

Infrastructure Investing

Key benefits and risks | 4Q2015

INFRASTRUCTURE CAN BE DEFINED AS THE ESSENTIAL FACILITIES AND SERVICES UPON WHICH THE ECONOMIC PRODUCTIVITY OF SOCIETY DEPENDS.

These assets are typically involved in the movement and storage of goods, people, water, and energy, and include:

- Regulated assets, including electricity transmission lines, gas and oil pipelines, water distribution systems, and wastewater collection and processing systems
- Transportation assets, including toll roads, bridges, tunnels, railroads, rapid transit links, seaports, and airports
- Communications assets, including radio and television broadcast towers, wireless communications towers, cable systems, and satellite networks
- Social infrastructure assets, including schools, hospitals, courthouses, and other government buildings.

Infrastructure is an expansive asset class, covering a wide span in the risk-return spectrum. The risk, return, and cash flow expectations vary on multiple dimensions such as an asset's maturity, service area demographics, regulatory and political risks. Core infrastructure covers the lower risk-lower return end of the spectrum. A core infrastructure asset is defined as an infrastructure asset for which the cash flows to equity owners is forecastable with a low margin of error. In that regard, core infrastructure consists of assets that are (i) mature beyond their demand ramp-up phases, (ii) functioning in established and transparent regulatory and political environments, (iii) serving demographically and economically sound service areas, and (iv) long-lived with minimal obsolescence or technology risks. Regulated utilities, energy assets with long term contracts, and transportation assets with long term concession agreements in the OECD economies can be defined as core assets, as long as they have the characteristics stated above. Historically, core infrastructure assets (the lower end of the risk spectrum) have offered equity investors low double digit returns with the majority of that return coming from cash yield and the rest from capital appreciation.

EXHIBIT 1: ILLUSTRATIVE RETURNS FOR CORE INFRASTRUCTURE ASSETS

Sector	Relative risk assessment	Avg. cash yield %	Avg. expected return (%) ¹	Capital appreciation potential
Social infrastructure/PPPs and PFIs ²	Low	4-5	5-8	Low
Contracted power generation ³	Low	5-8	6-10	Low
Regulated utilities	Low-medium	4-7	8-10	Low-medium
Toll roads	Low-medium	4-6	8-12	Low-medium
Airports	Medium	5-7	10-15	Medium
Seaports	Medium	5-7	11-16	Medium
Freight rail	Medium-high	6-8	12-16	Medium-high
Telecommunication infrastructure	High	5-9	12-18	High
Merchant power generation	High	0-4	14-20	High

Source: J.P. Morgan Asset Management as of March 31, 2015.

¹ Assumes sector average loan-to-value ratios, ranging between 50% and 85%.

² PPP stands for Public Private Partnership and PFI stands for Private Finance Initiative; both terms describe assets with government guaranteed payment mechanisms.

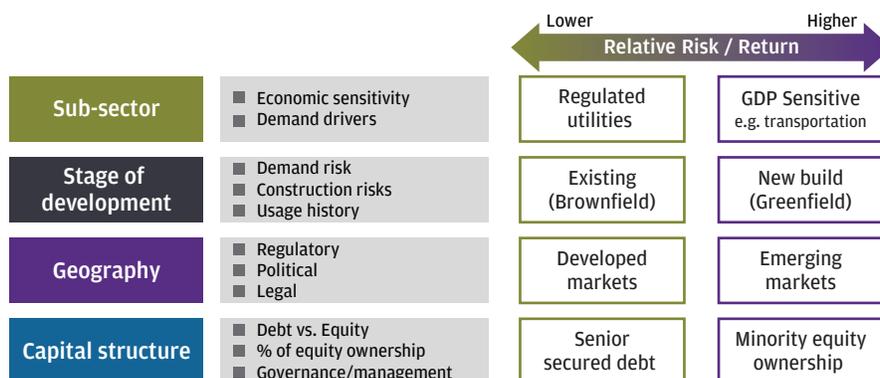
³ Assumes contract length of 10 or more years.

