INVESTMENT STRATEGY & RESEARCH

RESEARCH BRIEF

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INFLATION PROTECTION IN INFRASTRUCTURE PORTFOLIOS: NOT ALL ASSETS ARE CUT FROM THE SAME CLOTH

PATRIZIA

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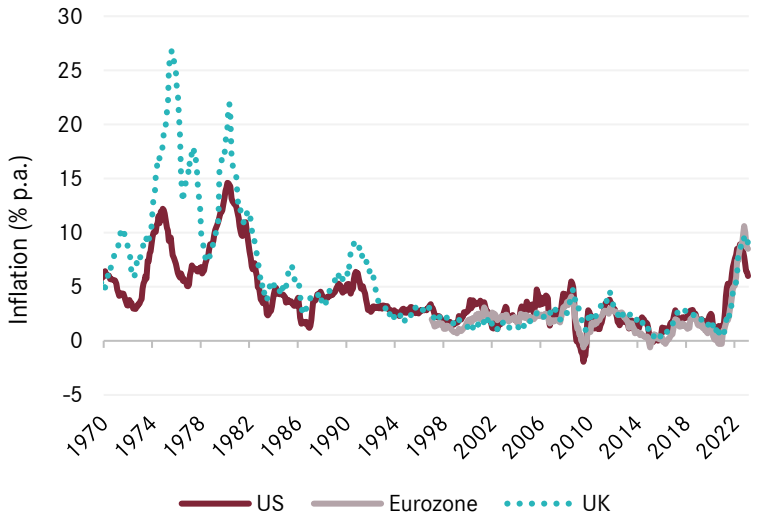
01 Introduction

NOT ALL ASSETS ARE CUT FROM THE SAME CLOTH

Inflation sat virtually dormant in developed markets in the decade between the GFC and the onset of the COVID-19 pandemic. Investors would be forgiven for not prioritising inflation protection in their portfolios during this time. Now, however, inflation has been running at multi-decade highs for close to two years. Broadly speaking, economists' forecasts suggested inflation would peak in the second half of 2022 before moderating towards central banks' targets (typically in the 2-3% range) in 2023. Inflation has been more persistent than had been broadly expected, only showing signs of moderating in the past few months. Considering the resilience of portfolios in the face of inflation has arguably not been this important in decades.

Infrastructure is often touted as an asset class that provides inflation protection. That is, infrastructure assets should be able to successfully navigate through a scenario of high inflation by passing on this inflation to end users – therefore protecting their operating cashflows in an inflationary environment. In the case of regulated infrastructure assets (such as water utilities), the level of inflation running through the economy is often a direct input into pricing and revenue. In other cases, high pricing power and strong profit margins reflecting the monopolistic and capital-intensive nature of many infrastructure assets mean that real asset investments are relatively well-placed to pass on higher costs to consumers.

Headline Inflation Rates, 1970 - 2023



Source: US BLS, Eurostat, ONS

However, we consider there is more to this story. While it is true that many of these assets can pass on higher costs, inflation spikes are typically accompanied by an increase in interest rates, reflecting the response from central banks and from bond investors' demand for higher returns to compensate for inflation. Rising interest rates can have a direct negative impact on cashflows due to higher debt servicing costs. Importantly, higher interest rates (in particular, higher real interest rates) are also likely to have a negative impact on the current value of real assets in the eyes of investors. Given the long duration of many of these real assets, this negative impact could be material.

In this brief, we present analysis that shows that when it comes to inflation proofing, not all infrastructure assets are the same. Broadly speaking, infrastructure assets can benefit at the operational level during a period of high inflation. However, in some cases, these gains can be more than offset from a revaluation perspective due to the effects of capital structure issues and higher applied discount rates as a result of a subsequent period of higher interest rates.

02 Inflation Proofing at an Operating Level

OPERATING CASHFLOWS REASONABLY RESILIENT TO INFLATION

The level of inflation proofing an infrastructure asset provides at the operating level is a function of:

- the level to which inflation can be passed through to end users;
- the degree to which costs are fixed and not affected by inflation;
- the elasticity of demand to absorb these higher costs; and
- the company's EBITDA margin.

In the sections that follow, we discuss the level of inflation proofing on offer from four broad categories of infrastructure assets based on the first three bullets above, before more broadly discussing the impact that the company's EBITDA margin has.

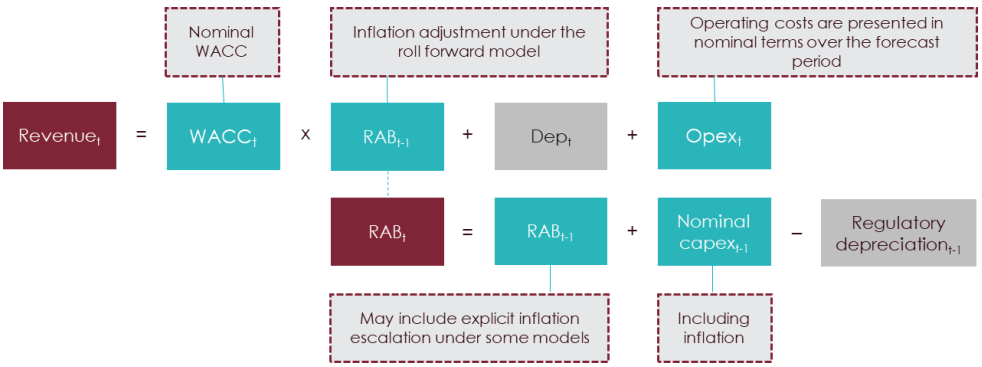
REGULATED ASSETS

Regulated assets such as water utilities, electricity and gas transmission and distribution assets typically enjoy a monopolistic position and therefore are overseen by a government regulator to ensure fair pricing is paid by the consumer.

Through the use of cost-based methodologies (distinct to incentive-based regulatory regimes), such regulated assets are allowed to achieve an appropriate return on their invested capital. While a wide range of regulatory regimes exist, many regulators use a 'building block' approach to public utility regulation. A key input into this determination is the presumed inflation cost on operating and capital costs, and implicitly, in the nominal weighted average cost of capital (WACC). The mechanical output of the methodology would result in higher revenue allowances in an inflationary environment.

