Network for Greening the Financial System

Technical document

Climate change and monetary policy strategy: a guide for central banks

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Foreword

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As climate change and the transition to net zero increasingly shape the macroeconomic environment, their implications for monetary policy are becoming more salient and more complex. Increasingly severe physical climate impacts, the implementation of mitigation policies, and structural changes associated with the transition are already affecting inflation, output, and therefore monetary policy. These developments raise important questions for central banks as they seek to deliver price stability in a world characterised by more frequent supply shocks and heightened uncertainty.

This report provides a guide for central banks on the implications of climate change and the transition for monetary policy strategy. Building on earlier work by the NGFS Workstream on Monetary Policy, it focuses on how climate-related developments can generate monetary policy trade-offs, affect the transmission of monetary policy, and impact structural variables such as the natural rate of interest. The report draws on a growing academic literature, new quantitative analysis, and policy experience to assess how monetary policymakers can incorporate climate-related considerations into their strategic frameworks while remaining firmly anchored in their mandates.

A central theme of the report is that climate change and the transition can impact price stability, and hence central banks should seek to understand and respond to the macroeconomic consequences. Climate-related shocks often present as negative supply shocks, with the potential to push inflation and output in opposite directions, creating trade-offs for monetary policy. The increasing frequency and persistence of physical climate shocks may reduce the scope to "look through" them, as second-round effects become more material. The transition to net zero can also generate relative price changes, sectoral reallocation, and investment dynamics that affect inflation and output over policy-relevant horizons.

The report highlights that climate change may imply more profound and lasting changes to the environment in which monetary policy is conducted. Recurrent physical shocks, heightened uncertainty, and large-scale structural reallocation have the potential to affect monetary policy transmission, influence equilibrium real interest rates, and complicate policy communication. These challenges underscore the importance of robust analytical frameworks, scenario analysis, and clear communication in maintaining the credibility and effectiveness of monetary policy.

This publication is part of a broader programme of work by the NGFS to support central banks in understanding the macro-financial implications of climate change. We are grateful to the NGFS members and observers, contributors to the joint modelling work with the International Monetary Fund and Swiss National Bank, as well as the NGFS Secretariat, for their contributions. We would particularly like to thank the co-leads of the subgroup – Solveig K. Erlandsen (Norges Bank), Sui-Jade Ho (Bank Negara Malaysia), and Danae Kyriakopoulou and Edwin Millar (Bank of England) – for bringing together this report. We hope this report contributes to deepening the understanding of how climate change and the transition to net zero interact with monetary policy strategy and supports central banks in navigating these challenges in the years ahead.

Executive Summary

Climate change and the transition to net zero greenhouse gas emissions are reshaping the macroeconomy, with important implications for monetary policy. This report provides a guide for monetary policymakers as they respond to these changes. It extends prior NGFS analytical work on the macroeconomic impacts of climate change and the transition by exploring the implications for monetary policy strategy and offering quantitative insights on the impacts of climate-related shocks and structural change. The analysis is supported by scenario modelling and draws on the latest research and policy experience.

Both physical and transition-related impacts can affect supply and demand and potentially generate trade-offs for monetary policymakers between stabilising inflation and output. Physical impacts, such as acute weather events and chronic shifts in climate patterns, can degrade productivity and disrupt supply chains, resulting in inflationary pressures and output losses. Transition impacts, arising from policies like carbon pricing and green subsidies, or changes in consumers' preferences, can also potentially generate monetary policy trade-offs, with sectoral mismatches and resource reallocation affecting prices and output. The magnitude and persistence of these effects depend on economic structure and the type, pace and credibility of mitigation policies.

In pursuing their mandates, central banks must respond to the economic effects of climate policies, while the responsibility, and tools, for setting those policies lies with governments. Despite the short-term costs, early coordinated transition to net zero emissions is likely to lead to net positive impacts on output in the long run, while delayed or fragmented action increases risks and long-term economic damage.

Monetary policymakers should respond to climate-related shocks as they would to any other relevant shock: by assessing the expected impacts on inflation and output over time. In this context, this report presents a framework to assess climate-related shocks, with a focus on negative supply-side shocks that generate trade-offs between stabilising inflation and output. It highlights features of climate-related shocks that are particularly relevant for central banks. For example, physical shocks often affect prices that are salient for households' inflation expectations (e.g., food). Ultimately, the monetary policy response should be assessed alongside a broader set of factors, including the central bank's remit, the state of the macroeconomy and the response of other actors (e.g., fiscal authorities). As climate-related shocks become more frequent and severe, their effects will be harder for monetary policymakers to "look through".

A new NGFS short-term scenario evaluates the potential impacts of repeated acute physical shocks – heatwaves, droughts, floods, and cyclones – over a five-year horizon across a range of countries. This scenario demonstrates that acute hazards can persistently push output and inflation in opposite directions, generating monetary policy trade-offs. The findings underscore that the severity and persistence of macroeconomic impacts depend on the type of hazard, the resilience of the affected economy, and the effectiveness of government policy interventions.

Quantitative analysis drawing on the IMF's Global Macroeconomic Model for the Energy Transition (GMMET) explores the macroeconomic impacts of transition policies. This analysis demonstrates that carbon pricing can lead to an increase in headline inflation, especially in regions with higher fossil fuel dependence. These inflationary pressures coincide with near-term reductions in economic activity, presenting a trade-off for monetary policymakers. The modelling highlights that policy mixes that combine carbon pricing with revenue recycling for targeted subsidies and regulation can attenuate some of the short-term impacts on inflation and output. While this can reduce the magnitude of monetary policy trade-offs, it may require greater fiscal capacity from governments. The ambition, pace, and credibility of policy implementation are crucial, as rapid or unanticipated policies can amplify inflationary effects.

Climate change and the transition may impact key channels of the monetary transmission mechanism (MTM). For example, physical shocks can tighten credit conditions and increase uncertainty, potentially weakening the effectiveness of monetary policy easing through the credit, investment and wealth channels. Impacts on monetary policy tightening are more ambiguous.

The transition may widen differences between high- and low-emission sectors, leading to more uneven responses to monetary policy via the credit and investment channels.

The natural rate of interest (r*) is likely to shift in response to the economic impacts of climate change and the transition. Physical impacts tend to put downward pressure on r* by dampening productivity growth, increasing precautionary saving, and destroying capital. Climate-related uncertainty can increase demand for safe assets, further suppressing equilibrium real rates. The transition could exert more mixed effects: large upfront investments in green technologies may temporarily push r* higher, while carbon pricing can exert downward pressure on r* in the short-term if it reduces investment and the average return on capital. Medium-term effects will depend on the pace of reallocation and the productivity of new technologies. Higher public debt associated with disaster response, adaptation or transition can exert upward pressure on r*. Overall, most models in the literature suggest a downward drift in r* under slow-transition or high-damage scenarios, where weaker productivity and higher uncertainty dominate. In more orderly transitions, r* may still fall initially during adjustment, with potential for partial recovery if reallocation and innovation translate into stronger productivity growth.

Increased uncertainty related to climate change and the transition is also likely to create challenges for monetary policy strategy. Depending on the nature and source of this uncertainty, policymakers may need to adopt either a more, or less, responsive approach to climate-related shocks, or place more weight on specific "worst case" outcomes. Scenario analysis can play an important role in helping policymakers assess and communicate these risks.

Clear communications will be essential for central banks as they respond to climate change and the transition. The report provides four recommendations for monetary policymakers. The first applies to all central banks, while the latter three apply to those who are acutely confronted with climate-related shocks, and need to proactively communicate on climate issues. They could: (i) clearly communicate their role in relation to climate change and the transition, given their objectives and mandate, (ii) acknowledge the complexity and uncertainty generated by climate change and the transition, for example through referring to climate scenario analyses, (iii) if faced with a climate-related shock, set out the broad factors that will determine their response, including how they plan to manage potential monetary policy trade-offs, and (iv) tailor their communications to different stakeholders to ensure clarity and effectiveness.

In summary, as climate change and the transition increasingly impact the macroeconomy, this will have important consequences for monetary policy. While there is considerable uncertainty about the scale and persistence of these effects, they are likely to amplify the existing challenges posed by a series of supply shocks in recent years. Central banks may therefore need to navigate trade-offs, understand the impacts on the transmission of monetary policy, and reassess structural variables like the natural rate of interest, while communicating policy clearly and effectively in the face of heightened uncertainty. Overall, this evolving landscape calls for careful analysis, robust scenario analysis, and transparent communication to ensure monetary policy remains credible, effective and resilient in a changing world.

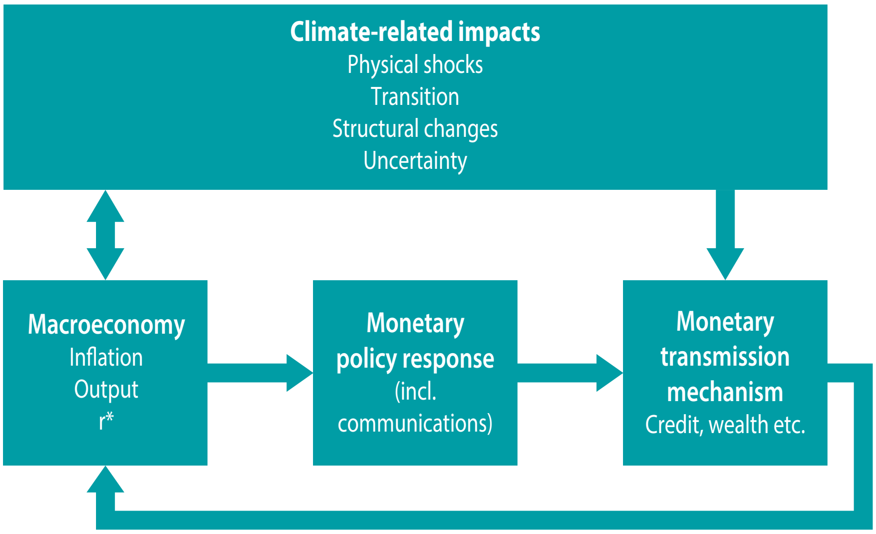
Introduction

This report explores how climate change and the transition to net zero affect monetary policy strategy. It is designed to be a guide for central banks and other stakeholders. It builds on work undertaken by the NGFS Workstream on Monetary Policy over 2022-24, which laid the analytical foundations for exploring the macroeconomic impacts of acute physical climate events and the transition (NGFS 2024a, 2024b).

Climate change and the transition can affect monetary policy in a range of ways. Figure 1 sets out how climate-related impacts feed through to inflation and economic activity, and therefore monetary policy. Climate change, the transition and related uncertainty affect the macroeconomic environment, impacting the inflation-output trade-offs faced by monetary policymakers, their policy decisions and communications. Climate-related factors may also affect the strength of the monetary transmission mechanism and structural features of the economy like the natural rate of interest, r*.

Central banks take climate science and government decisions on climate policy as given and focus on responding to their economic consequences. The responsibility – and the policy tools – for addressing climate change lie with governments. Central banks must then consider how these government-led policies affect their price stability objective, as well as any broader mandate they may have.

Figure 1.1 **Interactions between climate change, the macroeconomy and monetary policy**



The report is organised as follows: Chapter 1 reviews the literature on the macroeconomic impacts of climate change and the transition. Chapter 2 explores how different types of climate-related shocks impact the macroeconomy and considers how monetary policymakers can manage trade-offs arising from these shocks, drawing on new quantitative analysis. Chapter 3 examines how climate change and the transition could affect monetary transmission. Chapter 4 explores long-term structural effects on the natural interest rate (r*). Chapter 5 considers the implications of climate-related uncertainty for monetary policymakers. Chapter 6 focuses on monetary policy communications. Chapter 7 provides a practical step-by-step guide for monetary policymakers looking to apply the framework set out in this report in their jurisdiction.

1. Overview of the macroeconomic impacts of climate change and the transition

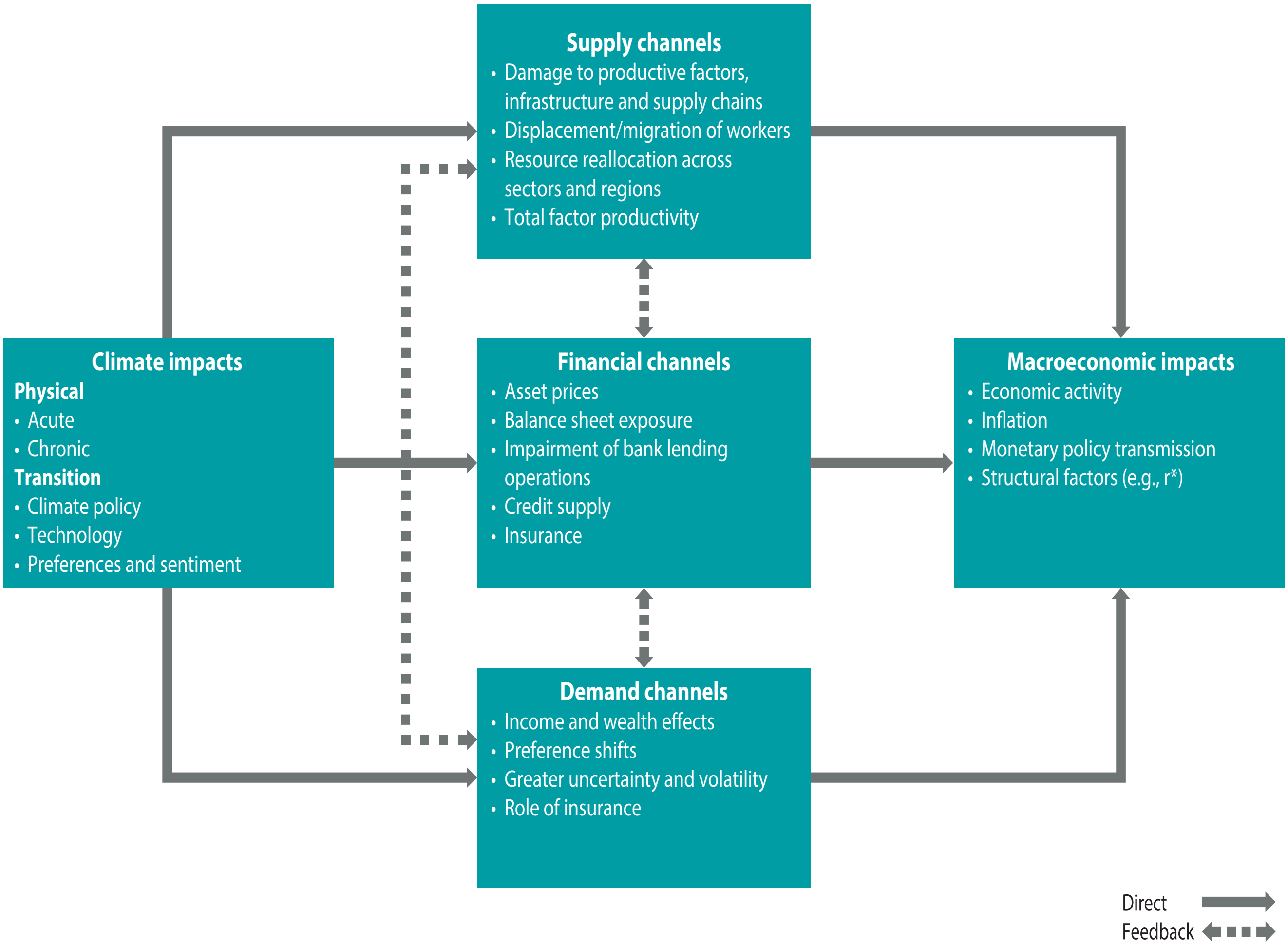
This chapter provides a brief overview of the literature on the macroeconomic impacts of climate change and the transition to net zero, building on the comprehensive summaries in NGFS 2024a and 2024b. Both physical hazards and the transition can have material macroeconomic effects, potentially leading to trade-offs for monetary policymakers. The most severe impacts from climate change occur in the absence of effective policy intervention.

Climate-related effects, whether from physical hazards or transition policies, affect production and consumption, and transmit through supply chains, sectoral interdependencies, and expectations, potentially requiring policymakers to manage trade-offs between price stability and output. *Physical impacts* refer to the economic effects of climate change, such as acute weather events – floods, hurricanes, heatwaves – and chronic shifts in environmental patterns, including rising average temperatures and sea levels (NGFS, 2024a). *Transition impacts* arise from the introduction of mitigation policies as well as technological innovation and changes in preferences. These include reform of high-emission sectors (e.g., through carbon taxes and emission trading schemes) and resource reallocation towards sustainable technologies, e.g., via green subsidies (NGFS, 2024b). These impacts operate through diverse and often interlinked channels (see Figure 1.2), affecting economies in both the short and long term.

Physical hazards can manifest as negative productivity shocks, simultaneously pushing output down and inflation up. Physical impacts affect the supply side of the economy by degrading the availability and efficiency of productive factors thereby reducing productivity, resulting in negative impacts on GDP (Ehlers *et al*., 2025; Ficarra and Mari, 2025; Costa and Hooley, 2025; Hallegatte, Jooste and McIsaac, 2024). For example, sectors like agriculture are exposed to weather-based risks, with extreme temperatures leading to lower yields in certain regions due to heat stress on workers, environmental degradation, and increased reliance on pesticides (NGFS, 2024a). In these instances, physical impacts can lead to higher inflation – so called 'climateflation' (Schnabel, 2022) – ultimately affecting headline inflation (Mukherjee and Ouattara, 2021; Kotz *et al*., 2024). Conversely, climate-induced downturns can weaken aggregate demand – and so offset some inflationary pressure (ECB, 2021; Cevik and Jalles, 2023; Monasterolo, Mazzocchetti and Naumann-Woleske, 2025; Faccia, Parker and Stracca, 2021; Dees, 2026). The net impact on inflation varies significantly across countries, with effects often having been small in advanced economies in the past, while lasting for several years in developing economies (Parker, 2018). Kabundi, Mlachila and Yao (2022) find that droughts generally have the most significant inflationary impact, materialising primarily through rising food prices, while floods can exert disinflationary pressures. Impacts are likely to increase in future as extreme weather events become more frequent and severe.

