3A. Note that the average value added over the entire period shown in Exhibits 2A/3A is, because of the data weighting scheme, equal to the average across all years.

Exhibits 2C through 7C – Net return statistics by year.

Exhibits 2C/3C show net return statistics by year for listed and unlisted real estate respectively. The return data is not the focus of this research but is shown for informational purposes. Note minor differences with the return data presented in our series of papers "Asset Allocation and Fund Performance of Defined Benefit Pension Funds in the U.S." because the data here includes in addition to U.S. DB pension funds family offices, trusts and other large institutional investors.

5. Value added by actively managed, dedicated listed equity REIT portfolios (Exhibits 2A and 2B).

Exhibit 2A and 2B display the net value added generated by dedicated listed equity REIT portfolios held by U.S. institutional investors in the United States over the 24-year period 1998-2021 (Exhibit 2C displays net returns by year). The total AUM included in the 2021 sample was nearly $20 billion, which, with a sample of 35 portfolios, implies an average portfolio size of a bit more than $0.5 billion. Three quarters of all listed equity REIT portfolios are actively managed. We stress that for listed equity REITs, the value added data is only shown for those portfolios that are managed actively. Listed equity REIT portfolios, like most portfolios held by U.S. institutional investors, are nearly always externally managed

[11] To eliminate the bias caused by the growth or contraction of the CEM database over years, each fund / year observation is weighted in proportion to the reciprocal of the number of observations within that year. For example, if we have 90 observations in 2020 and 110 in 2021, then each 2020 observation has a weight of 100/90 = 1.11 and each 2021 observation has a weight of 100/110 = 0.91 such that the total number of weighted observations remains 200. The weighting scheme allows a preservation of the averages across years; that is, if the average value added in 2020 is -0.25% and the average value added in 2021 is +0.25%, then the average value added should be zero.

by a third party investment management firm, with only 11% managed in-house by internal investment teams.

The average benchmark return of 9.6% is historically high relative to other asset classes: A passive investment in the average benchmark would have outperformed every major asset class with the exception of private equity and listed equity REITs themselves (on account of the success of active management).

The average gross value added by active listed equity REIT portfolios was 0.84%, resolved with an error of 0.26%. That gross value added was more than three standard errors away form zero makes it highly unlikely that the result is in fact consistent with an efficient market, here taken to be a market which generates no value added gross of investment expenses (since returns of a passive portfolio track that of the benchmark). Indeed, nearly 63% of all portfolio/year observations had a gross value added greater than zero. With 1,091 portfolio/year observations and 684 of those outperforming, the odds that the investors, in fact, display skill[12] gross of investment costs is 100%.

While the display of investor skill gross of investment expenses is interesting from an academic point of view, what matters to investors in practice is the display of skill net of investment expenses. In this respect, the performance data is less clear. The average net value added, which is indeed positive at 0.32%, is not far from 0%, being resolved to a standard error of +/- 0.25%. Statistically speaking, net value added 1.3 standard errors from zero means we cannot rule out a null result.

However, the brute fact remains that the distribution is negatively skewed (i.e., the distribution has excess weight in the negative tail). Thus, while the average net value added is consistent with zero, over 55% (604 of 1,091) of all portfolio/year observations generate value added greater than zero. Consequently, the probability that active listed equity REIT portfolios demonstrate skill is nearly certain at 99.98%.

The fact that value added for actively managed listed equity REIT portfolios is near zero, but that well over half of portfolios outperform, is an interesting contrast in comparison to our previous result on actively managed U.S. small cap. equity portfolios. In that case, the exact opposite situation was true; the average net value added of 0.53% +/- 0.18% is three standard errors greater than zero, but almost exactly 50% of portfolios outperformed.

In the case of actively managed U.S. small cap equity, the story is that while outperformance is a 50/50 endeavor, winners won more than losers lost, and hence skill is shown by those managers who pick big winners. In the case of actively managed listed equity REITs the story is different; rather than picking big winners, outperforming managers avoid big losers.

[12] The odds that investors have skill inferred from the count of portfolio / year observations with gross value added greater than zero is obtained from simple binomial statistics. The calculation for gross value added, with 684 of 1,091 observations being greater than zero, is:

$$P(skill) = \sum_{m=0}^{684} \frac{1{,}091!}{m!\,(1{,}091-m)!} 0.5^{m} \cdot 0.5^{1{,}091-m}$$

Exhibit 2A. Value added statistics: Dedicated listed equity REIT portfolios

Summary

CEM's data on dedicated listed equity REITs includes portfolio level returns, policy benchmark returns, policy weights, holdings and investment costs over the period 1998 - 2021 (24 years).

Asset class characteristics[1]

# of unique funds reporting data: 187
# of observations in full period (active only): 1,091
Total asset class AUM (2021): 19.6 billion (USD)
Actively managed fraction (2021): 76% of observations
Internally managed fraction (2021): 11% of observations
Average annualized benchmark return (1998 - 2021): 9.6%

Performance summary, gross (1998 - 2021, ex. Indexed)[2]

Average annual gross value added: 0.84% ± 0.26%
Proportion outperforming benchmark (POB), gross: 62.69%
Odds actual gross POB > 50%: 100.00%

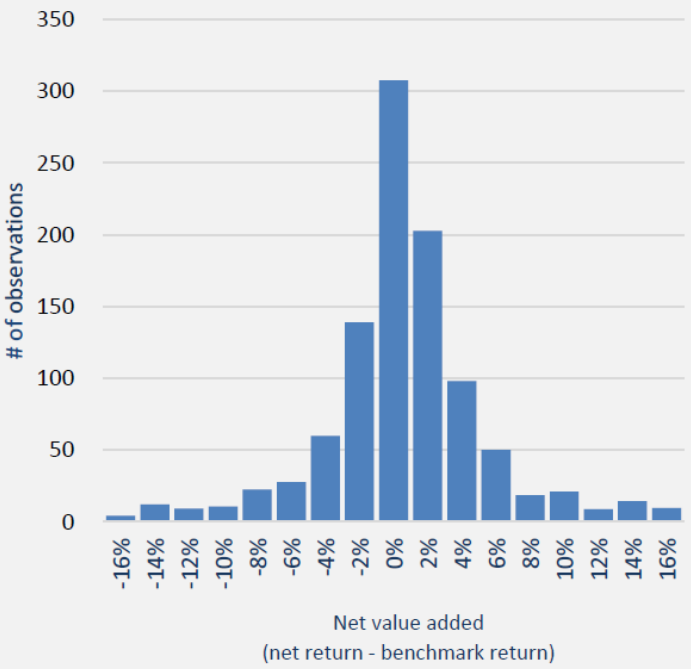
Performance summary, net (1998 - 2021, ex. indexed)[2]

Average annual net value added: 0.32% ± 0.25%
Proportion outperforming benchmark (POB), net: 55.36%
Odds actual net POB > 50%: 99.98%

Notes:

1. Average annual benchmark return is the compound average return of the annual average benchmark return.
2. Gross / net value added is portfolio annual return less benchmark return, gross / net of investment costs. Average annual gross / net value added is the arithmetic average across years. Proportion outperformng benchmark (i.e., POB) is the fraction of fund/year observations outperforming their benchmark either gross or net of investment costs. 'Odds actual POB > 50%' is the probability that the observed POB is indicative of skill in active management.
3. The distribution of investor-year net value added observations is provided in a histogram. Each observation is weighted by the year sample size to remove bias caused by changing growth in sample size.
4. Persistence of net value added shows, for the subset of net value added with consecutive year data, the joint distribution of observations that were in quartile X in year Y and in quartile X' in year $_{Y+1}$. (See Exhibit 5 for more detail.)

Net value added distribution[3] - histograms and statistics (1998 - 2021, ex. index holdings)



Moments (%):

Avg.:	0.32
Std. error:	0.25
Std. dev.:	8.34
Skewness:	-61.11

Counts:

Count (#):	1091
Count > 0 (#):	604
POB (%):	55.36
POB > 50% (%):	99.98

Percentiles (%):

100th:	47.83
90th:	6.91
75th:	2.76
50th:	0.44
25th:	-1.68
10th:	-6.31
0th:	-52.79

Persistence of net value added[4] - Joint distribution of net value added quartile ranking

Quartile (year 1) \ Quartile (year 2)	Q4	Q3	Q2	Q1
Q4	6.66%	7.02%	5.40%	6.66%
Q3	5.82%	7.18%	6.63%	4.64%
Q2	5.79%	5.90%	6.16%	6.42%
Q1	7.47%	4.17%	6.08%	8.02%

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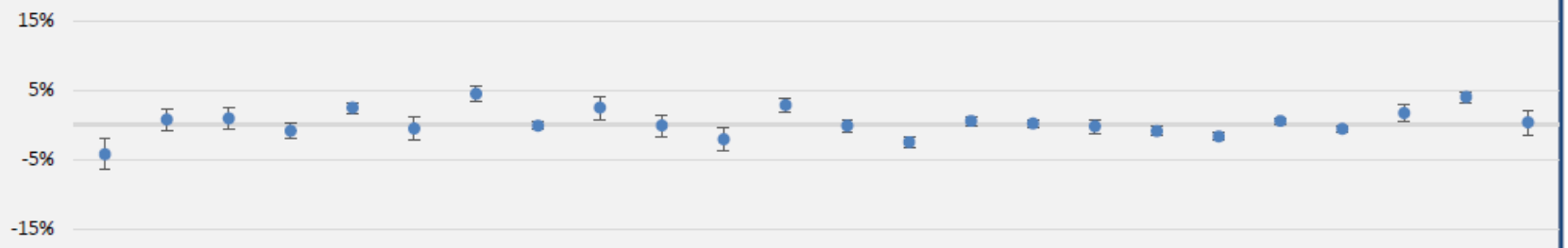
Quartiles (year 2)	Q4 + Q3	Q2 + Q1
	26.68%	23.32%
	23.32%	26.68%

Exhibit 2B. Net value added statistics by year: Dedicated listed equity REIT portfolios



	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	-4.3	0.8	1.0	-0.9	2.5	-0.5	4.5	-0.1	2.5	-0.1	-2.1	2.9	-0.1	-2.5	0.6	0.2	-0.2	-0.9	-1.7	0.6	-0.6	1.7	4.0	0.4
	Std. error (%):	2.2	1.6	1.6	1.1	0.8	1.7	1.1	0.6	1.6	1.5	1.7	1.1	0.9	0.8	0.7	0.6	1.1	0.6	0.6	0.4	0.4	1.3	0.8	1.8
	Std. dev. (%):	13.9	10.0	10.1	7.1	4.6	10.3	7.6	4.1	10.5	12.2	13.5	7.9	6.2	6.1	4.6	4.4	7.5	4.4	3.7	2.9	2.9	7.9	5.1	10.5
	Skewness (%):	-62	-44	-54	-9	123	-143	85	-10	-53	-89	-51	77	149	-121	201	217	-70	-142	-78	-110	-262	100	76	-2
	Count (#):	39	41	41	39	33	36	44	43	41	64	63	53	51	52	50	52	50	47	45	45	48	40	39	35
	Count > 0 (#):	14	24	19	15	24	20	37	23	33	43	25	40	25	21	25	21	29	18	9	33	21	29	34	22
	POB > 50% (%):	5	89	38	10	100	80	100	73	100	100	6	100	50	11	56	11	90	7	0	100	24	100	100	96
Percentiles (%)	100th:	23.8	30.8	26.2	19.2	15.4	24.3	27.1	13.6	31.0	30.0	47.8	45.6	25.2	8.0	21.3	16.9	24.4	12.0	6.5	7.4	4.9	34.2	18.3	45.3
Percentiles (%)	90th:	12.5	11.8	10.7	5.3	8.2	5.3	11.7	3.7	13.5	8.0	4.3	9.8	2.8	1.6	2.1	2.5	4.7	1.9	0.9	2.4	1.6	8.2	8.1	5.7
Percentiles (%)	75th:	1.6	5.0	4.7	2.2	4.3	3.9	5.4	1.8	5.0	2.3	1.5	3.3	1.3	0.6	0.9	0.7	1.4	0.7	0.0	1.3	0.6	2.2	5.7	2.8
Percentiles (%)	50th:	-1.5	0.9	-0.1	-0.8	1.2	0.3	3.0	0.1	2.1	0.6	-0.7	1.9	-0.1	-0.3	0.0	-0.3	0.2	-0.2	-1.0	0.4	0.0	1.0	2.6	1.1
Percentiles (%)	25th:	-9.8	-0.6	-1.8	-3.9	-0.1	-1.0	0.9	-1.8	0.1	-1.0	-3.6	-0.2	-1.9	-4.4	-1.0	-1.1	-1.6	-1.0	-2.8	-0.1	-0.7	0.0	0.7	-0.3
Percentiles (%)	10th:	-25.6	-11.7	-4.4	-5.7	-2.3	-6.8	-1.9	-3.2	-2.8	-17.7	-15.4	-2.5	-4.6	-9.4	-3.3	-2.4	-6.3	-2.9	-4.1	-1.0	-2.5	-1.4	-0.6	-11.3
Percentiles (%)	0th:	-37.0	-30.3	-28.6	-21.8	-4.7	-31.7	-14.6	-5.7	-22.6	-37.8	-50.2	-24.3	-15.8	-24.8	-12.3	-10.1	-31.4	-18.3	-13.6	-7.8	-15.4	-21.6	-5.9	-27.5