Furthermore, given the monopolistic nature of regulated utilities, demand is likely to remain relatively constant both during the high economic growth period accompanying the inflation shock, and through a recessionary period that may follow the central banks' increase in interest rates. Accordingly, together with the relatively stable underlying demand from consumers, we would expect to observe a strong inflation hedge from regulated entities at an operational level.

Basic Building Block Approach for Regulated Assets



Source: ACCC, The Australian Energy Regulator, PATRIZIA

TOLL ROADS

Toll road investments are typically structured so that the government enters into a concession agreement allowing the holder of the concession a grant to collect tolls for a defined period. Tolls are generally escalated at least annually and often as frequent as quarterly. The escalation mechanism, which varies by each individual concession agreement, is often calculated with reference to the observed rate of inflation. Examples of escalation mechanisms are presented in the table below, illustrating the assortment of approaches and the level to which inflation is passed through.

In comparison to regulated assets, where there is a relatively direct linkage between inflation and the regulated asset's revenues, a toll road operator's revenues are also impacted by patronage risk. That is, toll road traffic volumes are typically inversely related to toll road prices – an increase in toll prices are likely to reduce traffic volume.

Accordingly, concession agreements typically allow for relatively strong CPI linkages in the toll pricing arrangements (particularly where greater than CPI escalation is allowable), and the high operating margins generally observed for toll road operators provides the ability to pass through the price escalation to road users. However, the traffic volume elasticity of the toll road (which varies on an asset-by-asset basis) is an important consideration in determining the ability of an individual toll road to provide inflation proofing to equity investors at the operational level.

Examples of Toll Road Escalation Mechanisms

Inflation Linkage	Toll Road	Location	Frequency	Escalation Mechanism
Full Pass Through of Inflation	Lane Cove Tunnel	Sydney, Australia	Quarterly	Escalation at Capital Cities CPI
	Westlink M7	Sydney, Australia	Quarterly	Tolls escalate or de-escalate by Capital Cities CPI
	ADELAC	Eastern France	Annually	Escalation at French CPI plus a fixed percentage under the concession contract
Partial Pass Through of Inflation	APRR	Eastern France	Annually	Escalation by 70% of French CPI plus a fixed percentage under the concession contract
Inflation Pass Through with Floor	CityLink	Melbourne, Australia	Quarterly	Escalation at the greater of quarterly CPI or 1.0%
No inflation linkages	407 ETR	Toronto, Canada	Ad hoc	Owner has discretion over setting tolls, subject to constraints
	Dulles Greenway	Virginia, USA	Ad hoc	Owner can submit application to Virginia State Corporation Commission for toll increases

Source: Linkt, , Atlas Arteria

AIRPORTS

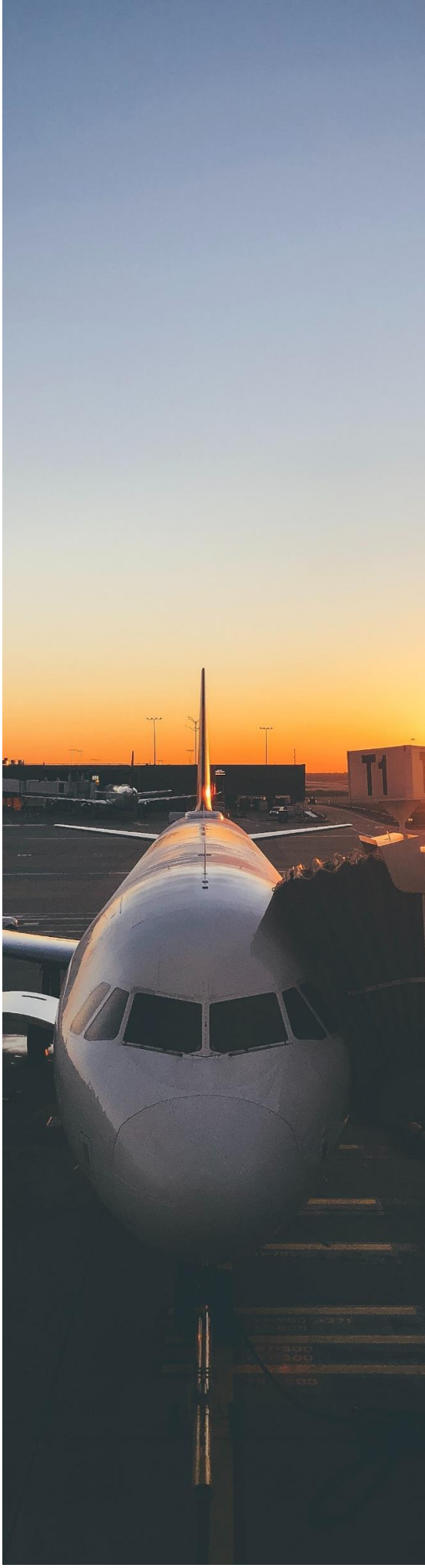
Airport activities can be split into two distinct lines, aeronautical and non-aeronautical businesses. Aeronautical services involve the management of the runways of the airport and revenue is charged on a per passenger basis. Non-aeronautical revenue consists of income from the use of the land bank at the airport such as revenue from car parking, retail and duty free, business park rental and rental car income. Given the monopolistic nature of these investments (similar to public utilities), airport revenue may be subject to regulation.

An airport's regulated revenue has a clear linkage to inflation – prices are set according to an approved regulatory regime in which inflation is a direct input. In addition, airports are likely to be able to proof themselves from inflation on their non-regulated revenue given:

- retail and business park leases are likely to have rental agreements in place with its lessees with rental increases allowed with consideration to inflation; and
- car parking operations have a highly inelastic customer base allowing the airport the ability to pass on inflation rises.

During a period of inflation or in a recessionary period likely to follow, the impact on passenger volumes will vary asset by asset. An airport's location and passenger mix will ultimately be key factors in determining the sensitivity of passenger volumes to changes in economic conditions. We would expect large international 'hub' airports with a diverse passenger base to generally exhibit relatively inelastic demand (except for in global pandemics, evidently).