Physical hazards often affect the prices of salient commodities and can propagate through global production networks. Disruptions in upstream sectors, especially those supplying essential intermediate goods like food, can cascade through supply chains (Zappalà, 2024), amplifying aggregate losses and contributing to persistent cost-push inflation (Merrino and Sibande, 2026). Physical shocks frequently affect salient commodities (e.g., food), whose price increases are quickly passed on to consumers and have an outsized impact on inflation expectations (Peersman, 2022; Ciccarelli, Kuik and Hernández, 2024). Similarly, local weather shocks can spill over internationally through trade and financial linkages. For instance, De Winne and Peersman (2021) find that weather-related shocks to harvests lead to higher agricultural commodity prices and lower economic activity globally. More broadly, a 10% increase in global food prices is estimated to cause approximately 0.5pp increase in inflation in advanced economies (Furceri *et al*., 2016).

Figure 1.2 **Propagation of climate-related impacts to the macroeconomy**



The transition to net zero emissions could also reduce output and increase inflation in the near term (NGFS, 2024b). Policies designed to discourage carbon-intensive economic activities, such as green regulations or carbon pricing, can reduce productivity in affected sectors and through their supply chains. Sectoral mismatches can depress output and increase unemployment, if not accompanied by government policies that support workers and capital moving to expanding "clean" sectors. During the transition, 'greenflation' may occur if surging demand for critical inputs – such as rare metals and renewable technologies – outpaces supply, fuelling inflation in green sectors[1] (Schnabel, 2022). 'Fossilflation' can arise from higher or more volatile energy prices e.g., triggered by geopolitical events or transition policies which constrain fossil fuel extraction, but may decrease in importance as countries shift away from fossil fuels (see Chapter 2). As clean technologies scale up, transition-related inflationary pressures may ease. Productivity gains from green innovation can help offset initial investment and adjustment costs. Impacts of specific transition policies are discussed in Chapter 2.

1 A nascent literature emphasizes that shocks to critical input prices linked to the green transition have materially different macroeconomic implications compared to fossil fuel price shocks. Concordel, Ho and Knittel (2026) argue that shocks to critical mineral prices affect the cost of creating new capital without altering the cost of existing capital (installed capacity). Bartocci *et al.* (2026) further show that when firms can rely on already installed capacity, the short-run effects on both GDP and inflation of rapid increases in the prices of critical minerals are significantly weaker, compared to an equally-sized shock to fossil fuel prices that directly affects the cost of utilizing existing capital.

In the longer term, taking physical and transition impacts together, the most severe macroeconomic impacts from climate change occur in the absence of effective climate policy intervention (NGFS, 2025a). Early, coordinated policy action that incentivises green energy investment significantly reduces long-term physical impacts (NGFS, 2026b; Diluiso *et al.*, 2021; Allen *et al.*, 2024). Risks that are difficult to model, such as tipping points (e.g., Atlantic Meridional Overturning Circulation (AMOC) collapse) and non-linear climate effects, could worsen the economic costs of inaction beyond current projections.

Finally, the impacts of climate change and the transition also depend on the capacity of the financial system and governments to provide support and absorb shocks. When climate-related shocks occur, the financial system can either amplify or absorb these impacts (FSB, 2025; Bank of England, 2025). These effects may be highly non-linear, as repeated or severe shocks can exceed financial buffers and trigger abrupt corrections in financial markets. Adequate insurance protection can help mitigate these effects. Governments can also play a crucial role: timely fiscal support, targeted regulation, and investment in adaptation and mitigation can cushion the economy from climate impacts. However, more frequent and severe weather events can erode fiscal capacity and impair insurance provision, which can further increase the impact of shocks, particularly in emerging market and developing economies (Noy, 2009).

In summary, climate change and the transition are increasingly generating significant short- and long-run macroeconomic impacts, but the ultimate magnitude, and persistence of these effects remain uncertain. The extent to which short-term price pressures translate into persistent inflation depends critically on wage-setting behaviour and the degree to which inflationary pressures feed into inflation expectations, which in turn is affected by monetary policy. As climate risks intensify and climate-related policies are rolled out, their effects may interact, making it more difficult for policymakers and markets to distinguish temporary from permanent shocks, and demand-driven from supply-driven disturbances.

2. Monetary policy trade-offs associated with climate change and the transition

Climate-related shocks often manifest as negative supply-side disturbances, generating trade-offs for monetary policymakers between stabilising inflation and supporting output. Monetary policymakers should respond to these shocks as they would to other macroeconomic shocks: by assessing their expected impact on inflation and output over time. However, some characteristics make climate-related shocks particularly challenging. These include the duration of their impacts and their salience for households (e.g., via food or energy prices). To determine their response, monetary policymakers should assess these impacts in the context of their remit and broader macroeconomic conditions. Although the first-round impacts of some physical shocks can be "looked through", this approach is likely to become more challenging as these shocks become more frequent and severe. Depending on governments' design choices, transition policies may lead to persistent relative price changes, which monetary policymakers may need to manage to contain impacts on inflation.

2.1 A framework for assessing climate-related shocks

This section presents a framework to help guide policymakers as they respond to climate-related shocks. We focus on trade-off-inducing shocks, which require the central bank to balance price stability against output stabilisation. Chapter 7 provides a practical step-by-step guide for monetary policymakers looking to apply this framework in their jurisdiction.

In general, negative supply-side shocks, which are the focus of this chapter, are more likely to generate trade-offs for monetary policymakers. Table 2.1 provides an overview of the key types of negative supply-side shocks that climate change and the transition may generate. Some climate-related shocks may manifest as demand shocks, e.g., adaptation spending or, in some instances, floods and tropical storms (see Box B), but these are less likely to lead to trade-offs as they generally move inflation and output in the same direction (Clarida, Galí and Gertler, 1999). Negative demand shocks could be challenging for monetary policy if they occur frequently, as they reduce monetary policy space (Dees, 2026). Positive supply shocks (e.g., green innovation) do not generally lead to material monetary policy trade-offs.

To determine the monetary policy response to a given shock, it is important for central banks to assess how impacts on supply and demand may evolve over time. Given lags in the monetary transmission mechanism, it is generally optimal for monetary policymakers to look through the first-round effects of a transitory shock, unless more persistent second-round effects are expected (Woodford, 2003). For shocks with more persistent impacts on inflation, a monetary policy response may be required. Table 2.1 highlights two stylised examples of supply-side shocks: (i) *Negative supply shock with persistent impacts on inflation*, where monetary policy may need to tighten to offset inflationary pressure, with corresponding negative implications for output; and (ii) *Negative supply shock with transitory impacts on inflation*, where monetary policymakers are more likely to be able to look-through the effects.[2]

A key distinction for policymakers is whether a climate-related shock remains a relative price shock or evolves into broad-based inflationary pressure. Such shocks, particularly those affecting energy and food, typically begin by raising the prices of a narrow set of goods. This alone does not warrant a monetary response: policy cannot offset the initial price increase and operates only with a lag. The central question is whether these relative price changes propagate into generalised inflation through firms passing higher input costs along supply chains, or workers seeking wage compensation for increases in the cost of living. When second-round effects remain limited, because demand is subdued, labour markets are loosening, or firms' pricing power is constrained, policymakers can

2 A subset of these types of shocks are so-called Keynesian negative supply shocks, where a negative supply shock in one sector, which is a complement to other sectors in the economy, leads to a drop in aggregate demand so large that the economy's overall output may fall below potential, leading to deflationary pressure in the medium term (Guerrieri *et al.*, 2022). In this case, it may be appropriate for policymakers to loosen policy, despite the near-term increase in inflation. An example could be a cyclone in a small country that impacts the tourism sector, leading to reduced demand in other sectors (e.g., restaurants, retail etc.).

appropriately look through the initial shock. But when the shock is large or persistent enough to risk embedding broader inflationary pressure, what began as a relative price adjustment can harden into a general price level shock, requiring a monetary policy response. Making this distinction is therefore essential: relative price adjustments are an unavoidable feature of both the physical impacts of climate change and the transition to net zero, but they become a monetary policy concern when they feed through to inflation expectations (see Box A) and trigger changes in wage- and price-setting behaviour that threaten medium-term inflation control. Clearly, making this assessment is challenging in practice – Chapter 6 discusses how policymakers can respond to this uncertainty. De Fiore, Lombardi and Rees (2022) and ECB (2023) set out a range of indicators that policymakers can monitor to assess persistence, including short-term inflation expectations and the co-movement of prices across sectors.

Table 2.1 **Classification of stylised supply-side shocks**

Type of shock	Impact	Monetary policy response	Rationale for response	Illustrative climate-related example
Negative supply shock with persistent impacts on inflation	Persistent inflationary pressure. Fall in output.	Tighten policy if inflation is expected to be persistently above target.	Persistence of inflationary pressure necessitates a monetary response.	*Multiple compound extreme weather events occurring over time.*
Negative supply shock with transitory impacts on inflation	Temporary inflationary pressure. Fall in output.	Leave stance unchanged – "look through".	Policy has limited impact on inflation in the near term due to lags in transmission.	*One-off increase in carbon tax.*

Several shock-specific factors determine to what extent a climate-related shock impacts demand and supply, and the persistence of inflationary effects. As summarised in Table 2.2, these factors[3] include the magnitude, duration, sectoral centrality in supply chains, origin, location, salience for households, and predictability of the shock. Assessing these factors can help monetary policymakers understand the potential impacts of a shock on inflation and output over time, and the appropriate monetary policy response.

Table 2.2 **Shock-specific factors that determine macroeconomic impacts**

Factor	Implications for inflation and output	Climate-related aspects
Magnitude	Larger shocks are more likely to have larger overall impacts on inflation and output.	Climate-related shocks are expected to increase in severity over time and are becoming increasingly severe across geographies (IPCC, 2023).
Duration	Longer lasting and/or compounding shocks are more likely to lead to persistent inflationary pressures.	Climate-related impacts are often persistent: Transition policies are designed to affect relative prices over the medium term. Acute physical impacts are becoming more frequent resulting in compounding effects, and chronic impacts are persistent by definition.
Sectoral centrality	Shocks affecting central sectors in the economy have larger and more persistent effects on inflation and output as their impacts transmit downstream.	Key upstream sectors such as energy and mining can be particularly affected by transition policies and/or highly exposed to extreme weather.
Origin	Small open economies may be particularly exposed to spillovers from international shocks.	Climate-related impacts often spill over internationally through trade, commodity markets and financial linkages.
Location	Some locations are particularly exposed to specific shocks, e.g., floodplains.	A heatwave could increase inflation in low-latitude regions due to reduced agricultural productivity but could lead to deflationary pressures in high-latitude countries due to higher agricultural productivity (Ortiz-Bobea *et al.*, 2021).
Salience of affected prices for households	Shocks that impact the prices of frequently purchased items are more likely to influence inflation expectations and lead to persistent inflationary pressure (Anesti, Esady and Naylor, 2025).	Goods with highly salient prices (e.g., food, energy) are particularly exposed to climate shocks.
Predictability	Clear and gradually implemented policies reduce the risk of inflation and output volatility, in contrast to unpredictable shocks.	Extreme weather events are inherently unpredictable. Transition policies can have implementation uncertainty.

3 Adapted from de Galhau (2024).

While the factors that define climate-related shocks are not unique to them and can also apply to other macroeconomic disturbances, some features stand out as especially relevant (Talbot, 2025; Breeden, 2025). The magnitude of climate-related shocks varies significantly by the type of shock and the economy affected, but they can be very large e.g., a small country hit by an extreme weather event. Climate shocks can have a long *duration* e.g., a carbon tax with a ratchet effect that is designed to affect relative prices over multiple years. Climate shocks can be international in *origin* and can affect *sectors that are central* to the economy and involve *prices that are particularly salient for households*. For example, shocks to international food or energy prices can affect the prices of domestic household essentials through global supply chains. Finally, although transition policies are generally designed to be *predictable* in nature, this is clearly not the case for physical hazards, which creates additional challenges for policymakers.

More frequent and severe climate-related shocks may have implications to monetary policy strategy. A sequence of shocks that are individually transitory can interact and compound over time, leading to more persistent effects on inflation, output and expectations. Repeated shocks can erode fiscal space and private-sector resilience, while successive relative-price disturbances may increasingly spill over into wage and price-setting behaviour. In such circumstances, the scope for monetary policy to "look-through" shocks diminishes, changing the optimal policy problem for central banks (Bandera *et al.,* 2023).

Beyond the characteristics of the shock itself, a range of institutional, cyclical and structural factors shape how climate-related shocks affect the economy and the implications for monetary policy, summarised in Table 2.3. These factors determine how much space policymakers have to respond to a shock, and how that shock is likely to propagate, ultimately affecting whether a climate shock produces a mild disruption or a severe and persistent macroeconomic contraction.

Table 2.3 **Factors that could affect the monetary policy response to a climate-related shock**

Factor	Explanation
Institutional factors	
Central bank remit	Monetary policymakers' decisions depend fundamentally on their remit. E.g., if they target inflation or an exchange-rate peg, or whether they have an employment objective alongside an inflation target.
Weight of inflation and output in policymakers' reaction function	For a given remit, policymakers will place different weights on inflation and output stabilisation in their reaction function. i.e., the balance between returning inflation rapidly to target and impacts on the output gap. This is also likely to vary depending on the shock.
Longer-term impacts of monetary policy	Depending on their remit, some policymakers may take account of longer-term impacts of monetary policy on the supply side of the economy, for example through scarring effects, hysteresis in labour markets, or weaker capital accumulation.
Cyclical factors	
Level of inflation and inflation expectations	If an inflationary shock hits the economy when inflation and/or inflation expectations are already elevated, risks of second-round effects or expectations "de-anchoring" may be higher, meaning a stronger monetary policy response may be required.
Business cycle position	An economy that is already running above potential faces greater inflationary pressure than one with spare capacity, altering the monetary policy trade-off.
Slope of the Phillips curve	The slope of the Phillips curve determines how inflation responds to economic slack. A steeper curve implies that a given degree of spare capacity exerts greater disinflationary pressure, shaping both the pace and scale of the policy response.
Fiscal response	If fiscal stimulus is implemented to support demand following a shock, this may boost output and inflation, altering the monetary policy trade-off.
Uncertainty	In the face of high levels of uncertainty, policymakers may need to act more decisively to guard against adverse tail outcomes.

Structural factors	
Economic structure and stage of development	Emerging markets are generally more exposed to the macroeconomic consequences of climate shocks than advanced economies. This vulnerability reflects a combination of greater physical vulnerability, higher dependence on climate-sensitive sectors, such as agriculture, and often a heavier reliance on fossil fuels. Furthermore, the monetary transmission mechanism may be weaker.
Insurance penetration and depth of financial system	High insurance penetration and rapid payouts following a physical hazard could support demand and push inflation up. Deep financial markets can help agents smooth their consumption following a shock.
Monetary transmission mechanism	If a shock affects monetary transmission mechanism (MTM) channels, for instance by disrupting credit markets, collateral values, or the interest rate sensitivity of spending, then policymakers may need to alter their response to a given shock.
Resilience and adaptation	The extent to which an economy has invested in adaptation shapes the severity of climate-related losses. Preventative measures – such as climate-resilient construction, production processes, and supply chains – reduce exposure *ex ante*, while curative responses limit damage after the fact.

Institutional factors

The monetary policy response to a climate-related shock will depend critically on the remit of the responding central bank. For example, exchange rate targeting central banks may face a different set of trade-offs to inflation targeters (discussed in Chapter 2.4). Central banks that pursue several objectives, for instance price stability and maximum employment, may be more willing to bring inflation back to target over a more extended time horizon, relative to central banks with a single price-stability objective.

More generally, the monetary policy response to a shock will depend on the weight that policymakers place on closing the output gap relative to stabilising inflation, which may vary depending on the type of shock. This weight is often denoted λ – or 'lambda' (Carney, 2017). A higher value of lambda implies a greater emphasis on output stabilisation and a weaker policy response to short-run increases in inflation. The slope of the Phillips curve (discussed below) is crucial in this context, as it determines the extent of the fall in output required to reduce inflation – the so-called *sacrifice ratio*. Other factors that influence lambda include the central bank's remit (discussed above) and the preferences and judgement of monetary policymakers. In a world of more frequent and severe climate-related inflationary shocks, policymakers may adopt a lower lambda (placing relatively more weight on inflation), in order to keep inflation expectations well-anchored.

Policymakers may also need to consider the longer-term effects of the monetary policy stance on the productive capacity of the economy. When faced with a supply-side shock, tightening can exacerbate longer-term negative impacts on output (Ball, 2014). This may in turn lead to long-term negative impacts on the supply side of the economy for example through scarring effects, hysteresis in labour markets, or weaker capital accumulation (Aghion, Hemous and Kharroubi, 2014). The extent to which monetary policymakers should incorporate these effects into their policy decisions will depend on their remit. For some central banks, these longer-term impacts may be particularly important during the transition, as the pace of the transition may be sensitive to the stance of monetary policy, as discussed in Chapter 3.

Cyclical factors

If inflation, or expectations of future inflation, are elevated when a climate-related shock hits, a tighter stance of monetary policy may be appropriate – as is the case for other supply-side shocks. A tighter stance will reduce the risk of second round effects on inflation, particularly if the shock affects salient prices including food or energy, as is common with climate-related shocks. Similarly, if medium-term inflation expectations are elevated, then monetary policy may need to act more forcefully against inflationary pressure as large or persistent deviations of inflation from target can affect agents' long-term inflation expectations, creating challenges for monetary policymakers (Bems *et al.*, 2021) as discussed in Box A.

More generally, the monetary policy response will be affected by the position of the economy in the business cycle and the slope of the Phillips curve when a shock occurs. If output is running above potential prior to the shock and inflationary pressures are already strong, then monetary policy may need to be more reactive. Higher levels of uncertainty associated with climate change and the transition may increase inflation volatility, resulting in firms adjusting prices more frequently and a steepening of the Phillips curve ECB (2025a, 2025b). Karadi *et al.* (2024) argue that increased volatility and a steeper Phillips Curve should lead to tighter monetary policy than in a standard menu cost model that does not account for state-dependent pricing.

