July 2024

Global Macro Insights: Race to net zero

Mapping the investment implications of a more disorderly transition

Salman Ahmed
Global Head of Macro and Strategic Asset Allocation

Edoardo Cilla
CMA Strategist

Fidelity INTERNATIONAL

Foreword

As we stressed in our recent Capital Market Assumptions (CMA) update, rapid changes within the economic, financial and geopolitical landscapes have disrupted structural trends that characterised markets prior to the Covid pandemic. This is impacting markets through multiple channels, including real economic growth, inflation, government and central bank policy, corporate and household behaviour, and more.

One of the key drivers of transformation is climate change. We have therefore placed increased emphasis on analysing this topic and its implications in our research, presenting some of the findings in series of white papers since 2021. Our aim is to help investors understand its impacts so that they can integrate climate risk considerations into their investment portfolios and align their practices with relevant regulation.

Consistent with this commitment, we have recently updated our Sustainable Investing Framework to ensure ongoing alignment with transparency and disclosure regulations. The revised framework has been designed to be flexible so that it can accommodate a range of different investment strategies across asset classes, while maintaining robust standards that demonstrate:

1. How we promote environmental and social characteristics.
2. How we determine sustainable investment objectives.

We hope you find the contents of this paper interesting and useful. If you have any questions on its content or our approach, please do not hesitate to contact your Fidelity representative.

Salman Ahmed
Global Head of Macro & Strategic Asset Allocation
Fidelity International

Contents

Executive summary of findings

Scenario probabilities

- Based on current information, a Delayed Transition is the most likely Network for Greening the Financial System (NGFS) scenario to materialise. However, the risk of a Hot House World or Fragmented World scenario has increased.

Capital Market Assumptions effects

- We believe that climate risks are still being underestimated by investors, partly due to challenges associated with modelling their impacts.
- We expect significant physical risk effects to be priced into equity markets in time, potentially even beyond the ten-year horizon used for strategic asset allocation (SAA) purposes. This will cause a deterioration in the equity risk/return trade off (Figure 1).
- Our models forecast that climate risks will have a relatively limited impact on structural aggregate fixed income returns, as price impacts and credit losses will be balanced by higher income levels (Figure 1).
- Climate risk will effect different sectors and regions in different ways, with some areas benefiting as others lose out.

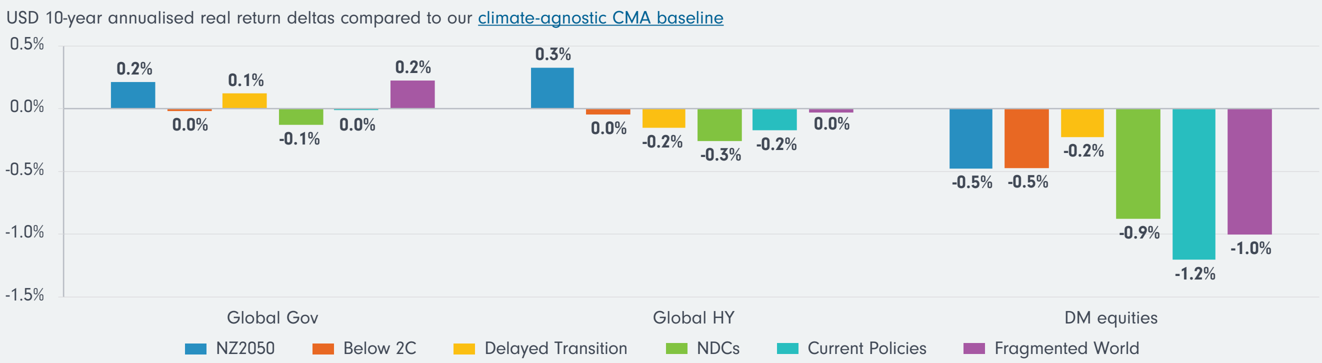
Asset allocation implications

- We expect climate risks to drive the efficient frontier lower and flatter in the future, which will have significant implications for asset allocation strategies. However, it is uncertain when climate risks will be priced into markets:
  - On a bottom-up basis, transition risks could be priced-in as specific policy developments are anticipated. However, it is more difficult for investors to price broad policy direction into markets effectively at the aggregate level.
  - Physical risks could be priced into securities on a bottom-up basis, but it may require a major physical risk event before the broad risk they present is reflected within market pricing at the aggregate level.

Next steps

- Future steps will likely involve assessing the varying impacts of climate risks across economic sectors and the regional implications.
- We will seek to use the findings of this paper and future updates to determine how it will affect strategic asset allocation decision making, including for investors concerned with the liabilities side of their balance sheets.

Figure 1: The impact of climate change on asset returns



For illustrative purposes only.

Source: Fidelity International, April 2024. Deltas are US-dollar denominated, based on proprietary CMA modelling. NDCs: Nationally Defined Contributions.

Introduction: climate risks and the investment process

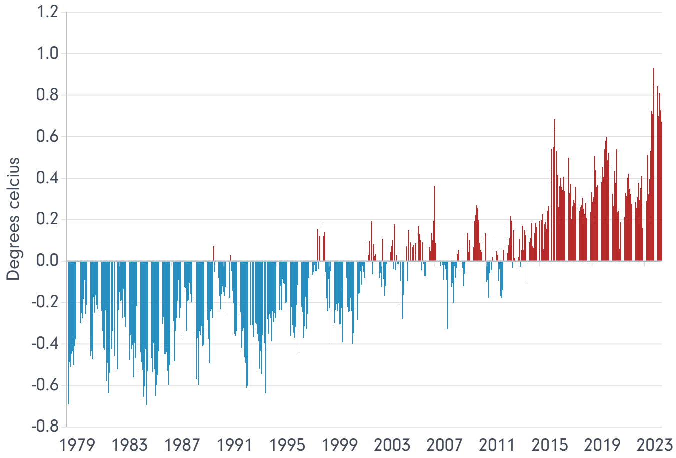
We are currently experiencing an exceptional period of global warming, unprecedented in human history. April 2024 was the warmest April on record, 0.67°C above even the 1991-2020 average, and the 11th consecutive month in which a 'hottest-month-on-record' statistic was recorded, according to the ERA5 reanalysis dataset[1] (Figure 2) While a similar period was experienced through 2015-2016, the year to April 2024 was also the warmest of any previous 12-month period, at 0.73°C above the 1991-2020 average and 1.61°C above the pre-industrial era average (1850-1900). Other studies go further, suggesting that it could be the warmest on earth for several millennia[2].

Global warming is also manifesting within the earth's ocean temperatures, records for which are increasingly seen as more accurate given the effects of urbanisation on temperature readings taken in cities. Despite the weakening of the irregular El Niño towards neutral conditions, April 2024's average global sea surface temperature (outside the polar regions) was also the warmest on record, continuing a series of 13 consecutive monthly records in a row[3]. This is having severe chronic effects, such as a pattern of sharp declines in Antarctic Sea ice in recent years.

On top of chronic issues like rising surface temperatures and declining ice coverage, we are also witnessing more frequent and severe acute weather events. In 2023 alone, these ranged from drought in the Amazon amid the lowest rainfall in 40 years to some of the most destructive wildfires on record during heatwaves across Southern Europe, Asia and the Western United States. We witnessed extensive flooding in countries like Pakistan and Libya damage food supply chains, and cyclones with severe localised effects as far afield as Kenya and New Zealand.

Global temperatures are expected to push higher as increasing concentrations of greenhouse gases trap more energy in the atmosphere and oceans. The adverse socioeconomic effects of both chronic and acute climate impacts are therefore forecast to become more frequent and severe, before possible climate tipping points are even considered.

Figure 2: Monthly global surface air temperature anomalies



Source: ERA5. Credit: Copernicus Climate Change Service/ECMWF.

Integration into the investment process

Adapting the investment process to account for the various types of climate risk is no easy task, largely because they can affect each step, from overall goal setting to portfolio design and implementation (Figure 3).

Our job as investors is to gauge the likely effects of climate risks on economies and capital markets to help improve investment decision making from both the top-down and bottom-up. The framework we have established to do so is based on the NGFS climate scenarios, which map out various potential pathways to describe the interplay between factors like climate change, technological progress, transition policies, and human preferences across a range of plausible outcomes.

The NGFS is a network of central banks and financial supervisors established to help develop environmental and climate risk management in the financial sector and to support the transition to a sustainable economy, including by assisting with the achievement of the Paris Agreement's objectives. Its multi-scenario approach is useful as it reflects the uncertainty inherent within the development or regression of underlying climate factor variables such as policy direction, technological change, and corporate action.

