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# Output, inflation and monetary policy response to immediate climate risks



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## Abstract

The Network for Greening the Financial System has recently released the first vintage of the short-term (ST) climate scenarios that quantify the impact of extreme weather events, transition risk, and their interplay, on the economy and the financial system over the next five years. These scenarios represent a significant effort to address some key issues identified by research and the industry to increase scenarios' usability for climate risk management. Among the novelties are (i) an explicit short-term focus (5 years in the future), which makes the scenarios more aligned with stress-testing exercises, (ii) a comprehensive assessment of acute physical risk, including extreme events and compound risk, based on probabilistic risk assessment models, and (iii) the explicit modelling of the financial sector and financial markets, providing adjustments in default probabilities, credit risk, and financial valuation of securities. Climate impacts are provided for 50 sectors and 46 countries worldwide, and for the first time they account for supply chain shock transmission, and cascading effects via trade and financial markets. Finally, the scenarios explicitly model the region specific supply and demand side channels of inflation, and the monetary policy response. This is important as extreme weather events and energy price shocks can have large impacts on output and inflation. Here we discuss how inflation and monetary policy are modelled in the ST scenarios, the risk transmission channels involved, results and their drivers.

## Introduction

The Network for Greening the Financial System short-term scenarios (ST) provide insights into how climate transition risk and acute physical risk interact and propagate through the economy, financial sector and financial markets, affecting output, inflation dynamics, and the monetary policy response.

The scenarios combine severe yet plausible extreme weather events and their compound, considering their cascading effects via supply chains, trade and financial markets to the rest of the world (see e.g. the Disaster and Policy Stagnation (DaPS) scenario). They also consider the interplay between extreme weather events and the unwinding in countries' climate policies and regulations, different financial and market conditions, and climate risk exposure, in both advanced economies and low-income and emerging countries (e.g. in the Diverging Realities (DiRe) scenario).

Compared to the traditional long-term climate scenarios that focus on mid-century targets, the ST scenarios capture shocks that may materialize over the next five years. This shorter time frame is important for policy and investment decisions, being more closely aligned with the stress-testing horizons of financial institutions, central banks and financial supervisors, and with monetary policy purposes. Impacts from abrupt changes in climate policy or extreme weather events can propagate quickly through supply chains in the economy and generate significant macro-financial fluctuations in the near term. They influence output and inflation, they affect firms' financing conditions, and they shape the monetary policy response at the country and regional level.

The scenarios' results highlight the importance of incorporating climate risks into near-term macro-financial analysis and decision-making. For instance, in the Sudden Wake Up Call scenario, a sudden increase in carbon price drives inflation up by 3 percentage points (pp) in Europe and 5 pp in North America compared to the baseline, leading to a monetary tightening. In the DaPS scenario, compound extreme weather events cause an increase in inflation of 0.5 pp in both Europe and North America, followed by an easing of price pressures.

The scenarios are produced with a novel coupled modelling framework that leverages the strengths of the individual models, combining detailed sectoral dynamics, country granularity and interdependencies, macro-financial feedback effects, and monetary policy responses within a single, logically consistent framework. The inflation and monetary policy channels are analyzed with the EIRIN Stock-Flow Consistent macro-financial model, which studies cost dynamics, inflation formation and output that affect the monetary policy response. The central bank adjusts the monetary policy to both inflation and the output gap in order to stabilize prices and maintain confidence in the inflation target.

EIRIN is a demand-driven model which features adaptive expectations and imperfect coordination among a limited number of heterogeneous agents. Adaptive expectations mean that decisions are formed based on past information and observed trends, enabling the model to capture decision-making under uncertainty. Within this structure, supply-side disruptions or policy-induced cost pressures from rapid increases in carbon prices pass to prices quickly, as agents imperfectly coordinate in a changing environment. This, in turn, induces the central bank to react to inflationary pressures by increasing rates, which pass to financial markets. These features are particularly relevant for the analysis of the short-term climate impacts, as information is often incomplete and uncertainty is high, limiting agents' foresight. The departure from rational expectations, and imperfect coordination, enable the identification of multiple equilibria that may emerge from the interplay of climate change, policy and investment decisions. In this regard, EIRIN's differences from the Dynamic Stochastic General Equilibrium (DSGE) models commonly in use at central banks provide complementary insights on inflationary and monetary response dynamics to immediate climate shocks. Indeed, DSGE typically rely on micro-founded intertemporal optimization decisions based on model-consistent expectations. The forward-looking optimization behavior leads agents to adapt to shocks in a coordinated manner, contributing to smooth the impact on GDP of even large climate shocks, which is gradually transmitted into consumption, investment decisions, and price adjustments.

