



Infrastructure and the Economy

Declan O'Brien
UBS

This series explores some of the key portfolio considerations of investing into infrastructure. Our first paper focused on the growing area of infrastructure debt. This paper, the second in our series, takes a closer look at how infrastructure returns might perform under various economic scenarios, and in particular in a rising interest rate environment. We use public and private infrastructure indices from 2004-2017 to help inform the analysis.

- In the current economic environment, solid GDP growth and increasing inflation expectations are putting pressure on central banks to raise interest rates.
- Although rising interest rates negatively impact infrastructure returns, faster GDP growth and rising inflation are both positive for infrastructure performance. We would

therefore expect a moderate rise in interest rates to be largely offset by accelerating GDP growth or higher inflation.

- Infrastructure returns in periods of rising real interest have historically been below average (-12% p.a. versus 2004-17 average); however, returns remained positive at 10.1% p.a.
- Infrastructure owners have been putting long-term facilities in place to lock-in low financing costs. This is a structural change from previous cycles that could mitigate the impact to the sector of rising real rates.
- Infrastructure is often referred to as a bond proxy. During 2004-2017, infrastructure performed best relative to listed equities when either GDP growth was below average or real interest rates were falling; this is also

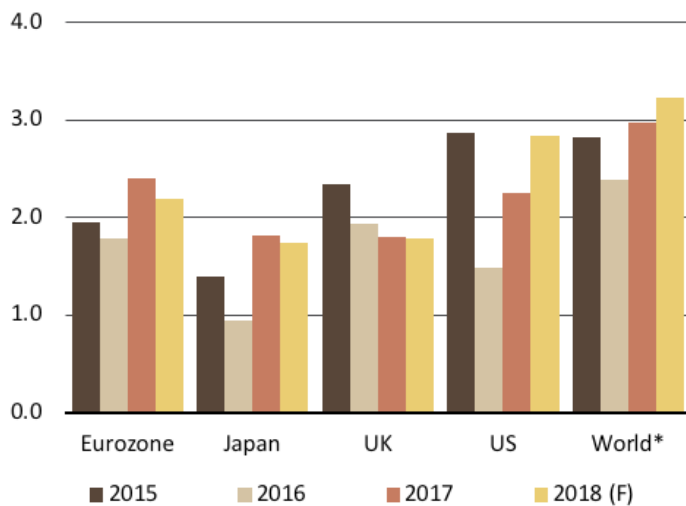


Exhibit 1: Strong Global GDP Growth in 2017

Source: Oxford Economics, March 2018

when bond returns performed best.

- The bond-like features of infrastructure, combined with the yield pick-up versus fixed income, were key factors supporting the significant inflows into the asset class over the past decade. During 2004-17, listed equities outperformed infrastructure when real rates were rising or GDP growth was above average. Investors' appetite for additional infrastructure allocations in such environments could be reduced.

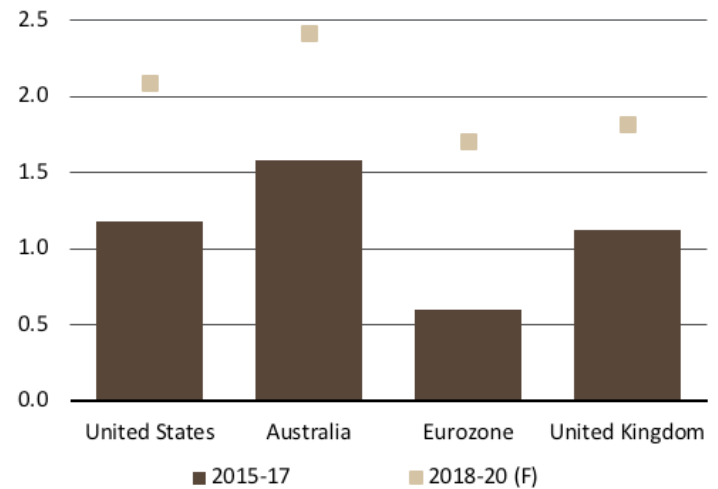


Exhibit 2: Forecast for Higher Inflation

Source: Oxford Economics, March 2018

identifying the key cashflow drivers by infrastructure sub-sector and evaluating how sensitive these drivers are to changing economic variables.

Secondly, we analyze data from public and private markets to test how the asset class has performed historically under certain economic scenarios. Finally, we investigate investor sentiment towards the infrastructure asset class, and look at how capital inflows could be impacted under these scenarios.

