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Global Macro Insights

Planetary risk: mapping climate pathways to macro and strategic asset allocation

From our partners at Fidelity International.

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Executive summary

- Climate change, and the policies aimed at slowing it, will shape the path of economic growth this century.
- Policy makers face a trade-off between the high upfront cost of moving quickly toward net-zero carbon targets and the long-term physical damage to economic growth and societal cohesion caused by rising temperatures if action is delayed.
- As a result, macroeconomic projections at the core of long-term capital market assumptions (CMAs) must incorporate both physical climate risks and policy transition risks. Only then will investors have a more complete picture of expected returns in the 21st century.

"No social processes of an exponential character are capable of indefinite continuance. Sooner or later, all such processes must overload their environment, consuming all its nutrients or poisoning it by the waste products associated with growth."

Robert L. Heilbroner, *Business Civilisation in Decline*, 1976

- The task of mitigating climate change is a difficult one. It will require tight policy coordination between countries with different emission rates, economic incentives and political objectives. Summits such as COP26 this year have a vital role to play.
- In our view, an effective response will require putting a price on carbon emissions, which have been both a free and fundamental part of economic growth for more than a century and a half. As carbon prices rise, this will contribute to inflation rising meaningfully from baseline levels.
- The costs associated with delaying tackling climate change are likely to be much greater, with the effects of rising temperatures spread unevenly across the globe and occurring in a non-linear fashion over time.
- As modelling techniques that map the transmission of climate change pathways on macroeconomic variables become more robust, we are focused on building climate-aware CMAs using the Network for Greening the Financial System (NGFS) framework, which will underpin our strategic asset allocation (SAA) process.
- Stress testing our current CMA machinery using the extreme climate scenario (which assumes a continued rise in greenhouse gas emissions) shows a significant impact on long-term risk and return profiles compared with our current baselines.
- We believe the NGFS framework will become the industry standard as key central banks, such as the European Central Bank and the Bank of England, use the same design to run climate risk stress tests.
- Turning to current market dynamics, we think investors are underestimating the impact of climate change and policies to tackle it on economic growth, inflation and asset prices.

Introduction

We have long known about climate change and the risk it poses to our way of life. But only relatively recently, with the effects on our weather systems and ecology now evident, coupled with a significant increase in general awareness of our collective role in driving climate change, have policymakers, investors and company executives started to take real action.

The task of mitigating climate change is a difficult one. It will require tight policy coordination between countries with different emission rates, economic incentives and political objectives at key summits such as COP26 this year. In the past, the signing of legally binding international treaties at meetings, such as the Paris Accord in 2015, has represented seminal moments in the fight against climate change.

Policies to encourage the "green transition" will shape the path of the global economy in this century, such as introducing a carbon price and both public and private sector investments in new energy technology. At the same time, increasing physical risks to our environment from rising temperature and extreme weather events will take their toll, unless aggressive and far-reaching action to transform our current economic model is taken to reduce emissions.

Focus of this paper

In this paper, we describe the framework developed by the NGFS for assessing the impact of these twin sources of risk – transition and physical – on key macroeconomic variables. The NGFS framework has been adopted by the People's Bank of China, the European Central Bank and 91 other central banks and regulators, including the U.S. Federal Reserve, which joined the body in December 2020. We also introduce the main points of consideration for integrating climate change outcomes into our CMAs, which underpin our SAA process.

To underscore the importance of incorporating climate change pathways into our CMAs, we lay out the results of a stress test study of our current machinery under a scenario where increases in greenhouse gases (GHGs) continue at the current pace, in turn leading to temperature increases in excess of 4°C above pre-industrial levels by the end of the century (also referred to by climate scientists as the Representative Concentration Pathway (RCP) 8.5 scenario).[1]

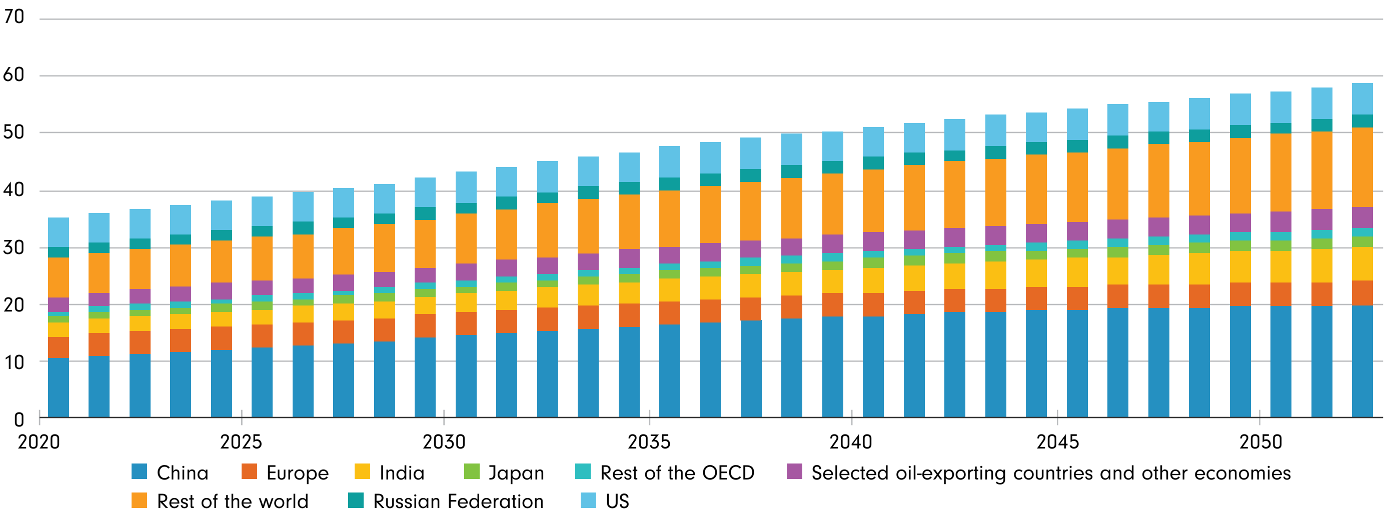
Nobody knows for sure what exact path climate change will take in the next decade, let alone over the course of the century. Nor can we know with complete certainty the mitigation and adaptation measures that will be introduced. Therefore, in building climate-aware CMAs, we aim to deploy the scenario architecture produced by the climate science community and adopted by the NGFS to ensure consistency between our approach and that increasingly used by central banks and supervisors globally.

Given the huge uncertainty involved, our focus is to create a flexible, transparent, yet robust scenario-based framework, representing the various possible states of the world to 2100, that can analytically capture projected shifts in policy and GHG emissions trajectories.

