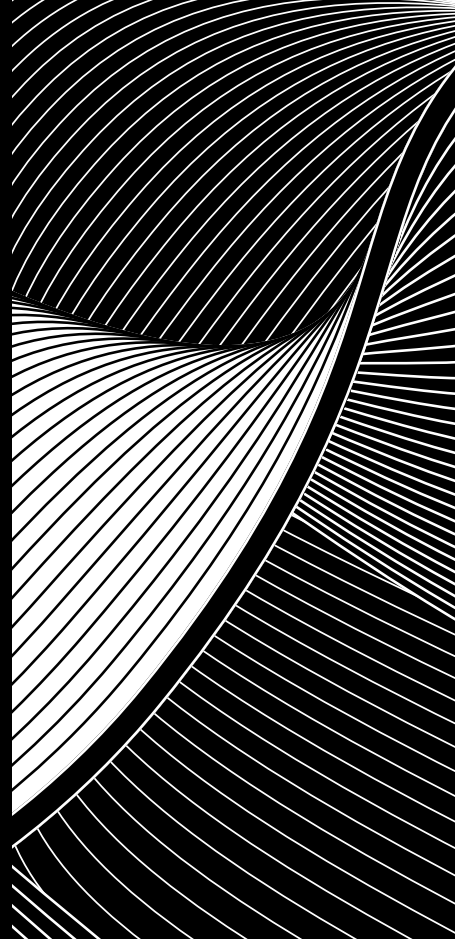


MACQUARIE ASSET MANAGEMENT

Pathways

Core infrastructure: The case for a long-term strategic allocation

September 2026



3	Core infrastructure: Definition and main traits
6	Performance: Long-run returns and volatility
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Executive summary



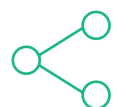
Competitive performance: Since March 2008, core infrastructure¹ has delivered an annualised return of 9.9%, stronger than global equities, global bonds and core real estate. With an annualised volatility of 7.8% (or 8.5% on an unsmoothed basis²), core infrastructure has delivered an attractive risk-adjusted return.



Strong yield profile: An average historical yield of 4.0% positions core infrastructure as a leading income-generating strategy among equity asset classes as well as investment-grade bonds (both corporate and government).



Resilience during downturns: Core infrastructure has delivered more defensive returns when economic growth was weak, delivering 7.8% per annum, more than double the return of global equities (2.8%) and well above global bonds (1.3%).



Inflation linkage: During periods of elevated or rising inflation, core infrastructure tends to deliver stronger returns than global equities and global bonds. During the inflation surge of 2021-2023, core infrastructure has performed better than other asset classes, including overall infrastructure.



Rate-cycle resilience: Despite being a long-duration asset class, core infrastructure delivered positive performance through the 2022-2023 interest rate hiking cycle, supported by inflation-linked revenues and regulatory reset mechanisms that helped offset pressure on valuations.

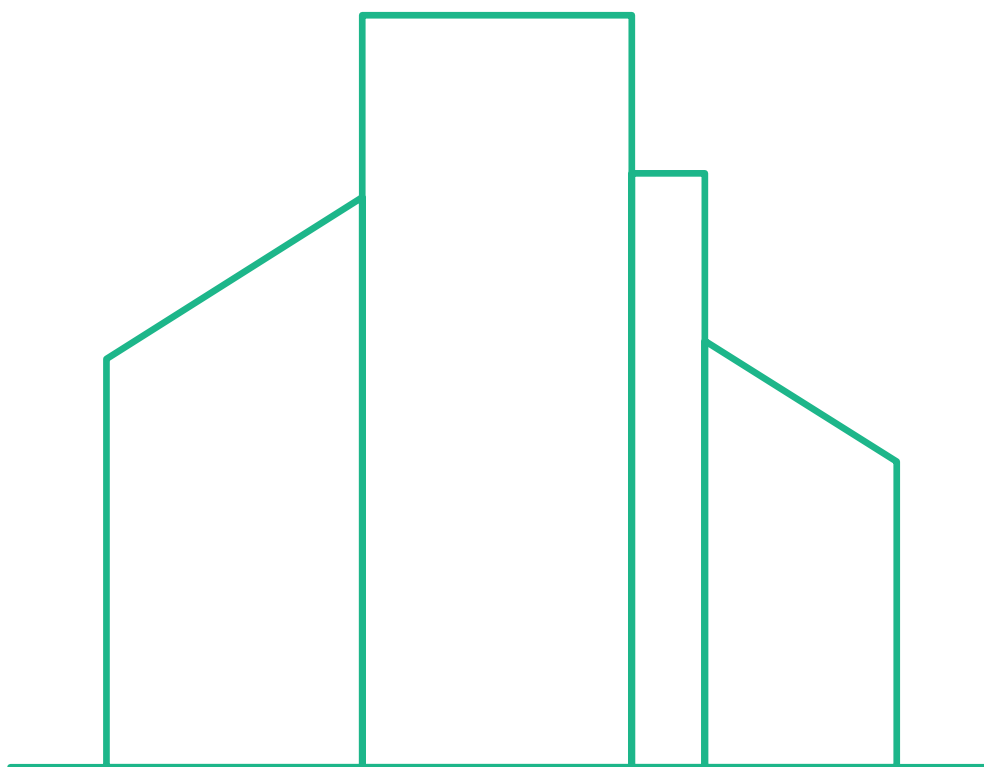


Role in a portfolio: Core infrastructure can serve a range of roles within a portfolio. As a result, the optimal allocation will depend on an investor's specific objectives. In this paper, we explore several theoretical portfolio optimisation scenarios and examine how core infrastructure may fit within different portfolio constructions.

1. MSCI Global Private Infrastructure Asset Index – Low Risk (USD), gross of tax and net of expenses for the investment.

2. Private-market indices are based on periodic appraisals rather than daily market pricing, which tends to understate period-to-period volatility relative to publicly traded markets; see Figure 5 for detail.

Core infrastructure: Definition and main traits



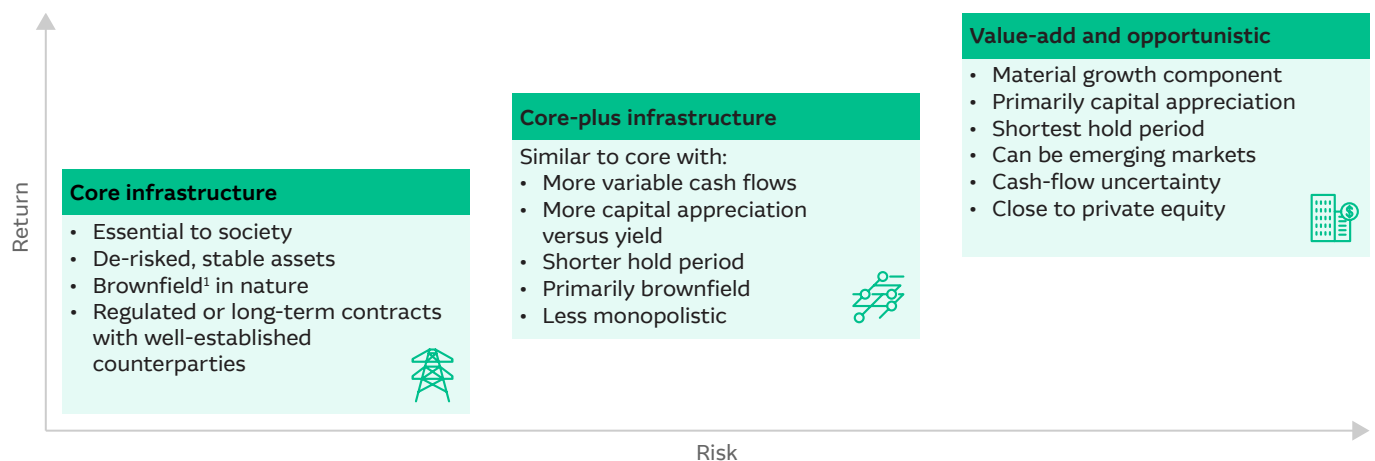
Core infrastructure, like infrastructure generally, is defined by its traits rather than by sector nomenclature. It is infrastructure that typically has several of the following traits:

- provides a critical service or function,
- operates in an environment of limited competition, often as a monopoly,
- has a stable long-term revenue stream, often regulated or under long-term contracts with low demand risk,
- generates predictable yield,
- has a large asset base.

Figure 1 summarises the key characteristics of core, core plus and value-add/opportunistic infrastructure. Importantly, core infrastructure represents the most defensive segment of the infrastructure market, typically comprising mature, operating assets with predictable cash flows and limited exposure to volume risk. These assets often benefit from regulated revenue frameworks, long-term contracts, or monopolistic market positions. Core plus assets retain many of the characteristics of core infrastructure but incorporate operational improvement, expansion, or customer growth opportunities that can enhance returns. Value-add infrastructure sits further along the risk-return spectrum, typically involving assets undergoing development, transformation, repositioning, or significant operational enhancement.

Figure 1.

Core infrastructure is defined by its traits, not sector nomenclature



Source: Macquarie Asset Management (July 2026). 1. Brownfield means the asset is built and investments are substantially capex focused. Chart is for illustrative purposes only.

The table below further summarises the key distinguishing characteristics of core infrastructure relative to core plus and value-add infrastructure.

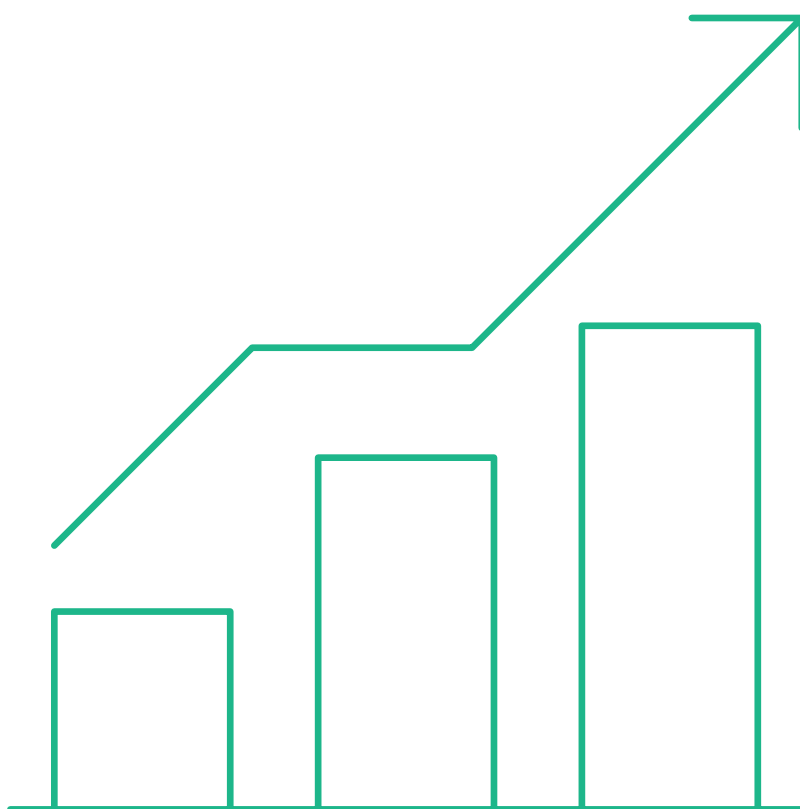
Figure 2.
Key characteristics of infrastructure strategies

Characteristic	Core infrastructure	Core plus infrastructure	Value-add infrastructure
Average yield	4-6%	3-5%	2-3%
Return drivers	Income return and capital appreciation	More driven by capital appreciation than by yield	Primarily capital appreciation
Capital appreciation drivers	Reinvesting into asset bases	Delivering growth projects, demand growth, multiple expansion	Predominantly demand growth and multiple expansion
Typical holding period	10-20+ years	7-15 years	3-10 years
Average leverage	40-60%	30-50%	Varies depending on business plan
Inflation linkage	Strong pass-through mechanisms	Inflation linkages embedded in contracts and/or pricing power	Variable, depending on asset
Sensitivity to GDP growth	Low	Low to moderate	Moderate to high
Examples	Regulated electricity transmission and distribution networks, regulated hub airports, large network toll roads, landlord ports, cell towers, stabilised data centres	Unregulated regional airports, leasehold port, last-mile fibre networks, data centre platforms, waste management, private hospitals	Merchant power generation, development projects in emerging markets

Source: Macquarie Asset Management (July 2026). Notes: GDP = Gross Domestic Product.

