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MACQUARIE ASSET MANAGEMENT

Pathways

Private infrastructure valuations: Relative value, macroeconomic drivers and implications for investors

June 2023

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Natural or environmental disasters, such as earthquakes, fires, floods, hurricanes, tsunamis, and other severe weather-related phenomena generally, and widespread disease, including pandemics and epidemics, have been and can be highly disruptive to economies and markets, adversely impacting individual companies, sectors, industries, markets, currencies, interest and inflation rates, credit ratings, investor sentiment, and other factors affecting the value of the Portfolio's investments. Given the increasing interdependence among global economies and markets, conditions in one country, market, or region are increasingly likely to adversely affect markets, issuers, and/or foreign exchange rates in other countries. These disruptions could prevent the Portfolio from executing advantageous investment decisions in a timely manner and could negatively impact the Portfolio's ability to achieve its investment objective. Any such event(s) could have a significant adverse impact on the value and risk profile of the Portfolio.

Investment strategies that hold securities issued by companies principally engaged in the infrastructure industry have greater exposure to the potential adverse economic, regulatory, political, and other changes affecting such entities.

Infrastructure companies are subject risks including increased costs associated with capital construction programs and environmental regulations, surplus capacity, increased competition, availability of fuel at reasonable prices, energy conservation policies, difficulty in raising capital, and increased susceptibility to terrorist acts or political actions.

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 **Dow Jones Brookfield Global Infrastructure Index** is designed to measure the performance of pure-play infrastructure companies domiciled globally. The index covers all sectors of the infrastructure market. To be included in the index, a company must derive at least 70% of cash flows from infrastructure lines of business.

The **S&P Global Infrastructure Index** is composed of 75 of the largest publicly listed companies in the global infrastructure industry. The index has balanced weights across three distinct infrastructure clusters: energy, transportation, and utilities. The "net total return" index reinvests regular cash dividends after the deduction of applicable withholding taxes.

The **US Consumer Price Index (CPI)** is a measure of inflation that is calculated by the US Department of Labor, representing changes in prices of all goods and services purchased for consumption by urban households.

Index performance returns do not reflect any management fees, transaction costs or expenses. Indices are unmanaged and one cannot invest directly in an index.

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Executive summary

Using a large dataset of more than 1,000 transactions, we have derived a time series of private infrastructure valuations. This allows us to make direct comparisons with valuations in listed equity markets.

By adjusting the series for maintenance capital expenditure (capex), we have also created an "infrastructure cap rate", enabling investors (for the first time as far as we know) to directly compare infrastructure valuations to those of real estate.

Unlisted infrastructure multiples did expand in the period of low interest rates following the global financial crisis (GFC). But infrastructure did not benefit materially more than other equity. Like for the S&P 500® index, the MSCI World index and other equity in general, the increase in the multiple was accretive to returns over this period, but it was earnings growth that accounted for the bulk of performance.

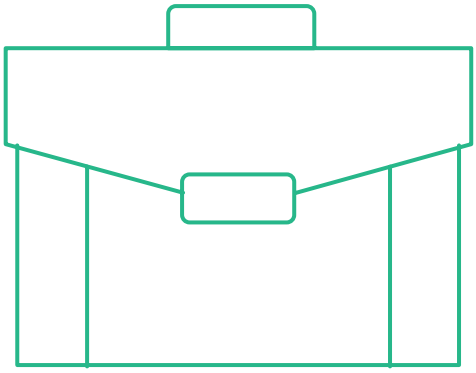
Infrastructure valuation multiples have a negative relationship with interest rates and a positive relationship with inflation. Since higher inflation is often followed by an increase in interest rates, there is often an offsetting impact from these two forces on infrastructure valuation multiples.

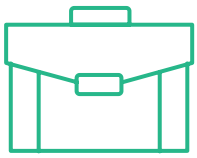
Many infrastructure investors are concerned that perceived high levels of dry powder have placed upward pressure on valuations in recent years. However, our analysis has not found statistically significant evidence that dry powder had an impact on valuations. Interestingly, it also has not been particularly high, growing only in line with expanding market opportunities.

Based on our findings in this paper, if the world returns to a "low inflation, low interest rates" environment, this could imply attractive entry opportunities for acquiring infrastructure assets in 2H23 and a quick bounce back in valuations in 2024. If inflation subsides but interest rates remain at a structurally higher level compared to the previous decade, there would be stronger downward pressure on valuations over the coming years.

To safeguard returns and valuations against the downward pressure from higher interest rates, greater focus on earnings growth will be required in the years ahead. Driving revenue growth, optimising costs, a prudent approach to leverage, careful management of regulatory risks and stakeholders, and the skills and expertise to unlock opportunities created by the energy transition will all be crucial to return delivery.

Introduction: Adding to investors' data tool kit





The data tool kit available to infrastructure investors is more limited than it is for other asset classes, such as listed equities, debt and real estate. While there are several total return indices for infrastructure, there is no (or very limited) time series data available on valuations.[1] In this paper, we aim to fill this gap. Using our database of more than 1,000 private market transactions, we have created a time series that tracks unlisted infrastructure valuations from the start of 2008 to the end of 2022. We use this series to perform cross asset class valuation comparisons and analyse the drivers of infrastructure valuations through time to give investors a potentially greater understanding of the dynamics that drive multiples.

Unlisted infrastructure valuations time series

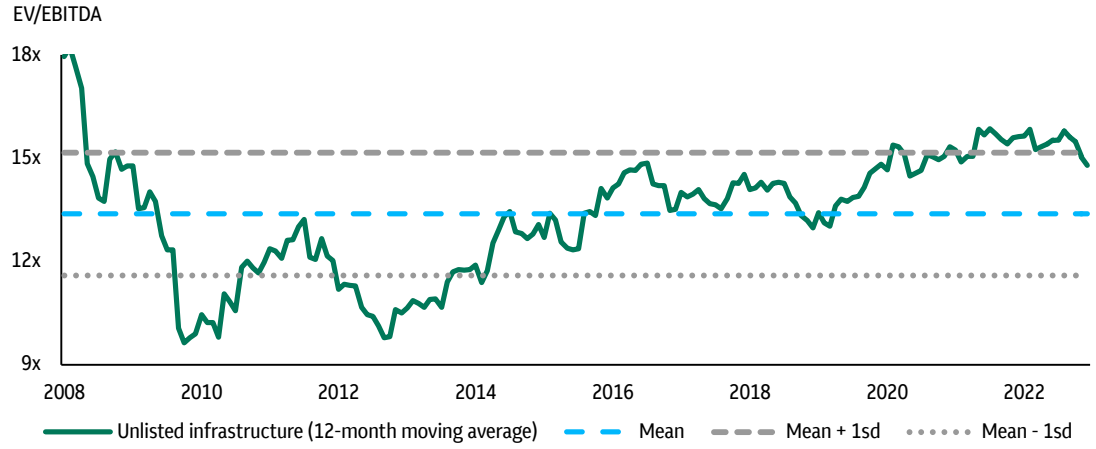
Our analysis focuses on EV/EBITDA, a ratio of enterprise value (EV) to a proxy of operating cash flow, earnings before interest, tax, depreciation and amortisation (EBITDA). In private markets, using EV/EBITDA is more common because EBITDA gives a cleaner picture of underlying business profitability and EV covers both the equity and debt components of the capital structure. When comparing businesses that have different capital structures, looking at EV/EBITDA can be more appropriate.