This policy note clarifies the model solution used for inflation and monetary policy analysis in the ST scenarios, and the implications on results. We illustrate how inflationary pressures triggered by climate-related shocks unfold over time and the monetary policy response in the NGFS ST scenarios, highlighting the key transmission channels and emerging trade-offs[1].

## Short-term scenarios narratives to account for compounding global risks

The NGFS ST scenarios provide four narratives of how acute climate physical risks, including extreme and compound events, and transition risk could unfold and interact (NGFS 2023, NGFS 2025a). They are designed as plausible narratives, with some intentionally reflecting more severe tail-risk scenarios, coherently with stress-testing approaches.

The **Highway to Paris (HWTP)** is an orderly scenario showing a gradual and technology-driven transition, in which carbon tax revenues are reinvested into green subsidies and investments. In contrast, the **Sudden wake-up call (SWUC)** represents a disorderly transition, resulting from a sudden change in policy, as well as a shift in consumers and investors' preferences, which may trigger a 'climate Minsky moment'.

The **Disasters and Policy Stagnation (DaPS)** scenario focuses on compound physical risks, via the subsequent realizations in two years (2026 and 2027) of continental scale compound events. These include a dry event combining droughts, heatwaves and wildfires in 2026, and a wet event combining storms and floods in 2027. The impacts are region and sector-specific and affect the global economy through supply chain disruptions, trade and financial markets.

The **Diverging Realities (DiRe)** scenario combines climate transition and acute physical risks at different geographical scales. While advanced economies pursue climate policies aligned with HWTP, low income and emerging economies are hit by a sequence of compound events (dry events in 2025 in Asia, 2026 in South America, and 2027 in Africa, and wet events in 2028 in Asia, in 2029 in South America, in 2030 in Africa). The impacts lead to disruptions of global supply chains and shortages in the supply of critical raw materials for the transition, with risk cascades on advanced economies.

## A novel real economy–finance modelling framework

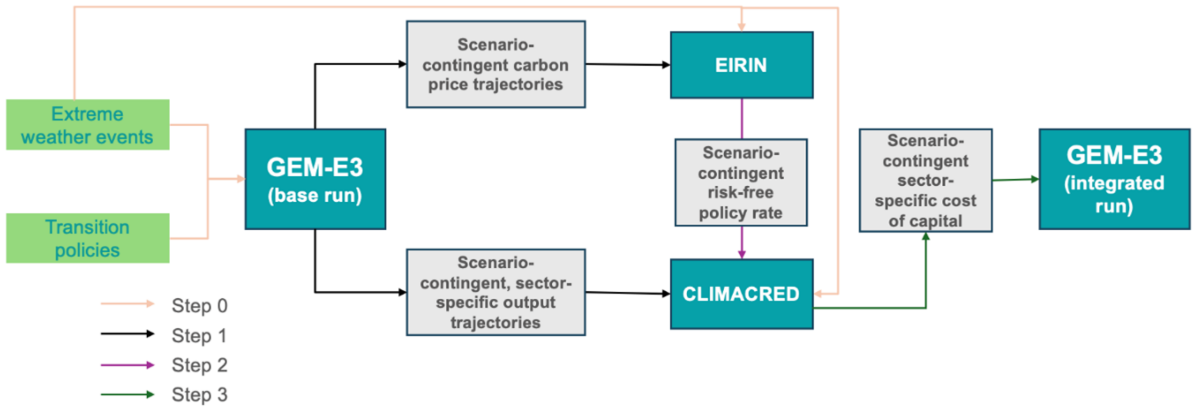
The macroeconomic and financial impacts of short-term climate physical and transition risks are analysed with a novel framework that couples for the first time a computable general equilibrium model (CGE), a Stock-Flow Consistent (SFC) model and a credit risk model, with complementary features (Figure 1):

