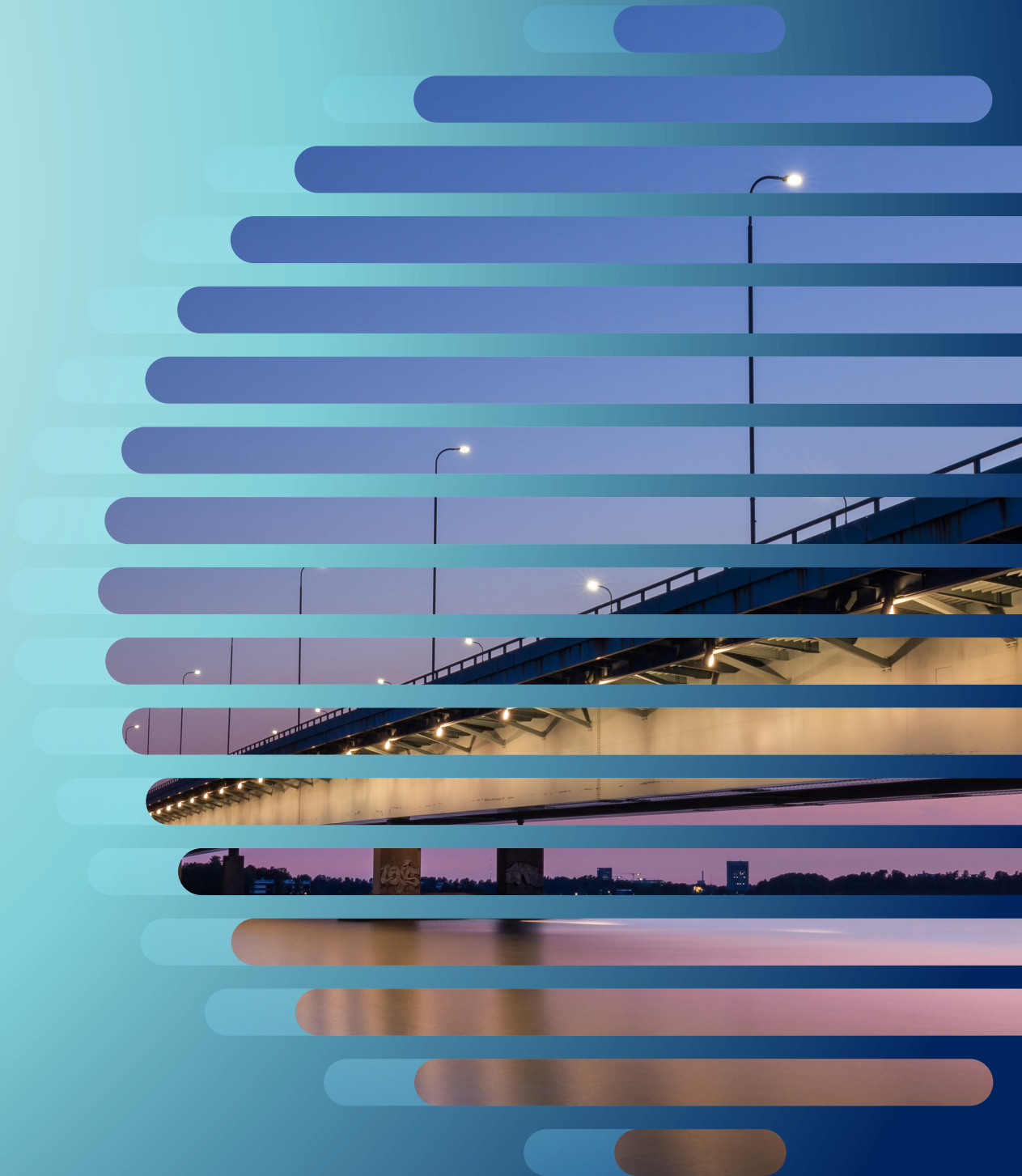


# Infrastructure investment performance

Infrastructure equity performance



## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE EQUITY PERFORMANCE

## Key findings

- The performance of listed and unlisted infrastructure equities makes them an attractive investment opportunity, and their different risk exposures can complement each other.
- Recent shocks negatively affected returns on all equities globally. Unlisted infrastructure equities were less affected, providing better downside protection than listed equities and exhibiting risk characteristics similar to those of bonds.
- Unlisted infrastructure equities have consistently provided higher risk-adjusted returns than listed equities.
- Listed infrastructure equities are less common in emerging markets and also perform better in developed markets.
- With their low risk and greater liquidity, listed infrastructure equities have continued to attract investors, even though they bring lower returns than unlisted equities.
- Recent crises led to an increase in the risk premium associated with infrastructure equities. Risk premiums have gradually declined since 2021 but remain higher than 2019 levels.
- Sharp interest rate hikes in 2022 and 2023 intensified downward pressure on the value of infrastructure equities.
- Although infrastructure generally offers inflation protection to investors – with varying degrees of protection – all sectors are sensitive to changes in interest rates.
- By 2050, the physical risks posed by climate change could reduce the value of infrastructure assets by up to 27%.



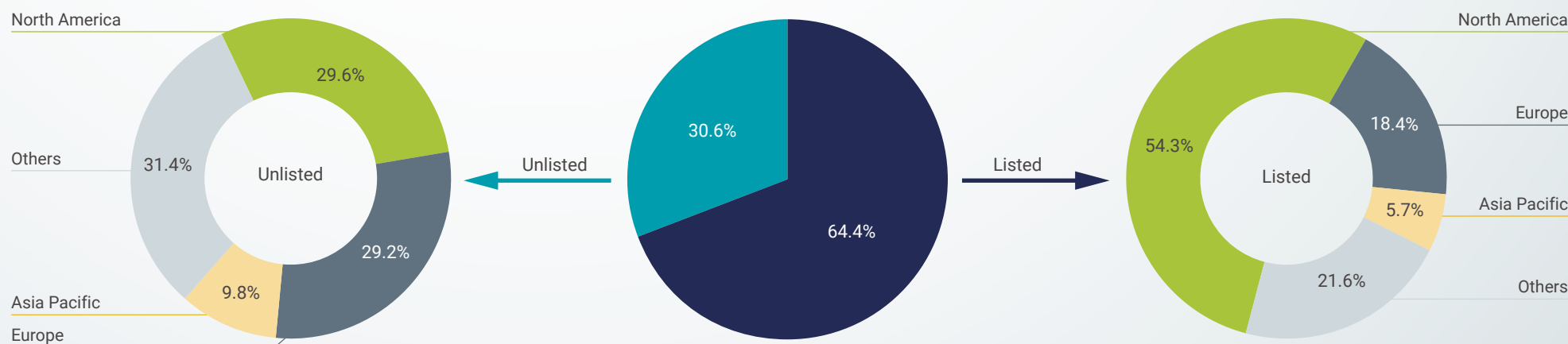
## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE EQUITY PERFORMANCE

## The performance of listed and unlisted infrastructure equities makes them an attractive investment opportunity, and their different risk exposures can complement each other.

- Global infrastructure assets traded in equity markets were valued at USD10 trillion at the end of 2021, representing between 20% and 50% of global infrastructure assets, according to the Global Listed Infrastructure Organisation (GLIO).
- Governments own the majority of other infrastructure assets, limiting the depth and maturity of the infrastructure asset class. This results in higher liquidity risk for private investors, who may be unable to secure attractive financing terms despite the large collateral provided by the asset.
- Listed markets accounted for 70% of the traded value of infrastructure assets. The infrastructure assets traded in listed markets are mainly regulated utilities and user-pays assets.
- Unlisted markets accounted for 30% of the traded value of infrastructure assets. Infrastructure assets traded in unlisted markets are mainly schools, universities, hospitals, government facilities, and telecommunications assets.
- Listed markets are most mature in North America, which accounted for more than half the total value of infrastructure assets traded in listed markets. In other regions, unlisted infrastructure equities are traded at volumes closer to listed infrastructure equities.

Global infrastructure assets traded in equity markets by region  
(USD billion)



Source: GLIO (2023).