In this paper, we examine the historical return performance of core infrastructure using the MSCI Global Private Infrastructure Asset Index – Low Risk as, in our view, the taxonomy of the MSCI private infrastructure indices reflects the fundamental traits of core infrastructure that we outlined above. For more details on the methodology of the MSCI private infrastructure indices please refer to Appendix 1 of this paper.

Performance: Long-run returns and volatility



The long-run performance record of core infrastructure demonstrates its distinctive capabilities to generate attractive equity-like returns with bond-like volatility.

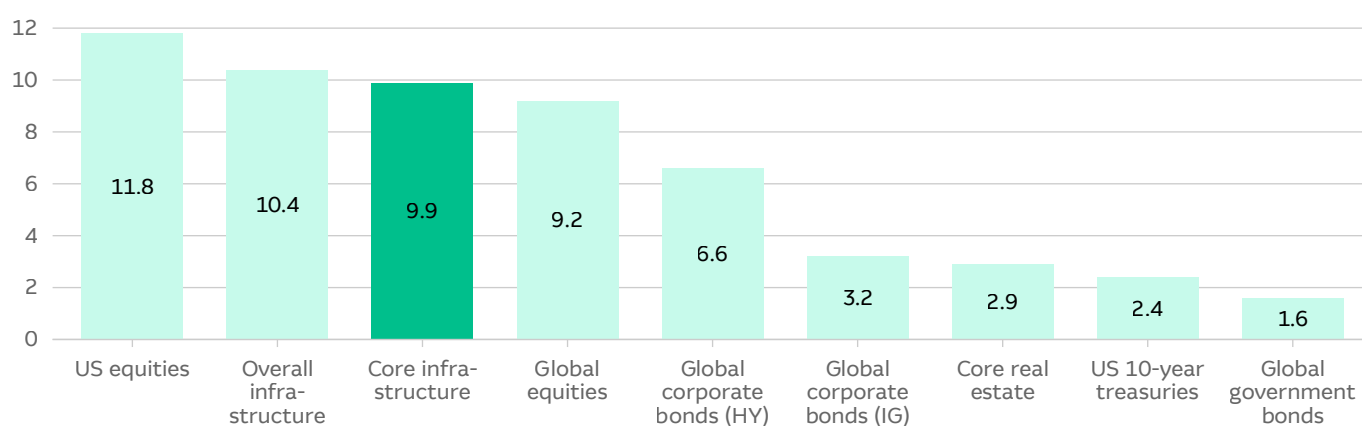
Long-run returns: Competitive return performance since 2008

Core infrastructure delivered an annualised total return of 9.9% from March 2008 through December 2025. This return places it ahead of global equities (9.2%), corporate bonds (both investment grade at 3.2% and high yield at 6.6%), core real estate (2.9%), US 10-year Treasuries (2.4%) and global government bonds (1.6%) while behind US equities (11.8%) and overall infrastructure (10.4%).

Figure 3.

Core infrastructure has delivered an annualised return of 9.9% over the long run

Annualised net return (%)



Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index, Bloomberg (as of June 2026). Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD), Overall infrastructure: MSCI Global Private Infrastructure Index – All (USD), US equities: S&P 500 Index Total Return Index (USD); Global equities: MSCI World Index (USD); Global government bonds: Bloomberg Global-Aggregate Total Return Index (USD); Global corporate bonds (HY): Bloomberg Global High Yield Corporate Total Return Index Value Unhedged (USD); Global corporate bonds (IG): Bloomberg Global Agg Corporate Total Return Index Value Unhedged (USD); Core real estate: INREV Global Real Estate Fund Index USD (GREFI). Analysis conducted between 31 March 2008 and 31 December 2025 using quarterly returns. Past performance is not indicative of future returns.

Long-run volatility: Comparable to bonds rather than equity

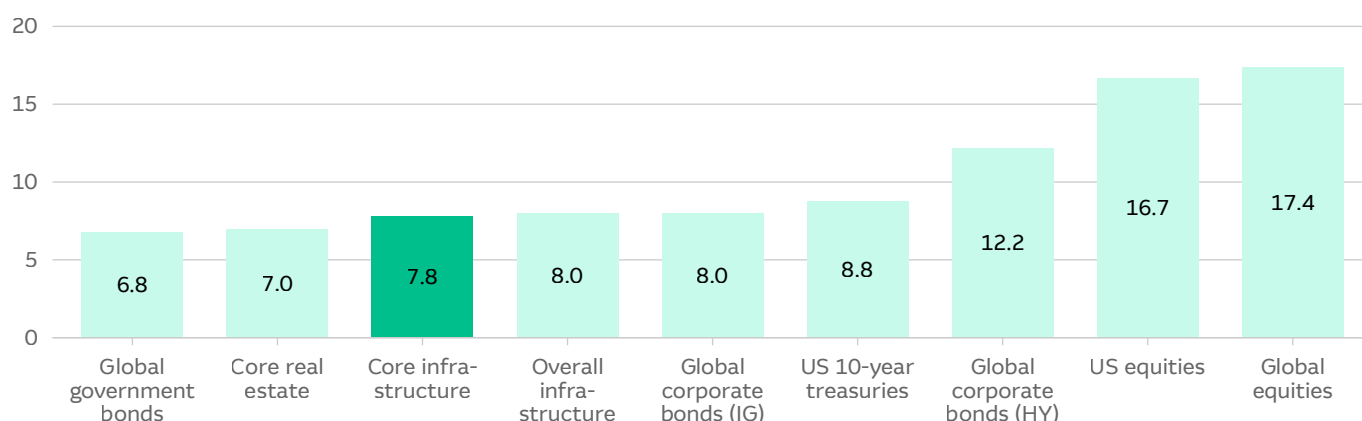
Since 2008, core infrastructure has generated annualised volatility of 7.8%. It is lower than the volatility of US equities (16.7%), global equities (17.4%), corporate high-yield bonds (12.2%), US 10-year Treasuries (8.8%), corporate investment-grade bonds (8.0%), and overall infrastructure (8.0%). Only global government bonds (6.8%) and core real estate (7.0%) tend to exhibit lower volatility, but both do so with returns of less than 3% per annum.

The lower volatility of core infrastructure stems from the contractual and regulatory frameworks supporting revenues: long-term concessions, regulated asset bases and inflation-linked tariff regimes tend to underpin stable and predictable cash flows.

Figure 4.

Core infrastructure has exhibited volatility comparable to global bonds

Annualised volatility (%)

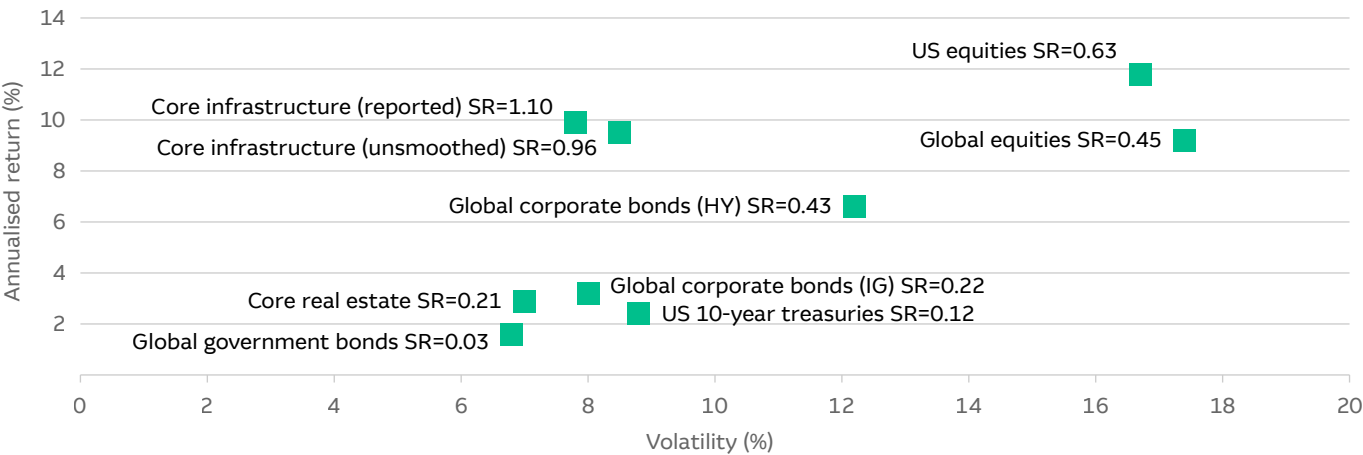


Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index, Bloomberg (as of June 2026). Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD), Overall infrastructure: MSCI Global Private Infrastructure Index – All (USD), US equities: S&P 500 Index Total Return Index (USD); Global equities: MSCI World Index (USD); Global government bonds: Bloomberg Global-Aggregate Total Return Index (USD); Global corporate bonds (HY): Bloomberg Global High Yield Corporate Total Return Index Value Unhedged (USD); Global corporate bonds (IG): Bloomberg Global Agg Corporate Total Return Index Value Unhedged (USD); Core real estate: INREV Global Real Estate Fund Index USD (GREFI). Analysis conducted between 31 March 2008 and 31 December 2025 using quarterly returns. Past performance is not indicative of future returns.

Sharpe ratio: Attractive risk-adjusted profile

On a risk-adjusted basis, core infrastructure has historically delivered a Sharpe ratio of 1.10 since March 2008. In our analysis (Figure 5), we have also calculated the Sharpe ratio using unsmoothed volatility³, which aims to adjust for the appraisal-based smoothing common in private market indices. The Sharpe ratio on an unsmoothed basis still results in a robust 0.96, above US equities (0.63), global equities (0.45), global high yield corporate bonds (0.43), global investment grade corporate bonds (0.22), core real estate (0.21), 10-year US Treasuries (0.12) and global bonds (0.03).

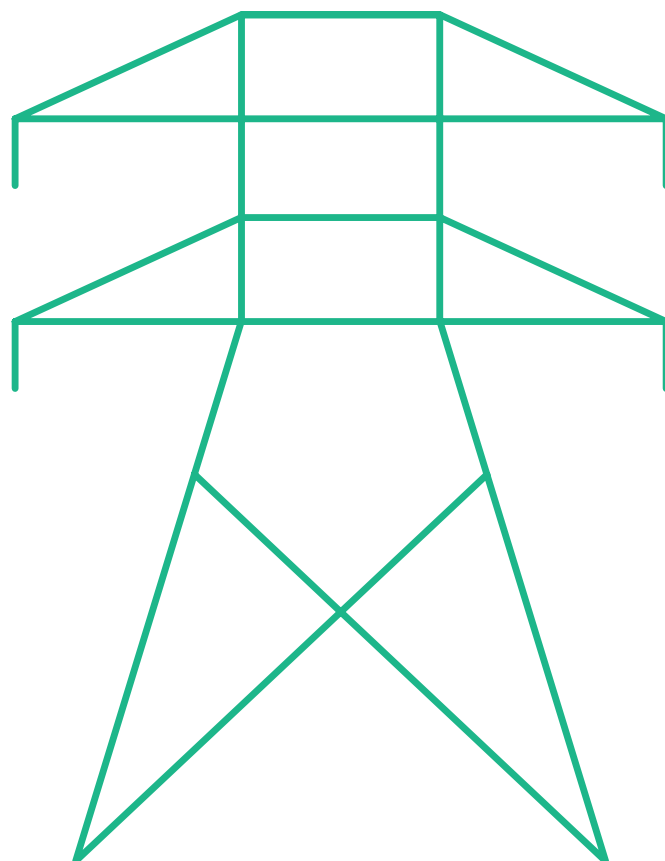
Figure 5.
Core infrastructure has delivered an attractive risk-adjusted return



Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index, Bloomberg (as of June 2026). Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD), Overall infrastructure: MSCI Global Private Infrastructure Index – All (USD), US equities: S&P 500 Index Total Return Index (USD); Global equities: MSCI World Index (USD); Global government bonds: Bloomberg Global-Aggregate Total Return Index (USD); Global corporate bonds (HY): Bloomberg Global High Yield Corporate Total Return Index Value Unhedged (USD); Global corporate bonds (IG): Bloomberg Global Agg Corporate Total Return Index Value Unhedged (USD); Core real estate: INREV Global Real Estate Fund Index USD (GREFI). Analysis conducted between 31 March 2008 and 31 December 2025 using quarterly returns. Past performance is not indicative of future returns.