Exhibit 2C. Net return statistics by year: Dedicated listed equity REIT portfolios

	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	-6.8	0.8	26.1	10.8	5.4	33.6	33.5	14.5	35.5	-10.7	-38.0	30.4	23.8	2.2	22.1	3.9	20.7	1.8	4.9	8.1	-4.0	22.7	-4.4	34.1
	Std. error (%):	2.2	1.2	1.4	1.2	0.7	1.7	1.4	0.5	1.0	1.2	1.6	1.6	1.0	1.0	1.0	0.5	1.1	0.5	0.4	0.5	0.5	1.1	0.6	1.5
	Std. dev. (%):	13.5	7.9	8.8	7.4	4.1	10.3	9.5	3.3	7.1	10.6	13.0	12.7	7.5	8.0	7.2	3.7	8.3	3.5	2.9	4.0	3.4	7.5	4.3	9.8
	Skewness (%):	54	94	-155	-46	137	-229	-109	157	-246	186	202	-298	-182	-11	-73	162	-19	102	-113	-39	220	-91	80	-10
	Count (#):	39	41	42	40	34	38	47	48	47	72	70	59	57	58	56	57	56	53	52	55	58	48	48	43
Percentiles (%)	100th:	24.0	24.3	35.5	31.6	19.0	43.0	58.7	27.6	43.3	23.6	3.1	51.8	35.4	16.7	37.5	18.7	33.9	14.2	9.8	18.3	8.1	45.0	10.4	54.2
Percentiles (%)	90th:	11.5	10.3	32.9	17.1	9.7	41.1	40.0	17.7	41.0	11.2	-19.4	40.2	30.4	10.6	29.2	7.6	31.8	4.9	8.4	12.0	0.0	27.9	0.1	46.5
Percentiles (%)	75th:	6.8	6.4	31.3	14.7	7.4	38.4	37.5	15.5	38.9	-10.2	-38.3	36.7	28.6	9.2	28.1	4.5	30.2	3.6	6.5	11.0	-4.1	26.9	-1.2	42.6
Percentiles (%)	50th:	-11.8	-1.7	29.7	9.8	4.1	36.5	35.4	14.1	37.3	-15.6	-40.2	31.3	25.9	2.6	23.9	3.0	19.5	1.4	4.9	8.5	-4.6	24.0	-5.0	32.2
Percentiles (%)	25th:	-18.0	-3.5	23.7	8.3	2.9	34.2	32.9	12.9	35.6	-17.0	-44.8	29.0	20.0	-5.5	17.2	1.8	15.3	-0.2	4.0	5.1	-5.6	21.8	-6.9	28.1
Percentiles (%)	10th:	-19.5	-5.0	13.9	5.7	0.9	21.2	17.2	10.7	29.1	-17.9	-48.3	26.7	17.7	-6.2	14.4	1.1	13.2	-1.1	1.2	3.8	-6.9	8.4	-9.0	22.2
Percentiles (%)	0th:	-28.4	-18.4	1.0	-13.2	-0.1	0.7	4.7	8.9	11.8	-19.6	-57.9	-25.1	-6.2	-16.5	-1.4	-5.6	0.3	-9.0	-5.0	-5.0	-8.6	1.8	-12.9	10.3

Another layer of evidence that actively managed listed equity REIT portfolios are inefficient is found in the net value added data by year (Exhibit 2B). Of the 24 of the years shown between 1998 and 2021, in 8 do we find a POB > 50% of 100%. It does not require math or statistics to realize that, if the market were simply random, such a result would be highly unlikely. Conversely, in only one year (2016), active listed equity REIT portfolios consistently underperform with a POB > 50% of 0%, when only 9 of 45 reported portfolios outperformed.

(A discussion of the persistence data is deferred to Section 6.)

6. Value added by unlisted real estate portfolios (Exhibits 3A and 3B).

Exhibit 3A and 3B display the net value added generated by unlisted (or private) real estate portfolios held by U.S. institutional investors in the United States over the 24-year period 1998-2021 (Exhibit 3C displays net returns by year). Total AUM included in the 2021 sample was over $175 billion, with a sample of 109 portfolios, implying an average portfolio size of a bit more than $1.6 billion. Unlike listed equity REITs, which may be passively managed via indexing to a benchmark, unlisted real estate portfolios are 100% actively managed. 97% of unlisted real estate held by U.S. institutional investors is externally managed by a third-party investment management firm, either through core funds, LP private-equity style opportunistic funds, or fund of funds. (Unlisted real estate net value added by investment style is discussed in Section 7.)

The average benchmark returns compounded and annualized over the period of 9.1% is high, relative to the returns of the average U.S. public sector DB pension fund (7.3%) or the average U.S. corporate sector DB pension fund (7.5%). The average benchmark return is also high relative to most asset classes, being comparable to U.S. large cap. stock (8.9%), higher than broad U.S. bonds (5.4%) and hedge funds (4.6%), but below that of private equity (11.4%) and listed equity REITs (9.4%)[13]. The average benchmark return is also higher than our best estimate of the average return of unlisted real estate itself (7.6%) for U.S. DB pension funds. The reasons are three-fold.

First, returns here are presented on an "as-reported" basis. Unlisted real estate and other private market asset classes suffer from the fact that reported returns are based on appraisals, and appraisals introduce a valuation lag whereby returns are not contemporaneous with markets. For example, the lag in unlisted real estate is of the order of a year for most investors, meaning that a return reported for say 2009 is actually the return achieved in 2008. While this view was once controversial, it is now widely recognized and clear from simply comparing the returns of unlisted real estate to that of listed equity REITs lagging one year.

Second, the sample here is larger than that used in our series of papers "Asset Allocation and Fund Performance of Defined Benefit Pension Funds in the United States." This difference in sample, however, introduces only a small difference between the return on an "as-reported" basis. Comparison of the return series presented here in Exhibit 3C with the return presented there shows that the average annual difference is small, less than 0.4%, with the most significant deviation occurring in 2009, the low point for unlisted real estate associated with the Global Financial Crisis of 2008.

[13] Historic returns here are taken from "Asset Allocation and Fund Performance of Defined Benefit Pension Funds in the United States, 1998-2021", CEM Benchmarking 2023.

Exhibit 3A. Value added statistics: Unlisted real estate portfolios

Summary

CEM data on unlisted real estate portfolios includes portfolio level returns, policy benchmark returns, policy weights, holdings and investment costs over the period 1998 - 2021 (24 years).

Asset class characteristics[1]

# of unique funds reporting data: 355
# of observations in full period: 2,928
Total asset class AUM (2021): 177.0 billion (USD)
Actively managed fraction (2021): 100% of observations
Internally managed fraction (2021): 3% of observations
Average annualized benchmark return (1998 - 2021): 9.1%

Performance summary, gross (1998 - 2021, ex. Indexed)[2]

Average annual gross value added: 1.01% ± 0.18%
Proportion outperforming benchmark (POB), gross: 61.84%
Odds actual gross POB > 50%: 100.00%

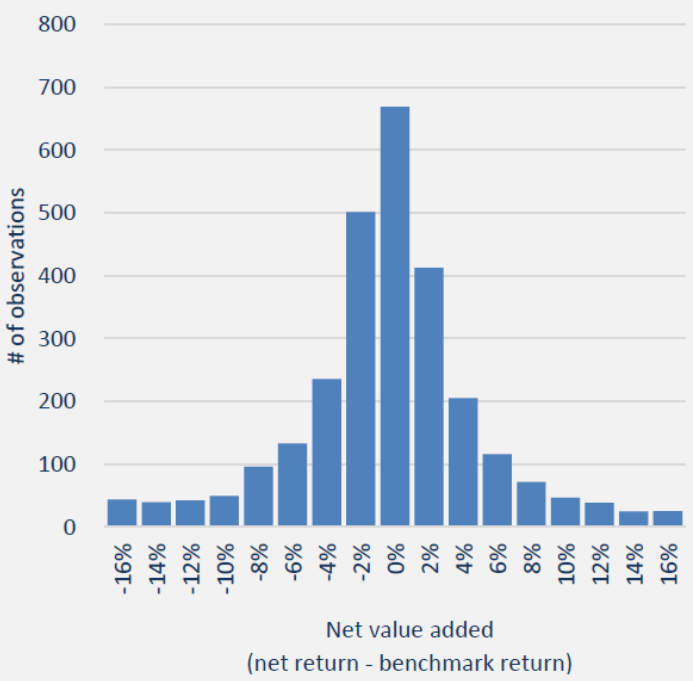
Performance summary, net (1998 - 2021, ex. indexed)[2]

Average annual net value added: -0.68% ± 0.18%
Proportion outperforming benchmark (POB), net: 44.13%
Odds actual net POB > 50%: 0.00%

Footnotes

1. Average annual benchmark return is the compound average return of the annual average benchmark return.
2. Gross / net value added is portfolio annual return less benchmark return, gross / net of investment costs. Average annual gross / net value added is the arithmetic average across years. Proportion outperformng benchmark (i.e., POB) is the fraction of fund/year observations outperforming their benchmark either gross or net of investment costs. 'Odds actual POB > 50%' is the probability that the observed POB is indicative of skill in active management.
3. The distribution of investor-year net value added observations is provided in a histogram. Each observation is weighted by the year sample size to remove bias caused by changing growth in sample size.
4. Persistence of net value added shows, for the subset of net value added with consecutive year data, the joint distribution of observations that were in quartile X in year Y and in quartile X in year $'_{Y+1}$. (See Exhibit 5 for more detail.)

Net value added distribution[3] - histograms and statistics (1998 - 2021, ex. index holdings)



Moments (%):	
Avg.:	-0.68
Std. error:	0.18
Std. dev.:	9.62
Skewness:	191.36

Counts:	
Count (#):	2928
Count > 0 (#):	1292
POB (%):	44.13
POB>50% (%):	0.00

Percentiles (%):	
100th:	161.08
90th:	6.63
75th:	2.12
50th:	-0.42
25th:	-3.10
10th:	-8.78
0th:	-69.39

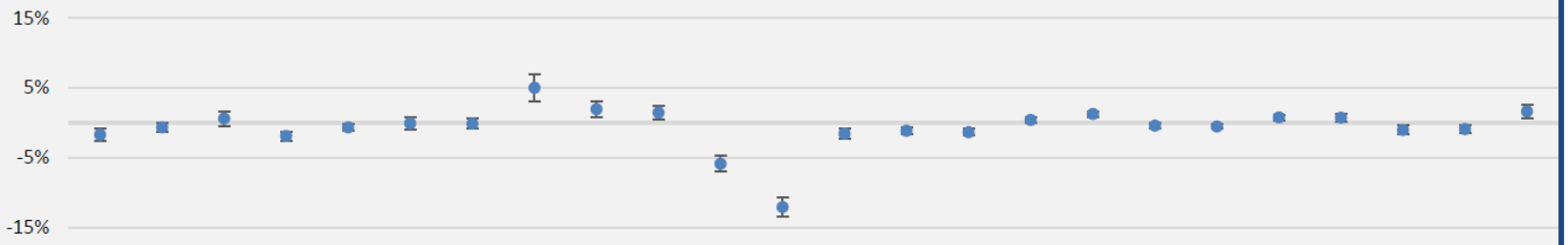
Persistence of net value added[4] - Joint distribution of net value added quartile ranking

Quartile (year 1) \ Quartile (year 2)	Q4	Q3	Q2	Q1
Q4	10.38%	6.04%	3.66%	5.18%
Q3	5.62%	7.69%	6.80%	4.61%
Q2	4.02%	7.06%	8.09%	5.54%
Q1	5.24%	3.94%	6.15%	9.96%