Using multiples to assess the value of an individual asset is often an oversimplification. But over a large sample size, such as when considering the asset class as a whole, multiples can provide valuable insights into relative valuations across markets and sectors as well as through time.

On the private infrastructure side, there is currently very limited knowledge of both current asset class-level valuations as well as their historical evolution. To address this, we have constructed a time series that aims to track global unlisted infrastructure EV/EBITDA multiples. Figure 1 shows the series constructed as a 12-month moving average of the actual prices paid for infrastructure assets rather than appraised valuations. In other words, this approach is not subject to the valuations "smoothing" that is common for privately held assets and aims to reflect the market volatility of asset prices.

1. At the time of writing, we have not identified a third-party time series that tracks infrastructure valuation multiples through history.

Figure 1.
Unlisted infrastructure's historical EV/EBITDA transaction multiples



Source: Macquarie Asset Management (March 2023). Analysis is based on 1,054 data transaction multiples for deals that reached financial close between January 2008 and December 2022. Notes: sd=standard deviation. Past performance is not indicative of future results. For illustrative purpose only.

Methodology

To ensure the time series is as accurate and representative as possible, we have used the following principles to build it:

- **Quality sources.** We have used our trusted internal database of EV/EBITDA multiples and reliable external data sources, such as Inframation and Bloomberg.
- **Large sample size.** Our database contains 1,054 data points for private infrastructure transactions that reached financial close between 2008 and 2022 (inclusive).
- **Long history.** Our time series covers a period of 15 years, including two recession periods (the GFC and COVID-19) and two recoveries.
- **Strict definition.** The dataset primarily includes brownfield assets that are underpinned by regulated or contracted cash flows, with limited exposure to assets with significant merchant risk.[2]
- **Diversification by sector.** The dataset is well diversified by sector, including transport, utilities[3], digital infrastructure, renewables[4], energy midstream[5] and diversified infrastructure [6] (Figure 2).
- **Diversification by country.** The dataset is also well diversified by country, with the largest exposures being to the US, UK, Spain, Italy, France and Australia (Figure 3).
- **Transparent approach.** No adjustments have been applied to the reported multiples, except the calculations of monthly (or quarterly where applicable) moving averages.

2. The dataset has limited exposure to platform infrastructure businesses.
3. Utilities here include regulated utilities, contracted power generation (excluding renewables), district heating and other segments.
4. This dataset has limited data on renewables.
5. The dataset excludes energy upstream and downstream.
6. Diversified infrastructure mainly includes waste management, healthcare, car parks and education.

Figure 2.
Dataset split by sector

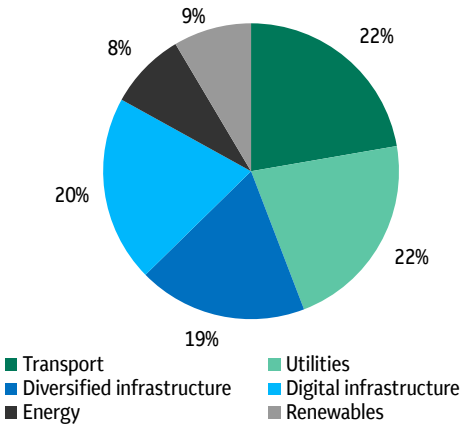
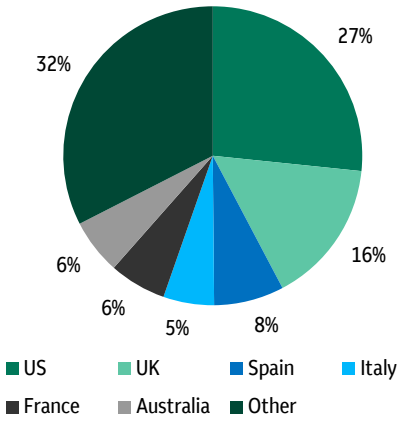


Figure 3.
Dataset split by country



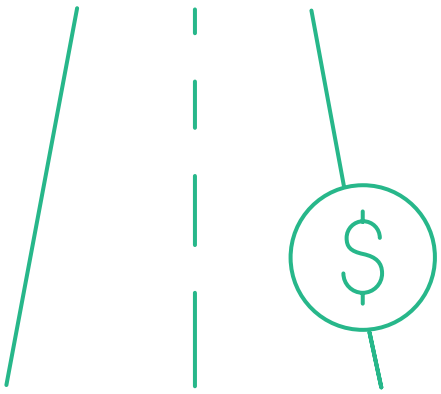
Source: Macquarie Asset Management (March 2023). Analysis is based on 1,054 data transaction multiples for deals that reached financial close between January 2008 and December 2022. Past performance is not indicative of future results. For illustrative purpose only.

Structure of the paper

The rest of this paper is structured as follows:

- In the second section, we compare unlisted infrastructure valuations to listed equity markets, examine how both have moved over time, and assess how large a contribution changes in multiples have made to returns for the two asset classes.
- In the third section, we introduce a new valuation tool – an "infrastructure cap rate" – to enable a like-for-like comparison with real estate, the other main real assets asset class.
- The fourth section uses regression analysis to assess the macroeconomic drivers (including dry powder) of changes in valuations over time.
- Finally, we take the results of our analysis to project where infrastructure multiples may go from here under different macroeconomic scenarios.

Unlisted infrastructure: Valuations relative to listed asset classes

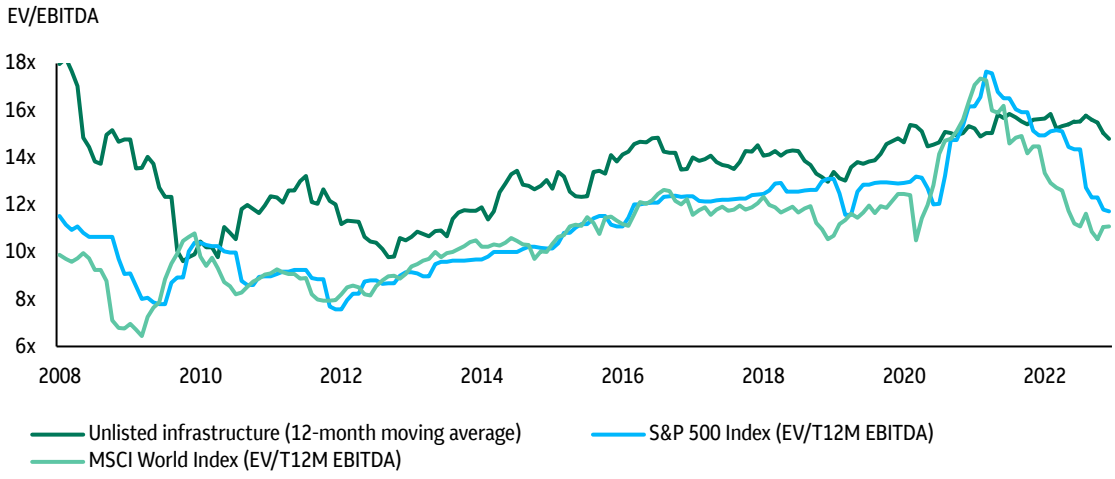


In this section, we compare unlisted infrastructure valuations to those of listed equities and listed infrastructure. We address the following questions: Does unlisted infrastructure trade above or below listed markets? What does any spread represent? Why did private infrastructure values not experience a sharp decline in 2022, as was observed in global listed equities?