In calibrating the base case informing our climate-aware CMAs, we aim to narrow the range of potential scenarios by harnessing insights from around 150 Fidelity International analysts monitoring the actions of more than 3,000 companies around the world. We will also change our working assumptions as our targeted bottom-up research informs us of changes in the facts on the ground. Over time, this unique data source will allow us to gauge how our baseline scenario for GDP growth, inflation and rates, which feeds into our CMA models, needs to be adjusted on the basis of changes coming through at the corporate, national and global level.

The last step in our journey will be to incorporate climate change pathways in our CMA framework to reflect more accurately the complex influence of climate change on asset market return and risk projections over various time horizons and geographies.

EXHIBIT 1: Estimates of CO_2 emission growth without action on climate change



Source: IMF WEO, October 2020, Chapter 3

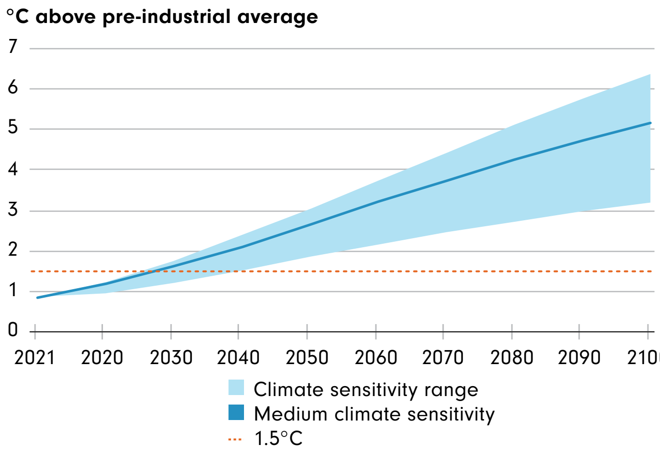
Stress testing CMAs using extreme climate change scenario

Capital market assumptions, which span the long-term risk and return profiles of various asset classes, play a critical role in underpinning SAA frameworks. As understanding of the economic implications of climate change develops, we stress test our current CMA approach using "business as usual" conditions, referred to as the RCP 8.5 scenario.

Specifically, under RCP 8.5, GHG emissions are expected to grow at their current pace, a plausible outcome if no action is taken to reduce emission-intensive activities (Exhibit 1). Given the link between greenhouse gas emissions and rising temperatures, the planet is expected to warm by around 4°C above pre-industrial averages by 2100 in this scenario (Exhibit 2).

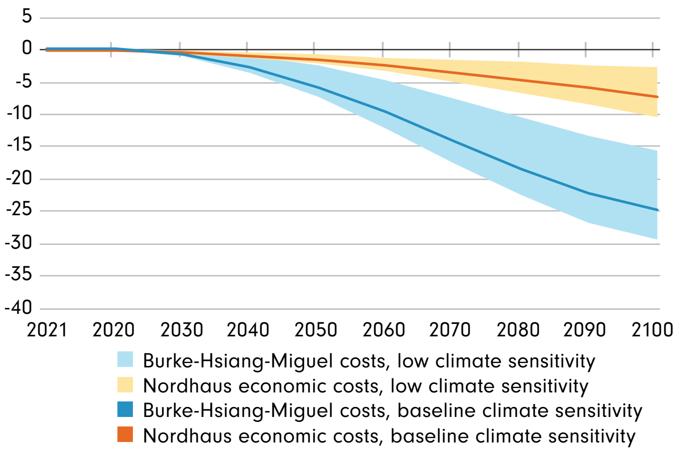
As a further step, a damage function can be used to map the projected temperature pathway onto deviations in economic output from expected baselines. The damage function calibrates the physical damage to economies implicit in the various climate change scenarios (in this case, the RCP 8.5). The whole assessment and mapping chain (from emission pathways to temperature projection to projected output losses) relies on a number of assumptions, generating a natural source of uncertainty.

EXHIBIT 2: Temperatures will rise under "business as usual" emissions



Source: IMF WEO, October 2020, Chapter 3

EXHIBIT 3: Estimates of CO_2 emission growth without action on climate change



Source: IMF WEO, October 2020, Chapter 3.

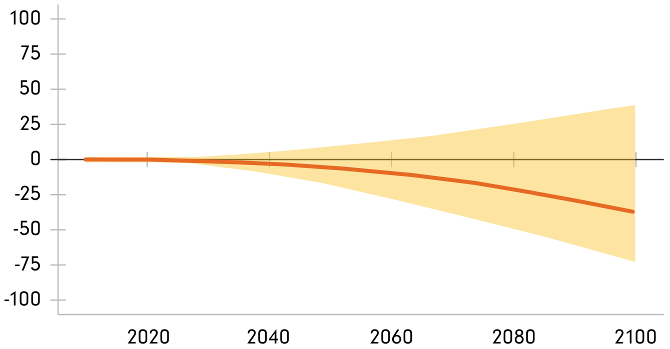
In order to stress test our CMAs, we used the Burke-Hsiang-Miguel (BHM) damage function, which captures the non-linear relationship between temperature pathways and projected output losses.[2] It is one of the more aggressive models used to project economic damage (Exhibit 3). The BHM model relies on projections based on gradual warming of the planet and does not take into account the potential impact of extreme weather events.

It shows that economic productivity peaks at an annual average temperature of 13°C and declines strongly at higher temperatures. The authors find that the relationship is consistent at a global level, is unchanged since 1960, and is apparent in agricultural and non-agricultural activity in both rich and poor countries. In addition, they report that if future adaptation mimics past adaptation, unmitigated warming is expected to reduce average global incomes by roughly 23% by 2100 and to widen global income inequality (given the geographical disparity in connection with expected output losses), relative to scenarios without climate change.

In addition, country-by-country and regional mapping of the projected damage shows the true extent of disparity embedded in the BHM output loss projections (Exhibit 4). Countries such as India and Brazil are projected to suffer damage in excess of 80% of output by 2100, while China and the U.S. are in the middle of the range, with output damage ranging between 30% and 40%, respectively, by the end of the century.

EXHIBIT 4: India and Brazil face devastation under climate change.