Figure 3: Adapting the investment process to account for climate risk

Setting investment goals and constraints	Setting macro/top-down expectations	Establishing climate aware CMAs	Optimising climate-aware SAA	Navigating the transition through TAA	Climate-aware manager selection
Climate change can inform investment objectives, which may include specific climate-aware preferences or regulatory constraints.	Activity associated with the transition to a net zero economy will affect economies as it occurs. However, it is expected that the physical impacts of climate change is will be higher in the future if such activity is delayed. Despite uncertainty around the interplay of these factors, it is better to make informed assumptions about their potential impact on economic variables such as GDP, inflation, and policy.	Economic impacts have the potential to affect capital market assumptions in different ways, through various channels, across asset classes. Scenario analysis that gauges the likely interplay between transition and physical risks across several plausible outcomes is important, given the inherent uncertainty in predicting a specific climate pathway.	Climate risks have the potential to structurally alter the risk/return characteristics of different asset classes and, therefore, create trade-offs within the portfolio construction process. This potentially has significant implications for strategic asset allocation and portfolio optimisation decisions.	Uncertainty around how interplay between physical and transition risks will play out makes relying on a pre-defined climate pathway inappropriate. However, a tactical asset allocation strategy can help capture opportunities as the pathway evolves through time. Judging changes in the climate pathway trajectory requires significant, granular expertise on how various sectors, geographies and actors are navigating the transition.	The interplay between physical and transition risks is likely to affect the fortunes of companies, separating winners from losers. Investors will therefore need to incorporate a thorough understanding of these dynamics into their research processes and decarbonisation strategies. Selecting the appropriate investment strategies is expected to provide investors with an edge when optimising their portfolios for both financial and environmental objectives.

For illustrative purposes only.

Source: Fidelity International, July 2024.

It also acknowledges another key challenge relating to the integration of climate risks into the investment process: while the implications of different types of climate risk vary across different climate pathways, they also play out across different timeframes. In relation to the trade-off between transition and physical risks, this can be considered a dual dimension of horizon considerations, as transition risks are borne in the relatively near term to mitigate the accumulation of physical risks that will affect both economies and markets over the longer term.

The near term is often considered to relate to the immediate bottom-up impact of climate risks on individual companies, sectors and economies. Meanwhile, the long term relates to the top-down impact of climate risks on the overall economy (through aggregate economic variables such as regional GDP, inflation, policy rates, etc). However, this is to an extent a function of capital markets' lack of ability to price-in highly uncertain risks and opportunities far into the future, a shortcoming that has the potential to create opportunities for research-led active strategies.

As a result, we track developments in real time on an ongoing basis as they evolve, harnessing the latest research on climate change and its impacts. In this paper specifically, we deal with the second and third steps of the investment process outlined in Figure 3. We seek to understand the channels through which physical and transition risks will affect economies and capital markets in both the near term and over extended time horizons, so that we can quantify the effects and improve our investment decision making. Ultimately, our goal is to help our clients navigate the challenging task of integrating climate risk considerations into their portfolios as their circumstances change.

NGFS climate scenarios: Phase IV

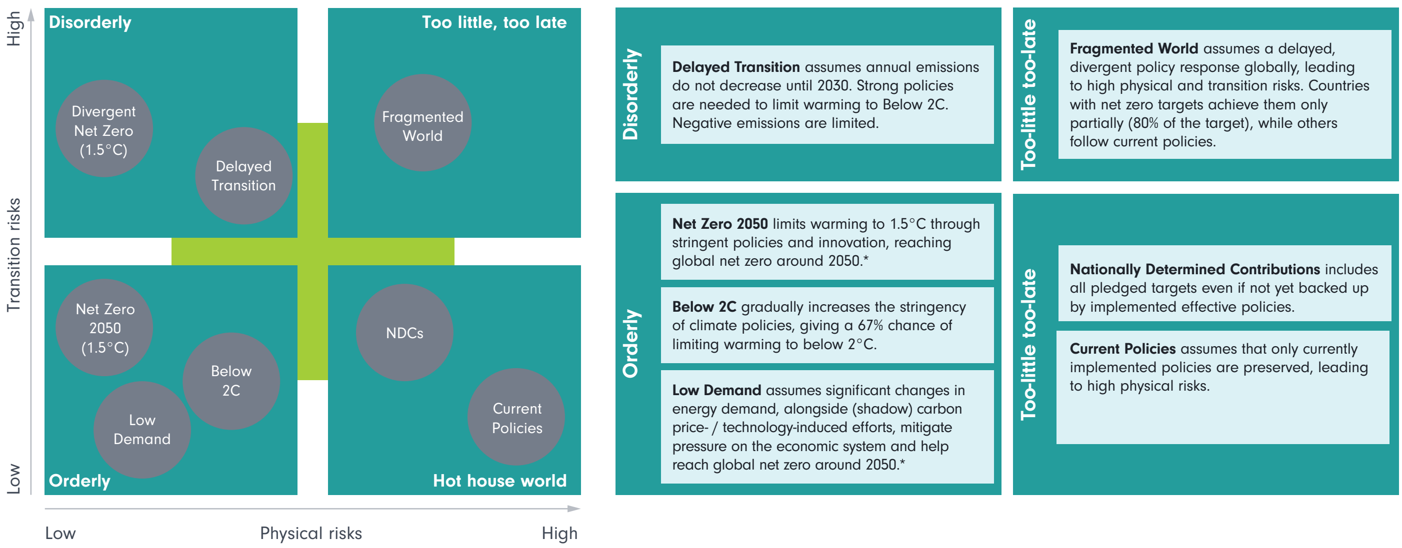
The NGFS scenarios (Figure 4) and their impact projections are an increasingly important reference standard for central banks, regulators, governments, and private actors to understand the impacts of climate change. This makes them a natural starting point for our analysis. In their fourth iteration, they now capture greater economic disruption from physical climate risks and transition activity across a broader range of potential pathways.

As scientific understanding has advanced, it has become apparent that the risks and uncertainties associated with both climate change and transition activity are greater than previously thought. In Phase IV, the scenarios have therefore become more disorderly, reflecting insufficient transition progress in recent years, recognition that complexity facilitating the transition is greater than previously thought, and acknowledgement that the severity of physical risk impacts will be more adverse. It also reflects the fact that ongoing energy demand and emissions have been persistently high to date and are likely to remain so in the near future.

Phase IV: Key updates

- The latest GDP and population data.
- Reassessed impact of new country-level climate policies, e.g. EU Fit-for-55, US Inflation Reduction Act, which contribute a slight decrease in physical risks.
- Current geopolitical context, including the consequences of the war in Ukraine on energy prices, which contributes to an overall increase in disorderliness.
- New climate data and improved modelling of physical risks, including more granular modelling of physical risks at the country level and the addition of two new acute physical risk hazards, droughts and heatwaves, in addition to floods and cyclones. This results in more adverse GDP impacts.
- The latest trends in renewable energy and other key mitigation technologies; for example, capital costs for solar PV will decrease more quickly.
- Revisited assumptions around the use of technology, such as lower availability of carbon capture and storage technologies, which make the scenarios more adverse.

Figure 4: Phase IV climate scenarios summary



Positioning of scenarios is approximate, based on an assessment of physical and transition risks out to 2100.

* In these scenarios, some jurisdictions such as the US, EU, UK, Canada, Australia and Japan reach net zero for all GHGs.

For illustrative purposes only.

Source: NGFS, Fidelity International, November 2023. NDCs: Nationally Defined Contributions.

Physical risk update

Across the board, the scenarios now reflect more adverse GDP impacts from extreme weather events and disruption to ecosystems and biodiversity (Figure 5). This reflects the incorporation of two new acute physical risk hazards, droughts and heatwaves (in addition to floods and cyclones), which have far greater economic ramifications due to their physically wider-ranging impacts. This reflects greater appreciation of these physical risks and the transmission channels through which they can affect economic activity.

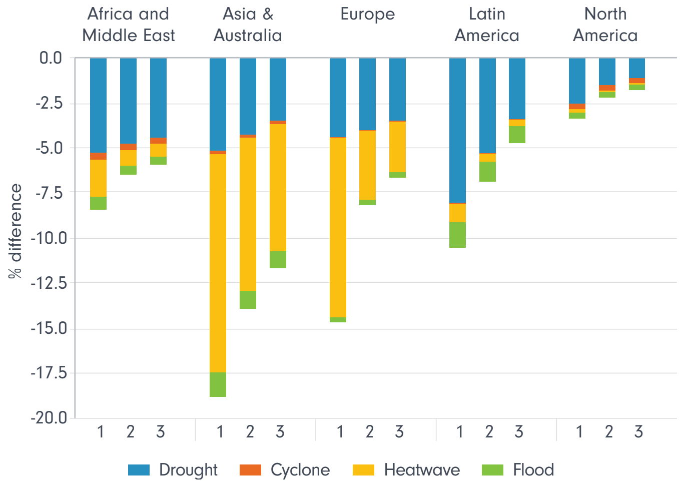
We note that the negative shift in physical risk impact is despite a positive impact of smaller magnitude from recent policy action, particularly in the US and EU. This has resulted in slightly improved temperature outlooks in the Hot House World scenarios, Nationally Determined Contributions and Current Policies (Figure 6).

Adverse GDP impacts become more controlled within the Orderly scenarios in the long run, but they continue to accumulate quickly across the non-Orderly scenarios. To quantify the potential impacts, the estimated additional GDP loss from acute physical risks in the baseline Net Zero 2050 and Delayed Transition scenarios is now around 1.5% and 2.5% by 2050, respectively, whereas it is almost 6% in the Current Policies scenario (for comparison, in Phase III, Current Policies estimated only about 1.4% GDP loss from acute physical risk by 2050).

The granularity of regional estimates has also been increased, with projections now included for five major regions. Figure 5 shows that droughts and heatwaves pose the largest risks to global GDP, and although their economic impacts are significant globally, they vary considerably between regions. Europe and Asia & Australia are most susceptible, while North America is most resilient. The relatively limited impacts of floods and cyclones are largely a result of their more localised nature.

