

Unpacking unlisted real assets in liquid portfolios

- Unlisted real assets (URAs) are investment vehicles or assets that are not publicly traded on a stock exchange, such as real estate/property and infrastructure. This paper examines the role of URA funds in Australian superannuation funds but is relevant to other multi-asset investors. We include only the categories of private real estate (PRE) and unlisted infrastructure (INFRA) funds in our discussion and analysis of URA funds.¹
- URAs are not a unique asset class. Rather, they are active expressions of publicly available asset classes plus a premium for illiquidity. Their unique characteristics mean an index solution is impossible to achieve, forcing investors to accept (and hopefully be compensated for) idiosyncratic risk.
- Unlike listed assets, which anyone can buy or sell on an exchange and whose prices are regularly updated and known to the public, URAs are priced infrequently and by appraisal only. This can affect the reported risk and return characteristics of URA funds, making it difficult to make accurate comparisons with public markets without proper adjustment.
- URA funds can play an important role in multi-asset portfolios, but their allocation in such portfolios hinges on selecting an outperforming manager and the degree to which that manager outperforms. Our analysis suggests that although the odds of selecting an outperforming URA fund manager by chance are low, bundling multiple managers can help give investors a better chance of success.

Introduction

URAs represent a sizeable allocation in Australian superannuation funds: As of June 2023, according to the APRA (Australian Prudential Regulation Authority) quarterly superannuation statistics, super funds allocated an average of 20% of assets to

private real estate and unlisted infrastructure. **Figure 1** presents commonly cited arguments for investing in URA funds and summaries of how the literature, including some of our own research, relates to these arguments.

¹ This is because these two categories account for the bulk of URA allocations in superannuation funds.

FIGURE 1
Deconstructing the case for URAs

Commonly cited reason for investing in URA funds	The literature and our findings
"They offer high risk-adjusted returns."	Infrequent reporting, appraisal-based valuations, and survivorship bias raise URA funds' reported returns and lower their volatility levels, but risk-adjusted returns for PRE and INFRA resemble those of public market proxies (REITs and infrastructure equities) when these factors are accounted for. In theory, investors should also be compensated for the illiquid nature of URAs, but the literature (and our data) find mixed evidence for an illiquidity premium.
"They provide exposure to unique risk factors."	Public market risk factors, including widely cited equity and fixed income factors, account for 60–75% of URA fund returns. De-smoothed URA fund returns exhibit correlations of 0.6–0.8 with returns for public market proxies and broad equities.
"They offer stable (inflation-linked) cash flows."	The literature is mixed on URAs' inflation-hedging capabilities.* The long-term wealth accumulation focus of superannuation funds means these funds need to do more than match inflation for all but the most conservative points on their glide paths.
"They provide an opportunity for a manager to outperform."	Research and our analysis of Preqin data show that URA funds are more likely to underperform reported private indexes and public proxies after fees but outperformers do exist.**

* See Ilmanen, Chandra, and McQuinn (2019), Chambers, Spaenjers, and Steiner (2021), and Rodel and Rothballer (2012).

** See Arnold, Ling, and Naranjo (2021) and Bollinger and Pagliari (2019). "Private indexes" refers to the Preqin Quarterly Index Real Estate—All and the Preqin Quarterly Index Infrastructure—All.

Source: Vanguard.

Notes on risk

All investing is subject to risk, including possible loss of principal.

Private investments involve a high degree of risk and, therefore, should be undertaken only by prospective investors capable of evaluating and bearing the risks such an investment represents. Investors in private equity generally must meet certain minimum financial qualifications that may make it unsuitable for specific market participants.

Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

IMPORTANT: The projections and other information generated by the Vanguard Capital Markets Model® (VCMM) regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations are as of December 31, 2023. Results from the model may vary with each use and over time. For more information, see the Appendix.

URAs as a unique asset class

Unlisted assets are not distinct asset classes, but rather active and less liquid representations of existing asset classes (Wallick et al., 2015). Investors have three options for accessing the underlying return streams of real estate and infrastructure in their portfolio. They can:

- **Invest directly in property or infrastructure.** This option comes with more control for the investor, but involves additional costs and expertise related to building management, transacting, and financing. It also pushes up the investment amount needed to obtain even minimal diversification. This approach is out of the scope of this paper.
- **Invest in a public market proxy.** These investments—for example, real estate investment trusts (REITs) or infrastructure equities—are included at market-capitalized weight in the public market indexes used to build MySuper portfolios.
- **Invest in private/unlisted funds as a limited partner (LP).** This route allows for more diversification because LPs can invest in multiple funds. However, it carries high fees, and LPs lack control. Our focus in this paper will largely be on this last option.

Both PRE funds and REITs derive their returns from the net cash flows and appreciation in value of their underlying real estate assets. With the exception of single-family residential property investment, we have found no evidence of any difference in the opportunity sets for these two types of real estate investment vehicles.² For infrastructure, the literature is more mixed. Inderst (2011) suggests it is not a distinct asset class, while Amenc et al. (2022) reveal significant differences between the types of infrastructure companies that dominate the listed infrastructure sector and those that dominate the private benchmarks.