Accordingly, we would expect to observe a price response for airports across aeronautical and non-aeronautical revenues approximately in line with the level of inflation.



PUBLIC PRIVATE PARTNERSHIPS & PRIVATE FINANCE INITIATIVES

Public Private Partnerships (PPP) and Private Finance Initiatives (PFI) are government projects such as schools, hospitals and roads in which a private consortium develop, build, maintain and operate the asset for a contractual period. In return, the consortium is provided with a service payment from the government for the length of the contract.

In the planning phase, PPPs typically require a value-for-money assessment, which entails comparing the proposed PPP with the cost of the public sector undertaking the project on a like-for-like basis. This analysis explicitly includes inflation expectations in the projected cash flows, a nominal discount rate, and sensitivity analysis of the inflation assumptions, thereby ensuring adequate consideration of the impact of inflation on the project.

During the construction and operating stages, governments are generally willing to accept a level of inflation risk on such projects. Therefore, service payments to the private consortiums are often linked to CPI thus providing inflation protection to investors.

IMPACT OF THE EBITDA MARGIN

As demonstrated, infrastructure assets by and large demonstrate a reasonable level of inflation proofing from the point of view that they are typically able to pass through a high proportion of the inflation pulses to end users. The level to which operating profit is affected by inflation is amplified by the operating/EBITDA margin of the business. The table below demonstrates this point with a simplified example of two investments which can pass on 90% of inflation in their revenue, but need to absorb 100% of expense inflation. The variable component is that each investment has a different EBITDA margin.

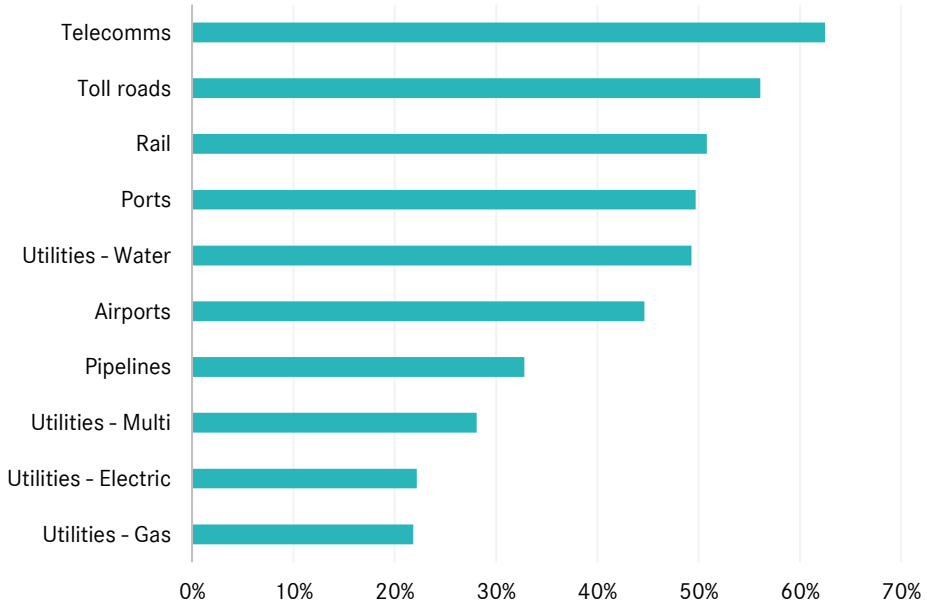
Table 1 highlights that in the case whereby not all inflation can be passed through in revenue, a business with a higher operating margin will be better protected from inflation. Per the example below, under a bout of inflation of 5%, Asset 1 is able to see its EBITDA rise by 4.3% whereas Asset 2's EBITDA increase is only 3.8%, given the lower EBITDA margin.

Effect of Operating/EBITDA Margin

	Asset 1 – 70% EBITDA Margin		Asset 2 – 40% EBITDA Margin	
	Base Case	Inflation at 5%	Base Case	Inflation at 5%
Revenue	$100.0	$104.5	$100.0	$104.5
Expenses	$30.0	$31.5	$60.0	$63.0
EBITDA margin	70%	70%	40%	40%
EBITDA	$70.0	$73.0	$40.0	$41.5
Change in EBITDA		*4.3%*		*3.8%*

> **EBITDA margins can vary by infrastructure sector and, of course, by asset within the same sector.**

EBITDA Margins by Infrastructure Sector



Source: Bloomberg

03

Inflation Proofing from an Equity Investor's Perspective

ALL THAT GLITTERS IS NOT GOLD

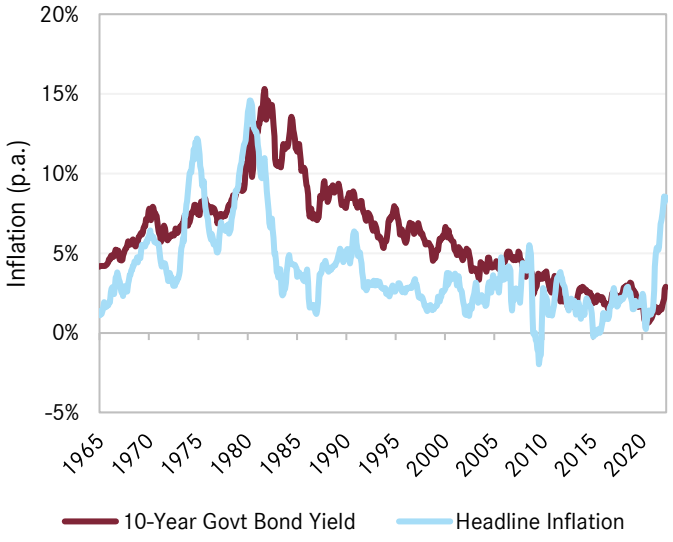
From the preceding discussion, it is clear that infrastructure assets are likely to possess reasonable inflation proofing qualities at an operating level during an inflationary environment. However, from the point of view of an equity investor, while a prolonged period of high inflation may increase the asset's EBITDA, this does not necessarily translate to such assets being beneficiaries of higher bouts of inflation.