In terms of empirical analysis using NGFS data, it is important to stress that acute risk data is only available for the Current Policies, Delayed Transition and Net Zero 2050 scenarios. To overcome this challenge in our analysis, we decided to apply the acute physical risk impacts for Current Policies to the Fragmented World and Nationally Determined Contributions scenarios, the impacts from Delayed transition to the Below 2C scenario, and those from Net Zero 2050 for the Low Demand scenario (following engagement with NGFS on the appropriateness).

Figure 5: Regional Acute GDP Impact by Hazard and Scenario - Region Averages



1. Current Policies, 2. Delayed transition, 3. Net Zero 2050

All values are differences from baseline (a hypothetical scenario with no transition nor physical risk). Simple averages across countries available for that region. Latin America is composed by Chile, Mexico and Argentina, with exception for Floods, only available for Mexico. North America includes US and Canada, but only US for floods. Africa includes Egypt and South Africa (only South Africa for floods).

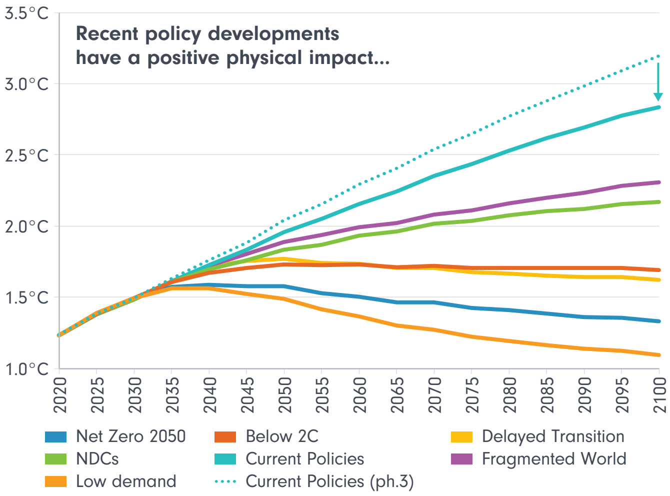
Source: NGFS Scenarios for central banks and supervisors, November 2023.

Transition risk update

While progress on policy initiatives like the EU Fit-for-55 and US Inflation Reduction Act is reflected in a slightly shallower temperature trajectory in the Current Policies scenario in Phase IV relative to Phase III (Figure 6), shadow carbon prices will still need to increase markedly for any alternative scenario to play out. This is reflected in even steeper shadow carbon price trajectories for the various scenarios, which represent the need for more ambitious transition efforts across all sectors of the economy, including more immediate and intense government policy responses and preference shifts.

Phase IV's Orderly transition scenarios (Net Zero 2050 and Below 2C) therefore entail increased transition risks. An estimated shadow carbon price of around $200/tCO2 by 2030 is now required by 2030 to support a Net Zero 2050 pathway (Figure 7). In turn, this represents larger adverse GDP impacts from transition action across all relevant scenarios. Nevertheless, the scenarios continue to demonstrate the fact that immediate coordinated action will ultimately prove less costly than a lack thereof in the long run.

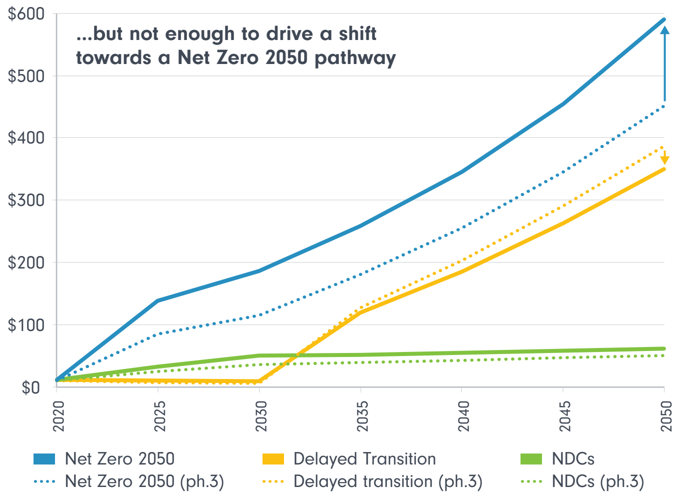
Figure 6: Phase 4 (vs 3) temperature and shadow carbon price (World)



For illustrative purposes only.

Source: NGFS, Fidelity International, April 2024. Results are preliminary. NDCs: Nationally Defined Contributions.

Figure 7: Phase 4 (vs 3) shadow carbon price forecasts



For illustrative purposes only.

Source: NGFS, Fidelity International, April 2024. Results are preliminary. NDCs: Nationally Defined Contributions.

We note that a new Low Demand scenario has also been included within the group of Orderly scenarios, which posits that substantial behavioural changes in energy generation and consumption activities could result in a Paris-aligned Orderly pathway without the manifestation of significant transition risks. However, given ongoing demand levels and limited progress on technological development and adoption to date, we see this optimistic scenario as little more than wishful thinking unless a major climate event with material global socioeconomic repercussions occurs and catalyses dramatic change.

When discussing transition risk, it is important to note that sectoral and geographic exposures are heterogeneous. For example, the energy sector is responsible for the sharpest drop in emissions in the Net Zero 2050 scenario, with transportation taking its place as the largest emitter by 2050. Energy producers therefore bear higher transition risk burdens within this scenario. As different jurisdictions have different net energy supply positions, these risks are not spread equitably geographically. The key aspect of these distributional issues is that the jurisdictions that face the greatest transition risks are not always those that face the greatest physical risks. For example, in the Net Zero 2050 scenario, developing Europe and the United States face the highest transition risks due to the structures of their economies (and therefore associated GDP sacrifices), but Asia & Australia would derive the greatest benefits from the reduction in physical risks associated with the transition.

Reflecting these developments, a new scenario, Fragmented World, has also been introduced to account for the ongoing uncertainty and delays we are witnessing in the implementation of transition policies across jurisdictions. Within this, individual countries prioritise their own interests over collective action, forcing a pathway in which countries delay the transition ('too late') and then diverge in the stringency of their mitigation efforts, resulting in insufficient overall progress ('too little'). The eventual result is a temperature increase close to that of the Hot House World and Nationally Determined Contributions scenarios by 2050. However, certain countries also employ transition policies within Fragmented World and these are made futile by a lack of mitigation elsewhere; the overall result is a more adverse GDP outcome globally. This highlights the value of boosting global international coordination and cooperation, a lack of which has emerged a key challenge within today's environment of geopolitical tensions.

Regional impact scenario case study

Transition risks associated with climate action have a negative impact on GDP, but climate inaction will eventually result in physical risks that are far more detrimental. The relative short and long-term GDP impacts of each scenario are therefore primarily dependent on the level of transition risk borne and the accumulated physical risks associated with inaction. However, the scenarios continue to illustrate that an immediate, coordinated transition will be less costly than inaction or a Disorderly Transition by 2050.

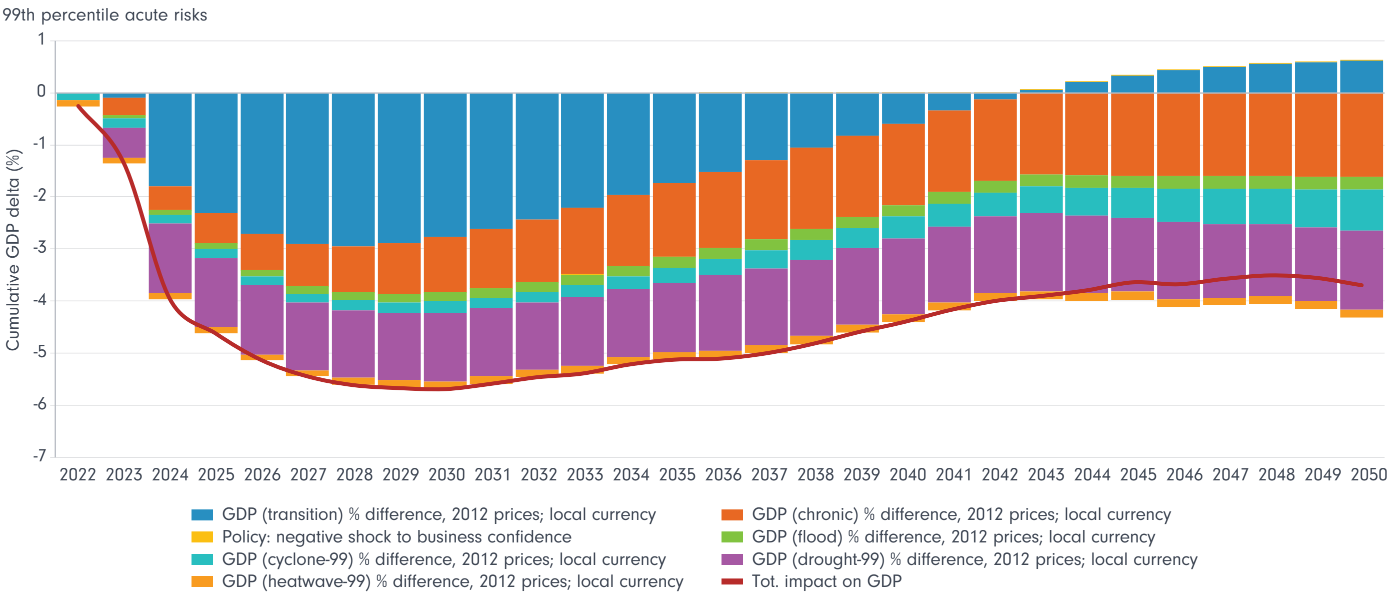
GDP impacts have increased markedly in Phase IV due to the incorporation of new acute physical risks. Absolute physical risks are set to increase significantly in the near term across all scenarios, given climate damage accumulated to date and the fact that the benefits of any climate action taken in the future will take time to materialise. However, the impacts of physical risks diverge in the longer term, as there is a surge in GDP loss within the Hot House World and Too-Little, Too-Late NGFS scenarios given a lack of mitigation action. Likewise, chronic physical risk becomes gradually more damaging over time.

