

Weekly Summary

Economics of Climate Change

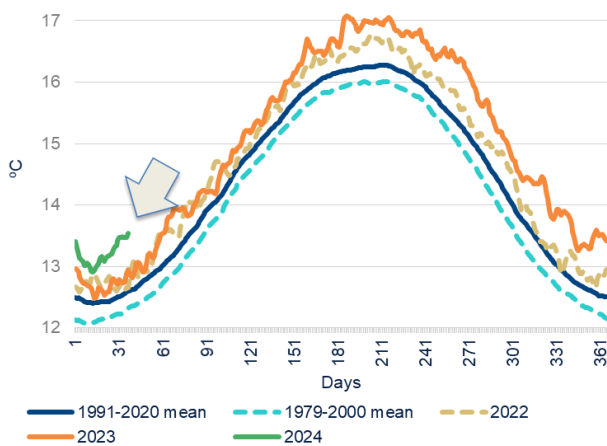
February 16, 2024

The design of short-term climate scenarios: applications, narratives, shocks and modelling

The increasing development of short-term climate scenarios is driven by enhanced supervisory expectation for a comprehensive understanding of the effects of climate change. Their design is a work in progress blending narratives, shocks and modeling tools.

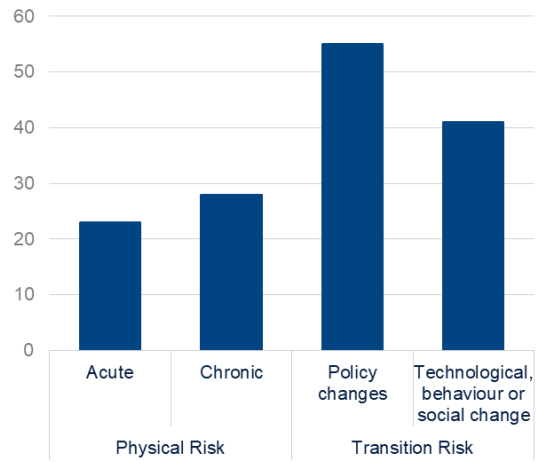
Increasing relevance of short term climate scenarios. The manifestations of climate change, both acute (droughts, floods, storms,...) and chronic (temperature increase), are increasingly present (**Figure 1**), same way that climate policies¹. This impacts on economic decisions of households, companies, and financial institutions. Physical or transition shocks triggered by climate events, policies or economic agents decisions might impact in the short term with the potential risk of activity disruptions, financial markets stress or financial stability tantrum.

Figure 1. **WORLD TEMPERATURE. 1979-2024. °C**



Source: BBVA Research from Daily 2-meter Air Temperature.

Figure 2. **CLIMATE RISKS CONSIDERED IN CLIMATE STRESS TEST EXERCISES. COUNT**



Source: 2022 FSB-NGFS Survey

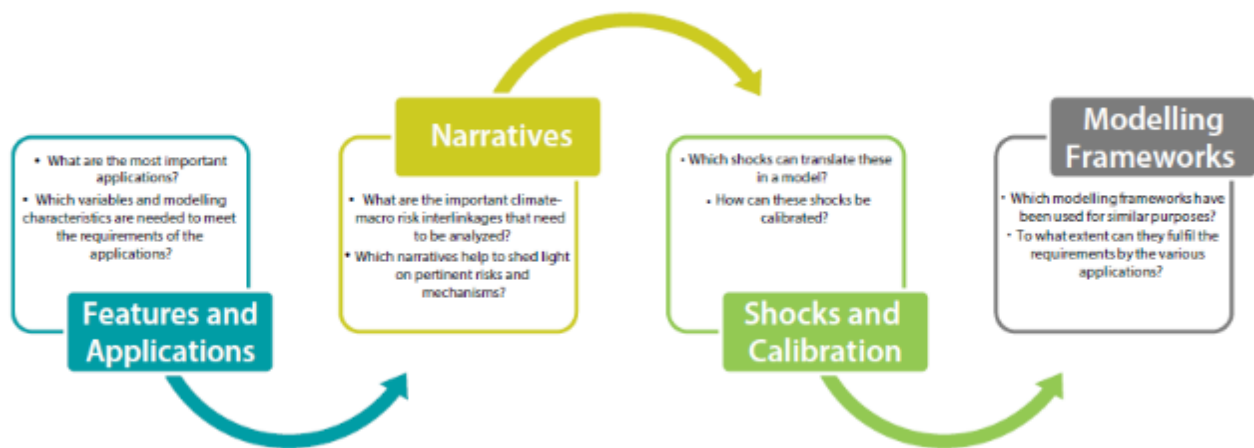
Against this backdrop, the well-known approach of stress testing exercise for an economy or sector is increasingly extended from macroeconomic shocks to climate shocks at the rhythm of data improvement, expansion of scenarios (triggers, impact channels), and modeling approaches (**Figure 2**). At this vein, the European Banking Authority and the European Central Bank are currently conducting a top-down stress test exercise² where “...One