3. Unsmoothed using Geltner method.

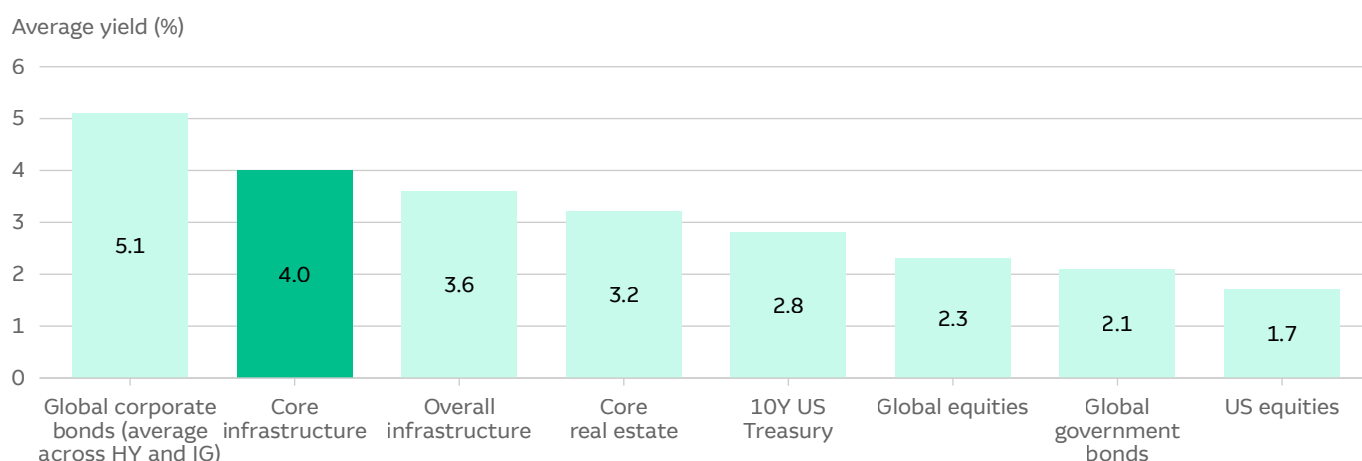
Yield: Providing stability to total return



Between 2016 and 2025, core infrastructure has delivered an average yield of 4.0% per annum. This compares to 5.1% for global corporate bonds (averaged across high yield and investment grade), 3.6% for overall broad infrastructure, 3.2% for core real estate, 2.8% for 10-year US Treasuries, 2.3% for global equities, 2.1% for global government bonds and 1.7% for US equities (Figure 6). Courtesy of its high and stable yield, core infrastructure has exhibited more stable returns because a larger portion of total return comes from predictable cash income rather than capital appreciation.

Figure 6.

Core infrastructure has historically generated a higher yield than overall infrastructure, core real estate, government bonds and global equities

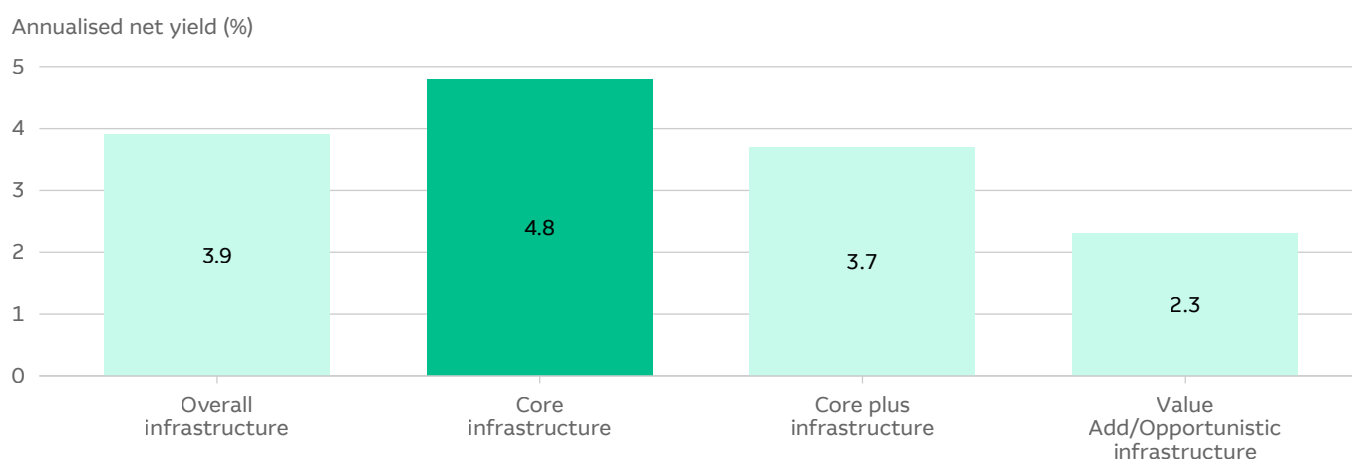


Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index, Bloomberg (as of June 2026). Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD), Overall infrastructure: MSCI Global Private Infrastructure Index – All (USD), US equities: S&P 500 Index Total Return Index (USD); Global equities: MSCI World Index (USD); Global government bonds: Bloomberg Global-Aggregate Total Return Index (USD); Global corporate bonds: Bloomberg Global-Aggregate Corporate Total Return Index (USD); core real estate: Global ODCE Income return Index. Analysis conducted between 31 December 2016 and 31 December 2025 using quarterly returns. Past performance is not indicative of future returns.

Within the infrastructure universe, core strategies have generated the highest yield since March 2008 (Figure 7). While core infrastructure tends to generate slightly lower total return (9.9%) than core plus infrastructure (11.2%), core infrastructure tends to achieve a higher income return (4.8% vs 3.7%). The income return tends to contribute 40-50% of total return for core infrastructure assets, making it a significant return driver along with capital appreciation.

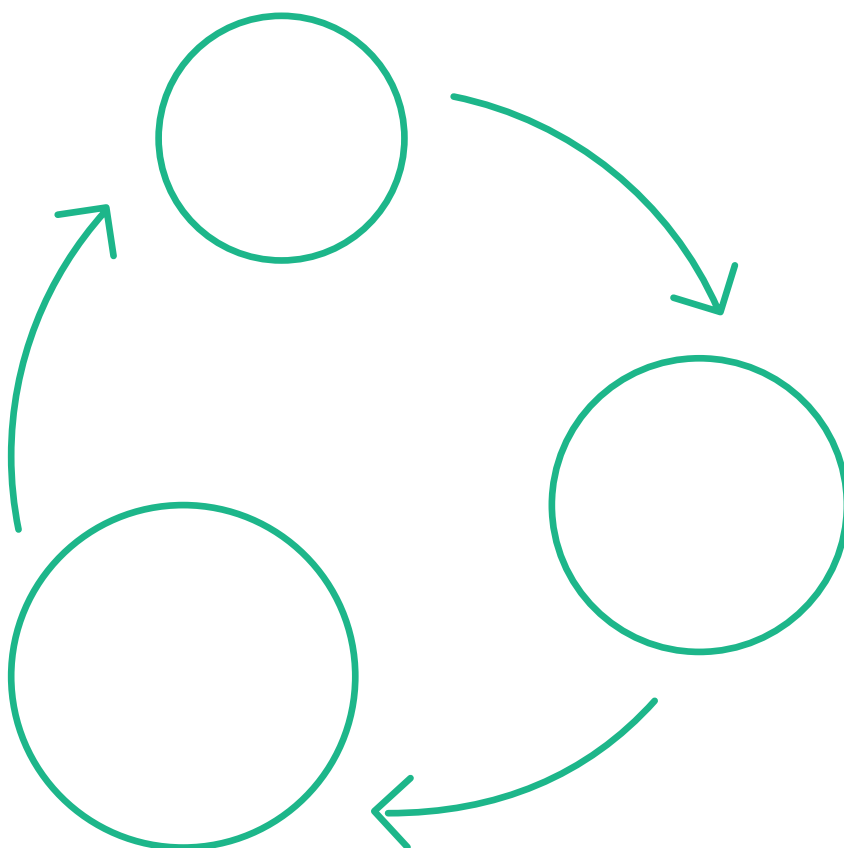
Figure 7.

Core infrastructure tends to generate higher yield than other infrastructure strategies



Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index (as of July 2026). Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD); Core plus infrastructure: MSCI Global Private Infrastructure Index – Moderate Risk (USD); Value Add/Opportunistic: MSCI Global Private Infrastructure Index – High Risk (USD); Overall infrastructure: MSCI Global Private Infrastructure Index – All (USD). Analysis conducted between 31 March 2008 and 31 December 2025 using quarterly returns. Past performance is not indicative of future returns.

Performance through the economic cycle



Historically, core infrastructure has demonstrated resilience across varying macroeconomic conditions. In this section, we explore in detail the relationship between core infrastructure returns and key macroeconomic variables: inflation, gross domestic product (GDP) growth and interest rates.

Testing inflation-hedge linkage with data

Core infrastructure assets often have inflation linkage built into their revenue models, either through regulatory frameworks or contractual mechanisms. The empirical evidence supports this linkage. As illustrated on Figure 8, when developed world Consumer Price Index (CPI) inflation was above its long-run average of 2.4%, core infrastructure generated an annualised return of 10.3%, performing better than global equities (8.1%) and global bonds (-2.7%). The rising inflation environment shows a similar picture (Figure 9): core infrastructure returned 11.6% per annum during periods of rising inflation, compared to 9.4% for global equities and -1.6% for global bonds. That said, general equities tend to perform better than infrastructure when inflation is below average or falling. We examine in detail how inflation-linkage mechanisms work under various regulatory frameworks in the next section.

Figure 8:
Core infrastructure delivers higher returns when inflation is above average...

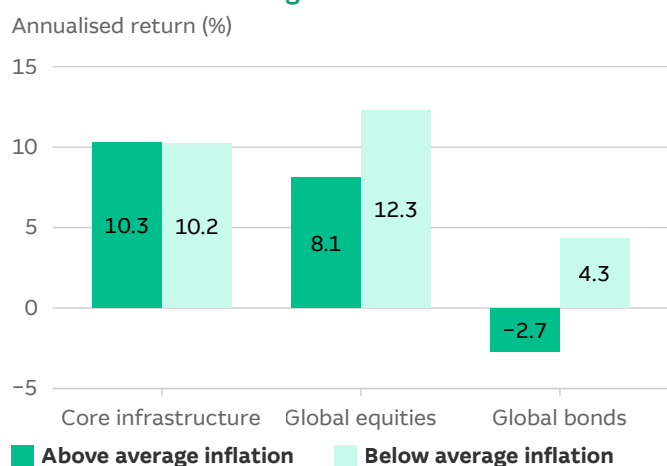
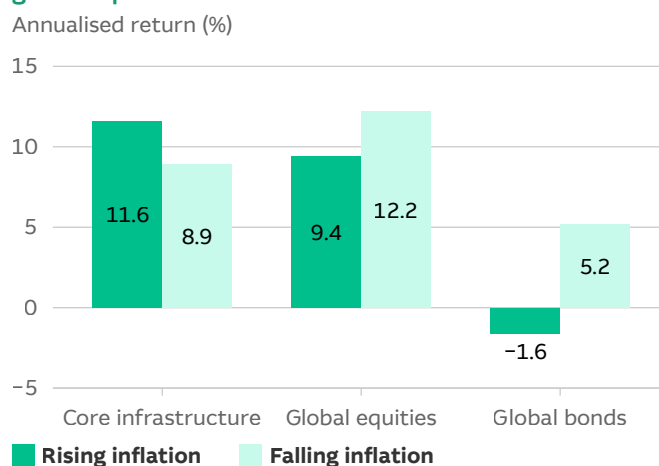


Figure 9:
...as well as when inflation is rising, outperforming global equities and bonds



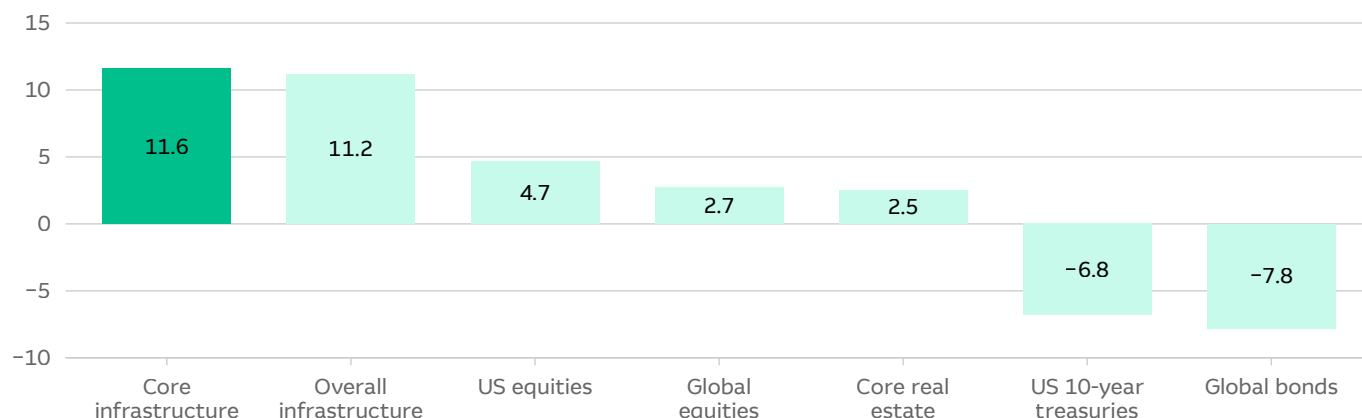
Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index, Bloomberg (as of July 2026). Core infrastructure represented by MSCI Global Private Infrastructure Index – Low Risk (USD), Global equities: MSCI World Index (USD); Global bonds: Bloomberg Global-Aggregate Total Return Index (USD). Analysis conducted between March 2008 and December 2025 using quarterly returns data. The CPI inflation during the period averaged 2.4%. Past performance is not indicative of future returns.