Transition risks lead to negative GDP impacts in scenarios where mitigation action is taken in the shorter term. This is reflected in the Net Zero 2050 scenario having a larger adverse GDP impact than Delayed Transition by 2030, but a lower impact subsequent to this as the sacrifices associated with early action reduce adverse acute and chronic physical risk effects.

For example, Figures 8 and 9 show the impacts of various drivers on US GDP in the Net Zero 2050 and Delayed Transition scenarios. These show that the overall adverse GDP impact is larger in Net Zero 2050 over the next ten years due to the impact of transition activities, but ultimately relatively smaller in the long run due to larger accumulated physical risk impacts in Delayed Transition.

An additional point of note is that the effects of physical and transition risk also vary by region, depending on idiosyncratic differences in climate vulnerability, but also economic structure. Both transition and physical risks impact sectors, and therefore macroeconomic outcomes like unemployment, inflation and policy rate levels across geographies.

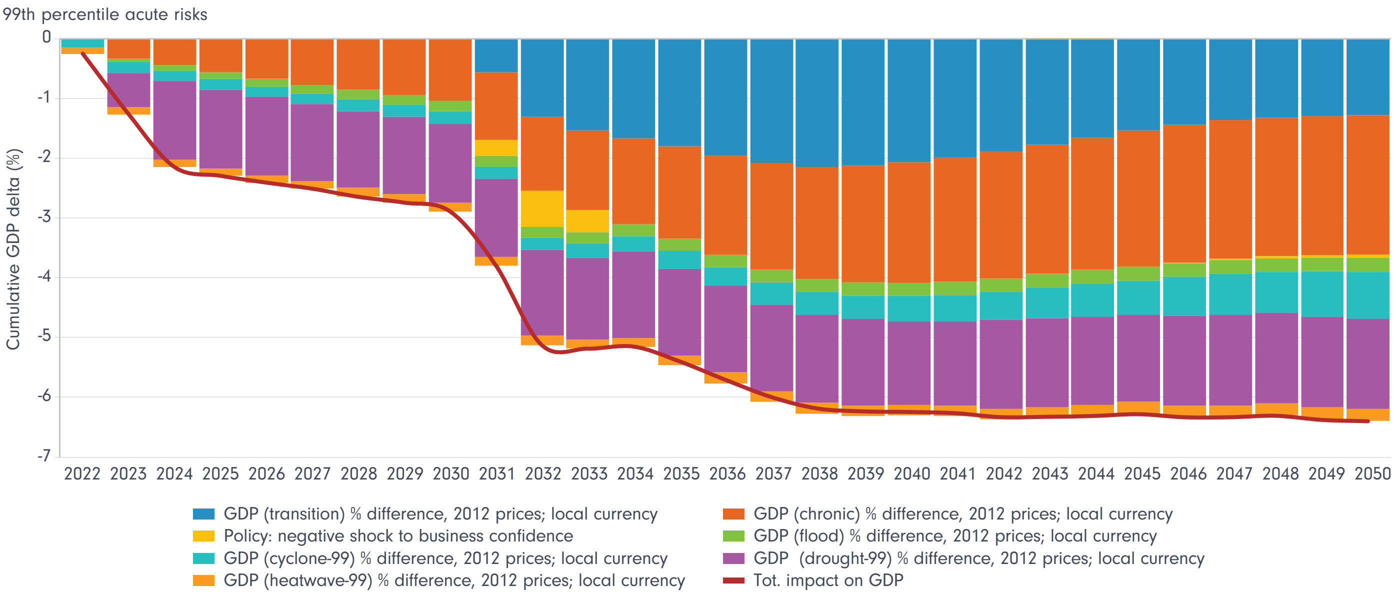
Chart 8: Phase IV GDP impact (Net Zero 2050, US)



For illustrative purposes only.

Source: NGFS, Fidelity International, April 2024. Results are preliminary.

Figure 9: Phase IV GDP impact (Delayed Transition, US)



For illustrative purposes only.

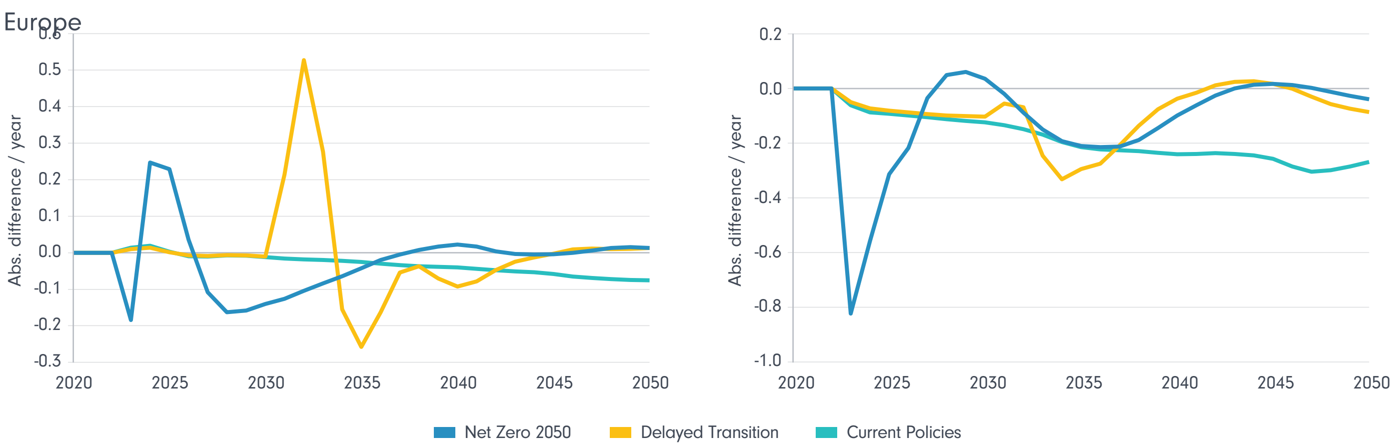
Source: NGFS, Fidelity International, April 2024. Results are preliminary.

For example, demonstrating the heterogenous nature of geographical impacts, there is an initial rise in unemployment in Europe (albeit it reverses quickly) in the Net Zero 2050 scenario, but the reverse is seen in in China due to its dominant position in global green technology supply chains (Figure 10). These dynamics are already manifesting in direct competition between countries direct competition between countries through policies like the implementation of trade tariffs and are a key underpinning of the Fragmented World scenario.

Another example is provided by the US's relatively low physical risk exposures (Figure 5), which are small enough to allow the declining GDP impact initially seen in the Net Zero 2050 pathway to reverse over time, emphasising the positive overall long-term impact of the transition on longer-term growth. This is not the case across all regions but is yet another factor that supports the inclusion of the Fragmented World scenario.

We can also compare the impact of scenarios across geographies. For example, Figures 9 and 11 show impacts in the Delayed Transition scenario across the US and Europe, respectively. What is immediately apparent is the large negative impact of heatwaves on European GDP, above that expected for the US. Meanwhile, the impact of transition, which we stress is largely dependent on social

Figure 10: Unemployment Rate Deviations

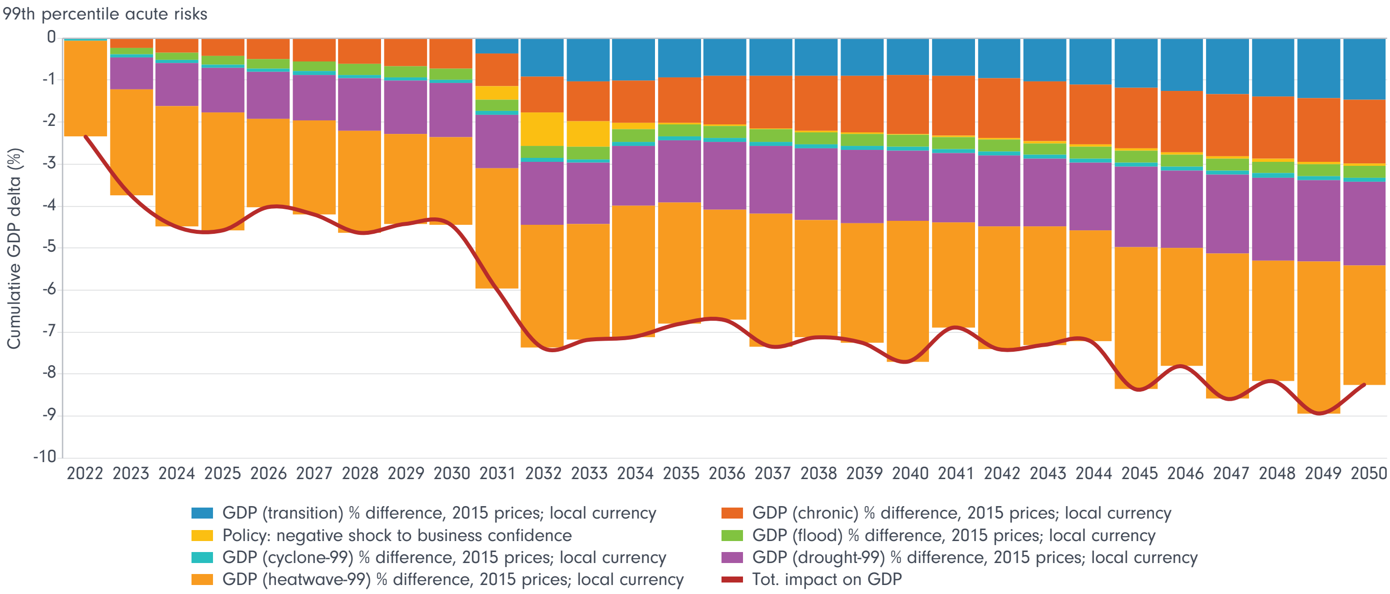


Source: NGFS Scenarios for central banks and supervisors - Combined Risk, NiGEM based on REMIND input), November 2023.