In the case of a physical shock, the government response will have an important bearing on the monetary policy response. For example, if a fiscal spending package is implemented in an area affected by a physical shock, negative impacts on demand may be attenuated, or could even turn positive if a large rebuilding programme is initiated. If the impacts of the shock on supply-side factors are broadly unchanged, this could lead to increased inflationary pressure, potentially requiring a tighter monetary policy stance. Dahlhaus, Duprey and Johnston (2025) find that natural disasters in Canada increase GDP volatility by initially destroying productive capacity, but the subsequent fiscal response and reconstruction spending often support economic activity, partially offsetting output losses. The capacity for governments to respond to physical shocks varies significantly across countries (Fuje *et al.*, 2023) and by the severity of the shock[4], and may decrease in future if shocks become more frequent and severe (Calcaterra *et al.*, 2025).

The prevailing degree of uncertainty in the economy, and how this is affected by climate-related shocks, will also have a bearing on the monetary policy response to a shock. As discussed in Chapter 5, specific forms of uncertainty may suggest a more activist, or a more cautious, approach to monetary policy.

Structural factors

Emerging markets and developing economies (EMDEs) are generally more exposed to the macroeconomic consequences of climate shocks than advanced economies (see Chapter 1), potentially presenting more acute trade-offs for monetary policymakers. This vulnerability reflects a combination of factors including higher dependence on climate-sensitive sectors, such as agriculture and more limited fiscal space to mount a stabilising policy response. Given that food expenditures represent a larger share of household consumption in many EMDEs, physical climate shocks can have more severe inflationary consequences. Commodity exporters may face an additional layer of exposure through terms-of-trade volatility, as climate shocks can simultaneously depress the productive capacity of export sectors while driving up the cost of imported goods.

Furthermore, the effectiveness of monetary policy in EMDEs is often constrained by less developed financial markets, higher levels of informal activity, and weaker institutional credibility. Less developed financial markets mean that transmission through traditional channels, such as interest rates, credit and expectations, may be materially weaker. The presence of a large informal sector can reduce the sensitivity of wages and inflation to economic shocks, but can also dampen monetary policy transmission. However, this same characteristic can make inflation more persistent in response to aggregate supply shocks. Additionally, formal firms – being the primary recipients of financial credit – are more directly affected by interest rate changes, while informal enterprises often operate outside the reach of conventional monetary policy channels. This dynamic leads to a higher sacrifice ratio for monetary policy, meaning greater output loss is required to achieve the same degree of inflation control (Alberola and Urrutia, 2020). Moreover, in some EMDEs central bank credibility is weak, resulting in unanchored inflation expectations that are highly sensitive to current inflation and exchange rate movements, increasing the persistence of inflationary pressures and the risk of second-round effects. In such cases, monetary policy needs to act more forcefully to re-anchor expectations, often at a higher cost in terms of output and employment.

Higher insurance penetration and deeper financial markets in an economy affected by a physical shock could dampen impacts on output (Giuzio *et al.*, 2026). Where insurance penetration is high, losses are transferred and distributed more broadly, reducing the risk that a single shock triggers firm insolvencies or household distress. As with fiscal spending, rapid and large-scale insurance payouts could lead to increased inflationary pressure. Relatedly, in economies with well-developed financial markets, households and firms can draw on credit and

4 See NGFS (2024a) for a discussion of resilience threshold: events below this threshold are associated with a significantly lower toll on the human and economic activity than events that surpass this threshold. The resilience threshold is country specific and is dependent on a country's wealth, fiscal capacity, and insurance mechanisms, among other factors. The resilience threshold is likely to be lower in lower-income countries than in higher-income ones, and as a result, lower-income countries experience relatively larger damages and economic repercussions from physical hazards.

savings to smooth consumption and rebuild after a shock, limiting the drag on demand.

Adaptation measures – investments and policy changes designed to reduce an economy's vulnerability to climate hazards – can dampen the macroeconomic impact of climate shocks. The impact of a physical hazard depends critically on the physical vulnerability and resilience threshold of the affected area, which tends to be lower for EMDEs (NGFS, 2024a). By lowering physical exposure ahead of a shock, measures such as flood defences, drought-resistant crops, or climate-resilient infrastructure reduce the scale of capital destruction and output losses when a shock materialises. Effective adaptation can also limit the drag on labour productivity, preserve collateral values, and reduce the fiscal burden of disaster relief – all of which support macroeconomic stability. However, the protective effect of adaptation depends critically on the scale and timeliness of investment, as well as on institutional capacity to implement it.

If a climate-related shock affects the monetary transmission mechanism (MTM), policymakers may need to adjust the monetary stance to account for this effect. As discussed in Chapter 3, different climate-related shocks have the potential to strengthen or weaken specific MTM channels, with implications for the monetary stance.

Box A

Impacts of climate-related shocks on inflation expectations

Climate-related shocks can have a significant impact on inflation expectations because they often increase prices for food and energy, which are particularly salient for households as they form their inflation expectations. For central banks, this may add to the challenge of steering inflation expectations in the face of climate-related shocks.

Anchoring inflation expectations is important for central banks, as it underpins both the effectiveness and credibility of monetary policy. Inflation expectations influence household saving and investment choices, shape firms' price-setting behaviour, and play a crucial role in wage negotiations (Coibion, Gorodnichenko and Kumar, 2018; D'Acunto *et al.*, 2024; Gautier, Savignac and Coibion, 2025). If households and firms trust that inflation will remain close to the central bank's target over the medium-term, wage and price formation tend to be more stable, reducing the risk that temporary shocks translate into persistent inflation. Conversely, weakly anchored inflation expectations can amplify and prolong the effects of shocks on inflation (Bems *et al.*, 2021).

While short-term inflation expectations are largely driven by recent price developments, medium- and long-term expectations serve as an important indicator of how well inflation expectations are anchored.[1] The academic literature highlights that inflationary shocks can lead to persistently higher inflation expectations and, in turn, higher realised inflation, especially if these shocks are large, repeated or occur when inflation is already elevated (Breckenfelder *et al.*, 2023; Weber *et al.*, 2025).

Furthermore, food prices, which are particularly exposed to physical climate shocks (see Chapter 2), play a prominent role in shaping households' inflation expectations (Dietrich, 2024). In Norway, for example, around 60 percent of households report that food prices are the most important factor in their formation of inflation expectations (Midthjell, 2017). This aligns with empirical studies showing that prices of frequently purchased goods, such as food, have a significant impact on how households form their expectations (Anesti, Esady and Naylor, 2025; D'Acunto *et al.*, 2021; Cavallo, Cruces and Perez-Truglia, 2017). Georgarakos *et al.* (2025) finds that a 0.5 °C increase in global temperatures can – partly driven by food prices – raise five-year-ahead inflation expectations by 0.7 percentage points.

…/…

1 In the literature, various criteria are used to assess whether inflation expectations are anchored. These include whether the public's medium- and long-term inflation expectations are relatively unresponsive to new information about realised inflation, whether these expectations are close to the inflation target, and whether the distribution of medium- and long-term inflation expectations shows low dispersion (Norges Bank, 2026).

Energy prices, which are sensitive to both physical and transition-related climate shocks (see Chapter 1), may also be important for households' inflation expectations. Jo and Klopack (2025) find a causal, and significant, link between petrol prices and household inflation expectations. Wehrhöfer (2023) documents that German households' inflation expectations increase when they experience rising electricity prices. Patzelt and Reis (2024) similarly find that increases in electricity prices raise expected inflation.

For firms, the empirical evidence on the relation between inflation expectations and energy prices is more mixed. Wehrhöfer (2023) finds that firms exposed to higher electricity prices do not differ in their inflation expectations from those without such exposure. In contrast, Hensel, Mangiante, and Moretti (2024) show that the effects of carbon policy shocks on firms' price expectations can be more persistent than on realized prices themselves, while Mangiante (2026) reports that increases in carbon prices raise firms' inflation expectations across all horizons. Similarly, Granziera *et al.* (2025) identify a causal relationship between firms' inflation expectations and the electricity price shocks they have experienced.

Climate-related increases in inflation volatility could drive non-linear increases in inflation expectations. This is partly because both households and firms tend to react more strongly to price increases than to price decreases when forming their expectations (D'Acunto *et al.*, 2021; De Fiore, Lombardi and Mangiante, 2025). Moreover, the asymmetric upside risk to global food prices from climate change (Kotz *et al.*, 2023), may further amplify the potential for rapid and pronounced shifts in inflation expectations. In this context, Karadi *et al.* (2024) argue that monetary policy should be set more tightly.

Against this backdrop, climate change could potentially make it more difficult for central banks to keep inflation expectations anchored. As set out in Chapter 5, concerns about "de-anchoring" could lead policymakers to respond more forcefully to inflation. This may be especially relevant for many EMDEs, where food and energy comprise a substantial share of the consumer price index (BIS, 2022).

Ultimately, maintaining well-anchored expectations as climate change intensifies will depend on central banks' ability to adapt their responses, reinforce their credibility, and communicate clearly with the public about the evolving sources of inflationary pressure (see Chapter 6). High credibility allows central banks to manage inflationary shocks more efficiently, since inflation expectations remain well-anchored, and second-round effects on wage- and price-setting are contained.

2.2 Monetary policy implications of physical hazards

The physical impacts of climate change can take the form of acute shocks, such as heat waves, droughts and floods, or chronic events, such as gradual warming and rising sea levels. Acute and chronic shocks influence inflation and output through various channels, potentially requiring a monetary policy response. These dynamics were explored extensively in NGFS (2024a) and are reviewed in Chapter 1.

Acute physical shocks frequently manifest as supply shocks that reduce output and push up prices in the short run, potentially generating a monetary policy trade-off. As discussed in Chapter 1, reductions in productive capacity due to infrastructure damage and production disruptions can trigger immediate supply constraints. Demand can fall because of income, wealth and/or confidence effects, though insurance and rebuilding efforts can mitigate this decline. In the short-term, inflationary impacts are often driven by disruptions in the supply of essential commodities like food and are exacerbated when shocks hit sectors that supply critical inputs to other sectors (e.g., energy and transport). In the medium-term, inflationary impacts are affected by the speed and strength of the recovery in supply and demand, which will be materially affected by the fiscal response and the scale and pace of insurance payouts. If inflationary impacts are expected to be short lived, then the standard monetary policy prescription is to "look through" the first-round impacts, given lags in the monetary policy transmission mechanism. If disinflationary pressure is expected in the medium-term, e.g., due to weak demand, then a loosening of policy could be appropriate further ahead.

Repeated acute physical shocks can be particularly challenging for monetary policymakers to manage. Although the inflationary impacts of each individual shock may be short lived, multiple shocks could have compounding impacts, potentially exacerbated by eroded resilience and fiscal capacity, leading to persistently above-target inflation necessitating a tightening of policy (Guerrieri *et al.*, 2022). Hence, when an acute shock hits, it is vital for monetary policymakers to consider whether future similar shocks are likely – drawing on external expertise where necessary. As noted above, emerging markets are generally more exposed to the macroeconomic consequences of physical climate shocks than advanced economies.

Chronic climate change, such as gradual warming and sea-level rise, can generate sustained inflationary pressures by steadily eroding labour productivity, or more broadly total factor productivity, and depreciating physical capital and infrastructure. These risks often affect sectors reliant on climate-sensitive inputs, like agriculture and tourism, and can lead to persistently higher marginal costs that transmit to inflation (Kahn *et al.*, 2021). These same chronic stresses can weaken demand over time by eroding household purchasing power, reducing investment, or slowing economic growth. As with acute shocks, the economic impact of chronic climate developments varies by sector, geography, fiscal capacity and the other factors set out in Tables 2.2 and 2.3, with developing economies especially vulnerable due to their reliance on essential goods.

Box B presents new quantitative scenario analysis of the monetary policy implications of different types of physical shocks. It shows that acute shocks can generate material trade-offs for monetary policy, which vary in scale depending on their characteristics and transmission channels. The scenario models a global "El Niño" narrative, with regional and year-to-year variance in physical shock occurrence and severity. In this scenario heatwaves reduce output, while increasing inflation volatility. Droughts reduce output and increase inflation, generating monetary policy trade-offs. Floods (and tropical storms) can potentially reduce both output and inflation if demand effects dominate. Repeated and increasingly severe shocks can produce persistent and compounding effects on inflation and output over time, exacerbating monetary policy trade-offs.

Case studies from past acute physical shocks also demonstrate how macroeconomic impacts and monetary policy responses can differ across different shocks and jurisdictions, as set out in Box C. The Bank of Mauritius "looked through" inflationary pressure following a severe cyclone in 2024, with fiscal policy providing the primary response. In contrast, following widespread floods in Pakistan in 2022, the State Bank of Pakistan tightened monetary policy significantly in response to a sharp increase in inflation. This shock occurred alongside a sharp currency depreciation, demonstrating how climate-related shocks can exacerbate the impacts of non-climate shocks. A modelled case study using Rwandan data (Jonsson *et al.*, 2025) highlights how an adverse weather shock leads to higher food prices and headline inflation, and lower agricultural output, creating a trade-off for monetary policy. Cantelmo *et al.*(2024) explore the monetary policy responses to physical shocks across sixteen disaster-prone countries from 1999 to 2017, finding that natural disasters in these countries often generate a monetary policy trade-off. They highlight the heterogeneity of responses across different countries and shocks, but note that monetary tightening is more common than loosening. This heterogeneity is further evidenced in a review of 31 extreme weather event case studies in NGFS, 2026b.

Drawing on the theory, modelling and case studies presented above, Table 2.4 sets out the potential monetary policy implications of some illustrative physical hazards. All of the examples are negative supply-side shocks, which lead to varying degrees of monetary policy trade-off.

Table 2.4 **Illustrative examples of the potential implications of physical hazards for monetary policy**

Physical hazard	Type of shock	Potential macroeconomic impacts	Considerations for monetary policy response
Heatwave that destroys crops	Shock to agricultural productivity	Food price inflation (particularly salient for households). Negative income and wealth effects for sectors affected, reducing demand.	Policy response will depend on passthrough to headline inflation, the persistence of inflationary effects and macro-level effects of sectoral demand reduction.
Flood of manufacturing area	Destruction of capital	Negative impact on supply, which depends on resilience/adaptation measures. Demand effects more ambiguous and depend on insurance, fiscal response etc.	Short-term inflationary pressure may fade if demand falls and/or supply recovers.
Repeated flood, cyclone or heatwave	Repeated shock to capital or labour	Same channels as single acute physical shocks, but repeated over time, potentially with compounding effects.	Repeated short-term inflationary spikes may lead to inflation persistently above target, and potential second-round effects.
Long-term drought in agricultural region	Chronic reduction in labour supply	Inflationary pressure in specific sector affected. Fall in demand from affected workers. Spillovers to macroeconomy depend on economic structure.	Potentially trade-off inducing, but impacts emerge more gradually, allowing more time for central banks to assess and respond.

Box B

Scenario analysis of the impacts of acute physical shocks

The NGFS collaborated with the National Institute of Economic and Social Research to develop a scenario that explores the impacts of acute physical shocks, building on and supplementing the existing NGFS long and short-term scenarios (NGFS, 2023, 2025b). The scenario is built using NiGEM[1] – the National Institute Global Econometric Model. More detail on the modelling approach is covered in NGFS, (2026a).

The model results show that acute physical shocks can produce material trade-offs for monetary policy, which vary in scale depending on the shock's characteristics and transmission. In the model, hot and dry events can push output and prices in opposite directions generating a monetary policy trade-off. Specifically, heatwaves increase inflation volatility while reducing output, while droughts increase inflation and reduce output. Conversely, floods and tropical storms, which manifest as negative demand shocks in the model, push down on both inflation and output, and hence are less likely to generate a trade-off. Repeated and increasingly severe shocks can produce persistent and compounding effects on inflation and output over time, exacerbating trade-offs. Recurring inflationary episodes would make it harder for central banks to 'look through' their effects.

…/…

1 This is a semi-structural econometric global general equilibrium policy model that is well-established among central banks for forecasting and scenario analysis. Relevant features of the model include sticky prices, the ability to model rational or adaptive expectations, and a monetary policy block with a range of possible policy settings, including Taylor Rule and a two-pillar rule. The model integrates individual country models for the major economies, linking them through trade and financial flows to capture global economic interdependencies and spillovers. It also includes a climate module and is used in NGFS long-term scenarios.

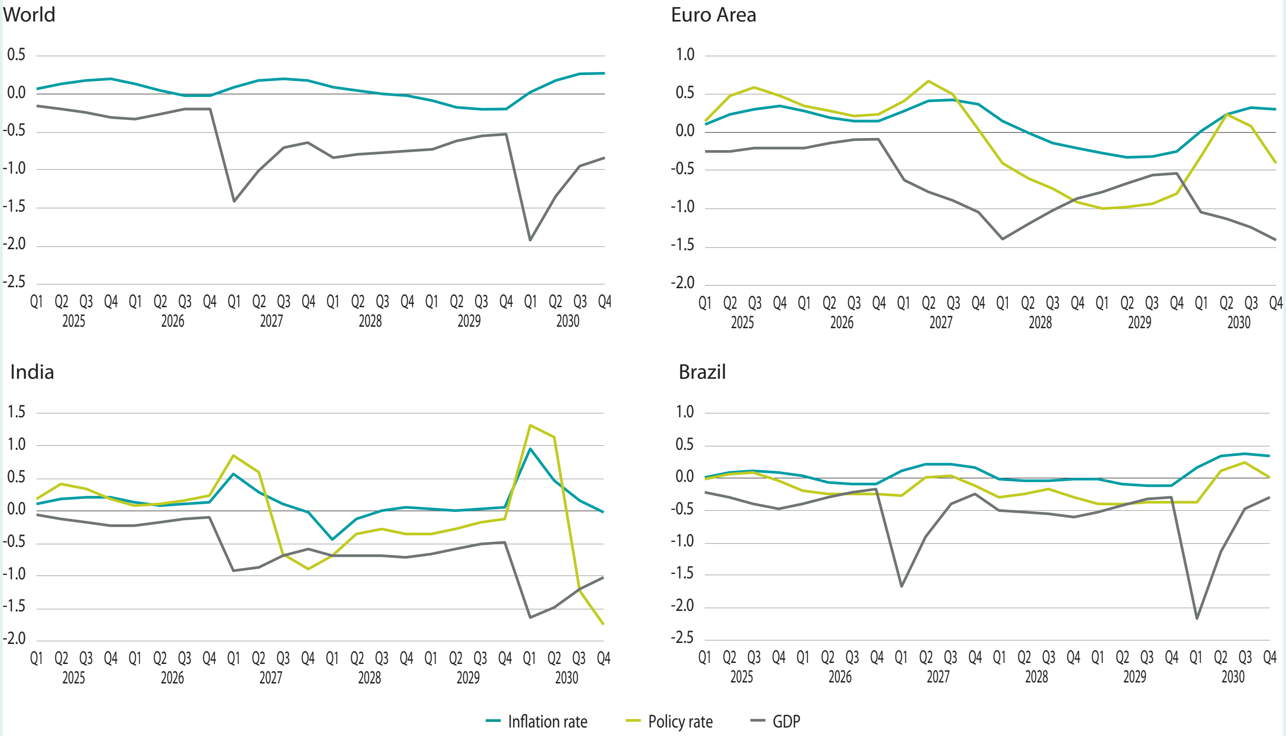
The scenario explores a stylised global "El Niño" narrative building on the NGFS physical climate storyline approach[2], with regional and year-to-year variance in physical shock occurrence and severity. Four acute hazards occurring at continent level are modelled (heatwaves, droughts, floods, tropical storms)[3]. These follow a storyline drawing on regional variability in types and severity of acute events influenced by the El Niño-Southern Oscillation (ENSO) cycle, the effects of which are likely to be magnified by climate change (see Cai *et al.*, 2021; IPCC, 2021). A scenario combining all shocks, and scenarios for each acute impact in isolation, are modelled.