- GEM-E3, a dynamic recursive CGE with a high level of sectoral (e.g. energy systems representation) and geographical granularity including high income, emerging markets and low-income countries (50 sectors, 46 regions) (Fragkos et al. 2017, Skelton et al. 2020). Its granular representation of the interactions between the economy, energy system and climate, enables to trace how both transition policies and physical shocks propagate across sectors, agents, and regions through production and trade effects.
- EIRIN, a multi-sector macro-financial SFC model of an open economy, with an explicit representation of the real economy and financial sectors, the financial market, the government, and the central bank (Monasterolo and Raberto 2018, Mazzocchetti et al. 2025). EIRIN includes a limited number of heterogeneous agents and sectors that are modelled as a network of interconnected balance-sheet items, and that interact through a set of markets and with the rest of the world[2]. The SFC structure enables to capture the co-evolution of real and financial stocks and flows, to consistently track the transmission channels of climate and policy impacts, and to identify shock amplification or mitigation channels. The model also embeds endogenous money creation, i.e., banks creating money through lending (McLeay et al. 2014).
- CLIMACRED, a micro-founded climate credit risk model that provides climate scenario-contingent adjustments of firms' default probability (PDs) and cost of capital, and valuation adjustment of corporate and sovereign bonds,

[1] The full model documentation is provided in the NGFS technical documentation (NGFS 2025a).
[2] EIRIN's agents and sectors are heterogeneous in terms of source of income and wealth, skills, access to finance, high/low-carbon capital and preferences. Markets include financial markets (bonds, stock shares, loans) and real markets, such as consumption goods and service markets, the labor market, the energy market, and the capital goods market.

and equity shares (Battiston et al. 2023, Mandel et al. 2025)[3]. As a main innovation, CLIMACRED embeds investors' expectations about the materialization of climate scenarios as a main driver of firms' and financial valuation adjustment. For example, physical risk that destroys firm's productive capital, diminishes the assets of the firm and/or increases its debt because of reconstruction costs, while business interruptions reduce the firm's cashflow.

**Figure 1. The NGFS ST scenarios modelling framework**




Source: NGFS (2025a).

This modelling approach enables us to capture the risk transmission channels that matter for fiscal and monetary policy response, and for portfolio management. In particular, it captures the macroeconomic and financial feedback loops that emerge from investors' scenario-contingent financial valuation and credit risk adjustment, affecting sectoral probability of default and the sectoral cost of capital. The adjustment can occur quickly because of investors' expectations about the materialization of climate risks for firms and governments (Battiston et al. 2021).

## Inflation and monetary policy in the EIRIN model[4]

In the short-term, climate physical and transition risks materialization may play an important role on inflation and monetary policy dynamics, through multiple supply and demand side effects. This motivates our focus on the modelling of inflation and monetary policy in the ST scenarios with the EIRIN model in this paper. As a main novelty, the model embeds heterogeneous agents with bounded rationality, adaptive expectations, and incomplete information. These characteristics result in more pronounced short-term effects of climate impacts on prices and output. As a result, it can capture in a comprehensive way the supply-side disruptions and cost pressures that quickly feed through to output, inflation, and monetary policy responses. In this regard, it complements DSGE models, which usually display a more gradual transmission of supply-side and cost-push shocks, as they rely on forward-looking optimization and coordinated adjustment.