and political will rather than physical susceptibility, is lower in Europe than the US. This demonstrates the inequity of physical and transition risk exposures across geographies, which is another unfortunate underpinning of the case for a Fragmented World pathway.

Despite these factors, the long-term implications of inaction are far more damaging across jurisdictions. It would also be dangerous to assume that factors forecast to damage certain regions will not find their way to affect others that are currently considered more resilient, given limited current understanding of global transmission channels. Unfortunately, even in geographies that are susceptible to physical risk impacts, societies tackling geopolitical and socioeconomic challenges are finding it difficult to address climate challenges with the necessary force to maximise long-term prosperity outcomes.

Figure 11: Phase IV GDP impact (Delayed Transition, Europe)



For illustrative purposes only.

Source: NGFS, Fidelity International, April 2024. Results are preliminary.

Climate Credibility Tracker update: a Delayed Transition with downside risks

Given significant variation in the capital market effects of the various NGFS's climate scenarios, our proprietary Climate Credibility Tracker gauges physical and transition progress globally with the intention of assessing which climate pathway is most likely to materialise and how it will play out (Figure 12). Our analysis consists of evaluations across three key transition enablers: corporate action, technological developments, and policy credibility, each of which have the potential to accelerate or decelerate transition progress. We will address our up-to-date thinking in this area in more detail in a subsequent paper.

While an Orderly transition that limits temperature increase to 1.5°C above pre-industrial levels remains possible, a Net Zero 2050 pathway unfortunately looks increasingly out of reach at present. Corporates are coming to terms with the fact that transitioning their businesses is more complex and difficult than previously thought amid greater regulatory scrutiny. While encouraging progress has been made in terms of adoption of transition technologies amid strong economic incentives, notably renewables electricity generation, the rate of adoption will still have to increase significantly to achieve an Orderly transition. Unfortunately, the economic and political climates of major economies around the world are increasingly risking regression from existing climate initiatives, rather than more intensive action. Major elections this year, particularly in the US, will be important in determining what comes next.

Considering these developments, we continue to assign higher probability to the Delayed Transition scenario, given that we expect the crystallisation of physical risks in the form of a major climate event with material global socioeconomic repercussions to eventually propel transition activity.

Figure 12: NGFS climate scenarios at a glance

		Physical risk	Transition risk			
Quadrant	**Scenario**	**End of century warming** (model averages)	**Policy reaction**	**Technology change**	**Carbon dioxide removal** *	**Regional policy variation** **
Orderly	Low Demand	1.4 °C (1.6 °C)	Immediate	Fast change	Medium use	Medium variation
	Net Zero 2050	1.4 °C (1.6 °C)	Immediate	Fast change	Medium-high use	Medium variation
	Below 2C	1.7 °C (1.8 °C)	Immediate and smooth	Moderate change	Medium use	Low variation
Disorderly	Delayed Transition	1.7 °C (1.8 °C)	Delayed	Slow/Fast change	Medium use	High variation
Hot house world	NDCs	2.4 °C (2.4 °C)	NDCs	Slow change	Low use	Medium variation
	Current Policies	2.9 °C (2.9 °C)	None – current policies	Slow change	Low use	Low variation
Too-little-too-late	Fragmented World	2.3 °C (2.3 °C)	Delayed and Fragmented	Slow/Fragmented change	Low-medium use	High variation

Colour coding indicates whether the characteristic makes the scenario more or less severe from a macro-financial risk perspective ***

Lower risk Moderate risk Higher risk

* The impact of CDR on transition risk is twofold: on the one hand, low levels of CDR imply an increase in transition costs, as reductions in gross emissions should be obtained in a different way; on the other hand, high reliance on CDR is also a risk if the technology does not become more widely available in the coming years.

** Risks will be higher in the countries and regions that have stronger policy. For example, in Net Zero 2050, various countries and regions reach net zero GHG by 2050, while many others have emission of several gigatons of CO2 equivalent.

*** This assessment is based on expert judgment based on how changing this assumption affects key drivers of physical and transition risk. For example, higher temperatures are correlated with higher impacts on physical assets and the economy. On the transition side economic and financial impacts increase with a) strong, sudden and/or divergent policy, b) fast technological change even if shadow carbon price changes are modest, c) limited availability of carbon dioxide removal meaning the transition must be more abrupt in other parts of the economy, d) stronger policy in those countries and/or regions.

Source: NGFS Scenarios for central banks and supervisors, November 2023. NDCs: Nationally Defined Contributions.

Nevertheless, the troubling lack of international policy co-ordination we are witnessing justifies a downside skew in risk towards a Fragmented World (with higher dispersion across countries) or Hot House World scenarios, given inadequate corporate action and insufficient progress in the development and adoption of decarbonisation technologies (including a lack of progress towards renewable energy use), which are largely due to effective net-zero policy implementation and the threat of regression towards policies which have been introduced. More broadly, we believe that this environment is due to both a lack of appreciation of the potential adverse physical repercussions of climate change and the magnitude of effort required to mitigate it.

We note that within the Delayed Transition scenario, the transition occurs primarily between 2032 and 2036. This raises questions about the exact timing of policy implementation, which is important given significant implications for policy rates, yield curves and equity valuations, among other factors. In turn, these factors are fundamental underlying components of asset class returns. The timing of policy implementation will also have important implications for the timing and extent to which investors price information about the transition and potential associated economic shocks into markets, especially if no concrete action is taken and the impact of hard-to-predict acute physical risks increases. Our analyses assume that this will indeed happen over the next ten years, with especially important implications for equities, whose prices discount medium- and long-term expectations.

Climate risks to financial risks

Over the years, we have developed a proprietary framework that combines inputs from the NGFS's analyses and our own proprietary research and models to compute the net effects of climate risks on our CMAs. Climate-related economic impacts on variables such as GDP, inflation and policy rates translate into asset class risk and return impacts through numerous price drivers, such as the expected shape of the yield curve, default losses, equity valuations, and corporate earnings growth effects. Importantly, these channels also consider the prevailing market environment at the time of computation; the outcomes of this analysis can therefore be used in context of an investor's objectives and risk budgets to inform their asset allocation decisions.

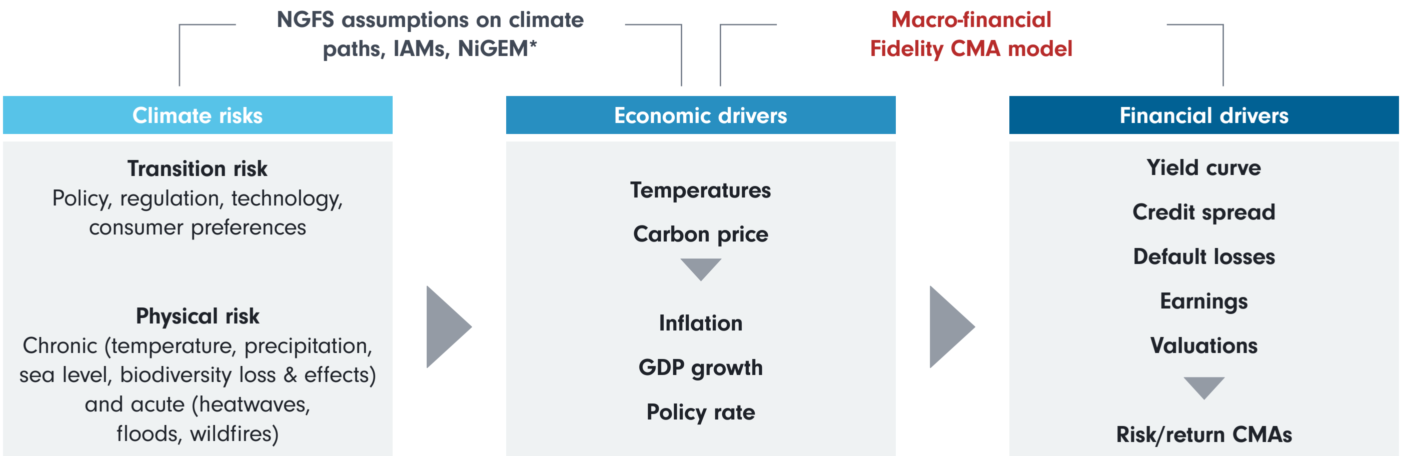
Given recent developments, current policy settings and market conditions, it is becoming more apparent that there is a timing/horizon issue at the intersection of climate risk and financial returns across two key dimensions: policy action and price discovery by market participants. As such, we believe there are three key questions that require careful consideration, given their importance to asset prices and therefore investment decisions:

1. Will policymakers implement sufficient measures to achieve Net Zero by 2050?
2. If the transition is delayed, will measures be implemented before the horizon used for SAA purposes (ten years)?
3. In the case of insufficient transition action, will investors price-in the increased longer-term impacts of physical risks that occur beyond the ten-year horizon? If so, how (and when) will they be priced-in?