This is because of:

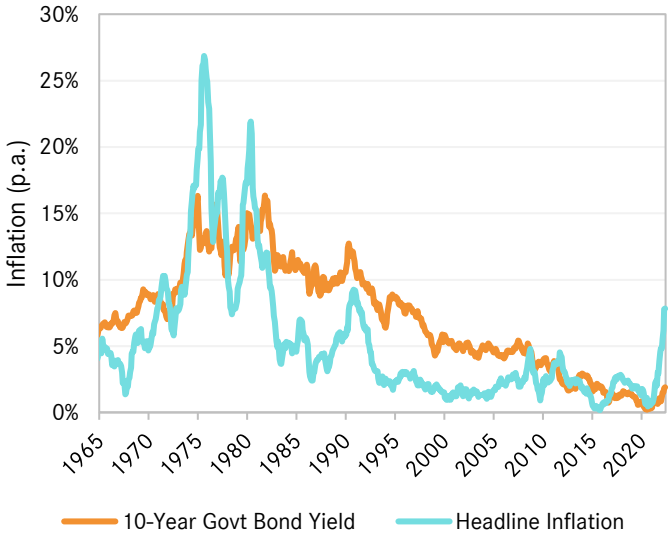
- the capital structure typically employed in investing in infrastructure;
- the way these assets are generally valued;
- the asset's expected capital expenditure program; and
- the multiples of earnings/EBITDA that investors will be willing to pay may fall in a high inflationary environment.

The first two factors above are as a result of the relationship between inflation and interest rates. As demonstrated in markets recently, there exists a strong positive correlation, albeit with a lag, in government bond rates and CPI in most developed economies. Central banks are typically explicitly mandated to ensure inflation stability. As such, bouts of inflation are likely to be met by a response from central banks through a rise in their cash rates. This results in higher government bond yields, as bondholders take into account the likelihood of higher cash rates and demand a higher return to compensate for rising inflation. The effect that a rise in the cash rates has on infrastructure assets is set out in the sub-sections that follow.

United States Inflation & Bond Yields



United Kingdom Inflation & Bond Yields



Source: Bloomberg

THE CAPITAL STRUCTURE

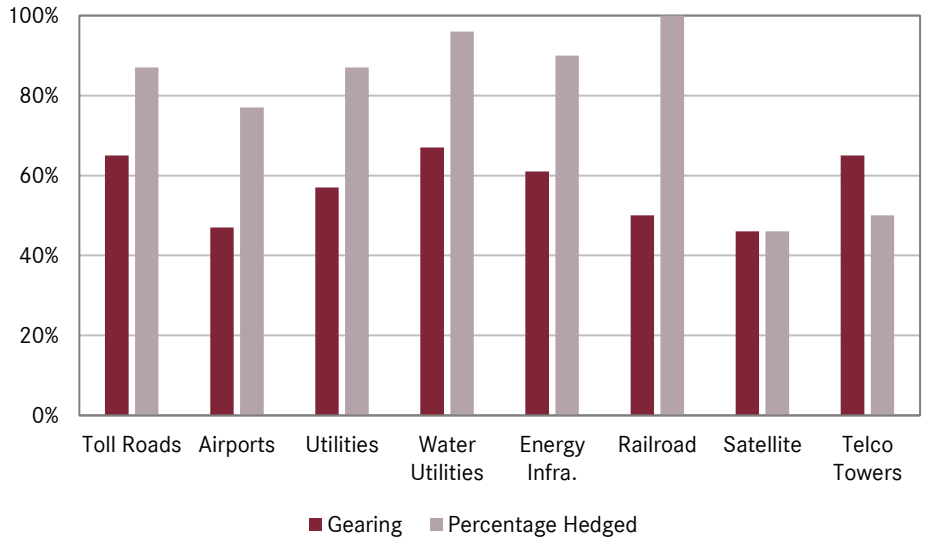
Infrastructure investments are typically financed by a combination of debt and equity, with this ratio often dependent on the stability of the investment's underlying cashflows. Gearing levels can be low (0% to 20%) for investments that are highly correlated to economic cycles, however these gearing levels can reach up to 90% for PPP/PFI investments given the highly predictable income stream and strong income providing counterparty.

As such, a rise in interest rates will affect each individual investment in a different way, depending on the specific gearing of the asset combined with the financing structure they have in place. Not only is the gearing important, the level and duration of interest rate hedging will greatly impact the vulnerability of a business' cashflows to a rise in interest rates.

If the asset has swapped its entire floating rate debt obligation into fixed rate debt, then a rise in base rates in response to an inflation pulse will not change its interest rate payment over the life of the swap. However, if the asset has left a portion of its debt in a variable rate – while the asset's profit may be protected from inflation, the same is not true for the free cash flow to equity, as a larger portion of free cash will be needed to pay for the subsequent higher interest.

Typically, infrastructure assets have a high proportion of their debt hedged, per the chart to the right, which protects them from an increase in interest rates in response to an inflation pulse.

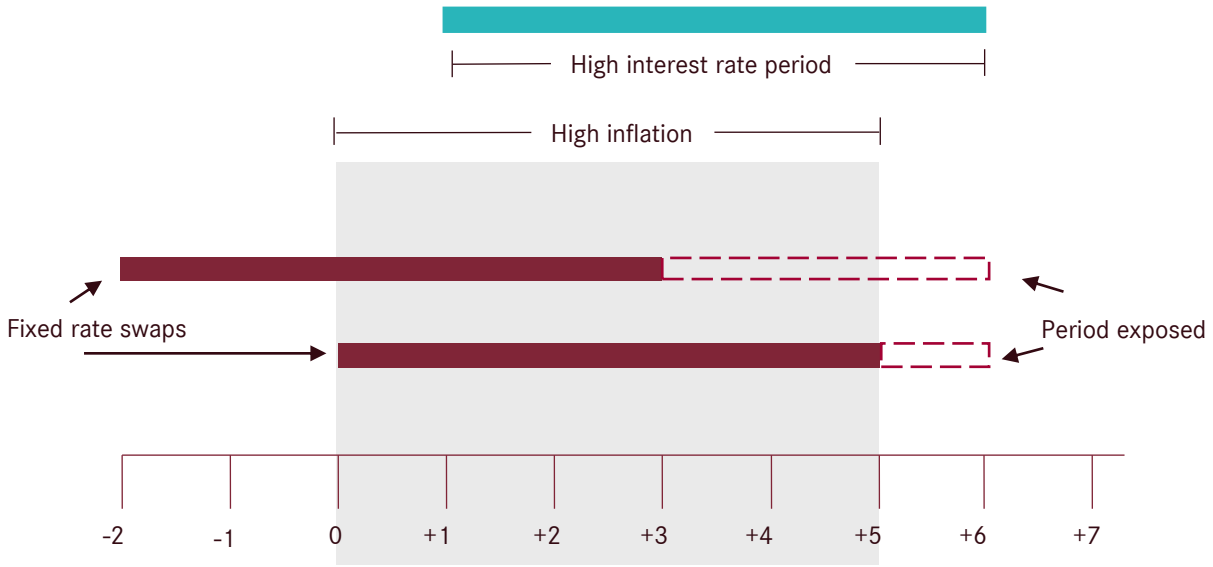
Debt Levels and Hedging of Infrastructure Subsectors