Unlisted infrastructure and listed equities

Figure 4 compares unlisted infrastructure valuations with two listed equities indices – the MSCI World Index and S&P 500 Index. From 2008 to 2022 unlisted infrastructure has consistently traded above listed equities, with the spread averaging about 2.5x EV/EBITDA. The spread has been largely stable over time, with the main exceptions being periods in and around crises. It did turn negative from November 2020 to June 2021, but this was mainly due to the volatility caused by COVID-19. The EV/EBITDA multiple for listed equities rose sharply from April 2020 as markets rallied (following the COVID-19 induced collapse in March) at the same time as earnings estimates were revised down. It then fell sharply during 2021 as earnings were revised up aggressively, taking the multiple, and spread against private markets infrastructure, back to normal levels.

Figure 4.
Unlisted infrastructure valuations compared to global listed equities



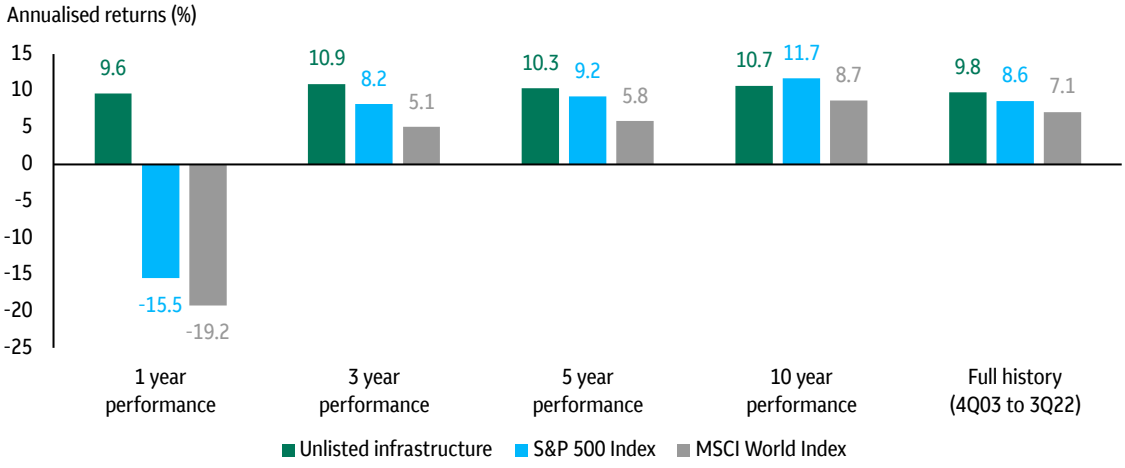
Sources: Bloomberg, Macquarie Asset Management (March 2023). Private infrastructure series is based on 1,054 data transaction multiples for deals that reached financial close between January 2008 and December 2022. Past performance is not indicative of future results. For illustrative purpose only.

Valuation multiples and total returns

The higher multiple paid for private infrastructure assets could be a function of their attractive characteristics. These include a stable and predictable return profile due to the regulated or long-term contracted nature of their cash flows, inflation-hedge properties, high barriers to entry and diversified customer base. In addition, infrastructure assets tend to have higher EBITDA margins than general equity, where the average margin for private infrastructure assets is around 50%[7], while for general listed equities the average is 16%.[8] Sustained high margins are often associated with an economic moat that limits competitive pressure, something that can support consistent earnings delivery over time.

The relationship between multiples and expected returns can be complicated but the history of the last two decades would suggest that the higher multiple paid for infrastructure assets has not been a headwind to returns. In fact, private infrastructure has delivered an annualised return of 9.8%[9] over the long term, compared to an annualised return of 8.6%[10] for US listed equities and 7.1%[11] for global listed equities over the same period (Figure 5). With infrastructure's return volatility lower than that of the S&P 500 Index or MSCI World Index, its risk-adjusted performance has been even stronger.[12]

Figure 5.
Private infrastructure and listed equities total returns



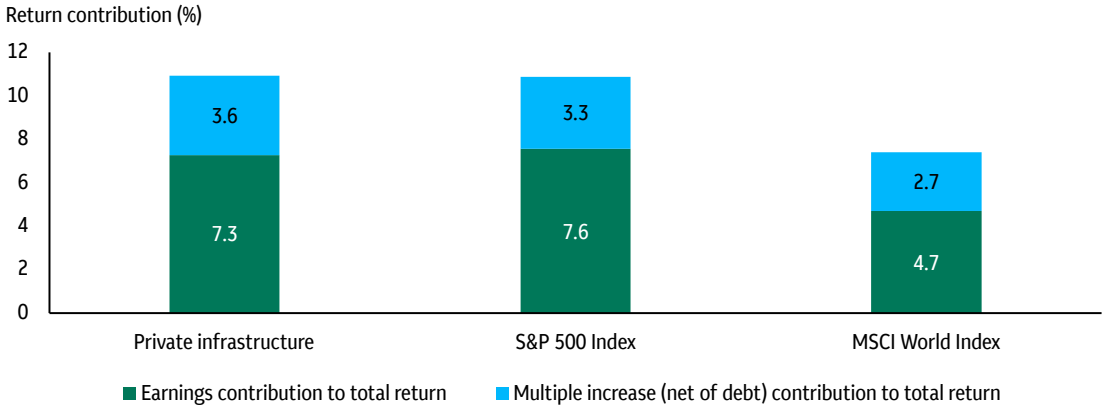
Sources: Bloomberg, Cambridge Associates (September 2022). The Cambridge Associates Infrastructure index is based on data from 164 infrastructure funds, with returns reported net of fees, expenses and carried interest. Analysis conducted between 4Q03 to 3Q22. Past performance is not indicative of future results. For illustrative purpose only.

7. Based on Macquarie Asset Management database of infrastructure companies. Average between 2013 and 2022.
8. Based on the MSCI World Index constituents. Average between 2013 and 2022.
9. Cambridge Associates Infrastructure Index, net of fees, expenses and carried interest over the period between 4Q03 and 3Q22.
10. Bloomberg, S&P 500 Index over the period between 4Q03 and 3Q22.
11. Bloomberg, MSCI World Index over the period between 4Q03 and 3Q22.
12. The standard deviation of YoY% returns of the S&P 500 Index was at 16.4%, of the MSCI World Index at 17.3% and of the Cambridge Associates Infrastructure Index at 10.5% over the period between 4Q03 and 3Q22.