Overview

The global economy is experiencing a period of synchronized growth and inflation is picking-up; these trends, if continued, will result in continued tightening of monetary policy. In a Preqin survey of investment consultants covering infrastructure, rising interest rates ranked highest among their investment concerns.

In this paper, we examine how infrastructure returns might respond in different economic environments. We assess the potential impact on infrastructure investment by, firstly,

In the wake of the financial crisis central banks around the world cut interest rates to record lows; however, weaning the economy off low interest rates will not be straightforward. Two tailwinds are now supporting a tightening of monetary policy: strong GDP growth and increasing inflation expectations (see Exhibit 1 and 2).

Sovereign bonds yield have already begun to adjust upwards to reflect these trends (see Exhibit 3), and forecasts suggest further increases ahead, although rates should remain low by historical standards.

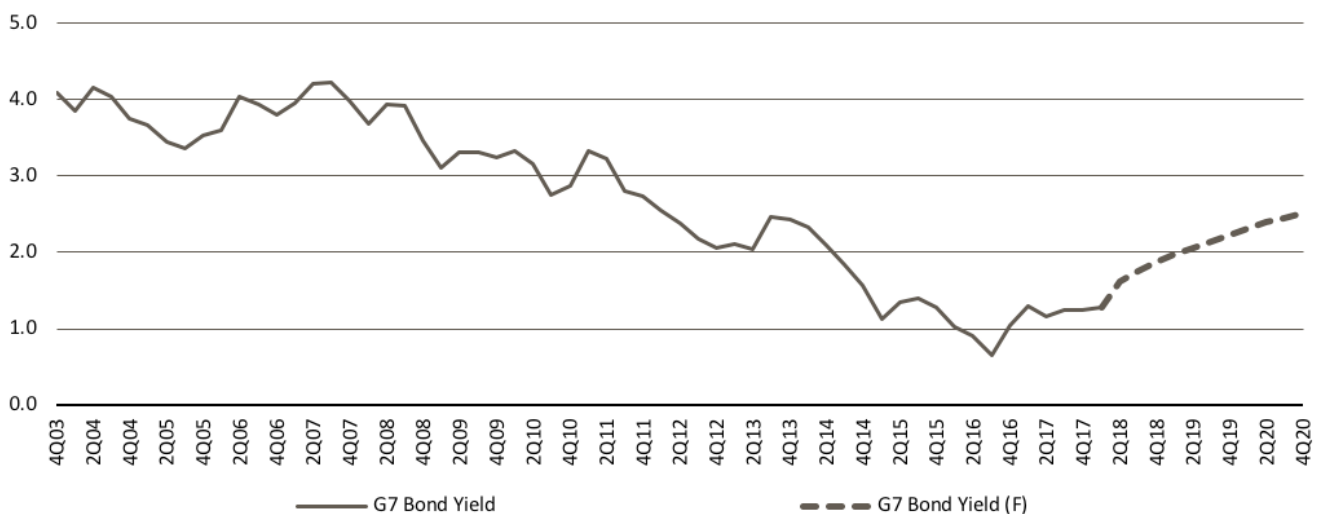


Exhibit 3: G7 Bond Yields¹ (nominal) (%)