¹ [Climate Policies: Widening Range and Enhanced Stringency, but More is Needed](#). BBVA Research, 19 January 2024.
² [One-off Fit-for-55 climate risk scenario analysis](#) | European Banking Authority.

scenario should focus on climate-change related risks that could already materialize in the near term, most likely in the form of asset price corrections triggered by a sudden reassessment of transition or physical risks...”³.

How are short-term climate scenarios designed? The NGFS⁴ approach: Narratives entailing both climate and macro shocks. While the development of near-term scenarios remains in progress (see **Figure 3**⁵), NGFS has already-provided reference within the available narratives, coupled with suggestions on transitioning from scenarios to stress tests. The narratives entail not only climate-related shocks but also additional short-run shocks in the macro-economy that interact with climate shocks. This comprehensive approach allows for a more nuanced understanding of the immediate impacts on the financial system and the whole economy (See **Box 1** on NGFS’ proposed narratives).

Figure 3. **DESIGN PROCESS OF SHORT-TERM CLIMATE SCENARIOS**



Source: BBVA Research from NGFS Oct23.

3: Request for a one-off scenario analysis exercise to be conducted jointly by the European Supervisory Authorities, the ECB.

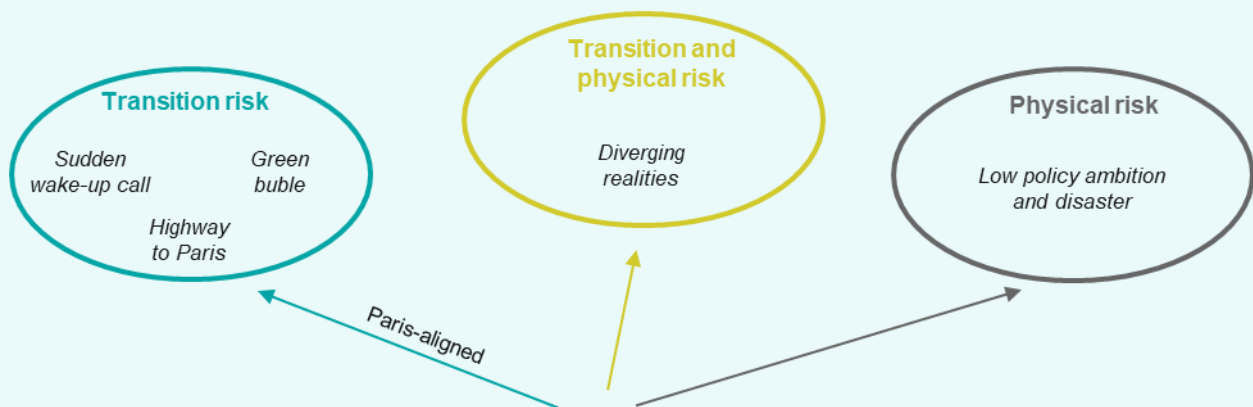
4: “Conceptual note on short-term climate scenarios. NGFS”. Network for Greening the Financial System short term climate scenarios, Oct-23. The paper delves into the assessment of diverse macroeconomic impacts of climate transition using a suite-of-model approach. It examines the consequences of various climate transition shocks, such as changes in carbon and energy prices and investments, on economic activity and inflation.

5: Figure 3 shows the interrelated issues on applications, narratives, shocks and calibration and modeling frameworks provided by NGFS. The arrows represent the logical chain of issues connected and not a direct dependence.