During the period from Q2 2021 through Q3 2023, when headline inflation surged to multi-decade highs across the developed world economies, core infrastructure delivered an annualised return of 11.6%, higher than equities, bonds and overall infrastructure (Figure 10). This provides additional evidence of core infrastructure's linkage with inflation based on recent historical performance.

Figure 10.

Core infrastructure has outperformed other asset classes during the inflation surge 2021-2023

Annualised return (%)



Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index, Bloomberg (as of July 2026). Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD), Overall infrastructure: MSCI Global Private Infrastructure Index – All (USD), US equities: S&P 500 Index Total Return Index (USD); Global equities: MSCI World Index (USD); Global bonds: Bloomberg Global-Aggregate Total Return Index (USD); Core real estate: INREV Global Real Estate Fund Index USD (GREFI). Analysis conducted between June 2021 and September 2023 inclusive using quarterly returns data. Past performance is not indicative of future returns.

Defensiveness during downturns

Core infrastructure has historically exhibited defensive characteristics when economic growth was weak or slowing down. When global GDP growth was below its long-run average, core infrastructure delivered 7.8% per annum, more than double the return of global equities (2.8%) and well above global bonds (1.3%). In decelerating growth environments, core infrastructure returned 9.4% versus 4.9% for global equities and 3.2% for global bonds (Figures 11 and 12).

Figure 11:

Core infrastructure delivers defensive returns when GDP growth is below average...

Annualised return (%)

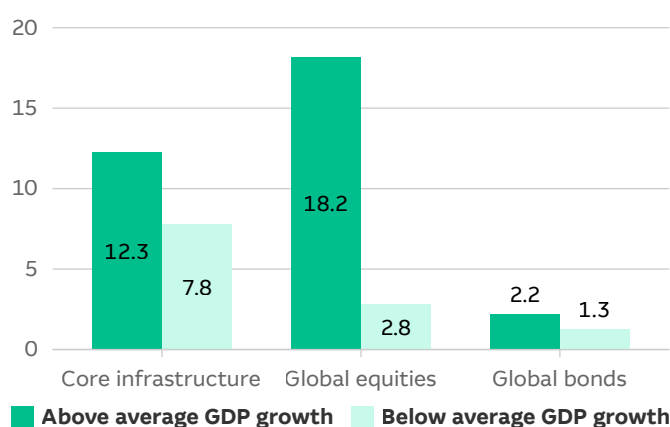
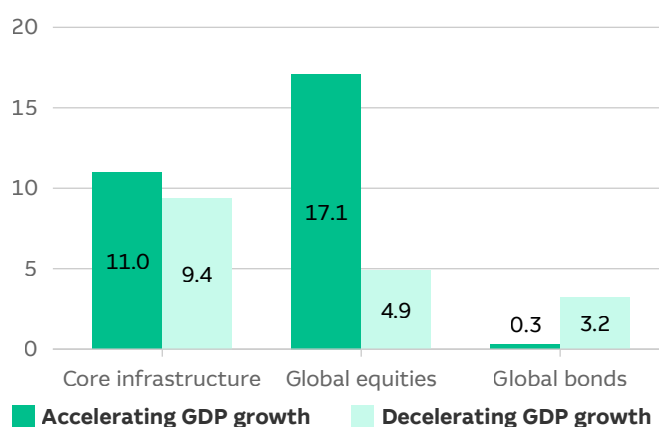


Figure 12:

...as well as when GDP growth is decelerating, outperforming global equities and bonds

Annualised return (%)

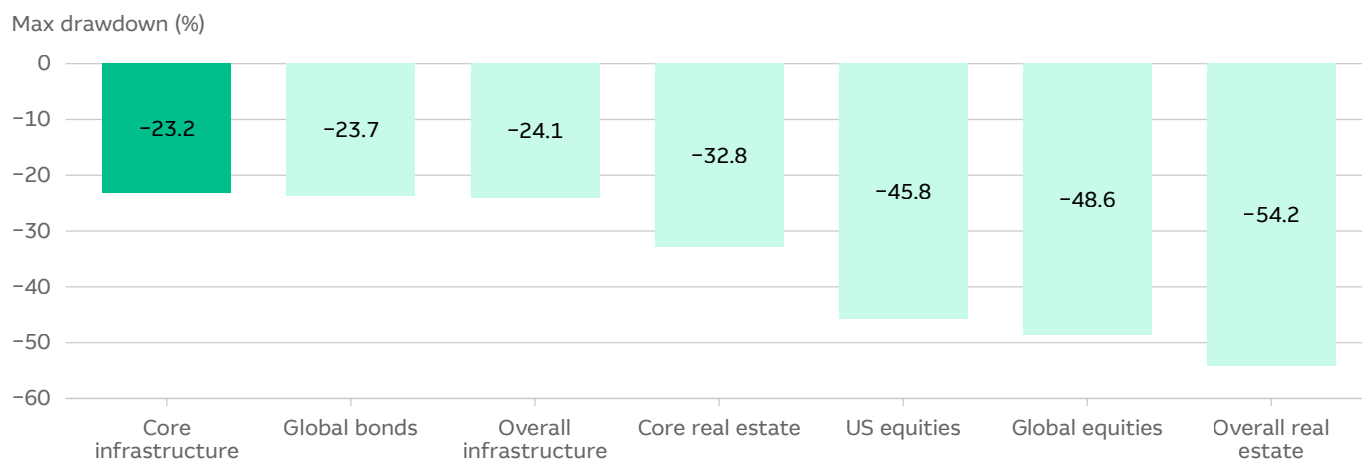


Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index, Bloomberg (as of July 2026). Core infrastructure represented by MSCI Global Private Infrastructure Index – Low Risk (USD), Global equities: MSCI World Index (USD); Global bonds: Bloomberg Global-Aggregate Total Return Index (USD). Analysis conducted between March 2008 and December 2025 using quarterly returns data. Past performance is not indicative of future returns.

During the global financial crisis (GFC), core infrastructure has also exhibited defensive characteristics: it has seen the peak-to-trough of -23.2%, below global equities with -48.6% and similar to global bonds with -23.7% (Figure 13). The limited exposure to volume risk underpins the resilience of core infrastructure during periods of economic downturn.

Figure 13.

Core infrastructure has exhibited the peak-to-trough fall similar to global bonds during the GFC



Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index, Bloomberg (as of July 2026). Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD), Overall infrastructure: MSCI Global Private Infrastructure Index – All (USD), US equities: S&P 500 Index Total Return Index (USD); Global equities: MSCI World Index (USD); Core real estate: INREV Global Real Estate Fund Index USD (GREFI); Global bonds: Bloomberg Global-Aggregate Total Return Index (USD); Overall real estate: Prequin Real Estate Index (USD). Core and overall infrastructure data starts from March 2008, while data for global equities and US equities captures the data from September 2007. Past performance is not indicative of future returns. Private market indices are based on periodic appraisals rather than daily market pricing, which tends to understate period-to-period volatility relative to publicly traded markets; see Figure 5 for detail.

Core infrastructure and interest rates

The relationship between core infrastructure and interest rates is more nuanced. Like other long-duration assets, infrastructure valuations can be sensitive to discount rate increases. However, core infrastructure's inflation-linked revenues and regulatory reset mechanisms often provide a meaningful offset.

There are several structural features that help moderate core infrastructure's interest rate sensitivity:

- **Regulatory resets:** Many regulatory frameworks incorporate periodic reviews that update the allowed cost of capital and operating costs, enabling asset owners to capture higher returns as rate environments change.
- **Revenue inflation linkage:** As discussed earlier, revenues are often indexed to inflation, which typically accompanies periods of rising rates, helping offset valuation pressure.

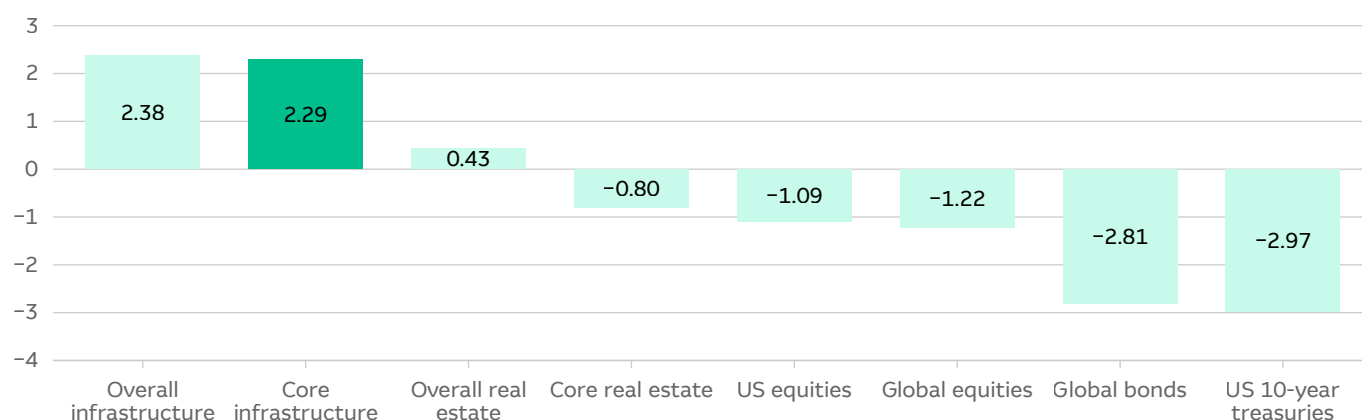
The 2022-2023 interest rate cycle provided a real-world test of these dynamics. As central banks raised policy rates by 400 to 500 basis points across developed markets, private infrastructure valuations came under pressure from higher discount rates. Core infrastructure assets were not immune. However, the concurrent rise in inflation (the primary driver of the interest rate rises) increased the nominal revenues and regulated asset bases (RABs) of regulated assets (albeit with a lag), partially offsetting the valuation impact. Core assets experienced significantly less valuation compression than higher-duration, lower-inflation-linked assets such as long-dated fixed-rate bonds or growth equities.

Figure 14 shows the annualised performance of core infrastructure and other asset classes during the interest rate hiking cycle between Q1 2022 and Q3 2023. Core infrastructure has delivered positive performance (+2.3%) over this period due to the positive offset from higher inflation, compared to the negative performance experienced by equity and bond markets. Importantly, when interest rates rise, both equity and bond markets tend to deteriorate, increasing the correlation within a portfolio.

Figure 14.

