



Impacts of the Inevitable Policy Response across asset classes

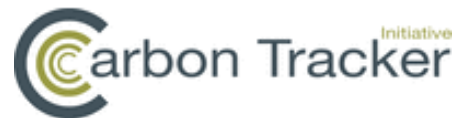
April 2020

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Consortium

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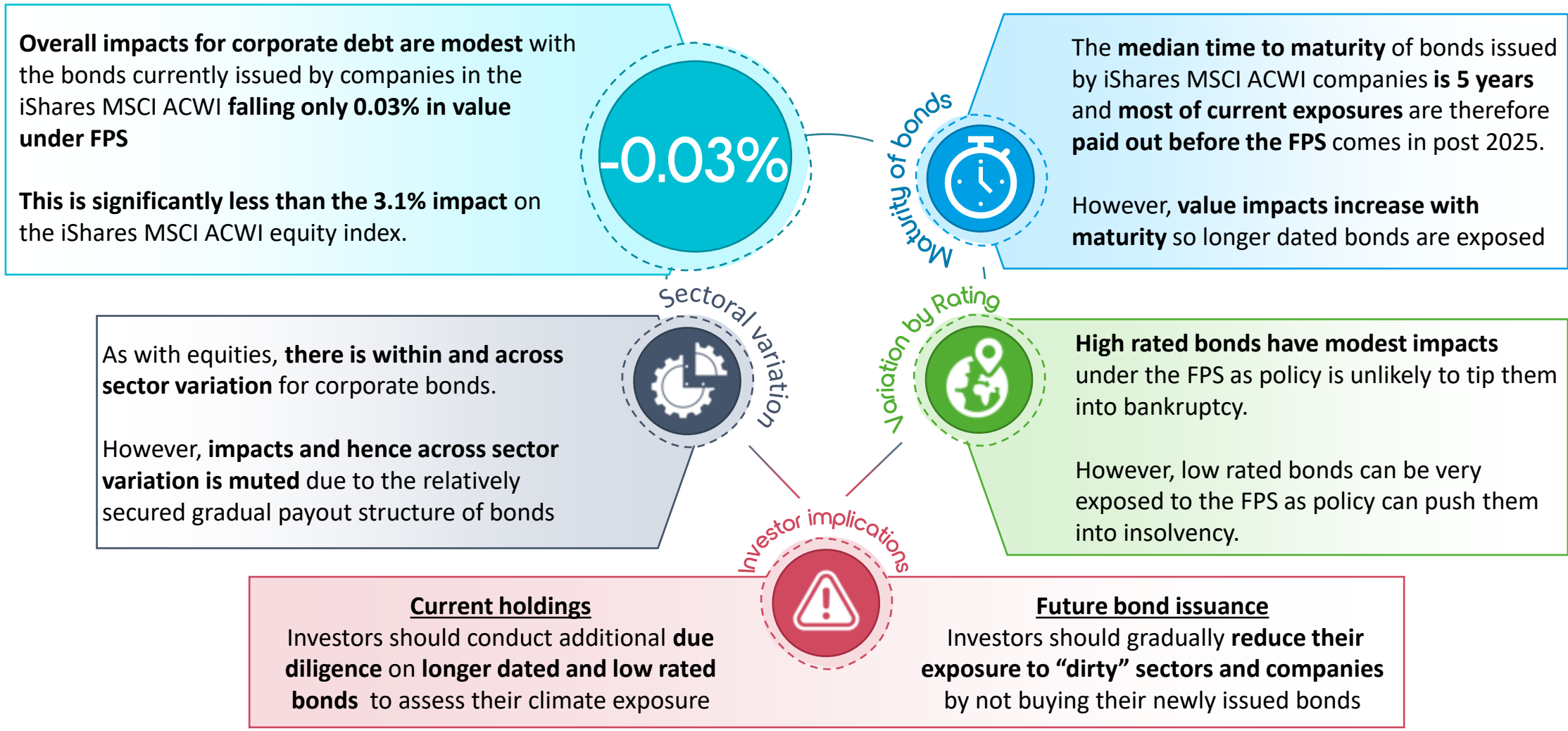
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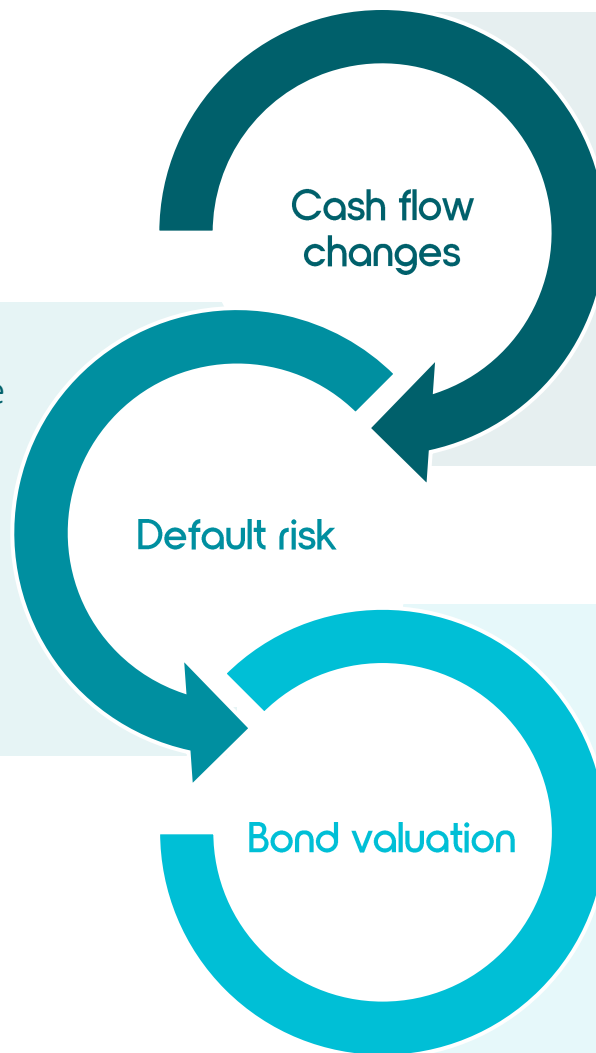
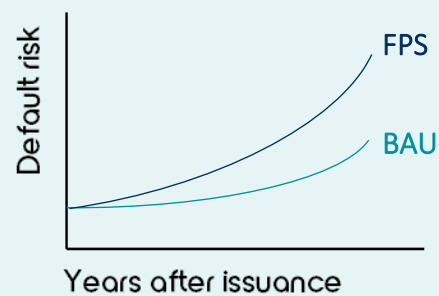
Corporate bond results (Vivid Economics)

Key Findings: Corporate debt impacts are modest as most issued bonds mature before the FPS kicks in, which presents a realignment opportunity for investors



Changes in company fundamentals arising from the FPS affect default risk and as a result corporate bond valuations

Changes in cash flows impact default risk, as companies ability to service their debt change



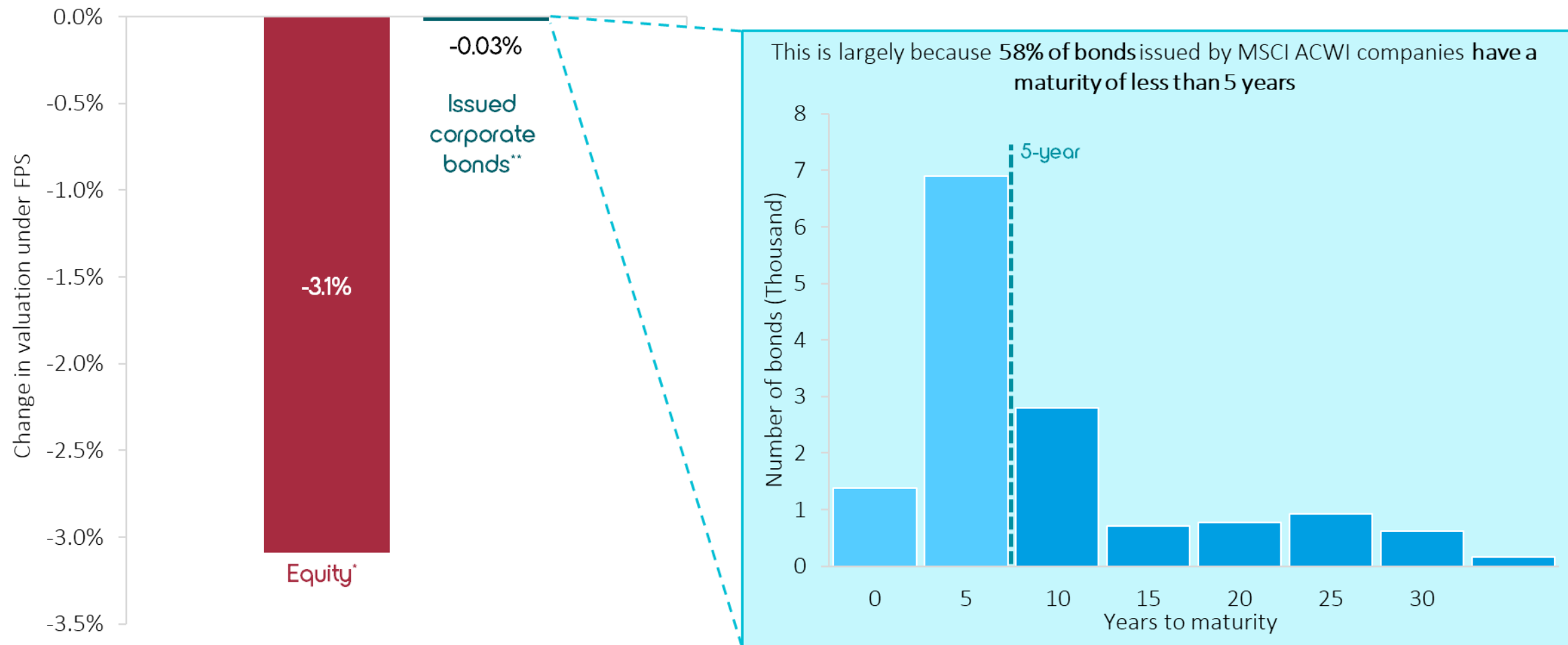
FPS decarbonization policies impact company performance as outlined in the equities analysis

Effects vary across companies depending on characteristics such as sectors

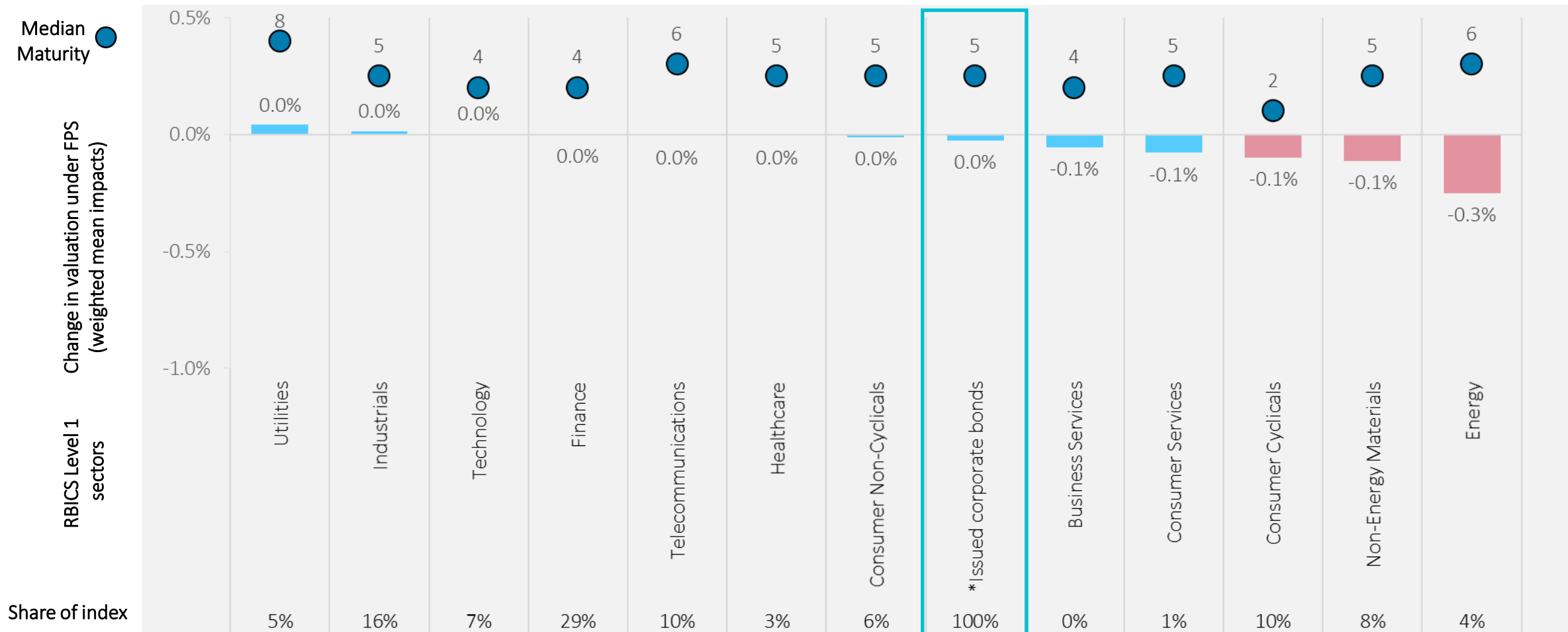
Changes in default risk are translated into adjusted bond prices, using standard fixed income security valuation techniques

Impacts differ depending on current credit ratings (default probabilities) and duration (time to maturity and payout structure)

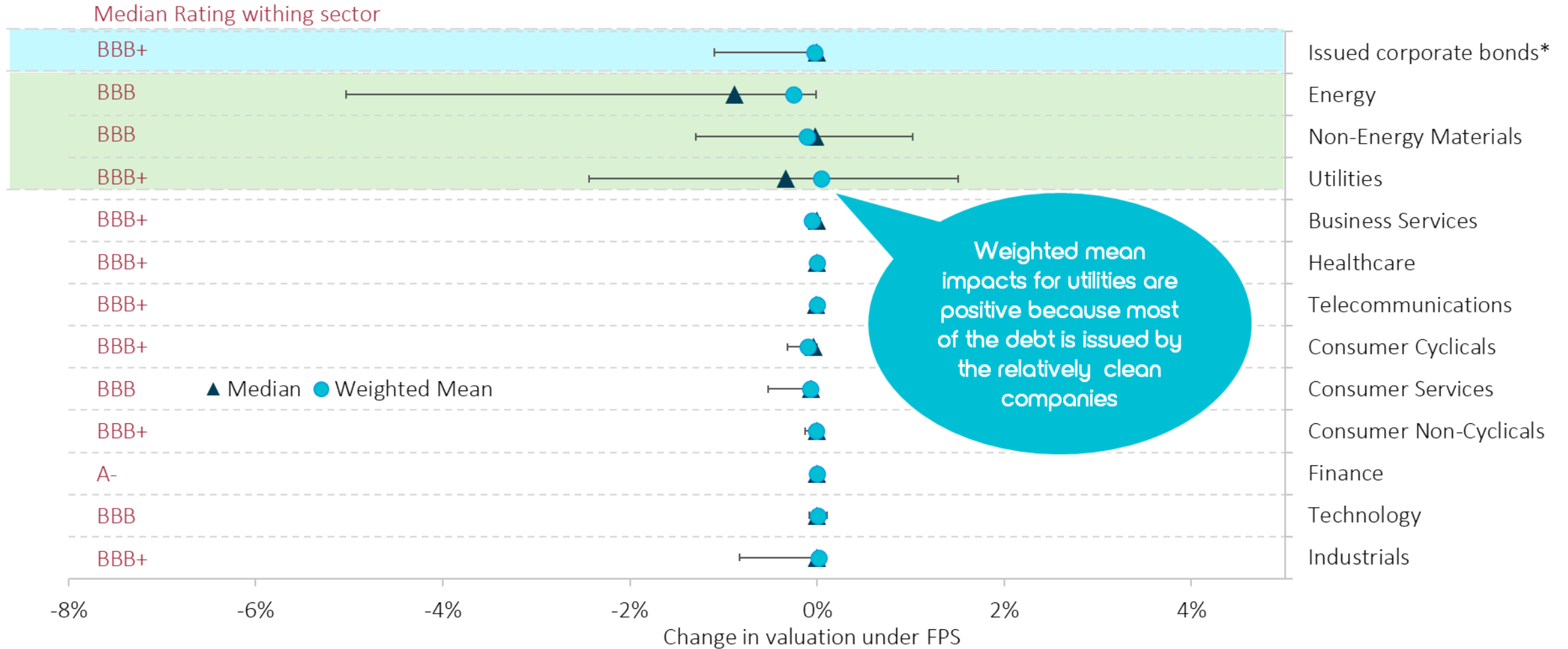
Overall impacts are modest relative to equities as most issued bonds pay out before impacts kick in – the majority of analysed bonds have a maturity under 5 years