Source: Magellan Asset Management

However, unless the investment has hedged its debt for a sufficiently long period, then an environment of prolonged high inflation and subsequently prolonged high interest rates may erode cashflows to investors in the tail of this period of higher interest rates as the life of the interest rate swap comes to an end. This is illustrated below.

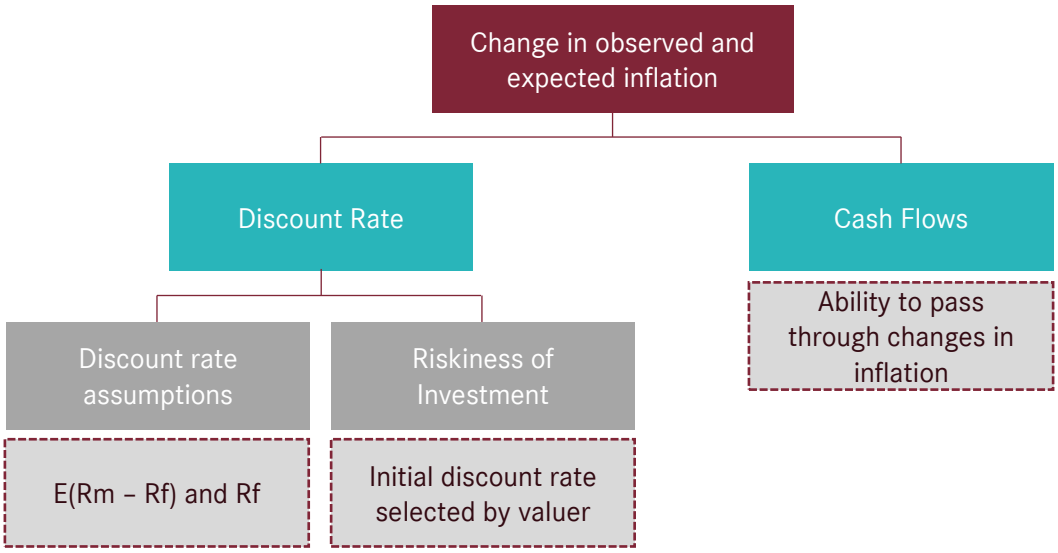
Potential for Exposure in Fixed Rate Debt



THE VALUATION OF INFRASTRUCTURE ASSETS

Per the previous section, higher inflation and subsequently higher interest rates can reduce the cashflows received by equity investors thereby reducing the investment's value. This issue is compounded by the way in which infrastructure assets are valued. Infrastructure investments are typically valued using a discounted cashflow methodology whereby the expected future cashflows to investors are discounted back at a determined discount rate. As set out in the figure below, changes to inflation impact the cashflows of an investment (as discussed in Section 2), as well as the discount rate parameters.

The Impact of Inflation to the Valuation Parameters



DISCOUNT RATE EFFECTS

Valuations for infrastructure assets are typically conducted on post-debt cash flows (i.e. free cashflows to equity). As such, the discount rate is often constructed using the Capital Asset Pricing Model. Assuming equity beta and ASP remain constant, inflationary changes ultimately impact the calculated discount rate through the risk-free rate and the equity market risk premium.

The implied equity market risk premium varies in response to economic conditions. An environment of high inflation increases uncertainty in the economy and in central bank policy. Simplistically, investors would require higher returns (in excess of the risk-free rate) during such periods which is aligned with the low-risk appetites observed at these times. However, we have observed that valuation practitioners have tended to keep equity market risk premiums relatively constant through time, except for in extraordinary market conditions (such as the global financial crisis and COVID-19 pandemic).

Discount Rate Assumptions

Discount rate = $R_f + \beta(E(R_m) - R_f) + ASP$

Where:

- R_f = the risk-free rate
- $E(R_m)$ = the expected market return
- $E(R_m) - R_f$ = the equity market risk premium
- β = the equity beta of the investment
- ASP = the asset specific premium

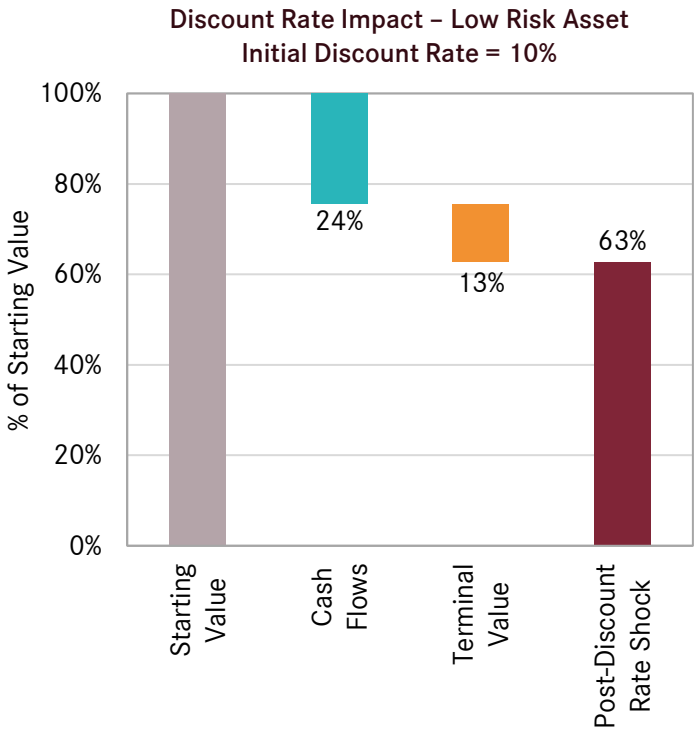
Accordingly, market interest rates are ultimately the principal CAPM assumption impacted by the change to inflation and inflation expectations. As discussed at the start of Section 3, during inflationary periods, we would expect to see an increase in key lending rates and an uplift in the yield curve. The risk-free rate is typically defined as the 10-year government bond yield, which we previously showed is highly correlated to the rate of inflation.