Source: Oxford Economics, March 2018

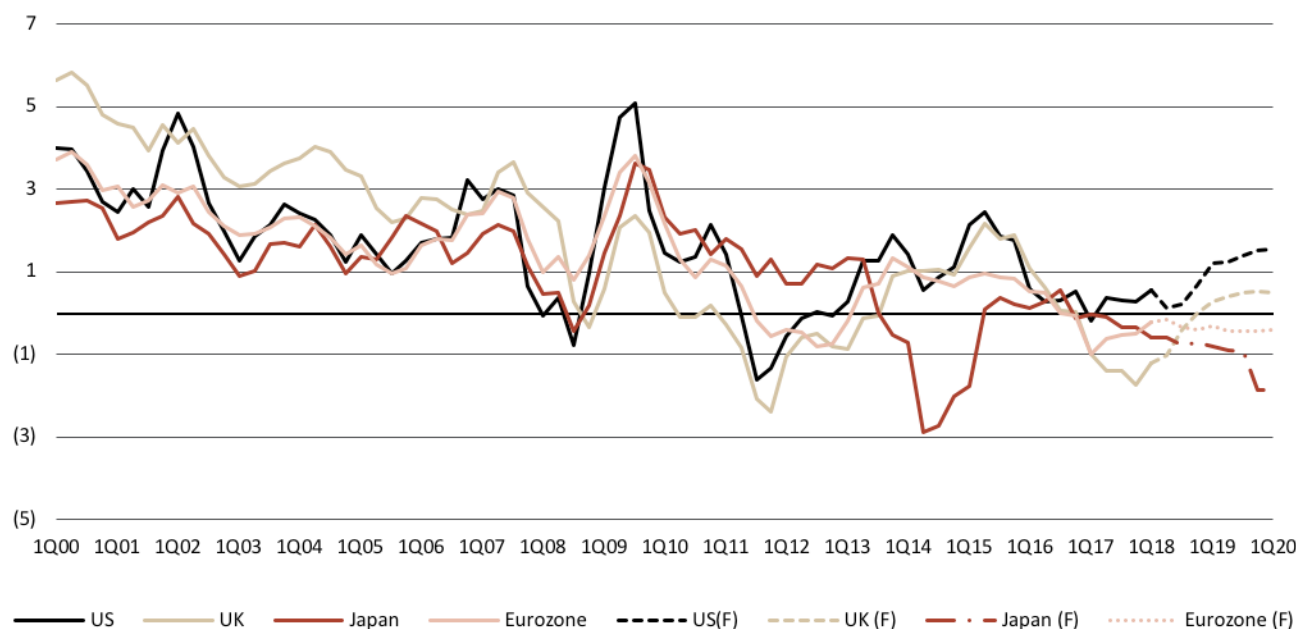


Exhibit 4: Real Interest Rates (%)

Source: Bloomberg, Oxford Economics, March 2018; historical data based on 10-year swap rates; forecast based on 10-year forward rates; Inflation = Consumer Price Inflation

In order to better understand the potential implications of rising interest rates for infrastructure investors, it is important to not just focus on nominal interest rates, but also on the components of nominal interest rates; i.e. the real interest rate and inflation expectations.

Once adjusted for inflation, rate rise expectations become more muted (see Exhibit 4). Markets expect the Federal Reserve to raise rates three to four times in 2018; however, we would expect interest rate normalization to be more gradual in other regions.

How will infrastructure returns perform in a rising rate environment?

This is not a straightforward question to answer. It depends on whether we refer to the performance of the cashflows, i.e. absolute performance or the attractiveness of the sector relative to other asset classes. We seek to provide some insights by applying a three-pronged approach:

- Identify the **cashflow drivers** for each infrastructure sub-sector and observe how we believe these assets will perform under different economic scenarios, based on typical asset features and contractual structures;
- **Analyze the historical performance** of listed and unlisted infrastructure from 2004 to 2017 to see if our observations in step 1 can be corroborated through the data; and
- Evaluate the drivers behind the record investor appetite for infrastructure, and **how elastic demand is to changing economic conditions**.

Cashflow Drivers



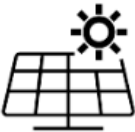


Rising interest rates seldom occur in isolation, and are typically a response to either strong GDP growth or inflation. We have set out below an illustration of how we would expect infrastructure cashflows to respond in such environments by infrastructure sub-sector.

Given the plethora of regulatory regimes across the world, we have simplified the analysis by focusing on a typical European asset in each sub-sector.

The impact of rising interest rates will ultimately depend on the capital structure of the investment, for example, the floating-fixed ratio of its debt and the level of exposure to refinancing risk. As rates have been at record lows for a prolonged period, many infrastructure owners have already put in place long-term financings to lock in lower rates. This should help mitigate the performance impact of the infrastructure sector from rising rates.

As illustrated below, rising inflation should increase revenues in most sectors, especially utilities and social infrastructure. Transportation assets should benefit most in a rising GDP growth environment.

The illustration below demonstrates the need to consider interest rates, inflation and GDP growth in their totality in order to understand the impact of rising interest rates. In the current environment where inflation and GDP growth are expected to increase, and capital structures have been de-risking, we expect the impact of rising interest rates on the infrastructure sector to be marginal.