The following illustrative returns and yields (**Exhibit 1**) are based on historical data and our expectations. Given the changing market environment, and increasing allocations to infrastructure by institutional investors, the return expectations are also subject to change.

There is a current and growing global need for governmental bodies to finance, maintain, modernize, expand and develop infrastructure facilities essential to ensuring continued growth in economic activity and productivity. It is estimated that \$45 trillion will be required to modernize and expand water, electricity and transportation systems in the U.S., Canada and Western Europe over the next 15 years.⁵ With governments increasingly hard-pressed to obtain the capital required to maintain and expand their infrastructure, they have begun to recognize that private sector capital can be used to satisfy those infrastructure needs, allowing them to focus existing limited resources toward

other vital functions within their communities. These trends present a significant opportunity for investors to acquire and manage high-quality assets around the world.

Investors are increasingly considering infrastructure as an attractive investment alternative primarily because these assets can provide portfolio diversification with the potential for stable cash yields.⁶ In the current market environment, the demand for core plus private infrastructure has been particularly strong because these investments seek to offer long-term exposure to relatively stable, economically insensitive, inflation protected cash flows. These assets have the potential to generate low volatility, consistent growth of cash flows and returns that are uncorrelated with other asset classes, resulting in very attractive diversification benefits for investors. This paper summarizes the key benefits and risks of investing in infrastructure.



⁵ OECD Publishing, Strategic Transport Infrastructure Needs to 2030, September 2012 and IEA, Energy Technology Perspectives, August 2013.

⁶ "Infrastructure Investing: A Portfolio Diversifier with Stable Cash Yields," J.P. Morgan Asset Management 2014.

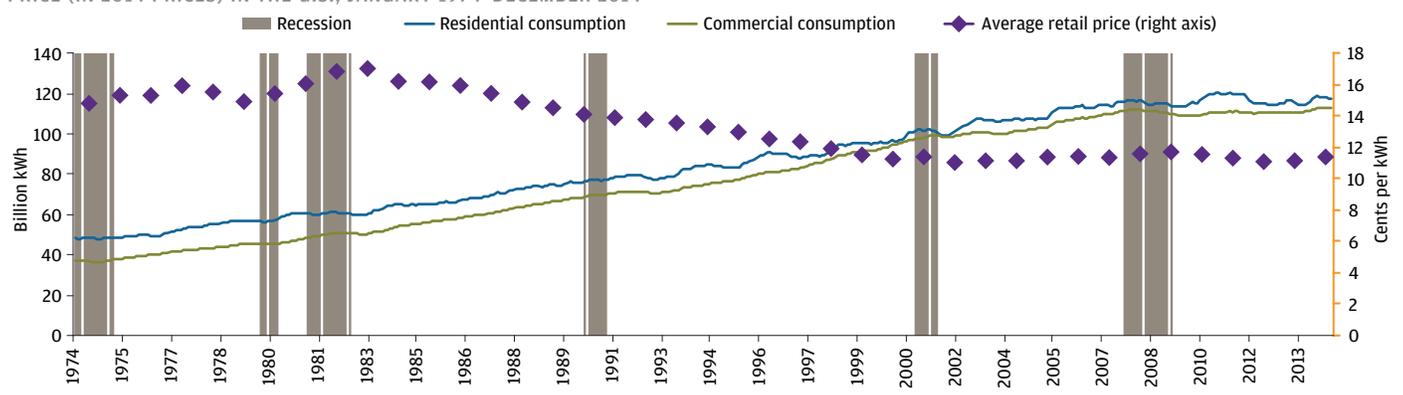
Infrastructure assets have several unique characteristics that make them attractive investments. Here are some potential benefits:

- **Stable cash flows and resilience to economic fluctuations:** Because most infrastructure assets have monopolistic positions in and provide essential services to the markets they serve, demand is often very stable. For those assets, usage does not materially decline with price increases or during periods of economic weakness.
- **Diversification benefits:** As a result of low usage volatility, economic insensitivity, and inflation-protection characteristics, a portfolio of infrastructure assets has low correlation to other major asset classes resulting in attractive diversification benefits.
- **Attractive long-term returns:** The services provided by infrastructure assets are essential for the functioning of a society. While not allowing infrastructure assets to charge monopoly prices, governments must allow private owners to earn fair returns in order to incentivize them to keep facilities in good working order, and invest for future growth and modernization.
- **Inflation protection:** Rates charged by infrastructure assets are determined by regulators, concession agreements with governments, and long-term contracts. Owners generally have the ability to increase rates at some level linked to inflation and/or the economy over time.

Concurrently, while they can be mitigated, there are several key risks of infrastructure investing:

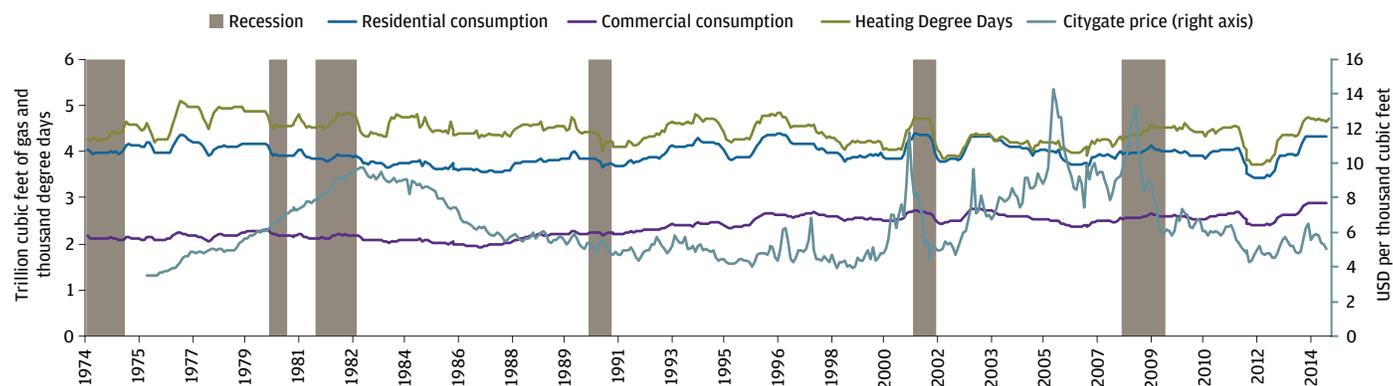
- **Sub-sector:** Each infrastructure sub-sector has different risk factors, return drivers, and economic sensitivities. Due to low correlation among sub-sectors, these risks can be reduced by constructing a well diversified infrastructure portfolio.
- **Political and regulatory:** Different countries/regions have different political, regulatory and legal frameworks. Especially in jurisdictions with relatively shorter regulatory histories, regulatory decisions may be inconsistent, increasing uncertainty for investors. Investing in politically stable regions with established legal and regulatory frameworks can reduce these risks.
- **Stage of development:** Development projects face higher construction risks and demand uncertainty compared to mature assets. Investors can choose to avoid these risks by investing only in existing infrastructure or by signing appropriate contracts with the developers. Those willing to take these added risks may be compensated with higher returns.
- **Liquidity:** Due to the size of some assets, the limited number of potential buyers and regulatory approval requirements, divestments of infrastructure assets can take a significant amount of time and effort. An open-ended fund provides a long-term investment approach that will not force asset sales and may provide added liquidity relative to closed end funds.
- **Credit market risk:** Infrastructure assets providing stable cash flows present opportunities to boost return on equity via leverage at the operating company level. Credit market conditions impact the amount, cost and terms of credit available to infrastructure assets. Managers can mitigate this risk by making conservative refinancing assumptions when

EXHIBIT 2: ELECTRICITY DELIVERED TO RESIDENTIAL AND COMMERCIAL CONSUMERS (ROLLING 12 MONTHS) VERSUS THE AVERAGE ANNUAL RETAIL PRICE (IN 2014 PRICES) IN THE U.S., JANUARY 1974-DECEMBER 2014



Sources: EIA and J.P. Morgan Asset Management, as of January 2015.