Answering these questions is a complex challenge involving the consideration of multiple actors and variables. While we view the market-pricing transmission mechanism as working when it comes to quantifiable risk, it struggles when risk is more uncertain. For example, it is hard to predict or assess the impact of geopolitical or domestic policy changes in the near term, let alone many years into the future. Likewise, it is very difficult to predict how investors might price the economic implications of erratic acute physical risk events whose scope and size might not yet have been encountered. A key consideration here being climate tipping points (critical thresholds whose crossing can result in large irreversible climate changes), whose occurrence is not modelled within the Phase IV scenarios.

We posit that a significant physical risk event may be required within a Disorderly, Hot House World, or Too-Little, Too-Late scenario before the probability of its recurrence is reflected more fairly within market pricing. Such an event may also be required to coerce policy to the position where it forces a Delayed Transition scenario. Within these scenarios, it is also possible that the potential impacts of such physical risks would hardly manifest within markets at all ahead of their occurrence.

Figure 13: From climate risks to financial risks



For illustrative purposes only.

Source: Fidelity International, April 2024. *NGFS modelling includes integrated assessment models (IAMs), Kalkuhl & Wenz (KW) damage function, and National Institute Global Econometric Model (NiGEM).

Capital Market Assumptions

The interplay between climate risks and macroeconomic variables such as growth, inflation and policy rates will affect asset-class returns in different ways, depending on the underlying components of their returns. Our CMA framework is built primarily to analyse the structural drivers of asset class returns, estimate the linkage between those and the macroeconomic environment, and guide our expectations for long-term risk premia. We forecast long-term public and private asset class total returns under different scenarios by estimating how their underlying components of return are likely to be affected.

For equities, we model returns through components such as:

- Earnings growth, further decomposed into:
  - Inflation
  - Real revenues
  - Profit margins
  - Net buyback activity
- Dividend yield
- Changes in valuations

In fixed income, we model returns through:

- Income return (the sum of coupons received over time minus losses due to defaults)
- Price return (respective of changes in yield levels)

For sovereign bond returns, both of these components are a direct function of the shape of the yield curve over time. In particular, of the three key factors that drive the yield curve: level, slope, and curvature. In the case of the climate scenarios, an increase in inflation and policy rate can lead to an increase in the level of the yield curve. Meanwhile, for corporate bonds, any deterioration in economic conditions (characterised by lower GDP growth) can affect higher default risk.

It is also notable that different regions could potentially experience vastly different outcomes within scenarios, depending on the structure of their economies and their susceptibility, or even perceived susceptibility, to transition and physical risks. For example, companies within the consumer staples sectors will be exposed to different climate risks than those in the technology, healthcare or energy sectors; as an example, technology companies might find it easier to decarbonise than energy companies, while consumer staples businesses' profits might be more susceptible to adverse impacts from soft commodity inflation than healthcare companies. Therefore, regional economies consisting of different exposures to underlying sectors and value chains will be affected in different ways, and so will their capital markets.

We establish CMAs quantitatively for each asset class regionally via logical forecasts based on our expectations and empirical data. In Figures 14 and 15, we demonstrate how including the consideration of climate risks would inform ten-year US equity and fixed income return projections, respectively.

The overall objective of this analysis is to establish CMA impacts based on current information, utilising the NGFS's data in conjunction with our own proprietary top-down and bottom-up inputs. It is important for clients with long term goals to consider such information in their decision making, given the scale of the impacts that climate risks may have.

Geographic factors

As climate change affects different regions in different ways, we must account for this in our CMA model through several channels.

For example, equity earnings growth is a direct function of macroeconomic variables such as inflation and GDP growth, as these define the path of aggregate real revenues over the long term. We therefore model corporate earnings growth through revenue exposures (the equity market of a given region is not simply exposed to the inflation and GDP of that region but is a function of the underlying revenue exposure of its constituent companies). Therefore, physical and transition risk factors that affect certain countries can affect the equity market returns of others through the corporate earnings channel.

Moreover, equity valuations are a direct function of the interest rate environment, which is also affected by the inflation outlook. Lower rates can contribute to higher equity valuations and vice versa. Rates also affect the current value of expected future earnings. As such, rate changes across countries can affect valuations and earnings of companies listed in others. We also incorporate the impact of potential pricing of earnings shocks due to GDP losses, especially in the more extreme scenarios, meaning that GDP factors also affect equity returns across borders.

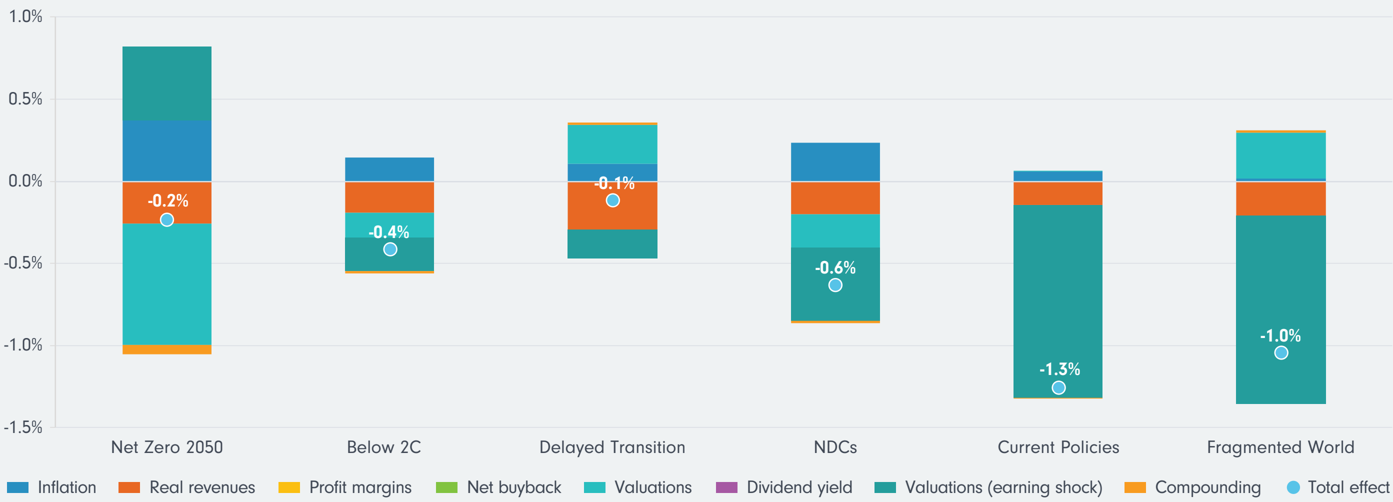
Equity market impacts

Inflation, real revenue growth, and valuation effects (both from the numerator, earnings expectations, and the denominator, cost of capital) are the key drivers of change when incorporating climate risks into our CMAs. We measure the impact as deviation from our climate-agnostic baseline CMAs using our CMA models. The key takeaway is that the impacts are negative in aggregate across all scenarios due to the implications of physical and transition risks in combination. However, the impacts vary nonlinearly by geography and scenario, given the heterogenous nature of impacts across sectors; for example, transition activity will boost certain industries that are helping to tackle climate change by attracting revenues and investment flows.

Within our ten-year SAA horizon, the delta on inflation's contribution to average long-term equity returns is dominated by transition risk factors affecting shadow carbon pricing. These include regulatory factors such as direct and indirect carbon taxes, technological developments, and demand dynamics like investment spending and consumer preferences. The effect of transition activity on inflation is something that we have been incorporating into our CMAs for some time, in recognition of the fact that it is likely to help keep the long-term equilibrium level above the 2% target, especially in the US and the UK. While we recognise that physical risks might also have some effect, for example through the effect of extreme weather patterns on crop yields, the NGFS's modelling of acute physical risks does yet extend to inflation. The impact of inflationary pressures makes a varying marginal positive effect on equity returns across all scenarios, with the effect higher in the Nationally Determined Contributions scenario than Delayed Transition because much of the necessary investment assumed in the latter takes place only towards the end of, or outside, our ten-year forecast period.

The contribution of real revenues is dominated by the economic effects of policy developments and the adverse impact of physical risks on GDP growth. Its contribution to equity returns is negative across scenarios due to the negative contribution of physical risks within the ten-year forecast period; outside of this period, physical risks will have a much larger adverse impact in the non-Orderly scenarios. However, in the Orderly scenarios policy impacts are higher within the forecast period so the negative impact of real revenues on equity returns is larger. Nonetheless, in our framework, GDP shocks beyond year 2034 are still accounted via the discounting mechanism typical of equity pricing and are included in the valuation component. Intricacies between the impact across scenarios reflect the stringency and timing of policy implementation; for example, in Delayed Transition, a lack of near-term action translates a requirement for even more stringent policy action at a later date relative to the Net Zero 2050 scenario, hence the adverse effect of real revenues is slightly greater.