Box 1. NGFS. Narratives of short-term scenarios

NGFS proposes five short-term scenarios with a 3 to 5-year horizon capturing a mix of transition and physical impacts and their interaction with the macroeconomy and financial sector (see Figure 4). A key difference to long-term scenarios is that **there is no tradeoff between transition and physical risk in the short run**. Still, they can be seen as describing short-run fluctuations around the long-term scenarios within the known quadrants reflecting an “orderly” transition, a “disorderly” transition, a “hot-house-world” long-term equilibrium or an ineffective “too-little-too-late” adjustment path, as detailed in [NGFS: Phase IV scenarios framework](#).

Figure 4. OVERVIEW OF NGFS SHORT-TERM SCENARIOS



Source: BBVA Research from NGFS Oct-23.

Three transition scenarios

- **The "Highway to Paris" scenario outlines a swift move towards green technologies** by the private sector, spurred by fossil fuel uncertainties and government-implemented carbon pricing aiming for net zero by 2050. This leads to decreased fossil fuel demand aligned with Paris Agreement goals, with carbon policy revenues being reinvested into green public ventures. The rapid transition may cause initial demand-supply imbalances in some sectors, with adjustments in international capital flows and lending. Green regulatory policies bolster the transition's credibility, minimizing financial disruptions.
- **The "Green Bubble" depicts a scenario in which excessive tax incentives, such as subsidies, cause an overflow of green investment**, creating a finance-driven transition. This leads to a mismatch between financial flows and real economic value creation, generating a credit bubble in the green sector. An unpredictable event bursts the bubble, generating a crisis of confidence and an increase in risk premiums. This scenario suggests a less efficient and costlier transition to low carbon emissions than the "Highway to Paris" scenario due to poorly targeted subsidies and poor investment allocations.
- **The "Sudden Wake-up Call" scenario describes a rapid and unexpected policy shift** toward aggressive climate action following prolonged inaction and a triggering event, such as a major natural disaster. Governments implement carbon policies to achieve net zero emissions by 2050, causing economic and financial turmoil, including asset abandonment and devaluation of polluting companies. This scenario shows the short-term dynamics of the NGFS delayed transition scenario and its destabilizing effects on the economy and financial systems.

Physical risk scenario

- The "Low Policy Ambition and Disasters" scenario depicts a future where inadequate global policy leads to extreme physical risks, as reliance on fossil fuels persists. Investors retreat, raising insurance costs and prompting households to save more. This scenario, fraught with high physical risks, could severely impact the global economy and financial system.

Transition and physical risk scenario

- The "Diverging Realities" scenario maps out possible futures with severe divergences across countries in the extent to which economies transition to net zero. The transition entails both strong transition risks in some countries and strong global physical risks, in line with a broader long-term narrative of an ineffective transition globally.

As shown in **Figure 5**, economic activity would be severely affected under all scenarios, except in "Highway to Paris" and "Green Bubble" as investments and private consumption support GDP. The source of adversity originates relatively more from the household side in the Sudden wake-up call scenario while the negative investment and trade effects are at the core of Diverging realities scenario. The transition scenarios are expected to be more inflationary than those involving physical risks, and financing conditions are under stress in all scenarios except the Highway to Paris.

Figure 5. SOURCES OF STRESS FOR EACH SCENARIO

	1 Highway to Paris	2 Green bubble	3 Sudden wake-up call	4 Diverging realities	5 Low Policy Ambition and disasters
GDP	Orange	Orange	Red	Red	Red
Investments	Green	Green	Orange	Red	Red
Private consumption	Green	Green	Red	Orange	Red
Trade	Orange	Orange	Orange	Red	Orange
Inflation	Red	Red	Red	Orange	Orange
Credit growth	Orange	Red	Orange	Orange	Orange
Fiscal balance	Red	Red	Orange	Red	Red
Risk premia	Orange	Red	Red	Red	Red
Lend conditions	Orange	Red	Red	Orange	Orange

Note: colors indicate the levels of stress. Red refers to "high" level of stress, yellow "medium" and green "low".
Source: BBVA Research from NGFS Oct23.