	GDP growth	Rising inflation	Tightening monetary policy
Transport 	<input checked="" type="checkbox"/> Strong correlation between GDP growth and transportation assets with traffic risk	<input checked="" type="checkbox"/> Most tariffs are linked, or can be adjusted, with inflation	<input checked="" type="checkbox"/> Mostly negative; impact dependent on debt structure = Recoverable in some cases through cost of capital adjustment
Social 	= Limited impact as assets typically for social purpose	<input checked="" type="checkbox"/> Most tariffs are linked to inflation so revenues should increase in line with inflation	<input checked="" type="checkbox"/> Marginal impact as most existing projects have long-term debt <input checked="" type="checkbox"/> Projects with large cash reserves will benefit
Energy 	<input checked="" type="checkbox"/> Power demand and price should increase with economic growth However, the impact of renewables and energy efficiency has reduced historical correlation	<input checked="" type="checkbox"/> Power purchase agreements and renewable subsidies typically increase with inflation Power prices should increase but not mechanically, and costs may rise with inflation	<input checked="" type="checkbox"/> Mostly negative; impact dependent on debt structure
Utilities 	= Regulated utilities' revenues not highly correlated with GDP <input checked="" type="checkbox"/> Unregulated utilities should benefit as per power assets above	<input checked="" type="checkbox"/> Most tariffs are linked to inflation, so revenues will increase with inflation	<input checked="" type="checkbox"/> Mostly negative; impact dependent on debt structure Regulated utilities may be able to recover through cost of capital adjustments (with a lag)
Communications 	<input checked="" type="checkbox"/> Revenues should increase with economic activity, although unregulated business is experiencing pricing pressures	<input checked="" type="checkbox"/> Tariffs typically increase with inflation	<input checked="" type="checkbox"/> Mostly negative; sector typically financed with shorter-term debt

Analysis of Historical Performance (2004-2017)

Infrastructure data

The issues around the quality of infrastructure data are well documented. We set out the detailed sources used in the analysis in the Appendix. For listed infrastructure, we use the Dow Jones Brookfield Global Infrastructure Index and its sub-sector indices; however, we note that the index has a higher proportion of transportation and telecommunication assets than we would expect to see in a typical unlisted infrastructure portfolio.

We, therefore, do not provide a comparison of the performance between listed and unlisted infrastructure. Nonetheless, the results of how both listed and unlisted infrastructure respond under economic conditions, both on an absolute return level and relative to listed equities, provide valuable insight into the return drivers for the asset class.

Our analysis of the infrastructure assets class focuses on three variables: (1) GDP growth; (2) inflation and (3) interest rates. For each variable we chart the returns for each asset class (in columns), and also mark the average growth rate (2004-2017) to show the relative impact of each variable on the asset class.

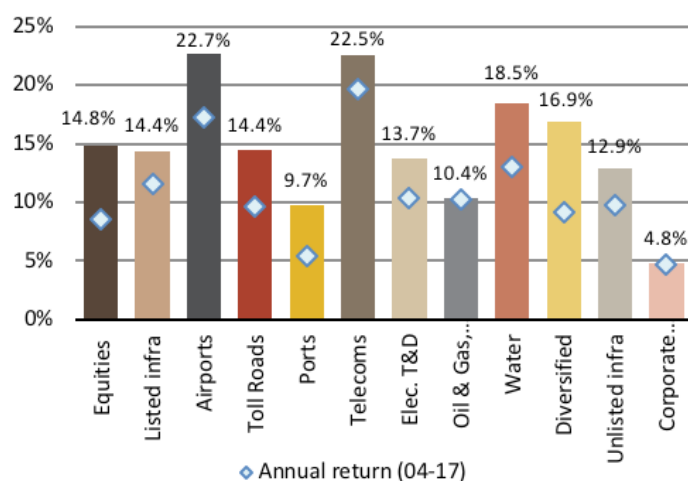


Exhibit 5a: GDP growth above average³

Source: Oxford Economics, March 2018

Infrastructure returns in above/below average² GDP growth environments

Above average GDP growth

Exhibit 5a shows listed and unlisted infrastructure returned 14.4% p.a. and 12.9% p.a., respectively, in above average GDP growth environments, among the highest absolute values under all economic scenarios tested (see Appendix).

Listed equities also performed strongly (14.8% p.a. vs. average of 8.5% p.a.) with returns of 74% above average annual rates, and comparatively better than listed and unlisted infrastructure with improvements of 25% and 32%, respectively.

Below average GDP growth

Conversely, absolute returns for infrastructure ranked lowest in environments where GDP growth was below average (see Exhibit 5b).

However, relative to listed equities, both listed (1.3% p.a.) and unlisted infrastructure (-1.4% p.a.) significantly outperformed listed equities (-12.6% p.a.) in low GDP growth rate environments.