=

Quartiles (year 2)	
Q4 + Q3	Q2 + Q1
29.74%	20.26%
20.26%	29.74%

Exhibit 3B. Net value added statistics by year: Unlisted real estate portfolios



	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	-1.7	-0.6	0.6	-1.9	-0.6	-0.1	-0.1	5.0	2.0	1.5	-5.9	-12.1	-1.6	-1.1	-1.4	0.4	1.2	-0.4	-0.5	0.8	0.7	-1.0	-0.9	1.6
	Std. error (%):	0.9	0.6	1.1	0.7	0.5	0.9	0.8	1.9	1.1	0.9	1.1	1.4	0.7	0.5	0.5	0.5	0.4	0.4	0.3	0.4	0.6	0.6	0.6	0.9
	Std. dev. (%):	10.1	6.6	11.1	6.6	5.1	8.2	7.7	19.0	11.2	10.7	13.5	16.6	8.5	5.7	5.7	5.7	5.2	5.0	3.6	4.9	6.9	6.9	6.2	9.5
	Skewness (%):	61	-43	147	-159	-73	55	34	576	399	302	59	-64	-15	-140	-120	-99	90	0	-218	-355	-491	-282	-26	50
	Count (#):	118	116	105	102	92	88	100	101	103	139	138	138	136	143	147	144	138	135	130	127	129	126	124	109
	Count > 0 (#):	43	49	46	33	43	46	45	66	43	57	29	23	52	56	59	82	76	61	50	79	79	61	49	65
	POB>50% (%):	0	6	12	0	30	70	18	100	6	2	0	0	0	1	1	96	90	15	1	100	100	39	1	98
Percentiles (%)	100^{th}:	46.0	20.6	56.0	15.1	12.0	33.1	27.9	161.1	83.9	73.1	50.2	44.8	30.6	15.5	17.2	25.5	30.6	24.9	10.9	15.0	22.1	16.3	21.4	53.2
	90^{th}:	8.3	4.4	10.2	3.9	5.4	5.7	7.8	17.2	13.2	10.3	7.0	3.3	8.4	4.1	3.1	4.3	6.8	2.5	3.0	4.9	4.5	4.1	3.6	10.3
	75^{th}:	1.1	1.4	2.7	1.1	1.9	2.3	3.1	8.0	4.4	3.9	-0.7	-3.6	3.2	2.0	0.9	2.8	3.1	1.0	1.0	2.6	1.9	1.9	1.0	6.7
	50^{th}:	-1.8	-0.6	-0.5	-1.3	-0.6	0.4	-0.5	1.4	-0.5	-0.8	-5.8	-11.7	-1.2	-1.3	-0.6	0.6	0.5	-0.2	-0.5	1.0	0.6	0.0	-0.7	1.1
	25^{th}:	-6.3	-3.5	-3.4	-4.4	-2.5	-2.8	-3.3	-1.5	-2.1	-2.8	-13.2	-16.9	-6.1	-3.6	-2.6	-1.2	-1.2	-1.8	-1.8	-0.4	-0.7	-2.0	-2.2	-1.3
	10^{th}:	-11.2	-6.1	-8.5	-7.7	-6.4	-8.6	-7.3	-5.3	-7.0	-5.9	-19.3	-33.2	-11.6	-6.7	-6.6	-3.7	-2.4	-4.6	-3.6	-1.8	-2.1	-4.5	-5.5	-5.5
	0^{th}:	-37.7	-30.8	-34.6	-38.3	-18.2	-26.8	-24.2	-27.8	-17.5	-23.8	-55.1	-69.4	-35.3	-33.3	-25.2	-31.5	-23.2	-21.8	-25.2	-35.1	-60.4	-42.1	-23.1	-29.8

Exhibit 3C. Net return statistics by year: Unlisted real estate portfolios

	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	12.7	10.1	13.1	6.4	5.1	10.0	14.0	23.4	19.0	16.7	-7.5	-28.3	9.7	13.6	10.2	12.4	12.5	12.7	8.3	7.6	7.7	6.0	0.2	20.1
	Std. error (%):	0.9	0.6	1.1	0.7	0.7	0.9	0.8	2.5	1.5	1.2	1.5	1.3	1.0	0.7	0.6	0.4	0.5	0.5	0.3	0.5	0.5	0.6	0.5	0.9
	Std. dev. (%):	10.2	5.4	11.1	8.3	5.2	7.3	6.1	18.0	11.0	9.0	11.4	14.4	8.8	5.7	4.8	4.2	3.5	4.6	2.5	3.4	3.6	5.0	4.3	7.6
	Skewness (%):	-255	-126	207	-309	-58	194	108	549	437	412	93	132	21	-155	-48	198	178	-243	99	-177	-14	220	-73	113
	Count (#):	118	116	106	103	93	88	100	102	103	142	142	140	139	144	148	144	140	135	131	128	132	126	124	110
Percentiles (%)	100^{th}:	33.0	27.5	64.5	27.2	18.7	39.6	39.5	169.1	101.5	88.9	55.5	38.3	38.7	35.8	28.2	40.9	32.5	24.7	20.1	15.7	27.9	35.1	22.3	47.7
	90^{th}:	23.2	14.4	22.6	12.6	10.8	15.3	21.2	35.6	28.9	23.4	4.9	-13.1	17.9	18.1	13.9	15.7	15.8	15.7	11.0	11.6	10.4	9.4	3.0	27.3
	75^{th}:	17.3	12.3	14.6	9.9	7.7	11.4	16.5	24.8	21.1	18.2	-2.9	-22.1	15.4	16.2	11.8	14.0	13.5	14.8	9.2	9.1	9.0	7.4	1.6	22.2
	50^{th}:	14.1	10.7	11.7	6.9	5.5	8.7	12.6	20.5	16.5	15.8	-7.3	-30.9	10.3	14.3	10.6	12.5	11.9	13.5	8.3	7.5	7.7	5.7	0.5	19.8
	25^{th}:	9.6	8.2	8.5	4.6	3.6	7.0	10.3	18.1	14.6	13.7	-12.3	-35.7	4.9	11.8	8.5	10.6	10.9	11.6	7.2	6.6	6.8	4.3	-0.8	16.0
	10^{th}:	1.9	4.6	2.8	1.7	-0.9	4.4	9.0	12.2	10.5	10.9	-19.6	-42.2	-1.8	8.7	6.4	8.8	9.5	9.4	5.9	5.3	5.8	2.7	-2.9	12.2
	0^{th}:	-54.6	-19.9	-11.5	-49.2	-11.5	-5.1	-1.4	-7.7	0.0	-5.9	-49.9	-68.1	-16.0	-17.2	-7.4	-0.8	2.6	-12.5	1.8	-12.2	-9.2	-11.0	-21.1	-1.1

Third, and most material, the average net value added generated in unlisted real estate portfolios is below zero, and significantly so. As provided in Exhibit 3A, the average net value added generated from unlisted real estate portfolios over the period 1998-2021 was -0.68%, which we can resolve with an error of 0.18%. That the average is more than three standard errors below zero makes it highly unlikely (i.e., > 99% confidence) that the real net value added is, in fact, zero, and our finite sample has, via luck, produced a result less than zero.

While this piece of evidence powerfully suggests that unlisted real estate portfolios held by institutional investors underperform their benchmarks on average, further evidence is found in the fraction of investors outperforming. As shown in Figure 3A, of the 2,929 fund/year unlisted real estate net value added observations in the CEM database, only 1,292 produce a net value added greater than zero (e.g., 44.13% of all observations). Consequently, the probability that unlisted real estate portfolios demonstrate skill net of investment costs is 0.00%.

7. Gross value added, net value added, and the demonstration of investment skill by real estate implementation style

In Exhibit 4A, we show the average annual value added, both gross and net of investment expenses, generated by listed equity REIT portfolios, unlisted real estate portfolios, and unlisted real estate portfolios separated into the four different implementation styles described below. In Exhibit 4B we show the fraction of fund / year observations outperforming their benchmark (i.e., POB) together with the odds that the fraction is indicative of skill (i.e., odds that POB > 50%) net of investment costs for the same set of implementation styles.

The four unlisted real estate implementation styles captured by CEM are:

1. Internal direct mandates, where the investment buy / sell decisions on individual properties are made by real estate investment professionals employed by the institutional investor themselves.
2. External core fund mandates, where institutional investors allocate capital to perpetual core real estate funds characterized by (typically) buy and hold strategies that looks to generate income from leases and long-term capital appreciation. Here, buy / sell decisions on properties are made by external, third party fund managers with minimal oversight from institutional investor real estate teams who instead focus on manager selection and oversight.
3. External opportunistic fund mandates, where institutional investors allocate capital to opportunistic, private equity style real estate funds characterized by (typically) finite-life investments in properties that looks to generate investment returns from the short-term capital appreciation generated by development / redevelopment.
4. Fund-of-fund mandates, where institutional investors allocate capital to a manager of a fund of fund, who then invests in individual core external core or opportunistic fund mandates. Fund of funds are characterized by the double layer of fees paid by investors, first to the fund of fund manager (the cost structure of which is transparent) and then from the fund of fund manager to the underlying fund (the cost structure of which is usually opaque, at least to the investor).

Exhibit 4A. Real estate value added by implementation style

Average gross (blue) and net (orange) value added by real estate by implementation style, with lines representing one standard error confidence estimates. Average gross value added greater than zero is indicative of an inefficient market. Average net value added greater than zero indicates that the inefficiency is captured by investors net of investment expenses.

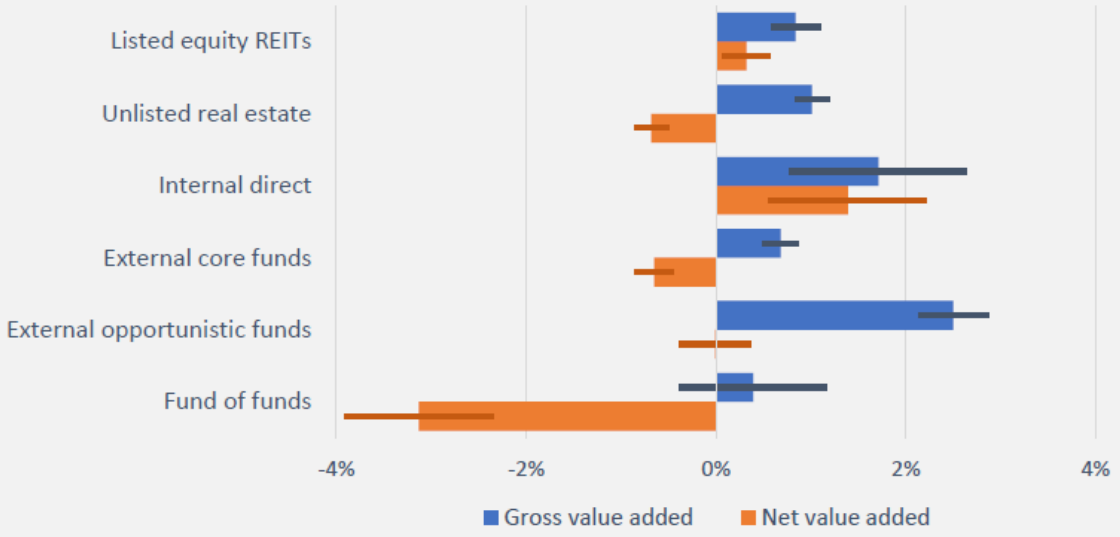
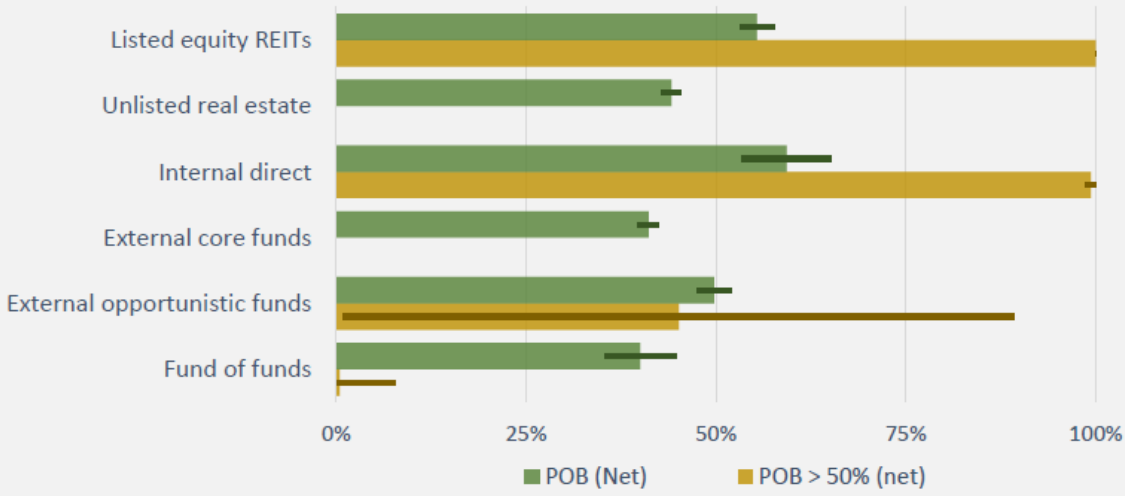


Exhibit 4B. Real estate market efficiency measured by POB > 50%, by implementation style

Proportion of portfolio / year observations outperforming their benchmark (POB) net of investment costs (green) and odds actual POB > 50% (yellow), with lines representing one standard error confidence estimates. Note that listed equity REITs and internal direct real estate both display strong evidence for investor skill net of investment expenses.