Short-term Climate Scenario Narratives: Diverse but, in the end, demand-driven or supply-driven. The Bank of France⁶ and NGFS⁷ propose eight and five different narratives respectively of short-term climate scenarios, trying to cover the range of potential risks, both physical and transition. However, it is straightforward to organize the different scenarios designed by both institutions into two major classifications: supply or demand, positive or

6: "Using Short-Term Scenarios to Assess the Macroeconomic Impacts of Climate Transition". Bank of France, Sept-23. The document focuses on the rationale behind creating short-term climate scenarios to understand near-term macro-financial impacts of climate change and mitigation policies. It highlights the importance of these scenarios in managing immediate risks and impacts on economies, financial systems, and institutions by anticipating and preparing for potential disruptions within a three to five-year horizon.

7: Ibid 4.

negative (**Figure 6**). **Supply shocks** are roughly those that affect the production function of the economy, the relative prices of productive factors or their productivity (i.e.: regulation changes such as carbon pricing, technological innovation, commodities availability, etc). Demand shocks are those related with expenditure of households and businesses (i.e.: disposable income shock, confidence change, monetary policy shocks, consumption shift towards green products, etc). The impacts of supply shocks tend to be more prolonged than demand shocks.

Figure 6. **CORRESPONDENCE BETWEEN BANK OF FRANCE AND NETWORK FOR GREENING THE FINANCIAL SYSTEM SHORT TERM CLIMATE SCENARIOS**

Shock	“Using Short-Term Scenarios to Assess the Macroeconomic Impacts of Climate Transition”. Bank of France, Sep-23	“Conceptual note on short-term climate scenarios Network for Greening the Financial System”. Oct-23
Negative Supply-side Shock	Disorderly carbon taxation (Discretionary introduction of public measures)	
	Sudden tightening of environmental regulations (implementation of stringent regulations to reduce drastically dependence on fossil fuels)	Sudden Wake-up Call (abrupt and unanticipated transition, a sudden change in policy stance, tightening of financial conditions...)
Negative Demand-side Shock	Uncertainty on transition policies (Climate Policy Uncertainty is associated with decreases in investment in pollution-intensive sectors)	Low Policy Ambition and Disasters (a ‘Hot House World’ scenario, where extreme physical risk impacts are analyzed)
	Financial market turmoil (sudden repricing of the transition risk on financial markets. The shock here is triggered by a sudden announcement of stringent carbon regulation policies in EU and the US)	Diverging Realities (risk of a lack of external financing from advanced economies (AEs) and local circumstances in emerging markets limiting the ability to transition globally in a timeline fashion)
Positive Demand-side Shock	Boom in green public investment (additional public investments are funded by a carbon tax, reducing the impact on public debt)	
	Green bubble (ballooning and bubble bursting when investors realise that a majority of the investments made were non-productive... leading to the bankruptcy of many companies ... and a major fall in the markets concerned)	Green bubble (fiscal subsidies lead to a glut of green private investment and expenditure... an unrelated random event leads to the burst of the bubble, inducing a confidence crisis and a sharp increase in risk premia)
Positive Supply-side Shock	Large green private capital expenditures (... It does not crowd out other types of investment and is fully financed by domestic private savings)	
	Green innovation (game-changing energy-related innovations that improve energy efficiency across all sectors of the economy and reduce the cost of producing energy)	Highway to Paris (an immediate and technology-driven transition, in which the private sector develops and adopts green technologies faster than expected, inducing a rapid shift on the supply side)

BBVA Research from [BdF Sep23](#) and [NGFS Oct23](#).

Short-term climate scenarios for stress testing: Narratives based on negative shocks, both demand or supply. The clustering of various alternative narratives into supply or demand shocks helps to develop transmission channels throughout the economic system and to shape the severity and persistence of their impacts on activity and inflation. For example, two different narratives among those developed by the Bank of France’s paper⁸, such as a disruption of financial markets due to regulatory changes in the price of carbon or a slowdown in demand from the most polluting sectors due to the uncertainty about the implementation of transition mitigation policies, are mainly negative demand-side shocks. This definition helps to develop the transmission channels through the economic system and to outline, for example, the severity and persistence of their impacts on activity and inflation. However, the calibration of the shock and its modeling are necessary for a complete definition of the scenario in question.