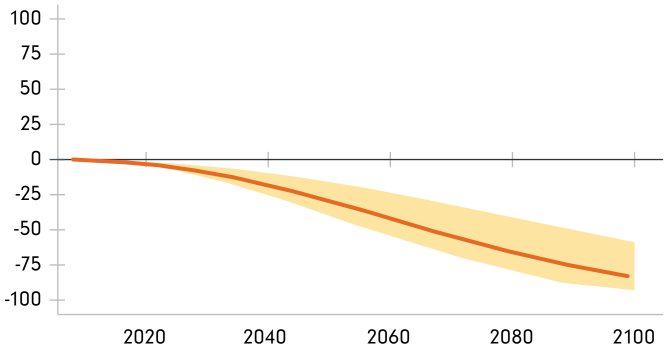
Economic impact of climate change on the US
% change in GDP/cap



Likelihood climate change will reduce US GDP per capita by:

- more than 0%: **84%**
- more than 10%: **79%**
- more than 20%: **71%**
- more than 50%: **28%**

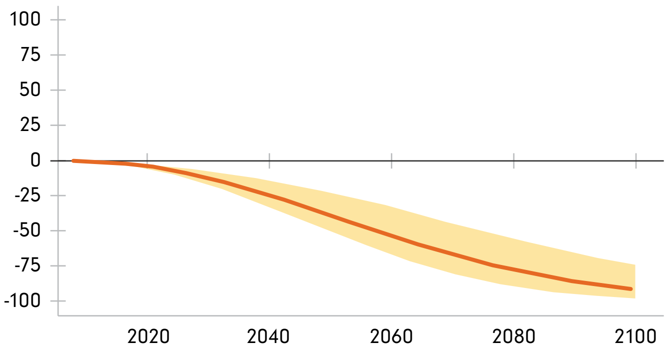
Economic impact of climate change on Brazil
% change in GDP/cap



Likelihood climate change will reduce Brazil's GDP per capita by:

- more than 0%: **100%**
- more than 10%: **100%**
- more than 20%: **100%**
- more than 50%: **98%**

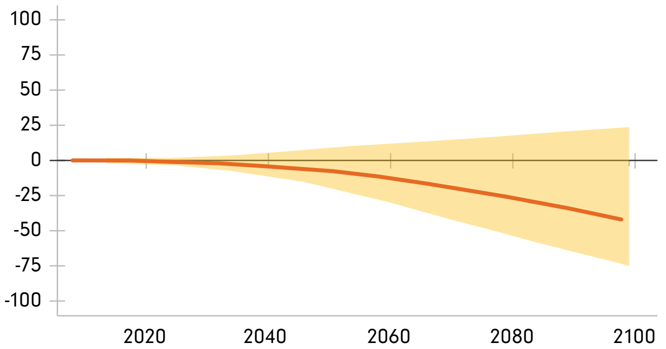
Economic impact of climate change on India
% change in GDP/cap



Likelihood climate change will reduce India's GDP per capita by:

- more than 0%: **100%**
- more than 10%: **100%**
- more than 20%: **100%**
- more than 50%: **100%**

Economic impact of climate change on China
% change in GDP/cap



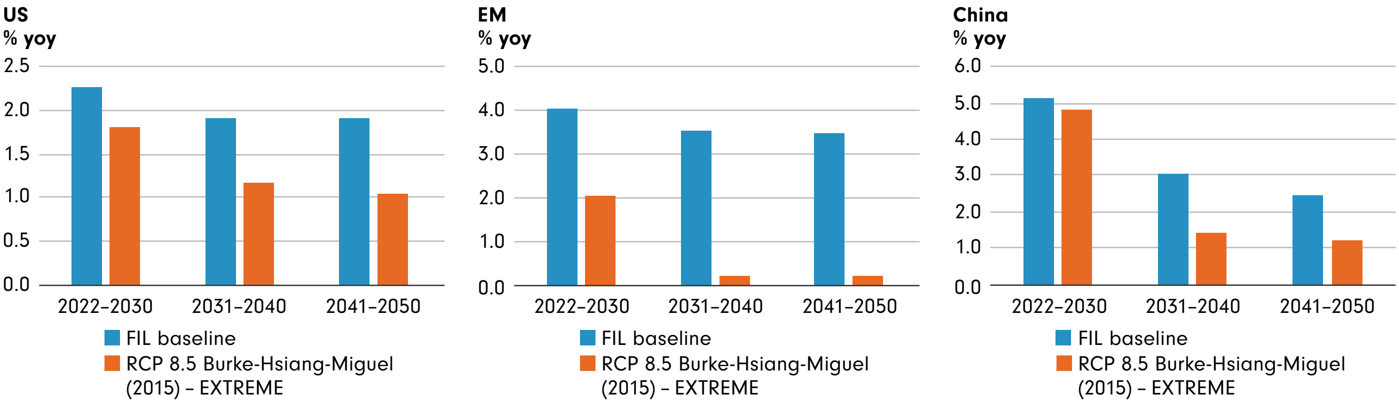
Likelihood climate change will reduce China's GDP per capita by:

- more than 0%: **89%**
- more than 10%: **84%**
- more than 20%: **77%**
- more than 50%: **35%**

Source: Burke, Hsiang and Miguel (2015).

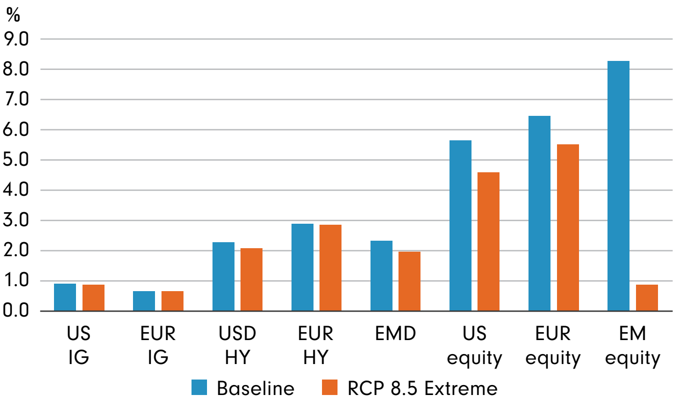
For China and emerging markets (EM), the BHM damage function-adjusted growth profiles are meaningfully different from our current baselines. In order to assess the impact on long-term asset return and risk profiles, we fed the BHM-adjusted growth profiles into our models, seen in Exhibit 5. The projections show a reduction in expected growth rates across the various regions, with the EM profile dramatically lower than our current baselines.

EXHIBIT 5: GDP growth under our baseline versus extreme climate change scenario – U.S., EM and China



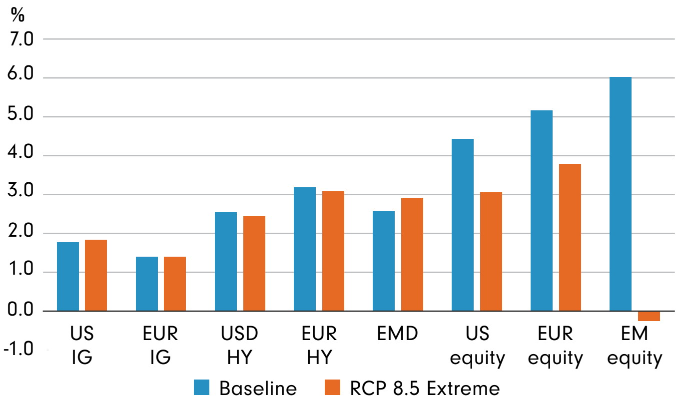
Source: Burke, Hsiang, and Miguel (2015), FIL calculations.