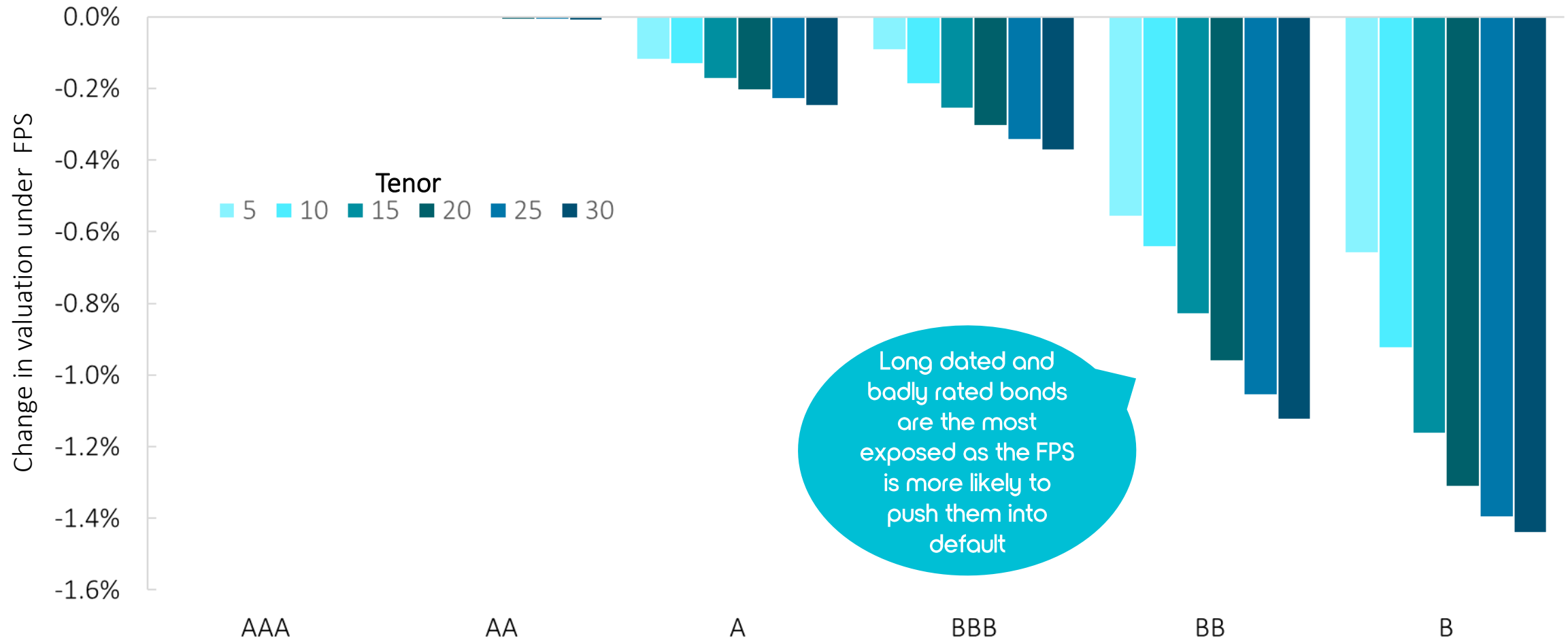
Impacts are small across sectors, as short maturities prevail across all major sectors



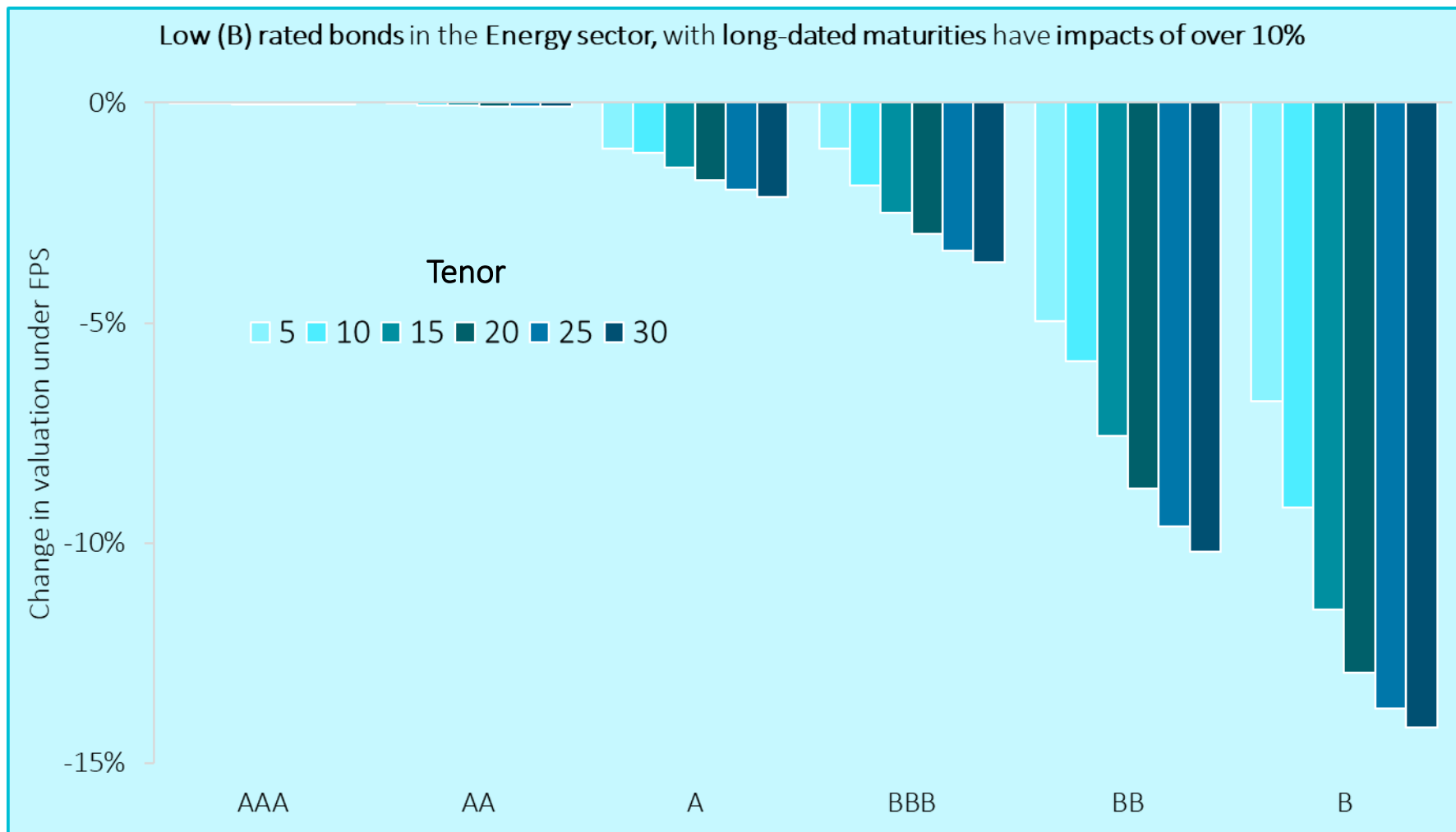
However, as with equities, within-sector variation can be significant, particularly for: energy, non-energy Materials and utilities



Beyond company fundamental, discussed in the equities release, variation in impacts can be explained by differences credit ratings and maturities*



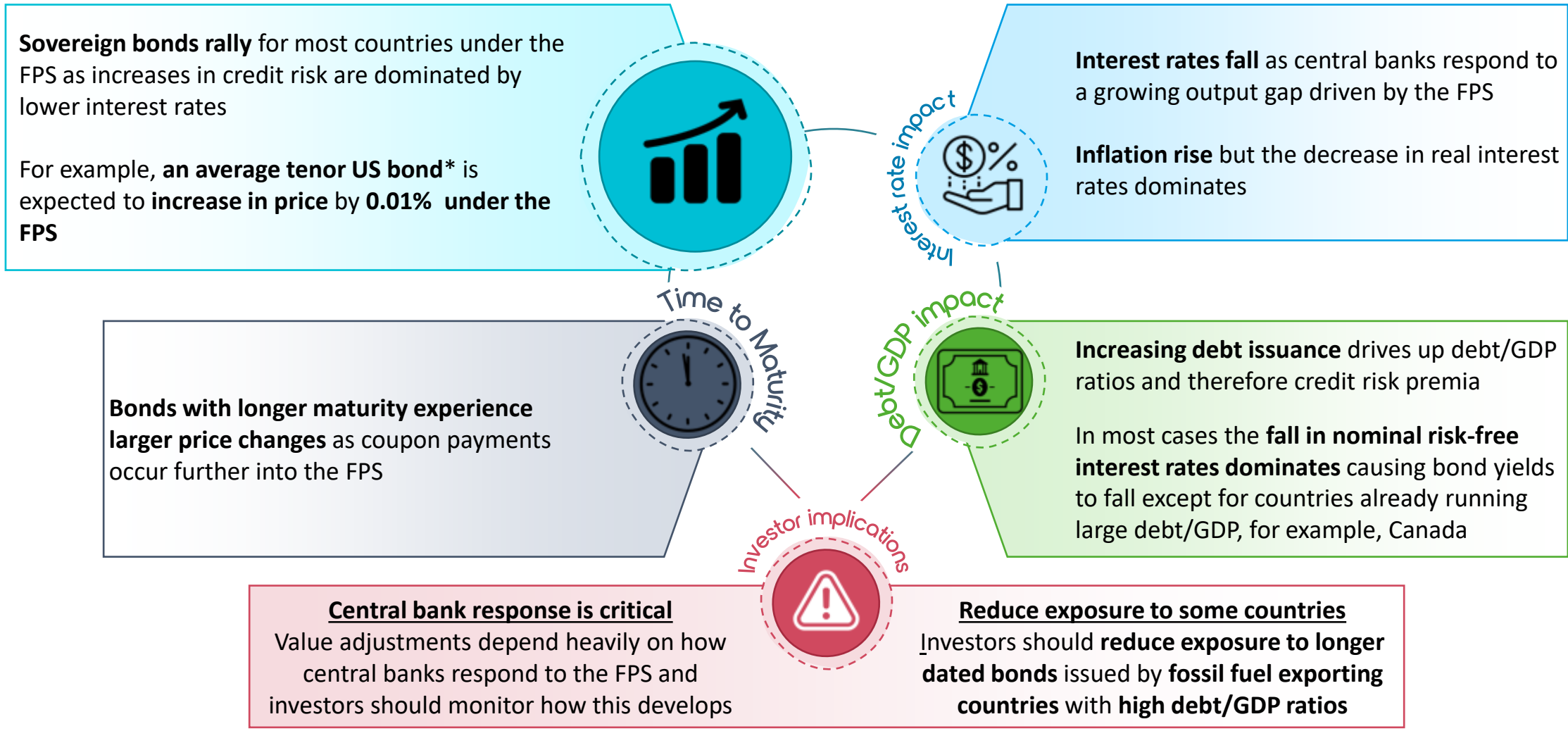
Although current bond portfolios face small risks, low rated bonds in exposed sectors, can be very exposed and extra due diligence is thus needed around new issuance



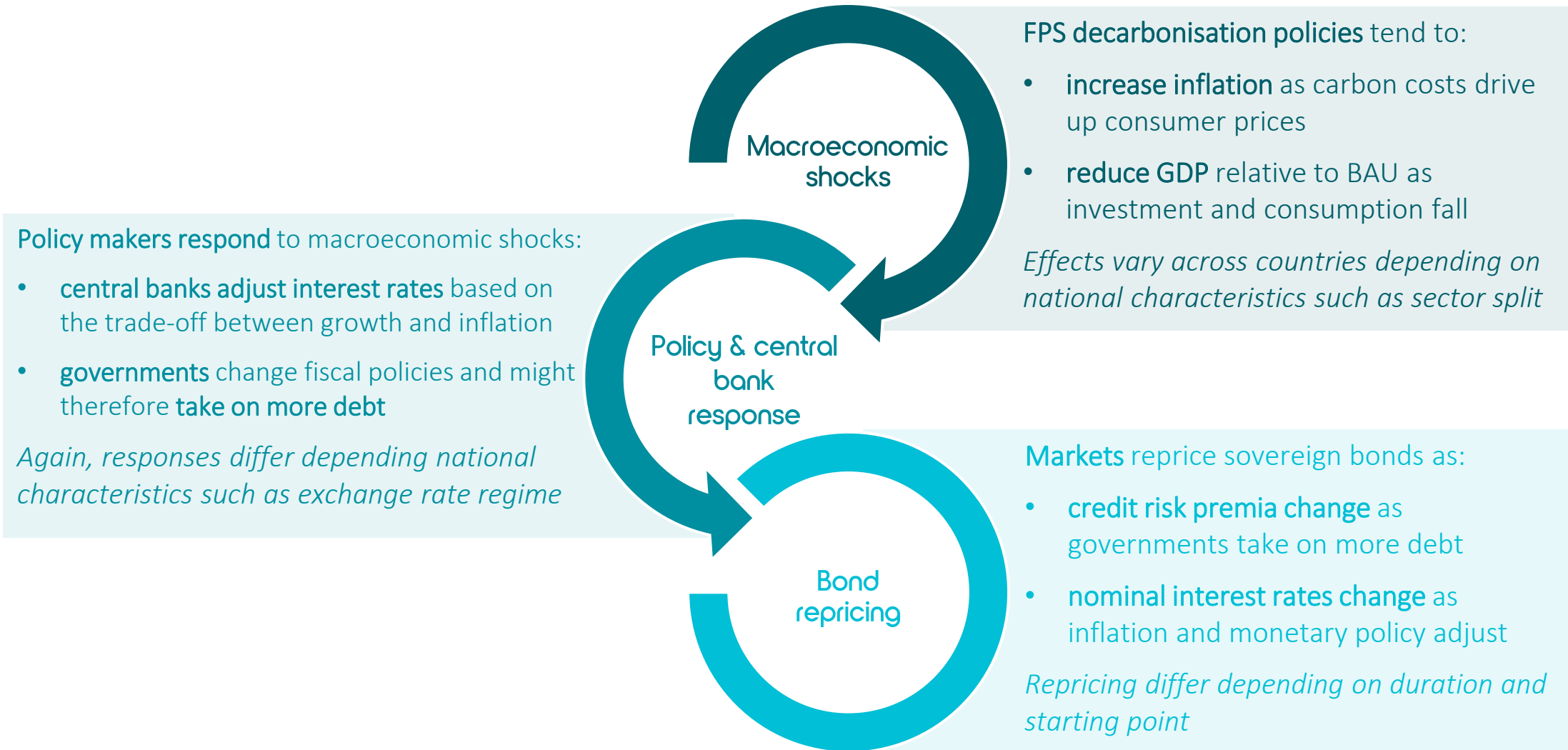


Sovereign debt results (Vivid Economics)