Pending details: shocks calibration and modeling approach. Features and applications of short-term climate scenarios represent the basis for the selection of modeling frameworks to calibrate the narratives. While NGFS

8: *ibid* 6.

long-term scenarios are useful for assessing climate-related financial risks over longer time horizons, they do not incorporate macro-financial impacts at business cycle frequency. Until now, these scenarios have added stress in the short term through additional frictions and shocks. Such exercises are welcome but there is a need for improvement. **Box 2** details criteria for designing and implementing short-term climate scenarios.

Box 2. Criteria for designing and implementing short-term climate scenarios

The analytical implementation of NGFS short-term climate scenarios is oriented towards the needs of central banks and supervisors in fulfilling their financial stability, supervisory as well as monetary policy responsibilities. The **guiding principles for the designing implementation of NGFS short-term climate scenarios** are the following:

- **Scenario narratives will be translated into calibrated shocks** or a stack of shocks and paths for exogenous variables to be simulated by a model.
- **A model whose features are best-able to capture features needed** by the identified applications will be chosen. This includes, inter alia, time steps, simulation horizon, the degree of sectoral and spatial decomposition.
- **The modeling infrastructure should be able to account for climate-related shocks** (i.e. related to transition and physical risk), as well as capture short-term amplification mechanisms, cross-sectoral substitution and granular impacts.
- **A baseline or reference scenario should be calibrated within the modeling framework.** This could be a set of different baselines for each scenario or one reference scenario.
- **The results should be collected for a set of macro financial and climate variables.**

Several modeling frameworks are available for calibrating short-term climate scenarios. Reduced forms models (i.e. VAR), Input-output models, computable general equilibrium (CGE) models, semi-structural models, environmental dynamic stochastic general equilibrium models (E-DSGE), or dynamic integrated assessment models (IAM), all of them can be used to calibrate short-term climate scenarios, depending on the requirements of the application these scenarios should be used for. These frameworks are chosen based on their ability to meet specific requirements like analytical tractability, modeling assumptions, data availability, and detailed regional/sectoral analysis. Often, several models are used in combination to complement each other's capabilities.

In short, beyond central banks and the supervisory community, there are many beneficiaries of the development of short-term climate scenarios. While the development of these scenarios remains in progress, NGFS and Bank of France have already provided different narratives, coupled with scenarios and suggestions on transitioning from scenarios to stress tests. The novelty of short-term scenarios is the combination of the rigor of climate mitigation with relevant dynamics and economic cycle shocks, which makes it possible to assess the resilience of the financial sector to climate-related financial risks.

Highlights of the Week

- **Global | How to know when the world has passed 1.5°C of global warming.** Determining when global warming surpasses 1.5°C involves complexities, including defining "pre-industrial levels" and measuring "global average temperature." Additionally, the appropriate timeframe for assessing the 1.5°C threshold is debated, with suggestions ranging from annual to multi-decadal averages. Despite these challenges, recognizing the surpassing of the Paris Agreement's 1.5°C target is seen as crucial for guiding climate policy and action.
- **Global | The relationship between growth in GDP and CO₂ has loosened; it needs to be cut completely.** Economic growth has been closely tied to a rise in greenhouse gas emissions through most of modern economic history. This relationship, however, is changing. With steady improvements in the energy intensity of economic growth (meaning that less energy is required to produce an additional unit of global GDP) and, more recently, a dramatic rise in clean energy deployment, there has been a growing divergence between GDP growth and CO₂ emissions in most economies around the world.
- **Global | Global green transition is re-energizing China's investments in Africa after pandemic slowdown.** African countries saw a 47% increase in Chinese construction contracts and a 114% increase in investments last year. Driving the increase was the need for minerals used in the electric vehicle, battery and renewable energy industries.
- **Europe | Climate change impacts, risks and adaptation.** Climate change is already impacting Europeans' daily lives and will continue to do so for the foreseeable future. Europe is expected to get warmer, some regions getting drier, while others wetter. These changes will not only impact our health but also the ecosystems we depend on. The EU is preparing to live with a changing climate through various adaptation measures.

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