The blue bars in Exhibit 4A depict the average annual gross value added by real estate portfolios segmented by each of the four implementation styles. The (darker) blue lines illustrate the confidence intervals about the averages at a one standard error level (the range over which we would expect 68% confidence in the result). The data does not provide any reason to believe that the gross value added of the different styles of real estate investing are in fact different, as all of the gross value averages overlap within one standard error with the exception of external opportunistic funds. In plain language, the data suggests that before consideration of investment costs, real estate portfolios with the exception of opportunistic funds generate the same value added which we estimate to be around 0.90 percent (+/- 0.10 percent).

The orange bars in Exhibit 4A depict the average annual net value added by real estate portfolios segmented by each of the four implementation styles. Likewise, the (darker) orange lines illustrate confidence intervals about the averages. Here, the impact of investment costs produces contrast across implementation styles. Net value added for listed equity REITs and internal direct real estate are greater than zero percent, while unlisted real estate as a whole, and external core funds, and fund-of-funds unlisted real estate are all below zero percent. In the case of opportunistic funds, investment costs consume all of the gross value added. While unlisted real estate as a whole underperforms, the data here shows that not all styles of unlisted real estate underperform. Indeed, lower cost internal direct real estate, like listed equity REITs, outperforms on account of lower investment costs.

The green bars in Exhibit 4B displays the fraction of portfolios outperforming the benchmark (i.e., POB), while the yellow bars show the odds that the observed POB is indicative of skill, both net of investment costs. Once again, the (darker) green and yellow lines illustrate one standard error confidence intervals. As discussed in the last section, while the net value added from listed equity REIT portfolios is only marginally greater than zero, the fraction of portfolios outperforming is significantly greater than 50 percent (about 2.5 standard errors difference), a real indication that actively managed listed equity REIT managers are able to beat the market more often than not net of investment costs. By contrast, unlisted real estate managers do not show this skill.

8. Persistence in performance: net value added year-over-year

Perhaps the best test of investor skill is persistence in performance. Beating the market in any one year is for many portfolios might just be the result of luck, but beating the market in consecutive years is more likely to be attributable to real skill. That said, determining whether the net value added of individual portfolios is attributable to luck or skill is far outside this white paper's scope.

What we are able to determine is whether ensembles of portfolios show indications of persistent skill. We have already shown that, in terms of one-year net value added, real estate portfolios have an extremely hard time beating self-reported benchmarks. Listed equity REITs and direct investments in real estate have positive net value added but are within two standard errors of zero, meaning that the result is marginal. Externally managed unlisted real estate portfolios as a whole produced negative net value added which is statistically, indicative of a lack of skill.

Exhibit 5. Persistence in year-over-year net value added performance quartiles

We demonstrate persistence in portfolio performance using the joint distributions of year-over-year quartile net value added. The joint distribution of year-over-year quartile net value added is a matrix whose elements are the frequencies with which we observe portfolios in one quartile QX in year Y, and in another quartile QX' in year Y+1, averaged over all Y. Persistence in performance appears where the joint distribution meaningfully deviates from the random (i.e., null) hypothesis whereby each matrix element is 1/16 or 6.25% (e.g., perfect persistence would see 25% of the observations along the diagonal, implying that top quartile investors always remain in the top quartile in subsequent years (and likewise for second, third and fourth quartile investors). Note that the quartile rank of each portfolio / year observation is relative to the subset of fund / year observations that have consecutive years of data[1].

The two sets of data show, for listed equity REIT portfolios (top) and for unlisted real estate portfolios (bottom):

A. The average **frequency** QX(Y) / QX'(Y+1) of year-over-year net value added quartile fund / year observations. Q1, Q2, Q3, Q4 refer to the first, second, third and fourth quartile respectively.
B. The **random** hypothesis (i.e., the null hypothesis) whereby relative quartile ranking is randomly distributed. For 16-element arrays, each frequency of the random hypothesis takes the value 6.25% (or 1/16).
C. The excess **signal**, which is the difference between the frequency and the random hypothesis.
D. The **significance**, which is the number of standard errors difference in signal from zero. Where significance is greater than two, one may state with 96% confidence that the signal is not the result of noise.

Listed equity REITs

Quartile (year 1)	A. Frequency: Quartile (year 2) Q4	Q3	Q2	Q1	B. Random: Quartile (year 2) Q4	Q3	Q2	Q1	C. Signal: Quartile (year 2) Q4	Q3	Q2	Q1	D. Significance: Quartile (year 2) Q4	Q3	Q2	Q1
Q4	6.66%	7.02%	5.40%	6.66%	6.25%	6.25%	6.25%	6.25%	0.41%	0.77%	-0.85%	0.41%	0.5	0.9	-1.2	0.5
Q3	5.82%	7.18%	6.63%	4.64%	6.25%	6.25%	6.25%	6.25%	-0.43%	0.93%	0.38%	-1.61%	-0.6	1.1	0.5	-2.4
Q2	5.79%	5.90%	6.16%	6.42%	6.25%	6.25%	6.25%	6.25%	-0.46%	-0.35%	-0.09%	0.17%	-0.6	-0.5	-0.1	0.2
Q1	7.47%	4.17%	6.08%	8.02%	6.25%	6.25%	6.25%	6.25%	1.22%	-2.08%	-0.17%	1.77%	1.4	-3.2	-0.2	2.0

Unlisted real estate

Quartile (year 1)	A. Frequency: Quartile (year 2) Q4	Q3	Q2	Q1	B. Random: Quartile (year 2) Q4	Q3	Q2	Q1	C. Signal: Quartile (year 2) Q4	Q3	Q2	Q1	D. Significance: Quartile (year 2) Q4	Q3	Q2	Q1
Q4	10.38%	6.04%	3.66%	5.18%	6.25%	6.25%	6.25%	6.25%	4.13%	-0.21%	-2.59%	-1.07%	4.2	-0.3	-4.2	-1.5
Q3	5.62%	7.69%	6.80%	4.61%	6.25%	6.25%	6.25%	6.25%	-0.63%	1.44%	0.55%	-1.64%	-0.8	1.7	0.7	-2.4
Q2	4.02%	7.06%	8.09%	5.54%	6.25%	6.25%	6.25%	6.25%	-2.23%	0.81%	1.84%	-0.71%	-3.5	1.0	2.1	-1.0
Q1	5.24%	3.94%	6.15%	9.96%	6.25%	6.25%	6.25%	6.25%	-1.01%	-2.31%	-0.10%	3.71%	-1.4	-3.7	-0.1	3.8

1. Since the set of consecutive-year data is only a subset of the data set used to create statistics in Exhibits 2 and 3, the quartiles used here (not shown) are calculated using this smaller subset to maintain the correct structure of the joint distribution matrices (e.g., column and row sums of A. Frequency equal 25% etc.).

In this section, we show a different and complementary measure of investor or investor skill, the persistence in year-over-year net value added. The question we would like to answer is: If an investor is a quartile X investor in a given year, what is the probability that the investor will be a quartile X' investor in the subsequent year? Does relative performance show persistence?

Exhibit 5 shows, in the first matrix, 'A. Frequency', the joint probability distribution of year-over-year net value added quartile performance. The exhibit shows data for both listed equity REIT portfolios and unlisted real estate portfolios, relative to annual quartiles calculated for the subset of investors with consecutive year-over-year data. If performance was perfectly persistent, and Q4 (i.e., top quartile) investors remained Q4 investors in perpetuity, then the value of the top left matrix element Q4 (year 1): Q4 (year 2) would equal 25 percent. Likewise, the other diagonal entries would all equal 25 percent, and the off-diagonal elements would all equal 0 percent, articulating that one quarter of portfolios were persistently top quartile, third quartile, second quartile, and bottom quartile respectively.

Conversely, the second matrix 'B. Random' contains the expected matrix elements where net value added quartile performance is merely random. In this case, a portfolio's position relative to the other portfolios is purely random, and given two years of four quartiles, each element takes the value of 1/16 or 6.25 percent.

The third matrix, 'C. Signal', shows the difference between matrices A and B. Where values are greater than zero, we observe more year-over-year portfolios than would be predicted by the random matrix and vice-versa. Of course, because the data set is finite[14], even if performance were perfectly random, deviations from the random (i.e., the matrix 'B. Random') would occur[15]. To learn about persistence, we need to consider such statistical effects.

The fourth matrix 'D. Significance' does just that. Here, we show the number of standard deviations from zero in the expected signal, which tests the statistical significance of the data. The usual standard to apply is for a signal of this kind to be real is that the significance (e.g., error divided by signal) should exceed two, which implies that the signal is real 19 times out of 20.

Listed equity REIT portfolio persistence of year-over-year net value added

Listed equity REIT portfolios show very little to no persistence of year-over-year net value added, with only a handful of exceptions; the Q1:Q3 matrix element of -3.2 is significant, as is the Q3:Q1 matrix element at -2.4. Thus, the data tells us that there is an *absence* of portfolios which persistently swing from top quartile to below median (but not bottom quartile) and vice-versa. Of marginal significance is the observation that bottom quartile portfolios show some persistence, with bottom quartile

[14] In the matrices of Exhibit 5, there are a total of 954 listed equity REIT portfolios with consecutive year data, and 2,374 unlisted real estate portfolios with consecutive year data.

[15] Because the matrix elements are binomial (a count is either observed or is not), we can easily estimate the expected variance in counts to be $\sqrt{p(1-p)N}$ where p is the expected probability (1/16), and N the total count. In terms of expected variance in frequencies we expect variance of $\sqrt{p(1-p)/N}$, which, with an expected probability of 6.25% is roughly 25%/$\sqrt{N}$. Thus, for listed equity REITs the typical "signal" for the null hypothesis would be a bit less than 1% in magnitude, and for unlisted real estate would be 0.5% in magnitude.

performers remaining bottom quartile performers in subsequent years at rates greater than we would expect were the data purely random.

Unlisted real estate portfolio persistence of year-over-year net value added

Unlike listed equity REIT portfolios, unlisted real estate portfolios show clear, significant signals of persistence in year-over-year net value added. More than 10% of portfolios with consecutive year-over-year data are in the top quartiles of net value added in those years. Symmetrically, nearly 10 percent of portfolios with consecutive year-over-year data are in the bottom quartiles in those years, too. Indeed, the diagonal (i.e., Q4:Q4, Q3:Q3, Q2:Q2 and Q1:Q1) elements are all larger than the random null hypothesis, significance elements being 4.2, 1.7, 2.1 and 3.8, respectively.

It is not a necessary condition to have strong negative elements in the significance matrix, given the four strong positive elements. However, four are: Q4:Q2, Q2:Q4, Q3:Q1, and Q1:Q3 are all significantly negative at -4.2, -3.5, -2.4 and -3.7, respectively. That the elements are the transpose of one another in the matrix is telling; top quartile performers are highly unlikely to become second quartile and second quartile investors are unlikely to become top quartile investors in consecutive years, and likewise with third quartile and bottom quartile. Why is this?

The source of the persistence data for unlisted real estate portfolios is almost certainly appraisal smoothing in unlisted real estate portfolios, something that has been apparent to researchers in real estate economics for at least 30 years[16]. If outperformance and underperformance are spread out over a number of years, persistence is expected: better-performing portfolios remain better, and worse-performing portfolios remain worse.

9. Summary

In this white paper, we have shown detailed statistics on the value added, gross, and net of investment expenses for listed and unlisted real estate. Gross of investment costs, real estate as a whole appears inefficient for the set of very large U.S. institutional investors in the CEM database. Listed real estate produces 0.84 percent gross value added, while unlisted real estate produces 1.01 percent gross value added. Further, 63 percent and 62 percent of listed/unlisted real estate portfolios show positive gross value added.

Investment costs impact this simple story in a significant way. Net value added for listed real estate drops to 0.32 percent on account of the average of 0.52 percent investment costs incurred. From a statistical standpoint, the net value added is only marginally greater than zero. However, the fraction of portfolios with greater than zero net value added is far greater than one half at 55 percent, which shows that the managers of listed real estate have skill in the sense that they beat their benchmark net of investment expenses more than half the time.

Investment costs for unlisted real estate are greater than for listed real estate. As such, while the gross value added of listed and unlisted real estate are comparable, the net value added is not. On average, the net value added of unlisted real estate portfolios is negative 0.68 percent, more than three standard errors different from zero, a highly significant result. Moreover, unlike listed real estate, unlisted real

[16] For the classic paper discussing appraisal smoothing in commercial real estate and the impact on volatility see David M. Geltner, “Smoothing in appraisal-based returns”, Journal of Real Estate Finance and Economics, 1991.

estate portfolios underperform their benchmark more often than not – only 44 percent of portfolios beat their benchmark net of investment costs.