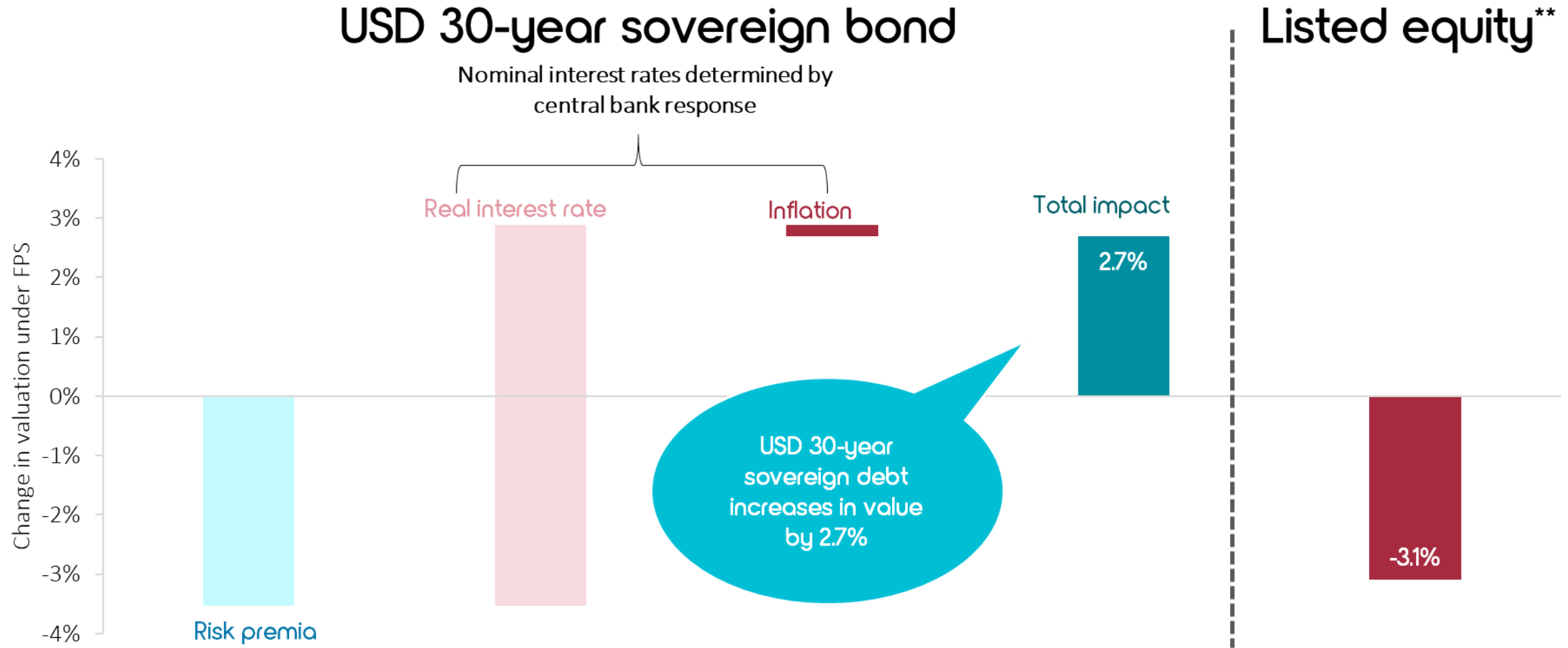
Key Findings: Sovereign bonds tend to rally under the FPS as increases in risk premia are offset by central banks cutting interest rates in response to the policy shock



Macroeconomic shocks and policy responses change nominal interest rates and credit risk premia which lead to a repricing of sovereign bonds



United States 30-year bond prices increase significantly due to expectations of lower future real interest rates

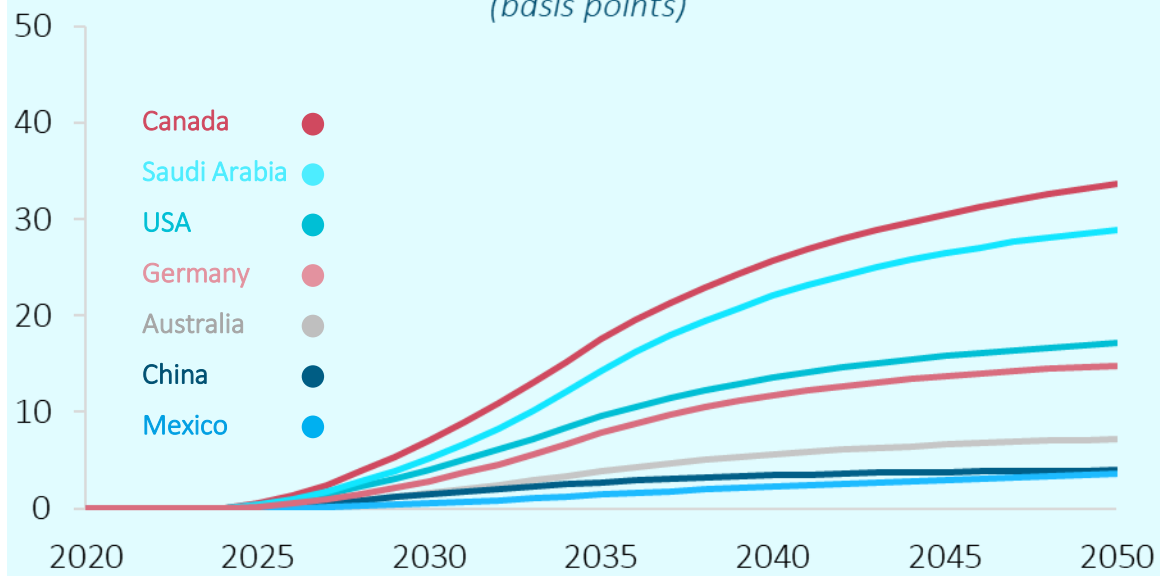


Financial markets price in higher sovereign credit risk, while central banks cut rates in response to the FPS

Risk premia rise (first order effect)

- Lower growth and fiscal expansion leads to an increase in debt/GDP ratios and as a result higher default probability
- Markets reprice based risk premia on sovereign bonds rise

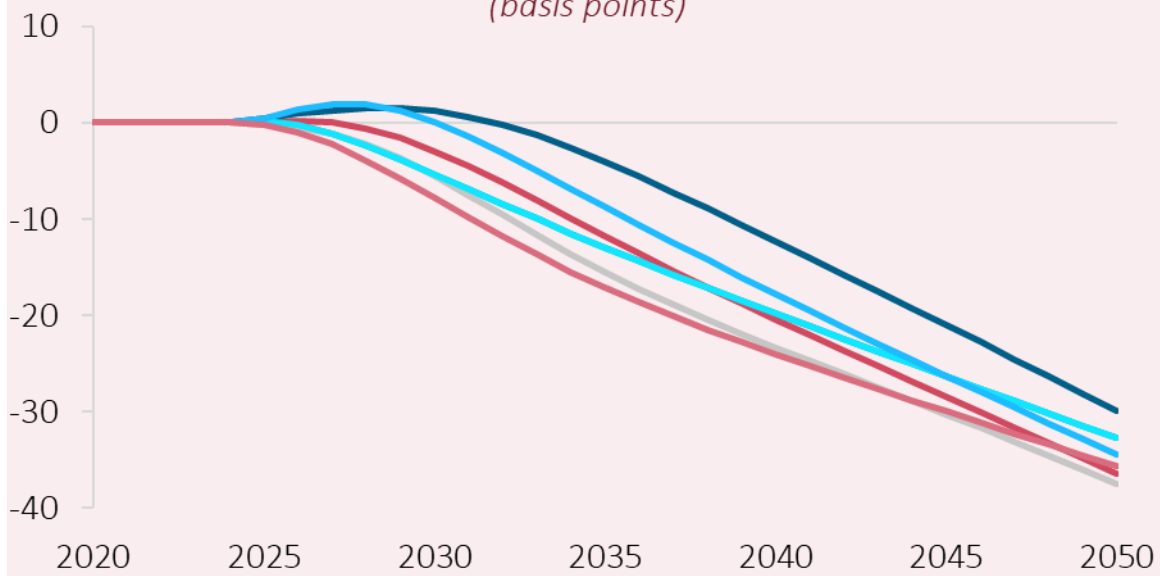
Default risk premium in FPS relative to BAU
(basis points)



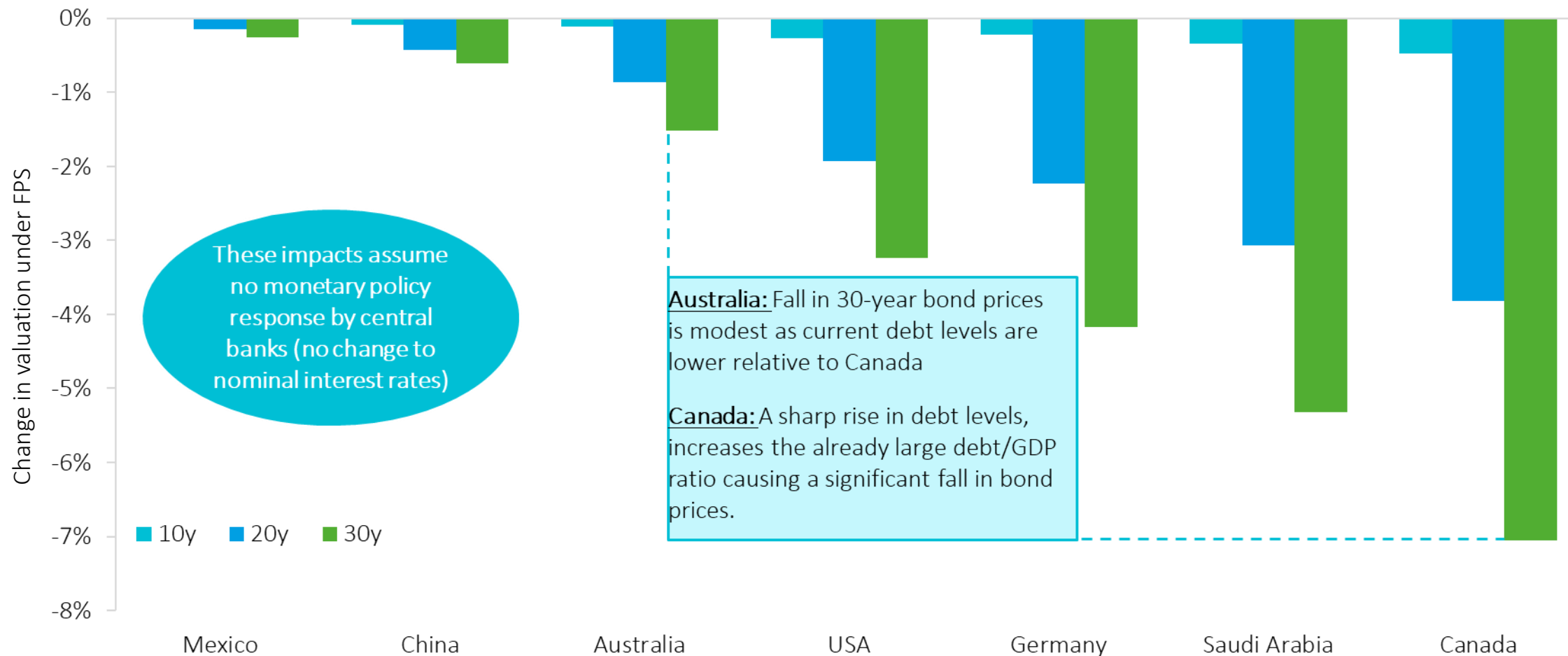
Interest rates fall (second order effect)

- Faced by a GDP output gap and increasing inflation, central banks chose to cut interest rates to stimulate growth
- This response is **highly dependent on the response of monetary authorities**, the FPS follows a classic Taylor rule

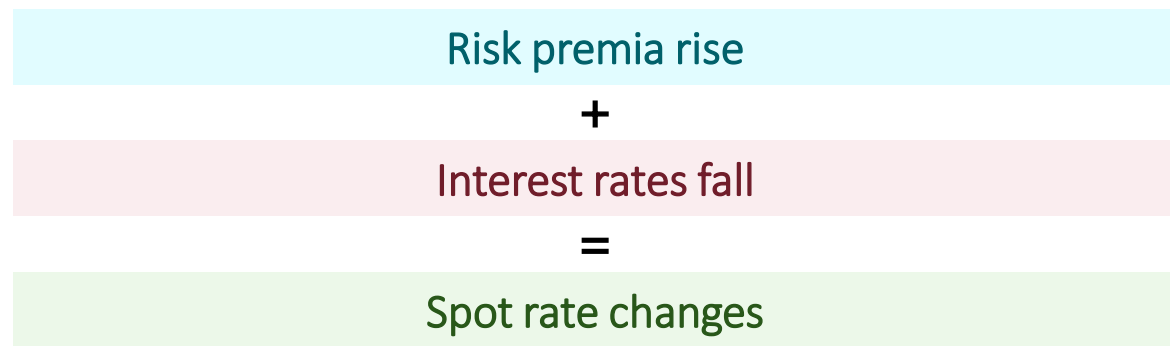
Nominal interest rates in FPS relative to BAU
(basis points)



In isolation, bond prices can fall significantly from rising debt/GDP as the sovereign default risk premia increases



However, combining risk premia and nominal interest rate changes into spot rates show that interest rate falls tend to dominate risk premia increases



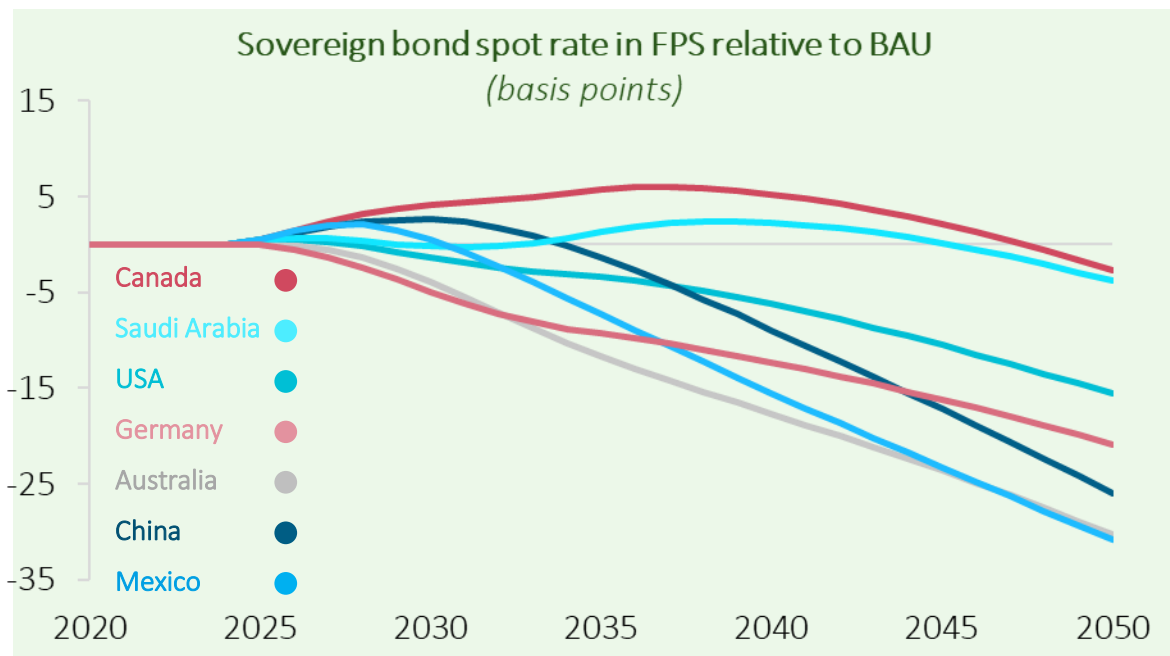
Technical detail on spot rate calculation