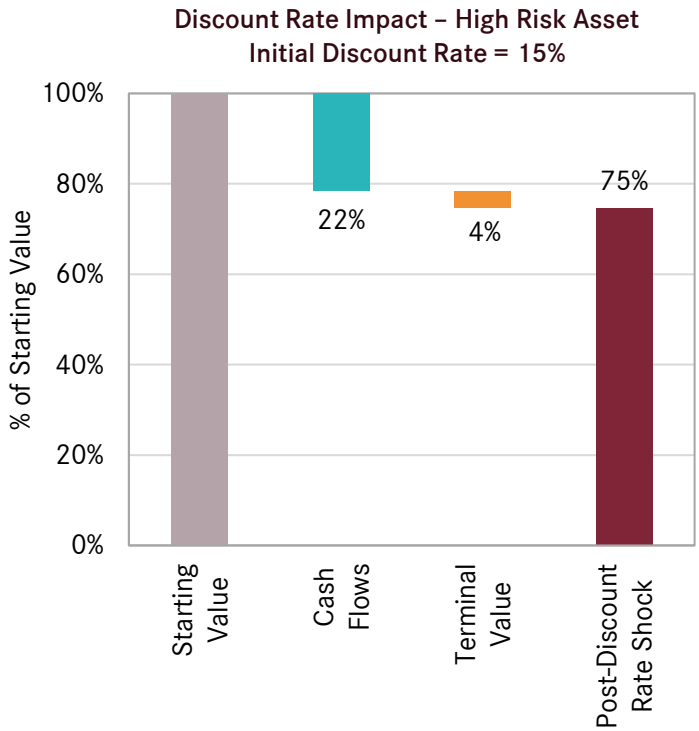
All else held constant, this would result in a higher discount rate applied to an investment's cashflows, leading to a lower valuation.

RISKINESS OF THE INVESTMENT

Ultimately, however, the impact of the discount rate charge is highly dependent on the cash flow profile of the asset, and the riskiness of the asset (noting that higher risk investments typically attract a higher discount rate). As a result of the exponential decay of the discount factors, an equal change in the discount rate selected by a valuer (due to a change in the risk-free rate) will impact lower and higher assets differently.

By way of a simple example, we have considered the impact of a 5% uplift in discount rates to a lower risk and higher risk asset, assuming all other variables remain constant and the only difference being the starting discount rates. The figures below show the impact of the discount rate change (assumed 5% uplift) on the discounted cashflows and terminal value, as a proportion of the starting value. Accordingly, during a high inflation period (where an increase in the risk-free rate is observed), we would expect the value of lower risk assets (such as utilities and brownfield toll roads) to be more impacted by discount rate uplifts, in comparison to higher risk assets (such as ports and airports).





CAPITAL EXPENDITURE PROGRAM

Whilst real assets may be able to pass on inflation to end users at an operational level, this does not factor in the higher costs of capital expenditure. Real assets such as infrastructure often benefit from limited competition due to their high barriers to entry which typically include high capital costs – often requiring the business to deploy significant amounts of money into expansionary and replacement capital works. A period of high inflation will likely lead to higher capital expenditure costs, which depending on the asset, may or not be able to be directly passed on.

Regulated assets are likely to be the most efficient at directly passing through higher capital expenditure costs given that the building block pricing model considers capital expenditure costs. However, for other real assets such as ports, an increased price of its capital expenditure program is likely to be absorbed by the business.

VALUATION MULTIPLES

A further consideration which is often neglected relates to the earnings multiple (typically measured by enterprise value/EBITDA) that infrastructure investors are willing to pay may fall in an environment of high inflation. Similar to a price/earnings (P/E) ratio in listed markets, EV/EBITDA is a valuation multiple widely used to measure the value of infrastructure investments.

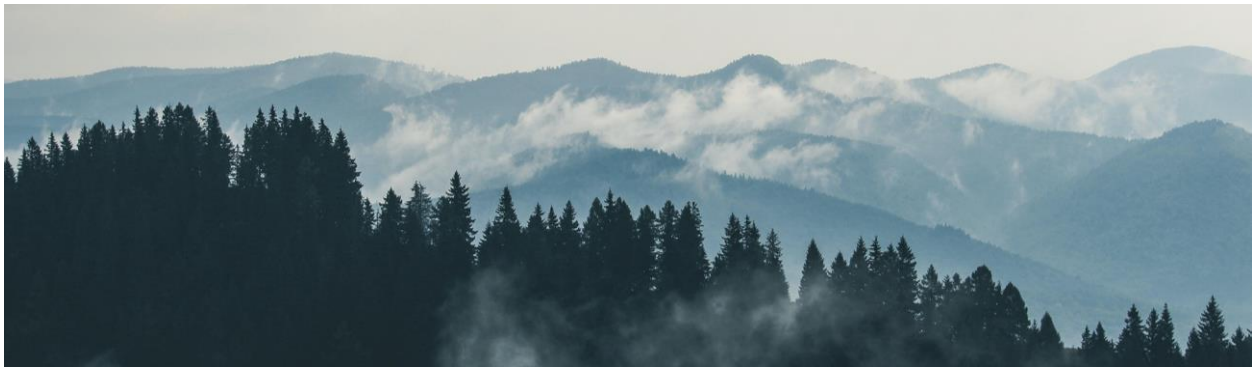
In the figure below, data from the S&P 500 Index since 1900 illustrates that lower P/E ratios have generally been observed during higher inflationary periods. Specifically, when inflation was between 6% and 10%, the average P/E ratio was 13 times, and when inflation was over 10%, the average P/E ratio decreased to 8 times.