Figure 14: US equities, ten-year annualised expected return deviations from baseline climate-agnostic CMAs



For illustrative purposes only.

Source: Fidelity International, April 2024. Deviations are US-dollar denominated, based on proprietary CMA modelling. NDCs: Nationally Defined Contributions.

The contribution of valuations is modelled as a function of the cost of capital and the expected future income, i.e. the respective denominator and numerator in a discounted cash flow model. In turn, the cost of capital is a function of expected policy rates. Again, this is a factor of the factors affecting shadow carbon prices and their timing. For example, in Net Zero 2050 the implementation of stringent policy and subsequent action creates immediate inflationary pressure which draws a commensurate higher-rate response from central banks. Conversely, a lack of immediate action results in the opposite inflation, policy rate and valuation reactions within Delayed Transition and Fragmented World.

The other component of the valuations impact is due to future earning shock, modelled as the present value of future expected revenues. In this, we see the effects of expectations outside our ten-year horizon. For example, forward-looking markets anticipate the long-term benefit on immediate co-ordinated transition action on long-term economic activity in the Net Zero 2050 scenario, resulting in a positive contribution to returns within the ten-year horizon. On the other hand, it also discounts the adverse effects of rising physical risks in the Current Policies and Fragmented World scenarios, resulting in strong negative contributions to aggregate equity returns.

Fixed income market impacts

Our CMA models project expected fixed income returns through several underlying return drivers, which each produce varying effects across climate scenarios. Cash, income (rates and spreads), price return (rates and spreads), and credit loss as the key underlying drivers. We again measure the impact as deviation from the ten-year baseline of our climate-agnostic CMAs.

Notably, the impact of the Net Zero 2050 scenario on fixed income returns is positive, primarily due to the implications of higher inflation on policy rates and, therefore, bond returns. The impacts of underlying return drivers within this scenario are also far greater than those of the other scenarios given the significant policy action and economic reorientation that it represents. Overall return impacts are relatively muted across the other scenarios.

The contribution of cash is among the greatest in all the scenarios where concrete transition policies are implemented. It mirrors broadly that of inflation in our equity returns, given that the expected central bank reaction to inflation delta is via policy rate adjustments. Hence, in the Orderly and Nationally Determined Contributions scenarios the impact is positive. However, in the Delayed Transition and Fragmented World scenarios, a lack of near-term policy action results in a negligible impact on inflation, rates, and the contribution of cash to aggregate fixed income returns over our ten-year horizon.

Credit loss deltas reflect the impacts of both changes in policy rates and economic growth on corporates' financial positions. Credit loss impacts are negative across all scenarios due to the adverse growth impacts of physical risks. Scenarios that involve higher transition risks exhibit greater credit losses still, given the limited effect of near-term transition activity on near-term physical risks.

The impacts of Income (rates) reflect the additional premium, beyond cash, earned by investing in government bonds. The impact of price return (rates) mirrors the impact of inflation on equity returns, via the mechanism whereby shadow carbon price changes affect inflationary pressures that draw central bank policy rate reactions.

The impact of income (spreads) primarily reflects the level of transition risk inherent within each scenario and the time of its crystallisation. For example, the immediate disruption it causes within the Net Zero 2050 scenario necessitates higher spreads, which create a positive contribution to real fixed income returns. In the Delayed Transition scenario, the fact that these risks are pushed out into the future reflects in a lower but still positive contribution, given that average spreads across the ten-year period will be lower, as they only widen later. The impact of price return (spreads) correlates negatively to the impact of income (spreads) in that widening spreads result in mark-to-market capital losses.

Figure 15: US high yield, ten-year annualised expected return deviations from baseline climate-agnostic CMAs

For illustrative purposes only.

Source: Fidelity International, April 2024. Deviations are US-dollar denominated, based on proprietary CMA modelling. NDCs: Nationally Defined Contributions.

Conclusion & next steps

Climate risk developments

- Forecasts of the magnitude of adverse physical risk impacts have increased, given better understanding of their likely frequency and severity, as well as improved knowledge of the transmission channels through which they affect economic activity.
- Physical risks will continue to accumulate, becoming more apparent in the coming years, irrespective of the climate pathway, as action taken within Orderly scenarios will take time to bear fruit. This justifies more granular assessments by sector and geography.
- Tipping points remain a key unexplored risk.

Scenario assessments

- Policymakers, electorates and investors are underestimating the long-term economic and financial implications of climate risks, as well as their likely variation across regions.
- Since our last paper, we have witnessed insufficient action to achieve a Net Zero 2050 pathway, despite progress on the EU Fit-for-55 and the US Inflation Reduction Act. Consequently, the Orderly pathways will now be more difficult to achieve and they represent larger transition risk.
- At the same time, we are seeing signs of political regression from established Nationally Determined Contributions due to political reactions in response to the pressure on living standards from high ongoing inflation.
- We see little chance of the NGFS's Low Demand scenario playing out, given current geopolitical and socioeconomic trends.
- Current trends suggest a short-term path away from an Orderly transition, but we posit that the adverse physical risk impacts will eventually force a Delayed Transition. Despite this, we see downside risks towards a Fragmented or Hot House World scenario given:
  - Recent geopolitical struggles.
  - Regional inequity between the costs and benefits a transition will deliver.
  - Chronological mismatches between the near-term nature of transition risk and longer-term nature of physical risks.

Economic and market implications

- Climate risks will contribute to flatter efficient frontiers:
  - Structural aggregate equity returns exhibit greater sensitivity to climate risks than their fixed income equivalents, due to their perpetual cash flow nature. We believe significant physical risk effects will be priced into equity markets in time, even beyond the ten-year horizon used for SAA purposes. This will cause the equity risk/return trade off to deteriorate.
  - Fixed income markets are likely to be less affected by climate change, as price impacts and credit losses are balanced by higher income.
  - In the Delayed Transition and Fragmented World scenarios the timing of policy action is crucial to determining the effects on CMAs.

Asset allocation strategy implications

- Analysis of the broader impact of climate change on economies and markets is expected to be a useful input into asset allocation strategies as we look forward.
- Given the uncertainty that surrounds both which scenario will materialise and how it will play out, top-down inputs can be complemented by active management decisions across the investment process, including in terms of tactical asset allocation (TAA) and portfolio implementation. We believe that rigorous investment research and bottom-up insights across markets, industries and regions can help investors navigate the transition by mitigating climate risks through time.
- There is still considerable uncertainty regarding the future trajectory of climate risks and their economic and financial implications. However, we will continue to update our framework with the latest climate data, transition information, and modelling methods, working to increase the granularity of our analysis across asset classes and geographies. Future steps will likely involve assessing the varying impacts of climate risks across economic sectors and the regional implications. Such enhancements should increase the precision of our CMAs and solutions design, allowing us to evolve investment strategies to better meet clients' specific objectives across requirements, preferences, and investment horizons.

References

[1] https://climate.copernicus.eu/april-2024-11th-consecutive-warmest-month-globally

[2] 2023 summer warmth unparalleled over the past 2,000 years | Nature

[3] [April 2024 – 11th consecutive warmest month globally | Copernicus]

Appendix

Evolution of our Climate CMAs

In July 2021, we published the first of our Global Macro Insights papers discussing the macroeconomic and capital market implications of physical climate and policy transition risks, 'Planetary risk: mapping climate pathways to macro and SAA'. This established that mitigating climate change would be a difficult and costly task, requiring tight policy coordination between countries with different emission rates, economic incentives, and political objectives, but that the costs associated with delaying tackling climate change would likely be much greater. It harnessed macroeconomic projections provided by the NGFS climate scenarios framework to incorporate climate risks into our CMAs, noting the uncertainty around key climate pathway variables, such as technological progress, political willpower, and the willingness of corporates and consumers to adapt.

In December 2021, following the UN Climate Change Conference in Glasgow (COP26), we released the second paper in our Climate CMA series, 'Towards a disorderly transition: tracking the credibility of climate commitments'. This introduced our climate credibility tracker, which monitors three core elements that are key to enabling the climate transition: corporate action, policy action and technological change. The intention was to gauge which scenario is the most likely to play out and, at the time, we concluded that a Disorderly Transition scenario was most likely. This envisions a world in which climate policy action is delayed and implemented unevenly across regions and sectors, resulting in increased physical and transition risks, which translate into a volatile environment for key macro indicators.

In February 2023, we released the next paper in our series of climate CMAs, 'Tracking Net Zero Progress: Too Little, Not Too Late'. This assessed the world's transition progress through developments relating to the enablers of corporate action, technology, and policy. Fidelity's proprietary Climate Ratings showed that most companies were seeking to mitigate their climate impacts but were struggling to align their activities to a 'net zero by 2050' pathway. We concluded that there was potential for technology to facilitate an orderly transition, but that sufficient development or adoption to do so was lacking in many areas. We also noted some encouraging progress in terms of policy at the regional level, with Europe and the US standing out, but international cooperation weak in key areas like carbon pricing. Overall, these developments were insufficient to change our baseline view from a Disorderly to an Orderly transition.