EXHIBIT 6A: Long-term excess return projections 2020–2040 in our baseline and extreme climate change scenarios



Source: Burke, Hsiang and Miguel (2015), FIL calculations.

EXHIBIT 6B: Long-term excess return projections (2040+) in our baseline and extreme climate change scenarios



Source: Burke, Hsiang and Miguel (2015), FIL calculations.

The exercise shows three key points:

A. If no action is taken to tackle climate change and the RCP 8.5 scenario does occur, then there is significant downside risk to long-term equity returns, especially in EM (Exhibit 6).

B. The assumptions underlying the whole calibration process are conservative, given that current models do not take into account extreme weather events and allow for only limited spillovers from EM to DM.

C. Not having formal climate change pathway modelling incorporated into CMAs misses critical influences on the global economy and, by extension, expected risk and return in connection with investing in risky assets.

This stress test exercise catalyzed our sense of urgency in needing to understand the complexity of climate change pathways and their impact on macro variables, our CMAs and, ultimately, investment portfolios.

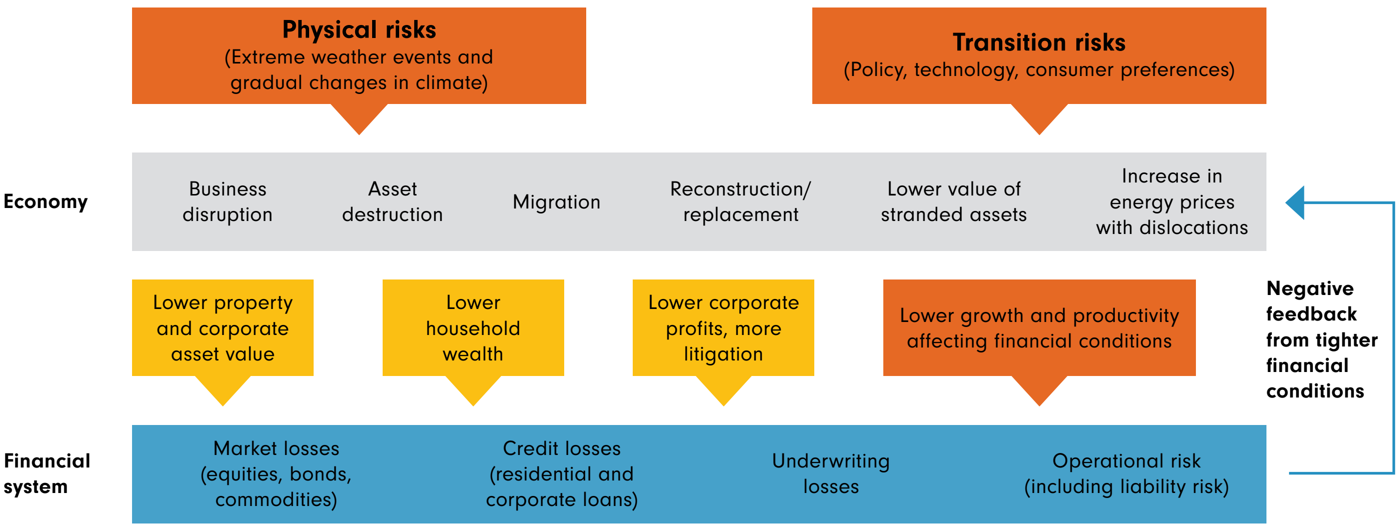
Transmission channels from climate to the economy

As analytical efforts to map the projected impact of climate change on macroeconomic variables of interest develop further, frameworks based on two key transmission channels are starting to take shape. First, **physical risks**, which refer to the effects of extreme weather events, such as hurricanes and floods, as well as the effects of gradual warming on our ecological system. Second, **transition risks**, which refer to the effects of restructuring the economy in response to the threat of climate change, for example, through new rules that limit carbon emissions, or through changes in consumer and corporate sector behaviour.

As Exhibit 7 shows, physical and transition risks can materialize in many ways, "with several second-round impacts and spillover effects that can affect all agents in the economy (sovereigns, companies and households)" (Banque de France Working Paper, Dec 2020).[3] There are feedback loops to consider as well, especially as the economic impact of climate change feeds through into the financial system, leading to tighter financial conditions that may curb the ability of economies to recover and grow.

The transition and physical risks are connected and cannot be considered in isolation. For example, physical risks decline relative to pessimistic run-away warming scenarios if measures to reduce emissions (which lead to slow temperature rises) are taken decisively and early on. In this respect, policy makers face a trade-off between the high upfront cost of moving quickly toward net-zero carbon targets and the long-term physical damage to economic growth and societal cohesion caused by rising temperatures if action is delayed.

EXHIBIT 7: Risks from climate change follow two channels, with multiple potential impacts.



Source: Climate Change, Central Banks and Financial Risk – IMF F&D | December 2019.

The technical aspects of modelling transition and physical risks

The interaction between physical and transition risks of climate change and their impact on the economy is an intense area of research within the international climate science community. The Intergovernmental Panel on Climate Change (IPCC) and the climate community generate key assumptions and models necessary for studying the economic impacts of climate change. These include the RCPs, which are climate scenarios with varying trajectories for GHG emissions, and the Shared Socioeconomic Pathways (SSPs), which are scenarios of projected socioeconomic global changes up to 2100. Combined, RCPs and SSPs allow explorations of possible future states of the world based on various assumptions about socioeconomic and climate trajectories.

To assess the economic impacts of transition and physical risks in different scenarios, the NGFS used a macroeconomic model, NiGEM, developed by the National Institute for Economic and Social Research. This model as used to translate quantified physical and transition risk inputs into economic outcomes.

The transition pathways for the NGFS scenarios have been generated by integrated assessment models (IAMs), which are models that combine macroeconomic, agriculture and land-use, energy, water and climate systems into a common numerical framework. The IAMs capture transition risks through assumptions about energy costs, energy efficiency, policy (including the trajectory of carbon prices) and the level of uncertainty.

Physical risks are modelled using a damage function that quantifies the effect of a change in global mean temperature on economic output. It takes a given temperature change as input and estimates the global percentage output loss compared with a world with a pre-industrial climate. Estimates of GDP losses from physical risk vary considerably depending on the scenario, assumptions about climate sensitivity and the method used to estimate economic damages. In the latest round of scenarios, the NGFS uses one damage function specification as defined in Kalkuhl and Wenz (2020).[4] It contains both linear and quadratic components and assigns increasingly large damage per °C of warming as temperate rises.