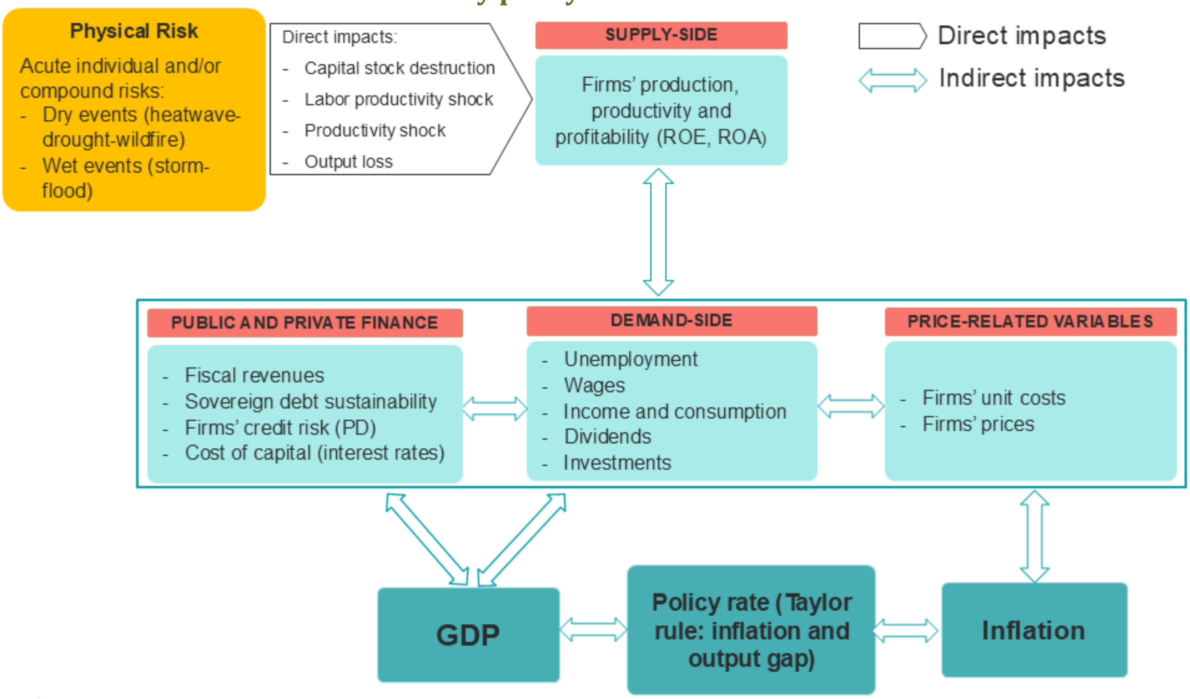
### Price formation and inflation in EIRIN

Sectors set the prices for goods and services as a mark-up on unit costs, which include: (1) unit labor costs dependent on wages and the productivity of labor; (2) unit energy and material costs; (3) carbon taxes and (4) depreciation costs. Prices exhibit inertia over time as the components of unit production costs evolve endogenously in response to the decisions and interactions of all agents in the economy. The wage dynamics affecting the unit labor cost follow a similar pattern, with the speed of adjustment influenced by past employment conditions and inflation.

[3] The baseline scenario for GEM-E3 and EIRIN is calibrated to match the International Monetary Fund (IMF) data for the past ten years and on the IMF projections 2023 at the country level (IMF 2023) for main macroeconomic variables (e.g. GDP, inflation, unemployment). The baseline financial characteristics in CLIMACRED are calibrated using market data (Damodaran 2025).
[4] For a comprehensive description of the model's structural and behavioral equations, and parameterization, see the NGFS short term scenarios' technical documentation (NGFS 2025a).

Higher prices of consumption goods and services constrain households' consumption budgets, which in turn lower aggregate demand. On the supply side, a decline in labor productivity increases the amount of labor required per unit of output, thereby raising unit labor costs and putting upward pressure on prices, while labor scarcity can add additional pressures. In the context of physical risk, inflation dynamics typically reflect a combination of supply- and demand-side effects. Initial supply disruptions tend to increase production costs and push prices upward, while subsequent declines in income and demand can partially offset these pressures and moderate inflation over time.
Figure 2 displays the main transmission channels from climate physical risk to inflation and monetary policy. To model the physical risk scenarios, EIRIN takes following the direct impacts as an input: (1) capital stock destruction, (2) productivity shock, (3) labour productivity shock, and (4) production loss. The natural hazards considered include floods, storms, heatwave, wildfire and drought[5].