The scenario highlights that, as physical shocks become more severe, frequent and overlapping, their compounding effects on inflation and output are likely to exacerbate trade-offs for monetary policy.

For example, in the scenario India experiences substantial hits to output alongside material spikes in inflation by up to 95 basis points driven predominantly by heatwaves and droughts. In the euro area, the combination of local and global shocks pushes down on output, while deflationary effects from domestic floods arising through the predominantly demand-affecting transmission channel in the model interact with inflationary pressures from both domestic and overseas droughts and heatwaves, leading to greater inflation volatility – at peak increasing inflation by 45 basis points (Figure B1). The magnitude of effects varies between jurisdictions depending on their economic structure and the type and severity of shocks they experience in the scenario, reflecting different levels of exposure across countries and regions.

…/…

Figure B1 **Scenario with repeated acute physical shocks**



Note: Effects of a global scenario combining the four acute shocks on key economic variables in select regions and aggregated at world level. Changes in inflation and policy rate shown in percentage points and changes in GDP in per cent, relative to a baseline scenario without acute shocks. In the scenario, central banks respond to deviations, relative to baseline, of headline inflation and the output gap, following the Taylor rule framework. The pattern of shocks differs between regions with the results reflecting international spillovers and potential amplifying / offsetting effects, with the strongest shocks in the El Niño years (assumed to be 2027 and 2030). See NGFS (2026a) for further detail on the modelled shocks pattern.

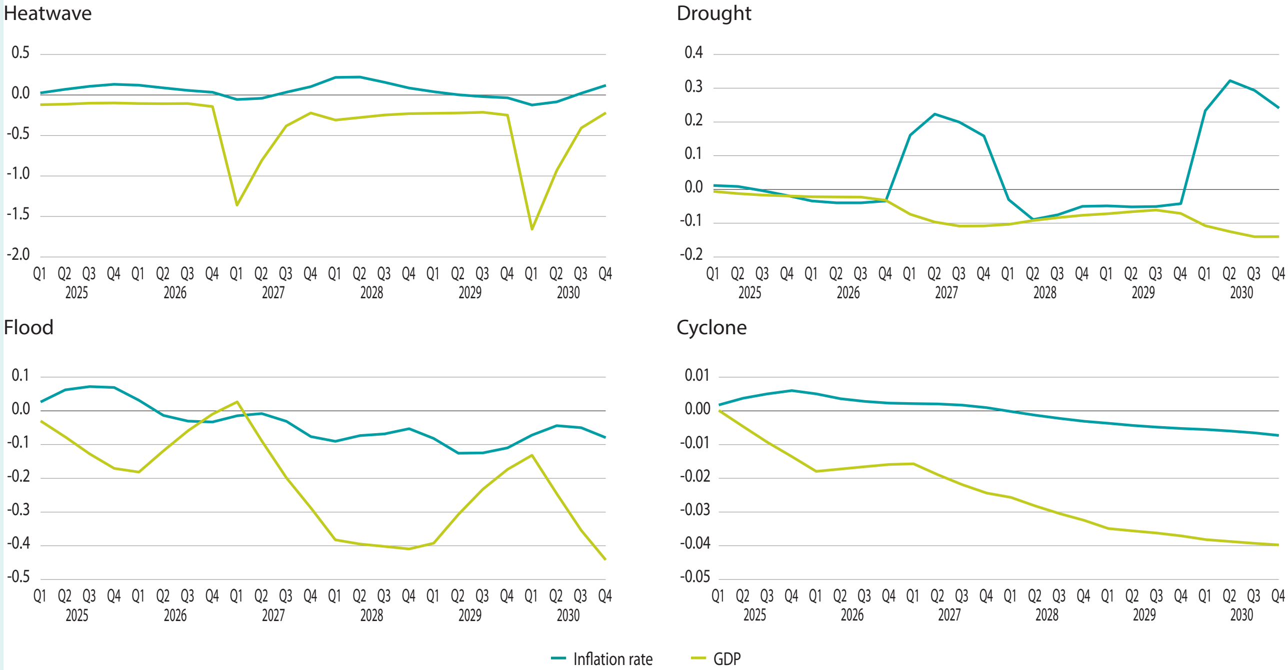
2 Storylines are not forecasts or probabilistic projections but instead they provide spatially and temporally coherent scenarios at the regional scale accounting for the uncertainty characterising specific local impacts of climate change. (Caviedes-Voullième and Shepherd, 2023; NGFS, 2025b).

3 The shocks in all cases are calibrated to be less severe than the tail acute impacts for each hazard in the NGFS long-term scenarios. The scenario assumes a simple pattern of La Niña year, followed by neutral followed by El Niño year, repeated once for the 6-year scenario duration, with severity lowest in 'neutral' years, higher in La Niña years (predominantly wet shocks), and highest in El Niño years (predominantly dry and hot shocks). The modelling leveraged NiGEM calibrations for different severities (stochastic bounds) estimated for NGFS Scenarios Phase IV using Climate Analytics inputs for the four acute hazards (NGFS, 2023).

Transmission to inflation and output varies by hazard. In this framework, heatwaves transmit as a shock to the economy's productive capacity, including by temporarily reducing labour force availability during the shock, leading to sharp but mostly temporary declines in output alongside greater inflation volatility. Droughts transmit as a shock to productive capacity in agriculture and spill over through reductions in agricultural exports, driving up global food prices while pushing down on output (Figure B2). Floods and cyclones[4] transmit through capital stock damage, which in the model reduces demand materially, resulting in declines in output combined with deflationary pressures[5]. While output generally recovers following a flood, impacts of tropical cyclones are more persistent, in part reflecting the fact that cyclones disproportionately affect less-developed countries with lower rebuilding capacity. Acute shocks that affect tradeable commodities, such as adverse impacts of droughts on agricultural production, can generate international spillover effects, leading to impacts on inflation and output in other countries.

The results illustrate that the increasingly severe and frequent acute shocks resulting from climate change can have material impacts on output and inflation that are relevant for monetary policy. Where acute physical hazards predominantly impact the supply side of the economy, such as droughts and heatwaves in the exercise, they are more likely to be trade-off inducing. If demand effects dominate, such as with floods and cyclones in this specific model, this can lead to deflationary pressure alongside declines in output, unless or until post-disaster recovery leads to a rebound in activity. No two acute shocks are the same, and the socioeconomic and environmental characteristics of the affected area influence the relative and absolute strength of supply and demand effects (see also NGFS, 2024a). For example, widespread flooding that significantly damages economic production such as agricultural output, can generate inflationary pressures (see Pakistan case study in Box C). Hazards affecting tradeable goods can lead to spillovers, impacting jurisdictions beyond the geographic area of the shock. More frequent and severe acute physical shocks resulting from climate change are likely to generate growing macroeconomic impacts, posing increased challenges for central banks.

Figure B2 **Acute hazards produce different macroeconomic effects in the model, with droughts the most inflationary and floods predominantly deflationary**



Note: Aggregated global-level impacts of each acute shock modelled in isolation, following the main 'El Niño' storyline for each hazard. Changes in inflation shown in percentage points and changes in GDP in per cent, relative to a baseline without acute shocks.

4 The analysis uses windspeed as a proxy for all cyclone losses and includes storm surge losses only implicitly.

5 Based on literature, flood impacts on EMDEs are calibrated via a ready-reckoner (derived from Li, 2024) introducing an inflationary shock on impact. Additionally, impacts of all hazards include term premia shock, based on Cantelmo, Lin and Zanetti (2026). Note that, in practice, impacts of shocks vary widely. E.g., the Pakistan flooding and Mauritius cyclone examples in Box C were both inflationary.

Box C

Case studies of physical shocks and monetary policy responses

Mauritius

Tropical Cyclone Belal in early 2024 presented a sudden, climate-related shock to the Mauritian economy, but it did not prompt any adjustment in the monetary policy stance. The cyclone caused severe flooding in Port Louis and widespread power outages and evacuations. The economic disruption was significant: curfew-related output losses alone were estimated at roughly Rs 3 billion[1] (around US$70 million, 0.5% of GDP). Inflation rose sharply in the weeks following the cyclone, year-on-year inflation increased by 2.3 percentage points (from 3.9% in December 2023 to 6.2% in February 2024), while food-price inflation accelerated from 3.6% to 15.8%. Throughout this period, the Bank of Mauritius maintained its monetary stance unchanged, judging that the impacts would be temporary and monetary policy could "look through" the first-round effects. This assessment was supported by softer core measures of inflation, which provided a more reliable indication of underlying demand pressures by excluding the more volatile food and energy components. It also reflected the view that the effects of earlier monetary tightening, together with the absorption of substantial excess rupee liquidity from the banking system under the new monetary policy framework, were continuing to work through the economy while keeping inflation expectations well anchored (Seegolam, 2024). Over the following year, inflation gradually fell back to its pre-shock level.

Fiscal authorities took action to provide economic support, while monetary policy remained focused on medium-term price stability. The government stepped in with financial assistance to affected households, planters and fishermen together with a compensation scheme that fully reimbursed affected policyholders of vehicles up to the sum insured and extended support to those without adequate insurance coverage, supporting household demand following the event.

Pakistan

Pakistan experienced unprecedented flooding across multiple regions in 2022, leading to substantial human and economic losses, with approximately 75,000 km^2 of land inundated at the peak. More than 33 million people – around 13% of the population – were affected. Against a backdrop of wider macroeconomic stress, including depleted foreign exchange reserves, tighter external financing conditions, exchange rate depreciation and already elevated inflationary pressures, real GDP, which had grown by 6.1% in FY22 due to expansionary fiscal stimulus, was estimated to have fallen by 0.6% in FY23. Agricultural land, homes, and infrastructure were destroyed. Economic damages reached US$14.9 billion, with a further US$15.2 billion in economic losses. Job disruptions affected an estimated 4.3 million workers, around one fifth of the pre-flood workforce, reflecting the scale of livelihood destruction. Export earnings also contracted by 13% as crop failures and supply-chain disruption reduced the availability of key agricultural goods.

Following a broader macroeconomic adjustment and sharp exchange rate depreciation, inflation surged to crisis levels, prompting one of the sharpest monetary tightening cycles in Pakistan's recent history. Flood induced destruction of crops and transport bottlenecks contributed to a rapid acceleration in food prices, pushing headline inflation from 12.2% to 29.2%. In response, the central bank raised its policy rate by 825 basis points to 22% in an effort to stabilise expectations, contain second round effects and limit exchange-rate pass-through. Sustained sound macroeconomic management, including tight fiscal and monetary policies under an IMF Extended Fund Facility program, helped drive inflation down to 4.5% by 2025. A large insurance protection gap likely contributed to fiscal pressures, with government providing substantial relief for some private losses, including those accruing to households, farms, and small enterprises.

…/…

1 All figures in this Box from NGFS (2026b).

Rwanda

In Rwanda, agriculture accounts for a large share of GDP and employment, and food prices have a substantial weight in the consumer price index. As in many developing economies, the country is highly exposed to adverse weather shocks, such as droughts and excessive rainfall. Climate change is likely to increase both the frequency and intensity of these events.

Using a Bayesian vector autoregression (BVAR) estimated on Rwandan data, Jonsson *et al.* (2025) show that an adverse weather shock raises agricultural prices and causes a persistent decline in agricultural output, with a gradual recovery over time. Because food has a high weight in the consumption basket, rising food prices materially drive headline inflation. This creates a policy dilemma for the central bank: whether to tighten monetary policy to contain inflation or to maintain accommodative conditions to support output.

To analyse this trade-off, the study uses a dynamic stochastic general equilibrium model calibrated to match the impulse responses from the BVAR model. The results indicate that, after an adverse weather shock, it can be appropriate for monetary policy to look through near-term effects and focus on more persistent effects (i.e., target core inflation rather than headline inflation). This holds under both a single headline inflation mandate and a dual mandate that also includes output stabilisation. If weather shocks have important distributional consequences, fiscal policy should address them through targeted transfers rather than through monetary policy.

2.3 Monetary policy implications of the transition to net zero

Transition impacts arise from the introduction of climate mitigation policies, such as carbon pricing (i.e., carbon taxes and emissions trading schemes), green support measures (green subsidies and increased green investment), or other transition dynamics (e.g., regulation, carbon border adjustment mechanisms). The potential macroeconomic implications of these developments were explored extensively in previous NGFS reports (NGFS, 2024b) and are summarised in Chapter 1. This section considers the monetary policy implications of various transition developments. Although the transition to net zero can lead to short-term impacts on inflation and output, the most severe long-term impacts occur if transition is delayed or delivered abruptly (NGFS, 2025a) .

The analysis in this section is supported by the results of a modelling exercise to quantify the short-to-medium-term macroeconomic impacts of various climate change mitigation policies and resulting monetary policy trade-offs, as set out in Box D. This exercise, using the IMF's GMMET model, explores the macroeconomic impacts of carbon pricing and other mitigation policies across various jurisdictions. It finds that transition policies, while necessary to prevent more severe economic impacts from climate change in the long-term, can generate near-term inflation-output trade-offs for monetary policymakers. The box discusses how these trade-offs change under different modelling assumptions.

Carbon pricing

Carbon pricing mechanisms, such as carbon taxes and emissions trading schemes (ETS), can initially manifest as a negative supply shock by raising energy costs, which can lower output and increase headline inflation, potentially leading to monetary policy trade-offs. The net macroeconomic effects of these measures depend critically on the implementing jurisdiction's economic structure and energy mix, policy design (such as the choice and calibration of the particular tool), how revenues are recycled, and the pace of implementation (Del Negro, Di Giovanni and Dogra, 2023; Olovsson and Vestin, 2025). Empirical studies generally find that the macroeconomic impact of carbon pricing on overall consumer prices has generally been small so far (Metcalf and Stock, 2023; Konradt and Weder di Mauro, 2023; Moessner, 2025), with larger impacts in developing economies, where inflation is already high, and in regions/sectors characterised by high emissions and low innovation capacity (Bettarelli *et al.*, 2024). However, carbon pricing policies introduced to date have generally been well below the level required to meet the Paris agreement (Black, Parry and Zhunussova, 2022; World Bank, 2025). Furthermore, considering the direct impact on fuel prices, which are highly visible to households, it is important for policymakers to remain alert to the potential for second-round effects on prices. In the longer term, studies find that inflationary pressures from carbon pricing often subside as markets adjust[5]. Carbon prices may also act as a catalyst for investment stimulus, boosting aggregate demand and supply over time and reducing inflationary pressures, particularly in clean sectors (Batten and Millard, 2026). Removal of existing fossil-fuel subsidies could have similar effects to a carbon tax (Parry, Black and Vernon, 2021).

Despite creating similar incentives to reduce emissions as a carbon tax, an ETS can induce greater volatility and uncertainty in headline inflation due to fluctuating permit prices (Mann, 2023). By contrast, a carbon tax typically provides a more predictable price path, which can make inflationary pressures associated with decarbonisation easier to anticipate. However, an ETS may help dampen output volatility because the effective carbon price tends to move countercyclically (Annicchiarico, Di Dio and Diluiso, 2024).

The impact of carbon pricing depends critically on how revenues are recycled. For example, the analysis presented in Box D shows that in some models if revenues from a carbon tax are used to subsidise green investment, rather than distributed as lump-sum transfers to households, the impact on inflation and output can be reduced in the short-term, attenuating monetary policy trade-offs. Such recycling can lower the cost of adopting low-carbon technologies, accelerate the reallocation of capital toward cleaner sectors, and mitigate the upward pressure on production costs that carbon pricing can initially create.

A carbon price policy that is introduced gradually over multiple years may be less likely to generate material monetary policy trade-offs. Conversely, should carbon pricing be implemented more rapidly or unpredictably, monetary policymakers may be required to take more proactive measures in addressing inflationary pressures (Box D, McKibbin *et al.*, 2020). For example, a carbon price regime that gradually ratchets up over time could lead to persistent but low-level and predictable inflationary pressure, which policymakers can more easily incorporate in forecasts and monetary policy decisions.

5 Carbon Prices and Inflation in the Euro Area, WP/24/31, February 2024.

Green support measures (subsidies & increased public investment)

Green subsidies are financial incentives offered by governments to correct externalities and promote environmentally sustainable practices, technologies, and products. They lower costs for activities like renewable energy adoption or green innovation, addressing market failures where environmental benefits are not fully priced in. Green subsidies include low-interest loans, direct payments or grants, and tax breaks.

Public subsidies to green investment can act as a positive demand shock, potentially raising output and inflation in the short run, but reducing inflation via productivity gains in the longer run. Investment subsidies can generate demand shocks by ramping up spending on green inputs like critical minerals, straining supply chains and inflating prices temporarily – so called "greenflation" (see Chapter 1). As supply chains adapt, subsidies can drive disinflation via productivity gains from green innovation and cheaper renewables. The monetary policy response will depend on the strength and timing of these second-round effects.