In unlisted real estate, when we look at performance by implementation style, investment costs come into sharper focus as the primary culprit for underperformance. Low-cost, direct investment in real estate allows investors to retain more of the gross value added, and most investors' net value added remains positive. By contrast, the investment costs for fund of funds (which allow for a kind of indexing in private markets) are so high, that while gross value added is essentially zero, net value added is almost guaranteed to be negative.

10. Appendix

Exhibits 6ABC, 7ABC, 8ABC, and 9ABC display the value added statistics for each of the four unlisted real estate styles internal direct, external core funds, external opportunistic funds, and fund-of-funds.

Exhibit 10 infers an average year in real estate investment by, for both listed equity REITs and unlisted real estate, by combining the average return for each with the average distribution of value added.

Exhibit 6A. Value added statistics: Unlisted real estate portfolios - Internal Direct

Summary

CEM data on unlisted real estate portfolios includes portfolio level returns, policy benchmark returns, policy weights, holdings and investment costs over the period 1992 - 2021 (30 years).

Asset class characteristics[1]

of unique funds reporting data: 29
# of observations in full period: 167
Total asset class AUM (2021): 19.2 billion (USD)
Actively managed fraction (2021): 100% of observations
Internally managed fraction (2021): 100% of observations
Average annualized benchmark return (1998 - 2021): 8.7%

Performance summary, gross (1998 - 2021, ex. Indexed)[2]

Average annual gross value added: 1.71% ± 0.93%
Proportion outperforming benchmark (POB), gross: 62.28%
Odds actual gross POB > 50%: 99.95%

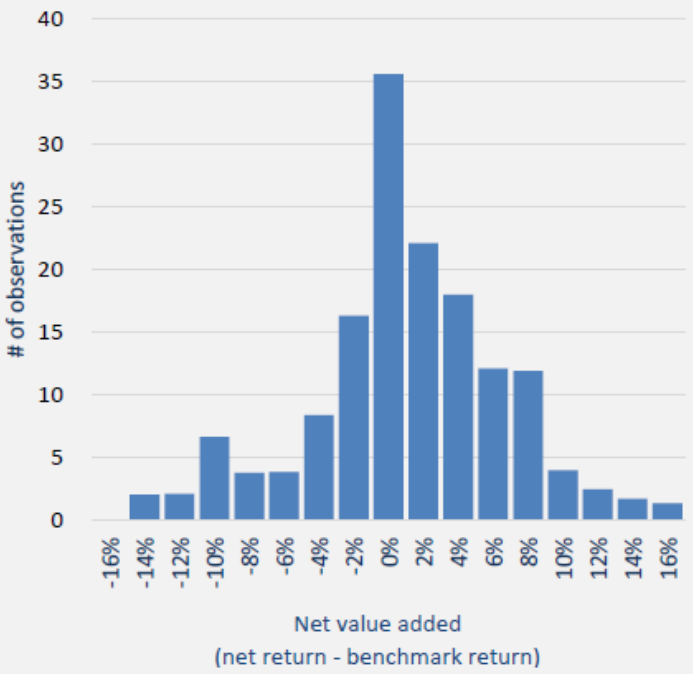
Performance summary, net (1998 - 2021, ex. indexed)[2]

Average annual net value added: 1.39% ± 0.83%
Proportion outperforming benchmark (POB), net: 59.28%
Odds actual net POB > 50%: 99.35%

Footnotes

1. Average annual benchmark return is the compound average return of the annual average benchmark return.
2. Gross / net value added is portfolio annual return less benchmark return, gross / net of investment costs. Average annual gross / net value added is the arithmetic average across years. Proportion outperformng benchmark (i.e., POB) is the fraction of fund/year observations outperforming their benchmark either gross or net of investment costs. 'Odds actual POB > 50%' is the probability that the observed POB is indicative of skill in active management.
3. The distribution of investor-year net value added observations is provided in a histogram. Each observation is weighted by the year sample size to remove bias caused by changing growth in sample size.
4. Persistence of net value added shows, for the subset of net value added with consecutive year data, the joint distribution of observations that were in quartile X in year Y and in quartile X in year $'_{Y+1}$. (See Exhibit 5 for more detail.)

Net value added distribution[3] - histograms and statistics (1998 - 2021, ex. index holdings)



Moments (%):	
Avg.:	1.39
Std. error:	0.83
Std. dev.:	10.73
Skewness:	-214.58

Counts:	
Count (#):	167
Count > 0 (#):	99
POB(%)	59.3
POB>50%:	99.3

Percentiles (%):	
100th:	29.98
90th:	10.39
75th:	5.16
50th:	0.90
25th:	-1.33
10th:	-8.34
0th:	-69.56

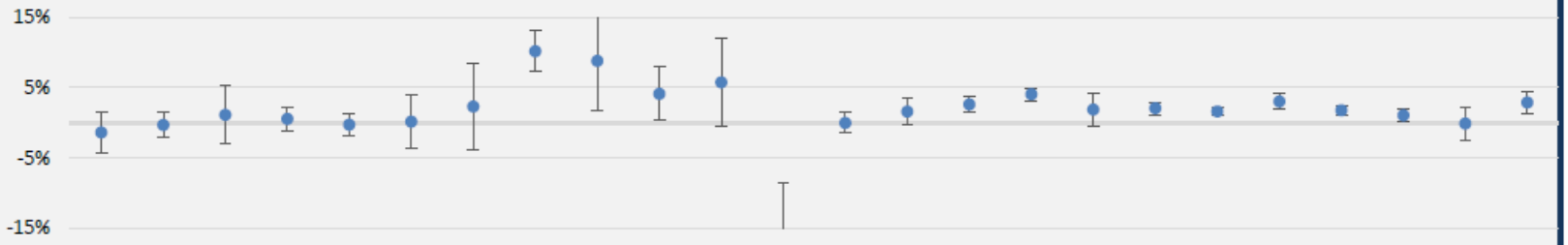
Persistence of net value added[4] - Joint distribution of net value added quartile ranking

Quartile (year 1) \ Quartile (year 2)	Q1	Q2	Q3	Q4
Q1	13.27%	7.12%	4.23%	5.00%
Q2	7.69%	4.81%	3.65%	4.23%
Q3	4.42%	5.19%	5.19%	5.58%
Q4	4.23%	3.27%	7.31%	14.81%

=

Quartiles (year 2)	
Q1 + Q2	Q3 + Q4
32.88%	17.12%
17.12%	32.88%

Exhibit 6B. Net value added statistics by year: Unlisted real estate portfolios - Internal Direct



	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	-1.4	-0.3	1.1	0.5	-0.3	0.1	2.3	10.2	8.8	4.1	5.8	-20.2	0.0	1.6	2.6	4.1	1.9	2.1	1.6	3.0	1.8	1.1	-0.1	2.9
	Std. error (%):	2.9	1.9	4.1	1.7	1.5	3.8	6.2	2.9	7.1	3.8	6.3	11.8	1.5	1.9	1.1	0.9	2.4	0.9	0.6	1.1	0.7	1.0	2.3	1.5
	Std. dev. (%):	9.8	5.6	13.1	4.6	4.9	10.8	16.4	7.2	14.2	8.5	14.1	26.3	2.9	4.6	2.8	2.2	6.4	2.6	1.6	2.9	1.9	2.6	5.6	4.1
	Skewness (%):	-143	8	122	15	135	196	-126	-15	46	-4	77	-157	127	68	87	23	-107	-16	97	-12	-4	44	-152	30
	Count (#):	11	9	10	7	10	8	7	6	4	5	5	5	4	6	7	6	7	8	8	7	7	7	6	7
	Count > 0 (#):	5	4	4	4	4	3	4	5	3	3	3	1	1	3	5	6	5	5	7	6	5	5	4	4
	POB>50% (%):	50	50	38	77	38	36	77	98	94	81	81	19	31	66	94	100	94	86	100	99	94	94	89	77
Percentiles (%)	100th:	46.0	20.6	56.0	15.1	12.0	33.1	27.9	161.1	83.9	73.1	50.2	44.8	30.6	15.5	17.2	25.5	30.6	24.9	10.9	15.0	22.1	16.3	21.4	53.2
	90th:	8.3	4.4	10.2	3.9	5.4	5.7	7.8	17.2	13.2	10.3	7.0	3.3	8.4	4.1	3.1	4.3	6.8	2.5	3.0	4.9	4.5	4.1	3.6	10.3
	75th:	1.1	1.4	2.7	1.1	1.9	2.3	3.1	8.0	4.4	3.9	-0.7	-3.6	3.2	2.0	0.9	2.8	3.1	1.0	1.0	2.6	1.9	1.9	1.0	6.7
	50th:	-1.8	-0.6	-0.5	-1.3	-0.6	0.4	-0.5	1.4	-0.5	-0.8	-5.8	-11.7	-1.2	-1.3	-0.6	0.6	0.5	-0.2	-0.5	1.0	0.6	0.0	-0.7	1.1
	25th:	-6.3	-3.5	-3.4	-4.4	-2.5	-2.8	-3.3	-1.5	-2.1	-2.8	-13.2	-16.9	-6.1	-3.6	-2.6	-1.2	-1.2	-1.8	-1.8	-0.4	-0.7	-2.0	-2.2	-1.3
	10th:	-11.2	-6.1	-8.5	-7.7	-6.4	-8.6	-7.3	-5.3	-7.0	-5.9	-19.3	-33.2	-11.6	-6.7	-6.6	-3.7	-2.4	-4.6	-3.6	-1.8	-2.1	-4.5	-5.5	-5.5
	0th:	-37.7	-30.8	-34.6	-38.3	-18.2	-26.8	-24.2	-27.8	-17.5	-23.8	-55.1	-69.4	-35.3	-33.3	-25.2	-31.5	-23.2	-21.8	-25.2	-35.1	-60.4	-42.1	-23.1	-29.8

Exhibit 6C. Net return statistics by year: Unlisted real estate portfolios - Internal Direct

	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	9.2	8.8	11.8	8.8	6.3	12.5	17.9	25.8	25.4	20.1	-1.3	-26.0	8.4	14.7	12.7	14.4	12.4	14.6	9.7	9.9	9.1	6.4	1.5	17.5
	Std. error (%):	2.6	1.5	3.3	1.4	1.5	3.9	4.2	3.4	6.9	4.0	5.0	8.1	1.4	2.7	1.2	2.0	2.6	1.2	0.4	1.0	0.6	0.9	1.7	1.7
	Std. dev. (%):	8.6	4.5	10.3	3.8	4.9	11.1	11.1	8.2	13.7	8.9	11.1	18.2	2.8	6.6	3.3	4.9	6.9	3.3	1.1	2.7	1.7	2.4	4.1	4.4
	Skewness (%):	-55	21	226	63	148	141	15	-46	33	22	-85	172	39	47	35	-39	-20	-47	-4	-18	-39	-12	-85	40
	Count (#):	11	9	10	7	10	8	7	6	4	5	5	5	4	6	7	6	7	8	8	8	8	7	6	7
Percentiles (%)	100th:	23.7	17.1	40.1	15.9	18.7	35.4	33.5	37.3	44.8	33.4	9.8	8.5	12.3	24.7	17.8	21.1	23.9	18.9	11.2	13.4	11.1	10.1	6.8	24.5
	90th:	19.7	13.3	18.0	13.2	8.9	29.2	32.1	34.7	40.5	30.5	9.6	-5.3	11.6	23.1	17.1	19.8	19.8	18.3	11.0	13.0	10.7	9.1	5.7	23.3
	75th:	12.0	11.5	12.7	10.5	7.3	13.8	27.9	31.2	34.1	26.2	9.3	-26.1	10.5	20.1	15.0	18.1	15.8	17.3	10.6	12.6	10.4	7.9	4.2	20.7
	50th:	10.0	9.7	9.1	9.2	5.8	8.2	14.0	26.6	24.3	18.6	1.2	-32.1	8.1	13.2	12.5	14.5	11.7	14.8	9.7	10.0	9.7	7.2	2.1	16.7
	25th:	7.6	5.4	7.1	5.8	4.8	5.2	10.3	21.6	15.6	14.5	-7.0	-37.2	6.0	8.6	10.3	11.9	9.7	12.6	8.7	7.4	7.4	4.5	-0.1	13.8
	10th:	-2.7	4.6	2.5	4.4	1.8	4.1	6.6	16.2	11.2	10.5	-14.6	-40.7	5.6	7.9	9.3	9.0	4.7	11.0	8.5	6.8	6.8	3.6	-3.4	12.3
	0th:	-9.0	1.4	1.7	4.2	-1.2	1.7	1.6	11.8	8.3	7.7	-19.7	-43.1	5.3	7.8	8.1	6.3	0.0	8.7	8.1	5.6	6.7	2.6	-6.1	12.2

Exhibit 7A. Value added statistics: Unlisted real estate portfolios - External (core) funds

Summary

CEM data on unlisted real estate portfolios includes portfolio level returns, policy benchmark returns, policy weights, holdings and investment costs over the period 1992 - 2021 (30 years).