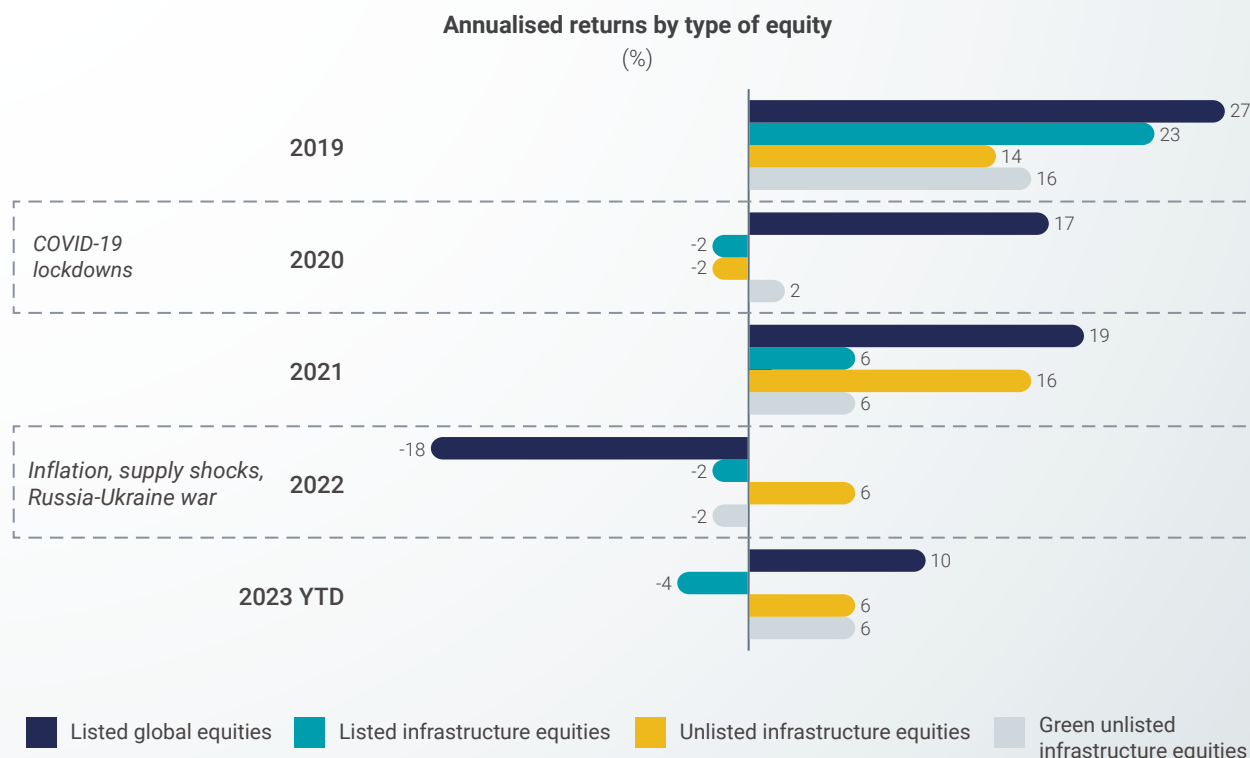
Note: Assets traded in the past 10 years and available to private buyers are included in these estimates. Unlisted infrastructure assets are less likely to be traded.

## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE EQUITY PERFORMANCE

## Recent shocks negatively affected returns on all equities globally. Unlisted infrastructure equities were less affected, providing better downside protection than listed equities and exhibiting risk characteristics similar to those of bonds.

- Annual returns on global infrastructure equities – listed and unlisted – declined from highly attractive levels in 2019 to nearly zero in 2020, due to COVID-19 lockdowns. The average return in global listed markets overall also declined in 2020 but remained closer to 2019 levels.
- As the world recovered from the COVID-19 pandemic in 2021, so too did infrastructure equity performance.
- The economic crises of 2022 – including rapid inflation, supply chain shocks, and the effects of the Russia-Ukraine war – impacted global listed equities more severely than infrastructure equities, reversing the gains that global listed equities made in 2021.
- In contrast, although unlisted infrastructure equity returns were negatively impacted by these economic crises, they remained positive.
- With inflationary pressures reducing in 2023, global listed equity market returns are recovering. Unlisted infrastructure equities – often backed by inflation-indexed contracts – continue to deliver positive returns.



Source: MSCI and EDHECInfra (2023a) as of 30 September 2023.

Note: Annual returns are based on monthly gross returns data in a calendar year. The indices present aggregate performance levels. Global equity performance is measured by the MSCI All Country World Index (MSCI ACWI). Listed infrastructure equity performance is measured by the MSCI ACWI Infrastructure Capped Index (MSCI ACWI-IC). Unlisted infrastructure equity performance is measured by the EDHECInfra Infra300 equity index. Green unlisted infrastructure equity performance is measured by the EDHECInfra InfraGreen index.

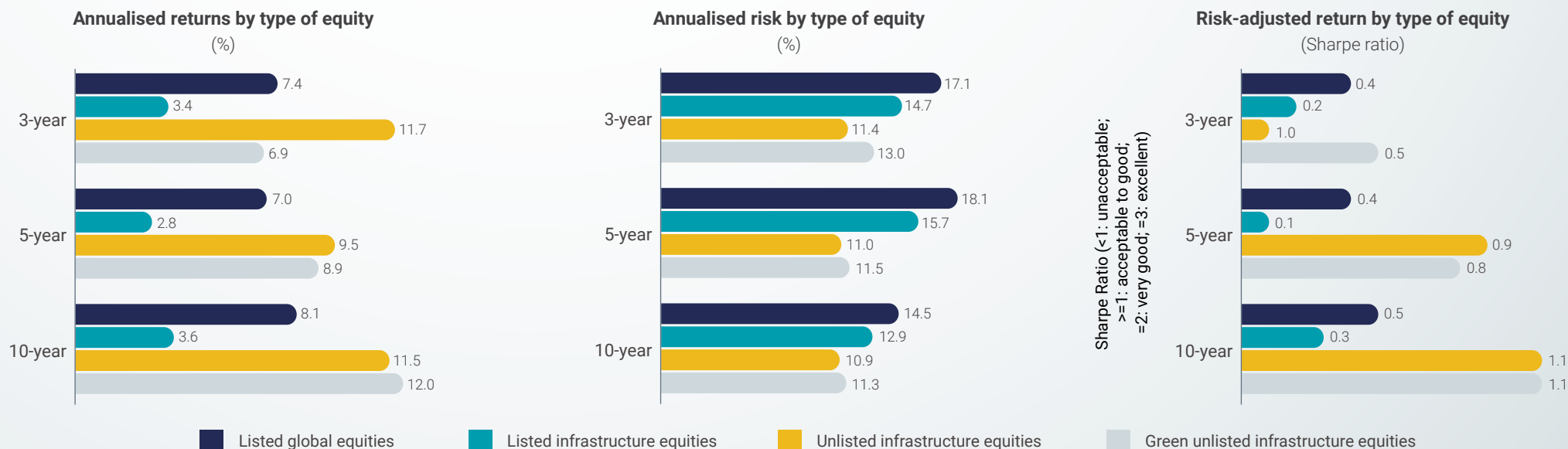


## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE EQUITY PERFORMANCE

## Unlisted infrastructure equities have consistently provided higher risk-adjusted returns than listed equities.

- Unlisted infrastructure equities have historically provided higher risk-adjusted returns than other equities, including global listed equities. Although listed equities provide high returns, their higher risk reduces their risk-adjusted returns.
- The lower risk of infrastructure equities (listed and unlisted) has meant stable returns for investors. In recent years, investors wanting to reduce their portfolio risk have sharpened their focus on the infrastructure asset class, making the market more competitive and driving up prices.
- Annual returns on unlisted infrastructure equities remain higher than returns on listed equities but fell from 11.5% over the last 10 years to 9.5% over the five years preceding June 2023.
- However, it is worth noting that the most recent returns on unlisted infrastructure equities in the three years preceding September 2023 increased to 11.7%. This is likely a result of telecommunications and social infrastructure projects performing well during the COVID-19 crisis. These projects comprise a sizeable share of unlisted infrastructure assets.
- Green unlisted infrastructure equities have become an attractive option for investors, with average returns and risk-adjusted returns similar to those of unlisted equities over the 10-year period preceding June 2023. In recent years, however, returns and risk-adjusted returns on green unlisted infrastructure equities reduced. An increase in demand, driven by the performance of these assets and the need to meet climate change commitments, may have increased competition and therefore reduced returns.



Source: MSCI and EDHECInfra (2023a) as of 30 September 2023.

Note: Risk-adjusted return is measured by the Sharpe ratio, which is the ratio of excess returns to the standard deviation of returns, where excess return is total return minus risk-free return. These estimates are based on gross returns regardless of fees. Fees to invest in the unlisted infrastructure asset class are higher than fees to invest in listed equities.

## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE EQUITY PERFORMANCE

## Unlisted infrastructure equities provided better downside protection than listed equities and exhibited risk characteristics similar to those of bonds.

Total return performance metrics: government bonds, corporate bonds, unlisted Infrastructure equities, listed equities, 2000–2022

Closest value to the unlisted infrastructure equities values is highlighted in yellow.

Metric	What does it measure?	Government bonds	Corporate bonds	Unlisted infrastructure equities	Listed equities
<b>Annualised risk</b>	Volatility of returns	5.09%	6.12%	8.26%	14.09%
<b>Skewness</b>	Deviation from symmetric normal distribution	-0.01	-0.66	-0.57	-0.69
<b>Kurtosis</b>	How often outliers occur	2.91	5.24	3.27	4.77
<b>Average drawdown</b>	Average drop from peak value until a new peak is reached	0.03	0.03	0.05	0.07
<b>Worst drawdown</b>	Maximum drop from peak value until a new peak is reached	0.12	0.16	0.15	0.47
<b>Average drawdown length</b>	Length of any peak-to-peak period	6.24	6.32	6.23	8.81
<b>Average drawdown recovery</b>	Extent of recovery from one peak to another	3.36	2.88	3.54	5.30
<b>Conditional drawdown (5%)</b>	Average of the worst 5% of drawdowns over a given time period using the average and maximum drawdown as boundaries	0.05	0.06	0.11	0.17

Source: EDHECInfra (2022a).

Note: Monthly local currency total returns data was used for estimation. Reference benchmarks for listed equities, government bonds, and corporate bonds were built as representative proxies covering the geographical composition of infra300 index, the EDHECInfra index for unlisted infrastructure equity.