Subsidies that reduce the price of green inputs mainly operate as positive supply shocks, boosting output while initially reducing inflation. In this case, subsidies operate mainly through the supply side, by reducing the marginal cost of green goods and expanding productive capacity (Acemoglu *et al.*, 2012; Boehl, Budianto and Takáts, 2024; Bistline, Mehrotra and Wolfram, 2023; NGFS, 2024b). However, second-round effects may emerge: as lower prices stimulate demand for green goods, rising utilisation and input demand in the green sector can push up marginal costs, especially if supply bottlenecks exist – potentially leading to renewed inflationary pressures.

The impact of subsidies depends critically on how they are financed by governments. As set out in Box D, subsidies may operate as complementary policies to carbon pricing, potentially attenuating some of the negative effects on inflation and output. More generally, aggregate effects on demand (and inflation) are likely to be larger if subsidies are financed by government borrowing, rather than increased taxes, in the near term (Spilimbergo, Symansky and Schindler, 2009).

Relatedly, the implications of increased green public investment for monetary policy depend on how it is financed. Increased public investment would have similar effects to green subsidies, discussed above. Increased private investment could potentially crowd out consumption. In the medium-term capital deepening and R&D could deliver productivity gains, increasing potential output and reducing inflation (see Chapter 4).

Carbon border adjustment mechanisms

Carbon border adjustment mechanisms (CBAMs), or carbon border taxes, apply tariffs on carbon-intensive imported goods based on their emissions content. For the imposing jurisdiction, carbon border taxes may resemble a negative supply shock in the near term, raising input costs for import-reliant firms and increasing inflation (Dolphin and Ferrucci, 2025). CBAMs are designed to prevent carbon leakage by ensuring that imports face similar carbon costs to domestic producers. Reduced import affordability boosts demand for domestic substitutes, amplifying pressures that may warrant monetary tightening, as seen in EU CBAM projections (ECB, 2025b)[6]. A tightening of monetary policy may be required to offset inflationary pressures, depending on their persistence. Over the medium and longer term, carbon border taxes may resemble a positive supply shock by incentivising investment and innovation in green energy sectors and technologies (Keen, Parry and Roaf, 2021).

Jurisdictions on the receiving end of a carbon border tax may experience a negative demand shock, as their terms of trade deteriorate and demand for their exports falls, leading to lower output and inflation. In these jurisdictions, an easing of monetary policy may be appropriate (Krogstrup and Oman, 2019). However, exchange rate depreciation as a result of the trade shock could contribute to import inflation.

Green regulations

New green regulations (e.g., efficiency standards) can manifest as a negative supply shock, potentially driving inflationary pressure in the near-term. The extent to which monetary policy can look through this near-term pressure depends on the medium-term effects of the policy and the likelihood of second round effects. As with other transition policies, well-designed regulations could encourage capital redeployment and stimulate green innovation, which can boost potential supply and reduce inflation over time.

Other aspects of the transition

Other transition factors, such as green innovation and green preferences can also influence inflation and output, potentially requiring a monetary policy response depending on the persistence and nature of the effects. For example, increased innovation could mitigate negative impacts from other transition policies, reducing the trade-offs faced by monetary policymakers. Effective policy design by governments and gradual, credible implementation can help minimise adverse trade-offs and support both inflation and output objectives (Box D, Annicchiarico, Di Dio and Diluiso, 2024).

Energy mixes and changes in energy markets as a result of the transition to renewables can affect inflation volatility. A number of studies find that where economies derive a larger share of their energy from renewables, global fossil fuel price shocks lead to relatively less energy inflation volatility – see Box E (Owolabi *et al.*, 2021; Altunöz, 2025; Markowski and Kotliński, 2023). As energy is a major component in most inflation baskets, this would reduce trade-offs for monetary policy when fossil-fuel shocks occur. Hence, countries that transition to a higher share of renewables in their energy mix should expect to see lower inflation volatility in future, all else equal. Relatedly, as set out in Box E, increased use of Contracts for Difference can reduce the volatility of energy prices for households, leading to reduced volatility in headline inflation.

6 This conclusion is challenged by Bianchi and Coulibaly (2025), who suggest that tariffs create a fiscal externality whereby private agents over-reduce imports, and that the optimal monetary policy response may therefore be expansionary – tolerating temporarily higher inflation to offset this inefficiency.

Box D

The monetary policy implications of climate mitigation policies: results from a new quantitative analysis

This box summarises the results of a joint modelling exercise between the NGFS, IMF, Swiss National Bank and Bank of England, which highlights that climate mitigation policies, while preventing more severe economic impacts from climate change in the long-term, can generate monetary policy trade-offs in the near-term by increasing inflation and reducing output (See full report: NGFS, 2026c). These trade-offs are generally larger when agents are less forward-looking, and transition policies are more ambitious and/or uncertain. In the model, trade-offs are reduced in scale if carbon tax revenues are used to fund green subsidies. By placing greater weight on headline inflation in their reaction function, monetary policymakers can bring inflation closer to target through tighter policy, but at the cost of a greater decline in output.

The exercise leverages the IMF's Global Macroeconomic Model for the Energy Transition (GMMET) to simulate the short- to medium-term effects of transition policies that achieve GHG emission reductions in line with countries' NDC pledges. The analysis explores two policy scenarios: broad-based carbon pricing (CP) with revenue recycling to households, and more detailed policy (DP) mixes. The latter vary between regions based on announced policies, combining a more targeted carbon tax with revenue recycling into green investment and subsidies, alongside green regulations. These are modelled for four regional blocks: the euro area, oil exporting countries, China and Rest of the world. Results are compared to a baseline in which no further mitigation policies are introduced over and above policies already implemented. These scenarios do not incorporate the policies' effects on the physical impacts of climate change, which are discussed separately below.

Under the CP scenario, as governments phase in a carbon tax, headline inflation tends to rise, especially in regions with higher dependence on fossil fuels either as exporters or consumers, although, under the default model assumptions and NDC targets, the impacts are relatively small in scale (Figure D1). Output falls as a result of the carbon tax because energy becomes more expensive and productivity declines. In the model, jurisdictions with a larger gap between current policies and NDC targets implement more ambitious carbon taxes, leading to larger impacts on inflation and output, all else equal (see euro area in Figure D1).[1] If governments pursue more ambitious policies and accelerated implementation, such as to align with the Paris Agreement objectives – of which the current NDCs fall short – this is likely to lead to greater macroeconomic effects and more acute near-term trade-offs.

…/…

1 In China, the gap between the baseline scenario and additional policies needed to meet its NDC is small, resulting in relatively small macroeconomic impacts despite the high fossil fuel intensity of its economy.

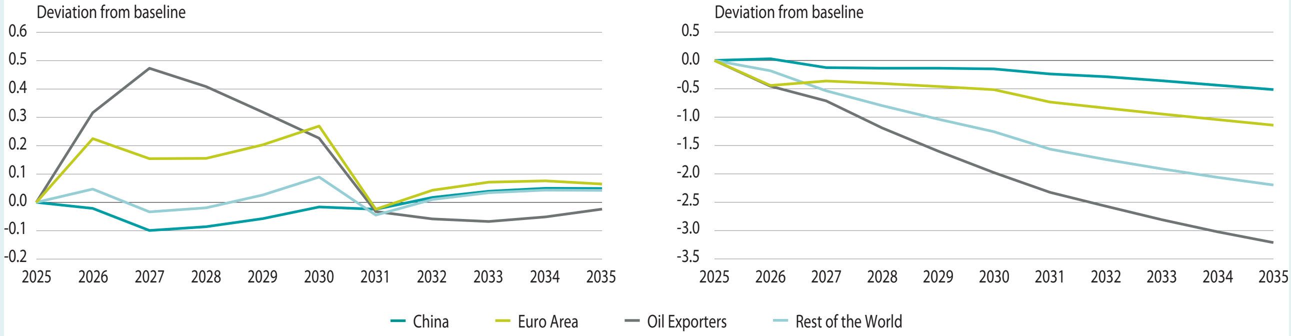
Figure D1 **A carbon tax can push up on inflation and down on output in the near-term, generating a trade-off for monetary policymakers**

(percentage points)

Headline inflation

(%)

Real GDP



Note: Impacts of carbon prices are modelled under the assumption of monetary policy "looking through" near-term increases in headline inflation. The 'looking through' approach is implemented by a Taylor rule that targets core inflation which excludes energy prices and ignores measures that directly affect consumer prices, such as EV subsidies. Under headline targeting (as in Figure D4), the rule applies a 100% weight to current period headline inflation, see NGFS (2026c).

The model relies on a range of assumptions including: agents have perfect foresight and climate policies are fully credible and anticipated, carbon tax revenues are distributed as lump-sum transfers to households, monetary policymakers balance inflation and output stabilisation in their response, and there is no accounting for the impact of reduction in physical damages related to mitigation policies. Below, we relax some of these assumptions to explore the potential macroeconomic implications.

If a carbon tax is not fully credible, or agents are uncertain about its implementation, then impacts on inflation can be larger. For example, if agents do not expect future carbon price increases in advance, the short-term impact on headline inflation in the euro area nearly doubles (see Figure D2). Impacts on output are delayed, since agents do not act early in anticipation of the future climate policy pathway, meaning that adjustments in investment and activity patterns are not frontloaded. While the magnitude of the monetary policy trade-off may not necessarily increase, the larger spike in headline inflation may pose additional challenges due to increased risks of second-round effects. …/…

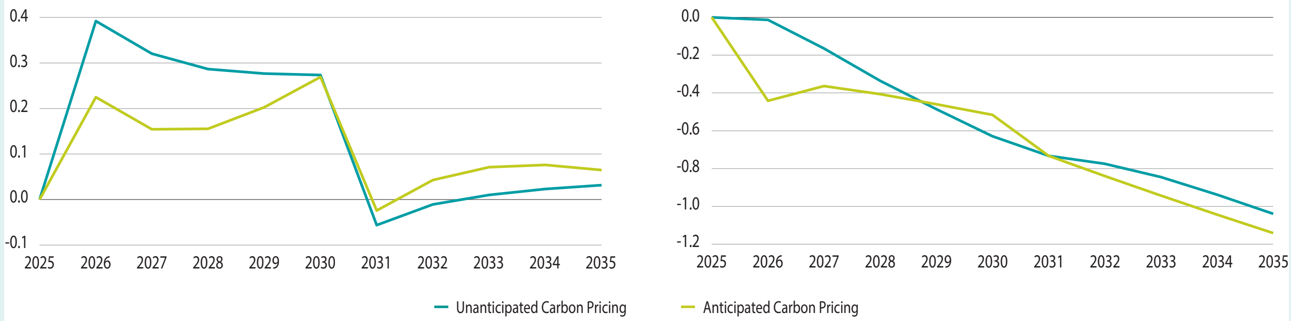
Figure D2 **If the introduction of carbon pricing is unanticipated by agents, then impacts on inflation can be larger**

(percentage points)

Headline inflation

(%)

Real GDP



Note: Comparison of euro area impacts on inflation and real GDP between a scenario where the implementation of a carbon tax is perfectly expected by agents, and a scenario where implementation is unexpected.

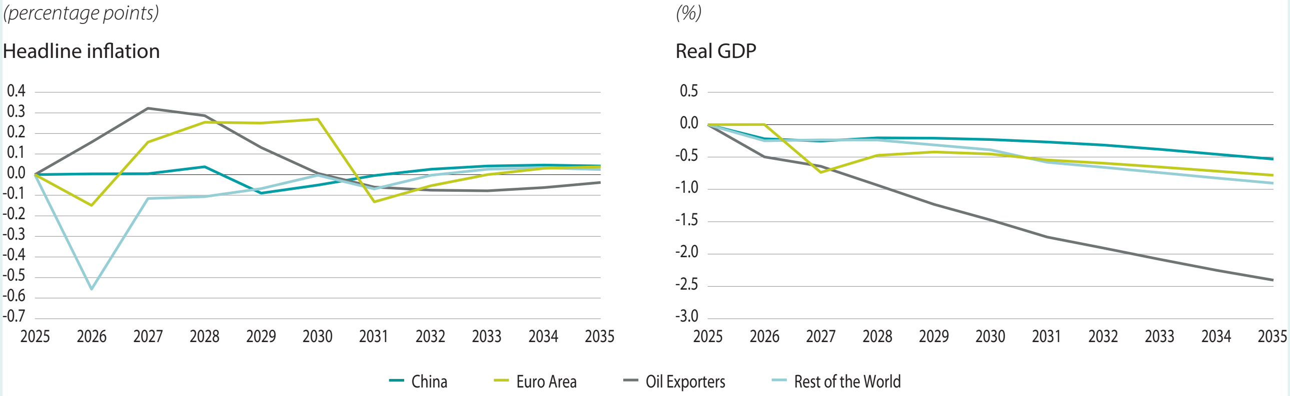
If a portion of carbon tax revenues is spent on green subsidies, as per the detailed policies (DP) scenario, then investment and GDP are generally higher, and inflationary impacts smaller, relative to the CP scenario (Figure D3). Regional impacts depend on the specific detailed policies modelled across green investment subsidies, EV incentives, and different carbon taxes, which are described in the full report (NGFS, 2026c). Regional economic structures and consumption baskets also affect the results. Carbon prices remain the primary driver of emission reductions in this scenario, and as the IMF finds, they offer the most efficient climate policy tool (see e.g., Chateau, Jaumotte and Schwerhoff, 2022; van den Bergh and Botzen, 2024).

During the phase-in of carbon prices, monetary policymakers may need to balance how strongly they act to bring inflation back to target against the impact of tighter policy on output – guided by their specific remit. The CP and DP results above assume that policymakers effectively 'look through' the first-round effects of carbon pricing on inflation, modelled as targeting core inflation in these simulations. This lessens the initial impact on GDP, but in turn leaves headline inflation above target for the duration of the carbon pricing phase-in (Figure D1). By placing greater weight on headline inflation in their reaction function, policymakers can bring inflation closer to target through tighter policy, but with a greater decline in output (Figure D4).

While mitigation policies can push down on GDP and pose trade-offs for monetary policy in the short term, accounting for avoided damages in the model highlights their benefits in the longer-term. The simulation results outlined above do not account for the reduction in economic losses associated with climate-related physical impacts as a result of reduced emissions, which are separately assessed below. As benefits from

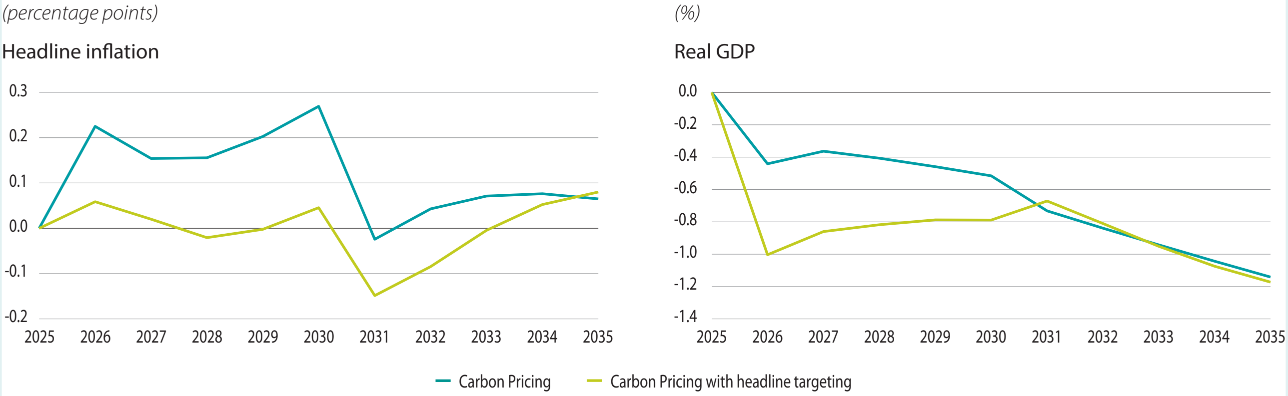
…/…

Figure D3 **Revenue recycling from carbon taxes to green subsidies under detailed policies (DP) tends to dampen impacts on inflation and output**



Note: Results for the "detailed policies" (DP) scenario under monetary policy "looking through", as proxied by targeting core inflation.

Figure D4 **Central banks can respond more aggressively to inflation, at the expense of output**



Note: Comparison of the effects of carbon prices for the euro area under monetary policy "looking through", as proxied by targeting core inflation, compared with headline inflation targeting.

avoided damages continue to accumulate over the longer term, in this simulation they produce net positive impact on global GDP by approximately mid-century, and (NGFS, 2026c). The simulations do not account for growth benefits from potential faster improvements in green technologies[2].

The analysis also considered the effects of transition on the neutral real interest rate. The results find that carbon pricing initially lowers the neutral rate by reducing aggregate investment, but in the model this effect reverses over time due to higher long-run capital intensity. These effects are discussed in Chapter 4.

Overall, the findings suggest that transition policies, while preventing more severe economic impacts from climate change in the long-term, can generate near-term inflation-output trade-offs. Under the assumptions of perfect foresight, and climate policies being credible and introduced in an orderly manner, the macroeconomic effects are relatively moderate. However, if policies are not credible or are unanticipated, the results show inflationary pressures can be materially higher. Broad-based carbon pricing generates greater trade-offs compared to policy mixes complemented with green subsidies and regulation. More ambitious policies generate greater initial trade-offs. Regions with economic structures more reliant on fossil fuels experience greater macroeconomic effects from the transition, with oil exporters facing the most adverse impacts due to their dependency on oil and gas exports, and the currency depreciation they experience as demand for these fuels drops.

2 GMMET simulations assume trend technology improvements but they do not allow for faster technological improvements if adoption of green technologies increases.