Combining our valuations series with the Cambridge Associates total return data, we can estimate the total return contribution from multiple expansion (EV/EBITDA adjusted for net debt increase) and from earnings[13] (EBITDA). We can also compare these contributions to those for US and global listed equities.[14] Figure 6 shows the results. The important point, which is shown in different forms in Figure 6 below and Figure 4 above, is that infrastructure has not benefitted more than other equities from the rise in valuation multiples that occurred in the low interest rate environment that prevailed in the aftermath of the GFC. Like for the S&P 500 Index, the World MSCI index and other equities in general, the increase in the multiple was accretive to returns over this period, but it was earnings growth that accounted for the bulk of performance.

The second point is how strong earnings growth appears to have been for infrastructure. Infrastructure tends to be low beta, steady and defensive, so *a priori* one would expect its earnings growth to be slower than for corporates in general. But it appears[15] as though infrastructure's earnings growth has been materially better than it has for the companies in MSCI World Index and in line with companies in the S&P 500 Index, which comprises arguably the most dynamic and efficiently managed companies in the world. Can infrastructure continue to sustainably deliver this level of earnings growth and, by extension, risk-adjusted return performance? We will explore this and many other questions in more detail in an upcoming Pathways paper.

Figure 6.
Estimating the attribution of EV/EBITDA multiple expansion and earnings growth to total return



Sources: Bloomberg, Cambridge Associates, Macquarie Asset Management (September 2022). Analysis conducted between 3Q13 to 3Q22. Past performance is not indicative of future results. For illustrative purpose only. This is an approximation only.

13. Earnings contribution is both dividend yield and the value accretion that comes from earnings expansion.
14. For several reasons, investors should view this as an approximation.
- The universe of our valuations series won't be exactly the same as the universe for the Cambridge Associates return benchmark.
- EBITDA is an earning number above the interest cost line whereas in an ideal world, we should arguably be taking one below the interest line (debt levels and interest costs have moved in opposite directions over the period of analysis, however, something that should limit the distorting impact of this).

15. Potential changes in dividend payout ratios could also play a role here, and we don't have data on payout ratios for infrastructure over this period. But mathematically, a very large increase in the payout ratio would have had to occur to undermine this conclusion.

Unlisted and listed infrastructure valuations

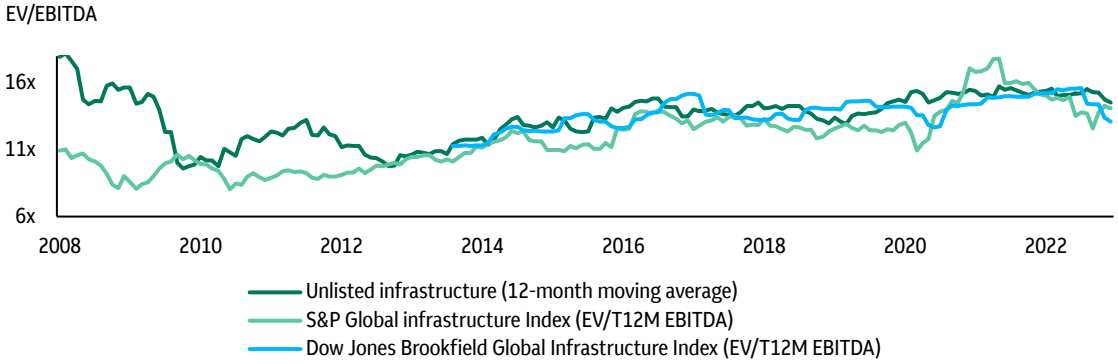
To compare unlisted infrastructure with listed infrastructure we use two listed infrastructure indices – the S&P Global Infrastructure Index and the Dow Jones Brookfield Global Infrastructure Index. Figure 7 shows the valuation multiples for these indices together with our time series for private infrastructure.[16] Over the period from 2013 to 2022 the spread has averaged 0.9x with the S&P Global Listed Infrastructure Index and 0.3x with the Dow Jones Brookfield Global Infrastructure Index.

Different spread levels may be linked to the different composition of these two indices. The S&P Global Infrastructure Index uses a broad-based approach,[17] while the Dow Jones Brookfield Global Infrastructure Index uses a pure-play approach. The pure-play approach refers to the rule of including only companies that obtain 70% or more of their cash flows from owning and operating infrastructure assets.[18] Our inclusion criteria used for private infrastructure is close to the one deployed by the Dow Jones Brookfield Global Infrastructure Index, which may explain the narrower spread with private infrastructure of 0.3x.

It is worth noting that there was a larger gap between private infrastructure valuations and the S&P Global Infrastructure Index before 2013, which could be attributed to these factors:

- Our dataset contains less data points during these periods and therefore may not fully reflect the true state of the market.
- In the pre-GFC period, some private infrastructure assets used financing structures that ex post turned out to be sub-optimal, resulting in a sharp decline in valuations during and immediately after the crisis.[19]

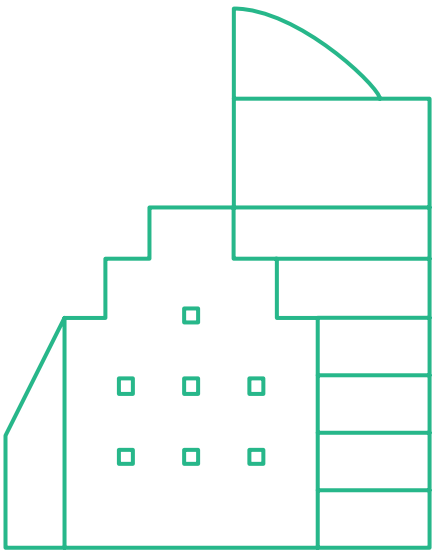
Figure 7.
Unlisted infrastructure valuations compared to global listed infrastructure

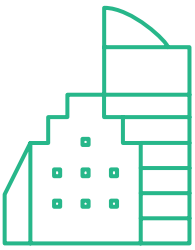


Source: Bloomberg, Macquarie Asset Management (March 2023). Private infrastructure series is based on 1,054 data transaction multiples for deals that reached financial close between January 2008 and December 2022. Past performance is not indicative of future results. For illustrative purpose only.

16. The valuation multiples for Dow Jones Brookfield Global Infrastructure Index are only available from 2013.
17. Broad-based approach includes pure-play infrastructure and infrastructure service companies. S&P Dow Jones Indices, "Approaches to Benchmarking Listed Infrastructure" (March 2020).
18. S&P Dow Jones Indices, "Approaches to Benchmarking Listed Infrastructure" (March 2020).
19. Several highly levered assets were identified in the pre-GFC period using the Inframation database.

Infrastructure and real estate: A new metric for a direct comparison





While the EV/EBITDA series enables investors to compare valuations with listed equities, it does not allow a direct comparison with real estate. Unlike infrastructure, real estate is not typically valued using standard equity metrics such as EBITDA multiples, but rather by using a capitalisation rate, commonly referred to as "cap rate". This has historically made it challenging to make a direct comparison between real estate and infrastructure valuations. In this section, we create an "infrastructure cap rate" which can provide investors with an additional tool for comparing infrastructure and real estate investments on a like-for-like basis.