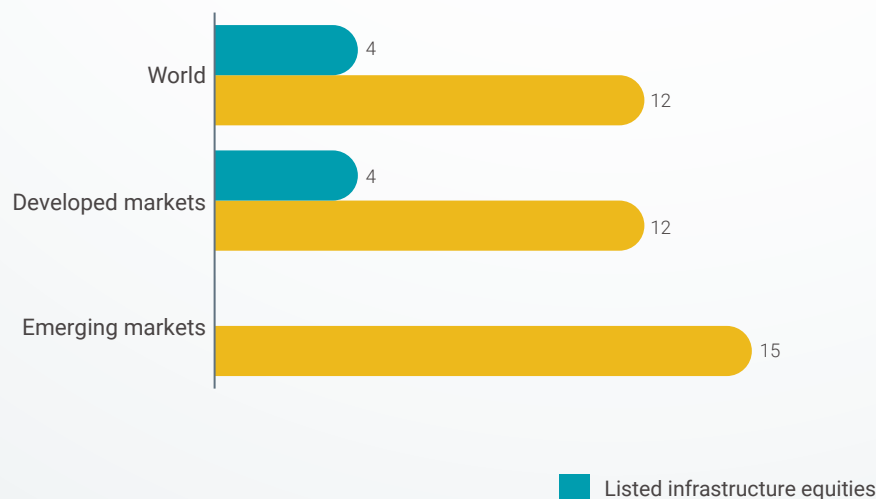
## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE EQUITY PERFORMANCE

## Listed infrastructure equities are less common in emerging markets and perform better in developed markets.

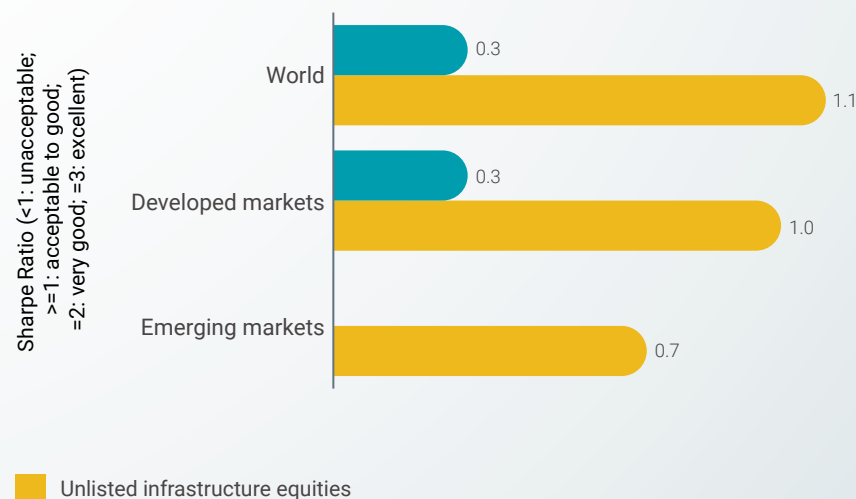
- The annualised 10-year return on unlisted infrastructure equities in emerging markets (15%) was higher than that in developed markets (12%).
- However, unlisted infrastructure equity risks are higher, and so the annualised 10-year risk-adjusted return (measured by the Sharpe ratio) is lower in emerging markets (0.7) than in developed markets (1.1).
- Listed infrastructure equities are less common in emerging markets and their performance was also significantly worse than that of unlisted infrastructure equities.

Annualised 10-year return by region and type of equity  
(%)



Source: MSCI and EDHECInfra (2023a) as of 30 September 2023.

Annualised 10-year risk-adjusted return by region and type of equity  
(Sharpe ratio)



Source: MSCI and EDHECInfra (2023a) as of 30 September 2023.

INFRASTRUCTURE INVESTMENT PERFORMANCE

INFRASTRUCTURE EQUITY PERFORMANCE

With their low risk and greater liquidity, listed infrastructure equities have continued to attract investors, even though they bring lower returns than unlisted equities.

Graph

- Lower risk, i.e. lower volatility in returns, is the factor that most drives the attractiveness of listed infrastructure equities across all markets globally.
- In developed markets, dividend yield is also a critical factor.
- Higher growth expectations in emerging markets, indicated by the greater weight of the momentum factor, support higher price-to-earnings ratios for listed infrastructure equities.

Table

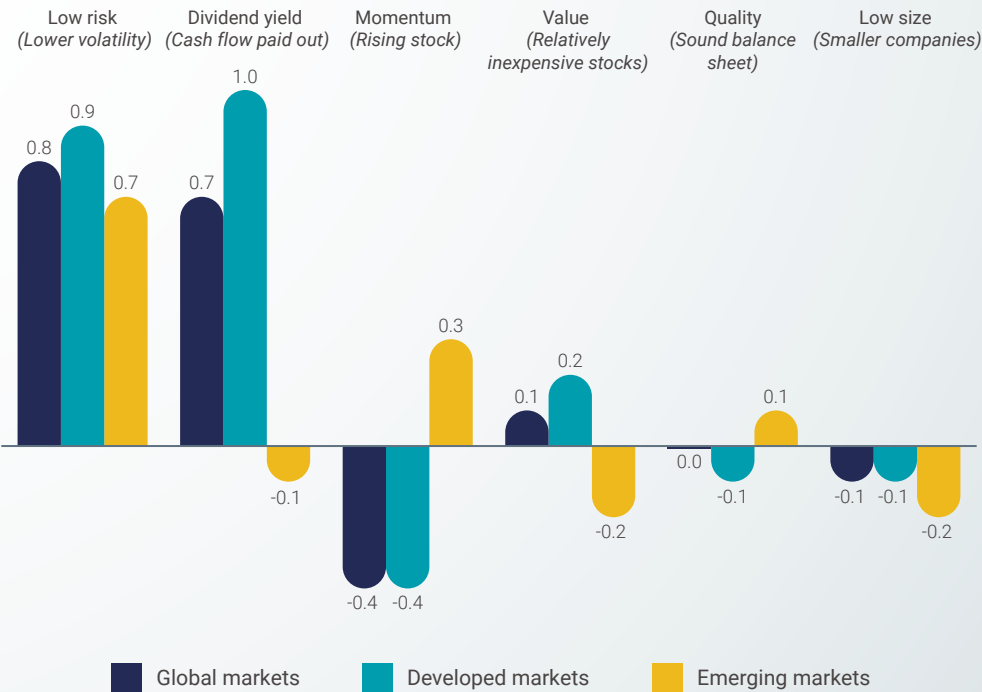
- In emerging markets, the price-to-book-value ratio for infrastructure equities was higher than that for other equities. This was not the case in developed markets.

Key factors explaining the value of listed equities by type of market

	Dividend yield (%)	Price to earnings ratio	Price to future earnings ratio	Price to book value ratio
Listed equities in developed markets				
All sectors	2.1%	19.5	16.1	2.9
Infrastructure	4.7%	15.3	12.6	1.8
Listed equities in emerging markets				
All sectors	3.1%	14.1	11.6	1.6
Infrastructure	3.3%	26.2	13.8	1.8

Source: MSCI (2023) as of September 2023.

Key factors that drive return of listed infrastructure equities (weightage)



Source: MSCI (2023).  
Note: Neutral line = 0 represents factor weights in the global equity universe determined by the MSCI Investable Market Index (IMI). Weight is the degree to which a factor is a driver of risk and return of listed infrastructure equities relative to the global equity universe. 'Overweight' means that the factor is more favourable for listed infrastructure equities relative to listed global equities. 'Underweight' means that the factor is less favourable for listed infrastructure equities relative to listed global equities. Research identifies these factors as the key drivers of risk and return, which are measured using 16 metrics. The data estimates depict factor exposure relative to MSCI IMI based on standardised values from a cross-sectional regression in the MSCI Barra Global Equity Factor Model. MSCI data are from January 1999 to 30 June 2023.

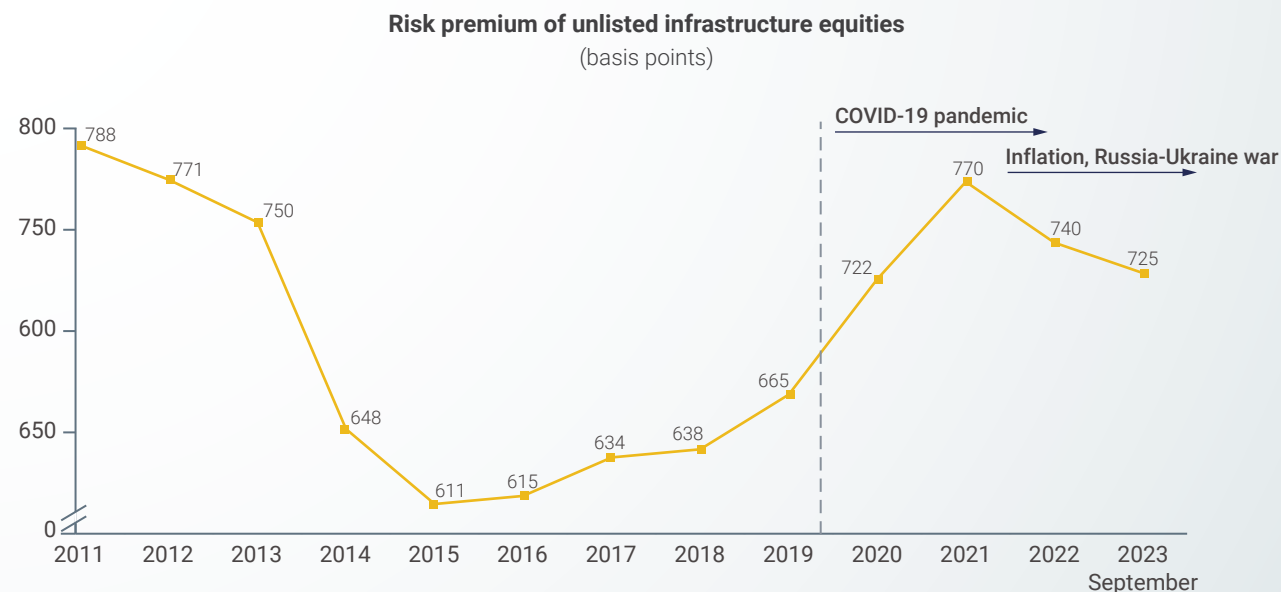


## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE EQUITY PERFORMANCE

## Recent crises led to an increase in risk premiums associated with infrastructure equities. Risk premiums have gradually declined since 2021 but remain higher than 2019 levels.

