Marketing Material*

January 2020 / Research Report

GLOBAL LISTED INFRASTRUCTURE AND MACROECONOMIC ENVIRONMENTS

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1 / Executive Summary

We last wrote a whitepaper on global-listed infrastructure in different macroeconomic environments in September 2013. In this paper, we are revisiting the same topic with six-more years of data. We have selected the Dow Jones Brookfield Global Infrastructure Index to represent the global-listed infrastructure asset class as the index is widely-used and can be utilized as a benchmark. The Dow Jones Brookfield Global Infrastructure Index was launched in July 2008 and therefore, our analysis starts then. Our analysis time frame ends in June 2019. At the time of this writing, the macro environment exhibits signs of being late cycle. GDP growth is slowing and inflation is decelerating. It is likely that we are in late-cycle territory, which is typically when we believe investors should favor lower-risk strategies. The infrastructure asset class has historically been viewed as defensive as cash flows are stable due to fixed-price contracts, and earnings before interest, tax, depreciation and amortization (EBITDA) growth was positive during the 2008-2009 financial crisis.

Over the past ten years, global-listed infrastructure securities (Dow Jones Brookfield Global Infrastructure Index) returned 12.5%, outperforming global equities (MSCI World Index) at 11.3% but underperforming U.S. equities (S&P 500 Index) at 14.9%. The past ten years have seen equities perform well due to lower interest rates and strong GDP growth globally. However, as we approach a more late-cycle environment, more defensive characteristics may be desired. Our analysis shows that global-listed infrastructure has historically performed well during periods of falling sovereign-bond yields[1] and rising corporate-yield spreads[2], as the stable cash flows of infrastructure companies allow debt funding[3] without significantly affecting equity risk premiums. In addition, global-listed infrastructure performed better during periods of below average GDP growth[4].

We determined periods during which GDP growth was above or below average, and during which interest rates and corporate-yield spreads were rising or falling, and computed the absolute and relative performance of global-listed infrastructure equities. Throughout the paper, we used global-macroeconomic variables to explain global infrastructure and sector performance, and utilized specific regional-macroeconomic indicators to explain regional-infrastructure returns.

The time period of our analysis spans eleven years, from July 2008 to June 2019, which only includes one downturn in 2008-2009. Longer-term results may be different from those discussed in this paper.

[1] Please refer to Exhibit 11, which shows the relative performance (to equities) of regional infrastructure indices during periods of falling/rising interest rates, and Exhibit 12, which shows the relative performance (to equities) of infrastructure sector indices during periods of falling/rising interest rates.
[2] Please refer to Exhibit 14, which shows the relative performance (to equities) of regional infrastructure indices during periods of rising/falling corporate yield spreads, and Exhibit 15, which shows the relative performance (to equities) of infrastructure sectors during periods of rising/falling corporate yield spreads.
[3] The Dow Jones Brookfield Global Infrastructure Index had a leverage level of 38.8% as of November 6, 2019.
[4] Please refer to Exhibit 8, which shows the relative performance (to equities) of regional infrastructure indices during periods of below/above average GDP growth, and Exhibit 9, which shows the relative performance (to equities) of infrastructure sectors during periods of below/above average GDP growth.

2 / Introduction

Global-listed infrastructure securities has historically exhibited defensive characteristics. Stable cash flows that underpin the sector's long-term fixed-price contracts contribute to the asset class' defensiveness which has historically been evident during periods of slower economic growth. In this paper, we investigate the behavior of global-listed infrastructure, as represented by the Dow Jones Brookfield Global Infrastructure Index, in different macroeconomic environments using data from July 2008 to June 2019 (11 years).[5]

At the time of this writing, the macro environment exhibits signs of being late cycle. GDP growth is slowing and inflation is decelerating. It is likely that we are in late-cycle territory, which is typically when we believe investors should favor lower-risk strategies.

Our analysis shows that global-listed infrastructure has historically performed well during periods of falling sovereign-bond yields and rising corporate-yield spreads, as the stable cash flows of infrastructure companies allow debt funding without significantly affecting equity risk premiums. In addition, infrastructure's defensive characteristics has historically provided better relative performance compared to equities during periods of below-average GDP growth.

[5] The Dow Jones Brookfield Global Infrastructure Index (USD) was launched in July 2008.

EXHIBIT 1: LISTED INFRASTRUCTURE PERFORMANCE RELATIVE TO EQUITY INDICES (JULY 2008 TO JUNE 2019)

Global/regional indices	Below-avg GDP growth	Above-avg GDP growth	Rising sov. bond yields	Falling sov. bond yields	Rising corp yield spreads	Falling corp yield spreads	Below-avg inflation & falling	Below-avg inflation & rising	Above-avg inflation & falling	Above-avg. inflation & rising
Global	□	□	⊠	✓	✓	⊠	□	□	□	□
Americas	✓	□	⊠	✓	✓	⊠	□	□	□	□
Europe	□	□	□	□	✓	⊠	□	□	□	✓
Asia Pacific	□	□	□	✓	□	□	□	□	□	□
Sector indices										
Airports	✓	□	□	✓	□	□	✓	✓	□	□
Oil & gas storage and transportation	□	□	⊠	✓	□	□	□	✓	✓	⊠
Toll roads	✓	□	□	□	□	□	✓	✓	□	□
Ports	⊠	□	□	⊠	⊠	⊠	⊠	□	⊠	□
Transmission & distribution	✓	□	⊠	✓	□	□	□	✓	✓	⊠
Communications	✓	□	□	✓	✓	□	✓	✓	✓	⊠
Water	✓	□	⊠	✓	✓	□	□	□	✓	□
Diversified infrastructure	□	□	□	□	□	□	✓	✓	⊠	✓

Legend:
✓ Outperform by more than 2.5% annually
□ Similar performance (outperform more than or underperform less than 2.5% annually)
⊠ Underperform by more than 2.5% annually

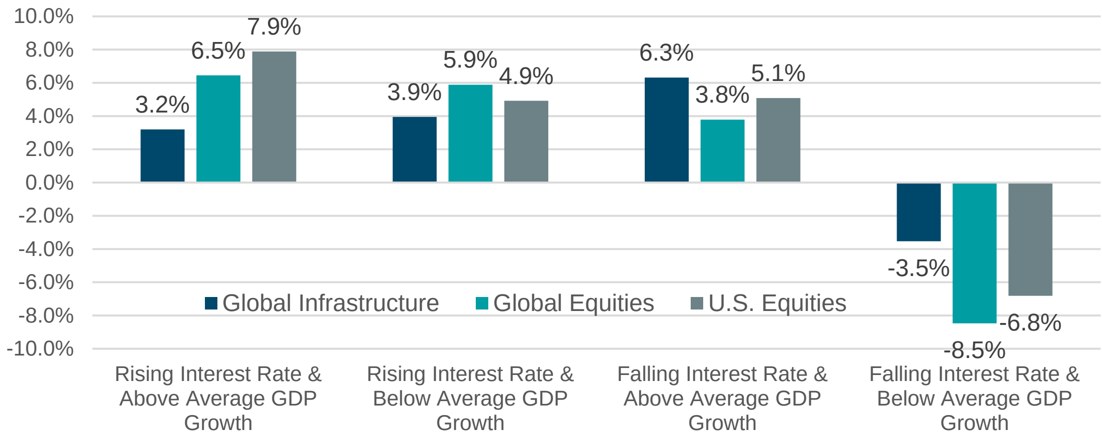
Sources: Bloomberg, MSCI, Oxford Economics, and DWS. As of November 2019. Time period of analysis is from July 2008 to June 2019 (latest data available).
Note: regional infrastructure indicies (Americas, Europe and Asia Pacific) are compared against their respective regional equities indices. All other infrastructure indices (global and all infrastructure sectors) are compared against the world equities index.
Asset class representation as follows: global, Dow Jones Brookfield Global Infrastructure Index; Americas, Dow Jones Brookfield Americas Infrastructure Index; Europe, Dow Jones Brookfield Europe Infrastructure Total Return Index; Asia Pacific, Dow Jones Brookfield Asia Pacific Infrastructure Total Return Index; world equities, MSCI World Index; U.S. equities, S&P 500 Index; European equities; Stoxx 600 Index; Asia Pacific equities, MSCI Asia Pacific Index; airport, Dow Jones Brookfield Airports Infrastructure Total Return Index; oil & gas storage, Dow Jones Brookfield Oil & Gas Storage Infrastructure Index; toll roads, Dow Jones Brookfield Toll Roads Infrastructure Index; ports, Dow Jones Brookfield Ports Infrastructure Index; transmission & distribution, Dow Jones Brookfield Electricity Transmission & Distribution Index; communication, Dow Jones Brookfield Communication Infrastructure Index; water, Dow Jones Brookfield Water Infrastructure Index; diversified, Dow Jones Brookfield Diversified Infrastructure Index; global, Dow Jones Brookfield Global Infrastructure Index.
GDP growth refers to quarter-over-quarter real GDP growth for G7 countries for Global and each region for Americas, Europe and Asia Pacific. Sovereign bond yields refer to G7 interest rates. Yield spreads refer to corporate bond yield spreads over sovereign bond yields. The yield spread indices utilized are as follows: global, Bloomberg Barclays Global Aggregate Corporates; Americas, Bloomberg Barclays US Baa Corporates; Europe, Bloomberg Barclays Pan-European Aggregate Corporate Baa; and Asia Pacific, Bloomberg Barclays Asia Pacific Baa Corporates.
Note: Forecasts may not be a reliable indicators of future returns. No assurance can be given that any forecast or target will be achieved. Forecasts are based on assumptions, estimates, opinions, models and analysis which may prove to be incorrect.