Climate credibility tracker

- **Assess the credibility of corporate action**
  We use Fidelity's proprietary Climate Rating, which focuses on corporates' net zero ambition, climate governance, and capital allocation decisions in consideration of the transition.
- **Track technological change**
  We focus on game-changing green technologies that can potentially make optimistic climate scenarios more realistic. By monitoring their rates of development, diffusion, penetration and cost, we can identify tipping points which accelerate the transition.
- **Measuring policy credibility**
  We have designed a framework that assesses the top five emitters' (US, EU, Russia, India and China) actions on carbon pricing, political environment, policy incentives, and international cooperation.

In March 2023, we released Capital market assumptions in the climate crisis, based off the NGFS Phase III climate scenarios. This highlighted that climate change adds uncertainty to the global economy and therefore increases macroeconomic and financial risks, materially impacting the risk-return characteristics of investment portfolios. It quantified how physical and transition risks would affect our CMAs through the economic channels established by the NGFS, harnessing the power of our CMAs models. The goal was to help investors incorporate evidence-based climate change scenarios into their strategic asset allocation, and ultimately, inform investment decisions to build climate resilience into their portfolios.

We continue to track the three key transition enablers of with the aid of analyst research, aiming to help investors navigate the tremendous uncertainty associated with physical and transition risks, and their impact on economies and capital markets. By capturing shifts in the likelihood of different climate scenarios in real time, we seek to understand how CMAs could shift and how strategic asset allocation processes should adapt. Our analysis leads us to believe that investors are underestimating the impact of climate change and policies to tackle it on economic growth, inflation, and asset prices. We have gauged this impact and presented the results within this paper.

NGFS: improved modelling of acute physical risks

Acute physical risk modelling was improved to provide economic impact estimates at the country level, to include more hazards, and to more accurately capture their transmission to the economy, including through additional channels.

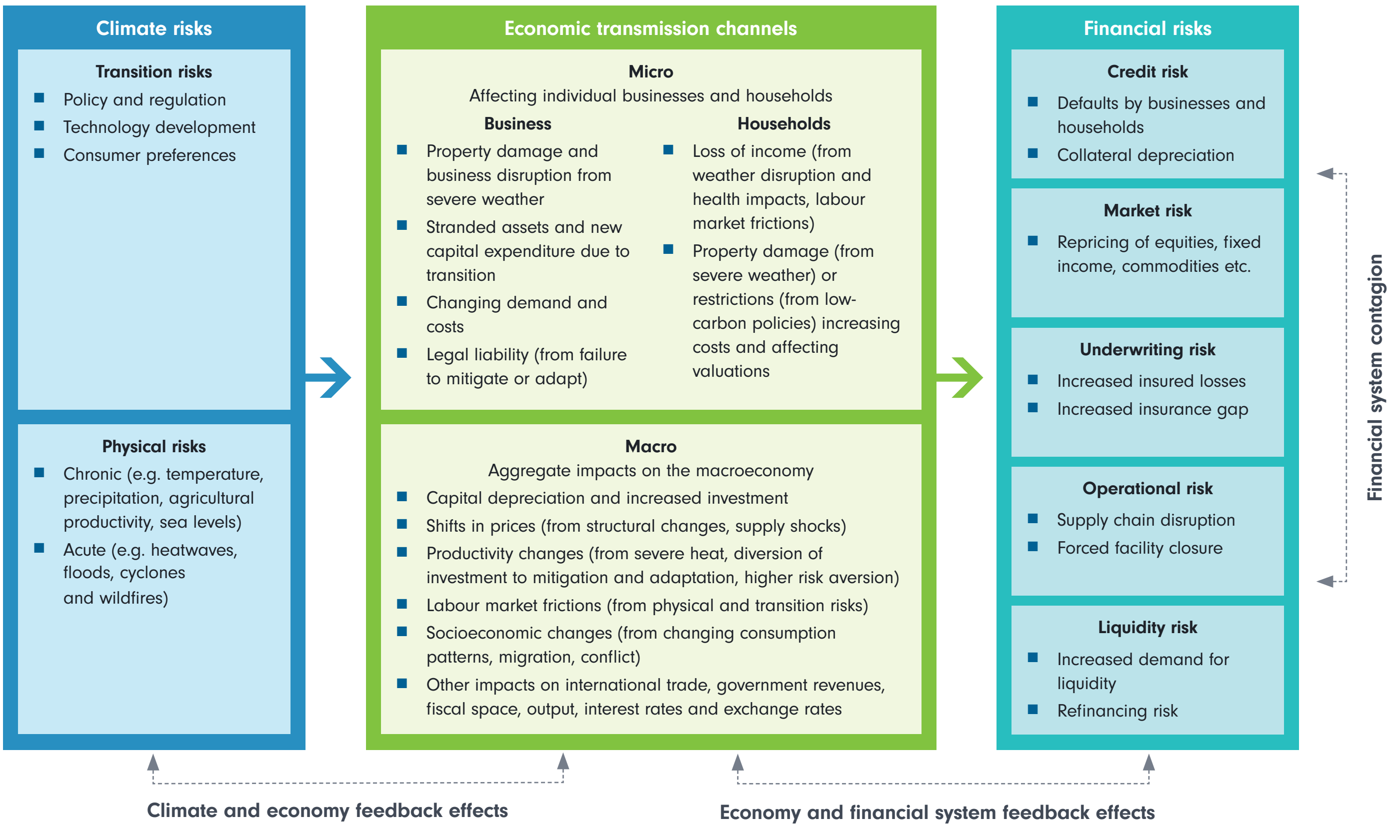
Physical risks affect the economy in two ways, chronic and acute impacts. The former includes increased temperatures, rising sea levels and precipitation changes, which may affect labour, capital, land and natural capital in specific areas, requiring significant investment and adaptation from companies, households and governments. The latter include extreme weather events that cause damage and business disruption, such as reduction of agricultural yields or of labour productivity. Such events can impair asset values and increase underwriting risks for insurers, possibly leading higher insurance premiums and/or lower insurance coverage in some regions.

Estimates of GDP losses from chronic risks follow the same modelling approach of phase III, based on a damage function driven by temperature changes. However, the impact of acute risks and captures of their macroeconomic impacts has been improved by more advanced physical risk modelling, including the incorporation of two new acute physical risk hazards, droughts and heatwaves (in addition to floods and cyclones). Additional channels of transmission of acute risks to the real economy have also been implemented to advance the representation of their macroeconomic impacts (although acute risk impact is only modelled for GDP, not for inflation or policy rate).

Despite the substantial progress in the modelling and estimates of acute physical risk in Phase IV, future improvements might capture physical chronic risk more comprehensively through additional climate hazards (e.g. precipitations), sector impacts and transmission channels (such as food inflation), which could result in higher damage estimates. It is also important to note that while modelling has improved, it remains limited; the scenarios do not capture the potential impact of known unknowns such as tipping point events or extreme tail risks, for example.

Figure 18: Transmission channels

Climate risks to financial risks



Source: NGFS Scenarios for central banks and supervisors, November 2023.

Important Information

This material is for Institutional Investors only; and should not be distributed to the general public or be relied upon by private investors.

All information is current as at 30 June 2024 unless otherwise stated. Not for use by or distribution to retail investors.

This document is issued by FIL Investment Management (Australia) Limited ABN 34 006 773 575, AFSL No. 237865 ("Fidelity Australia"). Fidelity Australia is a member of the FIL Limited group of companies commonly known as Fidelity International.

The information included in this document is for general information purposes only and intended for the restricted specified group of selected institutional investors to which it is addressed only. An "institutional investor" is a person who is a "wholesale client" under section 761G of the Corporations Act 2001 (Commonwealth of Australia) ("Corporations Act") and the information in this deck must not be distributed, conveyed or otherwise be made available to any other persons.

The information presented in this deck should not be relied upon because it may be incomplete and may be subject to change. Any forward-looking statements, opinions, projections and estimates in this document may be based on market conditions, beliefs, expectations, assumptions, interpretations, circumstances and contingencies which can change without notice, and may not be correct. Any forward-looking statements are provided as a general guide only and actual results or outcomes may be adverse and differ materially from these forward-looking statements. Any graphs, examples or case studies included are for illustrative purposes only and may be based on specific factual and other assumptions or circumstances. They are not and do not represent forecasts or guides regarding future returns or any other future matters. While the information contained in this document has been prepared with reasonable care, to the maximum extent permitted by law, no responsibility or liability is accepted for any errors or omissions or misstatements, however caused.

The issuer of Fidelity's managed investment schemes in Australia is FIL Responsible Entity (Australia) Limited ABN 33 148 059 009, AFSL No. 409340 ("FREAL"). FREAL does not offer retirement solutions or issue any insurance products or any interest in a superannuation fund. The Product Disclosure Statements ("PDS") and target market determinations ("TMDs") for the funds issued by FREAL are available on www.fidelity.com.au. All information included in this document is indicative only and does not constitute an offer or an invitation to subscribe for an interest in any financial product or to be provided any financial product or to be provided any financial service by FREAL or Fidelity Australia.

The document and the information it contains is confidential and proprietary to Fidelity Australia and may not be used, reproduced or transmitted without prior written permission of Fidelity Australia and may not be made available or otherwise conveyed to any other person.

Fidelity INTERNATIONAL