- The risk premium impacts asset valuation and private investor demand. The COVID-19 pandemic increased the risk premium of unlisted infrastructure equities from 665 basis points in 2019 to 770 basis points in 2021 – a level last seen in 2011. The heightened uncertainty regarding demand for infrastructure services and the expected trajectory of the economy increased the risk premium investors demanded for infrastructure equity investments.
- As the world recovered from the COVID-19 pandemic, the risk premium on infrastructure equities began to decline. However, it remains above the 2019 level (pre-pandemic). Since 2022, the valuation of infrastructure equities has been impacted by rapid interest rate hikes, which resulted from economic shocks like rising inflation and geopolitical conflicts, and associated supply chain disruptions.



Source: EDHECInfra (2023a) as of 30 September 2023.

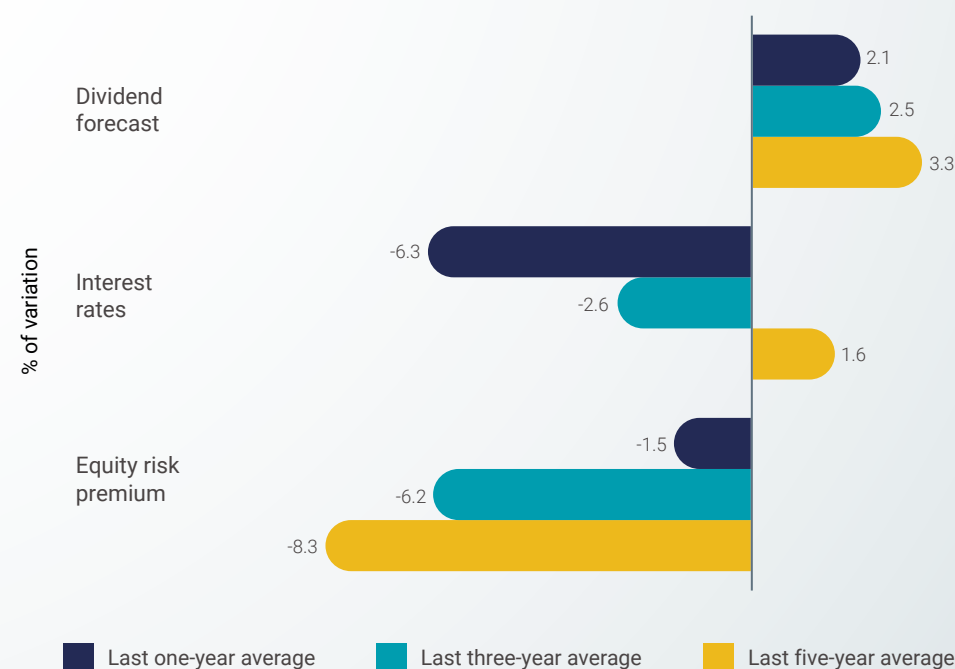
## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE EQUITY PERFORMANCE

## Sharp interest rate hikes in 2022 and 2023 intensified downward pressure on the value of infrastructure equities.

- The net value of an infrastructure equity can be estimated using a discounted dividend model in which dividend forecasts positively impact valuations. A discount factor – a combination of risk premium and interest rates – negatively impacts valuations.
- A rising risk premium during the COVID-19 pandemic negatively impacted the net value of infrastructure equities. The net impact on value of an infrastructure equity due to increase in equity risk premium averaged -6.2% per year during 2019 to 2022. As the risk premium declined in 2022, the negative impact reduced to -1.5% in 2022.
- However, overall recovery of the value of infrastructure equities has been hampered by sharp interest rate hikes. The negative impact of the rate hikes on the net value of an infrastructure equity increased to -6.3% in 2022, a sharp jump from -2.6% average impact over the three-year period, 2019–2022.
- The resilient cash flows of infrastructure equities help in maintaining stable dividend payouts. This resilience arises from contractual inflation indexation and/or from the intrinsically essential nature of infrastructure assets i.e. demand for infrastructure is not significantly impacted even when prices increase.
- Inflation shocks and recession expectations in 2022 had a marginal negative impact on dividend forecasts. These forecasts continued to positively increase the value of infrastructure equities at levels similar to previous years. Changes in dividend forecasts increased the net value of infrastructure equities by an annual average of 2.5% in the three years preceding 2022, declining to 2.1% in 2022.

### Average change in net asset value of global infrastructure equities due to increase in:



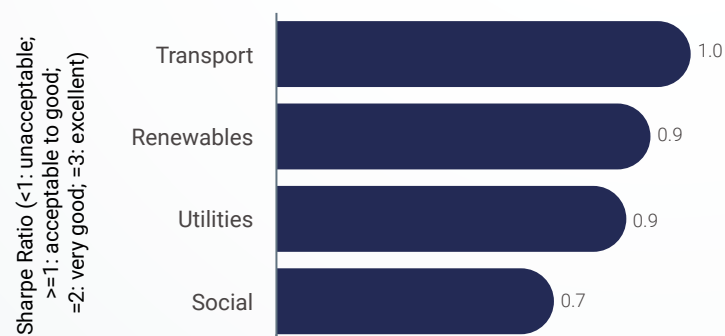
Source: EDHECInfra (2022a). Based on InfraMetrics 2022 data.

## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE EQUITY PERFORMANCE

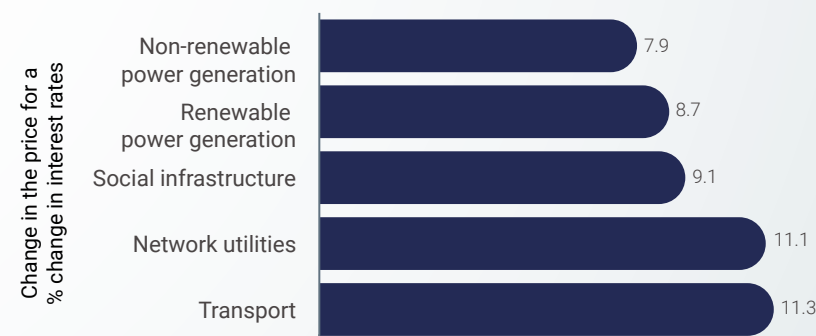
## Although infrastructure generally offers inflation protection to investors – with varying degrees of protection – all sectors are sensitive to changes in interest rates.

Annualised 10-year risk-adjusted return for  
unlisted infrastructure equities by sector  
(Sharpe ratio)



Source: EDHECInfra (2023a) as of September 2023.

Average interest rate sensitivity of  
unlisted infrastructure equity value by sector  
(Five-year average, 2017–2022)



Source: ARES (2022).

- Infrastructure assets can hedge against inflation shocks when their contracts are indexed to the consumer price index (CPI) or other related metrics. Although they both move in the same direction, interest rate changes usually lag inflation.
- The sensitivity of infrastructure equity prices to changes in interest rates varies by infrastructure sector.
- Data for unlisted infrastructure equities show that the transport sector offers the highest risk-adjusted returns, and that it is also the most sensitive to interest rate changes. The renewables sector also offers good risk-adjusted returns and exhibits relatively lower sensitivity to interest rate changes.
- The sensitivity of certain infrastructure assets to changes in inflation and interest rates reflects their business model.
- Contracted infrastructure models are often used in power generation projects, where revenues increase with inflation, so they are less sensitive to shocks.
- Merchant infrastructure models are often used in the transport sector and – compared to other sectors – are usually more exposed to fluctuations in demand in response to price increases.
- Although some transport services may have more flexibility than others to increase their prices in response to inflation, demand will be driven by how essential consumers consider services to be.
- Infrastructure equities in the transport sector are more sensitive to inflation and interest rate rises than in other sectors because the short-term impact on revenues is uncertain. However, the transport sector has historically yielded the highest annualised 10-year risk-adjusted returns, suggesting that revenues recover in the long-term.

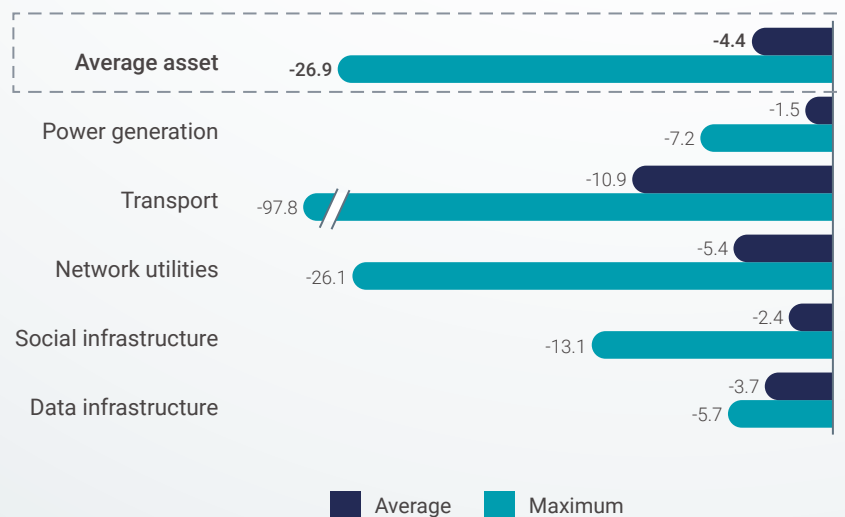
## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE EQUITY PERFORMANCE

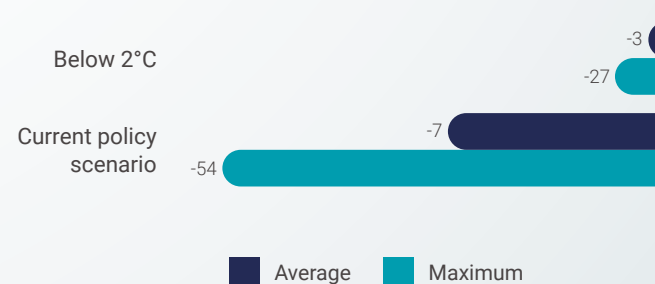
## By 2050, the physical risks posed by climate change could reduce the value of infrastructure assets by up to 27%.