From July 2008 to June 2019, many infrastructure sectors outperformed world equities during periods of below-average GDP growth and declining sovereign-bond yields. All sectors except for ports, oil-and-gas storage and transportation and diversified infrastructure outperformed global equities when GDP growth is below average. The outperformance can be attributed to infrastructure's historically defensive characteristics which would make the asset class more attractive than equities during periods of slower growth. Airports, oil-and-gas storage and transportation, electric transmission and distribution, communications and water have historically tended to outperform world equities during periods of falling sovereign bond yields. Most infrastructure companies tend to be leveraged[3] and would benefit from falling interest rates.

While regional infrastructure indices have shown outperformance during periods of rising corporate bond yield spreads (risk aversion), by sector, only the communications and water sectors have shown outperformance against world equities during periods of rising corporate-bond-yield spreads. Most infrastructure sectors outperformed world equities when inflation is below average and rising.

In addition to how infrastructure has performed relative to single-macroeconomic variables, we also examined how listed infrastructure has performed under a combination of interest rate and GDP growth environments (see Exhibit 2). Global infrastructure performed best when interest rates are falling and GDP growth is above average, which reflected income-generation abilities in favorable economic environments and as many infrastructure companies would benefit from cheaper financing. During stressed economic periods, or recessions (or recession-like conditions), global infrastructure declined less than global and US equities. Conversely, global infrastructure's relative performance was least when interest rates and GDP growth were above average.

EXHIBIT 2: PERFORMANCE COMPARISON DURING FOUR MACROECONOMIC SCENARIOS (JULY 2008 – JUNE 2019)



Sources: Bloomberg, Oxford Economics and DWS. As of October 2019.
Asset class representation as follows: global infrastructure, Dow Jones Brookfield Global Infrastructure Total Return Index; global equities, MSCI World Index; U.S. equities, S&P 500.

GDP growth refers to quarter-over-quarter real GDP growth for G7 countries, and interest rates refer to quarter-over-quarter G7 sovereign bond yield change.
Note: Forecasts may not be a reliable indicators of future returns.

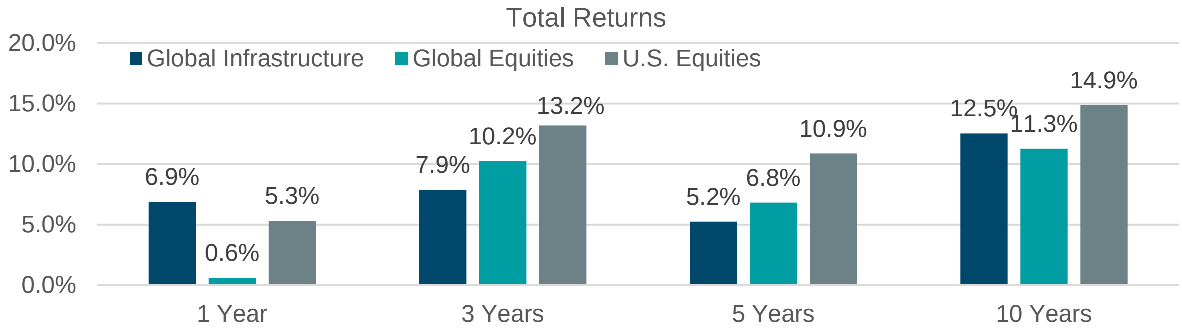
Overall, listed infrastructure has historically exhibited attributes of a defensive asset class with interest rate sensitivity. It has outperformed broad equity markets in favorable economic environments when GDP growth is above average and interest rates are falling and has performed relatively well during tougher time periods when GDP growth is below average. We characterize defensive asset classes as those with stable cash flows, less volatility, and can still have good relative performance during periods of slower growth and falling interest rates. By region, we find the Americas have historically been most defensive, and by sector, communications and water have historically been most attractive.

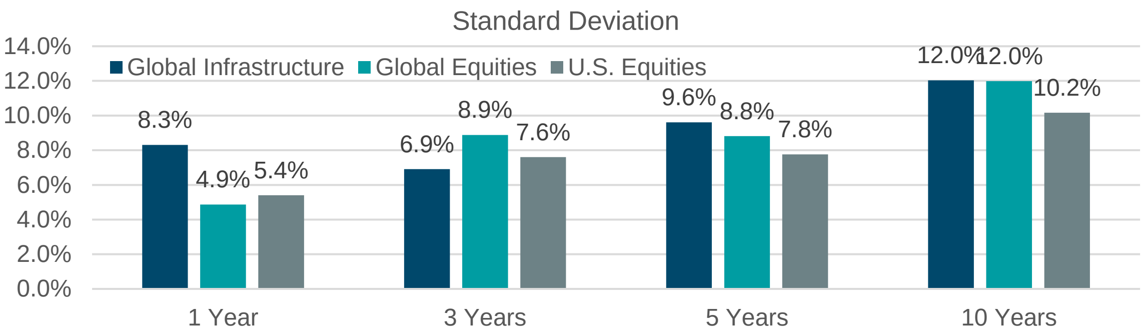
The time period of our analysis spans eleven years, from July 2008 to June 2019, which only includes one downturn in 2008-2009. We start our analysis in July 2008 as the Dow Jones Brookfield Global Infrastructure Index was only launched in July 2008. However, the S&P 500 had already declined by 18.5% from October 2007 to June 2008, whereas our analysis only starts in July 2008. Therefore, arguably, our analysis includes less than one downturn. Longer-term results may be different from those discussed in this paper.