The question of whether private real estate and infrastructure are distinct asset classes is, in the end, of little relevance. If they are, their large unit size, indivisibility, and less-than-perfect risk attribution makes it nearly impossible to get exposure to their returns without taking on idiosyncratic risk.³ If they are not, then the decision to include direct investment or URA allocations in the portfolio is largely based on how much the idiosyncratic risk is compensated—in other words, on alpha.

Unlike equities or fixed income, there is currently no widely adopted method for indexing in URAs (or other private markets). An investor cannot feasibly buy a little bit of every property or infrastructure asset or a stake in every private fund. (Fixed income indexing has the same challenges, but solves them by constructing portfolios with the same sector and factor risks as the benchmark. This approach works because the contractual nature of fixed income securities means prices react to interest rate changes in predictable ways.) Although property and infrastructure have contractual cash flows, their uncertain valuations mean that such precise attribution is not currently possible. Some industry research that uses market-cap-weighted indexes of asset- or fund-level returns tends to miss this nuance.⁴ Doing so overstates the diversification benefits within URAs and can lead to artificially increasing their loading in portfolios.

URA returns can be thought of as a public return stream, plus an illiquidity premium, plus manager alpha. In the next three sections, we consider each of these sources of return in turn.

² Some argue that private asset managers can take on more development-oriented or distressed asset projects and apply different leverage. However, we note that any higher returns from these funds are a result of their additional risk—not the fact that they are managed by a private asset manager.

³ Using U.S. data, Fisher and Goetzmann (2005) find that to reduce the idiosyncratic risk of their PRE portfolio by 50%, an investor would need to increase the number of properties in that portfolio tenfold.

⁴ See, for example, Koo et al. (2024) and De Andrade and Godbersen (2023).

Estimating a public return stream for URAs

There are two options for estimating a public return stream for URA funds. The first is to use the return of a public proxy (for example, REITs or infrastructure equities). The second is to calculate the weighted sum of public market equity and fixed income factor returns and weights estimated using statistical methods (that is, to apply a factor benchmark). We examine both approaches and find that they do not produce statistically significant differences in average returns. We thus proceed with the first option because of its simplicity—and then leverage the second approach to validate that return expectations are reasonable relative to history.

To compare reported private asset index returns to those of public markets is to make a classic apples-to-oranges comparison. As well as being uninvestable, these private asset indexes are infrequently reported (usually quarterly) and based on valuation appraisals that can occur as rarely as every other year or on even-less-frequent sales. This means that URA returns do not exhibit the same level of variability that comes from regular price discovery in public markets.

URA fund returns can be more easily compared to those of public markets by “de-smoothing” them and estimating how much of the variation in returns is accounted for by compensated risk

factors or idiosyncratic risk.⁵ De-smoothing is based on the theory that private asset appraisers use a mix of recent private valuations and public returns to value an asset. The smoothed return, therefore, is a function of past public market returns. Leveraging regression techniques and a suitable public market proxy can reverse the smoothing process applied to private asset valuations.

We employ the de-smoothing procedure from Mladina and Moore (2020) to aggregate PRE and INFRA index returns from Preqin and NCREIF.⁶ Mladina and Moore’s factor-optimized lagged-beta (FOLB) method produces a factor benchmark that can be considered a public market representation of private assets. Our results are shown in **Figure 2**.

Figure 2a focuses on PRE and highlights the differences and similarities between reported NCREIF NFI-ODCE Index returns, global REIT returns, and de-smoothed NCREIF NFI-ODCE Index returns. **Figure 2b** confirms that the risk/return characteristics of de-smoothed URA fund returns are much more like those for public proxies. The de-smoothed returns also exhibit volatilities that are close to those of public counterparts, and the difference in arithmetic average returns between de-smoothed PRE (INFRA) and global REITs (infrastructure equities) is not statistically significant.