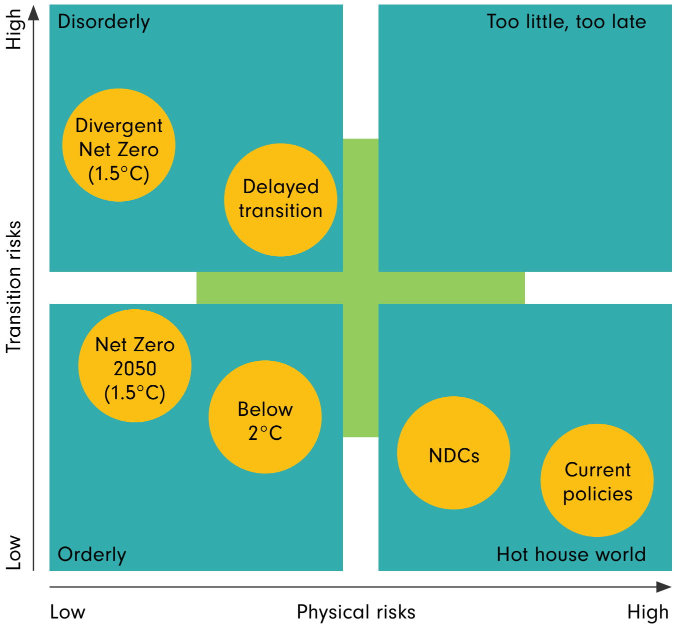
The Kalkuhl and Wenz specifications generate a wide range of potential damage outcomes for each scenario, but these are continuous in nature and do not consider potential "tipping point" temperatures beyond which global warming and economic damage would accelerate. We note that choosing a different specification (e.g., one that considers tipping points) would yield different, more dramatic results that, given the underlying uncertainty, would not be completely implausible.

In the final step, the transition outputs from IAMs and the damage estimates are exogenously introduced into NiGEM as shocks to capacity. The resultant economic impact outcomes vary greatly in scale and composition between the quadrants.

The NGFS climate scenarios framework

For the purposes of incorporating climate risks into our CMAs, we need to have macroeconomic projections, mapping physical and transition risks in different states of the world. The latest NGFS climate scenario work offers a comprehensive set of six scenarios, exploring a range of plausible outcomes under different assumptions about GHG emissions, societal choices, technology, climate adaptation and mitigation policies.[5] At their heart, these scenarios are an interplay between different projections of physical and transition risks across time and associated macro variables of interest. They help identify the scale of costs associated with different outcomes.

EXHIBIT 8: The NGFS scenario framework



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

Source: NGFS climate scenarios for central banks and supervisors, June 2021.

The scenarios are broadly divided across three quadrants and spanned by the physical and transition risk dimensions (Exhibit 8):

1. "Orderly," in which climate policies are introduced early, minimizing both transition and physical risks, including "net zero 2050" and "below 2°C" scenarios.
2. "Disorderly," in which policy changes are delayed, increasing transition costs, including "divergent net zero" and "delayed transition" scenarios.
3. "Hothouse world," in which global efforts are insufficient to halt significant global warming, leading to severe physical risks, including "nationally determined contributions (NDCs)" and "current policies" scenarios.

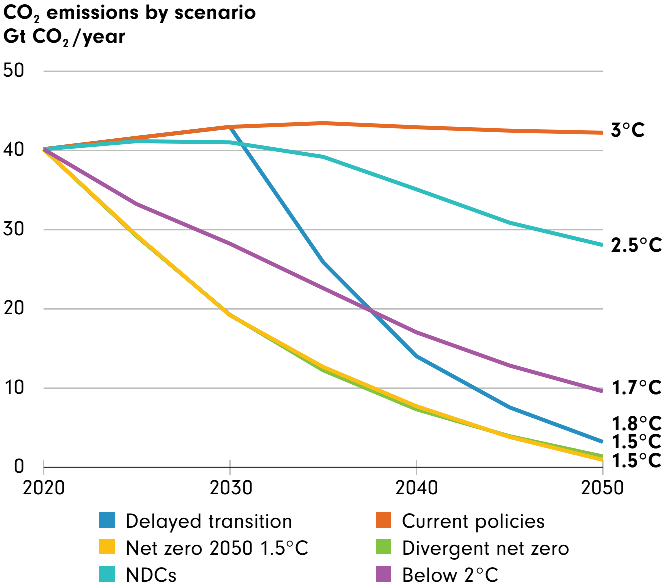
Exhibit 9 shows assumed CO_2 emissions trajectories and carbon price development under each scenario. One of the standout features of the two net zero scenarios (orderly and disorderly) is the strictness of the climate policy required to limit global warming to 1.5°C, which presents significantly higher risks from a macro-financial stability perspective. The "divergent net zero" scenario is also costlier, due to divergent policy actions, necessitating a faster and chaotic phasing out of fossil fuel use.

The costs of decarbonization: Carbon pricing

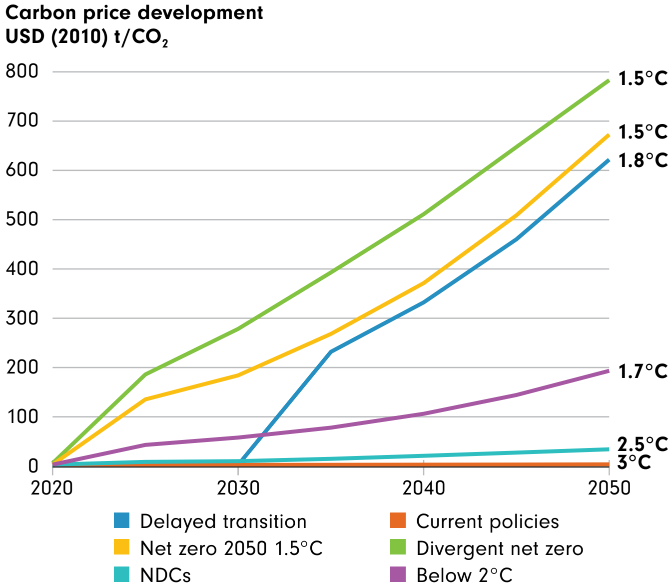
To achieve net zero by 2050, the carbon price trajectory is projected to be exceptionally steep, from around **$3 per tonne** currently (on average) to **$150–$200 per tonne** by the middle of this decade, **$200–$300 per tonne** by 2030 and around **$700–$800 per tonne** by 2050. The price of carbon can be either explicit or implicit and is best defined in this context as a measure of overall policy intensity. For example, a recent report published by the San Francisco Fed postulates that even an expectation of a rise in carbon prices can change behaviours and introduce shadow carbon price in the system, leading to a downward pressure on actual emissions.[6]

Indeed, higher carbon prices can be achieved through a range of fiscal policies and regulation, which are likely to vary hugely across countries, shaping the likelihood of the various scenarios laid out above. The speed and timing of the transition also depends on the availability and deployment of technologies for carbon dioxide removal (CDR). In this latest set of scenarios, NGFS assumes low to medium availability of CDR technologies, which seems to be a sensible assumption, given their limited current use. Of course, over time CDR technologies might become more scalable and affordable, in which case their effective deployment could accelerate the transition to net zero at lower carbon prices than currently projected.