Introducing the "infrastructure cap rate"

In real estate, the cap rate is used to determine the yield for property transactions over a one-year time horizon, allowing for the comparison of cashflows among various commercial rental properties before the impact of leverage, management fees and taxes. Like a bond yield, cap rates are inversely related to value. When cap rates compress, the value of real estate increases relative to underlying cash flows and vice versa. The real estate cap rate is derived as follows:

$$\textit{Real estate cap rate} = \frac{\textit{Net Operating Income}}{\textit{Property value}}$$

Net operating income (NOI) captures rental revenues paid by tenants before any depreciation, interest, taxes, corporate level expenses, capital expenditures, or financing payments. Nominal NOI typically excludes structural reserves for replacement (i.e., the funds that owners reserve for future major maintenance items), while the economic NOI typically used by analysts usually includes structural reserves. These reserves are required to meet future capital spending requirements to minimise obsolescence risks as the building ages, ensuring it remains competitive in the future.

In the world of infrastructure, a similar concept to structural reserves is maintenance capex. If the maintenance capex is known for infrastructure transactions at acquisition, it is possible to derive an "'infrastructure cap rate"' using the following formula:

$$\textit{Infrastructure cap rate} = \frac{\textit{EBITDA-Maintenance Capex}}{\textit{Enterprise Value}}$$

Maintenance capex is distinct from growth capex. It refers to the spending required to sustain the current state of growth and profitability, whereas growth capex refers to acquiring assets to increase operating cash flows beyond current levels.[20]

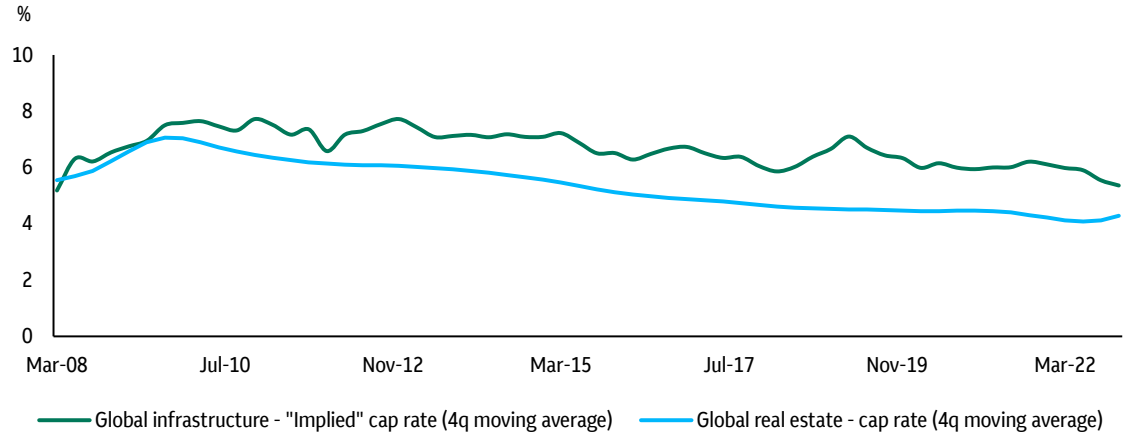
20. The calculation relies on the assumption that EBITDA is directly comparable to nominal NOI because both NOI and EBITDA measure the profitability of a property or business without including income taxes, cost of financing, amortisation and depreciation. In practice, however, NOI also takes into account lost revenues from vacancies, whereas EBITDA does not.

Implied "infrastructure cap rates"

Assessing maintenance capex accurately can be a challenging exercise. However, by drawing on the extensive knowledge and experience of our investment teams, we have been able to generate estimates of maintenance capex (as a percentage of EBITDA) in each infrastructure sector. Using our database of infrastructure transactions and the formula above, we can derive an implied infrastructure cap rate.

Figure 8 displays a comparison between the cap rate for global commercial real estate and our implied global infrastructure cap rate. The infrastructure cap rate fell from 7.6% in December 2009 to 5.4% in December 2022. This dynamic is consistent with global real estate, where cap rates have also compressed since the GFC as interest rates have fallen. On average, the cap rate for infrastructure has been higher (1.3 percentage points higher on average) than that of real estate, indicating a higher yield. It may also reflect the maturity of commercial real estate as an asset class given that institutional investors have been investing in the sector for 30 to 40 years, as in the case of the US. Compare this to infrastructure, which has only really seen institutional investment inflows since the early 2000s.

Figure 8.
Implied global infrastructure cap rate compared to global real estate cap rate



Source: Macquarie Asset Management (March 2023). Analysis conducted between January 2008 and December 2022. Past performance is not indicative of future results. Please note that real estate cap rate is an average across offices, logistics and retail, excluding shopping malls. For illustrative purpose only.

Spread over government bond yields

The cap rate represents a current-year yield at the time of acquisition and does not account for any expected growth in earnings. As a result, the cap rate is not equivalent to the discount rate used in discounted cash flow (DCF) models, which is an important distinction for infrastructure investors when using this metric. In this section, we also calculate a cap rate spread, which represents the difference between the yield on 10-year government bonds and the cap rate (or current yield).

Based on our calculations, infrastructure investors historically acquired assets at an average spread of 370 basis points (bps) over long-term government bond yields, with the range over the last 15 years extending from 110 bps to 560 bps.[21] During 2022, valuations remained robust across most infrastructure assets, leading to a reduction in the cap rate spread to approximately 200 bps by year-end. The latest data (as of 4Q 2022) indicate that transportation assets traded at the highest spread to long-term government bond yields of around 290 bps, with utilities and digital infrastructure are at around 160 bps and 110 bps respectively.

Figure 9:
"Implied" infrastructure cap rate (or one-year yield at acquisition)

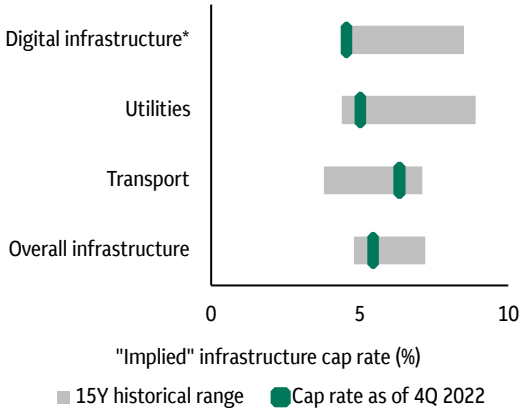
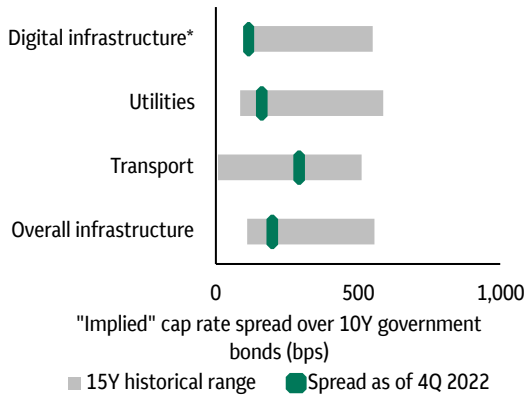


Figure 10:
Cap rate spread over 10-year government bond yield



Sources: Macquarie Asset Management, Macrobond (March 2023). Analysis conducted between January 2008 and December 2022. Past performance is not indicative of future results. *For digital infrastructure, data is only available from 2012. Data available for 2023 indicate that digital infrastructure cap rates have substantially widened compared to 4Q 2022. For illustrative purpose only.