**Figure 2. Climate physical and compound risk transmission channels to inflation and monetary policy in the EIRIN model**




Source: Authors' own elaboration.

Extreme weather events affect inflation and monetary policy through multiple interconnected channels. Direct impacts on the supply side reduce production capacity and lower firms' productivity and profitability. These effects translate into higher unit costs and prices, affecting inflation dynamics. Indirect effects emerge as changes in wages and income reduce demand. At the same time, shifts in fiscal revenues, sovereign debt sustainability, firms' credit risk, and the cost of capital influence financing conditions, shaping the response of investment in the aftermath of the shock, which then affects the level of overall production. Together, these channels shape the macroeconomic response of GDP, inflation, and the policy rate. The interaction between supply constraints and demand adjustments determines the persistence and magnitude of inflationary pressures and the overall macro-financial trajectory following a physical shock.

## Monetary policy setting and transmission channels

The central bank sets the policy rate according to a Taylor rule, building on the European Central Bank (ECB)'s New Area-Wide Model II (NAWM) Taylor Rule (Coenen et al. 2024). The central bank is characterized by a region-specific

[5] The direct impacts from physical risks are computed at the sectoral level, after matching EIRIN's sectors with GEM-E3 sectors.

year-on-year inflation target and a reaction to the output gap captured by a targeted short-term GDP growth rate[6], together with a persistence in policy rate.

Adaptive expectations, incomplete information, and agents' heterogeneity imply that the expectations channel of monetary policy has a less pronounced impact on inflation and output in comparison with DSGE models, in which the forward-looking optimization with model-consistent expectations "strengthens the expectations channel of interest rate policy. This explains the stronger initial impact of monetary policy compared to other types of models." (Lane, 2023). In contrast, in EIRIN inflation and output responses to monetary policy are mild, reproducing empirical data and their temporal pattern (Enzinger et al. 2025)[7]. Therefore, in the NGFS short-term scenarios the immediate impact of monetary policy on the inflationary and output dynamics in the aftermath of a climate shock, either stemming from physical or transition risk, may be limited (see Section 5).

The primary transmission mechanism of monetary policy in EIRIN occurs through the credit channel (Figure 3). When the central bank raises the policy rate in response to macroeconomic conditions, commercial banks increase the interest rates they charge on loans to firms. As borrowing becomes more expensive, firms reduce their demand for credit, which is used to finance new investments (shift along the curve of credit demand). Lower credit demand leads to lower investments, which leads to lower production and thus lower output, lower labor demand and higher unemployment. The increase in unemployment brings wages and the disposable income of worker households down, dampening consumption and aggregate demand. The combined effects of lower investment and lower consumption (demand-side) contribute to a slowdown in economic activity, resulting in lower inflation and GDP.

**Figure 3. Example of monetary policy transmission channel in EIRIN in the case of a contractionary policy rate shock**


Notes: Green arrow: direct impacts of policy rate on bank rates. Red arrows: indirect impacts in the economy.
Source: Authors' own elaboration.