EXHIBIT 9: CO_2 emissions and carbon prices by scenario



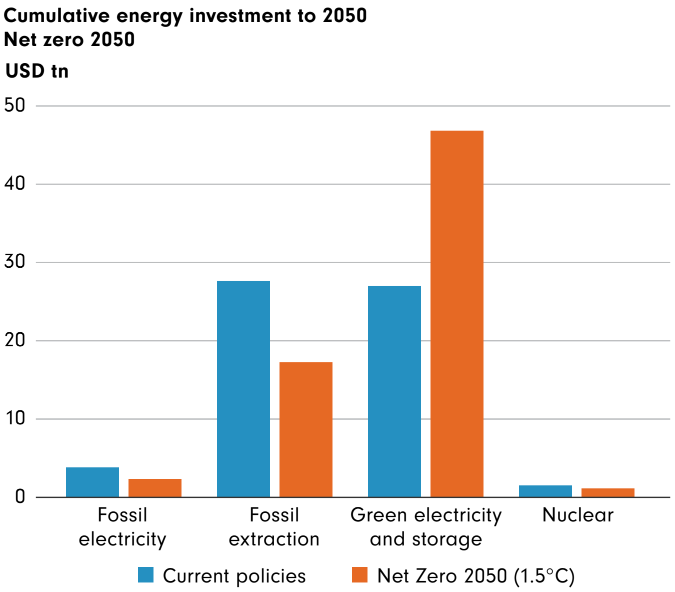
Source: NGFS climate scenarios for central banks and supervisors, June 2021. End-of-century outcomes shown.



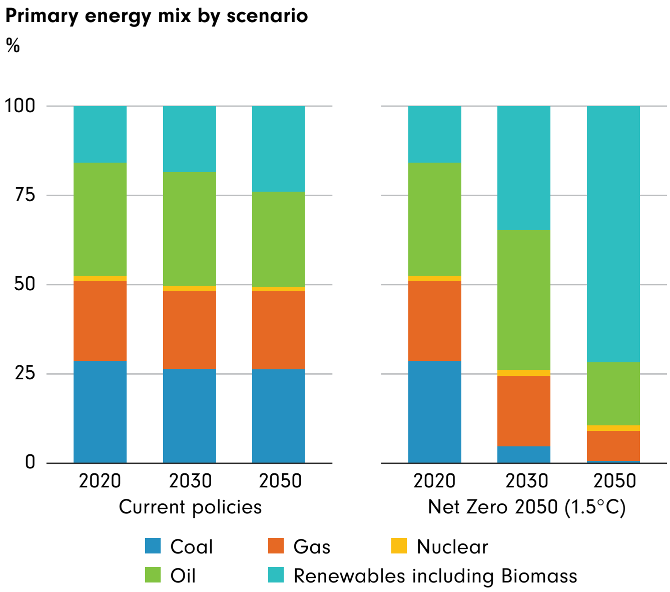
Source: NGFS climate scenarios for central banks and supervisors, June 2021. Carbon prices are weighted global averages. End-of-century outcomes shown.

In scenarios where emissions come down meaningfully, a steep carbon price trajectory is needed to produce a dramatic transition in the global primary energy mix, in which the share of renewables and biomass must rise from around 20% currently to 68% by 2050 (Exhibit 10). This will require significant investment and technological developments, in addition to higher carbon prices.

EXHIBIT 10: A dramatic change in the primary energy mix under the net zero 2050 scenario



Source: NGFS climate scenarios for central banks and supervisors, June 2021.



Source: NGFS climate scenarios for central banks and supervisors, June 2021.

Mapping transition and physical risks to GDP and inflation outcomes

According to NGFS calibrations, transition risk has a slightly positive impact on global GDP in the net zero 2050 scenario, but is negative in the disorderly scenario, as the speed of the transition, combined with investment uncertainty, affects consumption and investment (Exhibit 11). The divergence in physical risk, determined by the change in temperatures, is more notable under scenarios where transition fails to take hold. Both the net zero and delayed transition scenarios see a less than 5% shock to GDP caused by physical risks, while NGFS expects a nearly 15% fall in GDP by 2100 under current policies (hothouse world).

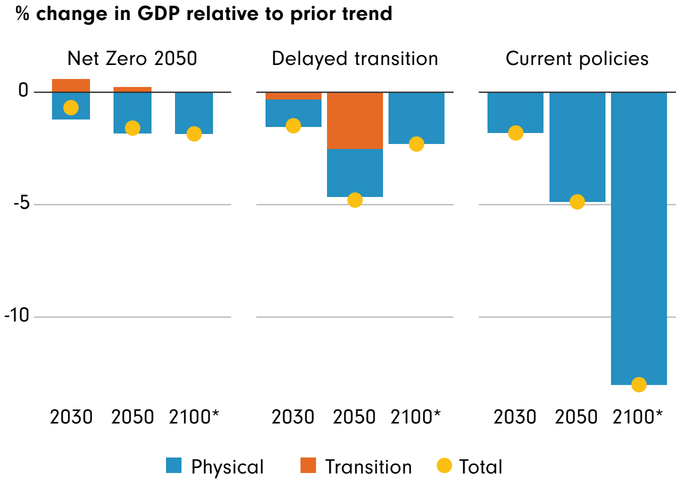
As with the Burke-Hsiang-Miguel calculations earlier, the impact on output profiles varies widely across countries, with those who face stricter emissions policies, higher carbon prices or higher physical risk damages (skewed toward countries in the southern hemisphere) likely to incur much higher costs relative to both the global average and climate-neutral baselines.

The impact on inflation trajectories under different scenarios is particularly interesting. While it can vary hugely depending on different assumptions about fiscal and monetary policy responses, it is clear that higher carbon prices in transition-heavy scenarios will have a meaningful impact on inflation.

As Exhibit 12 shows, the net zero 2050 scenario will be inflationary in the shorter term, with the inflation boost relative to baseline peaking in the current decade, at around 150–250 basis points (bp) p.a. in Europe and the U.S. and 400 bp p.a. in China. Under delayed transition, the inflation trajectory is backloaded, and the peaks are more subdued but still meaningful.