Core infrastructure has delivered positive performance during the interest rate hikes between Q1 2022 and Q3 2023 due to positive offset from higher inflation

Annualised return (%)



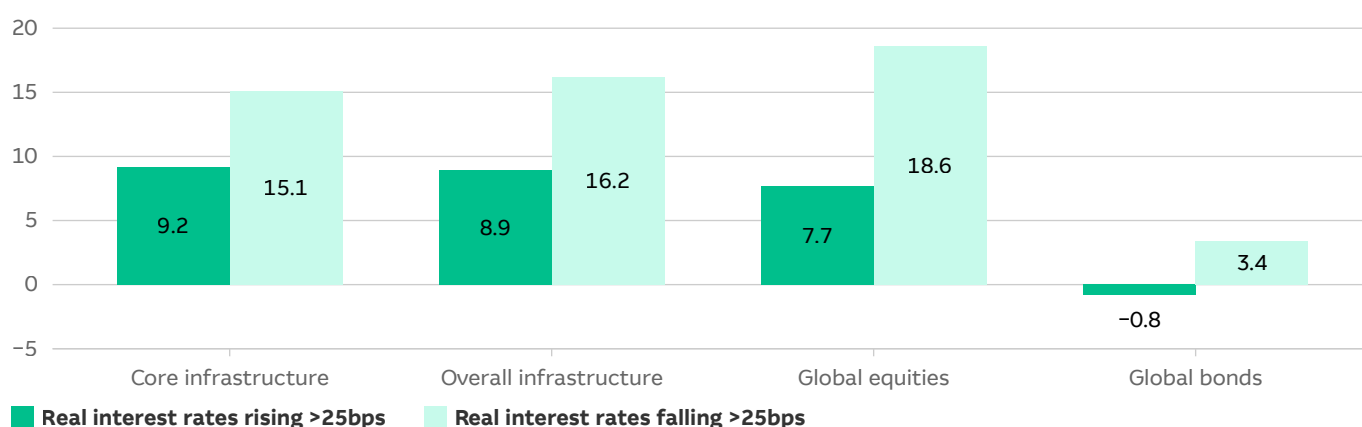
Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index, Bloomberg (as of July 2026). Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD), Overall infrastructure: MSCI Global Private Infrastructure Index – All (USD), US equities: S&P 500 Index Total Return Index (USD); Global equities: MSCI World Index (USD); Core real estate: INREV Global Real Estate Fund Index USD (GREFI); Global bonds: Bloomberg Global-Aggregate Total Return Index (USD); Overall real estate: Preqin Real Estate Index (USD). Past performance is not indicative of future returns.

To isolate the negative effect of interest rates from the positive effect of inflation, we analyse the sensitivity of core infrastructure returns to changes in real interest rates (calculated as nominal interest rates minus inflation). Figure 15 shows the performance of core infrastructure when real interest rates increased by more than 25 basis points (bps) and when real interest rates fell by more than 25 bps. Like all equity asset classes, core infrastructure benefits from falling real interest rates. However, when they rise, it tends to deliver more defensive returns (9.2%) than global equities (7.7%), global bonds (-0.8%) and overall infrastructure (8.9%).

Figure 15.

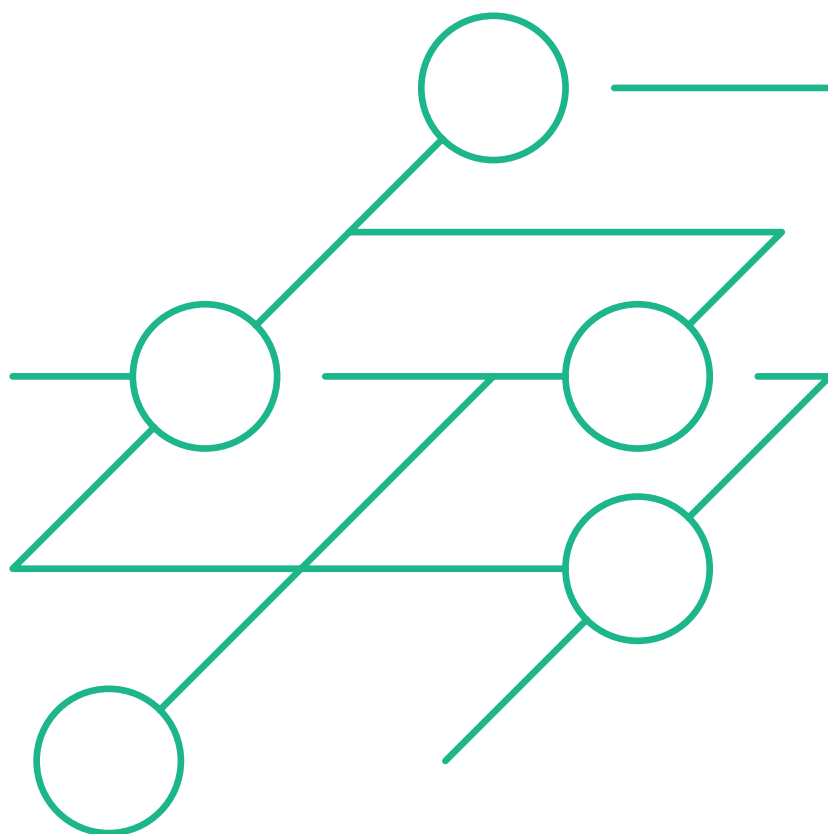
Core infrastructure is not immune to real interest rate increases, however, is less sensitive than global equities and global bonds

YoY%



Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index, Bloomberg (as of July 2026). Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD), Overall infrastructure: MSCI Global Private Infrastructure Index – All (USD), Global equities: MSCI World Index (USD); Global bonds: Bloomberg Global-Aggregate Total Return Index (USD). Past performance is not indicative of future returns.

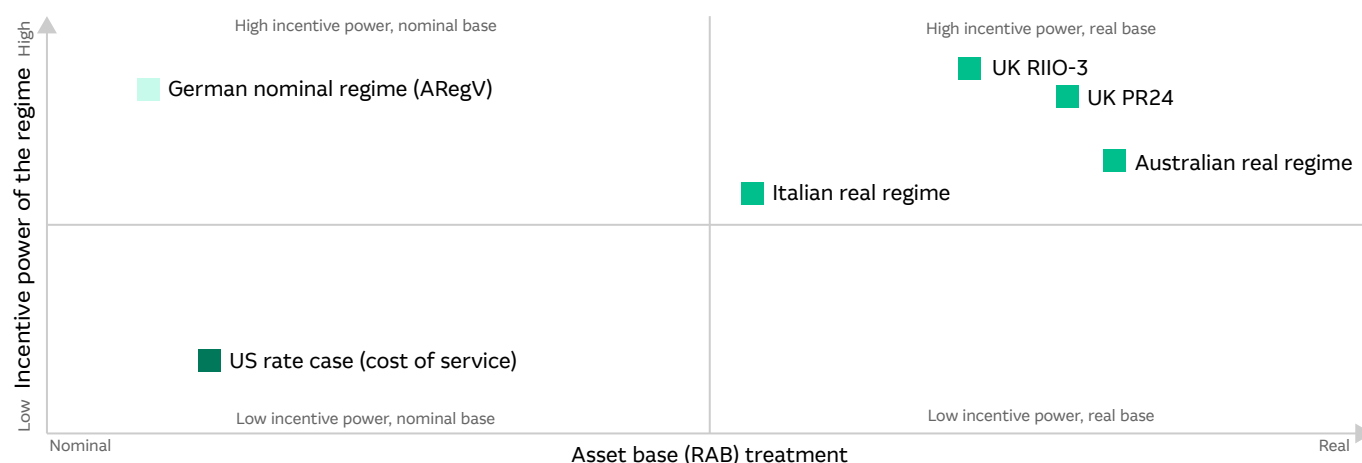
Revisiting regulated infrastructure frameworks



Regulated infrastructure is the cornerstone of core infrastructure, and the existing regulatory frameworks provide the mechanism behind the defensive and inflation-linked nature of core infrastructure assets. In this section, we provide an overview of the common regulatory frameworks that establish the rules under which operators are permitted to earn returns on their assets.

Frameworks are commonly presented as a menu of competing types, but they vary along two largely independent dimensions: how the asset base is valued and remunerated, and how much of its own cost performance the operator bears. The second of these, the incentive power of the framework, determines the risk transferred to investors (Figure 16):

Figure 16.
Regulatory frameworks: Incentive power vs asset base treatment



Source: Macquarie Asset Management (August 2026). Notes: ARegV (*Anreizregulierungsverordnung*) = German federal ordinance that regulates the network tariffs and operational revenues of electricity and gas grid operators; UK PR24 = 2024 Price Review by Ofwat. For illustrative purposes only.

Combining the two dimensions gives three broad families in common use:

1. Cost-based approaches (rate of return, cost of service): low incentive power, with most cost variance passed through to customers.
2. Incentive-based approaches (price cap, revenue cap): high incentive power, with cost variance retained by the operator within the control period.
3. Performance-based approaches: intermediate incentive power, with cost variance shared between operator and customers on a defined basis, and additional reward or penalty attached to service outcomes.

A RAB is common to all three families rather than a feature of the first. It is a valuation construct rather than an alternative to incentive regulation, and it exists to solve a specific problem. Utility assets are long-lived, physically sunk and specific to their use, and prices must sit above marginal cost for the operator to recover them. A regulator or government can therefore always be tempted to reduce allowed returns once capital has been committed, and investors who anticipate that will not commit it in the first place. The RAB addresses this time-inconsistency problem by fixing, and undertaking to honour, the value of capital sunk into the business. Read this way, the defensiveness of core infrastructure returns is a product of regulatory commitment rather than of asset type, which also locates the residual risk: the RAB is protected by licence, convention and rights of appeal rather than by property right, and to the extent that the commitment holds, the risk has been transferred to customers and taxpayers rather than removed from the system.

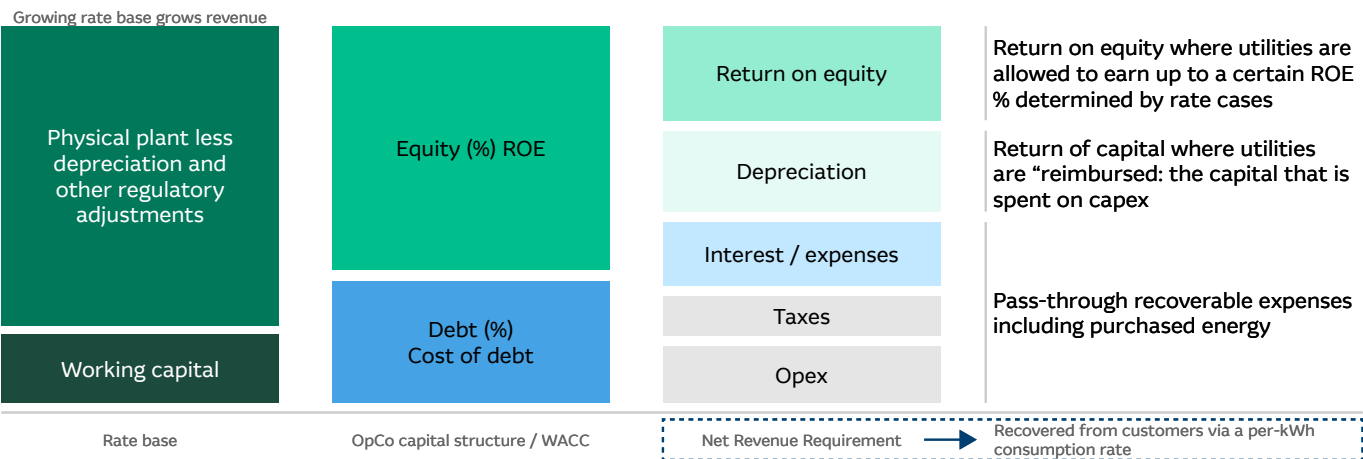
Cost-based approaches: A traditional model

Cost-of-service (COS), also known as rate-of-return regulation, is the traditional regulatory framework that was developed throughout the 20th century, during a period of substantial growth in electricity demand across the United States. Under this approach, the regulator sets an allowed return on the capital invested in the asset base, plus recovery of allowed operating costs, so the operator is allowed to earn a fair return. In the US, this is implemented through periodic rate cases: the utility petitions the state regulator for tariff adjustments, and the regulator approves an authorised return on equity (ROE) based on and of RAB, with debt costs and operating expenses passed through separately.⁴ Figure 17 illustrates a cost-of-service revenue model.

Utilities are generally protected from demand and revenue volatility because they periodically adjust tariffs through rate cases, though a regulatory lag between rising costs and tariff resets can temporarily affect earnings. However, protection from volume risk within the rate period can vary: US utilities generally retain exposure to demand unless a revenue decoupling mechanism is in place, and around half of US states have adopted decoupling for at least one electric or gas utility, with gas decoupling the more established of the two.⁵

The framework’s best-known weakness, identified by Averch and Johnson (1962), is that where the allowed return exceeds the operator’s true cost of capital, the operator has an incentive to overinvest, because additional capital enlarges the base on which the return is earned. Much of the subsequent history of utility regulation is an attempt to correct that capital bias without losing the commitment the asset base provides.

Figure 17.
An illustration of a regulated cost-of-service revenue model



Source: Macquarie Asset Management (July 2026). ROE = return on equity, WACC = weighted average cost of capital, Opex = operating expenses. For illustrative purposes only.