## Results

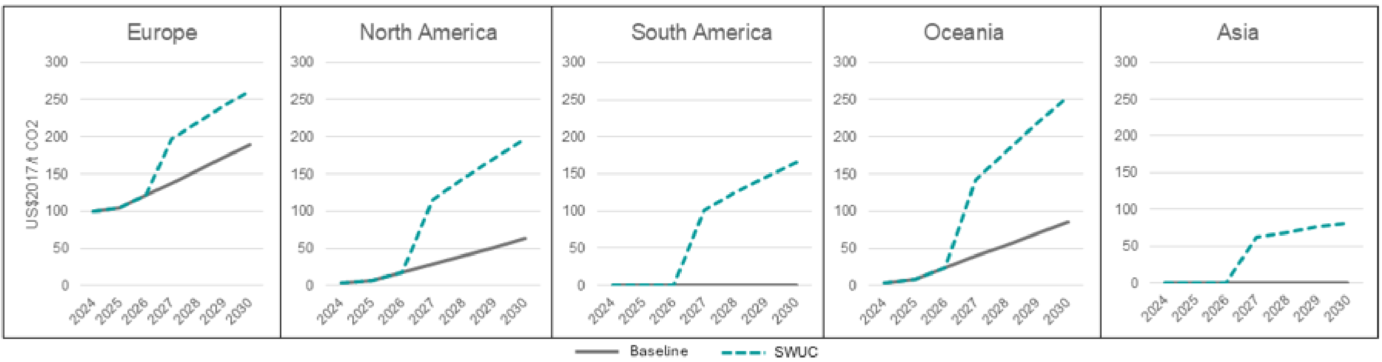
We illustrate here the results in two scenarios, the SWUC for transition risk, and the case of the DaPS scenario for physical risk[8].

### Sudden Wake Up Call (SWUC)

In the SWUC scenario, carbon prices rise sharply across all major regions after 2026, as governments implement stringent mitigation policies to close the gap with climate targets. This delayed policy action leads to a steep and rapid escalation of carbon costs compared with the smooth and gradual increase in the baseline, leading to a year-on-year increase in carbon price of 42% in Europe and 300% in North America, which transmits to prices (Figure 4). In North and South America, and Oceania, the surge is particularly pronounced, with carbon prices more than doubling relative to baseline levels in 2027. Instead, in Europe the gap between the baseline and the SWUC scenario is smaller. This reflects the fact that Europe's baseline carbon price is already relatively high, due to earlier policy implementation.

[6] As the EIRIN framework does not compute potential GDP, we instead base the target on the long-term GDP growth rates of the IMF projections used in the model's calibration process.
[7] In this regard, EIRIN's results are closer to those of semi-structural models.
[8] Results for inflation and monetary policy for all the scenarios are available in the NGFS ST presentation on the NGFS ST scenarios webpage (NGFS 2025b).

**Figure 4. Carbon price trajectories in the Baseline and SWUC scenarios**




Source: Battiston et al. (2025)[9].

The sudden increase in carbon price acts as a powerful cost-push shock, increasing production costs and prices across energy-intensive and high-carbon sectors. The adjustment unfolds as an initial level shift in carbon prices in 2027, followed by a more moderate year-on-year increase over subsequent years. As a result, headline inflation spikes significantly in 2027 in all regions (Figure 5). The magnitude of the inflationary shock varies by region, reflecting structural differences and the trajectories of the carbon price. Inflation peaks above 3 percentage points (pp) above baseline in Europe, and between 5 pp and 7 pp in North America, South America, Oceania, and Asia. The rapid increase in inflation occurs even as output growth slows, highlighting the non-core nature of the price pressures.