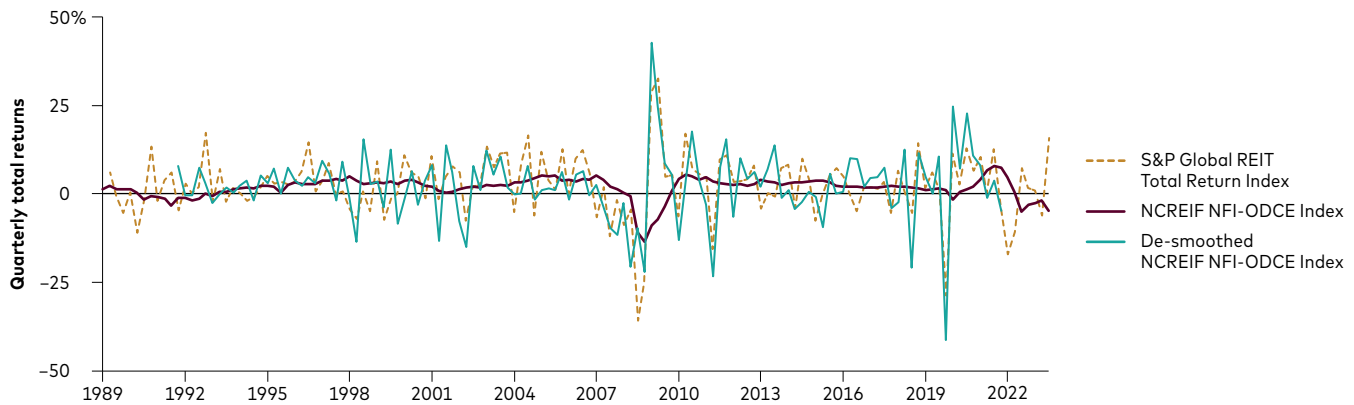
⁵ Widely cited research on de-smoothing includes Geltner (1993), Anson (2017), and Mladina and Moore (2020). Most research handles this in a two-step process (de-smooth returns, then run a factor regression). Mladina and Moore (2020) do the two steps simultaneously by optimizing a factor benchmark that, when run through a lagged beta regression on reported URA returns, minimizes the standard error.

⁶ Depending on the index used, factor attributions for PRE and INFRA have R-squared values between 60% and 75%. Preqin indexes are the Preqin Quarterly Index Real Estate—All and the Preqin Quarterly Index Infrastructure—All. The NCREIF index is the NCREIF Fund Index—Open End Diversified Core Equity, a capitalization-weighted, gross of fee, time-weighted return index with data going back to 1977. (The National Council of Real Estate Investment Fiduciaries [NCREIF] Fund Index is an index of U.S. private real estate fund-level returns going back to the 1970s.)

FIGURE 2

By de-smoothing URA fund returns, a more apples-to-apples comparison with public markets can be made

a. Comparing smoothed and de-smoothed PRE to REITs



b. De-smoothed private market returns are more comparable to listed assets

	Annualized arithmetic return	Annualized volatility	Correlation with listed asset class	Correlation with broad equities
Reported Preqin PRE	8.1%	9.1%	0.38	0.33
Reported NCREIF NFI-ODCE	6.8%	6.0%	0.10	0.02
De-smoothed Preqin PRE	7.9%	14.9%	0.72	0.79
De-smoothed NCREIF NFI-ODCE	6.8%	20.0%	0.68	0.84
Global REITs	7.8%	17.8%	—	0.69
Reported Preqin INFRA	9.1%	6.5%	0.12	0.04
De-smoothed Preqin INFRA	8.7%	8.0%	0.66	0.73
Global infrastructure equities	7.5%	16.7%	—	0.88

Notes: Reported PRE and reported INFRA returns are from Preqin and NCREIF data. The NCREIF NFI-ODCE Index represents a longer-dated index of U.S. private real estate funds, but it is reported gross of fees whereas the Preqin data is net of fees. De-smoothed returns use the FOLB (factor-optimized lagged-beta) method from Mladina and Moore (2020) and factors from Jensen et al. (2023). Preqin, NCREIF, REITs, global infrastructure equities, and broad equities data are through December 31, 2023, and their respective start dates are as follows: for NCREIF, June 30, 1989; for broad equities and REITs, September 30, 1989; for Preqin PRE, December 31, 2002; for Preqin INFRA, December 31, 2008; and for global infrastructure equities, March 29, 2002. For reasons of data availability, de-smoothed returns for Preqin are through 2022 and through 2021 for NCREIF. Correlation with listed asset class measure the correlation of all PRE series with REITs and all INFRA series with infrastructure equities. Preqin indexes are the Preqin Quarterly Index Real Estate—All and the Preqin Quarterly Index Infrastructure—All. The NCREIF index is the NCREIF Fund Index—Open End Diversified Core Equity. (The NCREIF NFI-ODCE Index is a capitalization-weighted, gross of fee, time-weighted return index with data going back to 1977; the National Council of Real Estate Investment Fiduciaries [NCREIF] Fund Index is an index of U.S. private real estate fund-level returns going back to the 1970s.) For global REITs, the index is the S&P Global REIT Total Return Index. For global infrastructure equities, the index is the S&P Global Infrastructure Index.