Box E

The impact of clean power on energy inflation volatility

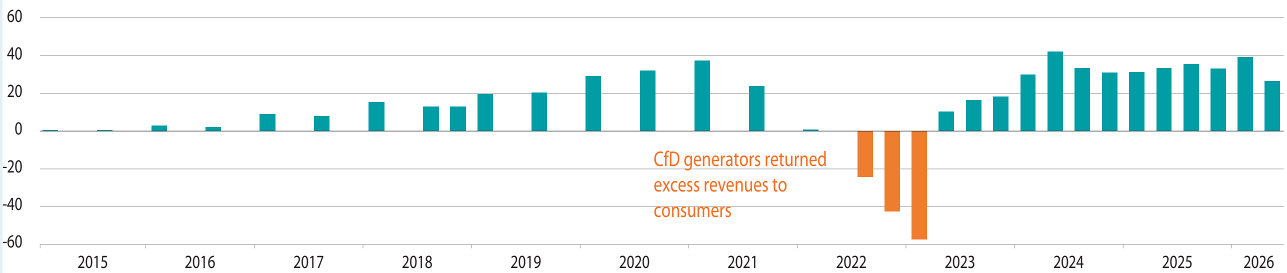
The UK's energy transition is characterised by an increase in clean power generation, much of it underpinned by Contracts for Difference (CfDs). The UK's CfDs are structured as fixed-price agreements, where generators receive a predetermined strike price for their output. If the market price falls below this strike price, consumers and firms pay the difference; conversely, if market prices rise above the strike price, generators return the excess to electricity users.

Clean power generation on fixed-price CfDs play a key role in dampening the transmission of energy price shocks into inflation. With prices fixed long-term, CfDs shield households and firms from energy shocks, thereby reducing the energy contribution to both the level and volatility of inflation. This stabilising effect is set to become increasingly significant as the share of CfDs in the electricity market expands (Low Carbon Contracts Company, 2026), making the mechanism an important

…/…

Figure E1 **Impact of CfD costs on domestic electricity bills**

CfD allowance for an average GB electricity bill under the single-rate metering (GBP)



Source: The Office of Gas and Electricity Markets (Ofgem), Bank calculations.

consideration for monetary policymakers in jurisdictions navigating the transition to low-carbon energy systems.

During the energy price shock of 2022/23, CfD-backed clean power played a critical role in mitigating the inflationary effects on UK electricity bills. As wholesale prices surged, CfD generators returned substantial excess revenues to consumers, helping to offset the broader impact of the crisis (Figure E1). However, from 2023 consumers paid more for CfD contracts than prevailing market rates, highlighting that CfDs put downward pressure on energy inflation in bad times but upward pressure in good times.

Looking ahead, a further increase in the share of electricity supplied under CfD contracts is expected. As CfD-backed generation rises, this should dampen the pass-through of short-term changes in fossil fuel prices to households and reduce inflation volatility.

2.4 Implications for exchange-rate-targeting central banks

This report focuses primarily on inflation-targeting central banks with flexible exchange rates. Climate-related shocks, as well as the transition to net zero, pose distinct challenges for policymakers in jurisdictions with less flexible exchange rates. To support the broader NGFS membership, this section discusses the impacts on such regimes and the related policy considerations.

The relationship between exchange rate flexibility and impacts of supply shocks is well covered in the literature.[7] In more rigid exchange rate regimes, the relative prices of imports and exports adjust more slowly. This reduces the ability of cheaper exports to contribute to increased domestic activity and slows the substitution away from foreign imports towards domestically produced alternatives. As a result, the economic adjustment is borne by the domestic economy, through a combination of slower economic growth, higher unemployment, weaker wage growth and other impacts. These impacts are exacerbated by sticky prices, where nominal prices of factors of production (such as wages) and output are less flexible in the short-term.

Climate-related shocks, often taking the form of supply shocks, show similar impacts in more rigid exchange rate regimes. Research exploring impacts of climate shocks on different monetary policy regimes remains a nascent topic. Nonetheless, available research shows results consistent with the general literature on supply shocks. For example, Cantelmo, Melina and Papageorgiou (2023) find that flexible inflation targeting regimes outperform hard pegs in response to natural disaster shocks. This is due to hard pegs being less able to absorb shocks through exchange rate changes, exacerbating the decline in output. In related research, Elekdag and Tuuli (2022) examine the impact of weather-related shocks under different exchange rate regimes. Results show that weather-related shocks result in a deeper and longer-lasting downturn in less flexible regimes. The underlying mechanism explaining the result was found to be the inability of the nominal exchange rate to adjust and support real export growth.

Climate-related supply shocks may increase the frequency and volume of foreign exchange intervention under rigid exchange rate regimes, necessitating larger precautionary buffers and improved forecasting of liquidity requirements. The use of foreign exchange reserves to stabilize currencies is a core operation in many central banks' policy toolkit. Approaches to assessing reserve adequacy may therefore need to be adapted to deal with challenges posed by climate-related shocks. Current approaches may need to be complemented with scenario-based approaches and forward-looking models to determine appropriate buffer sizes. In addition, application of central bank balance sheet stress testing, in order to assess policy solvency in response to such shocks, may also be used.

Accumulation of foreign exchange reserves might be challenging for some central banks in a transition scenario. In jurisdictions where transition-exposed primary commodities (e.g., oil) account for a large portion of export receipts, increasingly volatile export values may impact current accounts. Impacts of the transition may also affect financial flows and sovereign risk premia. This may affect

7 For example, see Friedman (1953), Mundell (1961) or Poole (1970).

the ability of some central banks to accumulate enough foreign reserves for defending the currency against supply shocks (Puyo *et al.*, 2024).

Heightened vulnerability to climate-related shocks in less flexible regimes necessitates policies that seek to build resilience. Central banks should assess the risks posed by such shocks and seek to build larger reserve buffers where necessary. Similarly, central banks may consider pursuing bilateral or multilateral swap lines in order to reduce vulnerability. They could also seek to strengthen policy arrangements with other policy-making institutions. Authorities should also ensure that their monetary policy implementation frameworks are sufficiently robust to handle such shocks and ensure that foreign exchange reserves are sufficiently liquid to respond to unforeseen capital outflows.

3. Climate change and monetary policy transmission

Climate change and the transition may impact key channels of the monetary transmission mechanism (MTM). Physical shocks can reduce collateral values, tighten credit conditions, increase uncertainty and constrain inter-temporal substitution, potentially weakening the effectiveness of monetary policy easing through the credit, investment, wealth and interest rate channels. Effects on monetary policy tightening are more ambiguous. Both physical hazards and the transition also have the potential to increase uncertainty and drive structural changes, affecting the MTM. For example, a shift to a greener capital stock may change the sensitivity of investment to interest rate changes.

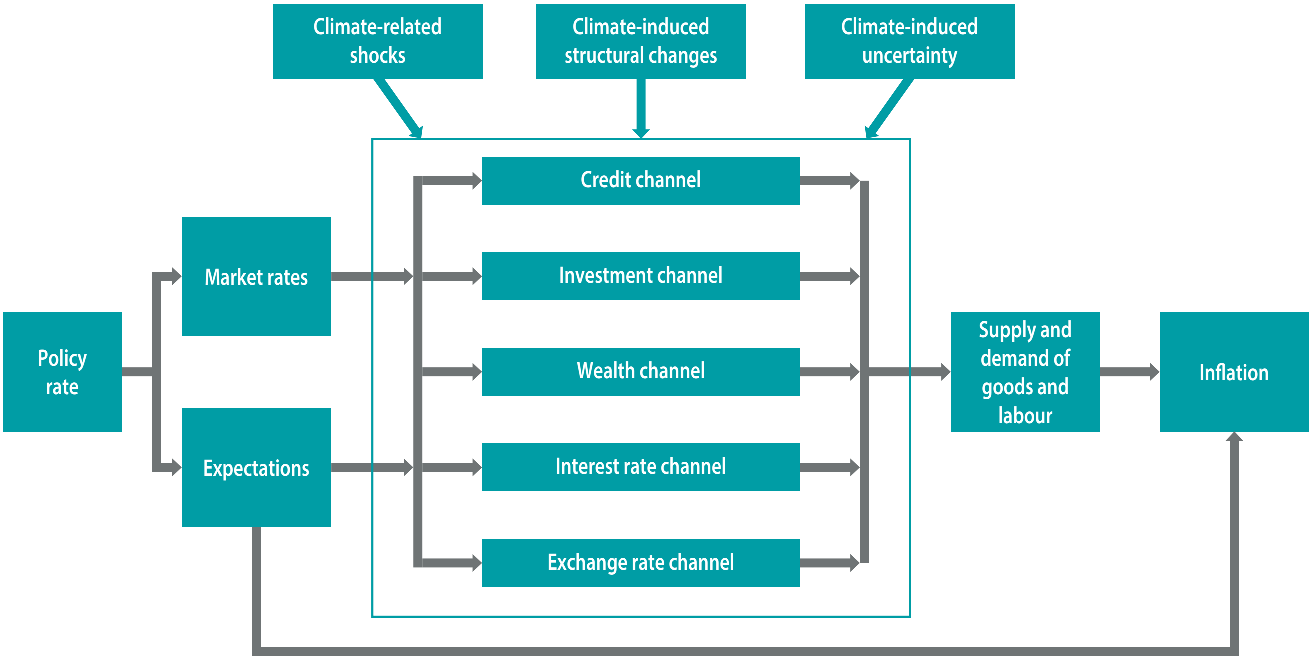
Climate change and the transition can alter the effectiveness of the monetary policy transmission mechanism (MTM) through post-shock disruption, structural changes, and increased uncertainty. The MTM refers to the process by which monetary policy influences interest rates, exchange rates, expectations, economic activity, and ultimately inflation, through various channels. These include the credit, investment, wealth, interest rate and exchange rate channels (Figure 3.1). Climate-related effects on MTM channels operate primarily through changing the elasticity of economic variables (demand, investment etc) with respect to monetary policy, either reinforcing or counteracting the direct effects of climate change discussed in the rest of this report. There are three key mechanisms through which these changes may occur. First, through disruption of transmission channels following a physical climate shock. Second, through structural changes in channels systematically exposed to physical or transition risk. And third, via the impacts of increased uncertainty as a result of climate change.

On balance, the literature suggests that physical climate shocks may weaken the pass-through of monetary policy easing, with more ambiguous effects for tightening. This is primarily driven by asset destruction increasing constraints on inter-temporal substitution and reducing the potential for agents to benefit from lower interest rates. As discussed in the rest of this report, in general climate-related shocks are more likely to require a tightening of monetary policy in response to inflationary pressures. Impacts on the pass through of tightening are more ambiguous, in part because climate-related shocks are likely to simultaneously have similar effects to policy tightening in some sectors (e.g., reducing credit supply to areas affected by a physical shock), as discussed in Chapters 1 and 2.

Climate change and the transition may drive longer-term structural changes in the economy, leading to more heterogenous and uncertain impacts across MTM channels. All channels could be affected by increased green investment, decarbonisation, stranded assets, more frequent and severe physical hazards and increased uncertainty. For example, the strength of the investment channel may change depending on whether green investment is more, or less, sensitive to interest rates than non-green investment. Impacts will vary depending on whether the transition is orderly or disorderly.

The impact of climate on the MTM will depend on a range of factors, including the type and scale of climate-related events, and the specific characteristics of the economy and financial system. For instance, in emerging market and developing economies (EMDEs), less developed financial markets, higher levels of informal activity, and potentially weaker institutional credibility mean that transmission may already be more constrained than in many advanced economies (AEs), as discussed in Chapter 2, and hence the impacts of climate change on the MTM may be a less material consideration. The remainder of this chapter draws on the nascent literature to provide an overview of how climate-related factors may affect MTM channels.

Figure 3.1 **Climate-related impacts and the monetary policy transmission mechanism**



Credit channel

Climate-related impacts can affect both supply and demand for credit, thereby influencing the strength of the credit channel. The credit channel reflects how changes in monetary policy impact banks' ability and willingness to lend. Some authors consider the credit channel to be the primary way through which climate change and the transition can affect the transmission of monetary policy to the macroeconomy (ECB, 2021). Central bank greening of monetary policy operations could also affect this channel (NGFS, 2026d).

A physical climate shock can disrupt the credit channel and potentially reduce the pass-through of monetary policy easing by damaging real estate and infrastructure, lowering collateral values and increasing default risk. These effects may reduce banks' willingness to lend and diminish borrowing capacity for both firms and households (Battiston *et al.*, 2017; Campiglio *et al.*, 2018), dampening the effects of expansionary monetary policy. Although credit demand may temporarily rise after disasters due to reconstruction needs (Berg and Schrader, 2012), credit supply often tightens as banks face higher risks and losses, further constrained by declining asset values and weakened capital and liquidity positions (Dafermos, Nikolaidi and Galanis, 2018; Brei, Mohan and Strobl, 2019). Similar dynamics could potentially strengthen the transmission of monetary policy tightening. The impacts are likely to be more pronounced in areas with higher physical risks, such as flood-prone areas, or in specific climate-exposed sectors like agriculture.

Higher property insurance premiums due to physical risks may weaken the transmission of expansionary monetary policy through the credit channel and amplify the impact of policy tightening. Extreme weather events are driving property insurance premiums higher in climate-exposed areas (Kaufman, 2026; Keys and Mulder, 2025; Kirti and Akshat, 2025). Ge, Johnson and Tzur-Ilan (2025) show that increases in insurance premiums heighten the probability of mortgage delinquency and worsen borrowers' creditworthiness, while Meisenzahl *et al.* (2026) find that higher property insurance premiums reduce both prospective and current homeowners' access to the mortgage market, and hence they are less able to take advantage of lower mortgage rates as a result of expansionary monetary policy. Damast, Kubitza and Sørensen (2025) find that physical climate hazard exposure amplifies the transmission of tighter monetary policy through homeowners' insurance. They find that contractionary monetary policy leads to higher insurance premiums because rate hikes reduce insurers' asset values and tighten their balance sheets, and that this impact is stronger in climate-exposed regions.

The transition, including the introduction of climate policies, green innovations or shifts in preferences, can also affect firms' collateral values, profitability and default risks, thereby influencing the credit channel. Transition risk can affect firms' borrowing costs (D'Arcangelo *et al.*, 2025; de Bandt *et al.*, 2025) and directly affect credit supply and demand. Differences in transition risk exposures may impact the effectiveness of the credit channel through compositional effects. For example, Altavilla *et al.* (2024) find that while unexpected monetary tightening increases credit costs and reduces lending for all firms, these effects are more pronounced – and accompanied by higher risk premiums – for firms with high emissions.

Climate-induced uncertainty complicates long-term risk assessments for both lenders and borrowers (see Chapter 5). Increased uncertainty may asymmetrically weaken the credit channel as firms become less willing to invest, even as credit conditions ease (Juelsrud and Larsen, 2023).

Investment channel

The investment channel may weaken as climate-related shocks increase capital costs and uncertainty. This channel focuses on how monetary policy affects investment through its impact on the cost of capital and Tobin's Q.[8] Physical and transition impacts can increase operational and insurance costs, shift demand, and raise uncertainty about future cash flows, thereby affecting asset valuations. Beyond their direct influence on Tobin's Q, such shocks can increase uncertainty and volatility, making firms' investment decisions more difficult by undermining the reliability of key investment indicators. As a result, firms' investments may become less responsive to changes in interest rates (Aastveit, Natvik and Sola, 2017).

As green investment grows during the transition, the strength of the investment channel will change depending on whether green investment is more, or less, sensitive to interest rates than non-green investment. Evidence on this question is mixed. Some studies suggest that green investments are more sensitive to higher interest rates than carbon-intensive investments, given that many green energy projects require significant upfront capital, have a long planning horizon, and are often highly debt-financed (Fornaro, Guerrieri and Reichlin, 2025; Barmes *et al.*, 2024; Aghion *et al.*, 2024).[9] For example, Serebriakova, Polzin and Sanders (2026) find that a rise in policy rates is associated with a decline in total installed capacity for renewables, while investments in fossil fuel, nuclear and large hydro installations are not affected. In contrast, other studies find that tighter monetary policy has a greater negative impact on the equity prices of high-emission firms than on greener firms, which, through Tobin's Q, can disincentivise investment more for the former (Bauer, Offner and Rudebusch, 2025; Benchora, Leroy and Raffestin, 2025; Döttling and Lam, 2025; Patozi, 2023). The relative insensitivity of green investments to interest rate changes may reflect the stabilizing effect of green subsidies or the fact that certain investment must be undertaken regardless of financing conditions in order to comply with new regulations, adapt to changing customer preferences, or build resilience against extreme weather events.[10] In the latter case, firms' climate investment spending may react less to increases in interest rates than to decreases, which aligns with the findings of Erlandsen, Garcia-Appendini and Kolasa (2026).

Wealth channel

Climate-related shocks can weaken the wealth channel by eroding household wealth. The wealth channel captures how changes in monetary policy influence asset prices, which in turn affect households' wealth and their consumption decisions. The aggregate strength of the wealth channel is increasing in the total wealth held by households. A physical climate shock, or increased risk of physical hazards, can trigger sharp declines in asset values such as housing in exposed areas (Chapter 1), reducing the strength of this channel.

8 Tobin's Q is a ratio that compares the market value of a firm's assets to their replacement cost, indicating whether it is cheaper to acquire existing assets or invest in new ones (Tobin, 1969).

9 In a similar vein, Dietrich, Leitenbacher and Muller (2025) argue that green durable purchases are more sensitive to interest rates than non-green durables, based on the assumption that non-green durables depreciate faster, due to transition risk, than green durables.

10 Känzig *et al.* (2025) argue that green innovation is less sensitive to short-term economic fluctuations than non-green innovation, suggesting the existence of a "green is the future" channel. This could also imply that the former is less sensitive to current interest rate changes.

Relatedly, the distribution of wealth losses across households can affect the elasticity of aggregate consumption to monetary policy changes. If households with high marginal propensity to consume (MPC) out of wealth are more exposed to physical hazards than those with low MPC – for instance, due to lower degree of insurance coverage – this can weaken further the effectiveness of policy loosening in the aftermath of a physical shock. Conversely, if climate-related factors reduce wealth and lead to households becoming more leveraged, then they may cut consumption more sharply in response to changes in monetary policy (Mian, Rao and Sufi, 2013).

Interest rate channel

If climate change and the transition lead to an increase in the stock of lending in the economy, this could strengthen the interest rate channel. The interest rate channel describes how changes in the policy rate affect real economic activity and inflation through borrowing costs and intertemporal substitution. If the transition leads to a permanent increase in the quantity of debt-financed capital, e.g., for green energy investments, then this may strengthen the interest rate channel. Similarly, reduced collateral values due to physical risk exposure and/or transition policies could make firms more reliant on external finance, increasing the impact of monetary policy changes.