'Baseline' spot rates are estimated using market data on sovereign bond yield curves:

- Current sovereign bond yield to maturities are converted into spot rates through bootstrapping (equating discounted cashflows based on spot rates and YTM's)
- The change in spot rates under FPS and BAU spot rates are used to estimate FPS spot rates
- These spot rates are then used to value bonds under the FPS

Findings

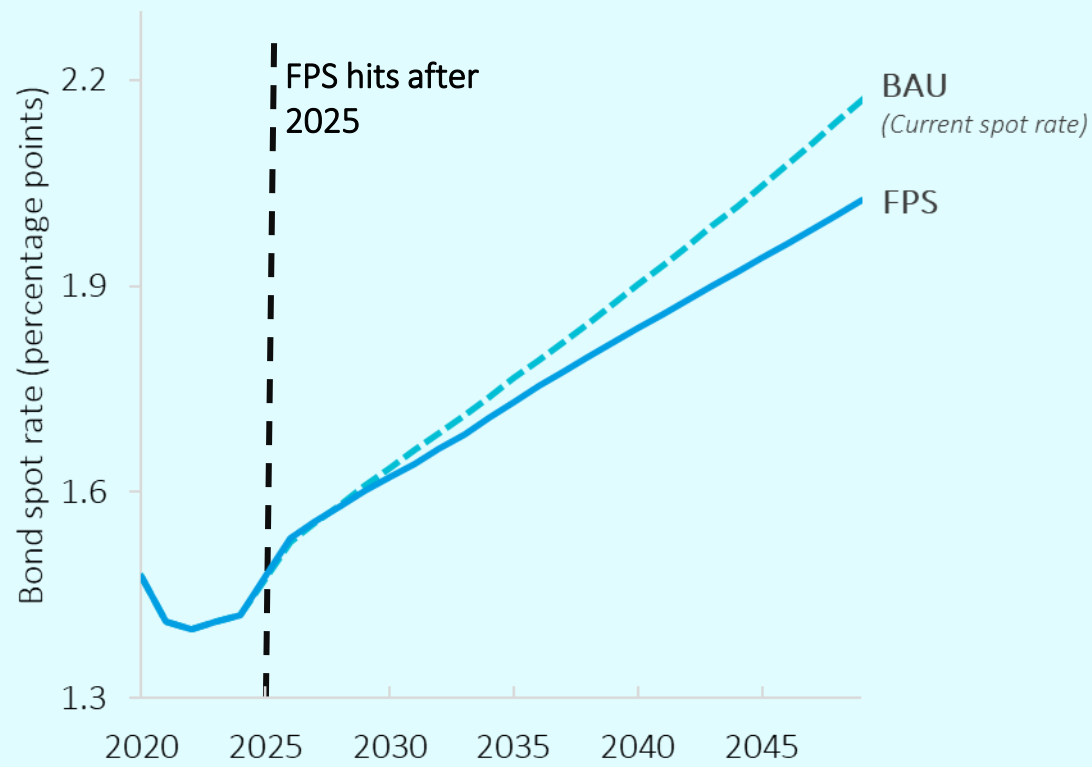
- Spot curves are flatter (for most countries) as spot rates in longer dated tenors fall more
- Canada and Saudi's spot curve is higher for shorter maturities and lower for longer maturities – as the change in default risk premia dominates nominal interest rate up to 2045.
- Australia's spot curve is lower by ~30bps in the 30 year tenor driven by a large decrease in nominal interest rates.



Combined impacts can be illustrated by 30-year US-treasury bonds for which increases in default premia are offset by lower interest rates

US-treasury spot curve

The US treasury spot curve flattens as markets price in the expected reduction in central bank interest rates under the FPS

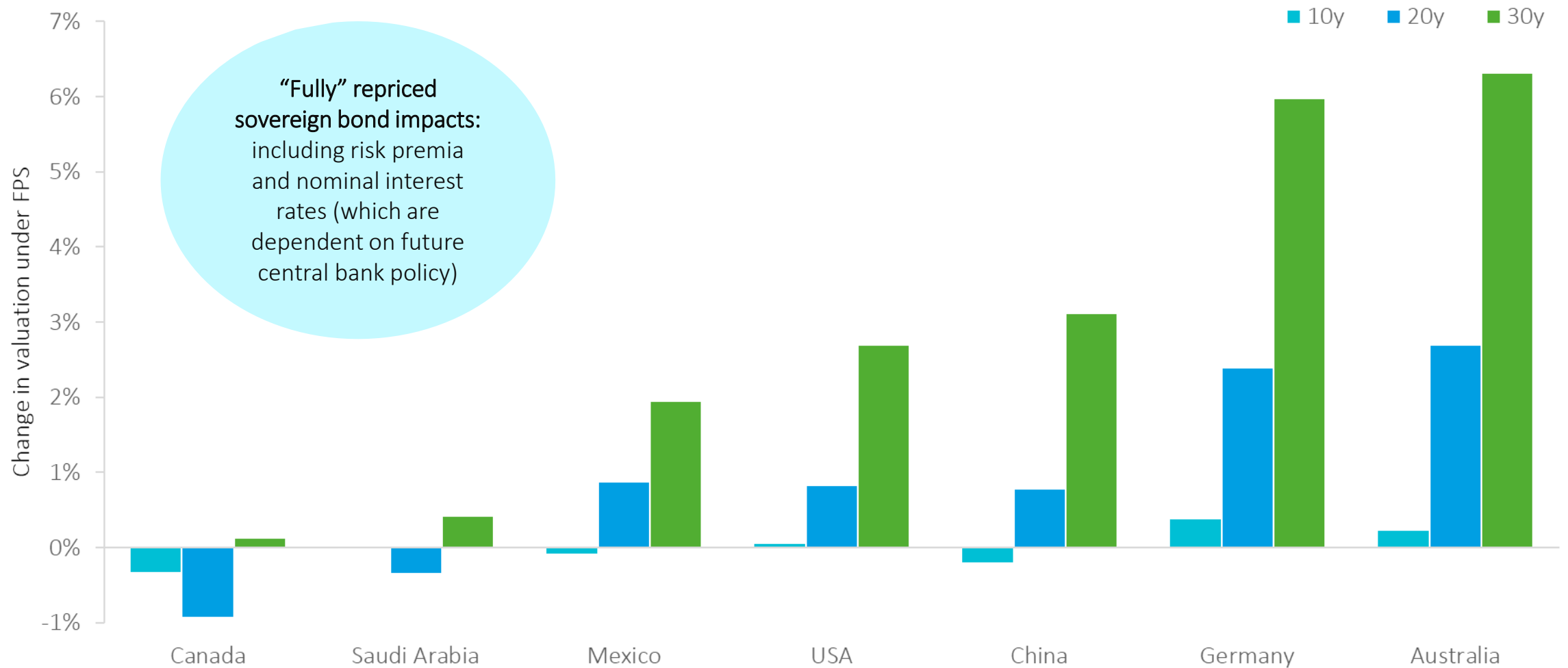


Bond valuation impacts

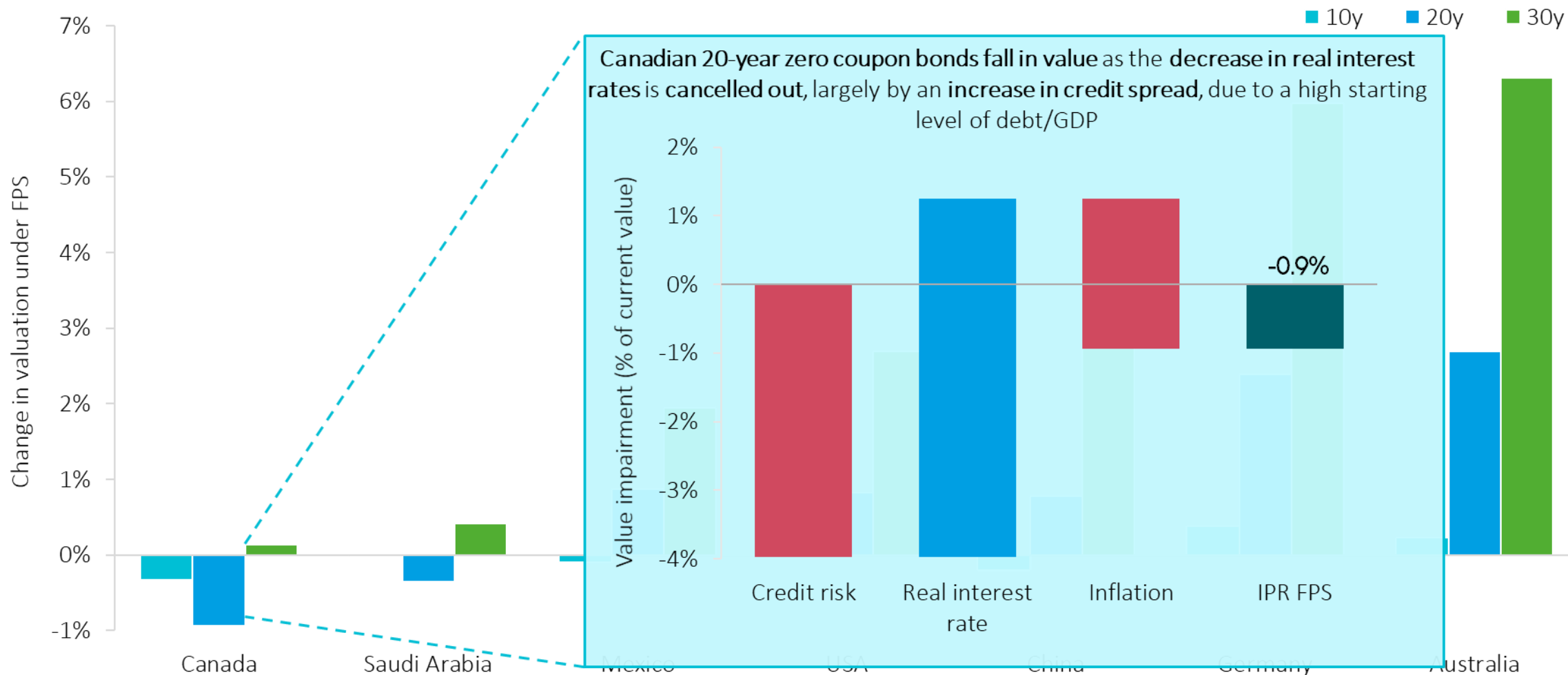
Real interest rates falls dominate the effect of increasing risk premia and inflation for 30-year US government bonds



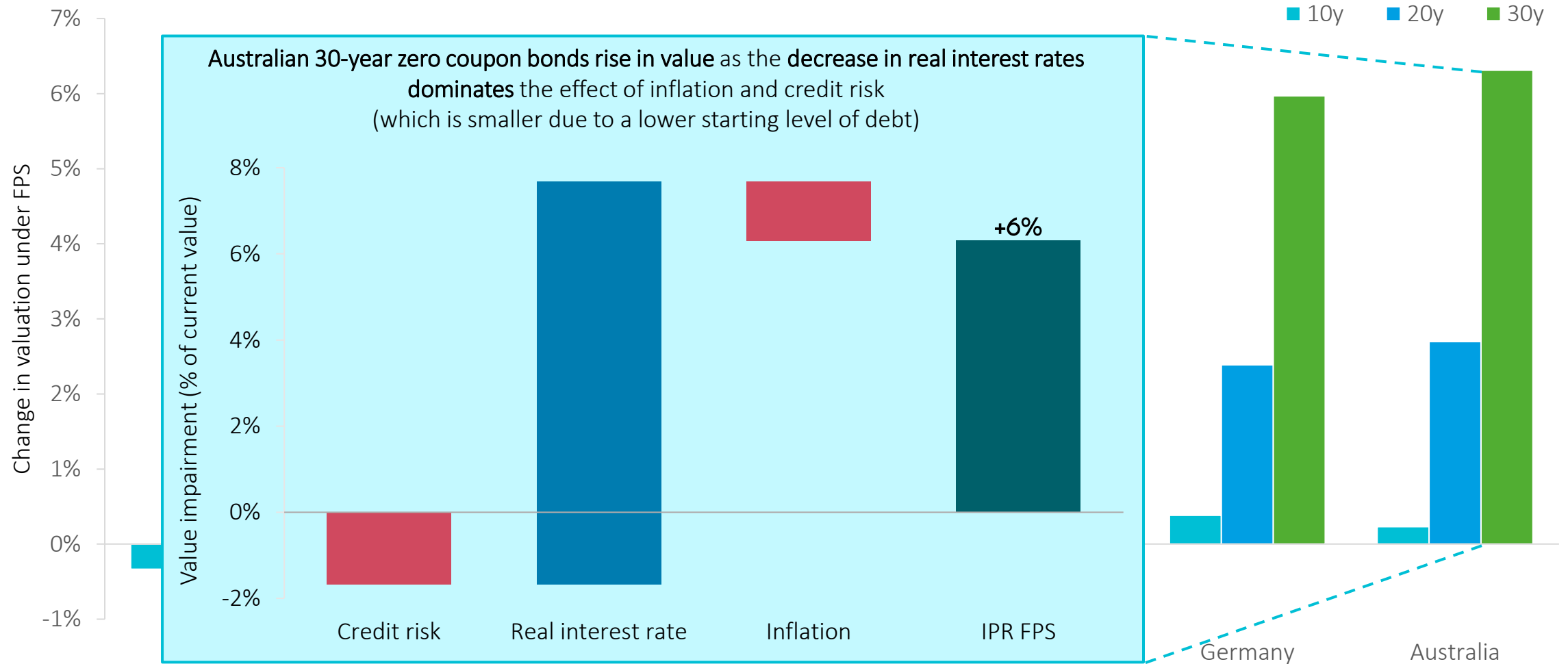
Full valuation impacts vary significantly across countries and by maturity, with longer-dated bonds having larger impacts, but most bonds rally under FPS



Higher credit risk can drive bond value reductions, but this is only for a small subset of highly exposed and leveraged countries such as Canada



For most countries, including Australia, increases in credit risk are so small that they are offset by the fall in interest rates