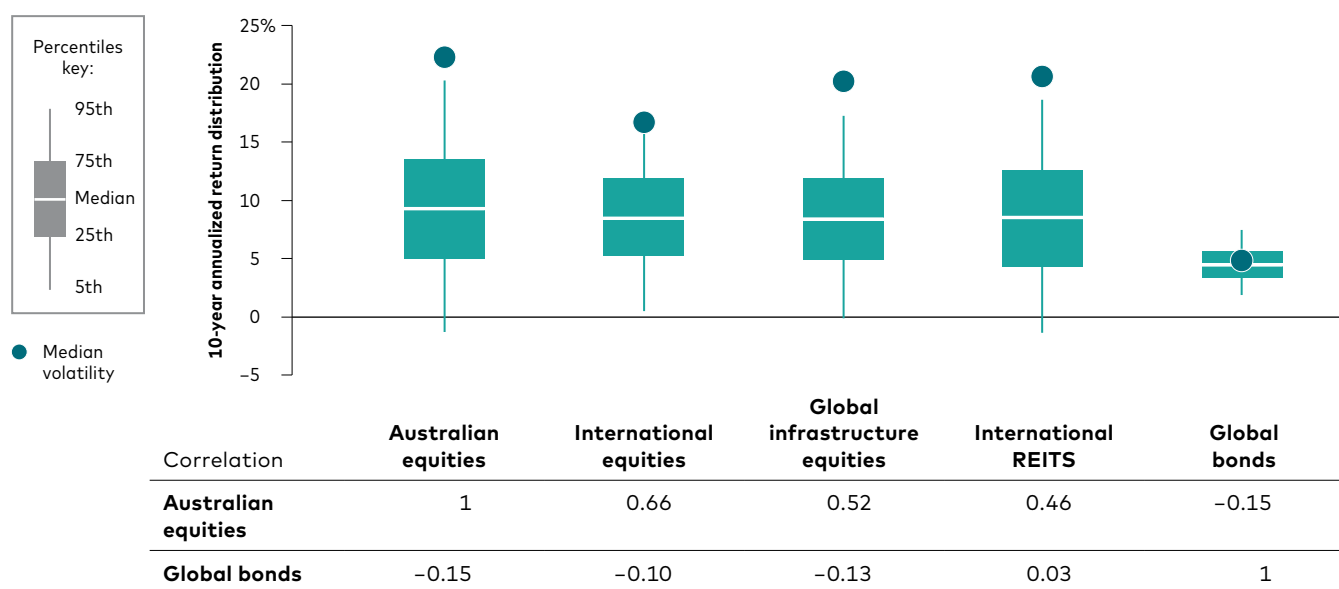
Sources: Vanguard calculations, based on data from Preqin and Bloomberg.

Past performance is not a guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

The low correlation of reported URA fund returns with equities (a procyclical asset class) suggests that they are less sensitive to economic cycles. However, the high correlation of *de-smoothed* returns with public equities suggests that the low correlation of the unsmoothed returns is merely a function of the infrequent reporting and appraisal-based valuations associated with URAs. The research we reviewed that estimates URA returns all suggests a positive loading for URAs to some measure of economic growth in their frameworks.⁷

For the purposes of this analysis, we use the Vanguard Capital Markets Model (VCMM) forecasts for international REITs and global infrastructure equities as the broad market index exposure for URAs. At a high level, the VCMM is a proprietary financial simulation tool that forecasts distributions of future returns for a wide array of broad asset classes.⁸ **Figure 3** shows the forward-looking return distribution, median volatility, and correlation assumption for REITs, global infrastructure, and core equities and fixed income from VCMM in Australian dollars as of December 31, 2023.

FIGURE 3
Core listed assets and public market proxies for PRE and INFRA: Forward-looking return distribution, median volatility, and correlation



IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations are as of December 31, 2023. Results from the model may vary with each use and over time.

Notes: The chart shows expected return distributions and correlations with Australian equities (represented by the MSCI Australia Hedged into Australian Dollars Index) and global bonds (represented by the Bloomberg Global Aggregate ex-AUS Bond Index) for international equities, international REITs (public market proxy for PRE), and global infrastructure equities (public market proxy for INFRA). International equities are represented by the MSCI All Country World ex-Australia Hedged into Australian Dollars Index; global infrastructure equities, by the FTSE Developed Core Infrastructure Hedged into Australian Dollars Index; and international REITs, by the FTSE EPRA NAREIT Developed Hedged into Australian Dollars Index. For more information on the VCMM, see the Appendix.

Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

Sources: Vanguard calculations, based on data from MSCI, Refinitiv, and Bloomberg.

⁷ See Gladstone et al. (2021) and Norges Bank Investment Management (NBIM) (2023).

⁸ For more information on the VCMM, see Davis et al. (2014).

The illiquidity premium

An illiquidity premium is the compensation that investors are, in theory, entitled to for locking their money up in an investment they cannot easily convert to cash. URAs should include an illiquidity premium for this reason. In keeping with the literature on the illiquidity premium in private assets, we find mixed evidence of its existence in URAs, and we expect that such a premium is likely time-varying. The statistically insignificant differences in arithmetic average returns for de-smoothed URAs and public proxies noted in our discussion of Figure 2b suggest a negligible illiquidity premium for URAs.⁹ Our factor decomposition analysis does find a higher constant term for INFRA than PRE, which suggests that an illiquidity premium could be present in infrastructure.¹⁰

Manager alpha (and tracking error)

Given the active nature of URA funds, the expected size and persistence of the information ratio (IR)—the ratio of alpha to tracking error, or the measure of an active manager’s ability to generate excess returns relative to a given benchmark—is the single most important factor in one’s decision to allocate to URAs. As with any active manager, costs are also a key consideration. Carlo, Eichholtz, and Kok (2021) find that PRE funds generally have fees around four times those of REITs. Costs eat into

the illiquidity premium/alpha and are regularly cited in Vanguard research as the driver of propensity for an active manager to outperform. (All Preqin performance data and all alpha/tracking error assumptions presented in this paper are net of fees unless otherwise noted.)