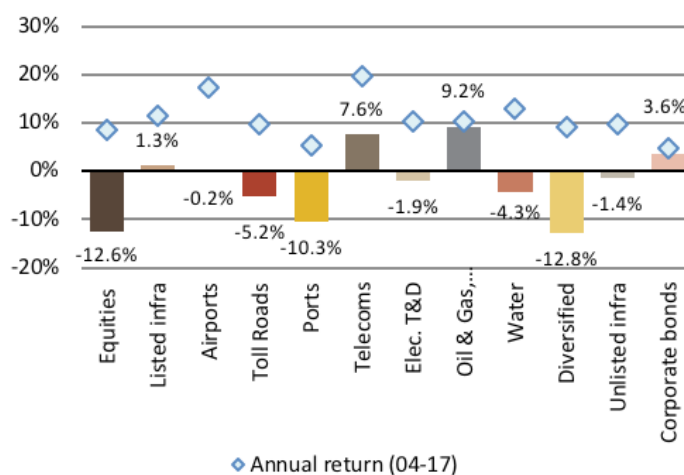


Exhibit 5b: GDP Growth Below Average

Source: Oxford Economics, March 2018

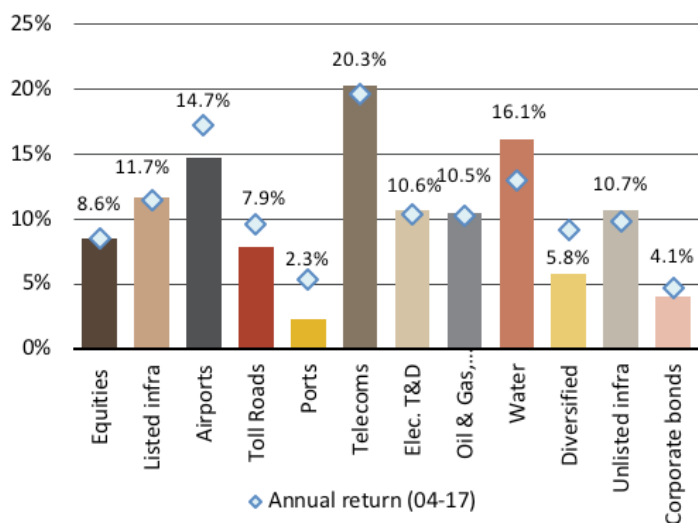


Exhibit 6a: Inflation⁴ Above Average

Source: Oxford Economics, March 2018

Infrastructure returns in high/low inflation environments

The correlation between infrastructure returns and inflation is relatively weak and does not appear to have a meaningful impact on absolute returns.

Given revenues are contractually linked to inflation for many infrastructure assets, the results were somewhat counter-intuitive.

We believe this is due to the timing impact of inflation. Where contractual and regulatory mechanisms exist within infrastructure assets, most adjust for inflation at the end of the year/with a year's lag. Therefore, we adjusted the test by lagging earnings by one year. This resulted in a stronger correlation and the results better reflect our understanding of how the asset class should behave (see Exhibits 7a and 7b).

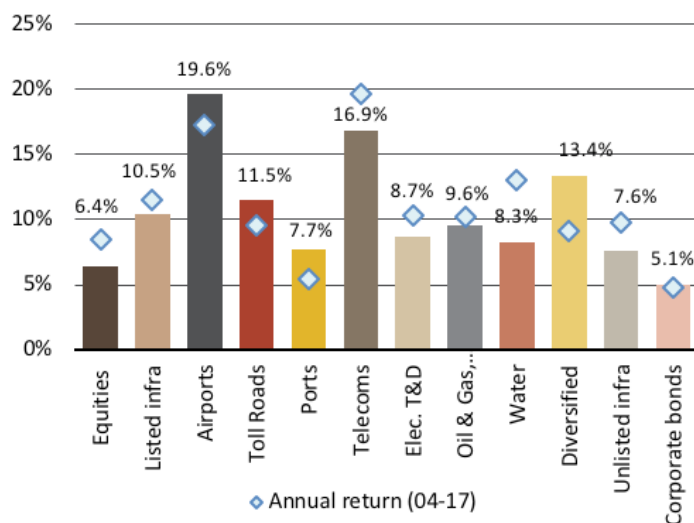


Exhibit 6b: Inflation Below Average

Source: Oxford Economics, March 2018

Above average inflation

Absolute returns for listed (18.9% p.a.) and unlisted infrastructure (14.4% p.a.) when inflation was above average ranked highest out of the scenarios that we tested (see Appendix).

Listed equities also performed well during high inflation periods (14.3% p.a.), so no material outperformance was noted.

Below average inflation

When inflation was below average, both infrastructure and equities returned significantly below average; however, on a relative basis, infrastructure outperformed equities in a low inflation environment.