21. Long-term government bond yields refer to 10-year government bonds yields weighted by nominal GDP across the US, the Eurozone and the UK.

Drivers: Key macro factors behind infrastructure valuations

Individual asset valuations are primarily driven by asset-specific factors, but macroeconomic variables also play a role and can exert influence on asset class level valuations. In this section, we use regression analysis to try to understand which macroeconomic variables matter for changes in infrastructure valuations and which do not. Sensitivities are also important, which is something we will turn to in the next section where we use scenario analysis to look forward and see how infrastructure multiples may evolve over the coming years.

Inflation, interest rates and economic growth

To begin our analysis, we conducted a multivariate regression of our unlisted infrastructure valuation series (quarterly data) against key macroeconomic variables: 10-year government bond yields, the Consumer Price Index (CPI) inflation, and real gross domestic product (GDP) growth. Table 1 below summarises the results for the period from 1Q08 to 4Q22.

The analysis shows that there is a negative, statistically significant relationship[22] between interest rates and infrastructure valuations. Higher interest rates put downward pressure on valuations owing to the higher discount rates applied to future cash flows. Secondly, the analysis suggests a positive relationship[23] between inflation and infrastructure valuations. Many infrastructure assets have a link between inflation and their revenue line. When inflation rises, it can provide an uplift not only to current earnings but also future cash flows due to higher inflation expectations. It may also be the case that investors' demand for assets that offer an inflation hedge increases in periods when inflation is high. Lastly, the coefficient for GDP growth is not statistically significant.[24] This suggests that valuation multiples are unlikely to be impacted by the deterioration in growth prospects that occurs during an economic downturn.[25]

22. The null hypothesis H0 is that the interest rates coefficient is zero. The null hypothesis is rejected as p-value is less than the significance level of 1%. When we reject the null hypothesis, it implies that the coefficient of the corresponding variable is not zero and as a result is statistically significant.
23. The null hypothesis H0 is that the inflation coefficient is zero. The null hypothesis is rejected as p-value is less than the significance level of 1%. When we reject the null hypothesis, it implies that the coefficient of the corresponding variable is not zero and as a result is statistically significant.
24. The null hypothesis H0 is that the GDP growth coefficient is zero. The null hypothesis cannot be rejected in this case.
25. There is a relationship between GDP growth and earnings for many assets, so asset values can still go down even if multiples do not.

Table 1.
Regression analysis of infrastructure valuations with macroeconomic variables

Macroeconomic variable	Coefficient	Standard error	t-stat	p-value	Statistical significance
Inflation	0.36	0.13	2.79	0.007	***
Interest rates	-0.39	0.12	-3.21	0.002	***
GDP growth	0.05	0.13	0.37	0.712	Not significant

Sources: Macquarie Asset Management, Macrobond (March 2023). Analysis conducted between January 2008 and December 2022. All variables are standardised by subtracting the mean and dividing by the standard deviation. Interest rates refer to 10-year government bond yields. Inflation and GDP growth refer to year-over-year changes. All macroeconomic variables are weighted by nominal GDP across the US, the Eurozone and the UK. The regression contains an intercept term which is not included in the table above. *** Statistically significant result when p-value is less than the significance level of 1%.

Dry powder: Does it have an impact on valuations?

Levels of dry powder have risen significantly in recent years and some investors believe that this has placed upward pressure on valuations and potentially pushed them above the level justified by fundamentals. Some argue that strong fundraising activity and the need to deploy capital by closed-end infrastructure funds may drive transaction prices higher due to stronger competition.

To explore this argument, we extend our analysis and include the change in dry powder as one of the explanatory variables. Table 2 shows the results. The coefficient on dry powder is statistically insignificant, suggesting that, historically, dry powder has not contributed to higher valuations. We have also run several regressions (with up to eight quarter lags) based on quarterly fundraising data[26] that also yielded similar results.[27] This may reflect capital deployment discipline within the asset class. But it is also the case that the amount of dry powder is not as large as many investors imagine.

26. Refers to quarterly changes in fundraising levels, based on data from Preqin over the period between March 2013 and December 2022.
27. While dry powder and fundraising data showed no statistically significant relationship with infrastructure valuations at an aggregate level, individual assets may have been impacted by the concentration of dry powder at different points in time.

Table 2.
Regression analysis of infrastructure valuations with macroeconomic variables and dry powder

Macroeconomic variable	Coefficient	Standard error	t-stat	p-value	Statistical significance
Inflation	0.36	0.2	1.83	0.09	*
Interest rates	-0.48	0.2	-2.44	0.03	**
Dry powder	0.1	0.19	0.51	0.62	Not significant

Sources: Macquarie Asset Management, Macrobond, Preqin (March 2023). Analysis conducted between 2008 and 2023. All variables are standardised by subtracting the mean and dividing by standard deviation. Interest rates refer to 10-year government bond yields. Inflation refers to year-over-year changes. Both variables are weighted by nominal GDP across the US, the Eurozone and the UK. The regression contains an intercept term which is not included in the table above. *** Statistically significant result when p-value is less than the significance level of 1%, ** when p-value is less than 5%, * and when p-value is less than 10%.

While the amount of infrastructure dry powder has increased sharply in recent years, it has actually been stable relative to the number of opportunities in the market. Figure 11 shows the development of dry powder and the volume of private infrastructure deals from 2007 to 2022. Dry powder has increased at a compound annual growth rate (CAGR) of 11.7% while deal volume has increased at a CAGR of 11.1%. Indeed, the ratio of dry powder to deal volumes has been largely stable over time, oscillating in a range from 0.34 to 0.56 (Figure 12).