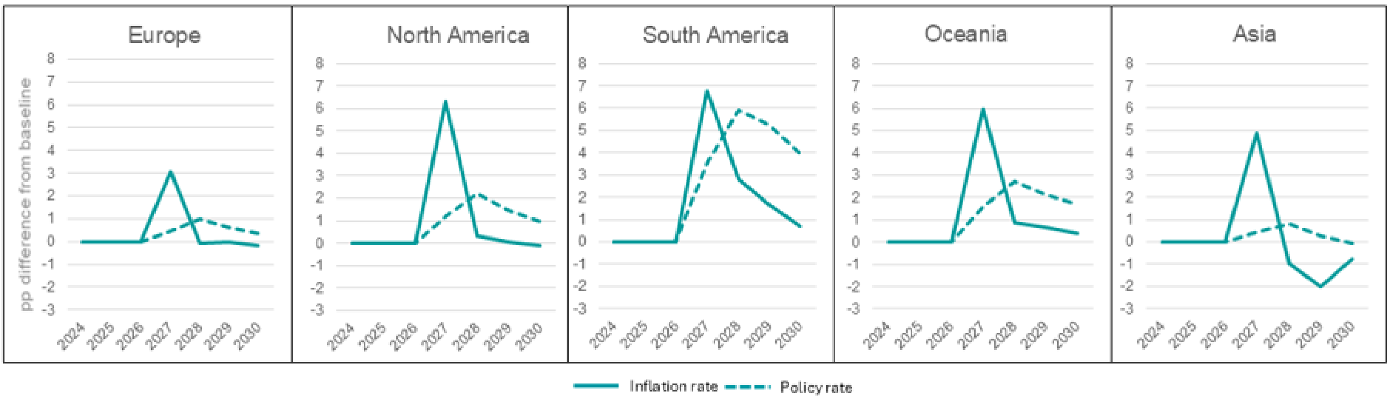
Following the initial level shift, inflation dynamics are driven by some key factors. First, the sharp increase in carbon prices is concentrated in 2027, followed by a more gradual rise that eases inflationary pressures. Second, higher carbon prices initially raise unit costs for carbon-intensive sectors, but they also incentivize investment in low-carbon technologies, which over time reduces emission intensity and limits price pass-through. In a more orderly transition pathway, such as the Highway to Paris scenario (HWTP), this adjustment happens more gradually, as predictable price signals accelerate the shift toward a low-carbon economy, limiting inflationary pressures (NGFS 2025b).

In addition, central banks respond to the initial spike in inflation by raising policy rates sharply with a peak in rates in 2028. The increases in the policy rate contribute to bringing inflation back towards the baseline, even as carbon prices continue rising. As price dynamics stabilize by 2029-2030, policy rates are lowered.

The SWUC scenario thus highlights that a sharp policy-induced cost shock can generate significant short-term inflation volatility, increasing the risk of trade-offs between price stability and economic growth.

[9] For South America and Asia, the calibration is based on the choice of a representative country in the region, i.e. Brazil for South America and China for Asia (NGFS 2025a).

**Figure 5. Inflation (solid line) and monetary policy rate (dashed line) in the SWUC scenario relative to the baseline scenario**



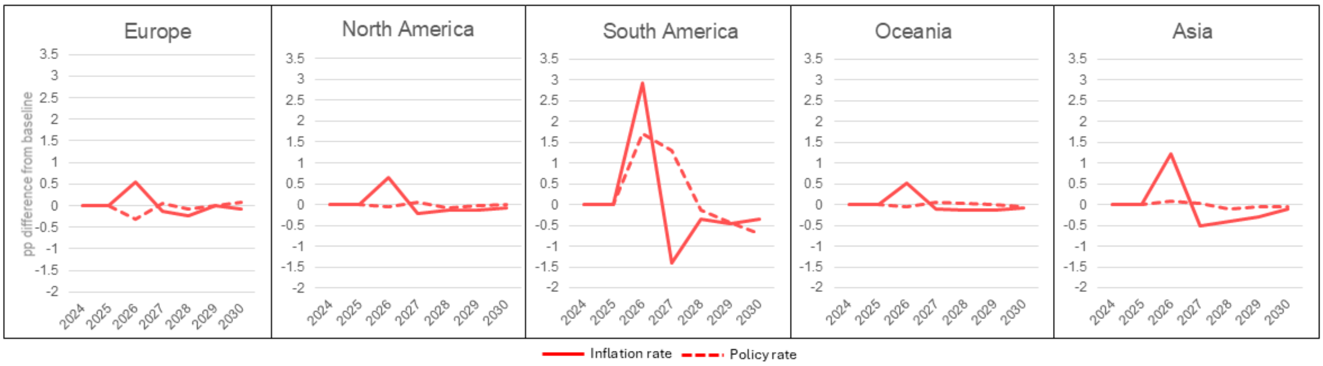

Source: NGFS (2025b)[10].

## Disasters and Policy Stagnation (DaPS)

The DaPS scenario examines the macro-financial effects of compounded extreme weather events occurring in 2026 and 2027. Dry events (droughts, wildfires, and heatwaves) strike in 2026, followed by wet events (storms and floods) in 2027. These shocks destroy capital, reduce labor productivity, and disrupt production.