However, other climate-related factors could reduce the pass-through of lower interest rates, weakening this channel. Income and wealth losses resulting from a physical climate shock can constrain affected households' intertemporal consumption decisions, limiting their ability or willingness to adjust spending in response to reduced interest rates. For example, a household facing an income reduction following an extreme weather event (Espegren *et al.*, 2026), may be unable to take advantage of a fall in mortgage rates driven by looser monetary policy.

Heightened uncertainty stemming from climate risks may also dampen households' responsiveness to changes in interest rates by increasing precautionary saving. These effects are likely to be most pronounced among households in disaster-prone areas and will also depend, amongst other factors, on their level of insurance coverage.

Exchange rate channel

Climate-induced shocks and structural changes can alter the exchange rate channel as they can affect trade and investment patterns across countries and sectors with different climate risk profiles. The exchange rate channel describes how monetary policy, by influencing capital flows and interest rate differentials, leads to movements in the exchange rate which in turn, affects import prices, export competitiveness, aggregate demand, and inflation. Climate shocks, or heightened risk of such shocks, can trigger sharp and often unpredictable currency movements, particularly in EMDEs. This increased volatility and uncertainty may weaken the link between policy rates and exchange rate dynamics (Akosah, Alagidede and Schaling, 2020).

Transition policies, such as carbon border adjustment mechanisms, have the potential to alter international trade patterns, altering the sensitivity of exchange rates to different factors. Green sectors may benefit from new market opportunities, while carbon-intensive sectors could face declining international demand, making exchange rate dynamics more sector-dependent and less predictable. In economies heavily reliant on fossil fuel exports, the transition may weaken the current account balance as energy exports decline. This can trigger exchange rate pressures, altering the historical relationship between interest rates and the exchange rate.

Over the longer term, the transition may also affect the exchange rate channel by shifting the composition of households' consumption basket of goods and services. If, for instance, the share of imported goods and services in the consumption basket increases, fluctuations in the exchange rate may have a larger impact on consumer prices. In such a case, the impact of monetary policy on inflation through the exchange rate channel may be amplified.

4. Climate change and the natural rate of interest (r*)

Climate change is likely to affect the natural rate of interest, r, through both physical damages and the transition to a low-carbon economy. These forces need not operate in the same direction, and their net effect depends on the horizon and scenario considered. In the near term, physical climate risks can put downward pressure on r* as they weigh on productivity, destroy capital and raise precautionary saving. Reconstruction, adaptation and replacement investment can partly offset this. Further out, the impact on r* depends on how successful the transition is. In delayed or disorderly transition scenarios, weaker productivity, stranded assets and heightened precautionary saving may keep r* lower for longer. In more orderly transitions, r* may still fall initially as non-green investment falls and physical shocks continue to dominate, but can later recover as productive green investment, capital reallocation, innovation and, in some cases, higher public borrowing support equilibrium real rates.*

The natural rate of interest is the real rate consistent with output at potential and inflation at target absent transitory shocks. Given that r* is unobserved, it is inferred from a combination of structural relationships and statistical filtering, and it is used in practice as a benchmark for the monetary stance and for policy-rule calibration. If climate change shifts the trend path of productivity, the composition and level of investment, or the demand for safe assets, it shifts the natural rate of interest.[11]

Transmission Channels

The key channels are best understood by distinguishing physical-risk effects from transition-related effects, and by considering how these effects evolve across horizons and scenarios. Physical-risk channels operate mainly through productivity, capital destruction, uncertainty and saving behaviour, while transition-related effects depend on adjustment costs, investment demand, innovation, policy credibility and whether the scenario involves an orderly or disorderly transition. Table 4.1 summarises the main channels through which climate change and the transition can affect r* across different horizons and scenarios. The

Table 4.1 **Key mechanisms that influence r* across horizons and scenarios**

Horizon	Main mechanisms	Direction
Near-term	• Physical shocks reduce labour productivity and accelerate depreciation; generate crop-yield losses in agriculture/vulnerable sectors.	Likely downward overall but can be partly offset by replacement demand.
	• Tail risks/uncertainty raise precautionary saving and safe-asset demand; adaptation, disaster relief and reconstruction needs can raise expected public borrowing and fiscal risk premia.	Ambiguous: downward where precautionary saving and safe-asset demand dominate; upward where expected adaptation/reconstruction borrowing or fiscal risk premia dominate.
Transition	• Stranded assets, adjustment costs, lower capital efficiency depress productivity/returns in carbon-intensive sectors.	Initially downward where adjustment costs and losses in carbon-intensive sectors dominate.
	• Policy-induced green investment in renewables, grids, transport; reallocation changes level/composition of investment demand.	Can support recovery in r* if investment is sufficiently large and productive.
	• Raises public investment; debt issuance; more safe-asset supply can push up safe yields, partly offset by higher demand for safety.	Upward pressure where public borrowing rises.
Long run	• Resources diverted to adaptation/mitigation reduce innovation; TFP weaker; but clean-tech learning-by-doing can offset.	Depends on transition success: lower r* if persistent damage and weak productivity dominate; partial recovery if innovation and reallocation succeed.
	• Labour supply effects; mortality effects; migration reallocates labour (receivers may gain).	Likely modest downward pressure overall, though effects may vary across economies.
	• Climate damages tend to hit lower-income households and vulnerable regions hardest; this can widen inequality and shift a larger share of income toward higher-saving groups, raising aggregate saving.	Potentially downward.

11 As the direction of these effects depends on the channel, horizon and scenario considered, statements about r* rising or falling should be interpreted relative to the relevant benchmark.

direction and persistence of these effects depend on the relevant benchmark, including whether physical damages continue to accumulate, and whether the transition is orderly, delayed or disorderly.

Empirical evidence

Following Reis (2026), it is useful to distinguish both the horizon of impact: i.e., effects that operate today, during the transition to a greener economy, and in the new steady state; as well as between different kinds of interest rates. In particular, climate change can shift (i) the return on capital, (ii) the safe yield on government debt, (iii) the ex post real return on nominal assets, and (iv) the neutral short-term policy rate. This distinction clarifies why empirical and model-based results can differ across studies, because they often speak to different horizons and different concepts of the natural rate.

In the near-term, climate risks, physical damages and uncertainty can affect the natural rate through productivity, investment, and safe-asset demand. On balance, these forces are more likely to put downward pressure on r* initially, although reconstruction, replacement and adaptation spending may partly offset this. Physical hazards can directly reduce productivity through damage to labour, capital, and natural resources, reducing long-run output and thereby exerting downward pressure on the natural rate (Angeli *et al.*, 2022). Physical risks such as heatwaves, droughts, and floods, can reduce labour productivity and accelerate capital depreciation. In addition, climate change introduces tail risks and uncertainty, which tends to push the natural rate down by boosting precautionary saving and discouraging investment through higher risk premia (Szoke, Xavier and Vazquez-Grande, 2024; Ferreira and Shousha, 2023; Cantelmo, 2022). Bylund and Jonsson (2020) argue that climate uncertainty increases risk premia and strengthens preferences for safe, liquid assets, which pushes the natural rate lower.

During the transition, policy-driven reallocation and near-term adjustment costs become more important. Transition risks, especially the near-term costs of decarbonisation, may depress productivity by stranding fossil-based assets, increasing adjustment costs, discouraging new investment and reducing capital efficiency (Casey, Fried and Peterman, 2024; Angeli *et al.*, 2022). At the same time, climate transition policies can spur significant new investment in green infrastructure such as renewable energy, electricity grids, and transport, thereby potentially raising the level and changing the composition of investment demand. If that investment proves sufficiently large, productive and durable, however, it can support a recovery in r* relative to the initial adjustment phase, and potentially relative to scenarios in which physical risks continue to accumulate, as capital is reallocated towards cleaner sectors and expected returns improve. These shifts primarily operate through the return on capital by changing expected returns and the allocation of capital across sectors, but they can also affect safe yields as the economy re-optimises saving and investment.

Model evidence suggests that, even when green investment rises, the net effect of the transition on r* can be negative in general equilibrium in its earlier stages, as adjustment costs and losses in carbon-intensive sectors dominate. Casey, Fried and Peterman (2024) find that a carbon tax growing at 3.5% annually can reduce the natural rate by 8-54 basis points, depending on fossil fuel price trends. Mehrotra (2025) similarly shows that the transition acts as a negative demand shock in general equilibrium, lowering the natural rate despite higher investment. Sahuc, Smets and Vermandel (2024) also find that climate mitigation raises capital obsolescence and reduces potential output, contributing to a fall in the natural rate. At the same time, these results do not imply that r* must remain lower throughout the transition. The medium-run effect depends on policy design and on whether capital is successfully reallocated towards more productive low-carbon uses. In an environment with perfect capital mobility, a carbon tax puts downward pressure on the natural rate, green subsidies put upward pressure, and policies promoting green preferences have negligible effects (Jonsson and Nilsson, 2025). With imperfect capital mobility, both a carbon tax and green subsidies put clear upward pressure on the natural rate in the green sector but downward pressure in the fossil-based sector (Jonsson and Nilsson, 2025).

Fiscal policy during the transition and in response to accumulating physical risks can also influence safe yields and the natural rate. The transition is likely to require a significant increase in public investment, and governments may issue additional debt to finance infrastructure, subsidies, reconstruction or adaptation (Garcia-Macia, Lam and Nguyen, 2024). An increase in public debt can raise the supply of safe assets, which could exert upward pressure on the natural rate through the safe-rate channel (Szoke, Xavier and Vazquez-Grande, 2024), although the net effect will depend on fiscal credibility, risk premia and the demand for safe assets. Garcia-Macia, Lam and Nguyen (2024) estimate that, even if the transition is financed by a mix of carbon-pricing and spending-based policies to deliver on net zero, public debt would still rise by around 10-15% of GDP in their model. Therefore, an orderly transition in line with the Paris Agreement would require additional debt issuance, which could put upward pressure on safe yields and the natural rate (Garcia-Macia, Lam and Nguyen, 2024; Szoke, Xavier and Vazquez-Grande, 2024). This channel suggests that, even if climate shocks and transition frictions push r* down initially, r* may later begin to recover where public borrowing raises safe-asset supply and supports productive investment.

In the new steady state, long-run productivity, labour supply, and inequality shape saving, investment, and growth, with the net effect on the natural rate depending increasingly on whether the transition ultimately proves successful and productivity-enhancing, or whether climate damages and adaptation costs continue to dominate. On the productivity side, climate change can continue to weigh on long-run output by damaging labour, capital, and natural resources (Angeli *et al.*, 2022; Bylund and Jonsson, 2020). Moreover, the reallocation of resources toward reconstruction and adaptation can reduce investment in innovation and weaken total factor productivity. However, productivity gains may also materialise over the long term from innovation in green sectors and learning-by-doing in clean technologies. Accordingly, the longer-run path of r* is likely to depend less on any single productivity channel than on whether the transition eventually succeeds in raising the productivity of new capital sufficiently to offset the drag from climate damages, adaptation needs and stranded legacy capital. Climate change can also influence investment and capital dynamics in the long run. Physical impacts can destroy capital stock through extreme weather events, raising replacement needs and adaptation costs. This destruction raises the effective depreciation rate, reduces net investment, and exerts downward pressure on the natural rate (Mongelli, Pointner and van den End, 2023). Where those losses are not offset by more productive green capital formation, r* is more likely to remain persistently below baseline; where they are offset, some recovery becomes more plausible.

Climate change may also affect the natural rate through labour supply, for example where extreme heat and natural disasters reduce labour productivity and effective labour input. To the extent that this lowers potential output and weakens investment demand, it could put downward pressure on r* over time (Angeli *et al.*, 2022). Distributional effects may also matter through saving behaviour, with the overall effect likely to depend on country circumstances and the nature of the shock.

Evidence from scenario-based simulations

A Bank of England research study (Abiry, Brandt and Dotta, 2026) quantifies the magnitudes of r* dynamics using two complementary models: Global r* (Cesa-Bianchi, Harrison and Sajedi, 2023) and GMMET (Carton *et al.*, 2023; NGFS, 2026c). Taken together, the results suggest that climate shocks are likely to lower r* relative to baseline initially, while the medium- to long-run path depends on the extent to which transition policies support a successful reallocation of capital and productivity. The Global r* approach is a structural, long-horizon framework that links r* mainly to slow-moving fundamentals such as trend productivity and public debt, using paths taken from NGFS climate scenarios[12] (i.e., Current Policies, Delayed Transition, and Net Zero 2050). GMMET[13] is a macro model used to explore transition dynamics; in this exercise, the neutral rate is interpreted as the trend component of the real policy rate and is shaped by the interaction of demand, investment and inflation dynamics. Box D presents broader results from the GMMET model.

12 NGFS Scenarios Portal.

13 GMMET uses a different scenario design i.e., an NDC pathway, so the timing and composition of shocks are not directly comparable with the Global r* model.

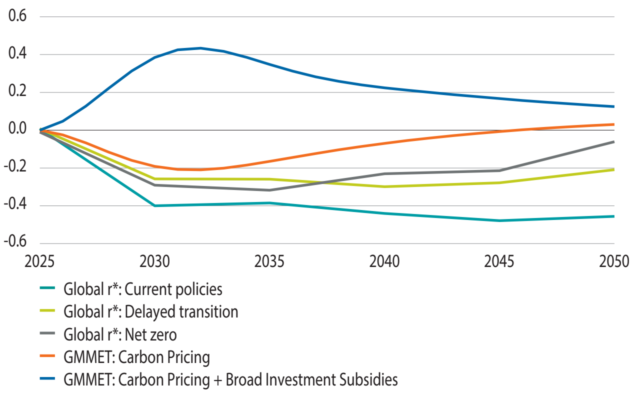
In the Global r* exercise, the natural rate declines relative to the model baseline[14] in the medium term in each NGFS scenario considered (Figure 4.1), as weaker productivity dominates the offsetting effect from higher public debt. This is followed by a partial recovery in the scenarios with more stringent climate policies ('delayed transition' and 'net zero') later in the horizon. By contrast, under 'current policies', r* remains persistently subdued and does not recover within the simulation window. This contrast shows that the longer-run path of r* depends materially on whether the transition is ultimately successful.[15] The dominant force behind these dynamics is the slowdown in productivity growth, which exerts sustained downward pressure on the marginal product of capital and hence on r*. Rising public debt works in the opposite direction by increasing the supply of safe assets and pushing up equilibrium returns, but in the baseline calibration this effect is not strong enough to overturn the productivity-driven decline. The overall importance of public debt for r* remains sensitive to the assumed government debt multiplier.[16]

GMMET dynamics broadly align with the Global r* results. In particular, they also exhibit a fall-recovery pattern in r* following the implementation of more ambitious climate policies. In the short-run, higher carbon prices raise production costs and depress investment in carbon-intensive sectors, leading to a decline in the neutral rate. Over time, however, the reallocation towards greener and more capital-intensive technologies increases investment demand, supporting a rebound in r*. Although r* experiences a quicker fall and recovery in GMMET, the overall pattern reinforces the Global r* narrative that transition policies can initially weigh on r*, but can later support a recovery as investment and reallocation effects strengthen. In an alternative scenario in which carbon pricing revenues are fully rebated in the form of investment subsidies (rather than lump-sum transfers to households), the dynamics invert and r* is initially pushed up, followed by a slow decline. The reason for the inverted dynamics is that investment subsidies more than offset negative impacts on aggregate investment from carbon pricing and lead to higher capital returns once subsidies are accounted for.

These results show that climate and transition policies can affect r* through both long-run structural factors and short-to-medium-run adjustment dynamics. Physical risk impact and transition frictions can put downward pressure on r* initially where productivity losses, uncertainty, carbon-pricing effects or adjustment costs dominate, while the longer-run path depends on whether investment, reallocation, innovation and lower future physical risk offset these forces.

Figure 4.1 **Marginal r* impacts (compared to baseline)**

(percentage points)



14 The simulation results are reported as deviations from a baseline path (so negative values indicate a lower r* than baseline at that horizon). Both models' baselines are similar. For Global r*, the baseline is the "current policies" scenario excluding physical impact, while in GMMET, the baseline is the "business-as-usual" pathway scenario, derived from historical emission trends over the past ten years.

15 These paths should therefore be read as model-specific results, reflecting the relative strength of the productivity, debt channels in the exercise.

16 In an alternative calibration where the public debt multiplier is fixed equal to the multiplier as in Rachel and Summers (2019) public debt is the dominating force in driving the results.

5. Monetary policy under climate-related uncertainty

Heightened uncertainty stemming from climate change and the transition can have implications for how monetary policymakers set policy – though the appropriate response depends on the source of that uncertainty. Uncertainty about inflation persistence can suggest that monetary policy should react more aggressively, while uncertainty about data or the monetary transmission mechanism (MTM) suggests a more cautious approach. Climate-induced uncertainty about unobservable structural factors like r could lead policymakers to place more weight on observable variables in their reaction function. In the presence of more general climate-induced uncertainty, a "robust control" approach may be appropriate, where more weight is placed on avoiding specific worst-case scenarios (e.g., strong second-round inflationary impacts from a supply shock). Scenario analysis can potentially help policymakers understand, and communicate, these risks.*

5.1 Sources and consequences of climate-related uncertainty

Climate-related uncertainty can alter the structure of the economy, affecting key economic relationships and potentially impacting the transmission of monetary policy (see Chapter 3) and the natural interest rate, r* (see Chapter 4). There are several types of climate-related uncertainty relevant to monetary policy, including uncertainty regarding the future developments of physical and transition events, and uncertainty regarding their macroeconomic impacts.

Physical climate uncertainty arises from the inherent complexity and unpredictability of the Earth's climate system. This uncertainty stems not only from climate variability but also from the challenges of accurately modelling these processes and the unpredictability of future GHG emissions. These difficulties are further amplified by the risk of tipping points, international spillovers and feedback mechanisms. Chavleishvili and Moench (2025) find that natural disasters drive substantially higher volatility of growth and inflation, as well as increased upside risk to inflation.

Transition uncertainty relates to the economic and policy disruptions associated with shifting to a low-carbon economy. This uncertainty includes: (1) *Policy uncertainty*: related to the timing, scope and coordination of future climate policies. (2) *Technological uncertainty*: around the pace of innovation in clean energy and other mitigation technologies. (3) *Market and behavioural uncertainty*: driven by evolving consumer preferences, investor sentiment and corporate strategies.