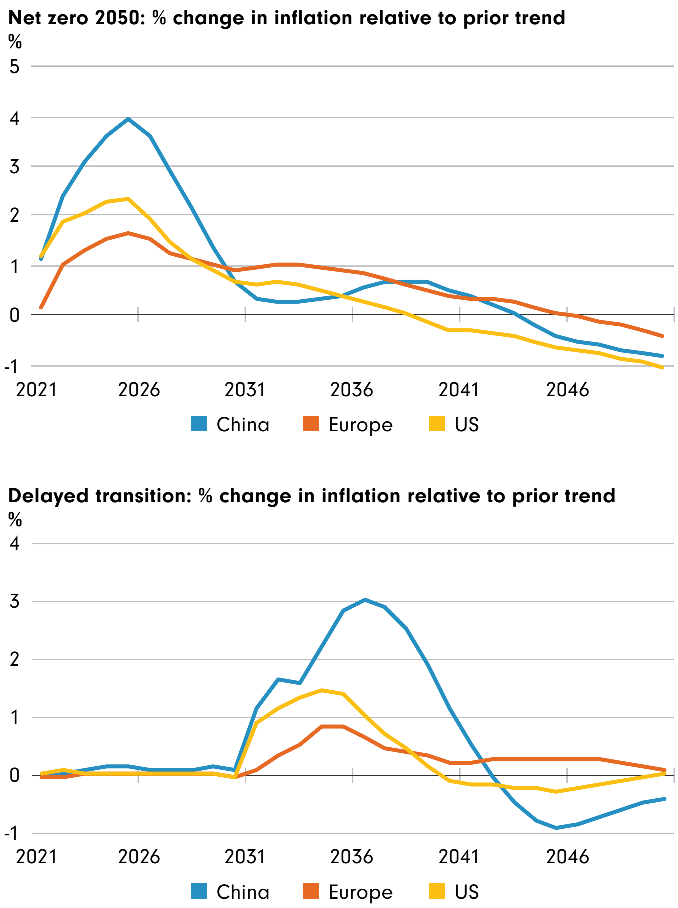
This is an important insight, especially as climate policy globally starts to take shape, and is particularly pertinent in light of the ongoing debate as to whether we are moving into a new (higher) inflation regime post-COVID-19. While a number of the factors currently putting pressure on inflation are most likely transitory, we believe policies to achieve net zero by 2050 have the potential to bring out more persistent inflationary forces that are still not discounted by the markets and are underestimated by investors.

EXHIBIT 11: Physical risks to GDP vary widely under different scenarios.



Source: NGFS climate scenarios for central banks and supervisors, June 2021.

EXHIBIT 12: Inflation pathways under net zero and delayed transition scenarios



Source: NGFS climate scenarios for central banks and supervisors, June 2021.

Assessing the credibility of net zero transition to form a climate-aware CMA base case

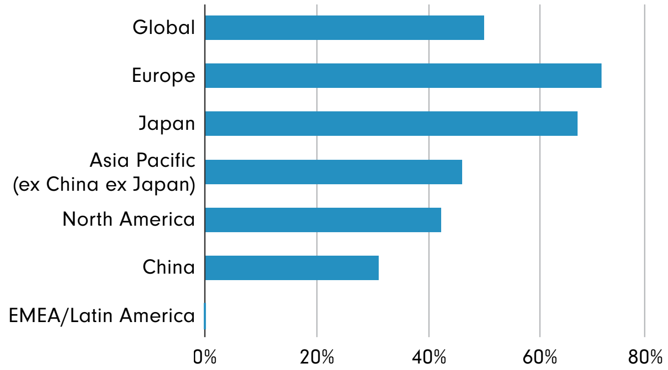
The scenarios laid out by the NGFS framework describe different, but possible, states of the world. To construct a base case for the climate-aware CMAs that will underpin our SAA framework, we must determine which scenario is most likely. Specifically, we believe more ambitious emissions targets are needed to reach net zero by 2050, an ongoing assessment that will be key in formulating the base case that shaped our climate-aware CMAs.

We benefit here from access to both sectoral and regional data. Globally, half of Fidelity's equity and fixed income analysts believe that firms will have to revise their targets upwards to achieve carbon neutrality, according to the latest analyst survey (Exhibit 13). Around 85% of utility analysts think their companies have ambitious enough emissions targets in place, while only 30% of energy analysts and 26% of consumer discretionary analysts are as confident (Exhibit 14).

In order to gauge the probability of different emissions outcomes, we will be working closely with our bottom-up research colleagues to assess the credibility of a net-zero world. Already, our analysts report sectoral differences regarding how companies communicate their climate initiatives. Understanding what is credible and what is not will be critical to shaping return and risk projections based on our climate-aware CMAs.

Over time, we think this robust combination of top-down and bottom-up analysis will allow us to gauge how our baseline scenario for GDP growth, inflation and interest rates, which feeds into our CMA models, needs to be adjusted at the corporate, national and global level.

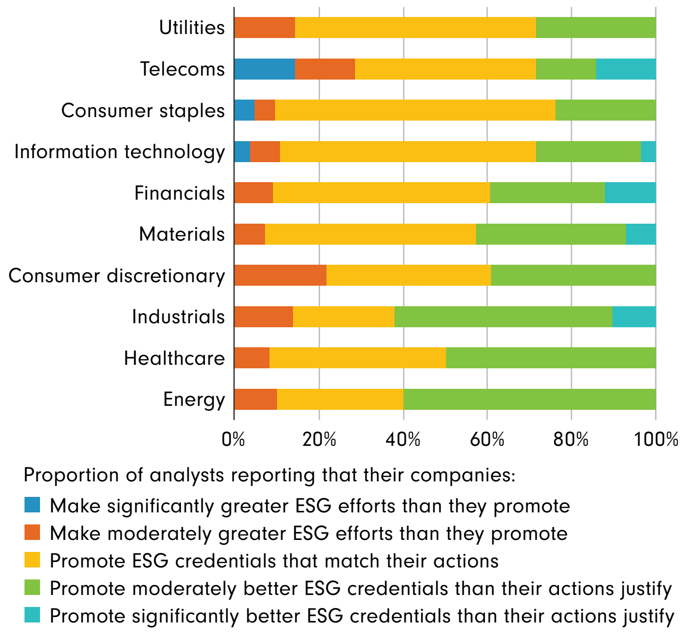
EXHIBIT 13: More ambition needed to reach net zero



Proportion of analysts reporting they are confident their companies' emissions targets are ambitious enough to reach net zero by 2050.