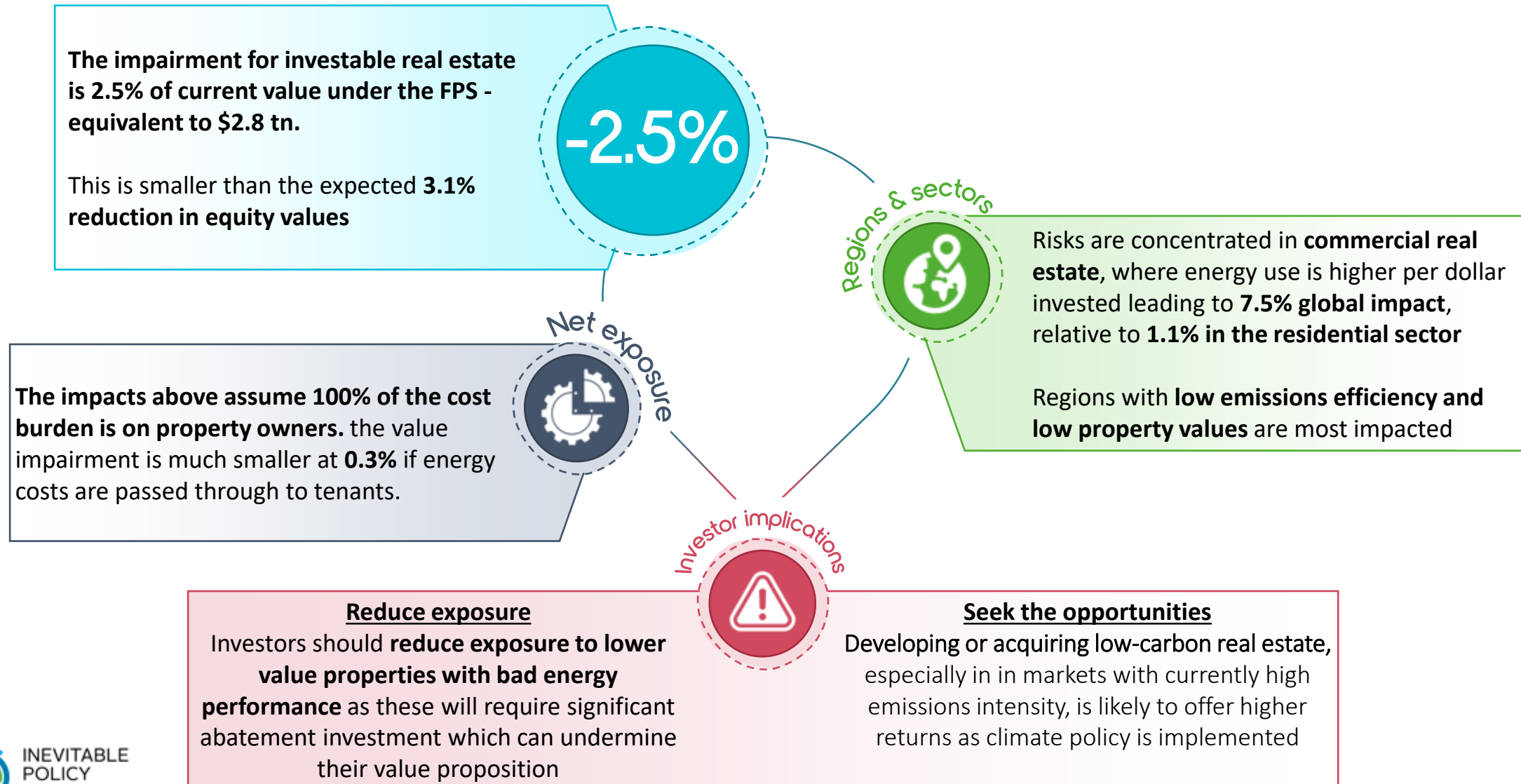
Sovereign debt impacts of the FPS are sensitive to assumptions around central bank response functions, and the relationship between debt-to-GDP and credit risk

- The macroeconomic analysis of the FPS assumes that **central banks respond to changes in GDP and inflation based on the Taylor rule**
- The **effect of increasing debt-to-GDP on default risk premia** is accounted for based on statistical relationships at the global-level
 - ◇ The **econometric specification** accounts for different starting points of debt-to-GDP, and uses a non-linear specification to account for the increasing marginal impact of debt-to-GDP on default risk premia
 - ◇ Sovereign credit risk is influenced by a range of other market and fundamental factors which are not accounted for in this analysis
 - ◇ Sensitivity analysis was done using different econometric specifications, to assure for robustness of results
- The Appendix shows how the bond valuation impacts of the FPS can be decomposed by risk factor (real interest rates, inflation and credit risk)
- **Under the FPS, interest rates do not change up to 2025, the year in which policy disruption begins**– this means that all bonds with a maturity of 5-years or less are unaffected
- Vivid’s bond pricing methodology uses the change in 1-year forward credit spreads and nominal interest rates, to calculate the change in spot rates over time.
 - ◇ Current (as of 4th February 2020) yield to maturities are obtained from Thompson Reuters which are converted to spot rates using a bootstrapping routine
 - ◇ The curves illustrated in this deck are spot curves i.e. each point on the curve represents the spot rate for that tenor
- For Eurozone countries, macroeconomic impacts are modeled at the Eurozone-level, with relevant outputs then downscaled to the country-level
- Saudi Arabia’s pegged exchange rate regime against the US dollar is assumed to hold

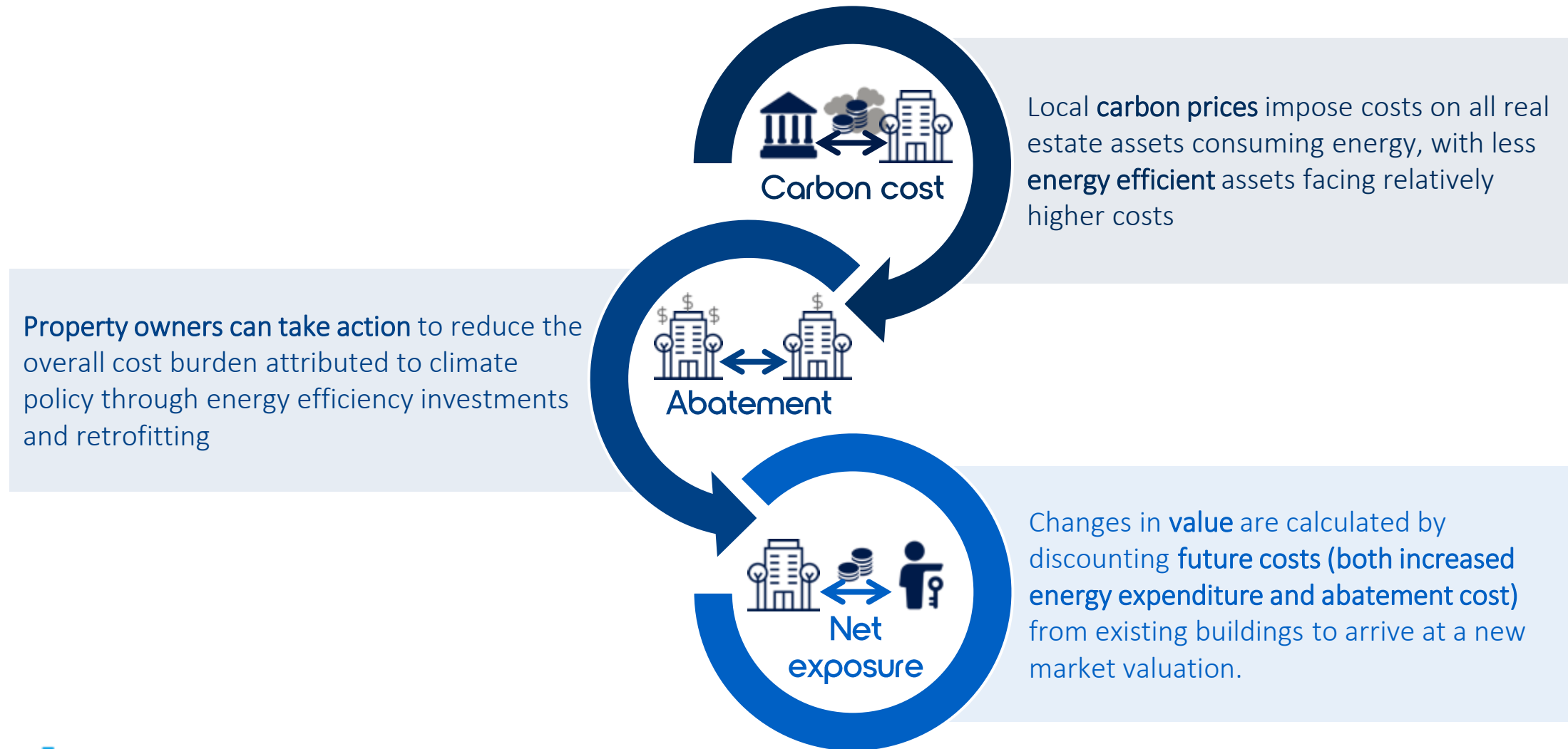


Real estate results (Vivid Economics)

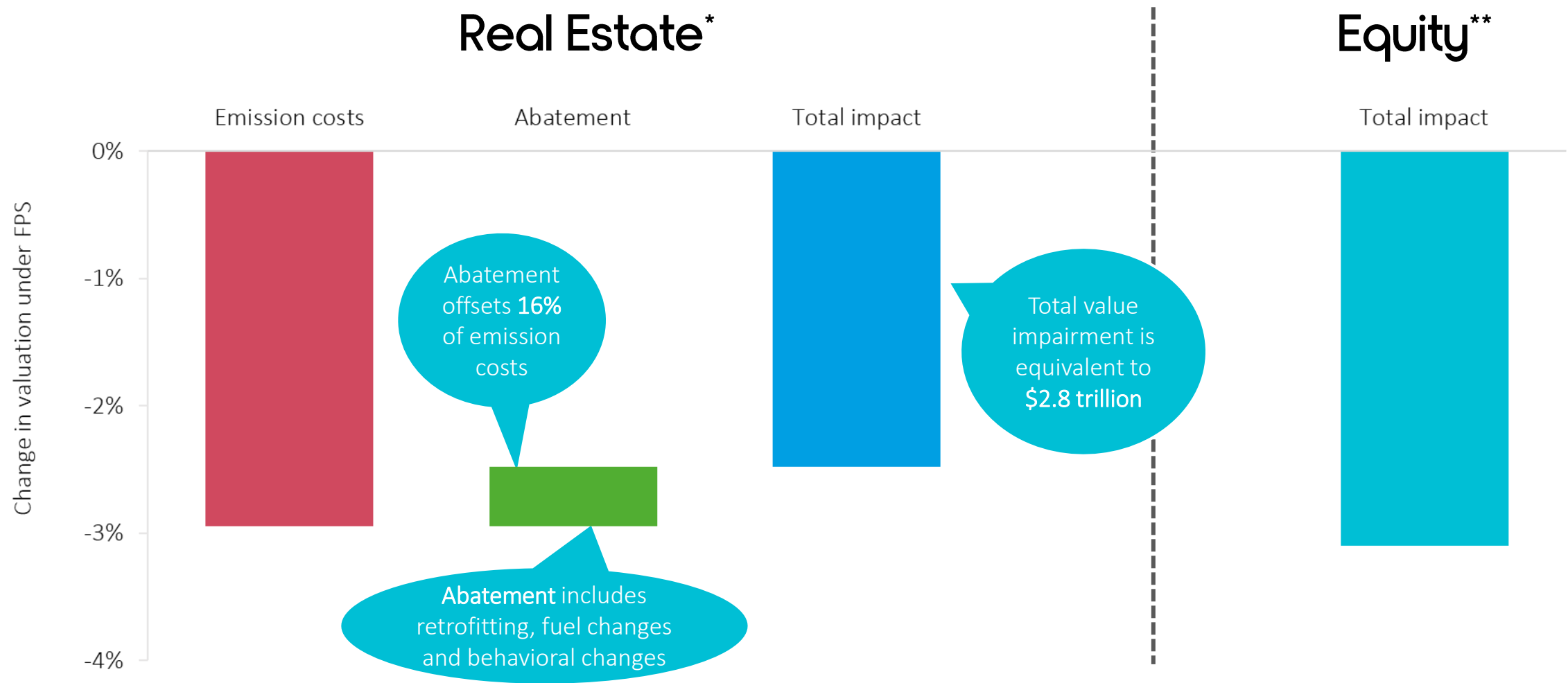
Key Findings: Real estate is almost as exposed as equities with impacts concentrated in commercial real estate and regions with high emissions intensity



The real estate model distributes the cost impact from carbon pricing between owners and tenants to estimate changes in property valuation



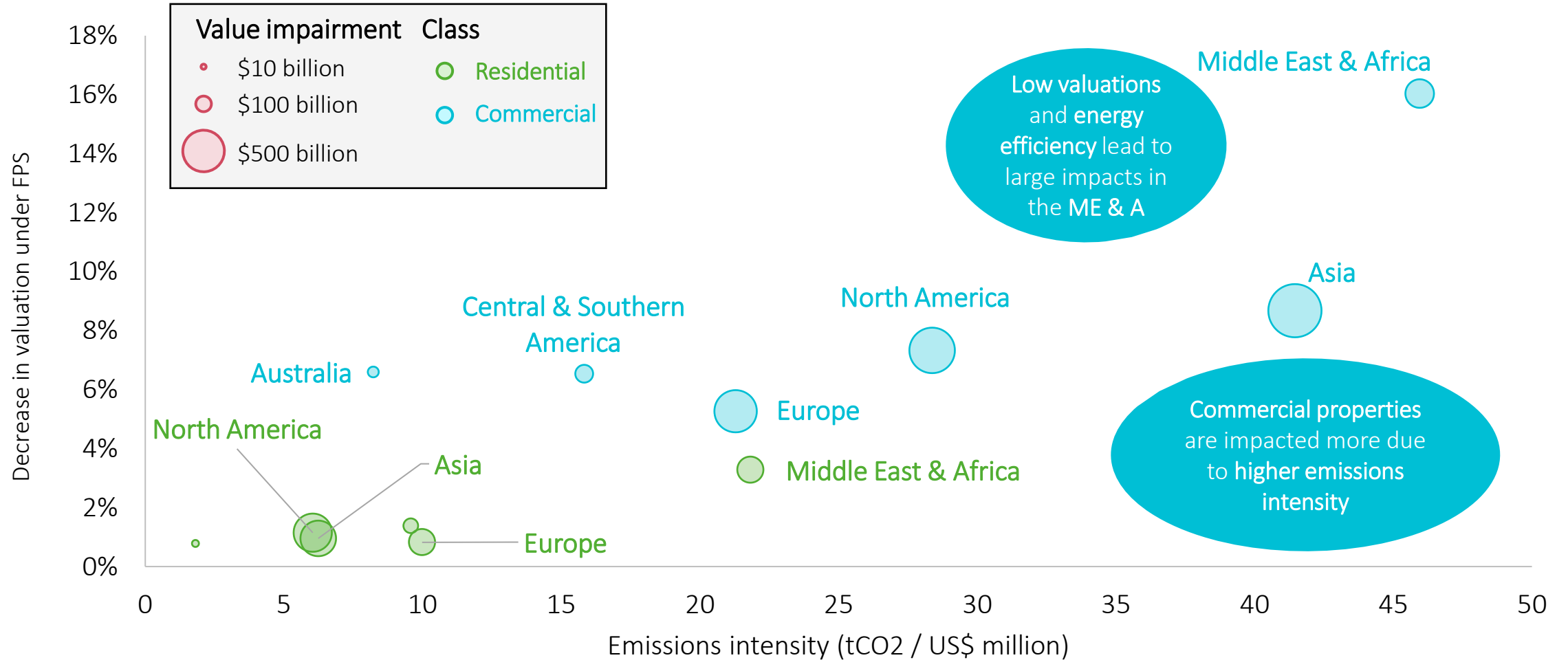
The value of investable real estate falls by US\$2.8 trillion under the FPS, 2.5% of its current value which is slightly less than the estimated impact on equities



* the global share of investable property by value is 34% in the residential sector and 67% in the commercial sector. As a result, \$114.5 trillion of the \$254 trillion global real estate market is included in this analysis. Savills (2017): <https://www.savills.co.uk/blog/article/216300/residential-property/how-much-is-the-world-worth.aspx>

** equity results are based on the MSCI ACWI: <https://www.msci.com/acwi>

Impacts are concentrated in commercial property, with high energy intensity to value increasing severity of regional impacts in both property classes