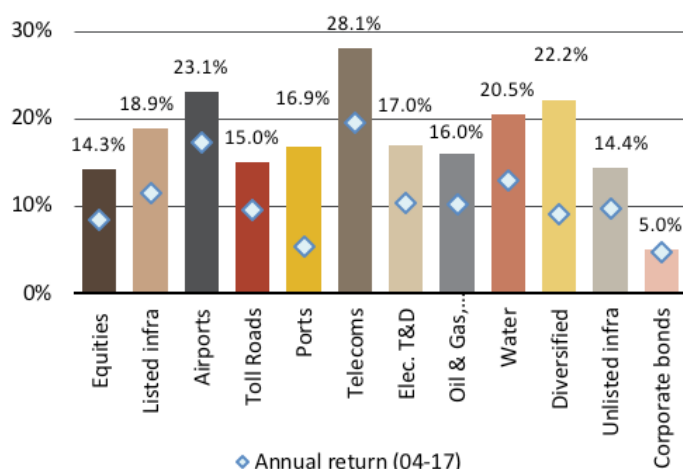


Exhibit 7a: Inflation Above Average (1-year lag)

Source: Oxford Economics, March 2018

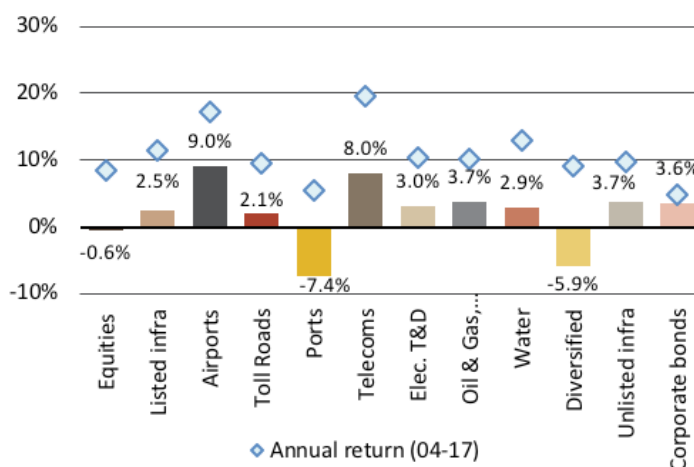


Exhibit 7b: Inflation Below Average (1-year lag)

Source: Oxford Economics, March 2018

Infrastructure returns in rising/falling real interest rate environments

Rising real interest rates

On a nominal basis, returns for both listed and unlisted infrastructure performed better than their average. As discussed in the introduction, nominal interest rates typically rise as a response to faster GDP growth or inflation, both of which are positive for infrastructure returns.

Returns for listed infrastructure when real rates were rising were 10.1% p.a. (12% p.a. below average returns) whereas listed equities returns were 10.4% p.a. (22% p.a. above average returns).

Falling real interest rates

Listed infrastructure returned 12.9% p.a. (vs. average of 11.5% p.a. or 12% above average) in periods of falling real rates, a significant outperformance versus listed equities which performed 31% p.a. below average.

This outperformance reflects the benefit of either falling real rates or rising inflation on infrastructure investments. The positive impact of falling real rates reflect the fact that infrastructure asset are typically highly levered.

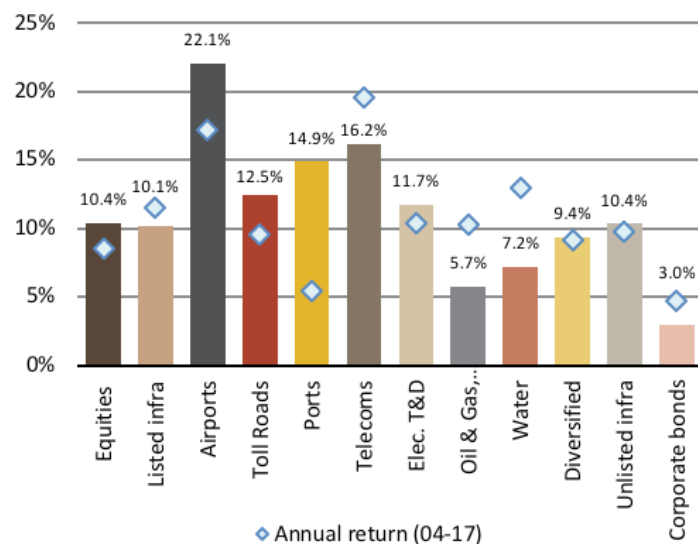


Exhibit 8a: Rising Real Interest Rates (%)

Source: Oxford Economics, March 2018

Observations

Infrastructure performs very well in falling real interest rate environments; however, returns for listed infrastructure in periods where real rates were rising were still positive with 10.1% (vs. average of 11.5%). The interest rate scenario was the only scenario tested where listed and unlisted infrastructure behaved materially differently. This is potentially due to different country exposures of the listed and unlisted indices.