Given that infrastructure is a relatively new asset class, it has not experienced a period of sustained high inflation and therefore it is not possible to analyse data on valuation multiples through such economic conditions. However, given the evidence in equities throughout these periods as well as the correlation between listed markets and listed infrastructure, it is not unreasonable to assume that there may be downward rerating in valuation multiples for unlisted infrastructure in a period of high inflation.

Relationship of P/E Ratios and CPI

	ALL PERIODS (1900 – 2021)		EXCLUDING LATE 1990s (1900 – 1994)	
CPI Range	Average CPI	Average P/E	Average CPI	Average P/E
<0%	-3.8%	14	-4.0%	14
0-0.99%	0.5%	18	0.6%	16
1-1.99%	1.4%	19	1.4%	16
2-2.99%	2.5%	23	2.6%	16
3-3.99%	3.3%	19	3.3%	16
4-4.99%	4.4%	19	4.3%	16
5-5.99%	5.5%	15	5.5%	15
6-9.99%	7.3%	13	7.3%	13
>10%	13.7%	8	13.7%	8

Source: Crestmont Research



04 Case Study

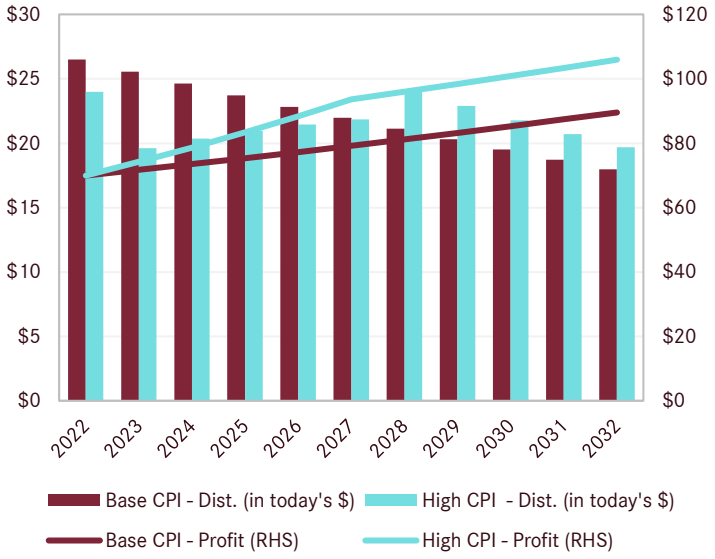
The following case study highlights the magnitude of the potential impact on an equity investor's value of a real asset if faced with the scenario akin to what is playing out currently – high inflation and initially high growth (with a recessionary tail). The case study involves two hypothetical companies, the parameters of which are below. The characteristics of Asset 1 are stereotypical of a regulated asset in which the CPI increase can be passed on to end-users in its entirety due to the higher allowed revenue under a regulated building block approach. Asset 2 is more akin to an airport or port, both of which would likely be able to pass on a significant, though not full, amount of the CPI increase to customers and their revenues are affected by GDP, given passenger numbers (airports) and container throughput (ports) are impacted by the real economy.

The charts demonstrate through a simple model, both the projected revenue and distributions to investors (in today's dollars) for the two assets under a base case if constant modest inflation and strong growth was met with a subsequent rise in interest rates that leads to a recessionary environment.

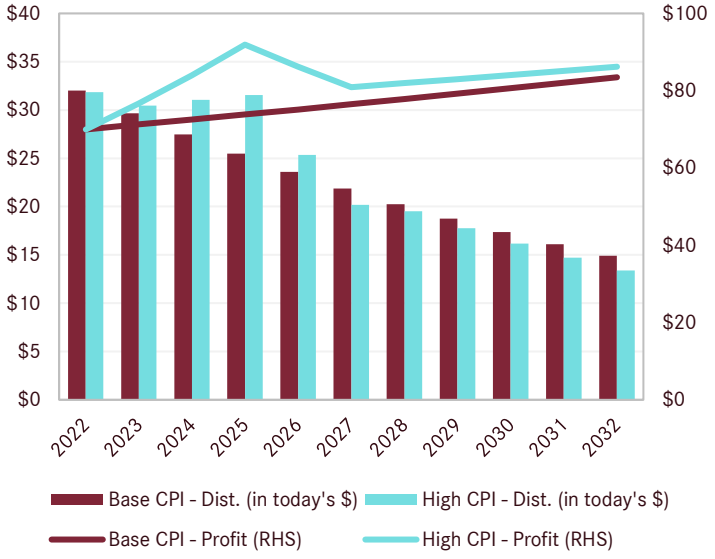
Operating and Capital Structure Assumptions

	Asset 1	Asset 2
CPI revenue pass-through	100%	80%
EBITDA margin	70%	40%
GDP correlation	Very low	Modest
Debt level	50%	25%
Hedging ratio	85%	85%
Initial discount rate	8%	10%