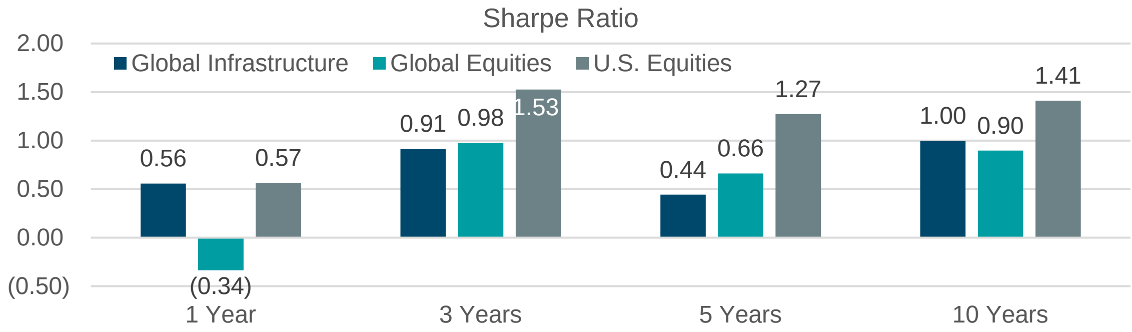
3 / Performance Attributes of Listed Infrastructure

Global-listed infrastructure has delivered attractive returns over various investment horizons on an absolute and risk-adjusted basis, as Exhibit 3 illustrates. Global-listed infrastructure total returns outperformed over the past year and ten years, but underperformed over the past 3- and 5-year time frames. Above average GDP growth over the past several years has contributed to better equity-market performance, and as outlined before, listed infrastructure tend to outperform during periods of below-average GDP growth. On a risk-adjusted basis, the Sharpe ratio shows global-listed infrastructure outperformed global equities over the past ten years, but underperformed U.S. equities. Volatility for global-listed infrastructure has been higher over the past ten years compared to global and US equities likely due to infrastructure companies having higher leverage as well as volatility stemming from the commodities sector in more recent years.

EXHIBIT 3: GLOBAL INFRASTRUCTURE (DOW JONES BROOKFIELD GLOBAL INFRASTRUCTURE INDEX) PERFORMANCE VS. BROAD EQUITY MARKET (MSCI WORLD EQUITIES INDEX FOR GLOBAL EQUITIES AND S&P 500 FOR U.S. EQUITIES)



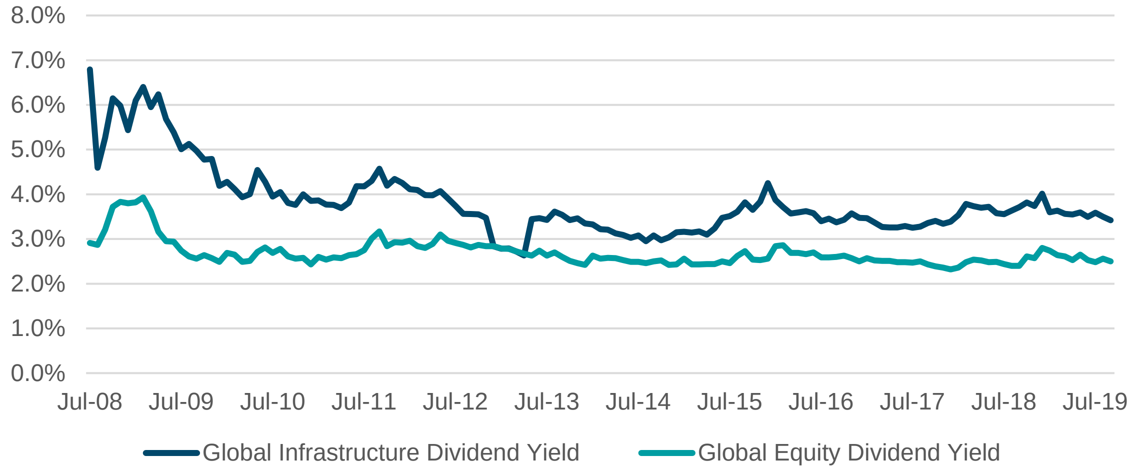




Sources: Bloomberg and DWS. As of October 2019.
Asset class representation as follows: global infrastructure, Dow Jones Brookfield Global Infrastructure Total Return Index; global equities, MSCI World Index; U.S. equities, S&P 500.
Note: Forecasts may not be a reliable indicators of future returns. No assurance can be given that any forecast or target will be achieved. Forecasts are based on assumptions, estimates, opinions, models and analysis which may prove to be incorrect.

Exhibit 4 shows dividend yields of global-listed infrastructure have historically been 1.15% higher than the broader equity markets since July 2008. Most recently, this gap stood at 92 bps as of September 2019. The higher dividend yields make the infrastructure asset class more attractive as bond yields have compressed globally. As of November 2019, the U.S. 10-year Treasury yield was 1.7%, the 10-year Bund yield was -0.33%, and the 10-year Japanese government bond yield was -0.09%.

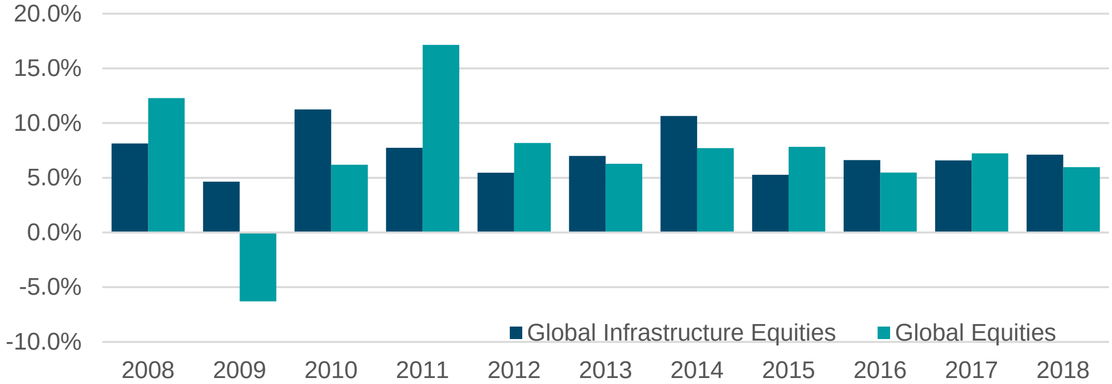
EXHIBIT 4: INFRASTRUCTURE DIVIDEND YIELDS ARE HIGHER THAN GLOBAL EQUITY DIVIDEND YIELDS (12-MONTH TRAILING)



Source: Bloomberg. As of October 2019.
Asset class representation as follows: global infrastructure, Dow Jones Brookfield Global Infrastructure Total Return Index; global equities, MSCI World Index; U.S. equities, S&P 500. Past performance may not be indicative of future results.

In addition as seen below in Exhibit 5, global-listed infrastructure generated positive EBITDA (earnings before interest taxes depreciation & amortization) growth annually since 2008, even during the financial crisis in 2009 when global equities EBITDA declined sharply. Fixed contracts and utility-like characteristics have contributed to infrastructure equities' defensiveness. Global infrastructure equities' EBITDA growth averaged 7.3% from 2008 to 2018, slightly higher than the broader equities market at 7.1%. Global infrastructure volatility from July 2008 to September 2019 is 17.0%, slightly lower than global equities at 17.9%.

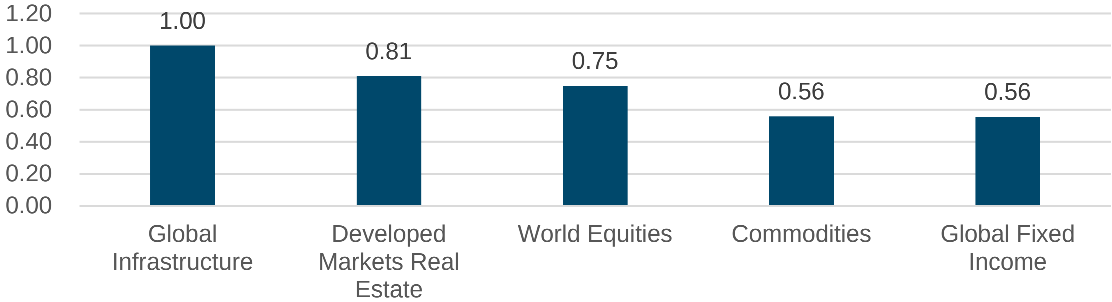
EXHIBIT 5: INFRASTRUCTURE ANNUAL EBITDA GROWTH HAS BEEN POSITIVE SINCE 2008



Source: BofA Merrill Lynch Global Quantitative Research, DWS, Factset, and Bloomberg. As of November 2019.
Asset class representation as follows: global infrastructure, Dow Jones Brookfield Global Infrastructure Total Return Index; global equities, MSCI World Index.
Past performance may not be indicative of future results.