The impact of interest rates on infrastructure depends on the capital structure of the investment. Given the prolonged low interest rates environment, the trend has been for infrastructure owners to de-risk the capital structure by putting in place long-term facilities to lock-in low rates. As a result, the performance impact of rising real rates on infrastructure could be very different from historical cycles.

Additionally, unlisted infrastructure valuations may be less impacted by the higher increasing interest rates as independent infrastructure valuations tend to use a "normalized" rate to adjust for ultra-low rates.

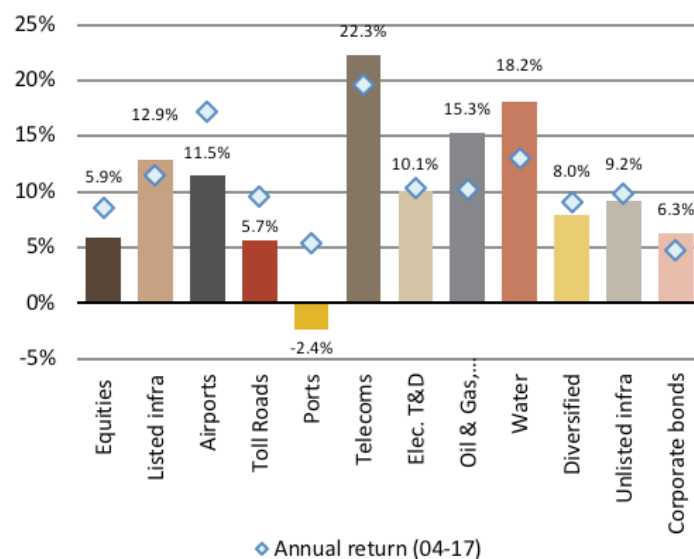


Exhibit 8b: Falling Real Interest Rates (%)

Source: Oxford Economics, March 2018

Key takeaways from historical performance analysis

GDP growth

On an absolute basis, infrastructure performed best in high GDP growth environments; however, relative to listed equities, it performed best in low GDP growth environments.

Inflation

Infrastructure performs well in periods of high inflation (assuming a lag), demonstrating that the asset class can provide protection against rising inflation.

Interest rates

Infrastructure performed well when real rates were falling, owing to the leverage inherent at asset level, and inflation protection.

These takeaways support the earlier observations in Section 1 around how we would expect infrastructure assets to behave based on asset features and contractual structures, i.e. strong correlation with rising GDP growth and inflation, but to be negatively impacted by real rates rises.

Attractiveness of the Asset Class

Infrastructure is often referred to as a bond proxy, and the performance of the asset class through the cycle may help to explain this: bonds and infrastructure both performed well relative to equities in periods of low GDP growth and falling rates environments (see Appendix).

The infrastructure asset class continued to receive strong new inflows in 2017 (see Exhibit 9). The bond-like features of infrastructure, combined with the yield pick-up versus fixed income, were key factors supporting the strong inflows into the asset class over the past decade.

While investment consultants are worried about interest rates, the attractiveness of infrastructure for investors is still high with 90% of investors expecting to deploy at least the same capital over the next 12 months; 93% of investors surveyed felt infrastructure had met or exceeded their expectations, a large increase from previous years.

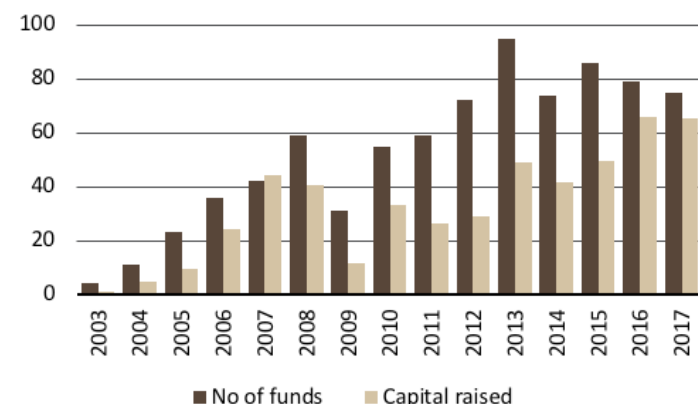


Exhibit 9: Significant Flows into Infrastructure

Source: Prequin, 2018

Conclusion

Overall, we expect nominal interest rates to increase as economies finally recover from the global financial crisis; however, the process should be gradual and real rate increases should be more muted.