Profit and Distribution Projections – Asset 1



Profit and Distribution Projections – Asset 2



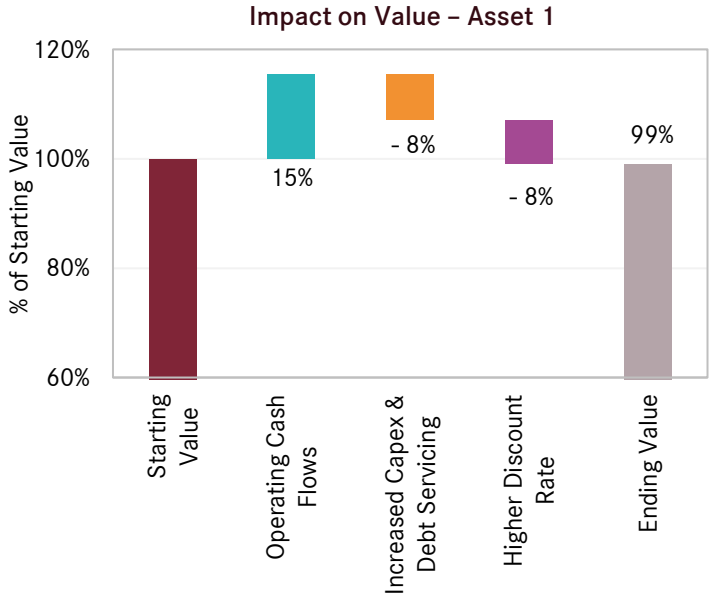
Asset 1's profit accelerates in the scenario presented, driven by its ability to pass on the entire inflation purse as is likely to occur in traditional regulated assets. For Asset 2, the increased revenue in the inflationary pulse is initially more pronounced than that of Asset 1 driven by the high growth environment which will supplement the asset's ability to capture high revenue through passing on the majority of the inflation pulse. However, we note the higher initial profit in Asset 2 is eroded under this scenario given the corresponding period of higher interest rates induces a short-term recession.

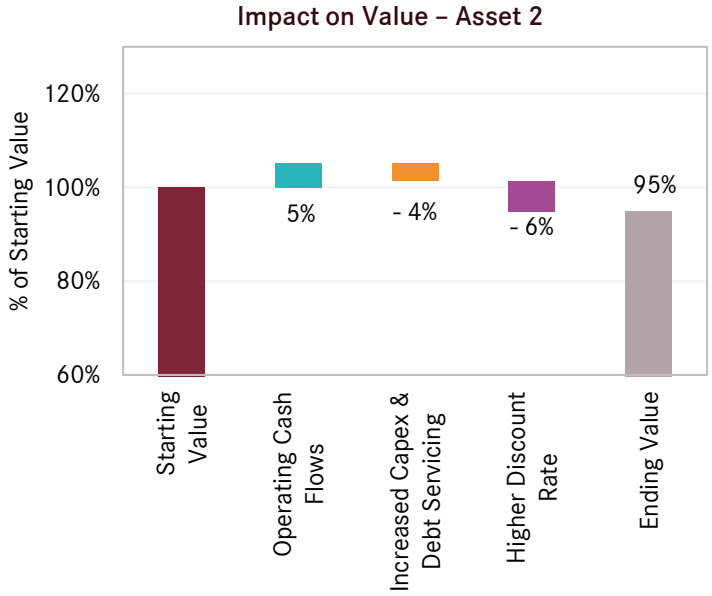
Both assets demonstrate higher profits in this inflationary scenario – this is the basis for the simplistic proclamation that infrastructure assets are inflation-proofed. However, the charts on the previous page also illustrate the other side of the story.

> "In an inflationary scenario, the compounding effect of higher interest and capital expenditure payments and a higher discount rate (as a result of a higher risk-free rate) greatly impacts what investors ultimately care about – this being distributions and the value of their investment.

This analysis suggests that an operational level, assets such as regulated entities are likely to fare better than GDP-linked investments such as airports and ports in a high inflation scenario, given that these regulated assets have the ability to pass on a higher amount of inflation to end users and not be impacted by a recessionary environment that may occur. However, such regulated assets are likely to carry more leverage than their GDP-exposed counterparts and be subject to a lower applied discount rate in their valuation, which is likely to translate to a greater negative effect on value than GDP-linked assets due to the higher interest rate effect in a high inflationary environment. Despite this greater fall, from an investor value's perspective, the net effect is that regulated assets are likely to hold up better under our inflationary scenario.

It is of course important to note that while we can make broad remarks about how these asset classes will fair in such a scenario, the individual characteristics of each investment will dictate how it will stand up to such an inflationary shock.





05
Conclusion

Commentators frequently, and quite rightly, remark on infrastructure's inflation proofing abilities, given the assets' ability to protect operating cashflows by passing on inflation to end users. Often overlooked, however, is the impact that the interest rate rises often accompanying a rise in inflation have on valuation outcomes, due to capital structure issues and higher applied discount rates. Furthermore, they are unlikely to be immune from lower valuation multiples in an inflationary environment. In any case, the immaturity of the asset class and the low inflation that has characterised so much of the past several decades means that neither side of the argument has been truly tested.

While their level of inflation proofing is not perfect, infrastructure investments still play a very important role as part of a diversified portfolio of assets in an inflationary environment such as the one we are currently in. We believe that such assets are likely to fare better than fixed interest and equity investments when subject to the same inflationary environment and offer prospective returns higher than cash and inflation-linked bonds, which are required in many diversified portfolios due to specified return objectives.

For investors seeking to maximise the inflation proofing qualities of infrastructure investments, this is best achieved through building a diversified portfolio of infrastructure assets that have direct linkages to CPI in their revenue, high operating margins and operating structures not susceptible to interest rate rises.

Nicole McMillan
Director, Investment Solutions

Nicole McMillan is a member of Investment Solutions, and is responsible for asset allocation as well as manager research, selection, appointment and monitoring for the Investment Solutions Group's asset consulting clients. She is also an author of PATRIZIA's thought leadership research, regularly writing on current trends in global financial markets. Prior to joining PATRIZIA, Nicole worked for Morneau Shepell, a Canadian human resources consulting firm, as an analyst within the Asset & Risk Management department. She was responsible for conducting asset liability studies, investment manager selection, and investment education presentations for the firm's defined benefit and defined contribution pension plan clients.

Justin Webb
Managing Director, Investment Solutions

Justin leads the Investment Solutions which is responsible for providing strategic advice and building investment strategies for institutional and government clients. Justin's particular fields of expertise centre around developing and managing investment risk management strategies and developing alternative asset portfolio plans for institutional investors, focusing on liquidity and illiquid asset investment programs. Justin is a Chartered Accountant and a member of the Australian Institute of Company Directors with extensive experience in infrastructure investment, corporate finance and financial modelling together with performance analysis, reporting and alternative asset management. Justin sits on PATRIZIA's Listed and Unlisted Infrastructure Investment Committees and is a member of PATRIZIA Infrastructure's Valuation Committee.

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