Incentive-based approaches: Evolution from the 1980s

Price cap regulation (CPI-X or RPI-X regulation) was developed as a practical regulatory tool in the early 1980s in Britain. Originally designed by Stephen Littlechild (1983) for the telecom sector, the model spread rapidly across other sectors amid the UK’s privatisation wave and market liberalisation efforts. Under this framework, the regulator fixes a formula for how prices can rise over a multi-year period, typically inflation minus an efficiency factor (X) set by the regulator. The firm can charge up to this ceiling but is not required to justify its actual costs during the control period. Littlechild advanced RPI-X in telecoms as a transitional framework until competition emerged, rather than as a permanent settlement (where competition did not arrive it has nonetheless endured for four decades).⁶

4. National Conference of State Legislatures, ‘Performance-Based Regulation: Harmonizing Electric Utility Priorities and State Policy’ (April 2023).
5. NRDC, ‘Gas and Electric Decoupling Across the United States’ (2020); American Council for an Energy-Efficient Economy, ‘A Decade of Decoupling for US Energy Utilities’. Coverage is measured as states adopting decoupling for at least one electric or gas utility.
6. S. C. Littlechild, ‘Regulation of British Telecommunications’ Profitability’, Department of Industry (1983). The characterisation of RPI-X as a transitional arrangement until competition arrived is Littlechild’s own; see also M. Cave, ‘Incentive regulation: expectations, surprises and the road ahead’ (2024).

Over time, this framework has evolved from its original form. A price fixed for five years gives the operator an incentive to defer capital expenditure and allow service quality to decline, so output and quality incentives had to be added. Information asymmetry meant regulators could not set X without reference to the operator's own cost forecasts, which reintroduced a form of cost pass-through and created a ratchet, since savings revealed in one period were absorbed into the next period's baseline. And the separate treatment of capital and operating expenditure created a bias toward whichever was the more generously remunerated. Through the 2000s and 2010s, most energy, water and airport regulation migrated toward hybrid models that explicitly separate capital costs. Ofgem's RPI-X@20 review set out this diagnosis and led directly to the Revenue, Incentives, Innovation and Outputs (RIIO) framework described below.⁷

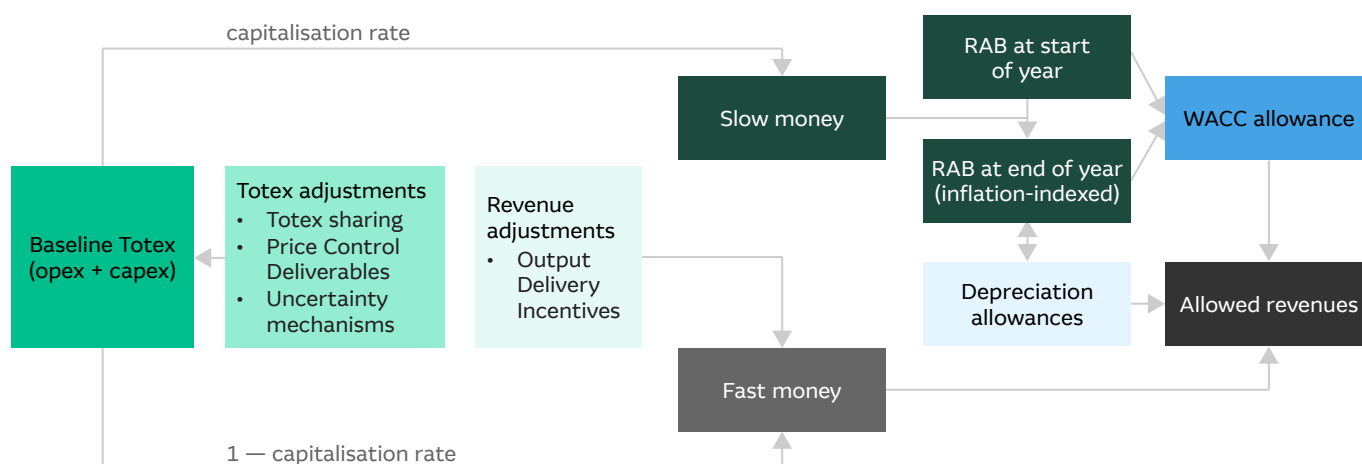
Performance-based approaches: Convergence on hybrid frameworks

Performance-based regulation (PBR) is a set of overlapping approaches to improve performance. Under PBR frameworks, utilities can earn rewards or incur penalties depending on their performance against predefined metrics such as network reliability, service quality, customer satisfaction, safety standards, environmental outcomes and network efficiency. This approach seeks to better align the interests of customers, regulators, and investors by rewarding companies that deliver superior outcomes (or conversely penalising those that do not) rather than simply recovering costs.

One of the most advanced examples of PBR is the UK's RIIO framework, administered by Ofgem (RIIO-3 runs from April 2026 to March 2031 for electricity transmission, gas transmission and gas distribution; electricity distribution sits on a separate cycle, with RIIO-ED2 running to March 2028). The regulation combines elements of RAB regulation, revenue caps and performance incentives into a single framework. Below are the key mechanisms of the framework:

- The allowed cost of equity is set by the regulator at each price control reset based on market cost-of-capital evidence, with partial indexing on an annual basis for changes in the risk-free rate. The allowed cost of debt is indexed annually to a trailing average of market yields, which leaves most of the interest rate risk on the debt component with customers rather than equity.
- If a network company spends less than its totex (opex plus capex) allowance, it keeps a share of the difference as extra profit (until the next reset); if it overspends, it absorbs part of the loss. The share retained or absorbed is set by the totex incentive mechanism, calibrated company by company through a menu designed to reward accurate cost forecasting.⁸
- Beyond totex, companies earn bonuses or penalties tied to specific outputs: reliability (fewer outages), safety, environmental performance and customer satisfaction.
- RAB and revenue are indexed to inflation which helps to protect real returns.

Figure 18.
UK's RIIO framework



Source: Council of European Energy Regulators (CEER) 'Regulatory Frameworks for European Energy Networks 2025' (January 2026). Notes: RAB = Regulated Asset Base: an agreed value of the asset base upon which the owner is entitled to earn a return; WACC = Weighted Average Cost of Capital: an agreed return based upon notional capital structure assumed by the regulator. For illustrative purposes only.

7. Ofgem, 'Regulating energy networks for the future: RPI-X@20 Decision document' (October 2010) and 'RIIO: a new way to regulate energy networks' (2010).

8. Ofgem, 'RIIO-3 Final Determinations' (December 2025). Tox incentive mechanism sharing factors are 39% for gas transmission and 50% for gas distribution; electricity transmission operates on banded sharing factors.

Inflation linkage under different regulatory regimes

Three qualifications matter for how much inflation protection a regulated asset can provide. First, RAB indexation to inflation belongs to real frameworks, principally the UK, Australia and Italy, and is the exception rather than the rule: US rate base regulation and most continental European regimes set a nominal allowed return on a historic-cost asset base, so inflation is compensated only at the next reset. A globally diversified core portfolio therefore has materially heterogeneous inflation linkage. Second, in a real framework the compensation arrives as an uplift to the asset base rather than as current cash, so it is accretive to value but deferred in cash terms. Third, the linkage is to a specified index rather than to the operator's own input costs. Where frameworks address this, they do so through a separate mechanism rather than through headline indexation: Ofgem adjusts allowances annually for real price effects, indexing specified non-controllable cost categories, being labour and materials for all networks and additionally plant and equipment for certain electricity transmission owners, to the extent those input prices diverge from general inflation. Not every regime does this, and thus not every regime is equal in terms of the inflation protection it provides.⁹

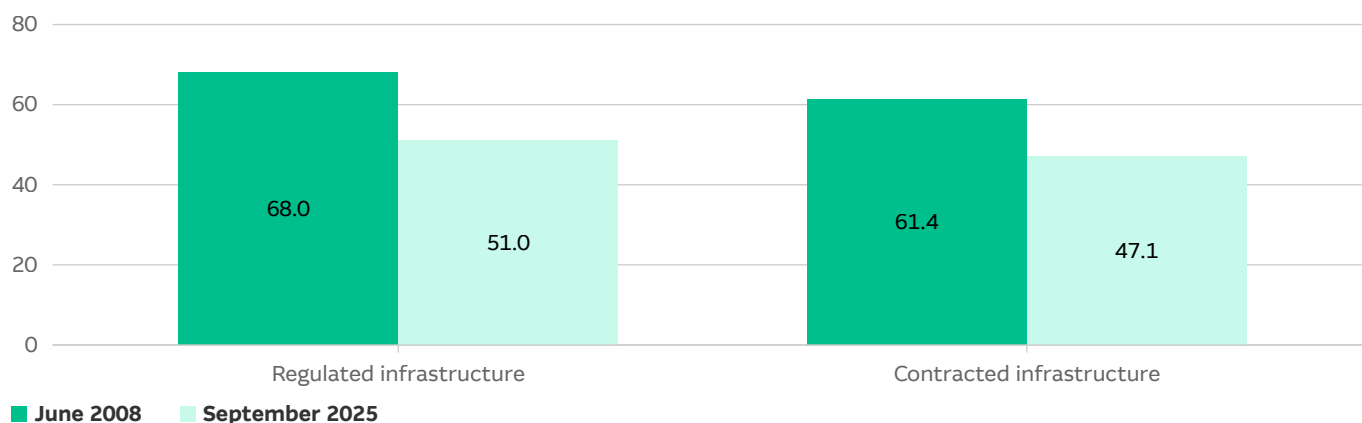
Leverage in regulated infrastructure: Higher but sustainable

Regulated infrastructure assets have historically carried higher leverage than other infrastructure segments, albeit this spread has reduced more recently. As of September 2025, regulated infrastructure had an average level of leverage at 51.0% compared to 47.1% for contracted infrastructure. We note that leverage levels across both regulated and contracted infrastructure have fallen significantly since the GFC. Regulated infrastructure assets have seen a particularly large reduction, with the average level falling from 68.0% to 51.0% in the June 2008 to September 2025 period.

Figure 19.

Average level of leverage for regulated and contracted infrastructure has fallen substantially since 2008

Debt (% of Enterprise Value)



Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index (as of July 2026). Regulated infrastructure: MSCI Global Private Infrastructure Index – Regulated (USD), Contracted infrastructure: MSCI Global Private Infrastructure Index – Contracted (USD). Past performance is not indicative of future returns.

9. Ofgem, 'RIIO-3 Final Determinations' (December 2025); Oxera, 'RIIO-3 Final Determinations' (January 2026). Real price effects indexation adjusts allowances for divergence between CPIH and cost-category input price indices.

Higher nominal leverage is typically associated with higher financial risk. Yet despite carrying leverage of 40-60% – levels that would be considered high in most unregulated, cyclical industries – most regulated infrastructure assets continue to carry investment-grade credit ratings. This reflects the fact that rating agencies and lenders have confidence in the regulatory frameworks in which these assets operate, given the following structural features:

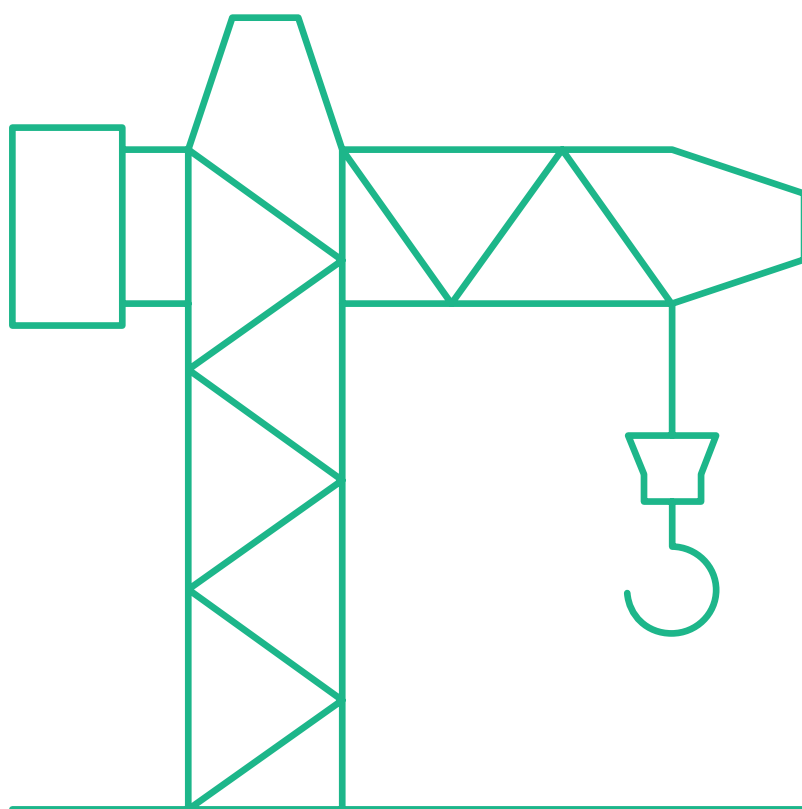
- **Predictable cash flows:** Stable, largely inflation-linked revenues support high, resilient debt service coverage ratios.
- **Flexibility to manage debt duration:** The long-lived nature of regulated assets gives utilities flexibility to manage debt duration and take advantage of market conditions by issuing shorter- or longer-dated debt.
- **Notional capital structure:** Allowed returns are set against a notional capital structure, giving lenders a transparent and externally set reference point for sustainable gearing.
- **Strong foundation of lender protection in the licence:** Lender protection derives less from enforceable security over the regulated assets, which licence conditions restrict and which the special administration regime displaces on insolvency, than from the licence itself. The licence contains a duty on the regulator to secure that the operator can finance its functions, and the transfer of the licence as a going concern. In covenanted and securitised financing structures, further protection comes from cash lock-ups, standstill arrangements and security over shares and receivables.¹⁰

As a result, a given level of leverage in a regulated business generally carries less financial risk than the same level in a cyclical industry, because the cash flow securing it is more predictable.