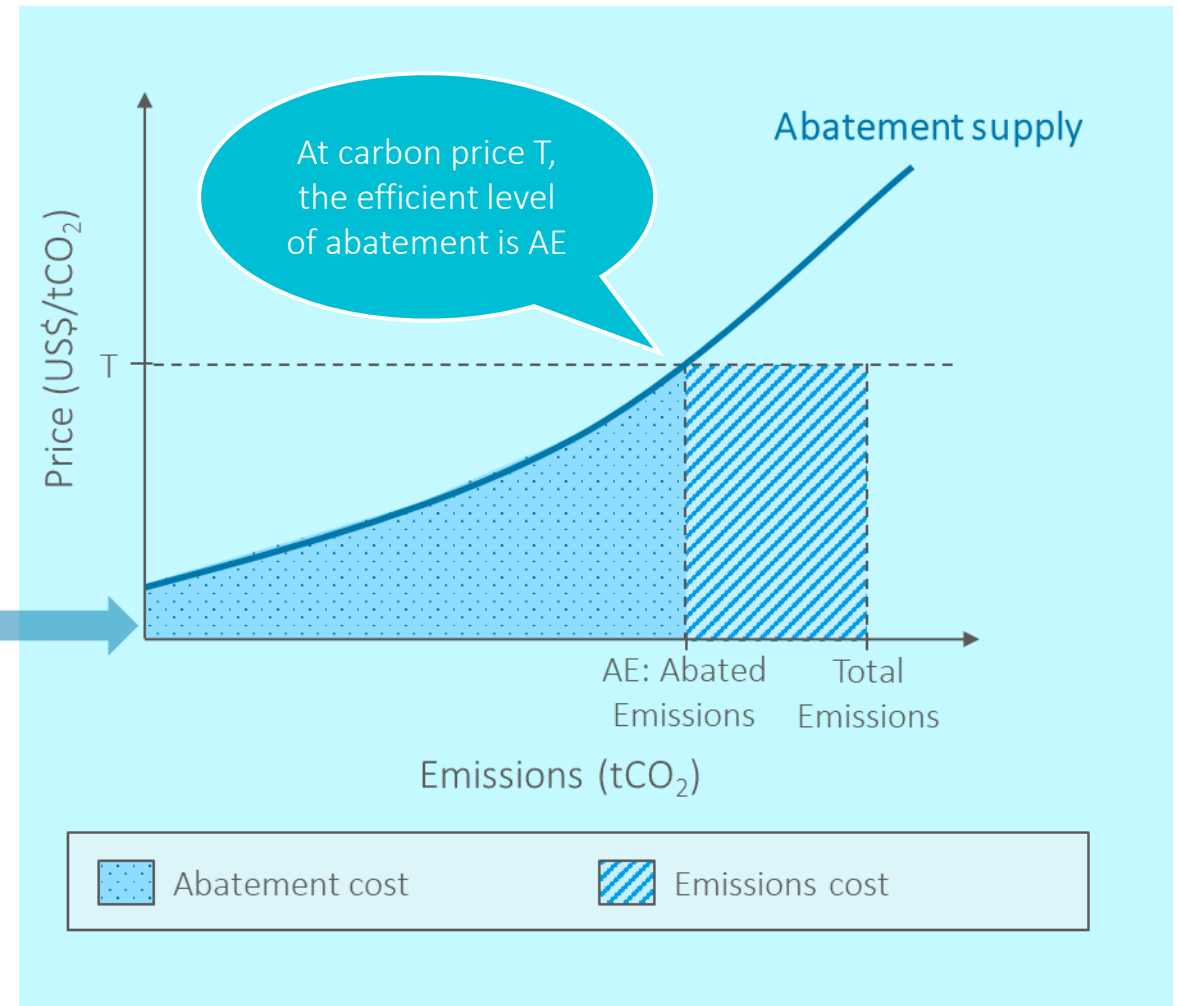


Increasing coverage and stringency of energy efficiency policies will lead to large-scale abatement activities

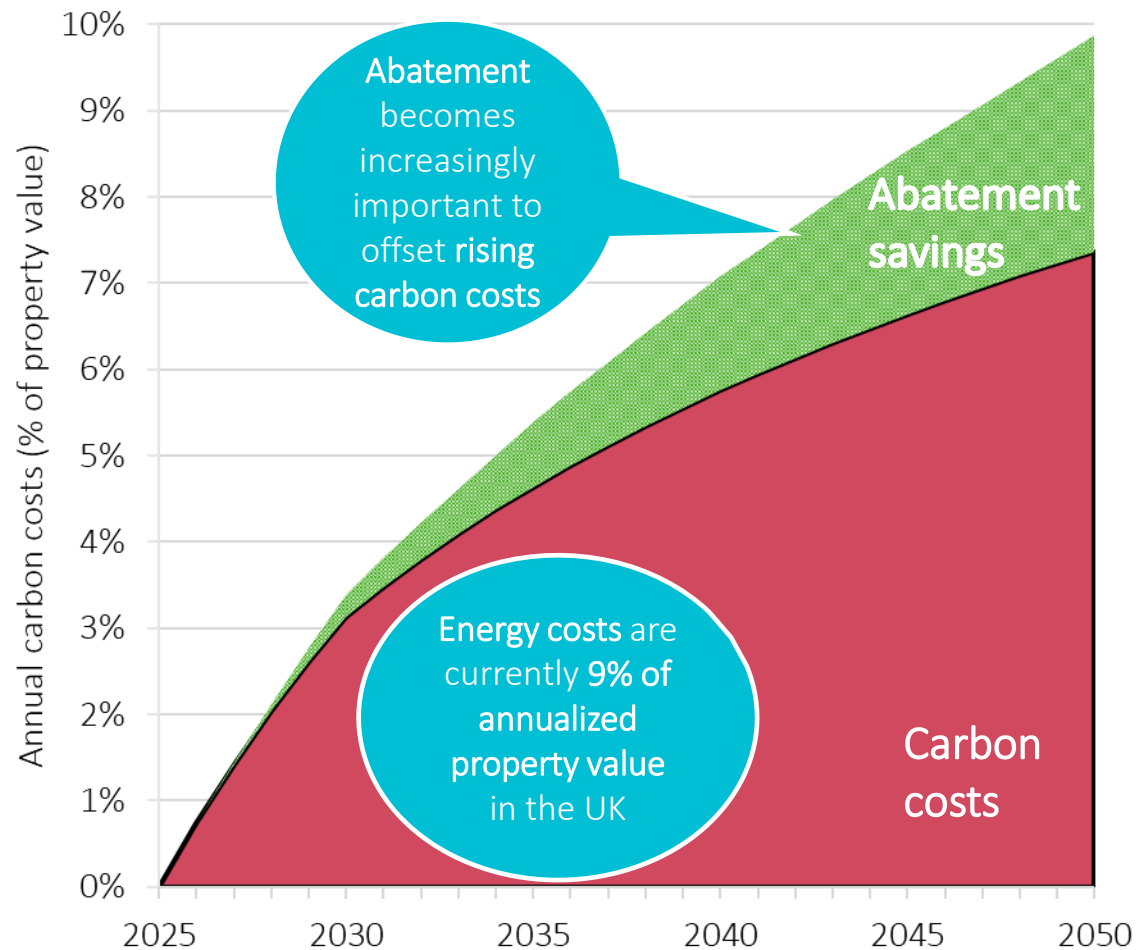
Under the FPS, mandatory energy efficiency measures lead to efficient levels of abatement in global real estate.

- In 2018, mandatory energy efficiency measures covered 32% of the global residential stock and 43% of the commercial building stock.
- These shares are expected to increase significantly to 2050, along with continued increases in policy stringency.
- These policies will drive building owners to implement **widespread abatement** activity despite the split incentives* in the rental sector.




Due to increasing emissions costs, properties with lower emission intensities will become increasingly attractive for tenants.



Low-emission properties become increasingly attractive under the FPS as carbon pricing increases energy bills



As energy costs rise, differentiating factors will become increasingly important for individual investors. Factors which will affect property level impacts include:

-  Physical characteristics: e.g. age, location, energy consumption by source, historic energy efficiency refurbishment expenditure*
-  Sensitivity of demand to price changes (by building type)
-  Building-level market value (current), discount rates used in current valuations

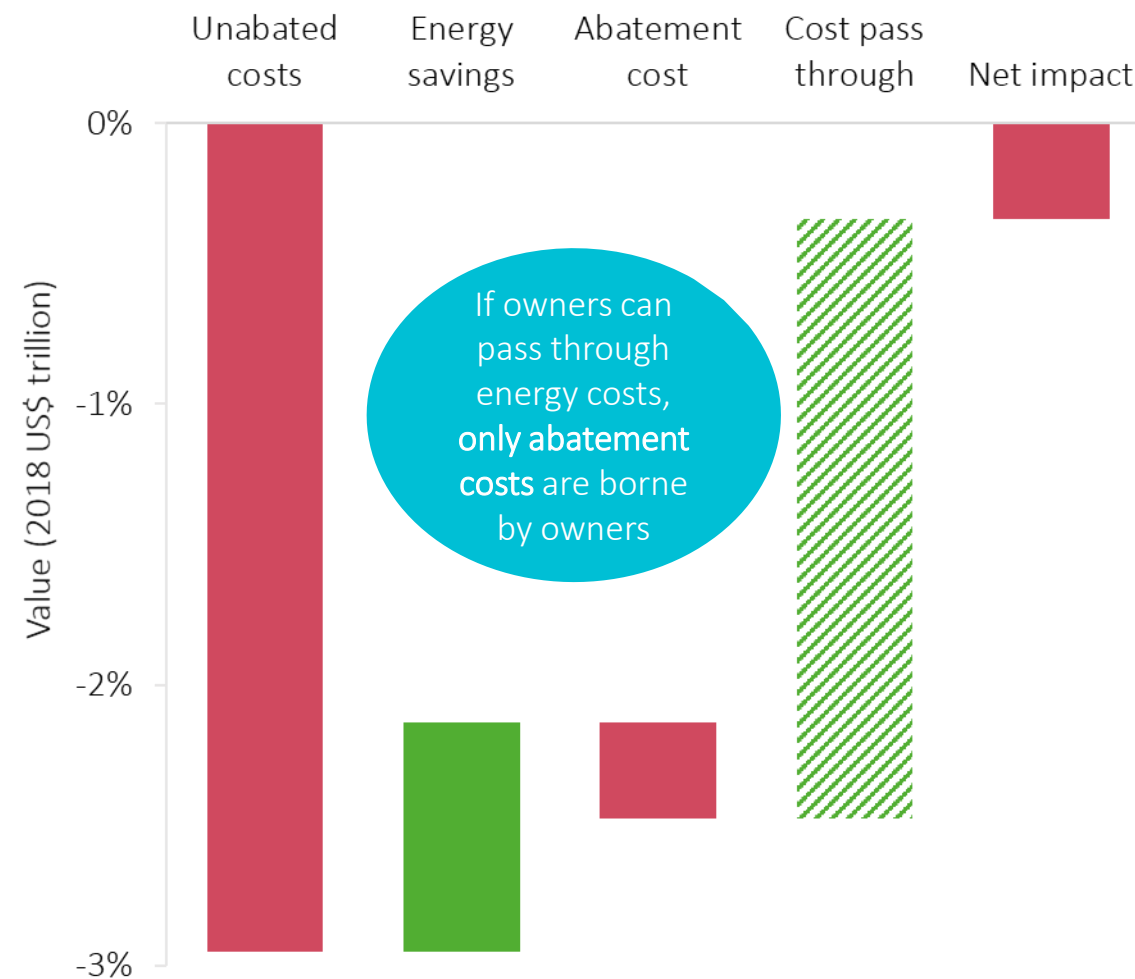
Cost pass through to tenants has the potential to reduce value impairments but depend on the regulatory and market context

These results assume that owners face 100% of the cost burden. If some of these costs is passed on to tenants, value impairments will be reduced.

The figure illustrates the scenario where energy costs are passed through to tenants completely, with owners bearing only the abatement costs. In this case valuation impairment is 0.3%, down from 2.5% without pass through.*

The extent of cost pass through depends on factors such as:

- 1) **Cost incidence** – typically tenants bear energy costs, while owners face refurbishment costs. Deviations will affect where the initial burden is placed.
- 2) **Regulation (e.g. rent controls)** – regulation may prevent owners from passing on abatement costs to tenants.
- 3) **Market dynamics** - the presence of low-carbon buildings will reduce the ability of other buildings to increase their costs.





Infrastructure

Key Findings: Large parts of global infrastructure is built for the high carbon economy and therefore exposed to the FPS

The iShares Global Infrastructure index falls by -11% , which is significantly larger than the impact to listed equity of -3.1% Infrastructure assets are typically investor specific but broad exposure can be understood through proxy infrastructure equity indices



Infrastructure impacts are large as the asset class is more exposed to sectors that are significantly impacted from the FPS, for example Utilities (-14%) and Energy (-29%). However cleaner infrastructure assets provide potentially large opportunities for targeted investors.



Investor implications

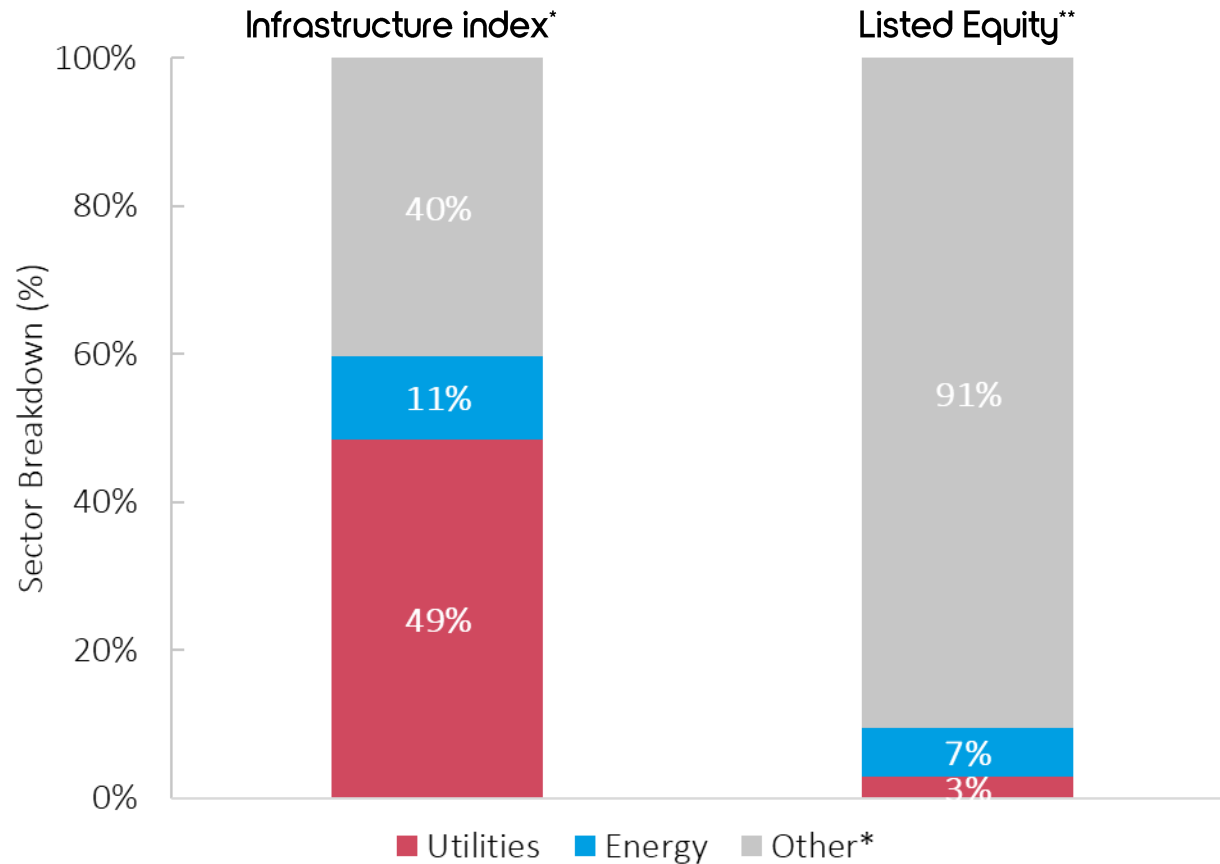


Large potential benefits by tilting to cleaner infrastructure. There is also need for increased due

diligence on existing holdings particularly within sectors that are exposed to the FPS, for example Energy.