Global-listed infrastructure has historically shown low correlation to equities, fixed income and commodities, as Exhibit 6 shows. Global-listed infrastructure can potentially be used to add diversification to a portfolio.

EXHIBIT 6: GLOBAL INFRASTRUCTURE 10-YEAR CORRELATION WITH OTHER GLOBAL ASSET CLASSES



Source: Bloomberg and DWS. As of October 2019.
Asset class representation as follows: global infrastructure, Dow Jones Brookfield Global Infrastructure Total Return Index; developed markets real estate, FTSE EPRA/NAREIT Developed Markets Real Estate Index; world equities, MSCI World Index; commodities, Bloomberg Commodities Index; global fixed income, Bloomberg Barclays Global Aggregate Total Return Index. Past performance may not be indicative of future results.

4 / Infrastructure Returns and Macro Environments

In this section, we discuss how macroeconomic environments over the past eleven years have affected listed infrastructure returns along three dimensions: GDP growth, rising/declining interest rates and inflation.

GDP growth

Across most regions, listed infrastructure tended to deliver higher returns when GDP growth was above average due to higher infrastructure utilization (Exhibit 7). During periods of economic expansion, particularly when GDP growth is above average, industrial production, global trade and travel tend to increase, thus contributing to increased demand for infrastructure. However, relative to equities, listed infrastructure tends to outperform during periods when GDP growth is below average.

Most infrastructure sectors (Exhibit 8) outperformed global equities when GDP growthwas below average, with airports, communications and water sectors delivering larger excess returns. Ports were the only infrastructure sector that did not exhibit outperformance during time periods with below average GDP growth, reflecting overcapacity and cyclical nature of global trade. More recently, trade disruptions have made ports a troubled sector. In addition, there are only five ports companies included in the Dow Jones Brookfield Global Infrastructure Index, and the two largest are subsidiaries of state-owned entities. These five port companies are small in size and only comprise 0.5% of the Dow Jones Brookfield Global Infrastructure Index as of November 2019.

EXHIBIT 7: LISTED INFRASTRUCTURE ANNUALIZED AVERAGE MONTHLY RETURNS DURING DIFFERENT GDP GROWTH SCENARIO (JULY 2008 – JUNE 2019)

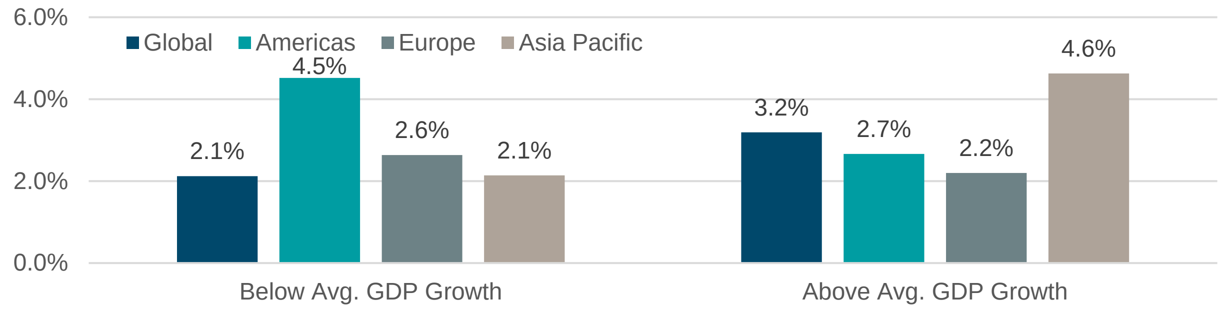


EXHIBIT 8: LISTED INFRASTRUCTURE RETURNS RELATIVE TO GLOBAL AND REGIONAL EQUITIES RETURNS DURING DIFFERENT GDP GROWTH SCENARIOS (JULY 2008 – JUNE 2019)

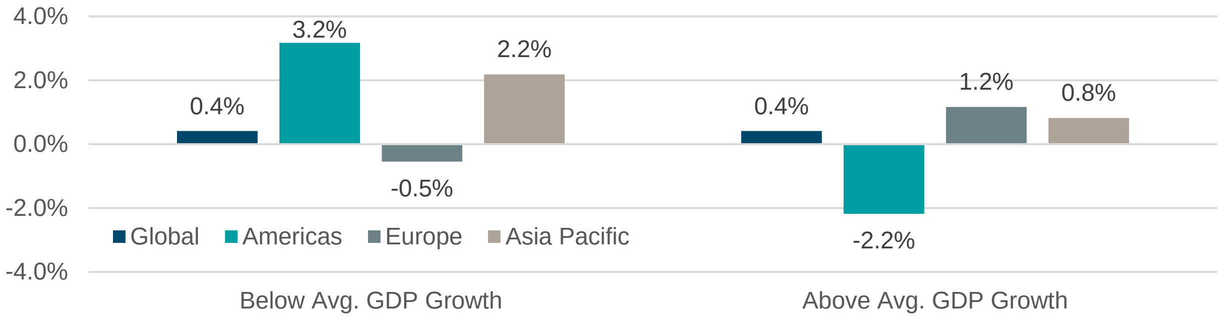
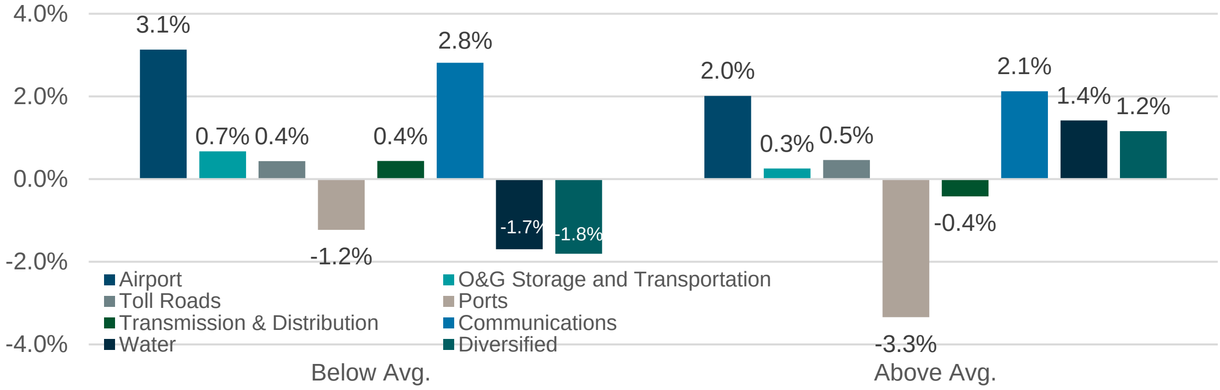


EXHIBIT 9: LISTED INFRASTRUCTURE SECTOR RETURNS RELATIVE TO MSCI WORLD INDEX RETURNS DURING DIFFERENT GDP GROWTH SCENARIOS (JULY 2008 – JUNE 2019)



Source: Bloomberg, Oxford Economics and DWS. As of October 2019. Returns are average annualized monthly returns. Performance is historical and does not guarantee future results. GDP growth refers to quarter-over-quarter annualized real GDP growth for OECD countries for Global and each region for Americas, Europe and Asia Pacific in Exhibit 7 & 8. GDP growth refers to quarter-over-quarter annualized real GDP growth for OECD countries in Exhibit 9.
Note: regional infrastructure indicies (Americas, Europe and Asia Pacific) are compared against their respective regional equities indices. All other infrastructure indices (global and all infrastructure sectors) are compared against the world equities index.
In Exhibit 7 & 8, asset-class representation is as follows: global, Dow Jones Brookfield Global Infrastructure Index; Americas, Dow Jones Brookfield Americas Infrastructure Index; Europe Dow Jones Brookfield European Infrastructure Index; Asia Pacific, Dow Jones Brookfield Asia Pacific Infrastructure Index; World equities, MSCI World Index; U.S. equities, S&P 500 Index; European equities; Stoxx 600 Index; Asia Pacific equities, MSCI Asia Pacific Index . In Exhibit 9, asset-class representation is as follows: airport, Dow Jones Brookfield Airports Infrastructure Total Return Index; oil & gas storage, Dow Jones Brookfield Oil & Gas Storage Infrastructure Index; toll roads, Dow Jones Brookfield Toll Roads Infrastructure Index; ports, Dow Jones Brookfield Ports Infrastructure Index; transmission & distribution, Dow Jones Brookfield Electricity Transmission & Distribution Index; communication, Dow Jones Brookfield Communication Infrastructure Index; water, Dow Jones Brookfield Water Infrastructure Index; diversified, Dow Jones Brookfield Diversified Infrastructure Index; global, Dow Jones Brookfield Global Infrastructure Index; world equities, MSCI World Index