Regulated utilities are often restricted by the regulator at how much debt they can carry at the operating company level. This is typically set by reference to a minimum credit rating.

10. On the interaction between licence conditions, the special administration regime and covenanted or securitised financing structures see, for example, Latham & Watkins, 'UK Water — A Perfect Storm'.

Resilient portfolio construction



In this section, we examine how core infrastructure interacts with core plus infrastructure within a portfolio and how it can fit within a broader portfolio context, based on historical data and theoretical portfolio optimisation exercises.

Core vs core plus infrastructure: Complementary, not competing

Core and core plus infrastructure are often presented as substitutes, but they are more accurately understood as complementary strategies with distinct risk-return profiles. The key differences are summarised below:

- **Return profile:** Core plus has delivered higher return than core over the long run (11.2% vs 9.9%). However, this comes with higher volatility (8.6% vs 7.8%) and a reduced income yield (3.7% vs 4.8%).
- **Income vs capital:** While both core and core plus infrastructure rely on capital appreciation, core infrastructure's higher yield tends to provide more stability to returns over the long term.
- **Capital appreciation:** Core and core plus infrastructure have distinct capital growth drivers. Core plus assets tend to rely more on demand growth, multiple expansion and build-out of platforms, while core assets focus on reinvesting into and growing its asset base.
- **Inflation linkage:** Both benefit from an inflation linkage, but regulated infrastructure within the core segment tends to provide more robust CPI pass-through.
- **Defensiveness:** Both strategies exhibit defensive characteristics relative to equities, but core infrastructure tends to provide stronger protection in economic downturns.

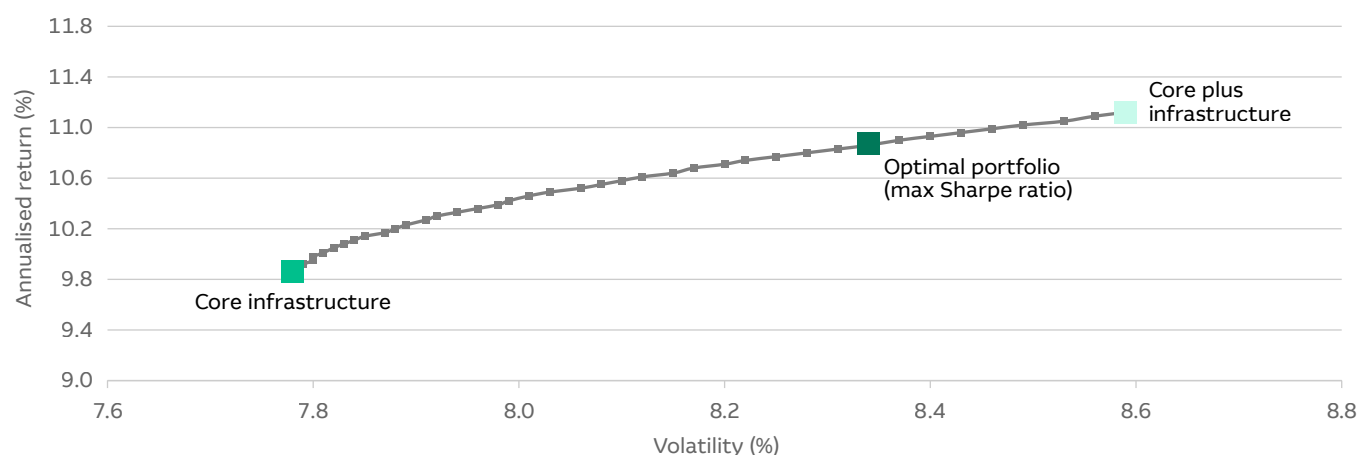
Portfolio blending: The diversification benefits

Combining core and core plus infrastructure may create a portfolio that benefits from the diversification of return sources while maintaining the defensive characteristics that distinguish infrastructure from other private asset classes.

The chart below illustrates the efficient frontier for blended core and core plus allocations based on historical data from March 2008 to December 2025. A simple mean-variance portfolio optimisation suggests that the portfolio with the highest Sharpe ratio comprises a 19.5% allocation to core infrastructure and 80.5% to core plus infrastructure.

Figure 20.

Illustrative risk-return profile of blended core and core plus infrastructure allocations

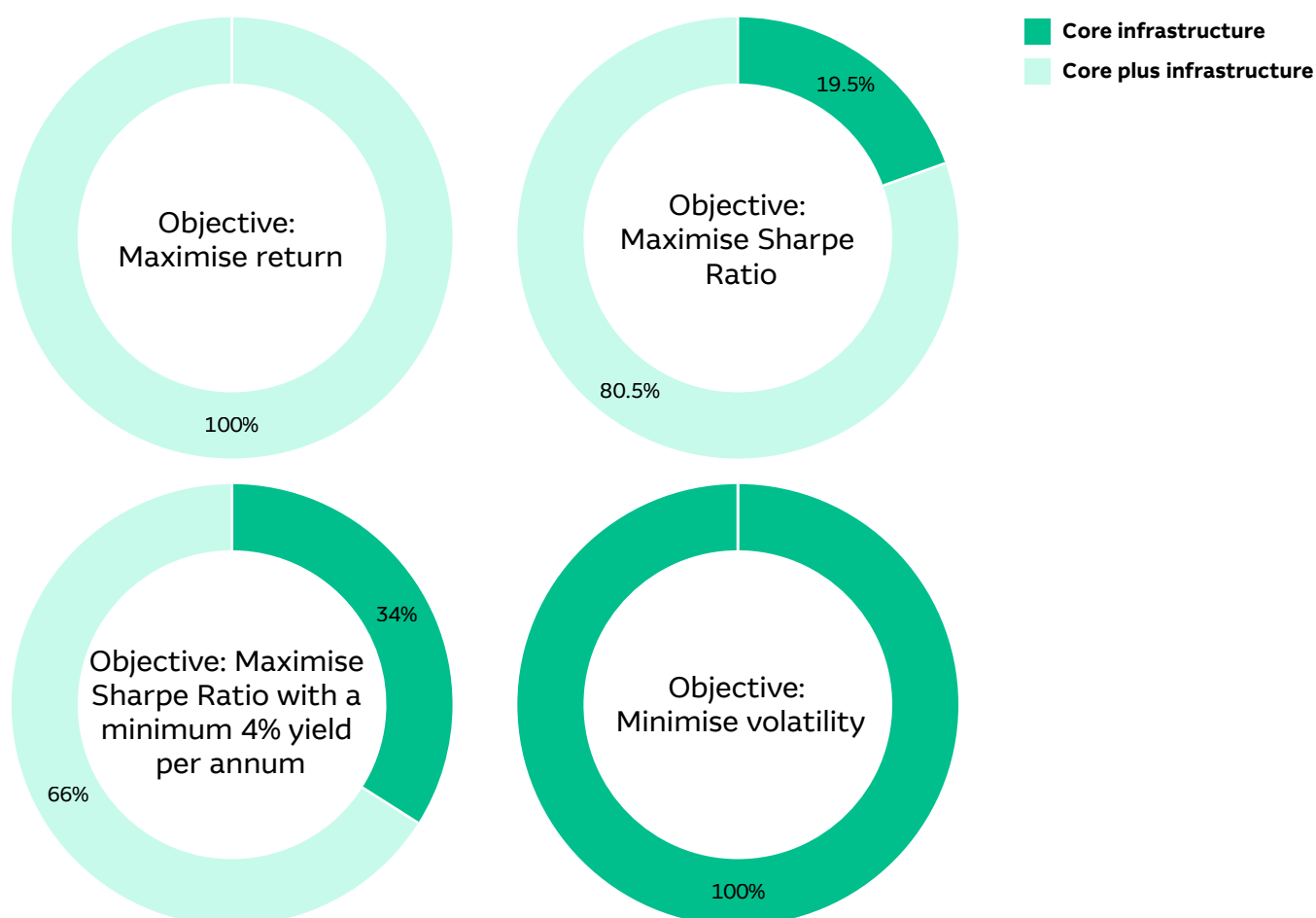


Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index (as of July 2026). Core infrastructure: MSCI Global Private Infrastructure Index - Low Risk (USD); Core plus infrastructure: MSCI Global Private Infrastructure Index - Moderate Risk (USD). Analysis conducted between 31 March 2008 and 31 December 2025 using quarterly returns. Risk-free rate = 2%. Past performance is not indicative of future returns. Does not constitute investment advice or recommendation. For illustrative purposes only, based on historical data and does not represent actual portfolios, not indicative of future results.

However, maximising a risk-adjusted return is not the only objective that shapes a blended allocation. Many long-term investors, particularly those with liability-driven or income-focused mandates, often need the portfolio to generate a minimum level of yield. To reflect this, we re-run the optimisation with an added constraint requiring a yield of at least 4% per annum. Under this constraint, the optimal allocation to core infrastructure rises from 19.5% to 34.0%, as core assets typically have higher and more stable income distributions. The more binding the yield requirement, the larger the core allocation becomes (Figure 21). Minimum volatility portfolios may see the highest share allocated to core infrastructure compared to core plus infrastructure (more on this below).

Figure 21.

Core and core plus mix within an infrastructure portfolio may vary depending on investment objectives



Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index (as of July 2026). Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD); Core plus infrastructure: MSCI Global Private Infrastructure Index – Moderate Risk (USD). Analysis conducted between 31 March 2008 and 31 December 2025 using quarterly returns. Risk-free rate = 2%. Past performance is not indicative of future returns.

The role of core infrastructure within a broader portfolio

There are several reasons why investors may include core infrastructure in their portfolio:

1. Long-term investors targeting yield stability: This could be true for pension funds and insurers who are looking for low-volatility assets with stable yield.
2. Liquidity requirements: Core infrastructure assets are often held through open-ended vehicles, while other infrastructure strategies are more commonly held via closed-ended structures.
3. Existing exposure to high-risk asset classes: Some investors may already have higher-risk, higher-return exposure elsewhere in the portfolio (e.g., through private equity), making a 100% core allocation within the dedicated infrastructure bucket a deliberate choice to add defensiveness to the portfolio.
4. Simplified governance: A full allocation to core can also simplify governance and risk budgeting: it allows infrastructure risk to be measured and reported consistently against a single return target.