Infrastructure, as proxied by the iShares Global Infrastructure Index, is significantly more exposed to Utilities and Energy than listed equity overall

Sector breakdown

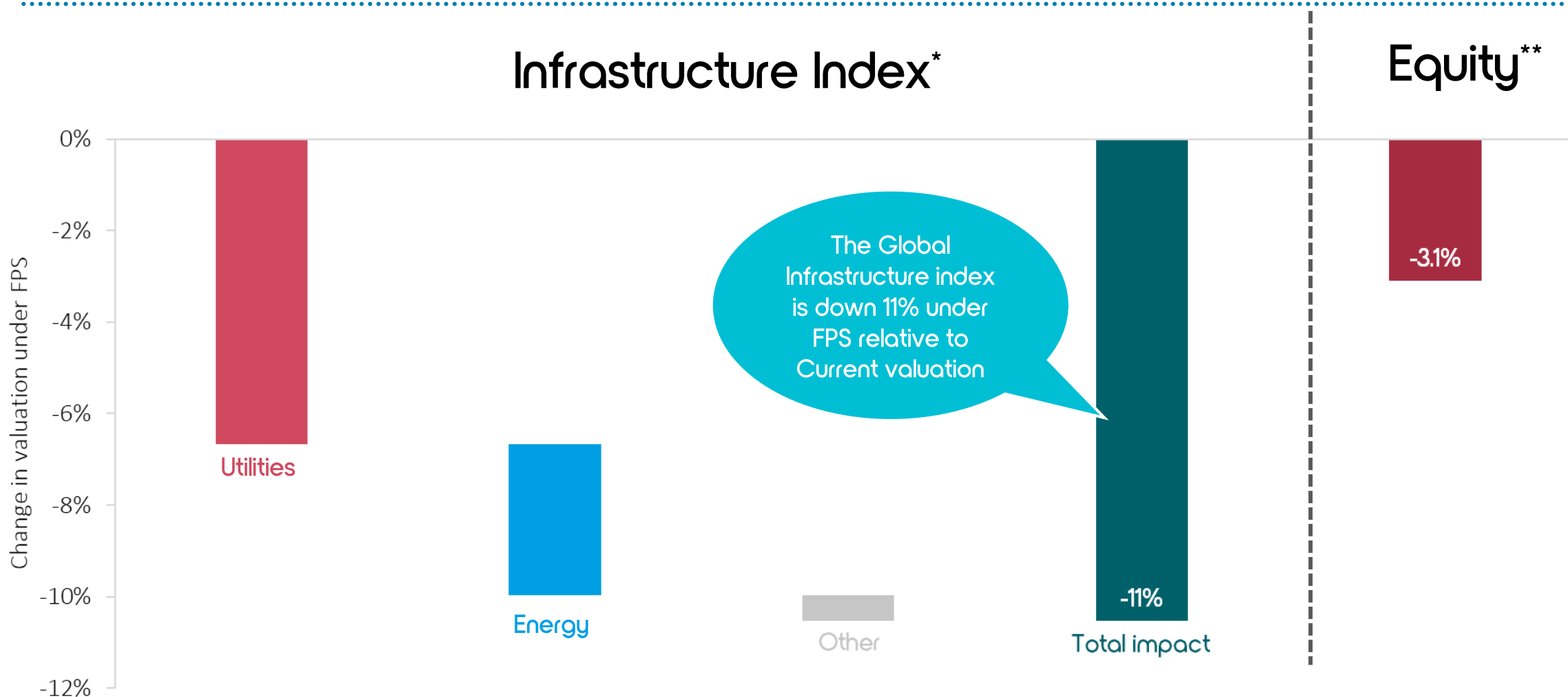


Infrastructure is an asset class that is owner specific there is limited data available

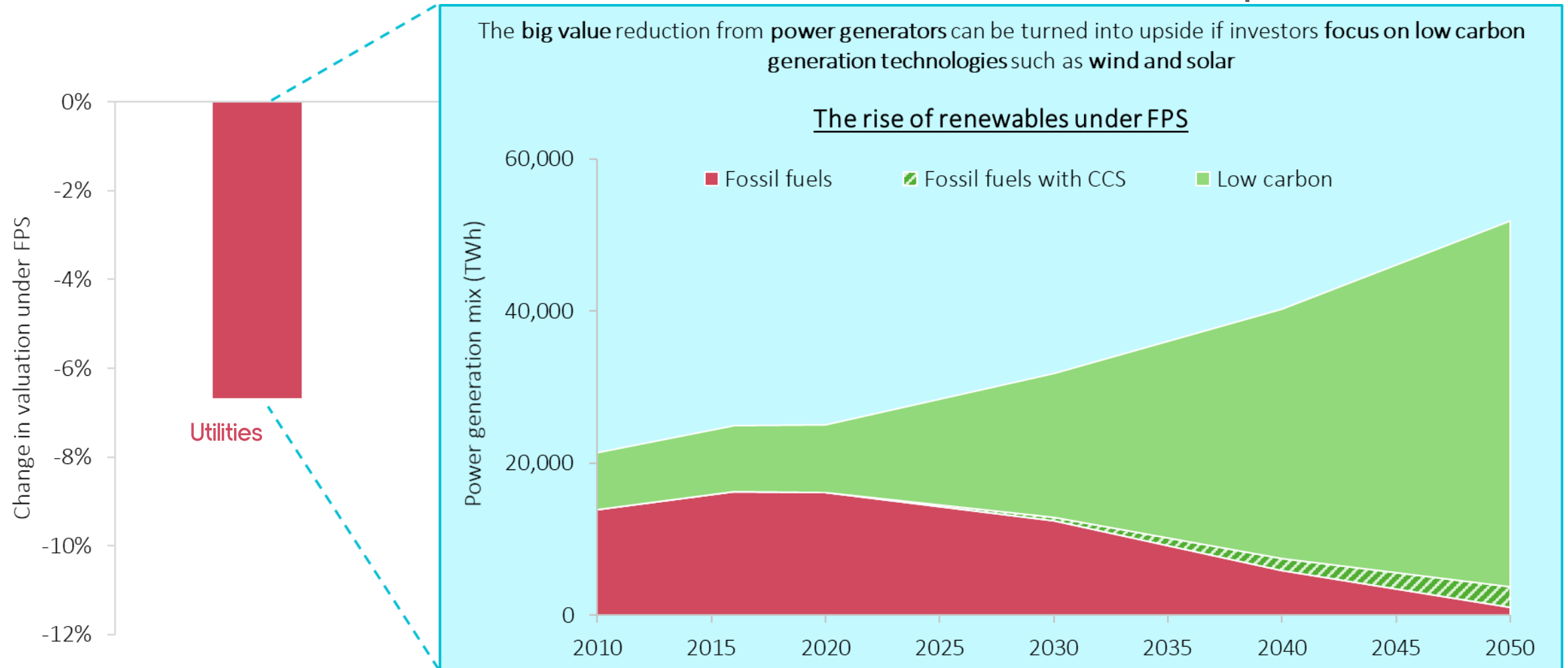
This analysis makes use of the iShares Global Infrastructure index, which tracks the performance of global listed infrastructure companies

The Global Infrastructure index is significantly more exposed to utilities and the energy sectors than the MSCI ACWI equity index

Awareness of risks posed by emissions-intensive utilities and energy companies in infrastructure portfolios is key, as current portfolios may contain high exposure



Investors who transition to low-carbon infrastructure such as renewable generation assets could turn downside into significant upside under the FPS





Private Equity

Key Findings: Private equity is likely to capture more green upside through smaller cleantech companies

The impact to a proxy private equity portfolio based on a representative portfolio of small and mid-cap listed equities is **-0.7%** which is smaller than the impact to listed equity of **-3.1%**

Private equity assets are investor specific but broad exposure can be understood through the use of small and mid-caps as proxies



Private equity impacts are **relatively small at the asset class level**. The **asset class is more exposed to cleantech companies in the industrials sector (relative to MSCI ACWI)**, which shows modest gains these are cancelled out by losses in energy.



Investor implications

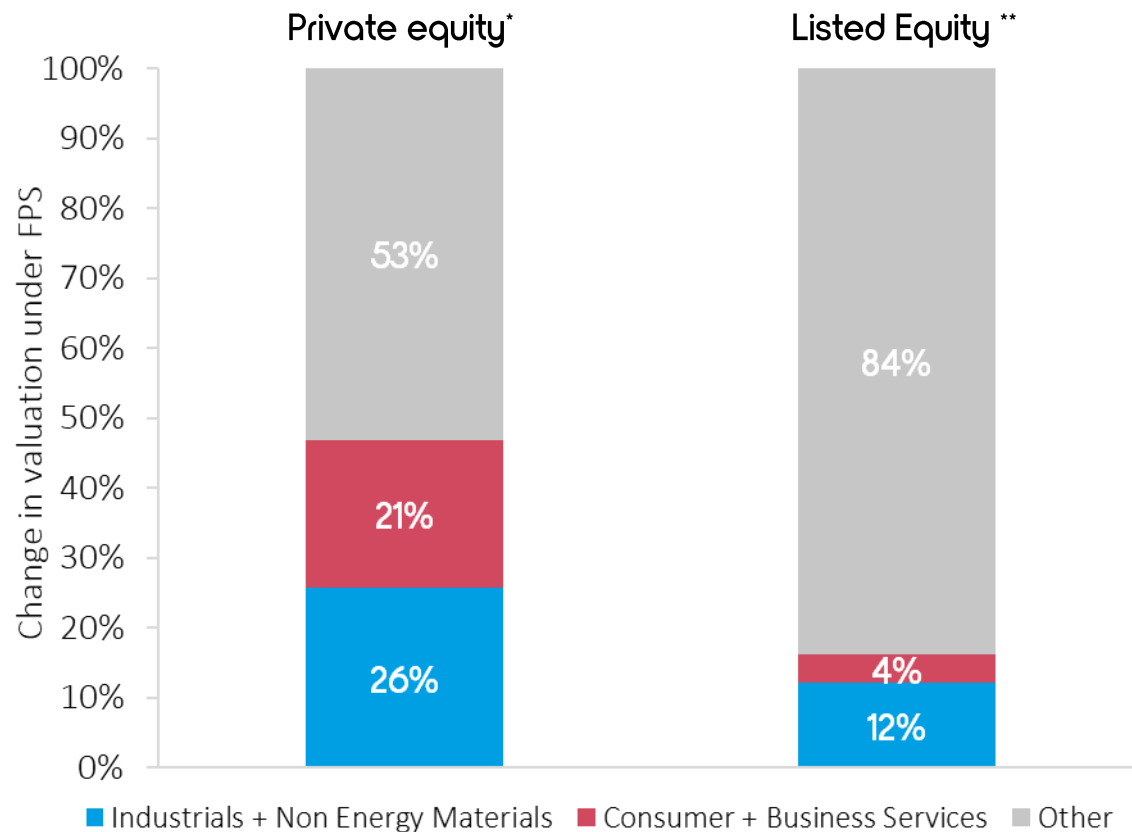


Large potential upside by investing in growing cleantech companies that have not matured to listed indexes that tend to contain more established firms.

Investors also need to be cautious of “dirty” energy firms in the sector which experience losses.

Private equity investment is disproportionately higher in industrial sectors which are more likely to benefit from cleantech growth, leading to a small overall impact

Sector breakdown

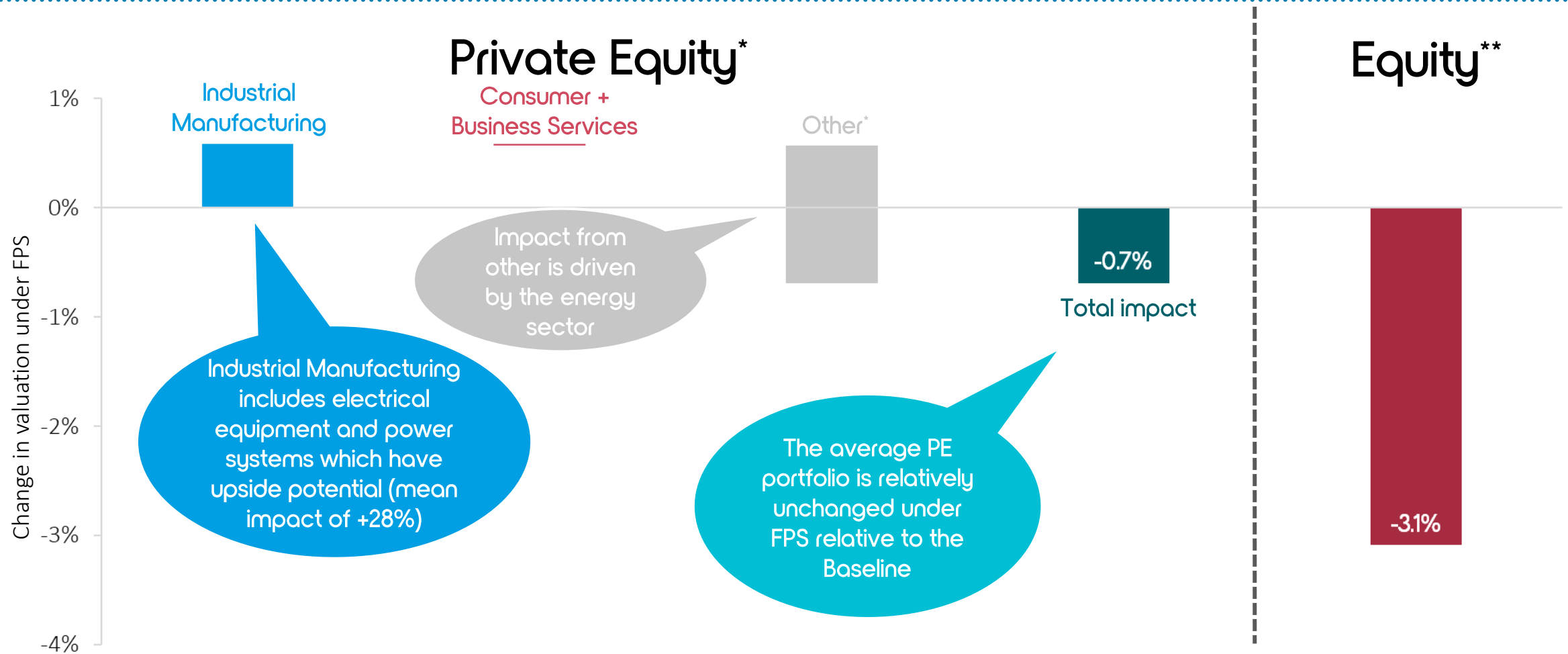


As private equity is owner specific, there is limited data available.