Rising/falling interest rates

Historically, listed infrastructure have generally produced better returns during periods of falling sovereign bond yields. As discussed above, infrastructure companies generally employ higher leverage compared to companies in the broader equities indicies, which makes the asset class more interest rate sensitive. As of November 2019, the Dow Jones Brookfield Global Infrastructure Index had a weighted average leverage (debt as a percentage of enterprise value) of 38.8%[6]. In contrast, the S&P 500 Index had weighted average leverage of 30.5%[6]. Historically, infrastructure assets tend to have long-duration contracts that generate stable cash flows, which is also likely why this asset class is more interest-rate sensitive. Sovereign-bond yields have generally declined over the past ten years, which has in turn supported infrastructure returns as companies would have lower debt burdens. Infrastructure companies in Asia Pacific showed the most resilience when rates increased. In fact, Asia Pacific infrastructure companies have historically appeared to be more growth sensitive as they outperformed other regions during periods of above average GDP growth, and less sensitive to interest rates compared to infrastructure companies in the Americas and Europe.

Similarly, all infrastructure sectors have historically outperformed equities during periods of falling sovereign bond yields except for ports. As with our analysis on GDP growth, port companies are dependent on global trade and therefore, more sensitive to global economic growth. Airports and communications companies had the largest excess returns during periods of falling bond yields.

[6] Bloomberg

EXHIBIT 10: LISTED INFRASTRUCTURE ANNUALIZED AVERAGE MONTHLY RETURNS DURING DIFFERENT INTEREST RATE SCENARIOS (JULY 2008 – JUNE 2019)

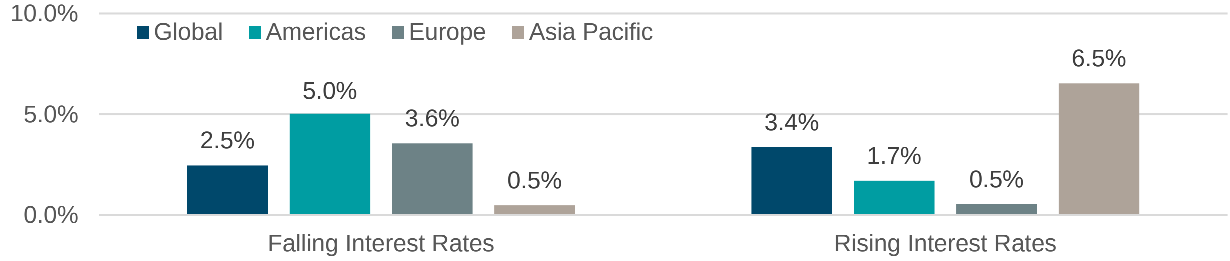


EXHIBIT 11: LISTED INFRASTRUCTURE RETURNS RELATIVE TO GLOBAL AND REGIONAL EQUITIES RETURNS DURING DIFFERENT INTEREST RATE SCENARIOS (JULY 2008 – JUNE 2019)

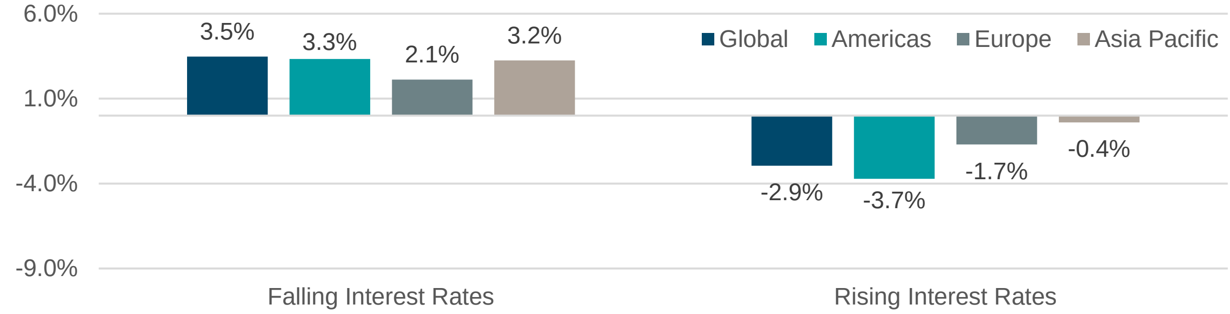
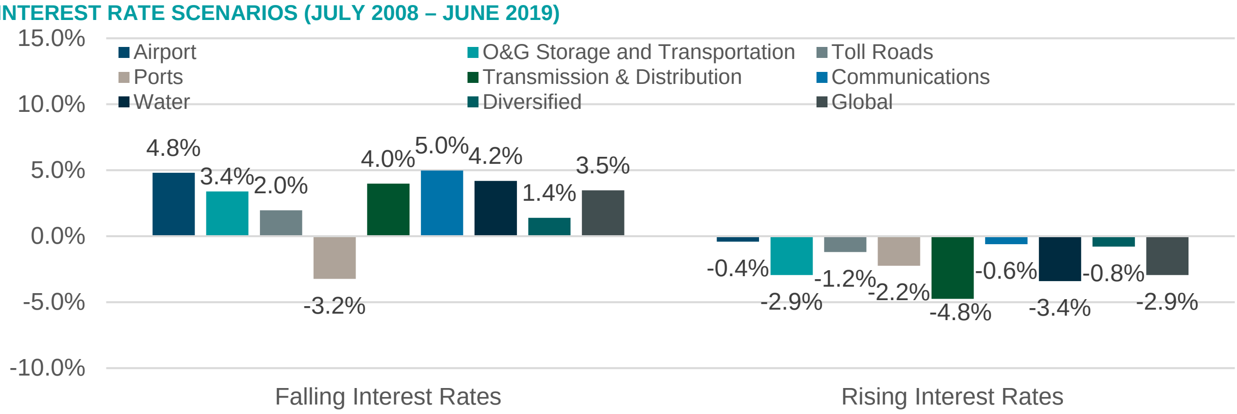


EXHIBIT 12: LISTED INFRASTRUCTURE SECTOR RETURNS RELATIVE TO MSCI WORLD INDEX RETURNS DURING DIFFERENT INTEREST RATE SCENARIOS (JULY 2008 – JUNE 2019)



Source: Bloomberg, Oxford Economics and DWS. As of November 2019. Returns are average annualized monthly returns. Performance is historical and does not guarantee future results. Interest rates refer to G7 interest rates from Oxford Economics for global, U.S. 10-year Treasury Yields for Americas, Bloomberg Barclays Euro Aggregate Treasury Index for Europe, and Bloomberg Barclays Asia Pacific Aggregate Government Related Index for Asia Pacific.
Note: regional infrastructure indicies (Americas, Europe and Asia Pacific) are compared against their respective regional equities indices. All other infrastructure indices (global and all infrastructure sectors) are compared against the world equities index. In Exhibit 10 and 11, asset-class representation is as follows: global, Dow Jones Brookfield Global Infrastructure Index; Americas, Dow Jones Brookfield Americas Infrastructure Index; Europe, Dow Jones Brookfield Europe Infrastructure Total Return Index; Asia Pacific, Dow Jones Brookfield Asia Pacific Infrastructure Total Return Index; world equities, MSCI World Index; U.S. equities, S&P 500 Index; European equities; Stoxx 600 Index; Asia Pacific equities, MSCI Asia Pacific Index. In Exhibit 12, asset-class representation is as follows: airport, Dow Jones Brookfield Airports Infrastructure Total Return Index; oil & gas storage, Dow Jones Brookfield Oil & Gas Storage Infrastructure Index; toll roads, Dow Jones Brookfield Toll Roads Infrastructure Index; ports, Dow Jones Brookfield Ports Infrastructure Index; transmission & distribution, Dow Jones Brookfield Electricity Transmission & Distribution Index; communication, Dow Jones Brookfield Communication Infrastructure Index; water, Dow Jones Brookfield Water Infrastructure Index; diversified, Dow Jones Brookfield Diversified Infrastructure Index; global, Dow Jones Brookfield Global Infrastructure Index.