- Climate change poses a significant threat to infrastructure. Rising sea levels, extreme weather events, and increased temperatures can all contribute to the deterioration of assets.
- Using currently available scenarios, the potential impact of climate change on infrastructure is significant. By 2050, the net value of infrastructure assets is expected to reduce by an average of 4.4%, and – in a worst-case scenario – by 26.7%.
- Negative impacts are expected across all infrastructure sectors. Transport assets are likely to be the most severely impacted, losing almost all (97.8%) of their value in a worst-case scenario. We expect that more value will be depleted in developed markets due to the higher value of assets in those markets.
- Infrastructure investors could see their portfolios reduce in value by an average of 7% by 2050. In a worst-case scenario, the value of portfolios could reduce to less than half of their current values.
- Most infrastructure investors with direct stakes in assets have less than 20 investments in their total portfolio. For these investors, the concentration of physical risk is high. Less diversification by holding a larger proportion of transport investments, which have higher potential devaluation (-10.9%), will result in higher portfolio losses. Even if the average increase in global temperatures by 2050 stays below 2°C, portfolio losses associated with the physical risks of climate change could average 3% and the loss could be 27% in the worst case.

**Potential infrastructure losses due to physical risks of climate change by scenario by 2050 in the current policy scenario**  
(% of net asset value loss by type of infrastructure asset)



**Potential investor portfolio value loss due to physical risks of climate change by scenario by 2050**  
(% of value loss)



Source: EDHECInfra (2023b).

Note: The analysis is based on a representative sample of 700+ companies for which asset-level climate risk estimates are available in the EDHECInfra InfraMetrics platform. Portfolio loss was estimated by creating thousands of random portfolios using hundreds of assets for which net asset value loss was estimated.



# Infrastructure investment performance

Infrastructure debt performance





## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE DEBT PERFORMANCE

## Key findings

- Default rates on infrastructure loans are lower than non-infrastructure loans, and as they continue to improve, the disparity between infrastructure and non-infrastructure loan default rates continues to widen.
- Considering lower default and higher recovery rates, average expected loss on infrastructure loans is just a quarter of average expected loss on non-infrastructure loans.
- Infrastructure loan default and recovery rates are strong in all countries, regardless of income level.
- Default rates on infrastructure loans are on a declining trend in most regions – Eastern Europe and Latin America are the exceptions.
- In 2021, default rates declined across all regions.
- Despite disparities in default rates, all regions exhibit higher recovery rates and lower expected losses than non-infrastructure debt.
- Default rates are on a declining trend for infrastructure loans in economic infrastructure subsectors but are on an increasing trend for loans in the social infrastructure subsector.
- In 2021, default rates declined across all infrastructure subsectors.
- Almost all infrastructure subsector loans have higher recovery rates and lower expected losses than non-infrastructure debt. Energy has a particularly high recovery rate.
- Green energy projects have a significantly lower default rate than conventional energy projects.
- Renewables are increasingly being supported by the export credit and investment insurance industry, and they have strong recovery potential.
- Still in all regions except Europe, recovery support for non-renewable energy exceeds renewable energy.



## INFRASTRUCTURE INVESTMENT PERFORMANCE

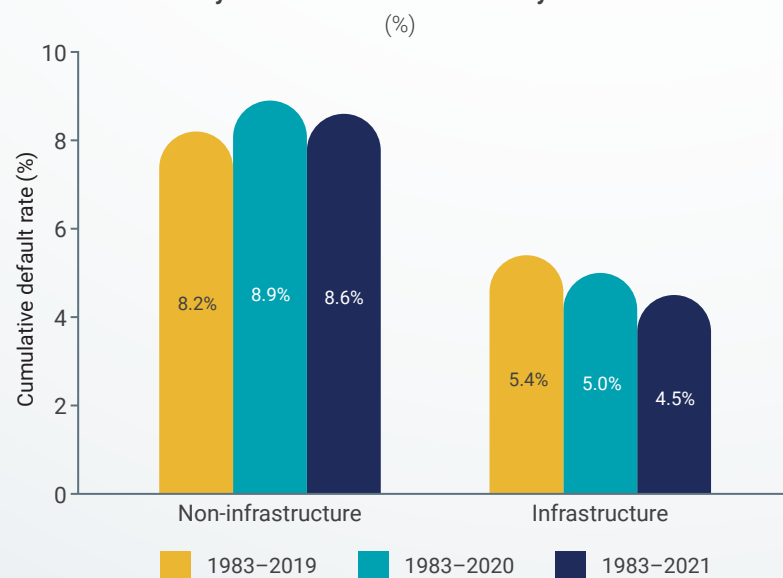
## INFRASTRUCTURE DEBT PERFORMANCE

## Default rates on infrastructure loans are lower than non-infrastructure loans, and as they continue to improve, the disparity between infrastructure and non-infrastructure loan default rates continues to widen.

- In 2021, the average 20-year cumulative default rate (CDR) for infrastructure continued to decline despite the ongoing shocks of the COVID-19 pandemic. In contrast, the CDR for non-infrastructure projects increased.
- Infrastructure debt typically reaches investment grade faster than non-infrastructure debt. An examination of loans that originated from 2010 onward shows that infrastructure debt reached investment grade eight years earlier on average than non-infrastructure debt.
- While government support for infrastructure projects during the COVID-19 pandemic may have helped reduce infrastructure loan default rates, they had been trending down for some time.

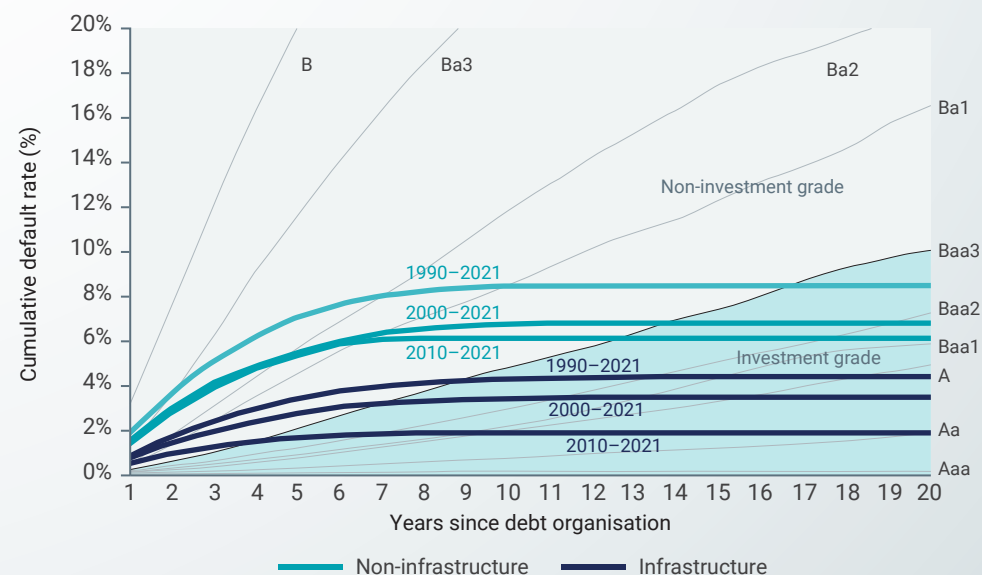
- Infrastructure debt performance has been improving over time because newer infrastructure debt is reaching investment grade faster than older infrastructure debt. This has been particularly true in the last decade. Infrastructure loans that originated from 2010 onward reached investment grade three years sooner than infrastructure loans that originated from 2000 onward. As a result, the 20-year CDR reduces from 3.5% to 1.8% when the loan origination year cut-off is shifted from 2000 to 2010.

20-year cumulative default rate by sector



Source: Moody's (2023a). Data as of 2021.

20-year cumulative default rate by sector and origination year



Source: Moody's (2023a). Data as of 2021.

Considering lower default and higher recovery rates, average expected loss on infrastructure loans is just a quarter of average expected loss on non-infrastructure loans.

- The superior performance of infrastructure loans is attributable to the combination of lower default rates and more robust recovery rates. When an infrastructure loan defaults, the average recovery rate is typically high.
- For infrastructure loans that originated from 1983 to 2021, the global average recovery rate was 83.8% – significantly higher than the 68.2% average recovery rate of non-infrastructure loans.
- For infrastructure loans that originated from 1983 to 2021, the 20-year average expected loss after default was 0.7%, while that of non-infrastructure loans was 2.7%.

Average recovery rates  
(% of total loan value, 1983–2021)



Source: Moody's (2023a). Data as of 2021.

Average 20-year expected loss  
(% of total loan value, 1983–2021)

	Expected loss (%) = (Over 20 years)	Default rate (%) (Cumulative over 20 years)	X	Loss given default rate (%) (1 - Recovery rate)
Infrastructure	0.7	4.5		16.2 (= 1-83.8%)
Non-infrastructure	2.7	8.6		31.8 (= 1-68.2%)

Source: Moody's (2023a). Data as of 2021.  
Note: Expected loss is the proportion of debt value expected to be lost from potential infrastructure debt defaults.

## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE DEBT PERFORMANCE

## Infrastructure loan default and recovery rates are strong in all countries, regardless of income level.

- The 20-year CDR for infrastructure loans fell in high-, middle-, and low-income countries in 2021.
- In high-income countries, the rate dropped from 5.2% in 2019 to 4.3% in 2021.
- In middle- and low-income countries, the rate dropped from 7.0% in 2019 to 5.9% in 2021.
- This decline may be attributable to one or more of these causes:
  - Government support during the COVID-19 pandemic may have helped save infrastructure projects from default.
  - The increasing maturity and sophistication of public-private partnerships (PPPs) for infrastructure development should lead to declining default rates.
  - The heightened risk aversion of private investors and the banking sector may have brought about a reduction in average default risk on private infrastructure loans.

Private investors seek low-risk projects to avoid the potential large losses associated with large infrastructure projects.

- Meanwhile, banking regulations – especially the Basel III reforms introduced in 2017 – apply higher than actual performance risk weights on infrastructure projects, meaning that debt financing from banks tends to flow to lower-risk projects.
- Although default risk is slightly higher in middle- and low-income countries, recovery rates are similar across countries. The average recovery rate on defaulted infrastructure loans remained stable at around 84% in both income groups.
- For infrastructure loans, the average expected loss after default was 0.7% in high-income countries and 0.9% in middle- and low-income countries over a 20-year loan tenure. Widespread use of credit-risk mitigation instruments and development finance is also likely to have supported higher recovery rates in middle- and low-income countries.

20-year cumulative default rate by income group

(%)

Origination years:	1983–2019	1983–2020	1983–2021
Global	5.4	5.0	4.5
High-income	5.2	4.8 ↓	4.3 ↓
Middle- and low-income	7.0	6.5 ↓	5.9 ↓

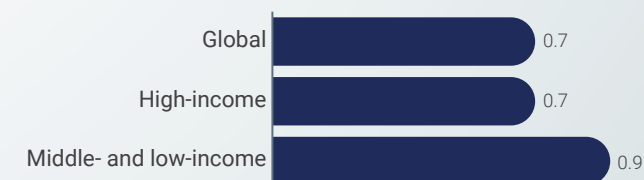
Average recovery rate by income group

(% of total loan value, 1983–2021)



Average 20-year expected loss by income group

(% of total loan value, 1983–2021)



Source: Moody's (2023a). Data as of 2021.

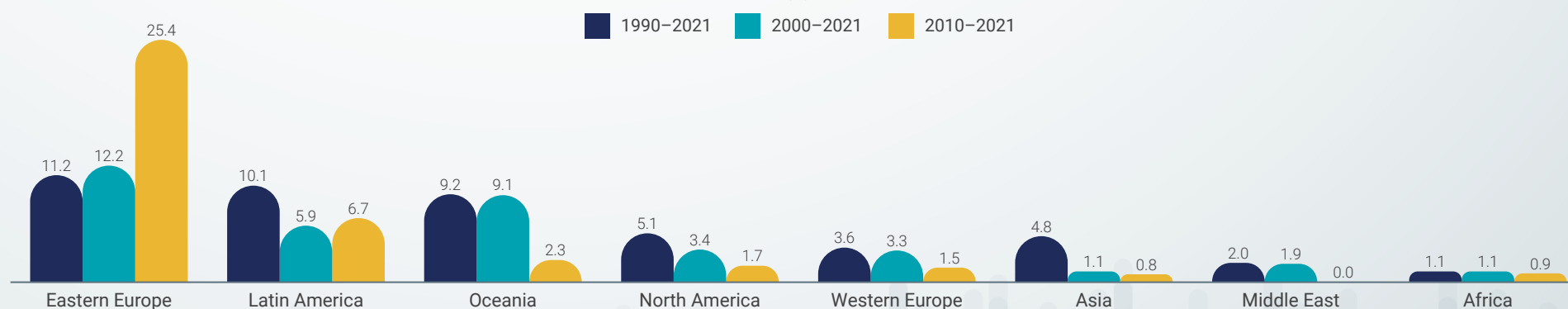
## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE DEBT PERFORMANCE

## Default rates on infrastructure loans are on a declining trend in most regions – Eastern Europe and Latin America are the exceptions.

- Eastern Europe and Latin America have the highest default rates on infrastructure loans globally, and rates in both regions worsened last decade (2010–2020).
- CDR generally spikes during economic or financial crises that severely impact government balances.
- In the 2010s, the default rate in **Eastern Europe** more than doubled after foreign capital inflows – which the region heavily relied on – collapsed as a result of the 2007–2008 Global Financial Crisis (GFC) and the eurozone crisis (EIB, 2017). However, it is important to note that the sample size in Eastern Europe is small and may suffer from selection bias, given the banks contributing the data. It is also notable that recovery rates on defaulted infrastructure loans were close to 100%, which reduced losses to below the global average.
- **Latin America's** debt crisis in the 1980s and banking crisis in the 1990s may have caused its high default rates prior to the 2000s. The banking crisis was mainly caused by a combination of macroeconomic imbalances, incomplete financial liberalisation, and lack of adequate bank supervision. As the crisis receded, 20-year CDR declined significantly from 10.1% for loans originating 1983–2021, to 5.9% for loans originating from 2000 onward. However, for loans originating from 2010 onward, CDR increased again to 6.7%.
- All other regions have shown an appreciable reduction in default rates.
- **Oceania** has shown the most remarkable reduction in default rates since 2010. The 20-year CDR reduced from over 9.0% for loans originating before 2010 to 2.3% for loans originating after 2010. Experts indicate that these markets have evolved to rely on more conservative forecasts for infrastructure projects.
- In **North America and Western Europe**, CDRs have almost halved since 2010, aided by the economic recovery after the 2007–2008 GFC.
- **Asia** had high default rates for loans originating before 2000, before the 1997 Asian financial crisis. CDR has reduced significantly since the 2000s.
- **The Middle East's** default rates have dropped to zero. There has been no default since 2010, probably as a result of strong support for infrastructure development by creditworthy governments.
- **Africa's** default rates have hovered around 1% for decades. Projects in the region that gain private sector capital typically have strong support from development finance institutions (DFIs) and a low risk profile.

20-year cumulative default rate by origination year and region  
(%)



Source: Moody's (2023a). Data as of 2021.



## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE DEBT PERFORMANCE

## In 2021, default rates declined across all regions.

- The global average CDR for infrastructure loans declined in 2020, but this decline was driven by Asia, North America, and Western Europe – which have more than 80% of total infrastructure loans.
- CDRs actually increased in 2020 in Africa, Eastern Europe, Latin America, the Middle East, and Oceania. The increase was most marked in Oceania, which implemented very strict measures to stop the spread of COVID-19. The Middle East had the second highest increase in default rates. It also implemented strict pandemic containment measures in 2020 (OECD, 2020).
- 2021 was undisputedly the year of default rate recovery across all regions. In several regions, average default rates in 2021 were even lower than in 2019. These results may be attributable to government support of infrastructure projects. If this support is offered, regardless of the market risk that is contractually allocated to the private sector, even projects positioned at the higher end of the risk spectrum may become less susceptible to default.

**20-year cumulative default rates by origination year and region**  
(%)

Loan origination years:	1983–2019	1983–2020	1983–2021
<b>Infrastructure</b>	<b>5.4</b>	<b>5.0 ↓</b>	<b>4.5 ↓</b>
Africa	1.1	1.8 ↑	1.1 ↓
Middle East	1.2	2.2 ↑	2.0 ↓
Western Europe	4.6	4.0 ↓	3.6 ↓
Asia	5.9	5.2 ↓	4.7 ↓
North America	6.8	6.6 ↓	5.4 ↓
Oceania	7.3	10.1 ↑	9.2 ↓
Latin America	10.3	10.5 ↑	10.1 ↓
Eastern Europe	11.8	11.8	11.2 ↓

Source: Moody's (2023a). Data as of 2021.

## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE DEBT PERFORMANCE

## Despite disparities in default rates, all regions exhibit higher recovery rates and lower expected losses than non-infrastructure debt.

- Infrastructure loans that originated from 1983 to 2021 have an average recovery rate of 83.8% globally.
- During this period, infrastructure loans in the **Middle East** had recovery rates of 100%, while those in **Eastern Europe** and **Asia** were 98% and 88%, respectively.
- Oceania** and **Latin America** had average recovery rates of nearly 80%.
- In all regions, infrastructure loan recovery rates are higher than the average global recovery rate for non-infrastructure loans, which was 68.2% for loans that originated from 1983 to 2021.
- The average expected loss after default over 20 years is lower than that for non-infrastructure project loans at 2.7% for 2021. Nonetheless, there are some disparities among income groups and regions. Most regions have extremely low levels of average expected loss on infrastructure loans at less than 1% over the loan origination period 1983–2021. Latin America has the highest default rates and the lowest recovery rates, which drove Latin American expected losses to high levels at 1.02% in its high-income countries and 2.8% in its middle- and low-income countries. High-income countries in Oceania also showed above average expected losses at 1.79%.