Asset class characteristics[1]

of unique funds reporting data: 288
# of observations in full period: 2,128
Total asset class AUM (2021): 116.8 billion (USD)
Actively managed fraction (2021): 100% of observations
Internally managed fraction (2021): 0% of observations
Average annualized benchmark return (1998 - 2021): 9.0%

Performance summary, gross (1998 - 2021, ex. Indexed)[2]

Average annual gross value added: 0.68% ± 0.19%
Proportion outperforming benchmark (POB), gross: 59.8%
Odds actual gross POB > 50%: 100.0%

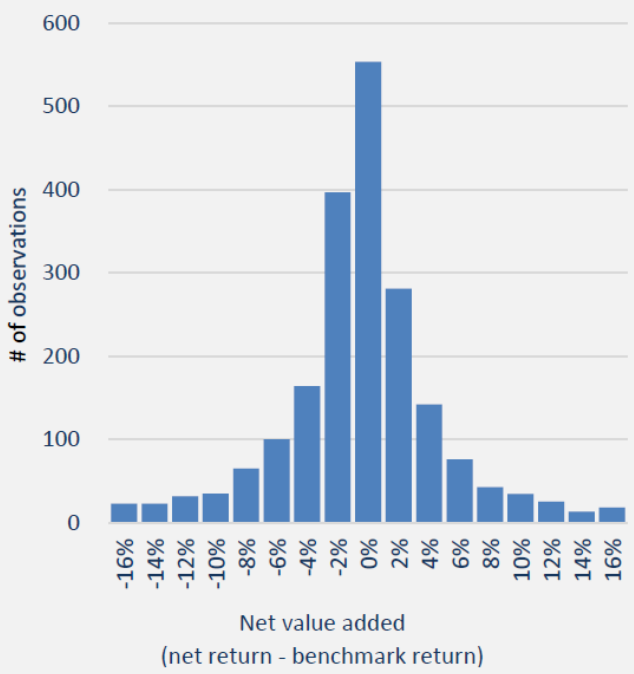
Performance summary, net (1998 - 2021, ex. indexed)[2]

Average annual net value added: -0.65% ± 0.19%
Proportion outperforming benchmark (POB), net: 42.2%
Odds actual net POB > 50%: 0.0%

Footnotes

1. Average annual benchmark return is the compound average return of the annual average benchmark return.
2. Gross / net value added is portfolio annual return less benchmark return, gross / net of investment costs. Average annual gross / net value added is the arithmetic average across years. Proportion outperformng benchmark (i.e., POB) is the fraction of fund/year observations outperforming their benchmark either gross or net of investment costs. 'Odds actual POB > 50%' is the probability that the observed POB is indicative of skill in active management.
3. The distribution of investor-year net value added observations is provided in a histogram. Each observation is weighted by the year sample size to remove bias caused by changing growth in sample size.
4. Persistence of net value added shows, for the subset of net value added with consecutive year data, the joint distribution of observations that were in quartile X in year Y and in quartile X in year '$_{Y+1}$. (See Exhibit 5 for more detail.)

Net value added distribution[3] - histograms and statistics (1998 - 2021, ex. index holdings)



Moments (%):	
Avg. (%):	-0.65
Std. error (%):	0.19
Std. dev. (%):	8.96
Skewness (%):	284.99

Counts:	
Count (#):	2128
Count > 0 (#):	875
POB(%)	41.12
POB>50%:	0.00

Percentiles (%):	
100th:	161.08
90th:	5.78
75th:	1.83
50th:	-0.46
25th:	-2.87
10th:	-7.76
0th:	-86.37

Persistence of net value added[4] - Joint distribution of net value added quartile ranking

Quartile (year 1) \ Quartile (year 2)	Q4	Q3	Q2	Q1
Q4	9.95%	6.24%	4.41%	4.80%
Q3	5.85%	7.36%	6.94%	4.47%
Q2	4.29%	7.33%	7.64%	5.35%
Q1	5.31%	3.69%	5.62%	10.78%

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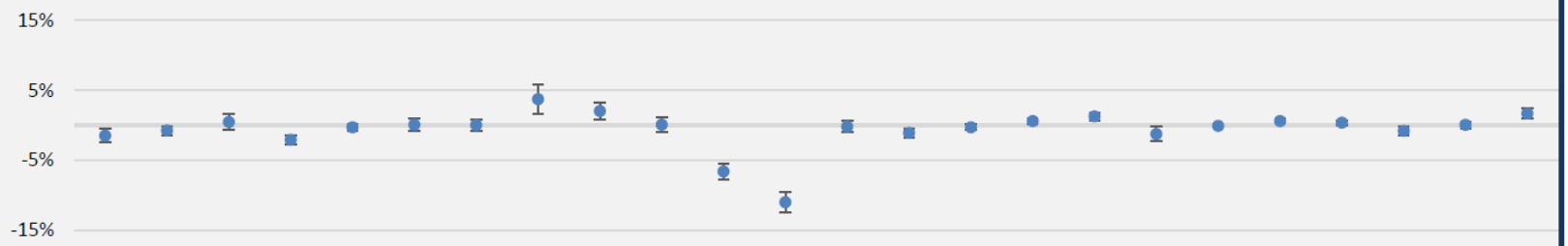
Quartiles (year 2)	
Q4 + Q3	Q2 + Q1
29.74%	20.26%
20.26%	29.74%

Exhibit 7B. Net value added statistics by year: Unlisted real estate portfolios - External (core) funds



	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	-1.5	-0.8	0.4	-2.1	-0.3	0.0	0.0	3.7	2.0	0.1	-6.6	-11.0	-0.2	-1.1	-0.3	0.6	1.2	-1.3	-0.1	0.6	0.3	-0.8	0.0	1.7
	Std. error (%):	1.0	0.6	1.2	0.7	0.5	0.8	0.8	2.1	1.3	1.0	1.1	1.4	0.8	0.6	0.4	0.4	0.6	1.1	0.3	0.3	0.3	0.6	0.5	0.7
	Std. dev. (%):	10.2	6.4	11.5	6.9	4.5	7.5	7.1	19.4	11.7	10.2	11.0	14.0	7.9	6.0	3.8	3.5	5.1	9.8	2.7	2.9	2.9	5.0	4.4	5.9
	Skewness (%):	74	-74	153	-146	-50	56	72	634	431	330	18	4	4	-211	61	7	307	-788	119	144	101	-239	197	-37
	Count (#):	106	104	95	92	79	78	85	85	87	109	101	94	96	91	90	88	86	85	78	81	88	76	84	70
	Count > 0 (#):	38	43	42	30	39	44	38	53	37	38	20	16	45	36	38	48	42	39	25	40	43	32	32	40
	POB>50% (%):	0	5	15	0	50	89	19	99	10	0	0	0	31	3	9	83	46	26	0	50	46	10	2	91
Percentiles (%)	100^{th}:	46.0	20.6	56.0	15.1	12.0	33.1	27.9	161.1	83.9	73.1	50.2	44.8	30.6	15.5	17.2	25.5	30.6	24.9	10.9	15.0	22.1	16.3	21.4	53.2
Percentiles (%)	90^{th}:	8.3	4.4	10.2	3.9	5.4	5.7	7.8	17.2	13.2	10.3	7.0	3.3	8.4	4.1	3.1	4.3	6.8	2.5	3.0	4.9	4.5	4.1	3.6	10.3
Percentiles (%)	75^{th}:	1.1	1.4	2.7	1.1	1.9	2.3	3.1	8.0	4.4	3.9	-0.7	-3.6	3.2	2.0	0.9	2.8	3.1	1.0	1.0	2.6	1.9	1.9	1.0	6.7
Percentiles (%)	50^{th}:	-1.8	-0.6	-0.5	-1.3	-0.6	0.4	-0.5	1.4	-0.5	-0.8	-5.8	-11.7	-1.2	-1.3	-0.6	0.6	0.5	-0.2	-0.5	1.0	0.6	0.0	-0.7	1.1
Percentiles (%)	25^{th}:	-6.3	-3.5	-3.4	-4.4	-2.5	-2.8	-3.3	-1.5	-2.1	-2.8	-13.2	-16.9	-6.1	-3.6	-2.6	-1.2	-1.2	-1.8	-1.8	-0.4	-0.7	-2.0	-2.2	-1.3
Percentiles (%)	10^{th}:	-11.2	-6.1	-8.5	-7.7	-6.4	-8.6	-7.3	-5.3	-7.0	-5.9	-19.3	-33.2	-11.6	-6.7	-6.6	-3.7	-2.4	-4.6	-3.6	-1.8	-2.1	-4.5	-5.5	-5.5
Percentiles (%)	0^{th}:	-37.7	-30.8	-34.6	-38.3	-18.2	-26.8	-24.2	-27.8	-17.5	-23.8	-55.1	-69.4	-35.3	-33.3	-25.2	-31.5	-23.2	-21.8	-25.2	-35.1	-60.4	-42.1	-23.1	-29.8

Exhibit 7C. Net return statistics by year: Unlisted real estate portfolios - External (core) funds

	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	13.1	10.0	12.9	6.1	5.6	9.8	13.7	22.3	18.7	15.7	-8.2	-31.8	10.3	13.9	10.5	12.3	12.7	12.4	8.4	7.4	7.6	5.4	0.9	19.0
	Std. error (%):	1.0	0.5	1.2	0.9	0.5	0.8	0.6	2.0	1.2	1.0	1.0	1.2	0.8	0.6	0.4	0.4	0.5	1.1	0.3	0.3	0.2	0.3	0.4	0.6
	Std. dev. (%):	10.2	5.3	11.3	8.7	4.5	6.9	5.7	18.2	11.5	9.9	9.8	11.5	8.2	5.8	3.7	3.5	4.7	9.7	2.7	3.1	2.2	2.7	3.5	4.9
	Skewness (%):	-279	-145	208	-286	-53	201	149	622	473	364	64	76	-32	-252	76	-36	380	-805	157	111	-48	43	261	4
	Count (#):	105	103	95	92	79	78	85	85	87	109	101	94	96	91	90	88	86	85	78	82	89	76	84	71
Percentiles (%)	100^{th}:	33.0	27.5	64.5	27.2	16.8	39.6	39.5	169.1	101.5	88.9	30.9	14.9	38.7	24.8	28.2	24.6	41.9	19.2	20.1	23.5	14.6	13.6	22.5	32.0
Percentiles (%)	90^{th}:	23.5	13.7	21.7	12.5	10.8	14.3	19.2	29.1	26.7	23.1	2.4	-21.1	17.5	18.4	14.4	15.5	15.5	15.8	11.5	10.7	9.6	8.5	3.9	25.2
Percentiles (%)	75^{th}:	17.4	12.0	14.9	9.9	8.1	11.4	16.0	23.0	20.0	16.9	-3.1	-27.0	16.1	17.2	11.9	13.8	13.7	14.9	9.1	8.4	8.6	7.2	1.8	22.1
Percentiles (%)	50^{th}:	14.3	10.5	11.5	6.5	5.6	8.7	12.6	20.4	16.5	14.8	-7.9	-32.2	10.8	14.1	10.4	12.6	11.7	13.8	7.9	7.2	7.7	5.2	0.6	19.1
Percentiles (%)	25^{th}:	10.0	8.1	8.3	3.7	3.9	7.0	10.3	17.9	14.6	12.9	-13.9	-37.1	6.0	12.2	8.6	10.7	10.5	12.3	7.1	6.0	6.7	3.5	-0.7	15.2
Percentiles (%)	10^{th}:	3.9	5.4	2.5	1.2	0.4	4.4	9.0	12.2	10.7	9.3	-20.2	-44.4	-0.2	10.1	7.0	9.0	9.2	10.9	6.3	5.3	6.0	2.5	-1.8	13.5
Percentiles (%)	0^{th}:	-54.6	-19.9	-11.5	-49.2	-9.4	-5.1	-0.6	-7.7	0.0	-16.9	-33.6	-68.1	-16.0	-17.2	-2.8	-0.8	4.6	-72.5	2.3	-2.6	-1.2	-0.6	-8.2	4.7

Exhibit 8A. Value added statistics: Unlisted real estate portfolios - Limited Partnership (opportunistic) funds

Summary

CEM data on unlisted real estate portfolios includes portfolio level returns, policy benchmark returns, policy weights, holdings and investment costs over the period 1992 - 2021 (30 years).