This analysis constructs a private equity portfolio based on a representative portfolio of small and mid-cap listed equities, with firm size and sector exposure based on the average private equity holdings***

The private equity portfolio is more exposed to smaller cleantech companies' in the industrials sector. Private equity is also more exposed to "cleaner" sectors for example consumer and business services (10%), relative to listed equity

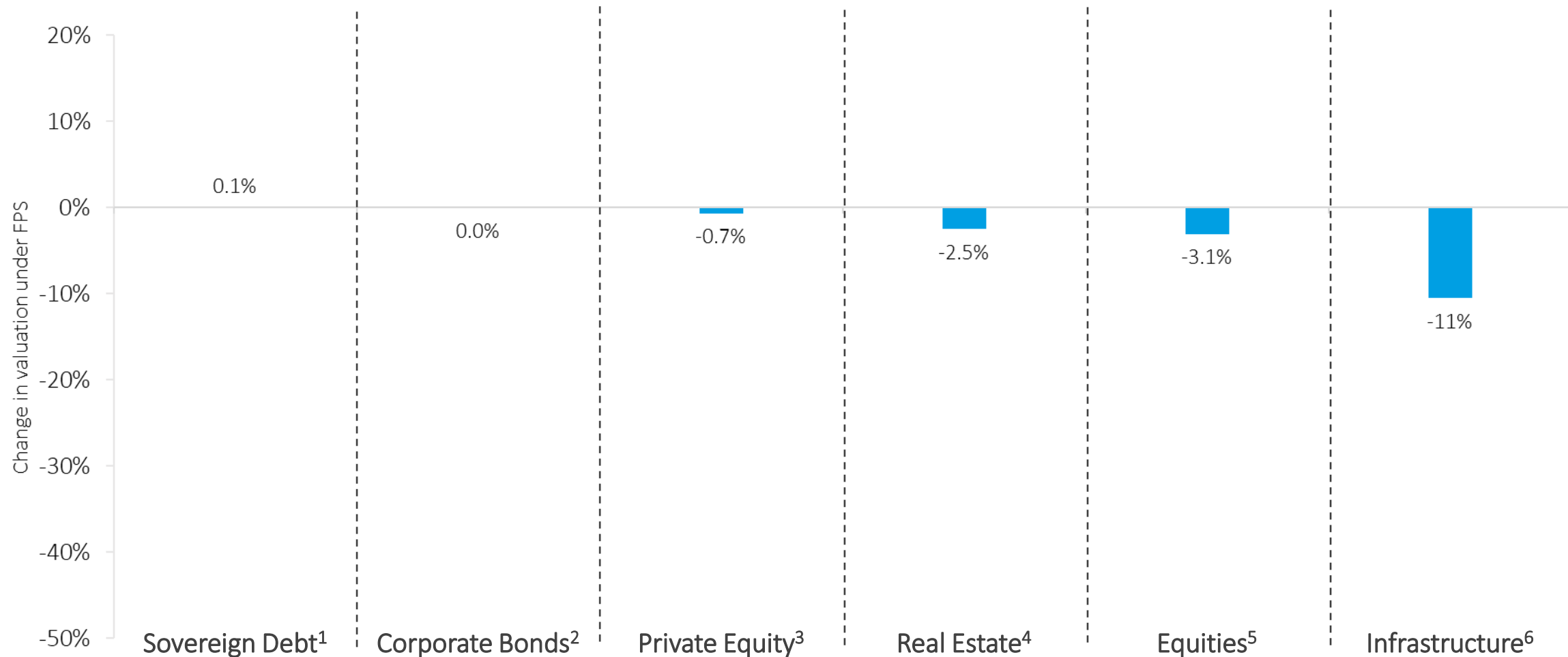
Private equity investors can turn risks into opportunity by focusing on growing cleantech companies that have not yet matured to listed indexes





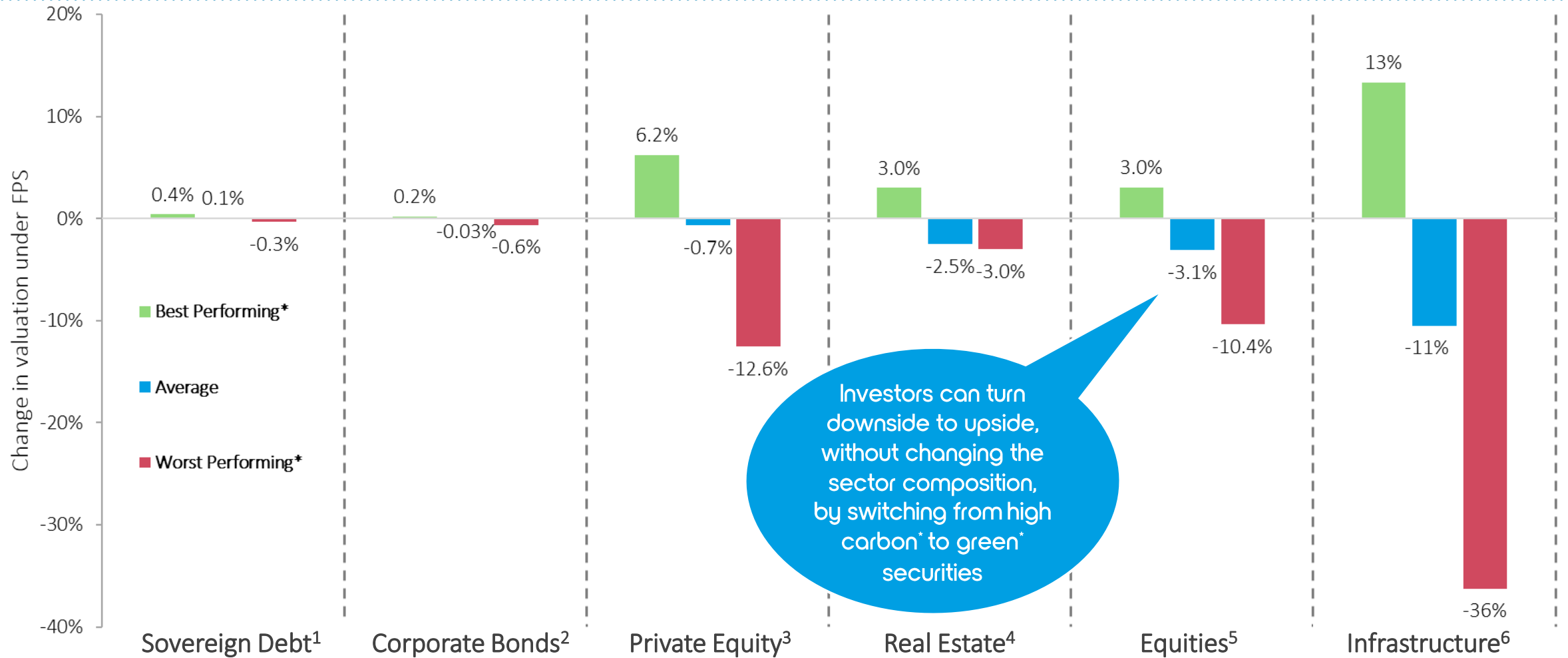
Strategic Asset Allocation (Vivid Economics)

Strategic Asset Allocation: Investors can reduce exposure by focusing on safer bond investments



1 Sovereign Debt: USD 6-year (average tenor for USD debt), 2) Corporate Bonds based on bonds issued by companies within the iShares MSCI ACWI ETF, 3) Private Equity details on portfolio in PE slide, 4) Real Estate details on portfolio in Real estate section, 5) Equities is based on the MSCI ACWI ETF, 6) Infrastructure is based on iShares MSCI Infrastructure index
Source: Vivid Economics (Net-Zero Toolkit)

Strategic Asset Allocation: However, the big opportunities are by tilting portfolios towards greener options within asset classes – especially in green infrastructure

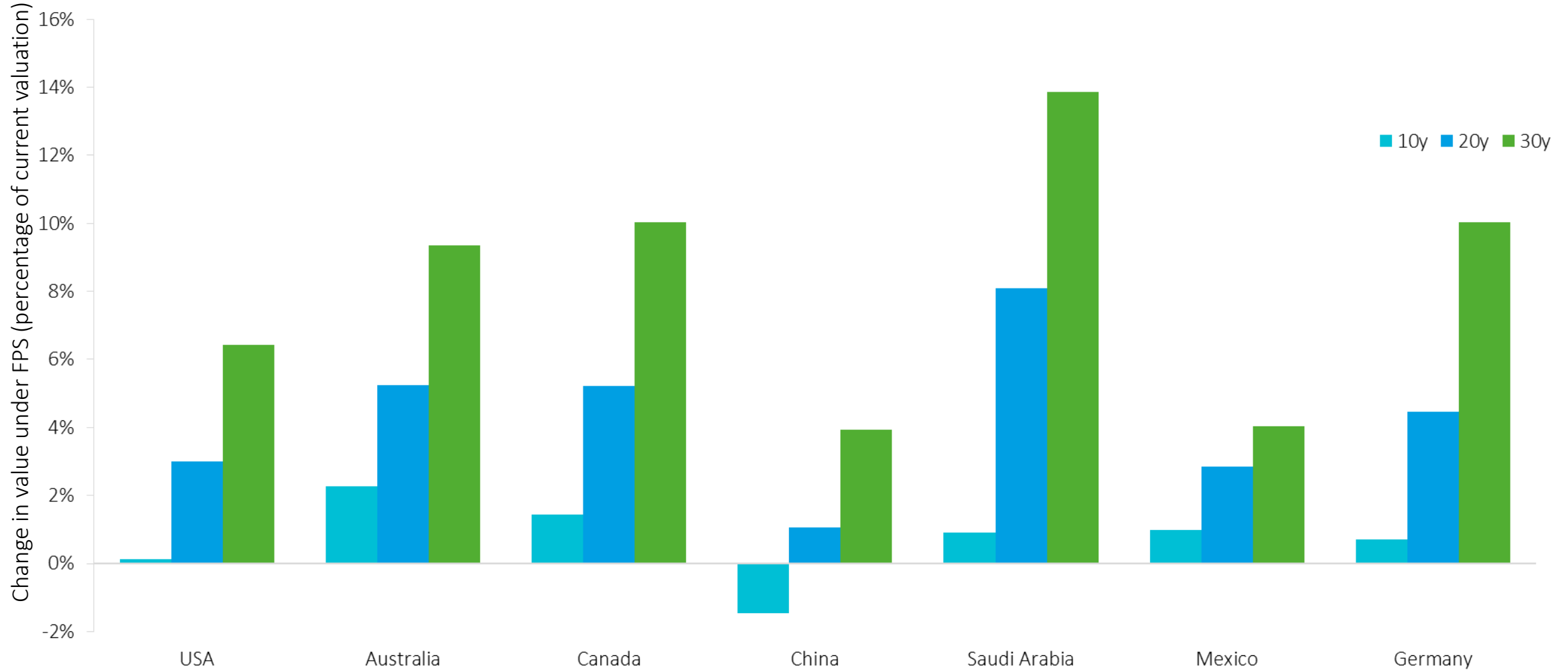


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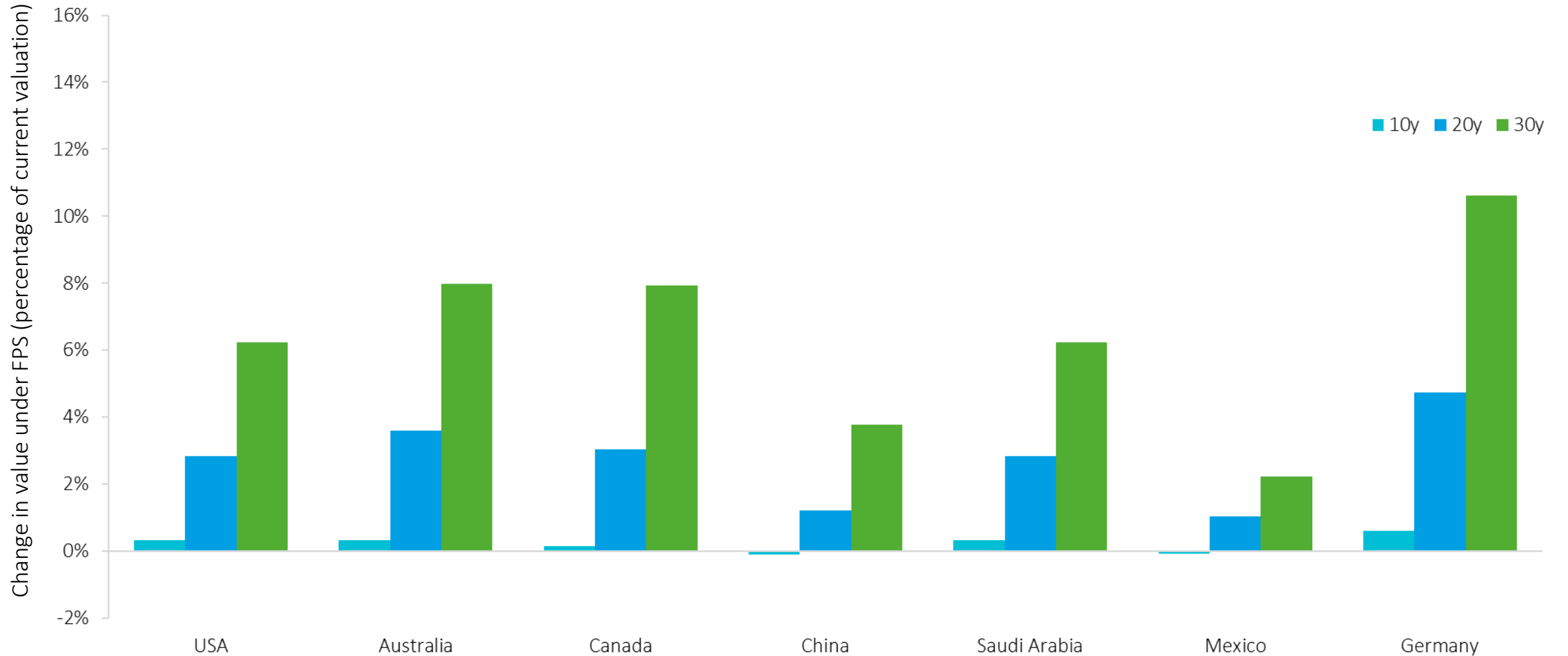
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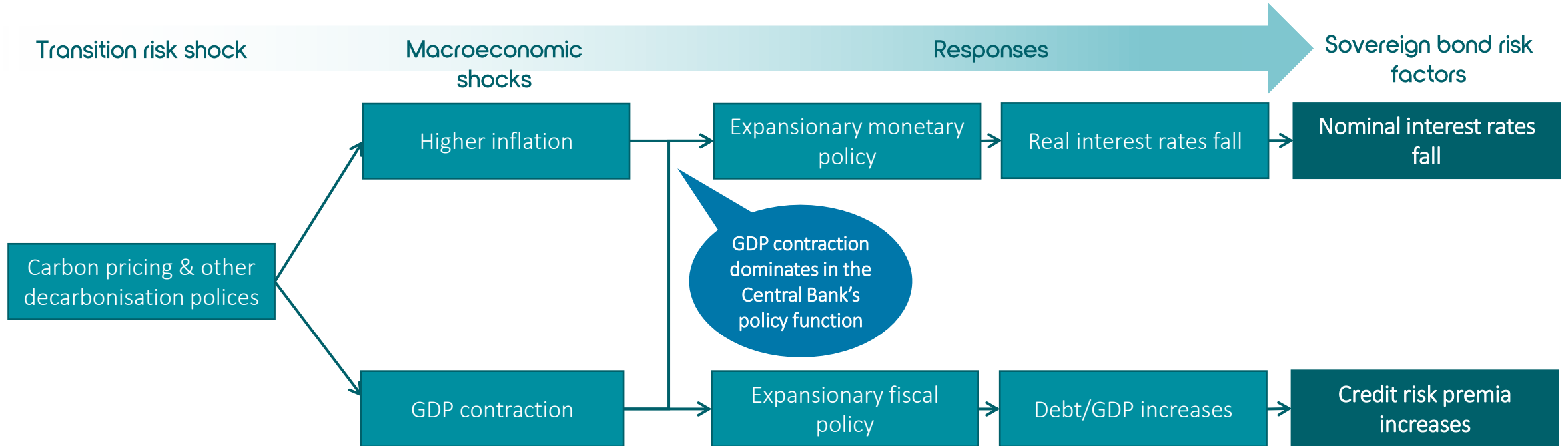
Appendix: sovereign bond price change from change in real interest rates



Appendix: sovereign bond price change from change in nominal interest rates



The sovereign bond methodology captures the dynamics of transition, by modelling changes bond risk factors through changes in macroeconomic variables and policy



- The Taylor rule in the macroeconomic model (G-Cubed) used in this analysis leads to lower interest rates as central banks optimise over lower output vs higher inflation, induced by carbon pricing policies.
- The diagram above depicts the *generic* impacts of the FPS on sovereign bond risk factors, but these vary by country.
 - ◇ Current macroeconomic conditions and FPS impacts differ by country, therefore policy response (fiscal and monetary) differ by country as well.

Private equity is disproportionately in industrial sectors which are more likely to benefit from cleantech growth, leading to a positive impact overall