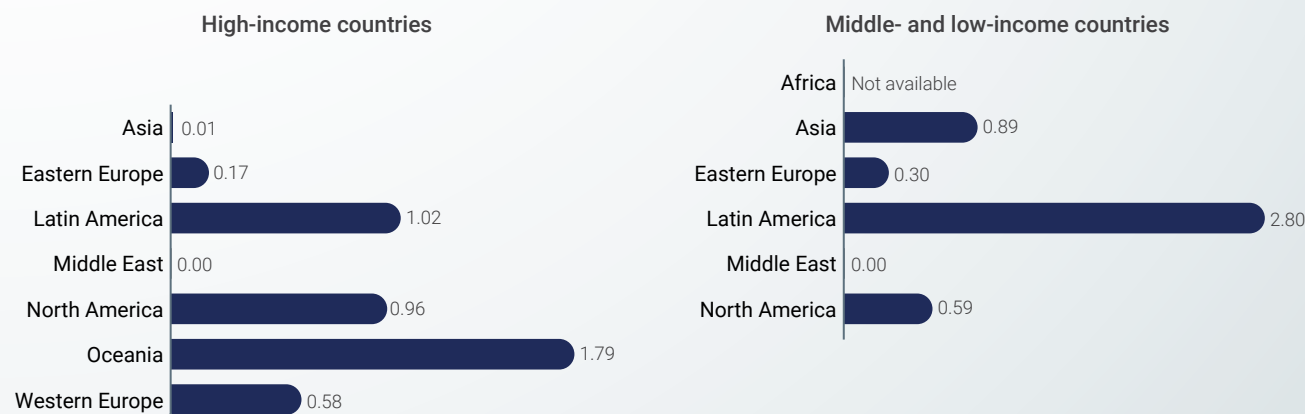
**Average recovery rate by region**

(% of total loan value, 1983–2021)



**Average 20-year expected loss by income group**

(% of total loan value, 1983–2021)



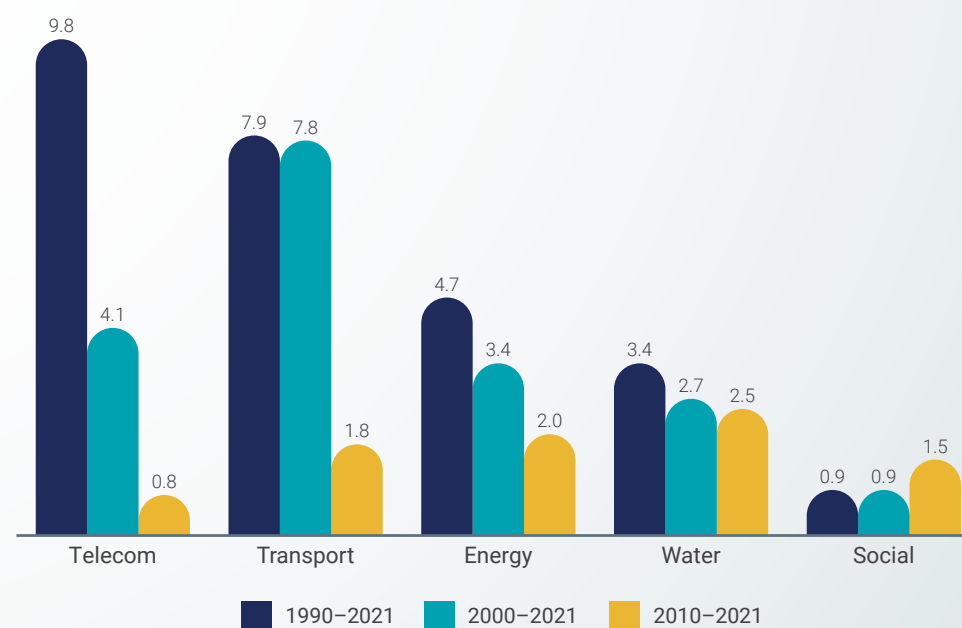
## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE DEBT PERFORMANCE

## Default rates are on a declining trend for infrastructure loans in economic infrastructure subsectors but are on an increasing trend for loans in the social infrastructure subsector.

- Default rates decreased most substantially in the telecommunication and transport subsectors.
  - Default rates on infrastructure loans in **telecommunication** have dropped drastically over time. When the subsector was liberalised and technology started to advance quickly in the 1990s, private investors were highly optimistic and invested heavily into a fast-evolving market. Since then, the subsector has matured significantly, the policy and regulatory environment has improved, and demand has grown rapidly due to innovative product offerings. Since the 2010s, telecommunication project loans have had the lowest default rate in the infrastructure sector.
  - Privatisation has been a strong trend in **transport**, particularly since the 2010s. With more mature markets and more mature regulatory and contractual arrangements, the subsector has seen its 20-year CDR fall significantly, from more than 7.8% for loans originating before the 2010s to 1.8% for loans originating after the 2010s.
- Default rates on **social infrastructure** loans crept up to 1.5% for loans that originated from 2010 onward, compared to rates that had been as low as 0.9% historically.
  - Social infrastructure loans have historically had the lowest default rate at 0.9%. This low rate may be attributable to the revenue stability conferred by availability payments, which are more common in this subsector, and to public sector participation in social infrastructure, which can help increase guarantees and reduce defaults. Nonetheless, within time the default rate of infrastructure loans within social sector has increased up to 1.5% for those loans that originated from 2010 onwards – still one of the lowest rate across sectors.

20-year cumulative default rate by origination year and sector (%)



Source: Moody's (2023a). Data as of 2021.

## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE DEBT PERFORMANCE

## In 2021, default rates declined across all infrastructure subsectors.

- Default rates declined for all infrastructure subsectors in 2021. Strong government support to prevent defaults during the COVID-19 pandemic was instrumental in this.
- In 2021, the **telecommunications** subsector showed the most significant reduction in 20-year CDR in both high-income and middle- and low-income countries. This is attributable to strong demand for telecommunication services during the COVID-19 lockdowns. In high-income countries, the 20-year CDR average reduced from 9.8% in 2020 to 8.6% in 2021. In middle- and low-income countries, CDR reduced from 14.0% in 2020 to 12.9% in 2021.
- In high-income countries, **transport** showed the biggest reduction in default rates, albeit from a high level of 10.2% in 2019 to 8.4% in 2021. This CDR of 8.4% is still higher than the CDR of 5.0% on transport infrastructure loans in middle- and low-income countries. The historical high default rates in the transport subsector were due to high demand risk in the contractual arrangements for transport infrastructure projects, especially in high-income countries. During the pandemic, government support to mitigate the demand shocks of pandemic-related lockdowns prevented defaults.
- The **social** and **water** subsectors in high-income countries have historically been the least risky, as they are underpinned by mature markets and enabling environments, strong government support, and higher consumer income levels. Recent challenges encountered by water assets may impact this trend moving forward. In middle- and low-income countries, where markets are less mature and there is more political pressure to make services affordable to consumers, these subsectors are riskier.
- The **energy** subsector saw an appreciable decline in default rates during the pandemic. This could be due to the growing share of renewable energy projects in this subsector, as those projects tend to have lower default rates than non-renewable energy projects.

20-year cumulative default rates by origination year, sector, and income group (%)

Loan origination years:	1983–2019	1983–2020	1983–2021
<b>High-income countries</b>			
Social	0.9	0.9	0.8 ↓
Water	3.4	3.1 ↓	2.8 ↓
Energy	5.8	5.3 ↓	4.7 ↓
Transport	10.2	9.5 ↓	8.4 ↓
Telecom	9.1	9.8 ↑	8.6 ↓
<b>Middle- and low-income countries</b>			
Transport	6.5	5.4 ↓	5.0 ↓
Energy	6.1	6.1	5.3 ↓
Social	9.0	5.9 ↓	5.4 ↓
Water	9.6	8.8 ↓	8.0 ↓
Telecom	14.4	14.0 ↓	12.9 ↓

Source: Moody's (2023a). Data as of 2021.

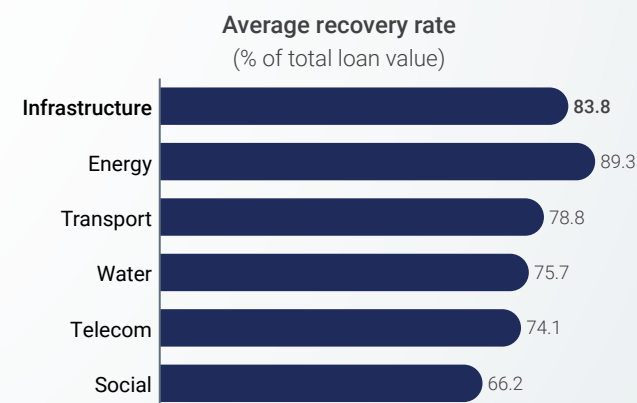
## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE DEBT PERFORMANCE

## Almost all infrastructure subsector loans have higher recovery rates and lower expected losses than non-infrastructure debt. Energy has a particularly high recovery rate.

- Among infrastructure loans that originated from 1983 to 2021, **telecommunication** loans had the highest expected losses, due to this subsector's historically high default rates and lower recovery rates. With the drastic decline in default rates in the 2010s and exceptional demand growth for telecommunications services in the aftermath of COVID-19 lockdowns, expected losses on telecommunications are expected to be much lower.
- The **transport** subsector showed high expected losses at 1.7%. However, the significant fall in 20-year CDR to more than 7.8% for loans originating before 2010s to 1.8% for loans originating after 2010s suggests that the expected losses can be lower on newer infrastructure loans for the transport sector.
- Historically, **social** infrastructure loans have consistently had the lowest default rates. Although they have also had the lowest recovery rates, their expected losses have been the lowest out of all infrastructure subsectors due to their low default levels.
- Energy** infrastructure loans had the highest recovery rates following default. This drives down the subsector's expected losses to 0.5%, which is less than the average across all other infrastructure subsectors.

### Infrastructure loans (1983–2021)



Source: Moody's (2023a). Data as of 2021.