Source: Fidelity International Analyst Survey, 2021.

EXHIBIT 14: Certain sectors are prone to over- and under promotion of climate efforts.



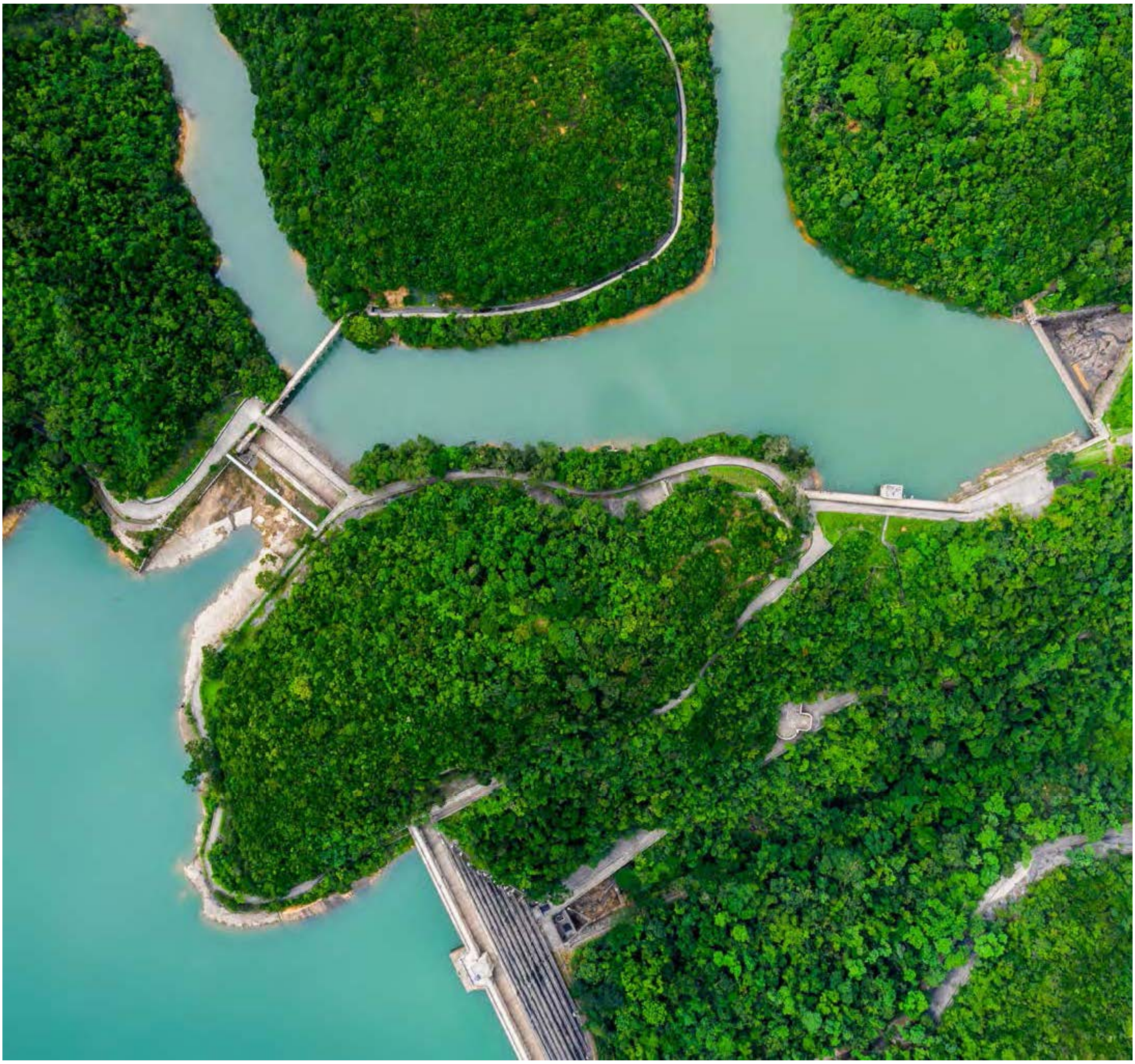
Source: Fidelity International Analyst Survey, 2021.

Conclusion

The science on climate change is sobering. The heat waves causing havoc in the northern hemisphere are another timely wake-up call for policy makers and investors alike. We believe that mainstream long-term macroeconomic projections, and consequently the consensus CMAs used by the investment industry, underplay both the magnitude and geographical dispersion of climate change impacts on key macroeconomic variables such as growth and inflation.

Stress testing of our present CMA machinery using the RCP 8.5 ("business as usual" scenario) calibrations highlights significant, differentiated impacts on long-term risk and return projections across different time horizons and geographies. The exercise shows the importance of incorporating climate change pathways into our existingCMAs and the necessity of having a well-defined climate pathway base case to underpin our climate-aware SAA framework. Here, we are linking up with the framework being designed by the NGFS, which we think will become the industry standard in coming years, given its recent deployment in shaping the climate stress tests currently applied by key central banks.

When it comes macro dynamics, market pricing and investment implications, as global policy kicks into gear and brings the transition risks associated with reducing emissions to life, the accompanying rise in carbon prices from a very low base poses meaningful upside risk to inflation over the next few years.



End notes

[1] RCP 8.5 refers to the concentration of GHGs that delivers global warming at an average of 8.5 watts per square metre across the planet. It is also sometimes described as the "worst case" scenario. A paper describing the pathway can be found here: RCP 8.5—A scenario of comparatively high greenhouse gas emissions | SpringerLink.

[2] Burke, M., Hsiang, S., and Miguel, E. Global non-linear effect of temperature on economic production. Nature 527, 235–239 (2015). https://doi.org/10.1038/nature15725

[3] Antoine Oustry, Bünyamin Erkan, Romain Svartzman and Pierre-François Weber, "Climate-related Risks and Central Banks' Collateral Policy: A Methodological Experiment." Banque de France Working Paper, December 2020. https://publications.banque-france.fr/sites/default/files/medias/documents/wp-790_0.pdf

[4] Kalkuhl, M., and Wenz, L. (2020). The Impact of Climate Conditions on Economic Production. Evidence from a Global Panel of Regions. EAERE. http://hdl.handle.net/10419/178288

[5] NGFS climate scenarios for central banks and supervisors, June 2021. https://www.ngfs.net/ngfs-scenarios-portal/

[6] Stephie Fried, Kevin Novan and William B. Peterman. "The Economy's response to potential climate policy." *FRBSF Economic Letter*, June 2021. https://www.frbsf.org/economic-research/publications/economic-letter/2021/june/economy-response-to-potential-climate-policy/?utm_ source=mailchimp&utm_medium=email&utm_campaign=economic-letter

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