EXHIBIT 3: NATURAL GAS CONSUMPTION IN RESIDENTIAL AND COMMERCIAL SECTORS AND NATIONAL HEATING DEGREE DAYS (ROLLING 12 MONTHS) VERSUS THE REAL NATURAL GAS PRICE IN THE U.S., JANUARY 1974–DECEMBER 2014



Sources: EIA and J.P. Morgan Asset Management, as of January 2015.

underwriting and employing leverage prudently, in quantity, structure and tenor.

- **Currency volatility:** A global infrastructure investment strategy provides diversification benefits to moderate several risks (e.g., political, regulatory, demographic) but does expose an investor to the currency volatility of the underlying portfolio companies. Investors can hedge this with a currency overlay strategy.

BENEFITS OF INFRASTRUCTURE INVESTING

Provision of essential services with little or no competition results in inelastic demand

Infrastructure assets supply essential services and, as a result, demonstrate a usage pattern similar to other non-discretionary consumer goods. Since these assets provide essential services, and rates that are charged for these services are affordable and are set at levels below monopoly prices, usage does not significantly decrease during periods of economic weakness or when rates are increased. **Exhibit 2** shows the steady increase in electricity usage in the U.S. since 1974 regardless of the economic environment or price of electricity. The estimated price elasticity for residential electricity consumption is -0.05 (i.e., a 20% increase in price leads to a 1% decline in consumption).

Similarly, the demand for natural gas is not highly correlated to the price of the underlying commodity. As demonstrated in

Exhibit 3, the demand for natural gas is driven by temperature; it is not dependent on the economy or on the price of the underlying commodity. The correlation coefficient between heating degree days (or HDD—which serve as a proxy for cold weather) and the monthly residential natural gas consumption in the U.S. is 0.86.

EXHIBIT 4: COMPOUNDED ANNUAL GROWTH RATES, STANDARD DEVIATIONS AND CORRELATION COEFFICIENTS OF INFRASTRUCTURE, CORPORATE AND REAL ESTATE CASH FLOWS, 1986 TO 2013

	Infrastructure EBITDA	Real Estate NOI	S&P Operating Earnings	U.S. inflation
CAGR (%)	4.05	2.07	8.30	2.83
STDEV (%)	2.21	4.11	17.29	1.15
Infrastructure EBITDA	1.00	0.44	0.34	0.33
Real Estate NOI		1.00	-0.10	0.15
S&P Operating Earnings			1.00	-0.21
U.S. inflation				1.00

Source: J.P. Morgan Asset Management, as of November 2014.

EXHIBIT 5: CORRELATION COEFFICIENTS OF 10-YEAR RETURNS

	U.S. Treasuries	Munis	U.S. Large Cap	EM Equities	Direct Real Estate
Infrastructure	-0.14	-0.01	0.30	0.23	0.40

Source: J.P. Morgan Asset Management Long Term Capital Market Assumptions, as of November 2014.

⁹ “Infrastructure Investing: A Portfolio Diversifier with Stable Cash Yields,” J.P. Morgan Asset Management 2014.

¹⁰ The historical return performance of a well-balanced infrastructure portfolio is difficult to obtain, since private involvement in some infrastructure sub-sectors, such as toll roads and airports, has commenced relatively recently.