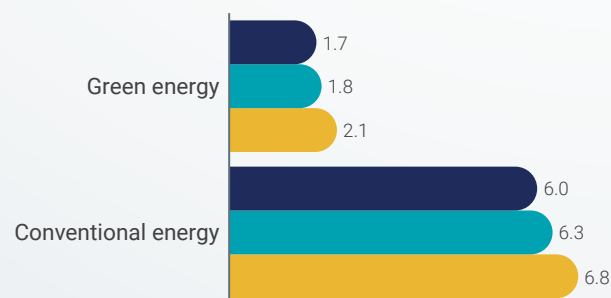
## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE DEBT PERFORMANCE

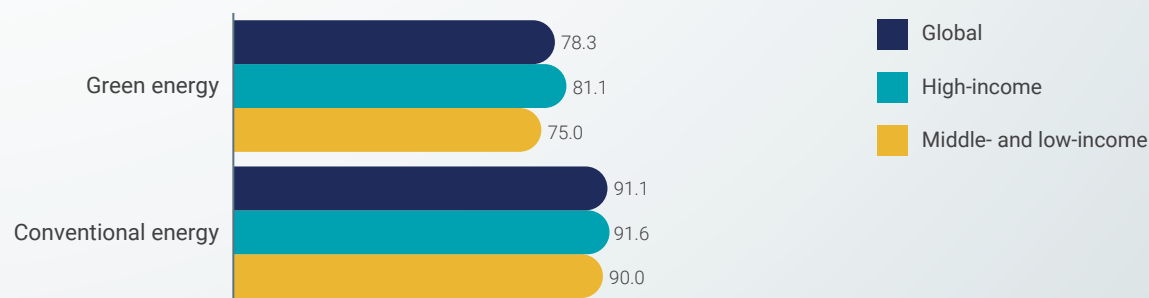
## Green energy projects have a significantly lower default rate than conventional energy projects.

- Energy projects have a significantly high recovery rate. In particular, energy projects that align with the green transition have a lower default rate than those that do not align with the green transition. While sustainability may help with getting financial support, it is not the main driver of the default or recovery rate. Other drivers include contractual arrangements, credit cycle phase, jurisdiction, industry, project-specific risks, country, and industry events, among others.
- For instance, the 10-year average CDR for green energy projects was 1.7%, whilst it was 6.0% for conventional (non-green) energy projects. This may be explained by several factors including a lower marginal cost of production and strong appetite from users, governments, and investors to buy electricity from green energy sources. Conversely, the conventional energy industry is not only facing transition risks, but its marginal production costs have been impacted by volatility in prices of inputs like coal, natural gas, etc.
- Prior to 2010, the availability of green energy projects was quite limited, so the sample mostly reflects conventional energy projects before 2010 and includes green energy projects from 2010 onwards. This may have played a significant role in reducing the default rate for energy investments.
- To illustrate this, when considering a 20-year CDR for energy projects from 1990 to 2021, the default rate was 4.7%. The default rate decreased substantially to 2% when we narrowed our focus to projects exclusively within the period from 2010 to 2021.
- Globally, the average recovery rate for green energy projects is 78.3% – lower than the recovery rate for conventional energy projects (91.1%).
- This is consistent across both country income groups. In high-income countries, the average recovery rate for green energy projects is 81.1%, and 91.6% for conventional energy projects. The gap is wider in middle- and low-income countries – where green energy markets are still at a relatively early stage of maturity – with an average recovery rate for green energy projects of 75%, and 90% for conventional energy projects.

**10-year cumulative default rate by energy subsector and country group**  
(%, 1983–2020)



**Average recovery rates by energy subsector and country group**  
(% of total loan value, 1983–2020)



Source: Moody's (2023b).

Note: Estimates are based on Moody's definition and methodology for default and recovery. Green energy includes renewable energy projects including solar, hydro, wind as well as other energy efficiency projects. High-income country group is proxied by European Economic Area countries and OECD member states in this graph. Middle- and low-income country group follows the World Bank Group classification.

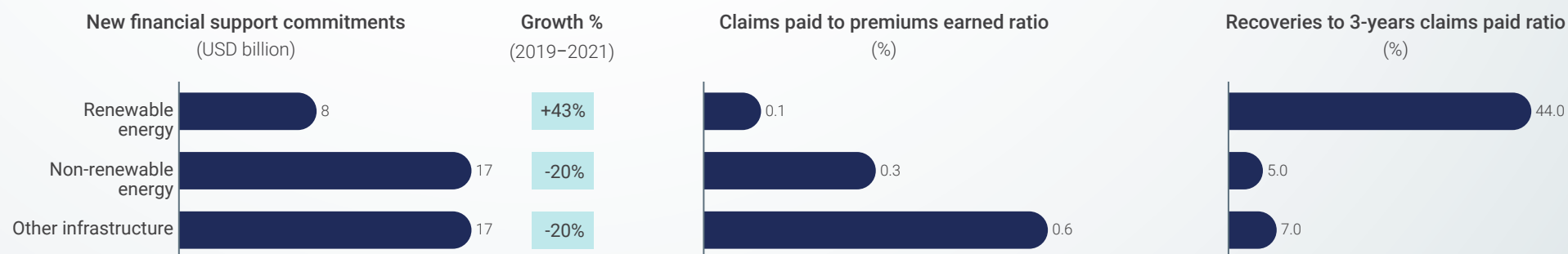
## INFRASTRUCTURE INVESTMENT PERFORMANCE

## INFRASTRUCTURE DEBT PERFORMANCE

## Renewables are increasingly being supported by the export credit and investment insurance industry, and they have strong recovery potential.

- Looking at performance across the global export credit and investment insurance industry, renewable energy projects have more potential for recovery compared to non-renewable energy projects. However, in developing economies, renewable energy markets are still underdeveloped, and non-renewable energy markets are larger.
- In 2021, new commitments for export credit insurance in the non-renewable energy sector totaled USD16.8 billion, whilst new commitments in the renewables sector were only USD8.0 billion. The new commitments for renewable energy projects in 2021 recorded the strongest growth so far, of 43%.
- As the renewable energy sector has lower default risk than the non-renewable energy sector, its claims ratio (0.1%) is also lower than that of non-renewables (0.3%). Renewable energy's 44% recovery rate is considerably higher than the recovery rate for non-renewable energy, which is only 5%.

### Export credit insurance market: Financial support by sector, 2021



Source: Berne Union (2022).

Note: Medium and long-term insurance, guarantee and lending for export credit, political risk insurance and other cross-border credit are included. New commitments: insurance/guarantee/loan/etc. commitments issued to support recovery.

## INFRASTRUCTURE INVESTMENT PERFORMANCE

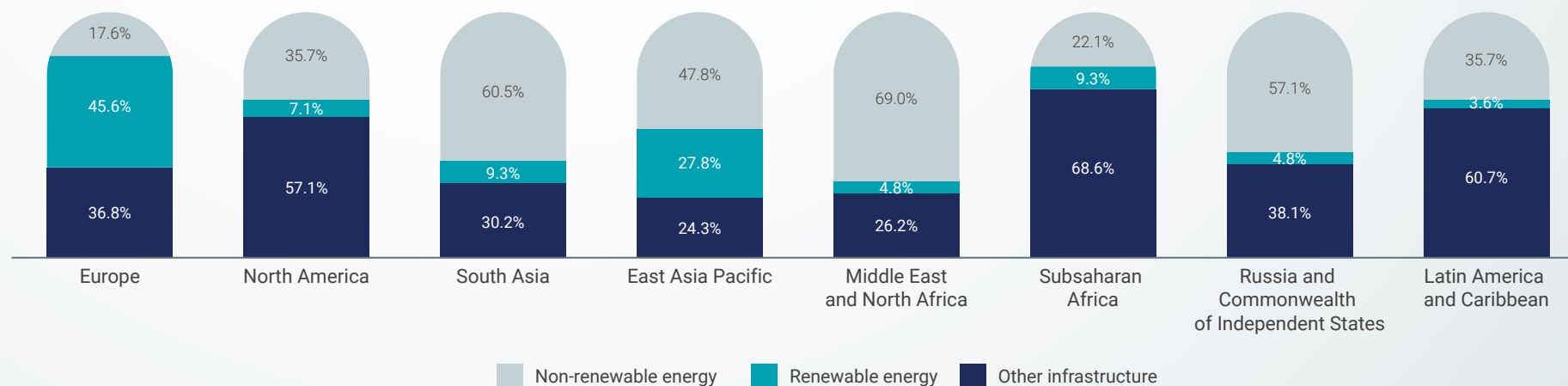
## INFRASTRUCTURE DEBT PERFORMANCE

## In all regions except Europe, the export credit and investment insurance industry's support for non-renewable energy still exceeds renewable energy.

- In all other regions except Europe, non-renewable energy projects recorded significantly higher levels of new export credit insurance commitments than renewable energy projects. The differences vary between regions, with the biggest difference recorded in the Middle East and North Africa (69.0% non-renewables vs. 4.8% renewables).
- East Asia Pacific and Sub-Saharan Africa recorded the smallest differences, and a large uptick in new commitments for renewables in 2021.
- Climate goals and the renewable energy sector's higher recovery potential is expected to increase coverage and availability of these supporting instruments in all regions in the near future. In Europe, renewable energy projects already have better recovery rates (93.3%) than non-renewable energy projects (89.8%).

### Export credit insurance market: New financial support commitments by sector

(Share in total value of new financial support commitments, 2021)



Source: Berne Union (2022)

Note: Medium and long-term insurance, guarantee and lending for export credit and political risk insurance are included.