We calculate quarterly total returns using reported capital calls, distributions, and unrealized fair values (appraisals) for URA funds from 2000 to 2020 from Preqin. This approach is preferable to internal rate of return (IRR) because it allows for changes in the interest rate environment and reflects realized net cash distributions.¹¹ We stop our fund vintages at the end of 2020 because the j-curve effect in private markets means that reported returns in the three years preceding the vintage year are often highly volatile and speculative.¹² At the fund level, we estimate alpha and tracking error by comparing fund total returns to a “vintage-controlled” index total return from Preqin. Alpha (tracking error) is defined as the average (standard deviation) of the difference between fund-level returns and the index.

Our analysis of the Preqin data, presented in **Figure 4**, suggests that across URAs there is a low probability of finding a reasonably high information ratio manager by chance.¹³

⁹ This finding is consistent with Ang, Nabar, and Wald (2013) and Ilmanen, Chandra, and McQuinn (2020), who do not find an illiquidity premium in private real estate and private equity. They hypothesize that this could be because of investors overpaying for smoothed return streams or high demand for private investments relative to supply. Reid, Louw, and Robson (2023) similarly find a low beta to size (a proxy for illiquidity) in their study of U.K. unlevered property returns.

¹⁰ This premium is not enough to make the return difference to public equities statistically significant—suggesting that some other factor is subsuming the illiquidity premium.

¹¹ IRR calculations assume distributions are reinvested at the initial rate of return. This overstates returns in a falling rate environment such as the one that persisted for a majority of our sample.

¹² See Arnold, Ling, and Naranjo (2019 and 2021) for more on the importance of controlling for vintage year in fund benchmarking.

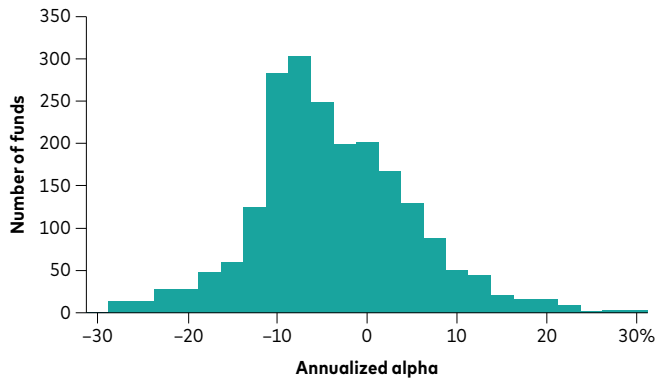
¹³ Results are not materially different if we isolate to just core/core-plus strategies.

FIGURE 4

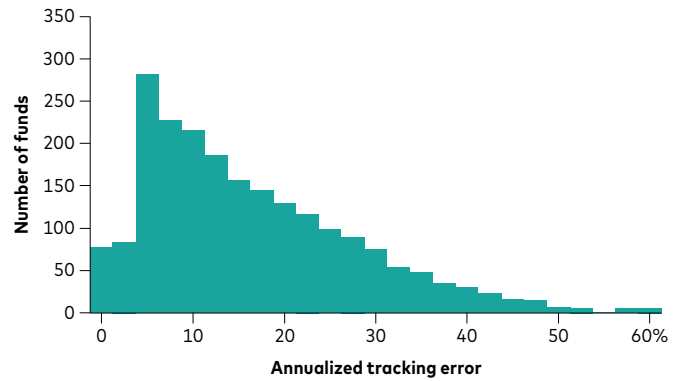
Across URA funds, there is a low probability of finding an outperforming manager by chance

Distributions of annualized alpha and tracking error for private real estate and infrastructure funds, vintage years 2000–2020