Asset class characteristics

of unique funds reporting data: 134
# of observations in full period: 1,056
Total asset class AUM (2021): 35.1 billion (USD)
Actively managed fraction (2021): 100% of observations
Internally managed fraction (2021): 0% of observations
Average annualized benchmark return (1998 - 2021): 9.2%

Performance summary, gross (1998 - 2021, ex. indexed)

Average annual gross value added: 2.50% ± 0.37%
Proportion outperforming benchmark (POB), gross: 70.9%
Odds actual gross POB > 50%: 100.0%

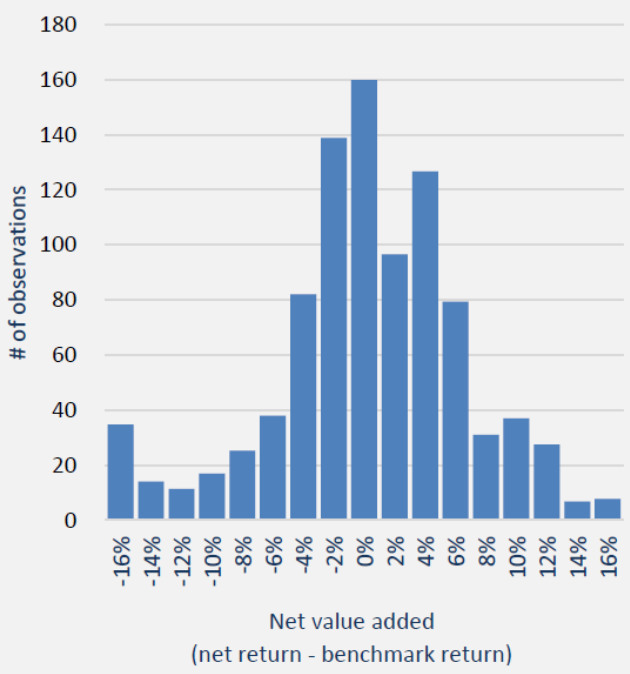
Performance summary, net (1998 - 2021, ex. indexed)

Average annual net value added: -0.01% ± 0.37%
Proportion outperforming benchmark (POB), net: 50.9%
Odds actual net POB > 50%: 74.1%

Footnotes

1. Average annual benchmark return is the compound average return of the annual average benchmark return.
2. Gross / net value added is portfolio annual return less benchmark return, gross / net of investment costs. Average annual gross / net value added is the arithmetic average across years. Proportion outperformng benchmark (i.e., POB) is the fraction of fund/year observations outperforming their benchmark either gross or net of investment costs. 'Odds actual POB > 50%' is the probability that the observed POB is indicative of skill in active management.
3. The distribution of investor-year net value added observations is provided in a histogram. Each observation is weighted by the year sample size to remove bias caused by changing growth in sample size.
4. Persistence of net value added shows, for the subset of net value added with consecutive year data, the joint distribution of observations that were in quartile X in year Y and in quartile X in year $'_{Y+1}$. (See Exhibit 5 for more detail.)

Net value added distribution[3] - histograms and statistics (1998 - 2021, ex. index holdings)



Moments (%):	
Avg. (%):	-0.01
Std. error (%):	0.37
Std. dev. (%):	11.96
Skewness (%):	-48.35

Counts:	
Count (#):	1056
Count > 0 (#):	538
POB(%)	50.95
POB>50%:	75.09

Percentiles (%):	
100th:	55.14
90th:	10.89
75th:	4.78
50th:	0.22
25th:	-3.61
10th:	-14.21
0th:	-79.33

Persistence of net value added[4] - Joint distribution of net value added quartile ranking

Quartile (year 1) \ Quartile (year 2)	Q4	Q3	Q2	Q1
Q4	9.86%	5.98%	5.09%	4.80%
Q3	7.20%	7.49%	5.78%	3.87%
Q2	4.34%	6.24%	7.57%	6.13%
Q1	4.34%	4.62%	5.84%	10.87%

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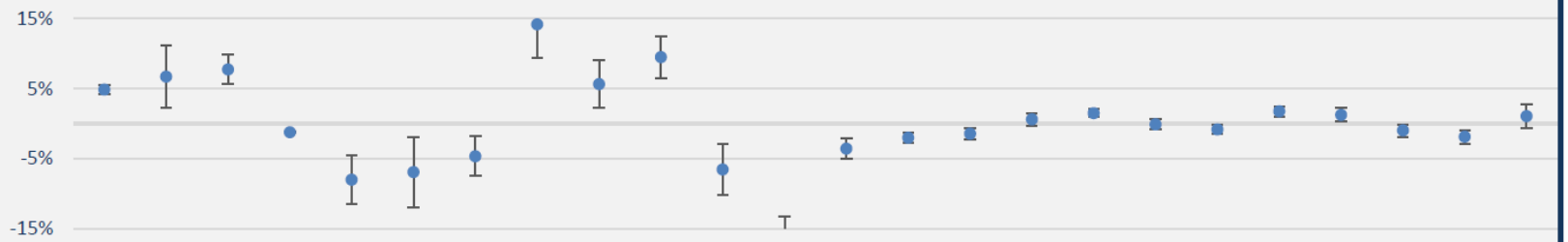
Quartiles (year 2)	
Q4 + Q3	Q2 + Q1
30.52%	19.54%
19.54%	30.40%

Exhibit 8B. Net value added statistics by year: Unlisted real estate portfolios - Limited Partnership (opportunistic) funds



	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	4.8	6.7	7.7	-1.3	-8.0	-7.0	-4.7	14.2	5.6	9.5	-6.6	-16.2	-3.6	-2.0	-1.5	0.6	1.5	-0.1	-0.9	1.7	1.2	-1.0	-1.9	1.0
	Std. error (%):	0.7	4.5	2.1	0.1	3.5	5.0	2.8	4.8	3.4	3.0	3.7	3.0	1.5	0.8	0.8	0.9	0.6	0.7	0.6	0.7	1.0	0.9	1.0	1.8
	Std. dev. (%):	1.2	9.0	3.0	0.2	7.8	10.0	9.0	16.0	11.9	13.6	19.1	19.6	10.2	6.2	7.4	7.8	5.1	6.5	5.3	6.6	8.9	8.3	8.3	15.2
	Skewness (%):	-155	25	n/a	-22	6	-187	-53	164	55	134	57	-126	-41	-30	49	-36	-149	23	-278	-260	-385	-242	12	-161
	Count (#):	3	4	2	3	5	4	10	11	12	21	27	44	49	62	79	80	83	81	78	79	81	86	77	75
	Count > 0 (#):	3	3	2	0	1	1	4	9	6	16	7	6	15	21	31	49	52	38	38	60	54	48	30	44
	POB>50% (%):	100	94	100	13	19	31	38	99	61	100	1	0	0	1	4	98	99	33	45	100	100	88	3	95
Percentiles (%)	100th:	46.0	20.6	56.0	15.1	12.0	33.1	27.9	161.1	83.9	73.1	50.2	44.8	30.6	15.5	17.2	25.5	30.6	24.9	10.9	15.0	22.1	16.3	21.4	53.2
Percentiles (%)	90th:	8.3	4.4	10.2	3.9	5.4	5.7	7.8	17.2	13.2	10.3	7.0	3.3	8.4	4.1	3.1	4.3	6.8	2.5	3.0	4.9	4.5	4.1	3.6	10.3
Percentiles (%)	75th:	1.1	1.4	2.7	1.1	1.9	2.3	3.1	8.0	4.4	3.9	-0.7	-3.6	3.2	2.0	0.9	2.8	3.1	1.0	1.0	2.6	1.9	1.9	1.0	6.7
Percentiles (%)	50th:	-1.8	-0.6	-0.5	-1.3	-0.6	0.4	-0.5	1.4	-0.5	-0.8	-5.8	-11.7	-1.2	-1.3	-0.6	0.6	0.5	-0.2	-0.5	1.0	0.6	0.0	-0.7	1.1
Percentiles (%)	25th:	-6.3	-3.5	-3.4	-4.4	-2.5	-2.8	-3.3	-1.5	-2.1	-2.8	-13.2	-16.9	-6.1	-3.6	-2.6	-1.2	-1.2	-1.8	-1.8	-0.4	-0.7	-2.0	-2.2	-1.3
Percentiles (%)	10th:	-11.2	-6.1	-8.5	-7.7	-6.4	-8.6	-7.3	-5.3	-7.0	-5.9	-19.3	-33.2	-11.6	-6.7	-6.6	-3.7	-2.4	-4.6	-3.6	-1.8	-2.1	-4.5	-5.5	-5.5
Percentiles (%)	0th:	-37.7	-30.8	-34.6	-38.3	-18.2	-26.8	-24.2	-27.8	-17.5	-23.8	-55.1	-69.4	-35.3	-33.3	-25.2	-31.5	-23.2	-21.8	-25.2	-35.1	-60.4	-42.1	-23.1	-29.8

Exhibit 8C. Net return statistics by year: Unlisted real estate portfolios - Limited Partnership (opportunistic) funds

	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	11.0	15.1	25.5	8.7	-4.0	8.5	12.3	33.2	24.8	20.3	-11.1	-30.4	6.7	12.3	10.1	12.5	13.1	12.6	7.8	8.8	7.9	5.9	-1.2	20.4
	Std. error (%):	8.6	2.8	7.4	2.1	2.6	1.5	2.1	5.2	3.2	2.3	3.1	1.8	1.4	0.9	0.9	0.5	0.5	0.6	0.6	0.8	0.9	0.8	0.7	1.8
	Std. dev. (%):	14.9	5.5	10.5	3.6	5.9	3.1	6.5	17.4	11.2	10.4	16.3	12.2	10.1	6.8	7.7	4.9	4.6	5.5	5.2	6.9	8.2	7.0	6.5	15.8
	Skewness (%):	-167	-36	n/a	171	61	51	-83	92	78	141	203	17	43	-6	333	18	-152	-104	-288	-405	-513	-212	-35	-126
	Count (#):	3	4	2	3	5	4	10	11	12	21	27	44	49	62	79	80	83	81	79	81	83	86	77	75
Percentiles (%)	100th:	23.1	22.5	36.0	13.8	5.8	13.0	19.9	75.2	45.9	53.5	55.5	-4.0	38.3	35.8	61.0	29.1	25.0	24.7	19.5	19.4	27.9	35.1	23.0	84.9
Percentiles (%)	90th:	22.5	20.4	33.9	12.3	2.3	11.9	18.6	46.4	43.1	32.4	-4.8	-14.0	16.5	19.5	15.3	16.6	18.7	17.5	12.2	13.4	13.0	10.2	4.1	34.4
Percentiles (%)	75th:	21.5	17.4	30.7	10.1	-2.9	10.3	18.0	38.6	29.6	22.7	-7.3	-23.9	12.5	16.1	11.8	14.6	15.5	15.1	10.4	11.8	10.6	8.8	1.8	25.7
Percentiles (%)	50th:	19.9	15.5	25.5	6.4	-2.9	8.2	12.9	31.9	21.9	20.5	-10.6	-31.9	6.7	12.7	10.0	13.0	12.8	13.3	8.9	9.9	8.7	6.9	0.1	20.6
Percentiles (%)	25th:	4.9	13.2	20.2	6.1	-8.4	6.4	9.2	24.6	16.0	13.7	-17.3	-37.6	-1.7	8.9	7.8	10.3	10.9	10.6	5.9	8.1	6.5	4.6	-3.8	14.6
Percentiles (%)	10th:	-4.0	9.4	17.1	6.0	-10.3	5.4	4.6	17.8	14.2	10.0	-20.6	-44.3	-4.0	3.5	4.2	8.1	9.1	7.6	3.3	3.6	3.2	1.5	-8.8	7.6
Percentiles (%)	0th:	-10.0	6.9	15.0	5.9	-11.5	4.8	-1.4	3.6	10.5	3.9	-49.9	-57.0	-17.2	-6.0	-7.8	-3.9	-11.4	-8.5	-18.0	-37.0	-53.7	-35.7	-21.1	-67.2

Exhibit 9A. Value added statistics: Unlisted real estate portfolios - Fund-of-fund (core + opportunistic) funds

Summary

CEM data on unlisted real estate portfolios includes portfolio level returns, policy benchmark returns, policy weights, holdings and investment costs over the period 1995 - 2021 (27 years).