Rising/Falling Corporate Bond Yield Spread

Corporate-bond-yield spreads over sovereign-bond yields can signal a risk-on (falling spreads) or risk-off/aversion (rising spreads) environments. Infrastructure returns were historically strongest during risk-on (falling spreads) environments as infrastructure utilization increases with better economic activity as described in the section on GDP growth. However, infrastructure's relative performance to equities has historically been better during risk-off (rising spreads) environments which speaks to the defensive nature of the asset class. Stable cash flows and fixed contracts have historically been defensive features for infrastructure.

Most infrastructure sectors also have historically shown higher relative returns during risk-off (rising spread) periods. The communications and water sectors showed the highest excess returns. The infrastructure sectors that have underperformed equities during risk-off (rising spread) periods have historically been the toll road, port and diversified sectors.

EXHIBIT 13: LISTED INFRASTRUCTURE ANNUALIZED AVERAGE MONTHLY RETURNS DURING DIFFERENT YIELD SPREAD SCENARIOS (JULY 2008 – SEPTEMBER 2019)

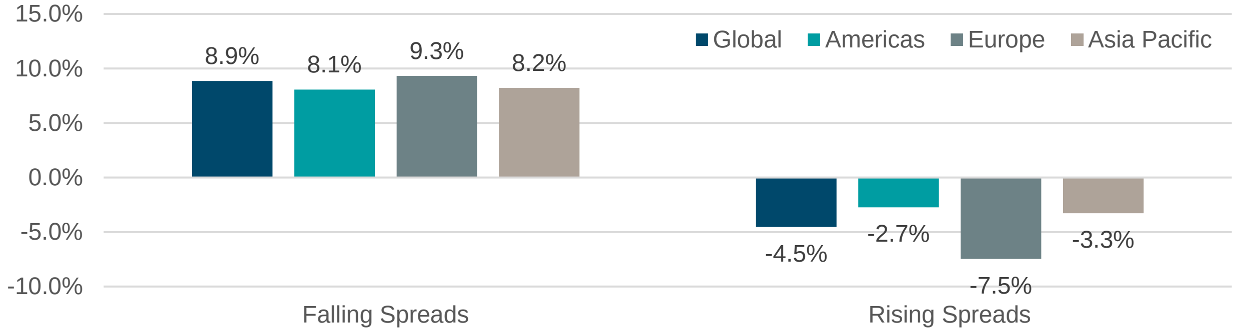


EXHIBIT 14: LISTED INFRASTRUCTURE RETURNS RELATIVE TO GLOBAL AND REGIONAL EQUITIES RETURNS DURING DIFFERENT YIELD SPREAD SCENARIOS (JULY 2008 – SEPTEMBER 2019)

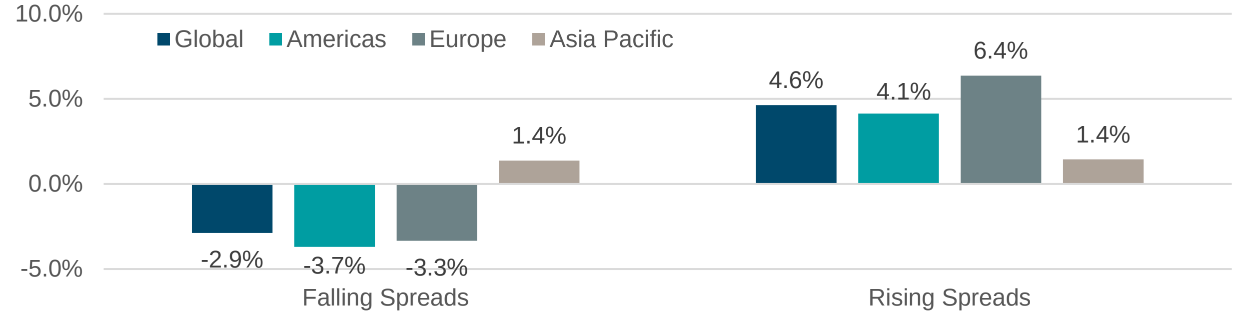
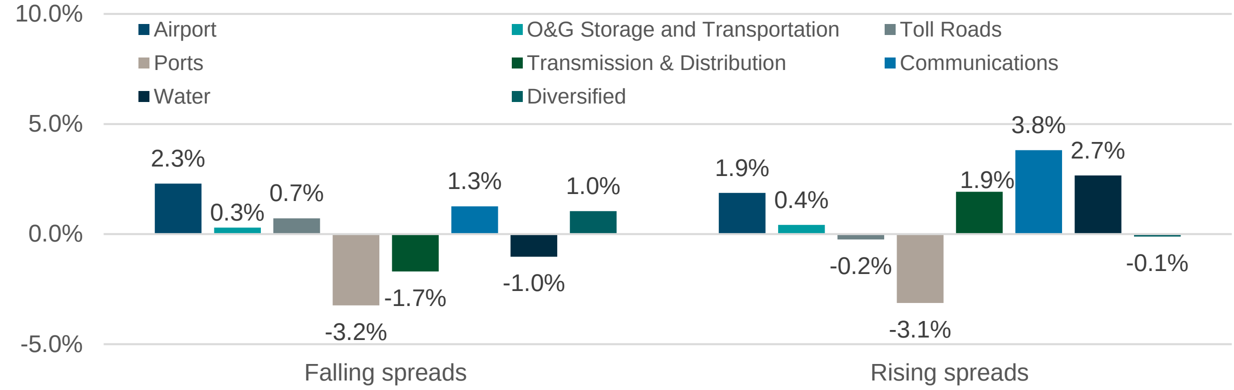


EXHIBIT 15: LISTED INFRASTRUCTURE SECTOR RETURNS RELATIVE TO MSCI WORLD INDEX RETURNS DURING DIFFERENT YIELD SPREAD SCENARIOS (JULY 2008 – SEPTEMBER 2019)



Source: Bloomberg, Oxford Economics and DWS. As of October 2019. Returns are average annualized monthly returns. Performance is historical and does not guarantee future results. Yield spreads refer to corporate bond yield spreads over sovereign bond yields. The yield spread indices utilized are as follows: global, Bloomberg Barclays Global Aggregate Corporates; Americas, Bloomberg Barclays US Baa Corporates; Europe, Bloomberg Barclays Pan-European Aggregate Corporate Baa; and Asia Pacific, Bloomberg Barclays Asia Pacific Baa Corporates.
Note: regional infrastructure indicies (Americas, Europe and Asia Pacific) are compared against their respective regional equities indices. All other infrastructure indices (global and all infrastructure sectors) are compared against the world equities index.
The asset class representations are as follows: global, Dow Jones Brookfield Global Infrastructure Index; Americas, Dow Jones Brookfield Americas Infrastructure Index; Europe, Dow Jones Brookfield Europe Infrastructure Total Return Index; Asia Pacific, Dow Jones Brookfield Asia Pacific Infrastructure Total Return Index; world equities, MSCI World Index; U.S. equities, S&P 500 Index; European equities; Stoxx 600 Index; Asia Pacific equities, MSCI Asia

Pacific Index; airport, Dow Jones Brookfield Airports Infrastructure Total Return Index; oil & gas storage, Dow Jones Brookfield Oil & Gas Storage Infrastructure Index; toll roads, Dow Jones Brookfield Toll Roads Infrastructure Index; ports, Dow Jones Brookfield Ports Infrastructure Index; transmission & distribution, Dow Jones Brookfield Electricity Transmission & Distribution Index; communication, Dow Jones Brookfield Communication Infrastructure Index; water, Dow Jones Brookfield Water Infrastructure Index; diversified, Dow Jones Brookfield Diversified Infrastructure Index; global, Dow Jones Brookfield Global Infrastructure Index.