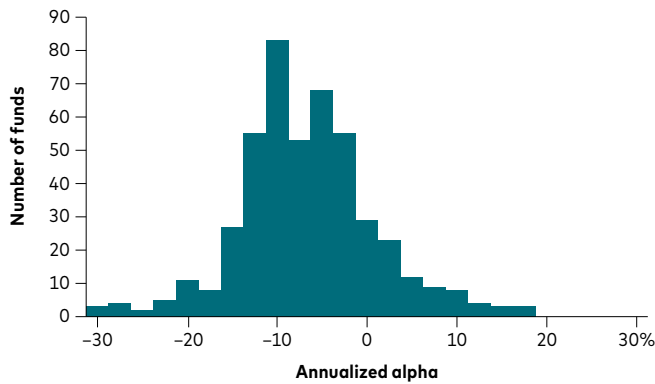
a. PRE—distribution of annualized alpha



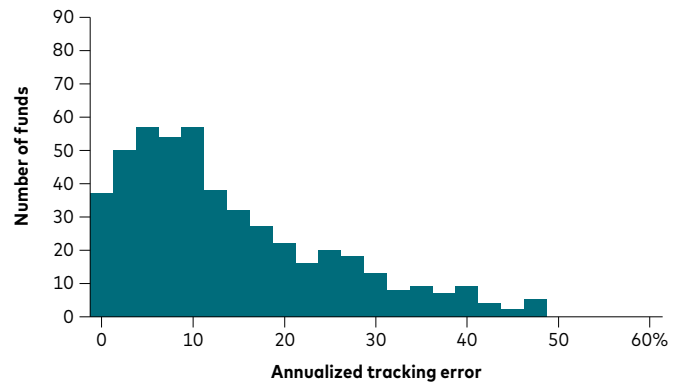
b. PRE—distribution of annualized tracking error



c. INFRA—distribution of annualized alpha



d. INFRA—distribution of annualized tracking error



Notes: The charts show the distributions of annualized alpha and tracking error for closed-end private real estate and infrastructure funds for vintage years 2000 through 2020. Global private real estate includes 2,075 funds; global private infrastructure, 477. Fund strategies included for real estate are real estate core, real estate core-plus, real estate value added, real estate opportunistic, and real estate fund of funds. Fund strategies included for infrastructure are infrastructure core, infrastructure core-plus, infrastructure opportunistic, infrastructure secondaries, and infrastructure fund of funds. For reasons of data availability, neither index nor fund returns are controlled for leverage.

Sources: Vanguard calculations, based on data from Preqin as of December 31, 2023.

Past performance is not a guarantee of future returns.

Focusing on PRE (Figures 4a and 4b), we see a median annual alpha of -5% with an interquartile range (25th–75th percentile) of -9% to 1%, suggesting a low probability of selecting an outperforming manager by chance. Median annual tracking error is 15%, with an interquartile range of 8% to 24%. For INFRA (Figures 4c and 4d), the median annualized alpha is -6% and the interquartile range is -10% to -1%. The median annualized tracking error is 12%, with an interquartile range of 7% to 22%.

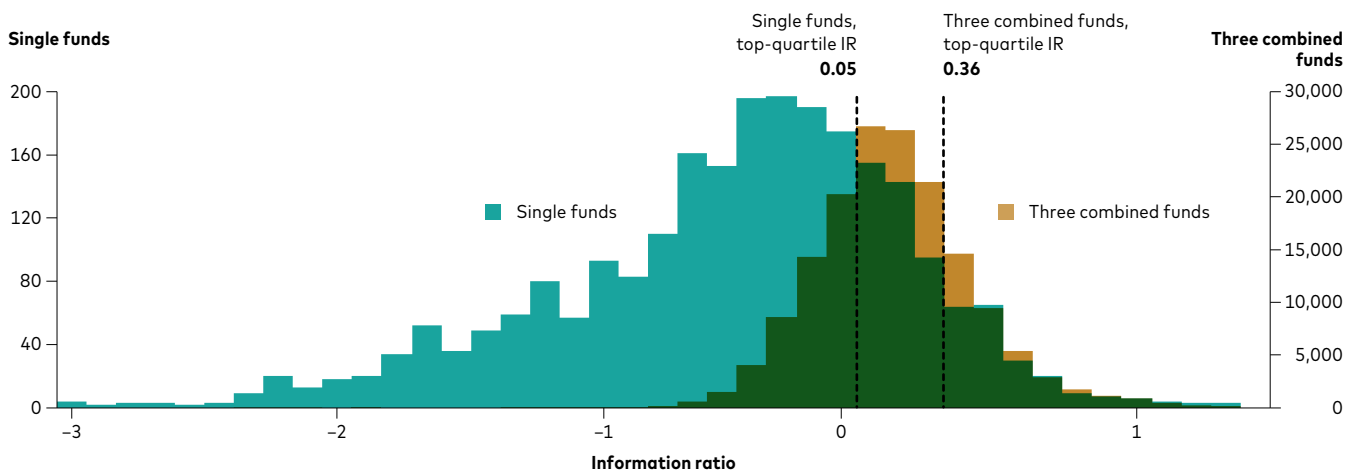
There is nothing, however, that limits investors with sufficient size from investing in multiple URA funds to diversify their portfolio. The turquoise histogram in Figure 5 shows the distribution of IRs for all URA funds from the Preqin dataset for vintage years 2000–2020. The median IR is negative, which is a function of the median after-cost reported alpha relative to the Preqin benchmark. This distribution is also quite wide (the interquartile range is -0.86 to 0.05), suggesting a large degree of variability. An IR

of 0.2—the lower bound of what Vanguard usually looks for when evaluating active managers—is at the 83rd percentile of the distribution.