Asset class characteristics

of unique funds reporting data: 36
# of observations in full period: 191
Total asset class AUM (2021): 1.2 billion (USD)
Actively managed fraction (2021): 100% of observations
Internally managed fraction (2021): 0% of observations
Average annualized benchmark return (1998 - 2021): 9.1%

Performance summary, gross (1998 - 2021, ex. indexed)

Average annual gross value added: 0.38% ± 0.78%
Proportion outperforming benchmark (POB), gross: 65.6%
Odds actual gross POB > 50%: 100.0%

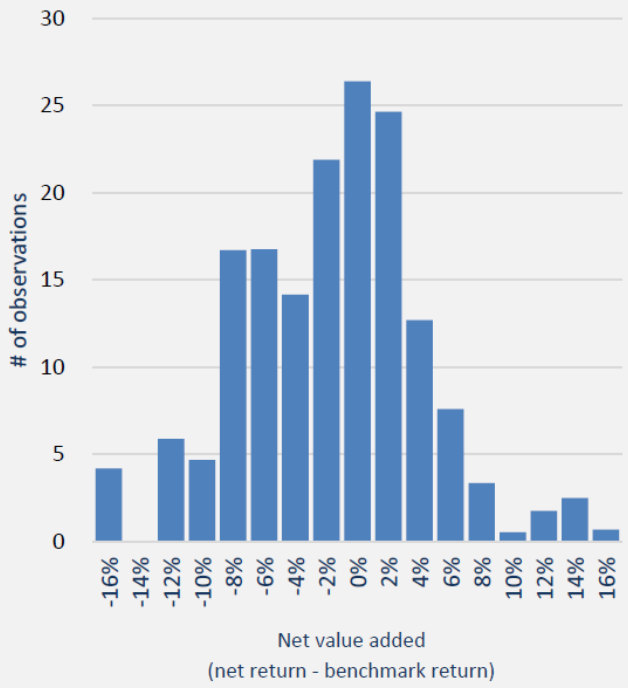
Performance summary, net (1998 - 2021, ex. indexed)

Average annual net value added: -3.13% ± 0.78%
Proportion outperforming benchmark (POB), net: 40.0%
Odds actual net POB > 50%: 0.4%

Footnotes

1. Average annual benchmark return is the compound average return of the annual average benchmark return.
2. Gross / net value added is portfolio annual return less benchmark return, gross / net of investment costs. Average annual gross / net value added is the arithmetic average across years. Proportion outperformng benchmark (i.e., POB) is the fraction of fund/year observations outperforming their benchmark either gross or net of investment costs. 'Odds actual POB > 50%' is the probability that the observed POB is indicative of skill in active management.
3. The distribution of investor-year net value added observations is provided in a histogram. Each observation is weighted by the year sample size to remove bias caused by changing growth in sample size.
4. Persistence of net value added shows, for the subset of net value added with consecutive year data, the joint distribution of observations that were in quartile X in year Y and in quartile X in year $'_{Y+1}$. (See Exhibit 5 for more detail.)

Net value added distribution[3] - histograms and statistics (1998 - 2021, ex. index holdings)



Moments (%):	
Avg. (%):	-3.13
Std. error (%):	0.78
Std. dev. (%):	10.51
Skewness (%):	-64.85

Counts:	
Count (#):	180
Count > 0 (#):	72
POB(%)	40.00
POB>50%:	0.45

Percentiles (%):	
100th:	44.75
90th:	5.40
75th:	1.78
50th:	-2.10
25th:	-6.81
10th:	-13.54
0th:	-51.43

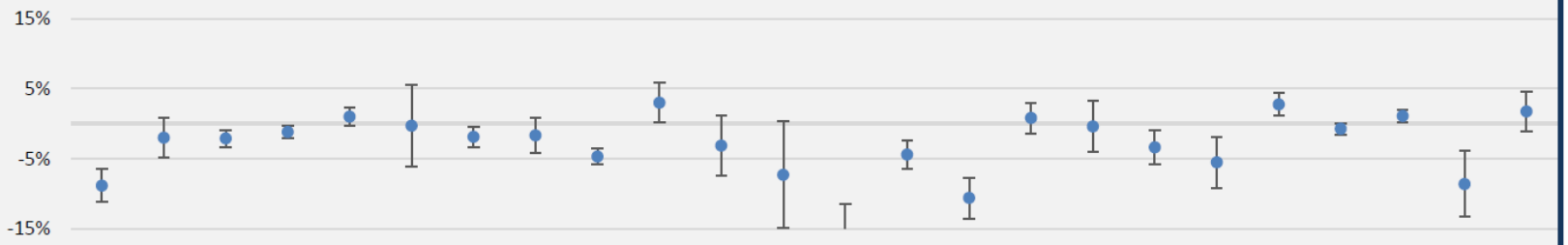
Persistence of net value added[4] - Joint distribution of net value added quartile ranking

Quartile (year 1) \ Quartile (year 2)	Q4	Q3	Q2	Q1
Q4	9.86%	5.98%	5.09%	4.80%
Q3	7.20%	7.49%	5.78%	3.87%
Q2	4.34%	6.24%	7.57%	6.13%
Q1	4.34%	4.62%	5.84%	10.87%

=

Quartiles (year 2)	Q4 + Q3	Q2 + Q1
Q4 + Q3	30.52%	19.54%
Q2 + Q1	19.54%	30.40%

Exhibit 9B. Net value added statistics by year: Unlisted real estate portfolios - Fund-of-fund (core + opportunistic) funds



	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	-8.8	-2.0	-2.1	-1.2	1.0	-0.3	-1.9	-1.7	-4.7	3.0	-3.1	-7.3	-17.6	-4.4	-10.6	0.8	-0.4	-3.4	-5.5	2.8	-0.7	1.1	-8.6	1.8
	Std. error (%):	2.3	2.8	1.2	0.9	1.3	5.9	1.4	2.6	1.2	2.8	4.3	7.6	6.1	2.1	2.9	2.2	3.7	2.5	3.7	1.6	0.8	0.9	4.7	2.8
	Std. dev. (%):	3.3	4.8	2.1	1.6	2.2	10.2	2.5	3.6	2.0	9.4	15.0	22.8	13.6	6.9	8.8	8.2	13.2	7.5	11.9	5.1	2.4	2.7	13.9	7.5
	Skewness (%):	n/a	-99	-166	170	-145	172	76	n/a	35	147	94	96	-58	-99	9	-131	-41	-161	-163	173	-78	47	-266	-150
	Count (#):	2	3	3	3	3	3	3	2	3	11	12	9	5	11	9	14	15	11	14	12	11	11	12	9
	Count > 0 (#):	0	1	0	1	2	1	1	1	0	5	2	3	0	5	2	8	8	4	5	9	5	6	2	6
	POB>50% (%):	25	50	13	50	88	50	50	75	13	50	2	25	3	50	9	79	79	38	11	97	38	83	5	86
Percentiles (%)	100th:	46.0	20.6	56.0	15.1	12.0	33.1	27.9	161.1	83.9	73.1	50.2	44.8	30.6	15.5	17.2	25.5	30.6	24.9	10.9	15.0	22.1	16.3	21.4	53.2
Percentiles (%)	90th:	8.3	4.4	10.2	3.9	5.4	5.7	7.8	17.2	13.2	10.3	7.0	3.3	8.4	4.1	3.1	4.3	6.8	2.5	3.0	4.9	4.5	4.1	3.6	10.3
Percentiles (%)	75th:	1.1	1.4	2.7	1.1	1.9	2.3	3.1	8.0	4.4	3.9	-0.7	-3.6	3.2	2.0	0.9	2.8	3.1	1.0	1.0	2.6	1.9	1.9	1.0	6.7
Percentiles (%)	50th:	-1.8	-0.6	-0.5	-1.3	-0.6	0.4	-0.5	1.4	-0.5	-0.8	-5.8	-11.7	-1.2	-1.3	-0.6	0.6	0.5	-0.2	-0.5	1.0	0.6	0.0	-0.7	1.1
Percentiles (%)	25th:	-6.3	-3.5	-3.4	-4.4	-2.5	-2.8	-3.3	-1.5	-2.1	-2.8	-13.2	-16.9	-6.1	-3.6	-2.6	-1.2	-1.2	-1.8	-1.8	-0.4	-0.7	-2.0	-2.2	-1.3
Percentiles (%)	10th:	-11.2	-6.1	-8.5	-7.7	-6.4	-8.6	-7.3	-5.3	-7.0	-5.9	-19.3	-33.2	-11.6	-6.7	-6.6	-3.7	-2.4	-4.6	-3.6	-1.8	-2.1	-4.5	-5.5	-5.5
Percentiles (%)	0th:	-37.7	-30.8	-34.6	-38.3	-18.2	-26.8	-24.2	-27.8	-17.5	-23.8	-55.1	-69.4	-35.3	-33.3	-25.2	-31.5	-23.2	-21.8	-25.2	-35.1	-60.4	-42.1	-23.1	-29.8

Exhibit 9C. Net return statistics by year: Unlisted real estate portfolios - Fund-of-fund (core + opportunistic) funds

	Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Avg. (%):	10.2	12.7	8.8	5.5	6.7	11.1	9.3	18.0	11.6	18.9	-3.8	-24.3	6.5	7.4	-1.5	12.8	5.3	8.8	2.6	8.1	5.9	6.7	-4.6	15.0
	Std. error (%):	1.0	0.9	1.6	0.2	2.1	7.9	0.5	2.9	0.8	2.7	2.2	4.2	0.0	0.5	3.7	3.1	4.4	3.1	3.2	1.7	1.0	0.8	3.0	0.9
	Std. dev. (%):	1.4	1.3	2.2	0.3	3.0	11.2	0.7	4.1	1.1	6.0	4.4	8.4	0.0	0.9	7.4	9.3	12.5	8.2	7.1	3.5	2.1	1.6	6.0	1.3
	Skewness (%):	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	49	87	69	n/a	169	187	-152	-158	-184	-174	18	30	5	-171	n/a
	Count (#):	2	2	2	2	2	2	2	2	2	5	4	4	1	3	4	9	8	7	5	4	4	4	4	2
Percentiles (%)	100th:	11.6	14.0	11.0	5.8	9.7	22.3	10.0	22.0	12.7	28.6	3.0	-11.9	6.5	8.6	11.1	25.8	16.7	15.9	8.1	13.1	8.7	8.8	0.9	16.3
Percentiles (%)	90th:	11.3	13.8	10.6	5.8	9.1	20.1	9.9	21.2	12.5	25.9	1.3	-14.9	6.5	8.2	6.3	20.0	15.0	15.9	7.9	11.8	8.2	8.5	0.0	16.0
Percentiles (%)	75th:	10.9	13.4	9.9	5.7	8.2	16.7	9.7	20.0	12.2	21.9	-1.3	-19.4	6.5	7.7	-0.8	17.2	12.9	14.6	7.5	9.9	7.4	8.0	-1.4	15.6
Percentiles (%)	50th:	10.2	12.7	8.8	5.5	6.7	11.1	9.3	18.0	11.6	18.1	-4.8	-25.8	6.5	6.8	-4.8	14.3	10.0	11.7	6.7	8.0	5.6	6.7	-2.3	15.0
Percentiles (%)	25th:	9.5	12.0	7.7	5.4	5.1	5.5	8.9	15.9	11.1	15.0	-7.2	-30.7	6.5	6.7	-5.5	10.5	4.6	7.4	1.6	6.3	4.1	5.4	-5.5	14.4
Percentiles (%)	10th:	9.1	11.7	7.0	5.3	4.2	2.1	8.7	14.7	10.8	12.5	-8.0	-32.6	6.5	6.7	-6.7	4.7	-12.3	0.2	-5.8	4.5	3.7	4.9	-11.1	14.0
Percentiles (%)	0th:	8.9	11.4	6.5	5.2	3.6	-0.1	8.5	13.9	10.5	10.9	-8.5	-33.9	6.5	6.7	-7.4	-9.8	-21.9	-9.7	-10.8	3.4	3.5	4.7	-14.8	13.8

Exhibit 10: An inferred average year in real estate (1998-2021)

In any given year, all investors face the same market return but earn their own unique return in the context of that market. The below table gives the distribution of gross and net returns for bothlisted and unlisted real estate portfolios in a 'typical' year. These inferences are established by taking the average (arithmetical) benchmark returns for each (net return listed and unlisted; gross return listed and unlisted) in the period 1998 to 2021 and adding to these the respective distributions of NVA (see exhibits 2A and 3A) and GVA.

		Net Return		Gross Return	
		Listed equity REITs	Unlisted real estate	Listed equity REITs	Unlisted real estate
Average (arithmetic) benchmark return:		10.95%	9.37%	10.95%	9.37%
Average benchmark plus NVA, assuming NVA percentile is:	90th:	17.87%	16.00%	18.51%	17.90%
	75th:	13.72%	11.49%	14.22%	13.16%
	50th:	11.40%	8.95%	11.88%	10.46%
	25th:	9.28%	6.27%	9.87%	7.92%
	10th:	4.65%	0.59%	5.08%	2.15%