Figure 11.
Dry powder and deal volume evolution

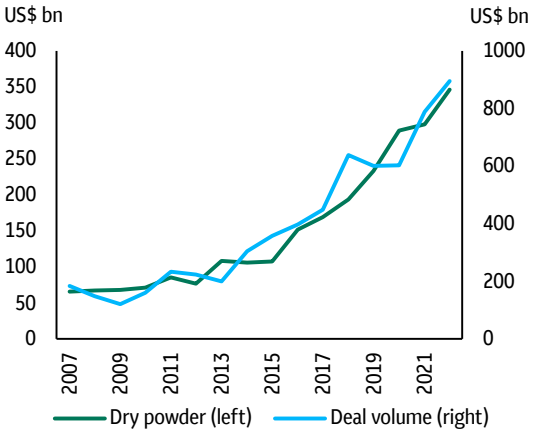
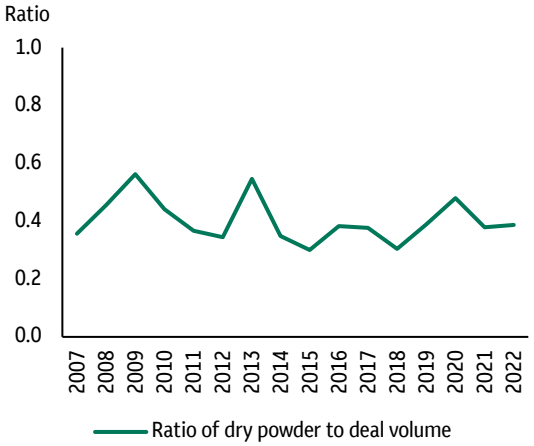


Figure 12.
Ratio of dry powder to deal volume



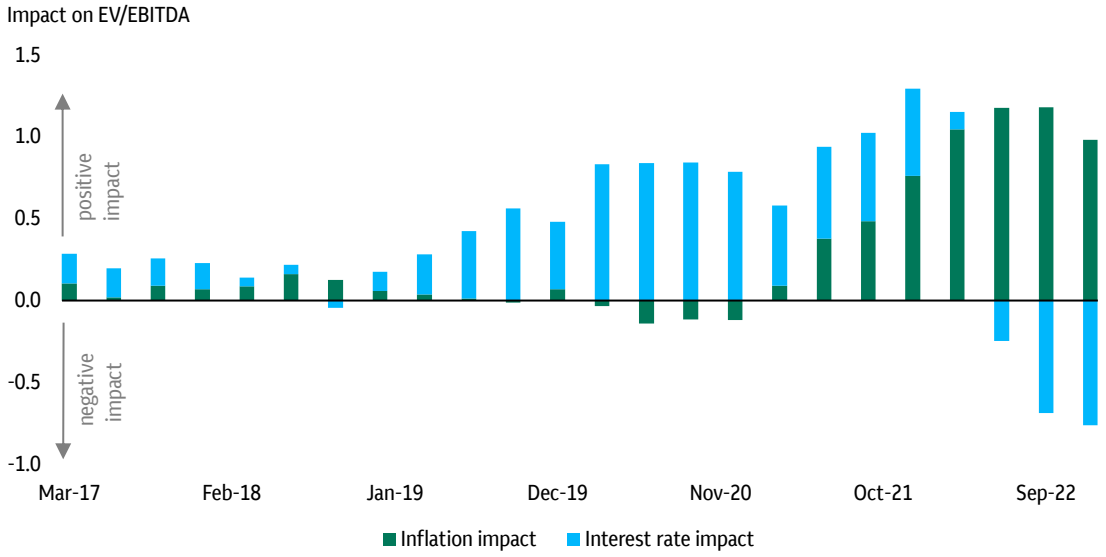
Sources: Macquarie Asset Management, Preqin, Infralogic by Inframation (March 2023). Dry powder refers to dry powder in infrastructure equity funds. Deal activity excludes energy downstream and upstream. Past performance is not indicative of future results. For illustrative purpose only.

Visualising the impact of inflation and interest rates

Our analysis concludes that there are two main macroeconomic variables that impact unlisted infrastructure valuations: inflation and interest rates.[28] While higher inflation has a positive impact, higher interest rates have a negative impact. Since higher inflation is often followed by an increase in interest rates as central banks react to bring inflation back to their target range, there is often an offsetting impact from these two forces for infrastructure assets.

Figure 13 shows the historic contribution of these variables to EV/EBITDA multiples based on the outcomes from the regression model. The data suggest that during the period between 2019 and 2021 the low interest rate environment placed upward pressure on infrastructure valuations. In 2022 infrastructure managed to avoid the sharp declines observed in global listed equities as higher inflation supported valuations. Risks rose towards the end of 2022 though, as the negative impact from higher interest rates became greater than the positive impact from high inflation.

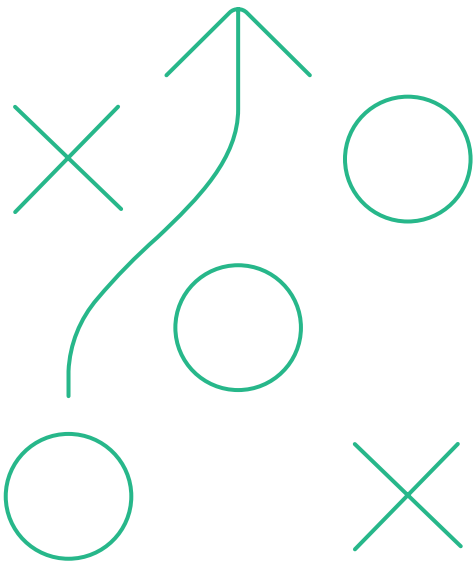
Figure 13.
Impact of inflation and interest rates on valuations based on the regression model

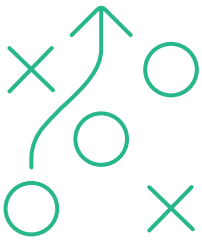


Sources: Macquarie Asset Management, Macrobond (March 2023). Analysis conducted between March 2017 and December 2022. Past performance is not indicative of future results. For illustrative purpose only. Please note the analysis only captures the impact of macroeconomic variables and does not account for other factors that impact the asset class.

28. Based on stepwise regression and derived by adding and removing potential explanatory variables in succession and testing for statistical significance after each iteration.

Scenario analysis: Navigating the uncertain economic environment





In this final section, we use scenario analysis to consider potential trajectories for infrastructure valuations based on the observations and conclusions derived from the previous sections. While macroeconomic variables cannot explain all fluctuations in valuations, macroeconomic scenario analysis can provide a guide to where valuations may go under certain conditions.[29]

Macroeconomic scenarios

We consider three macroeconomic scenarios to see how infrastructure valuations could evolve over the next 12 to 18 months:

Scenario 1 (S1) – "Inflation falls sharply, interest rates are cut". This scenario assumes that the global economy returns to the pre-COVID-19 economic environment characterised by low inflation and low interest rates. We assume that inflation falls back to below 2% across the advanced economies and the weighted average[30] of 10-year government bond yields falls to around 1.3%[31] by the end of 2024.

Scenario 2 (S2) – "Inflation remains sticky, interest rates increase". Scenario 2 assumes that inflation remains at high single-digit levels over the coming 12 to 18 months. Central banks increase policy rates in response to the higher-than-expected inflation and 10-year government bond yields increase by another 100 bps.

Scenario 3 (S3) – "Inflation moderates, interest rates unchanged". This scenario assumes that inflation in the advanced economies cools but does not fall back to central bank targets of ~2%. Policy rates and 10-year government bond yields remain unchanged as a result.