There is, however, cause for some cautious optimism for URA investors. Because alpha between URA managers is less than perfectly correlated, there are diversification benefits from allocating to multiple URA managers. To quantify these benefits, we looked at a sample of equally weighted portfolios of above-median URA fund managers and calculated the alpha, tracking error, and IR distributions.¹⁴ The dark yellow histogram in Figure 5 shows that combining managers narrows the distribution of outcomes, pushes the median IR into positive territory, and increases the probability of a 0.2 or higher IR from 17% to 45%. Of course, selecting three above-median managers is no easy task. But for investors with a high degree of confidence in their selection ability, our analysis suggests a much stronger case for including URA funds in liquid multi-asset portfolios.

FIGURE 5
While selecting an outperforming URA manager by chance is unlikely, odds appear to improve when combining above-median managers

Distributions of information ratios for single funds and three combined funds, vintage years 2000–2020



Notes: The chart shows two distributions of information ratios (IRs) for the 2,552 URA funds in our Preqin dataset (2,075 global private real estate, 477 global private infrastructure) for vintage years 2000 to 2020: the distribution for all single funds (turquoise histogram) and the distribution for an equally weighted portfolio of three randomly selected above-median URA funds (dark yellow histogram). Probabilities derived from the distributions can be thought of as the odds of selecting a manager with an IR greater than or equal to a given value. For the single funds distribution, the median is -0.33, and the 75th percentile, shown as a black vertical dashed line, is 0.05. For the three combined funds distribution, the median is 0.17 and the 75th percentile, shown as a black vertical dashed line, is 0.36.

Sources: Vanguard calculations, based on data from Preqin as of December 31, 2023.

¹⁴ The managers must be above-median because a negative median return (as described here) in the numerator of the IR calculation and a lower denominator as a result of diversification creates a more negative IR distribution.

Conclusion

In summary, our analysis of URA fund returns and fund-level data suggests three things:

- Any allocation to URAs introduces active risk to the portfolio. This risk is not inherently bad, but investors should consider the probability of finding a persistent outperforming URA manager relative to the additional volatility and investment fees.
- Controlling for the distorting effects of smoothed returns suggests that URA risk factors (particularly for PRE) can be accessed through public market exposures.
- Based on available data, there appears to be limited scope for a reasonably high probability of selecting a high IR manager by chance. If, however, a bundle of above-median managers can be identified through a superior manager selection process, the investment case improves greatly.

Taken together, our research indicates that there is no "one-size-fits-all" approach to URAs. Their allocation in multi-asset portfolios hinges critically on one's confidence in selecting a manager. Skillful manager selection and perseverance through periods of underperformance can be rewarded, but the risks should not be ignored.

References

- Aliaga-Díaz, Roger, Giulio Renzi-Ricci, Harshdeep Ahluwalia, Douglas M. Grim, and Chris Tidmore, 2020. *The Role of Private Equity in Strategic Portfolios*. Valley Forge, Pa.: The Vanguard Group.
- Amenc, Noël, Frédéric Blanc-Brude, Abhishek Gupta, and Tim Whittaker, 2022. An Infrastructure Investment Primer: From Valuation to Allocation and Manager Selection. *The Journal of Portfolio Management* 48(0): 117–202.
- Ang, Andrew, Neil Nabar, and Samuel J. Wald, 2013. Searching for a Common Factor in Public and Private Real Estate Returns. *The Journal of Portfolio Management* 39(5): 120–133.
- Anson, Mark, 2017. Measuring Liquidity Premiums for Illiquid Assets. *Journal of Alternative Investments* 20(2): 39–50.
- Arnold, Thomas R., David C. Ling, and Andy Naranjo, 2019. Private Equity Real Estate Funds: Returns, Risk Exposures, and Persistence. *The Journal of Portfolio Management* 45(7): 24–42.
- Arnold, Thomas R., David C. Ling, and Andy Naranjo, 2021. Private Equity Real Estate Fund Performance: A Comparison to REITs and Open-End Core Funds. *The Journal of Portfolio Management* 47(10): 107–126.
- Bollinger, Mitchell A., and Joseph L. Pagliari, Jr., 2019. Another Look at Private Real Estate Returns by Strategy. *The Journal of Portfolio Management* 45(7): 95–112.
- Carlo, Alexander, Piet Eichholtz, and Nils Kok, 2021. Three Decades of Global Institutional Investment in Commercial Real Estate. *The Journal of Portfolio Management* 47(10): 25–40.
- Chambers, David, Christopher Spaenjers, and Eva Steiner, 2021. The Rate of Return on Real Estate: Long-Run Micro-Level Evidence. *The Review of Financial Studies* 34(8): 3572–3607.