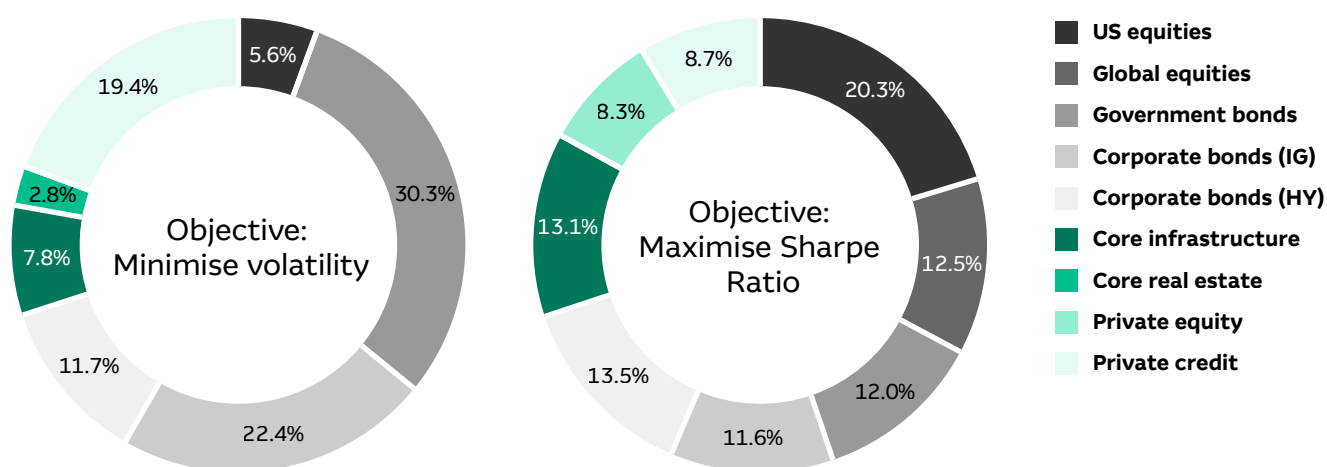
To illustrate the role infrastructure can play in a broader portfolio, we consider two theoretical portfolio optimisation exercises for a portfolio with existing allocations to other asset classes, both public markets (equities and bonds) and private markets (private equity, private credit and core real estate). These two portfolios have distinct objectives:

- Portfolio 1: Minimise volatility
- Portfolio 2: Maximise Sharpe ratio

Figure 22 illustrates the results of these optimisations under commonly used constraints.¹¹ Portfolio 1 finds that the optimal allocation to core infrastructure could be 7.8%, the second largest allocation within private markets after private credit, courtesy of its low volatility (on an unsmoothed-return basis). Portfolio 2 shows that a mean-variance optimisation suggests that an optimal allocation to core infrastructure is around 13.1% due to its high Sharpe ratio. As highlighted earlier, core infrastructure can play various roles within portfolios, depending on investment objectives.

Figure 22.

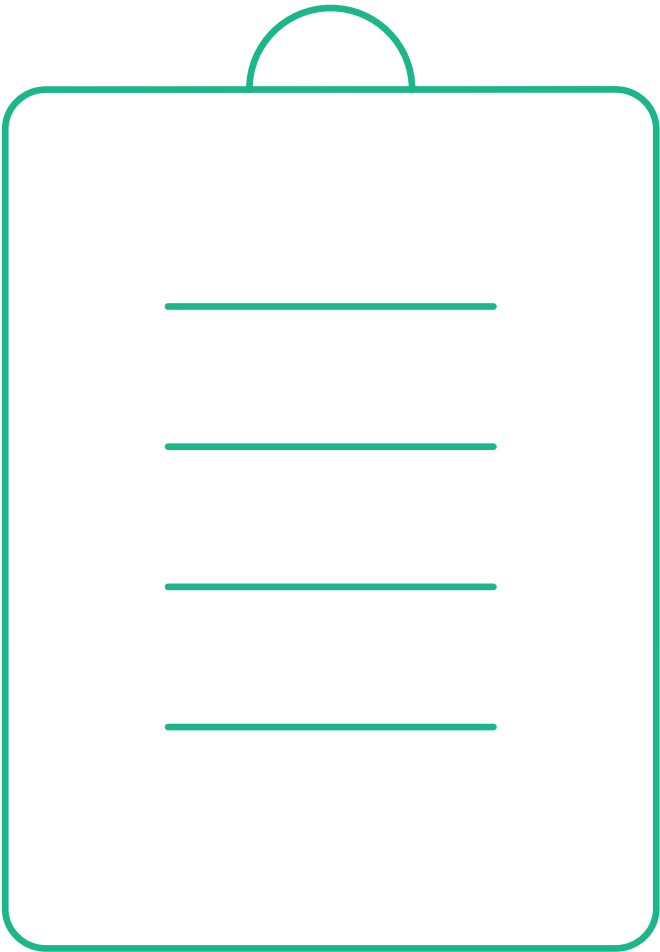
Examples of how core infrastructure may fit in an institutional portfolio under distinct investment objectives



Sources: MSCI, Cliffwater, INREV, Bloomberg (July 2026). US equities: S&P 500 Index; Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD); Global equities: MSCI World Index; Global corporate bonds (HY): Bloomberg Global High Yield Corporate Total Return Index Value Unhedged (USD); Global corporate bonds (IG): Bloomberg Global Agg Corporate Total Return Index Value Unhedged (USD); Private credit: Cliffwater Direct Lending Index (unsmoothed), adjusted to account for management and incentive fees; Private equity: Cambridge Associates US Private Equity Index (unsmoothed), returns are net of fees, expenses and carried interest; Core real estate: INREV Global Real Estate Fund Index (GREFI). Analysis conducted from 31 March 2008 to 31 December 2025. Subject to full investment, no short-selling, liquidity (max 30% in private markets) and diversification constraints. All private market indices were unsmoothed using Geltner method. Does not constitute investment advice or recommendation. This analysis is based on historical performance and is therefore not suitable for forward-looking interpretation. Past performance is not indicative of future returns. For illustrative purposes only

11. Constraints: Full investment, no short selling, max allocation to private markets = 30%, Herfindahl-Hirschman Index (HHI) diversification constraint.

Appendix



Appendix 1. MSCI Global Quarterly Private Infrastructure Asset Index classification by asset style

MSCI classification	MSCI Private Infrastructure Asset Index - Low Risk	MSCI Private Infrastructure Asset Index - Moderate Risk	MSCI Private Infrastructure Asset Index - High Risk
Return Driver	- Income & Capital mix - Income yield constitutes a significant component of total return	Generally, income and capital both contribute to total return	Capital return component primary driver of total return over the short to medium term
Nature of Income (Demand Profile)	- Predictable & regulated revenues/ costs - Long term contract (>10 years) - Long term concession - Assets for which sovereign counterparties (AAA or similar) pay revenues unrelated to volume/usage	- Relatively predictable/stable revenues and costs - Medium term contract (5-10 years) - Income streams with steady growth profile - Strong operational focus	- Assets with market-based revenue streams in the development stage or within emerging markets - Income stream with a higher degree of volatility
Investment Horizon	Long-term Investment Horizon	Medium to Long-term investment horizon	- Generally short to medium-term investment horizon - Characterized by J-curve investment phase
Market Exposure	Geographically mature markets	- Geographically mature markets - Geographically maturing markets	- Geographically mature markets - Geographically maturing markets - Geographically emerging markets - Infrastructure asset located in non-OECD countries
Asset Stage	Brownfield assets	- Brownfield or rehabilitated brownfield assets and certain state government privatisations - Greenfield social infrastructure assets with contractual protection during construction phase	- High risk brownfield assets - Greenfield assets (developing)

Source: MSCI Global Quarterly Private Infrastructure Asset Index methodology (February 2026).

Appendix 2. Index performance summary

Annualised performance	3Y	5Y	10Y	15Y	Since 2008
US equities	23.0%	14.4%	14.8%	14.1%	11.8%
Global equities	21.7%	12.7%	12.7%	11.2%	9.2%
Overall infrastructure	11.5%	11.8%	12.0%	11.2%	10.4%
Core plus infrastructure	11.3%	11.6%	12.5%	11.7%	11.2%
Core infrastructure	11.2%	11.8%	11.5%	11.1%	9.9%
Global bonds	4.0%	-2.1%	1.3%	1.1%	1.6%
US 10-year treasuries	3.2%	-2.4%	0.8%	2.1%	2.4%
Core real estate	-0.4%	2.3%	4.8%	5.4%	2.9%

Source: Macquarie Asset Management calculations based on MSCI Global Private Infrastructure Asset Index, Bloomberg (as of June 2026). Core infrastructure: MSCI Global Private Infrastructure Index – Low Risk (USD), Core plus infrastructure: MSCI Global Private Infrastructure Index – Moderate Risk (USD), Overall infrastructure: MSCI Global Private Infrastructure Index – All (USD), US equities: S&P 500 Index Total Return Index (USD); Global equities: MSCI World Index (USD); Global bonds: Bloomberg Global-Aggregate Total Return Index (USD); Core real estate: INREV Global Real Estate Fund Index USD (GREFI). Analysis conducted between 31 March 2008 and 31 December 2025 using quarterly returns data. Past performance is not indicative of future returns.

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Market risk is the risk that all or a majority of the securities in a certain market – like the stock market or bond market – will decline in value because of factors such as adverse political or economic conditions, future expectations, investor confidence, or heavy institutional selling.

International investments entail risks including fluctuation in currency values, differences in accounting principles, or economic or political instability. Investing in emerging markets can be riskier than investing in established foreign markets due to increased volatility, lower trading volume, and higher risk of market closures. In many emerging markets, there is substantially less publicly available information and the available information may be incomplete or misleading. Legal claims are generally more difficult to pursue.

Currency risk is the risk that fluctuations in exchange rates between the US dollar and foreign currencies and between various foreign currencies may cause the value of an investment to decline. The market for some (or all) currencies may from time to time have low trading volume and become illiquid, which may prevent an investment from effecting positions or from promptly liquidating unfavourable positions in such markets, thus subjecting the investment to substantial losses.

Infrastructure companies may be subject to a variety of factors that may adversely affect their business or operations, including high interest costs, high leverage, economic slowdowns, surplus capacity, increased competition, commodity prices, regulatory and political developments, difficulty raising capital, and terrorist acts or political actions, and general changes in market sentiment.

The global financial crisis (GFC) refers to the period of extreme stress in global financial markets and banking systems between mid-2007 and early 2009.

Inflation is the rate at which the general level of prices for goods and services is rising, and, subsequently, purchasing power is falling. Central banks attempt to stop severe inflation, along with severe deflation, in an attempt to keep the excessive growth of prices to a minimum.

The Sharpe ratio is a measure of risk-adjusted return, calculated as an investment's excess return above the risk-free rate divided by the standard deviation of that excess return (volatility). A higher Sharpe ratio indicates a more favourable return earned per unit of risk taken.

The unsmoothing (Geltner method) refers to a widely used industry technique that adjusts reported private market returns to correct for valuation 'smoothing', a feature of appraisal-based indices that can understate period-to-period volatility relative to indices based on daily market pricing.

The **Bloomberg Global Aggregate Total Return Index** measures the performance of global investment grade fixed income securities. This index is widely used as a benchmark for fixed income securities.

The **Bloomberg Global Aggregate Corporate Total Return Index** is a flagship measure of global investment grade, fixed-rate corporate debt. This multi-currency benchmark includes bonds from developed and emerging markets issuers within the industrial, utility and financial sectors.

The **Bloomberg Global High Yield Corporate Total Return Index** is a multi-currency benchmark measuring the performance of the global high yield (sub-investment grade), fixed-rate corporate debt market, combining the US High Yield, Pan-European High Yield and Emerging Markets Hard Currency High Yield indices.

The **Cambridge Associates US Private Equity Index** is a horizon calculation of pooled returns, net of fees, expenses and carried interest, based on data compiled from US buyout, growth equity and other private equity funds, including fully liquidated partnerships.

The **Cliffwater Direct Lending Index (CDLI)** measures the unlevered, gross-of-fees performance of US middle market corporate loans, as represented by the underlying loan assets of business development companies (BDCs), including both exchange-traded and unlisted vehicles.

The **Herfindahl-Hirschman Index (HHI)** is a measure of concentration, calculated as the sum of the squared weights of each holding or asset class in a portfolio. In a portfolio construction context, a lower HHI indicates greater diversification across holdings, while a higher HHI indicates concentration in fewer positions.

The **US Consumer Price Index (CPI)** is a measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services.

The **INREV Global Real Estate Fund Index (GREFI)** measures net asset value weighted performance of non-listed real estate funds on a quarterly basis.

The **MSCI Global Private Infrastructure Asset Index** is an asset-level benchmark that measures the unlisted, private market performance of global infrastructure investments across sectors including power generation, transmission and distribution, renewables, transport and social infrastructure. The index is published across a number of risk-based sub-indices (including Low Risk, Moderate Risk, High Risk, Regulated, Contracted

and Merchant/Value-Add) as well as an aggregate 'All' index.

The **MSCI World Index** represents large- and mid-cap stocks across 23 developed market countries worldwide. The index covers approximately 85% of the free float-adjusted market capitalization in each country.

The **S&P 500 Index** measures the performance of 500 mostly large-cap stocks weighted by market value and is often used to represent performance of the US stock market.

The **Preqin Real Estate Index** is a horizon-based benchmark that tracks the aggregate, capital-weighted performance of closed-end private real estate funds globally, net of fees, and is used in this report as a broad measure of overall (as distinct from core) private real estate performance.

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