Inflation Scenarios

We focused on how three-year rolling inflation from July 2008 through June 2019 has affected the performance of listed infrastructure. On an absolute basis, infrastructure across all regions have performed better when inflation is above average and falling. Relative to equities, infrastructure outperformed when inflation is above average and rising or falling.

However, there does not seem to be a clear pattern within the different infrastructure sectors. Many infrastructure sectors (O&G Storage and Transportation, Toll Roads, Transmission & Distribution, Communications, and Water) underperformed equities when inflation was above average and rising. Above-average and rising inflation signals better economic growth, which is when equities tended to outperform infrastructure. In general, most infrastructure sectors outperformed equities during other periods, for instance when inflation was below average and falling or rising, and above average and falling. Infrastructure assets are explicitly indexed to inflation through regulation or contracts, and assets without such an explicit link often have regulation with implicit inflationary pass-throughs to achieve similar outcomes. Therefore, infrastructure historically often acts as a hedge against inflation, which could explain why infrastructure tends to be resilient to changes in inflation.

EXHIBIT 16: LISTED INFRASTRUCTURE ANNUALIZED AVERAGE MONTHLY RETURNS DURING DIFFERENT INFLATION SCENARIOS (JULY 2008 – JUNE 2019)

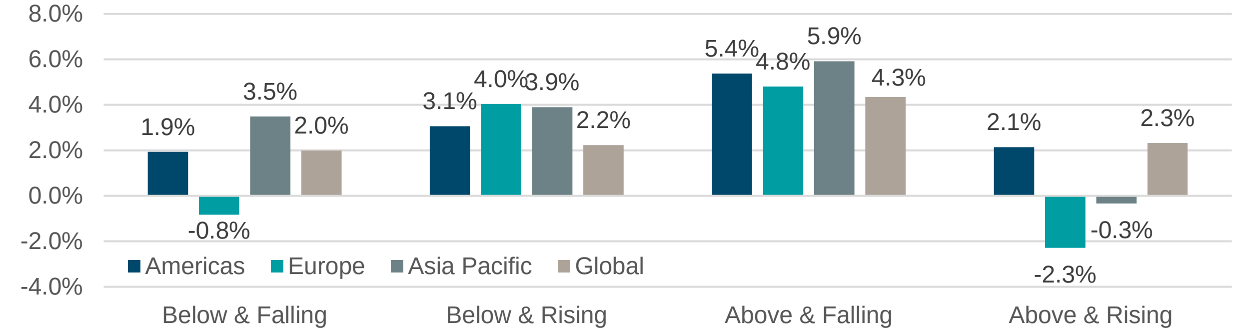


EXHIBIT 17: LISTED INFRASTRUCTURE RETURNS RELATIVE TO GLOBAL AND REGIONAL EQUITIES RETURNS DURING DIFFERENT INFLATION SCENARIOS (JULY 2008 – JUNE 2019)

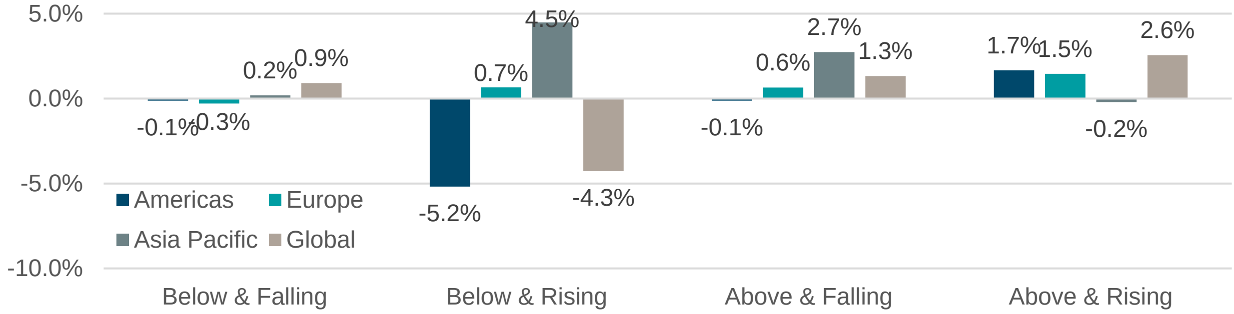
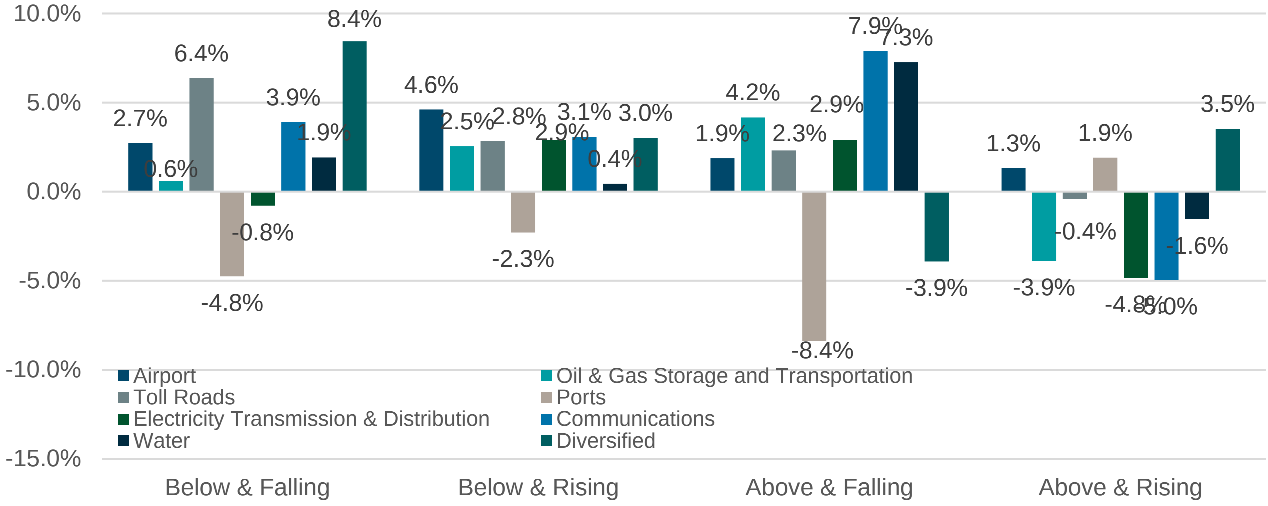


EXHIBIT 18: LISTED INFRASTRUCTURE SECTOR RETURNS RELATIVE TO MSCI WORLD INDEX RETURNS DURING DIFFERENT INFLATION SCENARIOS (JULY 2008 – JUNE 2019)



Source: Bloomberg, Oxford Economics and DWS. As of October 2019. Returns are average annualized monthly returns. Performance is historical and does not guarantee future results. Inflation refers to annual inflation rates from Oxford Economics; global refers to G7 countries inflation, Europe refers to Western Europe inflation, and Asia Pacific refers to Asia Pacific inflation.
Note: regional infrastructure indicies (Americas, Europe and Asia Pacific) are compared against their respective regional equities indices. All other infrastructure indices (global and all infrastructure sectors) are compared against the world equities index.
The asset class representations are as follows: global, Dow Jones Brookfield Global Infrastructure Index; Americas, Dow Jones Brookfield Americas Infrastructure Index; Europe, Dow Jones Brookfield Europe Infrastructure Total Return Index; Asia Pacific, Dow Jones Brookfield Asia Pacific Infrastructure Total Return Index; world equities, MSCI World Index; U.S. equities, S&P 500 Index; European equities; Stoxx 600 Index; Asia Pacific equities, MSCI Asia Pacific Index; airport, Dow Jones Brookfield Airports Infrastructure Total Return Index; oil & gas storage, Dow Jones Brookfield Oil & Gas Storage Infrastructure Index; toll roads, Dow Jones Brookfield Toll Roads Infrastructure Index; ports, Dow Jones Brookfield Ports Infrastructure Index; transmission & distribution, Dow Jones Brookfield Electricity Transmission & Distribution Index; communication, Dow Jones Brookfield Communication Infrastructure Index; water, Dow Jones Brookfield Water Infrastructure Index; diversified, Dow Jones Brookfield Diversified Infrastructure Index; global, Dow Jones Brookfield Global Infrastructure Index.