Infrastructure assets can provide diversification benefits

As a result of low usage volatility, economic insensitivity, and inflation-protection characteristics, a portfolio of infrastructure assets has low correlation to other major asset classes resulting in attractive diversification benefits. Historical long-term return data for a broad set of infrastructure assets do not exist, particularly in the U.S. where toll roads, bridges, airports and seaports are largely owned by the government or quasi-government agencies and have, until recently, rarely been bought and sold on the open market. As a result, in a recent analysis, we examined historical cash flows of 229 core infrastructure assets and determined that infrastructure cash flows are not highly correlated to those of equities and real estate, as shown in **Exhibit 4**.^{9,10}

In order to provide investors with a viable way of analyzing infrastructure performance so that informed asset allocation decisions can be made, historical cash flows were used as the primary factor to determine hypothetical historical returns. Those returns have had very low correlations to the returns of other asset classes over the last ten years and may therefore significantly improve portfolio diversification and risk-adjusted returns.

Governments and regulators allow fair returns in order to entice private capital to invest in infrastructure

Infrastructure assets provide services that are essential for economic activity and a basic standard of living in modern society. Without the services supplied by infrastructure assets, ranging from water and sewerage systems to electricity and airports, a modern economy could not function. For that reason, governments are increasingly focused on ensuring that infrastructure assets are available, in good condition and are consistently reliable. The causality between the availability of infrastructure services and economic productivity is well-established, and governments across the developing world make provision of infrastructure a high priority. In the developed world, the need for infrastructure investment just to maintain the existing networks and enhance capacity to allow for population increases is estimated to be around \$5trillion a year.¹¹ Many governments are not in a fiscal position to meet this spending need. Budget constraints continue to be restrictive.

As a result, governments are becoming more willing to involve private capital in the process and allow private capital to earn a fair return that will incentivize the required infrastructure investment. Further, governments are working to implement best practices in their regulatory institutions, ranging from transparency to predictability. Lowering the regulatory risk for private investors lowers the risk premium, reducing costs and creating long-term benefits for the end-users through lower rates and tariffs.

Most infrastructure assets are *natural monopolies*—assets with relatively high fixed costs, and low variable costs. By definition, a natural monopoly exists when one provider can serve that market at a lower cost than multiple providers. For example, it does not make economic sense to construct a second set of electric cables, or water or gas pipes to serve one neighborhood. Similarly, a second highway, airport, or even a power generation plant is economical only if the existing asset is capacity-constrained. Since infrastructure assets are providing essential services, regulators ensure that the owners do not charge monopoly prices to the end-users, but rather that owners are compensated sufficiently to maintain the assets and provide reliable service, while keeping the costs to end-users at affordable levels.

Infrastructure assets can provide protection against inflation

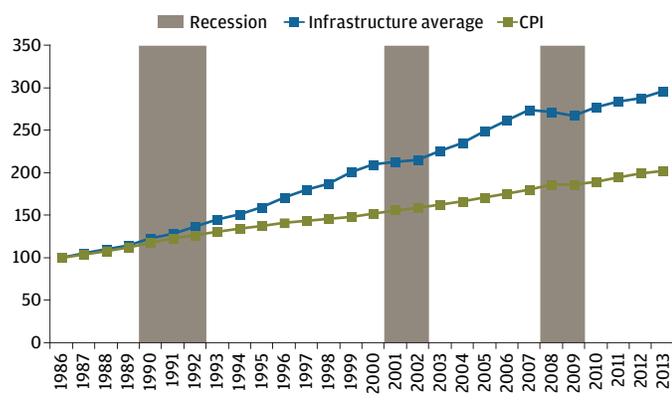
Whether they are determined by the regulators, concession agreements, or long-term contracts, the rates that are charged for usage of infrastructure assets are usually linked to inflation in the long run. Specifically, revenues of infrastructure assets are determined by:

- **Regulators:** Regulated electricity, natural gas, and water and sewerage utilities have periodic “rate cases” where regulators determine the allowed return on equity based on the necessary capital and maintenance expenditures. All of the variable costs, such as the cost of wholesale natural gas or electricity, are passed through to end-users.
- **Concession agreements:** Mainly used in the transportation sector, concession agreements define the upper limits on rate or toll increases that the concessionaire can charge. The rate increases are usually linked to inflation, and in the case of deferred maintenance of a previously publicly-owned asset, allow for the recovery of maintenance costs.