- Davis, Joseph, Roger Aliaga-Díaz, Harshdeep Ahluwalia, Frank Polanco, and Christos Tasopoulos, 2014. *Vanguard Global Capital Markets Model*. Valley Forge, Pa.: The Vanguard Group.
- De Andrade, Charles, and Soren Godbersen, 2023. *The 60/40 Portfolio Needs an Alts Infusion*. CFA Institute Blogs.
- Fisher, Jeffrey D., and William N. Goetzmann, 2005. The Performance of Real Estate Portfolios: A Simulation Approach. *The Journal of Portfolio Management* 31(5): 32–45.
- Geltner, David, 1993. Estimating Market Values From Appraised Values Without Assuming an Efficient Market. *Journal of Real Estate Research* 8(3): 325–345.
- Geysen, Aidan, 2018. *The Role of Infrastructure in a Portfolio*. Valley Forge, Pa.: The Vanguard Group.
- Gladstone, Scott, Ananth Madhavan, Anita Rana, and Andrew Ang (2021). Macro Factor Model: Application to Liquid Private Portfolios. *The Journal of Portfolio Management* 47(5): 72–90.
- Ilmanen, Antti, Swati Chandra, and Nicholas McQuinn, 2019. *Demystifying Illiquid Assets: Expected Returns for Private Real Estate*. AQR Whitepaper.
- Ilmanen, Antti, Swati Chandra, and Nicholas McQuinn, 2020. Demystifying Illiquid Assets: Expected Returns for Private Equity. *Journal of Alternative Investing* 22 (3): 8–22.
- Inderst, George, 2011. Infrastructure as an Asset Class. CAIA Level II: Core and Integrated Topics.
- Jensen, Theis Ingerslev, Kelly, Bryan T., and Pedersen, Lasse Heje, 2023. Is There a Replication Crisis in Finance? *The Journal of Finance* 78(8): 2413–3049.
- Koo, Grace, Vincent Juvyns, Evan Grace, Jared Gross, Gareth Haslip, Ayesha Khalid, Jed Laskowitz, Thushka Maharaj, Shay Schmidt, and Gareth Turner, 2023. *A Smarter Portfolio to Mitigate Shocks in a Less Predictable World*. J.P. Morgan 2024 Long-Term Capital Market Assumptions (53–67).
- Mladina, Peter, and David Moore, 2020. Detecting Factor Risk in Private Asset Returns. *The Journal of Portfolio Management* 46(2): 156–167.
- Norges Bank Investment Management (NBIM), 2023. *Drivers of Listed and Unlisted Real Estate Returns*. Discussion Note (#3-2023); available at <https://www.nbim.no/contentassets/906061453cf44ba5936f3e6c1dd0a1cd/drivers-of-listed-and-unlisted-real-estate-returns.pdf>
- Phillips, Christopher, 2009. *Commercial Real Estate: A Framework for Analysis*. Valley Forge, Pa.: The Vanguard Group.
- Reid, Bryan, Fritz Louw, and Will Robson, 2023. Style Factors for Private Real Estate—Beyond Property Type and Location. *The Journal of Portfolio Management* 49(10): 59–68.
- Rodel, Maximilian, and Christopher Rothballer, 2012. Infrastructure as Hedge against Inflation: Factor or Fantasy. *Journal of Alternative Investments* 15(1): 110–123.
- Rudin, Alexander, and Daniel Farley, 2022. Public and Private Equity Returns: Different or Same? *The Journal of Portfolio Management* 48(3): 117–127.
- Wallick, Daniel W., Douglas M. Grim, Christos Tasopoulos, and James Balsamo, 2015. *The Allure of the Outlier: A Framework for Considering Alternative Investments*. Valley Forge, Pa.: The Vanguard Group.

Appendix

About the Vanguard Capital Markets Model

IMPORTANT: The projections and other information generated by the Vanguard Capital Markets Model (VCMM) regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. VCMM results will vary with each use and over time.

The VCMM projections are based on a statistical analysis of historical data. Future returns may behave differently from the historical patterns captured in the VCMM. More important, the VCMM may be underestimating extreme negative scenarios unobserved in the historical period on which the model estimation is based.

The VCMM is a proprietary financial simulation tool developed and maintained by Vanguard's primary investment research and advice teams. The model forecasts distributions of future returns for a wide array of broad asset classes. Those asset classes include U.S. and international

equity markets, several maturities of the U.S. Treasury and corporate fixed income markets, international fixed income markets, U.S. money markets, commodities, and certain alternative investment strategies. The theoretical and empirical foundation for the VCMM is that the returns of various asset classes reflect the compensation investors require for bearing different types of systematic risk (beta). At the core of the model are estimates of the dynamic statistical relationship between risk factors and asset returns, obtained from statistical analysis based on available monthly financial and economic data from as early as 1960. Using a system of estimated equations, the model then applies a Monte Carlo simulation method to project the estimated interrelationships among risk factors and asset classes as well as uncertainty and randomness over time. The model generates a large set of simulated outcomes for each asset class over several time horizons. Forecasts are obtained by computing measures of central tendency in these simulations. Results produced by the tool will vary with each use and over time.

Authors



Ian Kresnak,
CFA



Maziar Nikpour,
Ph.D.



Carole Okigbo

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