The revenue structure for a typical infrastructure asset should respond to increasing GDP growth and inflation. This is also shown in the historical data (2004-2017), where GDP growth and inflation (with a lag) are strongly correlated with infrastructure returns. We would therefore expect the absolute performance of infrastructure to be robust in such an environment.

Investor sentiment towards the asset class is positive and infrastructure will continue to play an important part in diversifying investors' portfolios. Future allocations to the asset class will ultimately be determined by the relative performance of infrastructure to listed equities and other asset classes.

Endnotes

1. 10-year bond yield for G7 countries equally weighted.
2. Average real GDP (Q1 2004 to Q3 2007) for G7 countries, equally weighted.
3. Weighted average GDP for G7 countries from Q1 2004-Q3 2007. Asset class sources are detailed in Appendix.
4. Inflation is the G7 weighted average Consumer Price Inflation (CPI).
5. Real interest rates uses the G7 weighted 10-year bond yield and subtracts inflation (CPI).

Appendix - Summary table

Macro scenario	Equities	Listed infra	Airports	Toll Roads	Ports	Telecoms	Elec. T&D	Oil & Gas, transport	Water	Diversified	Unlisted infra	Corporate bonds
Annual return (04-17)	8.52%	11.50%	17.25%	9.61%	5.40%	19.60%	10.35%	10.26%	13.01%	9.13%	9.78%	4.75%
Rising real yield	10.4%	10.1%	22.1%	12.5%	14.9%	16.2%	11.7%	5.7%	7.2%	9.4%	10.4%	3.0%
Falling real yield	5.9%	12.9%	11.5%	5.7%	-2.4%	22.3%	10.1%	15.3%	18.2%	8.0%	9.2%	6.3%
Rising nominal yield	19.8%	15.4%	35.1%	17.7%	38.1%	24.7%	12.3%	12.6%	15.5%	25.1%	12.1%	3.8%
Falling nominal yield	3.1%	10.5%	11.3%	8.4%	-5.9%	18.0%	10.0%	10.8%	13.0%	5.9%	8.5%	5.2%
Above average GDP growth	14.8%	14.4%	22.7%	14.4%	9.7%	22.5%	13.7%	10.4%	18.5%	16.9%	12.9%	4.8%
Below average GDP growth	-12.6%	1.3%	-0.2%	-5.2%	-10.3%	7.6%	-1.9%	9.2%	-4.3%	-12.8%	-1.4%	3.6%
Above average inflation	8.6%	11.7%	14.7%	7.9%	2.3%	20.3%	10.6%	10.5%	16.1%	5.8%	10.7%	4.1%
Below average inflation	6.4%	10.5%	19.6%	11.5%	7.7%	16.9%	8.7%	9.6%	8.3%	13.4%	7.6%	5.1%
Above avg inflation (lag)	14.3%	18.9%	23.1%	15.0%	16.9%	28.1%	17.0%	16.0%	20.5%	22.2%	14.4%	5.0%
Below avg inflation (lag)	-0.6%	2.5%	9.0%	2.1%	-7.4%	8.0%	3.0%	3.7%	2.9%	-5.9%	3.7%	3.6%

■ result for asset class under economic variable is 10% (or more) above equities (using delta from average returns, see note for methodology)
■ result for asset class under economic variable is 10% (or more) below equities (using delta from average returns, see note for methodology)

Note: The figures used in the above calculation (red/green illustration) correspond to the performance of the asset class under the specific economic variable relative to its respective annual return (04-17). For example, under the "Above average GDP growth" scenario, listed infrastructure returns were 25% above the average annual rate (14.4%/11.5% - 1), 49% lower than the returns for equities of 74% (14.8%/8.5% - 1), so the result is highlighted red as listed infrastructure underperforms equities by more than 10%. This analysis is provided for illustration only.

Author Bio



Declan O'Brien

UBS

Declan O'Brien is a Senior Infrastructure Analyst in the Research & Strategy team, which forms part of Real Estate & Private Markets within UBS Asset Management.

Declan joined UBS-AM's business in October 2017 and is based in London. In this role, he is primarily responsible for

providing quantitative and qualitative cross-regional analysis of infrastructure investment markets. Declan joined from Legal & General Investment Management (LGIM) (2015–2017), where he was responsible for LGIM's research and strategy in the infrastructure sector. His previous roles were Assistant Vice President – Infrastructure with Moody's Investors Services in London and Madrid (2009–2015), where he covered credits across the energy, transportation and telecommunications sectors; and at KBC Bank N.V. in Dublin and Sydney (2004–2008), where he structured and originated project finance transactions. Declan is a member of the ACCA.