The macroeconomic consequences are significant and display a distinctive time profile. In 2026 direct impacts dominate. Destruction of productive capital, reduced labor productivity, and disrupted supply chains constrain output and push up production costs. This results in lower GDP and a sharp, though temporary, increase in inflation as supply constraints raise prices despite the economic slowdown (Figure 6).

**Figure 6. Inflation (solid line) and monetary policy rate (dashed line) in the DaPS scenario relative to the baseline scenario**




Source: NGFS (2025b).

As the shock propagates and feedback effects materialize, the macroeconomic environment shifts. By 2027, demand-side effects from lower income and weakening of household consumption and private investment following the 2026 events dominate over the initial supply constraints. As aggregate demand falls against a backdrop of continued supply constraints, price pressures ease and inflation declines, relative to the previous year. This delayed demand effect reflects the behavioral dynamics in EIRIN, where agents adjust their decisions in response to changing economic and financial conditions. Over time, inflation tends to move back toward its baseline path, driven by the recovery of supply

[10] Price levels and policy rates are shown as differences from Baseline. The data shown are the year-on-year inflation rates of the final quarter of the year. The EIRIN model provides quarterly frequency (which is available on the IIASA portal).

conditions through capital reconstruction. As productive capacity is restored and household demand slowly rebounds, the balance between supply and demand stabilizes.

The monetary policy response reflects this dual nature of the shock. Initially, central banks face the challenge of responding to inflation driven by production and supply chains disruption. This should lead to a contractionary response. Nevertheless, the simultaneous economic downturn leads to a more accommodative stance in some regions, despite still high price levels. This is particularly evident in Europe, where policy rates fall relative to the baseline in 2026, followed by a gradual increase as the economy begins to recover.

Overall, the monetary policy response across regions reflects the interplay between inflationary pressures and output losses, as captured by the regional Taylor-rule calibration (NGFS 2025a,b).

## Conclusions and policy implications

In the short-term, climate-related extreme weather events can give rise to inflationary dynamics, with implications on output and investments recovery in the aftermath of the natural disaster. In addition, the interplay of extreme weather events and abruptly changing climate policies affect prices through different supply and demand side channels, which play out at the same time in the real economy, in different geographies. In highly interconnected markets, these climate-induced supply chains disruptions are transmitted to prices and amplified via trade and financial markets.

In this context, central banks' monetary policy reaction is expected to play a main role in taming inflation and smoothing the recovery. However, the understanding of an optimal monetary policy response is challenged by the complexity of climate risks, which affect different countries and sectors worldwide, uncoordinated governments' response, and geopolitical tensions.

The NGFS ST scenarios contribute to this scope, by providing an analysis of the impacts of compounding extreme weather events and climate transition risks on inflation dynamics and monetary policy response, through the EIRIN model.

Results show that both climate transition risk, such as sudden carbon price increases, and physical risks, such as extreme weather events, primarily generate cost-push inflation rather than demand-driven price pressures. These non-core inflationary dynamics emerge from higher production costs, disrupted supply chains, and reduced productive capacity, occurring to a different extent to different sectors and countries in the world. In addition, the resulting inflation spikes often occur alongside declining output, leaving central banks to face trade-offs between price stability and output growth.

These results offer relevant insights for monetary and prudential policy. Indeed, disentangling the nature of climate-related shocks and their specific transmission channels on both the supply and demand sides of the economy is a main step ahead to inform effective monetary policy response to immediate climate risk. As climate shocks become more frequent and severe, and countries' economic and financial vulnerability increase, understanding their short-term economic and financial implications will be crucial for central banks aiming to preserve prices and financial stability, governments aiming to find the balance between fiscal spending for mitigation and adaptation and public debt sustainability, and investors seeking to hedge climate risks.

The NGFS ST scenarios results show not only the importance of monetary policy response but also the crucial role of climate policy. Early, credible and coordinated climate policies, such as predictable carbon pricing, targeted investment incentives, and resilience-building measures, can help reduce uncertainty and anchor market expectations, limiting price volatility.

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