¹¹ OECD Publishing, Strategic Transport Infrastructure Needs to 2030, September 2012 and IEA, Energy Technology Perspectives, August 2013.

¹² “Infrastructure Investing: A Portfolio Diversifier with Stable Cash Yields,” J.P. Morgan Asset Management 2014.

EXHIBIT 6: INDICES OF ANNUAL CASH FLOWS FOR EU-15 INFRASTRUCTURE SUB-SECTORS AGAINST AVERAGE HIGH INCOME OECD CPI, 1986 TO 2013 (1986=100)



Source: J.P. Morgan Asset Management, as of November 2014.

- **Long-term contracts:** Regulated electricity utilities have mandates to provide long-term resource plans to the regulators, based on reliability and minimum-cost characteristics. Qualifying power generators, especially generators that produce energy from clean sources, usually have 20+ year contracts where payments depend on availability and can be escalated or indexed to inflation.

To demonstrate this inflation-protection characteristic, we analyzed how the annual cash flows (measured by EBITDA) of 229 mature infrastructure assets in the U.S. and EU-15 performed from 1986–2013. Cash flows grew steadily, at a rate above inflation (as measured by the Consumer Price Index) regardless of the global economic environment.¹²

KEY RISKS

Sub-sector risk

Each infrastructure sub-sector has unique risks. Sub-sectors are regulated by different governing bodies. They have varied economic sensitivities (e.g., a seaport is more dependent on trade and economic activity than residential water usage) and varied dependencies on the availability of natural resources. As one would suspect, bridge or air traffic has a very low correlation to residential electricity or water consumption.

As shown in **Exhibit 7**, correlations among sub-sectors are relatively low, so much of this sub-sector risk can be mitigated by creating a well-diversified infrastructure portfolio.

EXHIBIT 7: CORRELATION COEFFICIENTS OF ANNUAL CASH FLOW GROWTH RATES OF U.S. INFRASTRUCTURE SUB-SECTORS, 1986 TO 2013

	Toll roads	Airports	Seaports	Electric companies	Gas companies	Water and sewer utilities
Toll roads	1.00	0.50	0.31	-0.18	-0.31	0.02
Airports		1.00	0.39	-0.23	-0.16	0.20
Seaports			1.00	0.02	0.08	-0.05
Electric companies				1.00	0.28	-0.01
Gas companies					1.00	0.05
Water and sewer utilities						1.00

Source: J.P. Morgan Asset Management, as of November 2014.

Political and regulatory risk

As previously mentioned, infrastructure assets are essential for the functioning of a society, and hence governments continuously monitor and regulate them. The regulatory environment can vary significantly from one authority to another, so managers must have a strong understanding of political developments and experience in assessing regulatory risk. Regulated utilities can have unfavorable rate cases where regulators may reduce the returns on equity without any justification. In some extreme cases, especially in jurisdictions where the rule of law is not well-established, regulators can claim underperformance and try to re-possess an asset.

Investors can mitigate this risk through the decision of where to invest. This decision requires a keen understanding of various geographies, political, regulatory and legal environments. Additionally, a manager’s investment strategy and relationship with the regulators can help reduce this risk. All else being equal, government regulators view long-term investors more favorably than investors who have short-term holding periods (i.e., closed-end fund structures) and are trying to maximize profits in the short-run, potentially to the detriment of end-users.

Greenfield investments

The history of greenfield infrastructure investing is rich with examples of underperformance as a result of cost overruns, completion delays, usage shortfalls, longer than expected

demand ramp-up periods, etc. However, there are also examples of greenfield projects succeeding beyond the initial expectations, or because the risks of start-up and ramp-up were mitigated by appropriately allocating them to parties best suited to manage such risks. There are basically two types of risks involved in greenfield infrastructure investing: (i) the completion risk, due to construction delays, cost overruns, or bureaucratic red-tape; and (ii) the usage risk, due to insufficient demand for the service that the infrastructure asset will provide once it is built.