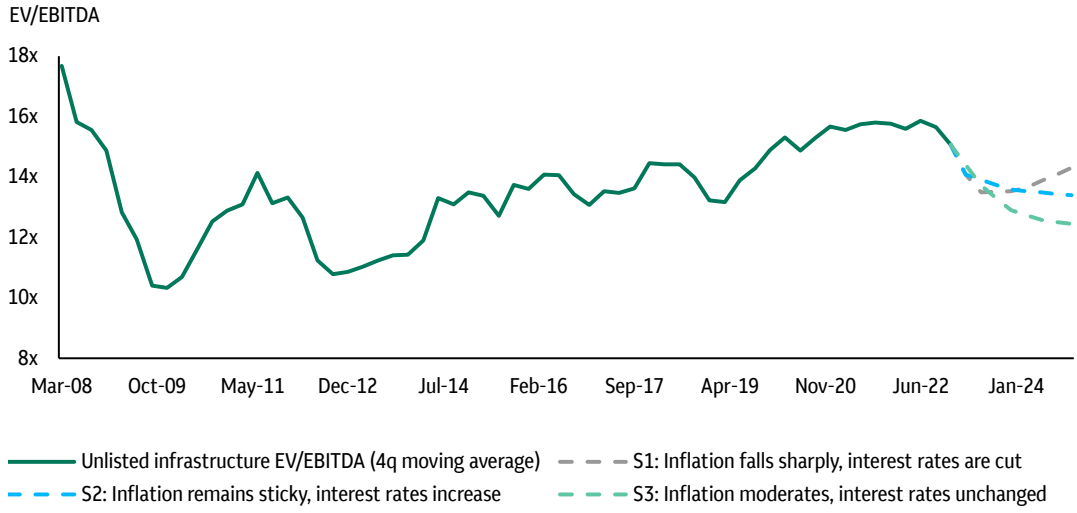
Potential evolution of infrastructure valuations

Figure 14 shows the potential impact of these different macroeconomic scenarios on unlisted infrastructure valuations. In the first scenario, valuation multiples come under pressure in 1H23 but start to recover towards the end of 2023 as long-term interest rates fall. By the end of 2024 valuation multiples could be back to 2019 levels. Such a scenario would imply attractive entry opportunities in 2H23 and a quick bounce back of valuations in 2024.

The second scenario implies that if inflation remains stubborn and leads to higher interest rates, valuation multiples are likely to face headwinds for longer. In this scenario, higher interest rates would put more downward pressure on valuations, but valuations would continue to be supported by high inflation. Multiples would fall to ~13.4x by the end of 2024, down from ~15.1x as of the end of 2022.

29. Please note that our analysis assesses the development of valuation multiples assuming all else outside of the macroeconomic environment remaining equal (or ceteris paribus).
30. Nominal GDP-weighted average across the US, the Eurozone and the UK.
31. Refers to the weighted average of 10-year government bond yields over the six quarters before COVID-19.

Figure 14.
Impact of various macroeconomic scenarios on unlisted infrastructure valuations



Source: Macquarie Asset Management (March 2023). Past performance is not indicative of future results. For illustrative purpose only. Does not constitute investment advice or recommendation.

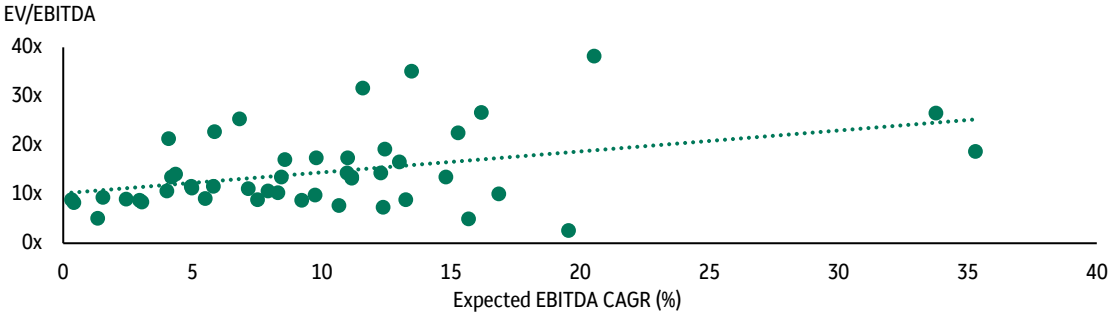
While in the first two scenarios inflation and interest rates move in the same direction, the third scenario is potentially more damaging for valuations because as the tailwind from high inflation fades there is no compensating relief in the form of lower interest rates. This leads to a longer lasting drag on valuation multiples, bringing them to ~12.5x by the end of 2024, or -17% below their level at the end of 2022.

It is worth noting that some asset managers have historically employed conservative assumptions for long-term interest rates and may have embedded additional buffers in discount rates that could provide some protection for valuation multiples. The description above is, therefore, a generalisation and not all infrastructure assets will be affected in the same way.

Earnings, earnings, earnings

Systematic factors such as the macroeconomic environment are outside investors' control. That said, there are ways infrastructure investors can position their portfolios to help protect asset values at exit. While higher interest rates may act as a drag on infrastructure valuations in the future, improving profitability margins and focusing on earnings growth may help preserve valuation multiples. There is often a positive relationship between expected earnings growth and valuation multiples at acquisition (Figure 15). Growth in EBITDA could be achieved through operational improvements, expanding margins or unlocking new growth opportunities. Buy-and-build strategies where platforms are built through bolt-on acquisitions may enable investors to access economies of scale and benefit from synergies between the acquirer and the target company.

Figure 15.
Higher expected EBITDA growth is associated with higher valuations



Source: Macquarie Asset Management proprietary database of infrastructure companies (March 2023). Past performance is not indicative of future results. For illustrative purpose only. Does not constitute investment advice or recommendation.

Strategic considerations

If we have entered a new macroeconomic regime where higher interest rates are required to keep inflation under control (see our "Outlook 2023: Opportunity in a volatile world" for more details), this means the days of acquiring infrastructure assets and relying on valuation multiple expansion driven by falling interest rates to drive value accretion are gone. Active asset management, innovative business plans, and specialist industry and energy transition expertise will likely be critical to delivering quality growth and protecting valuations against higher interest rates. Table 3 highlights some key strategic considerations for infrastructure investors:

Table 3.
Strategic consideration to protect asset valuations at exit

Focus on earnings growth	Generating value by driving revenue growth, optimising costs and improving margins will be crucial for value and may support valuations at exit.
Prudent approach to leverage	Lessons learned from the GFC suggest that valuations of highly levered assets are at risk of falling sharply during periods of banking distress. A prudent approach to leverage will be important over the coming years.
Specialist expertise	The energy transition presents large growth opportunities for infrastructure investors. Those with the expertise and skills to execute on these opportunities will arguably have an advantage in the years and decades ahead.
Navigating the regulatory environment	Experience in complicated regulatory environments and the ability to manage stakeholders will be key to delivering sustainable growth and essential services to communities in a more volatile macroeconomic environment.
Active asset management	Active asset management should be crucial to delivering on growth. Deep expertise across established and emerging sectors and technologies will likely be increasingly important.

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Pathways

For more information, or to speak to the author of this issue, Aizhan Meldebek, please contact your Macquarie Asset Management Relationship Manager.

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