Conclusion

Global-listed infrastructure has exhibited defensive traits that would appeal to investors seeking opportunities in a late-cycle environment as we believe we are experiencing today. We have shown in our analysis that historically, listed infrastructure has tended to outperform the broader equities market during periods of below-average GDP growth and during periods of falling interest rates. In addition, infrastructure equities also tended to outperform the broader equities market during periods of rising corporate-bond-yield spreads (“risk-off”). Infrastructure has also historically served as a good hedge against inflation due to assets being explicitly indexed to inflation through contracts or regulation. In fact, our analysis shows that infrastructure equities outperformed broader equities when inflation was above average.

It is important to note that this research paper analyzes the behavior of infrastructure equities during the time period of July 2008 to June 2019, a total of eleven years which only includes a partial period of one market-cycle downturn. Analysis using longer time periods covering more downturns may have yielded different results.

We see the following potentially as key benefits to investing in infrastructure:

1. Better risk-adjusted returns compared to global equities: On an historical basis, global listed infrastructure has produced better Sharpe ratio compared to global equities, although lower than U.S. equities.
2. Better performance during times of below average GDP growth: Infrastructure equities have shown better performance relative to global equities during periods of slower economic growth, similar to late-cycle environments. In addition, infrastructure equities have shown resilience during “risk-off” time periods when corporate bond yields rise.

3. Hedge against inflation: Many infrastructure assets are explicitly indexed to inflation through contracts or regulation and is therefore a good hedge against inflation. In addition, we have shown that infrastructure outperformed equities during periods of above average inflation.
4. Higher dividend yields: Infrastructure equities have historically produced higher dividends compared to the broader equities market, by 1.15% since 2008.
5. Stable EBITDA growth: Infrastructure EBITDA growth has been stable, averaging 7.3% from 2008 to 2018, slightly higher than global equities at 7.1%. Furthermore, EBITDA growth was positive for all time periods, even during the recession in 2008 when global equities EBITDA growth declined sharply.

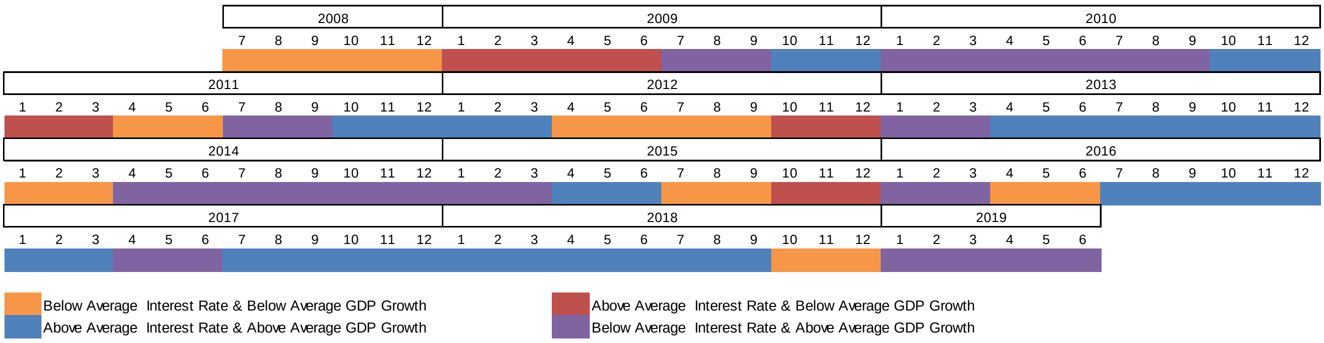
5 / Appendix

EXHIBIT 19: DOW JONES BROOKFIELD INFRASTRUCTURE INDICES

Global/regional indices	Number of constituents	Market cap (USD $billions)	Top 5 components
Global	101	1,125	American Tower Corp., Endbridge Inc., Crown Castle Intl Corp., Vinci SA, TC Energy Corp.
Americas	44	721	American Tower Corp., Endbridge Inc., Crown Castle Intl Corp., TC Energy Corp, Sempra Energy
Europe	29	258	Vinci SA, National Grid, Ferrovial SA, Aena SME, Cellnex Telecom SA
Asia Pacific	28	146	Transurban Group, Hong Kong & China Gas, China Tower Corp, Tokyo Gas, APA Group
Sector indices	**Number of constituents**	**Market cap (USD $billions)**	**Top 5 components**
Communications	8	216	American Tower Corp., Crown Castle Intl Corp, SBA Communications, Cellnex Telecom, China Tower Corp.
Oil and gas storage and transportation	38	457	Endbridge Inc, TC Energy, Sempra Energy, Kinder Morgan, Oneok Inc
Airports	11	53	Aena SME, Sydney Airport, ADP, Auckland Intl Airport, Grupo Aeroporuario
Ports	5	5.5	China Merchants Port Holdings, Cosco Shipping Ports, Hutchison Port, Westshore Terminals Inv, Hamburger Hafen
Toll Roads	11	112	Vinci SA, Transurban Group, Atlantia SPA, Getlink SE, Altas Arteria
Transmission & Distribution	13	178	National Grid, Consolidated Edison, Eversource Energy, Edison Intl, Fortis Inc.
Water	11	68	American Water Works, Aqua America, United Utilities, Severn Trent, Pennon Group
Diversified infrastructure	4	35	Centerpoint Energy, Ferrovial, HICL Infrastructure, 3I Infrastructure

Source: Bloomberg, as of November 2019.

EXHIBIT 20: TIME FRAME FOR MACROECONOMIC SCENARIOS



Source: Oxford Economics and DWS as of June 2019

EXHIBIT 21: FIVE YEAR TOTAL RETURNS FOR INFRASTRUCTURE INDICES

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	YTD 11/8/19
Dow Jones Brookfield Global Infrastructure Index	16.3%	-14.4%	12.5%	15.8%	-7.9%	21.8%
Dow Jones Brookfield Americas Infrastructure Index	19.9%	-22.6%	25.2%	10.0%	-8.1%	22.3%
Dow Jones Brookfield Europe Infrastructure Index	11.9%	0.5%	-8.6%	27.2%	-11.5%	23.9%
Dow Jones Brookfield Asia Pacific Infrastructure Index	10.0%	2.3%	-0.6%	24.0%	0.7%	16.6%
Dow Jones Brookfield Communications Infrastructure Index	17.7%	-0.4%	1.6%	33.9%	6.4%	29.0%
Dow Jones Brookfield Oil & Gas Storage Infrastructure Index	15.8%	-30.3%	27.5%	6.4%	-8.1%	21.0%
Dow Jones Brookfield Airports Infrastructure Index	14.2%	17.9%	4.2%	39.5%	-14.9%	22.0%
Dow Jones Brookfield Ports Infrastructure Index	3.4%	-19.9%	-4.3%	7.7%	-25.1%	-5.2%
Dow Jones Brookfield Toll Roads Infrastructure Index	9.9%	4.4%	-6.1%	43.1%	-15.3%	25.7%
Dow Jones Brookfield Transmission & Distribution Infra. Index	22.3%	0.1%	3.6%	4.4%	-11.5%	11.1%
Dow Jones Brookfield Water Infrastructure Index	17.9%	4.2%	3.6%	20.0%	-8.8%	27.6%
Dow Jones Brookfield Diversified Infrastructure Index	5.7%	-3.9%	7.5%	36.8%	-11.6%	30.1%

Source: Bloomberg and DWS. As of November 2019.

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