Investors can largely avoid greenfield investment risks by investing only in mature assets with stable operating histories or funds that are focused on development only to the extent that it involves replacing an existing asset. If an investor wants greenfield exposure, there are often ways to mitigate the associated risks. Experience shows that completion risk can be mitigated by aligning the interests of involved parties and carefully crafting concession agreements or public-private partnerships. Usage risk, on the other hand, depends on the nature of the project, the existence of close substitutes, and preferences and habits of potential end-users. Comprehensive research and economic analysis can be used to help understand and mitigate those risks faced by each individual project. However, each infrastructure asset is unique, and inference based on experience in comparable situations can result in a relatively high margin of error.

Liquidity

Infrastructure investments can be less liquid than many other assets and are best suited for a long-term investment strategy. Individual infrastructure assets are usually larger in value than real estate assets and have a smaller universe of potential buyers. Because of the extensive due diligence effort and regulatory approval these assets typically require, divestiture of an infrastructure asset may take a considerable amount of time and substantial resources.

Investors can gain exposure to infrastructure assets through a number of vehicles with varying liquidity terms. Open-ended funds generally take a very long-term investment approach and will not be forced to divest an asset simply because the fund may be nearing the end of its term. Open-ended funds which offer redemption privileges may provide investors more liquid exposure to infrastructure relative to closed-end funds.

Credit markets

The cash flow potential of infrastructure assets may present opportunities to boost return on equity via leverage at the operating company level. Credit market conditions impact the amount, cost and terms of credit available to infrastructure assets. Managers can mitigate this risk by making conservative refinancing assumptions when underwriting, and employing leverage prudently—in quantity, structure and tenor.

We believe that the defining attributes of infrastructure assets make this asset class relatively well-positioned to weather a turbulent credit market environment. Core infrastructure assets have generated low volatility and steadily growing cash flows regardless of economic conditions, making infrastructure loans much less risky than most other types of loans.

Currency volatility

While diversification of infrastructure investments across countries generally provides benefits to a portfolio, such an approach also adds exchange rate volatility to returns. Exchange rates, especially between currencies of similarly-developed countries, generally revert to the mean in the long run, so for long-term investors in core and core-plus investments, short-term exchange rate fluctuations have less importance. Depending on availability of information, it is often possible for investors to cost-effectively hedge this exposure with a currency overlay. Additionally, investing in a fund with explicit diversification guidelines limiting over-concentration to specific geographies can help to lessen these risks.

CONCLUSION

In today's extremely volatile markets, investors are increasingly considering allocations to infrastructure. These assets generally have monopolistic positions and provide essential services in the areas in which they operate. As a result, demand for these services is relatively insensitive to economic weakness and price increases. Additionally, regulators usually allow private owners of infrastructure to earn fair real returns in order to incentivize them to provide adequate service to the public—regardless of the economic or inflationary environment. Infrastructure assets have produced stable, predictable and growing returns that in some cases have provided an inflation hedge by being linked to price levels via either a regulated return framework or a contracted rate of return.

The low volatility of demand and inherent inflation protection characteristics of infrastructure assets result in their low correlation to other major asset classes. These assets provide investors with an attractive diversification opportunity and the possibility to materially improve a portfolio's risk-adjusted return. Demand for infrastructure assets has increased, particularly with institutional investors, because they are a good match for defined-benefit pension liabilities, endowment and foundation obligations, and annuity and life insurance liabilities.

There are several risks in infrastructure investing, but as discussed, they can be mitigated by investors and managers. Infrastructure managers must have expertise in a variety of sub-sectors and regions with intimate knowledge of various regulatory frameworks in order to successfully underwrite and to later manage these assets. Additionally, the type of vehicle (we advocate the perpetual, open-end structure) through which investors gain exposure to infrastructure, can serve to mitigate liquidity and capital market risks while offering investors exposure to this attractive asset class.

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