Climate-related uncertainty can reduce investment and output and increase inflation, potentially generating trade-offs for monetary policy. Previous work by the NGFS (NGFS, 2024b) highlights how uncertainty related to the timing, scope and coordination of future climate policies can delay or dampen short-term investment. Box D shows that policy uncertainty can amplify the impacts of transition on inflation and output, increasing the trade-offs faced by monetary policymakers. This finding is corroborated by Gavriilidis *et al.* (2026), which find that increased climate-related policy uncertainty transmits as a supply shock, reducing GDP and increasing inflation[17] and creating a trade-off for monetary policy.

5.2 The monetary policy implications of climate-related uncertainty

This section discusses the implications of climate-related uncertainty through the lens of the established monetary strategy literature. It is helpful to split uncertainty into data uncertainty and model uncertainty.

Data uncertainty

Data uncertainty refers to uncertainty about the true values of measured variables available to policymakers in real time (e.g., GDP, inflation), due to measurement error and subsequent revisions. Measurement of these variables may be particularly challenging in the context of climate change. For example, physical shocks may disrupt measurement of output, prices etc. in affected areas.

17 Note that this finding is in contrast to Baker, Bloom and Davis (2016)'s finding that more general uncertainty shocks transmit as demand shocks.

There are no robust general rules for how data uncertainty affects optimal monetary policy. Aoki (2003) and Orphanides (2003) both suggest that monetary policy should be set more cautiously, with a focus on stickier prices and more observable indicators respectively. Svensson and Woodford (2004) suggest placing relatively greater weight on less noisy (observable) indicators as inputs when forming estimates of unobservable variables.

Model uncertainty

Policymakers may be uncertain about the true structure of the economy, how shocks transmit through the economy, and how the economy will respond to monetary policy. As discussed in this report, climate change and the transition are likely to increase uncertainty around these aspects. The literature offers the following insights on how policy can manage different types of model uncertainty.

- **Uncertainty about inflation persistence,** for example, in the aftermath of a physical shock. Policy should be set more responsively than in the absence of this source of uncertainty (Söderström, 2002) in order to drive down the risk of inflation persistence (e.g., through anchoring inflation expectations).[18]
- **Uncertainty about the monetary transmission mechanism,** as discussed in Chapter 3. Policy should be set less responsively per 'Brainard conservatism' (Brainard, 1967). This approach reduces the risk of large policy errors and economic volatility arising from a stronger than expected MTM.
- **Unobservable variable uncertainty.** As discussed in Chapter 4, unobservable variables like r* may become more uncertain due to climate change. Similar to the case of data uncertainty, policy should be set according to a rule that is robust to persistence in the misperceptions of unobservable variables by placing less weight on estimates of them and more weight on observable variables (Orphanides and Williams, 2003). For example, placing weight on output growth or unemployment instead of the output gap, and the current policy rate instead of r*.
- **Pervasive, general model uncertainty.** If a policymaker cannot assign probabilities across competing models and is concerned about model misspecification, then a "robust control" approach may be appropriate (Hansen and Sargent, 2001, 2011) whereby policy approaches are followed that perform tolerably for the worst-case scenario within a set of plausible models (determined, for example, through analysis of simple policy rules).

Risk management

A "risk management" approach to monetary policy is one option in the face of shocks. Policymakers weigh probabilities and potential risks, then choose an action that balances expected outcomes. i.e., the policymaker "insures" against particular risks materialising. For example, the policymaker may be particularly concerned about a climate-related food-price shock leading to persistent second-round effects on inflation.

A policymaker could follow a policy approach that performs well for the mean of a set of models or scenarios or follow a 'robust' rule that delivers reasonable outcomes in each of those models/scenarios. For example, in the context of the increased frequency and severity of extreme weather events that could introduce asymmetric upside risks to inflation, De Polis, Melosi and Petrella (2025) suggest that policymakers could endeavour to shift agents' expectations counter to the direction of inflation risk, implying tighter monetary policy than in the absence of such uncertainty. Similarly, Cieslak *et al.* (2023) call for tighter monetary policy if inflation shock uncertainty rises because of climate change, as the uncertainty itself will increase inflationary pressure. Relatedly, Thakoor and Kara (2023) present a model that suggests that monetary policymakers should place greater weight on output growth stabilization when rare climate-induced disasters alter the skewness of inflation and output risks.

18 Orphanides and Williams (2008) reach a related conclusion – that a policymaker who targets only inflation stabilisation is more robust when agents are not fully rational, such that there is a risk of expectations drifting.

Alternatively, policymakers may wish to follow a policy approach that performs well in some plausible 'worst case' scenario. This would be consistent with a severe risk aversion to that particular risk crystallising. The policymaker might take this approach if they feel unable to assign probabilities to all plausible models/scenarios they face (i.e., a robust control approach, discussed above). This aligns with the precautionary principle, which prioritizes avoiding catastrophic outcomes (Type II errors) over the risk of overreacting (Type I errors) when risks are high and uncertain.

5.3 Managing climate-related uncertainty in practice

While theoretical treatments of monetary policy under uncertainty provide many valuable insights, they are often too stylised to apply in practice. Haberis *et al.* (2025), drawing on the insights of Blinder (1998), identify three 'perspectives' on the practical policy problem that policymakers may take, guided by theory – a 'forecast-based', 'news-based', and 'rules-based' perspective. 'Case-based', or analogical, reasoning can be a way to understand how to apply what they learn from one situation (or 'case', as in Gilboa and Schmeidler, 2009) – e.g., model-based simulations, theory, etc. – to real world policy problems. Further, policymakers' "trained intuition" (Solow, 1984, Faust, 2005) provides them the means through which they are able to interpret and synthesise a range of disparate inputs in setting monetary policy.

A practical way to address heightened climate-related uncertainty could be through greater use of scenario analysis. Bernanke (2024) recommends that alternative risk scenarios regularly supplement the baseline forecast to help monetary policymakers understand risks and sensitivities. Scenario analysis can be particularly helpful in the context of both physical and transition risks, given limited historical data and high future uncertainty. As discussed in Chapter 6, publicly communicating these scenarios can improve understanding of policy decisions and risks to the outlook (ECB, 2025a). Recognising this, central banks are increasingly factoring climate-related uncertainty into their policy assessments. For instance, the European Central Bank (ECB) has highlighted that extreme weather events may be a risk factor which could drive up food prices (ECB, 2024), while Banco de México regularly cites climate-related factors as upside risks to inflation forecasts (Banco de México, 2025). As part of its response to the Bernanke Review, the Bank of England has begun to make more systematic use of scenarios for monetary policy (Lombardelli, 2024; Talbot, 2025).

6. Implications of climate change for monetary policy communications

Clear communications will be essential for central banks as they respond to climate change and the transition. This chapter provides four recommendations for monetary policymakers. The first applies to all central banks, while the latter three apply to those who are confronted with climate-related shocks and need to proactively communicate on climate issues.

Recommendation 1: Monetary policymakers should clearly communicate their role in relation to climate change and the transition, given their objectives and mandate.

Recommendation 2: In their communications on climate change and the transition, monetary policymakers should acknowledge the importance of uncertainty, for example through referring to climate scenario analyses.

Recommendation 3: If faced with a climate-related shock, monetary policymakers should set out the broad factors that will determine their response, including how they plan to manage potential monetary policy trade-offs.

Recommendation 4: Central banks should tailor their communications to different stakeholders to ensure clarity and effectiveness.

Clear communications can help monetary policymakers anchor expectations and preserve credibility as they respond to climate change and the transition.[19] As discussed throughout this report, climate change may generate a range of challenges for monetary policymakers, including more frequent and severe supply-side shocks, placing additional pressure on policymakers to anchor expectations and maintain credibility. This chapter discusses four recommendations for policymakers as they respond to these challenges. The first applies to all central banks, while the latter three apply to those who are confronted with climate-related shocks and need to proactively communicate on climate issues. Box F provides a complementary overview of climate-related central bank communications over the past decade.

Recommendation 1: Monetary policymakers should clearly communicate their role in relation to climate change and the transition, given their objectives and mandate

Monetary policymakers should clearly set out their role in relation to climate change and the transition, based on their objectives and mandate. Some central banks have explicit objectives in relation to climate change, while many are affected by climate-related factors only to the extent they affect price or financial stability. Clear communications on these objectives are essential to guide public expectations, and in turn support credibility and accountability. For example, the National Bank of Belgium notes that monetary policy may face a communication challenge if the public expect central banks to actively support the transition when this is beyond their remit (Wunsch, 2024).

Central banks should clarify the division of responsibilities between themselves, government and other actors. Central banks are generally climate policy-*takers* – i.e., climate-related policies are set by government, and central banks take these as given when setting policy. Several central banks have been explicit on this point, emphasizing that political authorities bear the main responsibility for climate action and possess the most effective tools to address climate change (Norges Bank, 2024).

Many central banks have already highlighted the importance of aligning communications with their mandate and remit, including through NGFS communications. For example, the Central Bank of Ireland has emphasised that its role is to ensure that the financial system is resilient to the risk posed by climate change and to understand the macroeconomic implications for the setting of monetary policy (Makhlouf, 2022). Many central banks communicate that central banks can contribute to the transition by ensuring low and stable inflation, providing the

19 The broader literature on monetary policy communication highlights its role in enhancing policy effectiveness by anchoring and steering expectations (Blinder, 2001; Woodford, 2005; Blinder *et al.*, 2008), and supporting central bank accountability, public trust, and independence (Blinder *et al.*, 2024).

macroeconomic stability that forms a necessary foundation to support green investment (Talbot, 2025; ECB 2025a; Nagel, 2023).

Recommendation 2: In their communications on climate change and the transition, monetary policymakers should acknowledge the importance of uncertainty, for example through referring to climate scenario analyses

By communicating openly about the uncertainty introduced by climate change and the transition, central banks will be better positioned to explain their response when shocks occur. As discussed in this report, climate shocks may have complex effects that require careful management of trade-offs, which can be challenging to explain to the public. Many central banks are already publicly discussing these complexities, laying the groundwork for more detailed explanations of their policy response when shocks occur. Arseneau, Drexler, and Osada (2022) observe that speeches addressing climate-related issues by central banks tend to employ language reflecting uncertainty at a higher rate compared to other types of speeches. Lagarde (2026) and Nagel (2023) are among central bankers that have noted that climate-related changes may elevate uncertainty. Furthermore, several central banks note that climate-related factors pose risks to the inflation outlook in their economic outlooks or monetary policy reports (see for instance Bank of Japan, 2025; ECB, 2024; Banco de México, 2025).

Central banks can illustrate this uncertainty, and the trade-offs shocks may generate, through referring to scenario-based analyses.[20] Scenarios can help shift communication towards risks, alternative outcomes, and uncertainty, rather than point estimates. Recent BIS analysis highlights that, in an environment of heightened global uncertainty and complex cross-border transmission channels, clear scenario-based communication can help policymakers and markets distinguish temporary shocks from more persistent risks to inflation and financial conditions (Bell *et al.*, 2026). Scenarios can also highlight upside and downside risks, model uncertainty and structural change, and the factors that could lead to a change in policy stance (Bernanke, 2024). However, it is important to note that scenario analysis is not without limitations as it can potentially exacerbate uncertainty if not formulated and communicated clearly (English, 2025). Choosing whether to publish climate scenarios should be consistent with how each central bank chooses to communicate more broadly on monetary policy issues.

Recommendation 3: If faced with a climate-related shock, monetary policymakers should consider setting out the broad factors that will determine their response, including how they plan to manage potential monetary policy trade-offs that arise from climate-related shocks

Communication about the factors central banks will consider when responding to climate change and the transition will help agents understand central banks' reaction functions during a climate-related shock. In turn, this will help enhance the predictability of the central bank's actions, anchor inflation expectations, and support informed decision making by economic agents. These communications could be built on the analytical framework set out in Chapter 2, adapted to individual jurisdictions. Explaining how climate change could affect monetary policy over different time horizons would help clarify which developments are most relevant for near-term policy decisions and which are better understood as part of a broader framework.

Central banks could explain how climate-related shocks can lead to a trade-off between stabilising inflation and supporting output, noting similarities and differences with other supply-side shocks. For instance, a central bank could re-iterate its mandate and explain that it will "look through" the first-round effects of a one-off extreme weather event, while making clear that it would respond if second-round inflationary pressures are expected. Several central banks have communicated along these lines. For instance, the Reserve Bank of Australia explained its decision to "look through" a temporary rise in inflation driven by cyclone-induced banana shortages, while noting that climate change represents a more persistent trend, making such assessments more complex if supply shocks

20 Scenarios are an important tool in the face of increasing supply-side shocks (Bank of England, 2024) and are being used increasingly in central bank communication more generally, see Bank of Canada (2025) and Lombardelli (2025) for recent examples.

become longer lasting (Debelle, 2019). The Reserve Bank of India found that repeated weather shocks made food price inflation more persistent and has communicated that a stronger monetary policy response may be warranted in such circumstances (Patra, John and George, 2024). The ECB has highlighted that the transition could lead to sustained energy price inflation, potentially requiring a tightening of monetary policy to keep inflation expectations anchored (Schnabel, 2022).

Communications about central banks' reaction functions could also include sharing information about how climate change is incorporated into the broader monetary policy framework. This could include analysis of how climate change may impact key monetary policy variables such as potential output and the natural interest rate (r*) as well as the transmission mechanism. Among others, the ECB and the Riksbank have explicitly acknowledged climate change's implications for their monetary policy framework (ECB, 2021; The Riksbank, 2025).

Recommendation 4: Central banks should tailor their communications to different stakeholders to ensure clarity and effectiveness

Communication effectiveness is enhanced by tailoring messages to the expertise and interests of different audiences. For example, information about the central bank's reaction function and analytical framework may be shared with market participants, while broad principles can be communicated to the general public and politicians to increase legitimacy and trust. Furthermore, when engaging with the general public, plain language and accessible illustrations are valuable tools for conveying how climate-related developments may affect inflation and the broader economy. Several central banks regularly publish "monetary policy at a glance" summaries that distil key messages for non-specialist readers, which could, when relevant, also include how climate-related factors affect the economic outlook and policy response, see the Bank of Uganda (2022) for an example.

Box F

An overview of central bank communication about climate change

Central banks have been communicating about the importance of climate change for their objectives for more than a decade. Mark Carney's 2015 speech, "Breaking the tragedy of the horizon – climate change and financial stability," (Carney, 2015) is often seen as pivotal for putting climate change on central banks' agendas, though some – especially in Southeast Asia – had addressed climate issues since the mid-2000s. Deepening interest in the subject has been reflected in the number of speeches: between 2018-19, there were 23 central bank speeches on these subjects, with the majority (13) coming from the Eurosystem (Kyriakopoulou, 2020). Central bank communication on climate-related risks surged through to 2021, peaking at around 550 speeches a year (Campiglio *et al.*, 2025).[1] When monetary policy is discussed in central bank speeches on climate change, it is often in relation to how climate-related changes affect economic activity or brings about structural shifts, with implications for productivity and the natural interest rate (Arseneau, Drexler, and Osada, 2022).

Central banks cover a wide range of climate-related topics in their communications, from the effects of climate change on the economy to financial innovation, sustainable finance, monetary policy, and central bank mandates. (Kyriakopoulou, 2020; Arseneau, Drexler and Osada, 2022, Campiglio *et al.*, 2025). Central banks in developing and emerging economies, as well as those supervising international financial hubs, tend to adopt a more 'promotional' perspective and promote green finance opportunities as drivers of economic development, reflecting stronger market involvement and adherence to political strategies (Dikau and Volz, 2021). In contrast, central banks in high-income economies often take a 'prudential' approach, focusing on climate-related financial risks, in line with their independence and narrower mandates. Feldkircher and Teliha (2024) note that more independent central banks engage more intensively in climate-related communication.

1 Campiglio *et al.* (2025) review 35,487 speeches delivered by 131 central banks over the period 1986-2023.

7. Responding to climate-related events in practice: a guide for monetary policymakers

This chapter translates the analytical framework set out in this report into a practical step-by-step process that monetary policymakers can follow when responding to a climate-related event (Figure 7.1). The framework is designed to be applied flexibly: all climate-related shocks are unique, and policymakers should draw creatively on the available evidence and analytical tools to inform their assessment.

Figure 7.1 **A step-by-step process for responding to climate-related events**

Steps	Example: Localised destruction of crops due to flooding
1 Identify the shock	• Identify key features of the shock including regions and sectors affected, expected duration, magnitude etc. • Assess whether shock has compounding impacts with other shocks (e.g., energy price shock).
2 Assess the propagation of the shock	• Assess the adequacy of the monetary stance and expected first and second-round effects on inflation and output, including impacts on inflation expectations. Draw on modelling, case studies and academic research to form these judgements. • In this specific example, first-round effects include direct impact on food prices. Second-round effects may be material, depending on weight of specific crop in households' consumption basket, salience of affected prices and spillovers to other sectors (e.g., restaurants). • Take account of fiscal response, insurance etc, and potential longer-term impacts on r* and uncertainty.
3 Assess whether a monetary policy trade-off arises	• Are material second-round effects on inflation expected? If so, a policy response may be necessary. Weigh this against impact of policy tightening on output. • Assess trade-off over time in context of remit and other institutional, cyclical and structural factors. • Evaluate potential impacts of the shock on the transmission of monetary policy.
4 Set monetary policy & communicate decision	• Explain policy decision in context of the monetary policy remit and expected impacts on inflation and output over time. • Explain that future policy decisions will be contingent on realised inflation, measures of inflation expectations and other factors.
5 Monitor & reassess	• Monitor whether economy is evolving in line with expectations. Track food prices, second-round effects, changes in households' consumption basket etc. • Adjust policy in response to data developments, including measures of inflation expectations. • Draw on external expertise to assess probability of repeated / compounding shocks. • Monitor longer-term impacts (e.g., impact of uncertainty, structural changes).

Step 1: Identify the shock. The first step is to identify the key features of the shock, drawing on the factors set out in Table 2.2. Policymakers should consider the type of shock (acute physical, chronic physical, or transition-related), its magnitude, regions and sectors affected, expected duration, and the degree to which its inflationary and output impacts are likely to persist. Relevant questions include: Is this a one-off event or part of a pattern of increasingly frequent or severe shocks? Are other shocks occurring simultaneously that may compound the effects (e.g., energy price shock)?

Step 2: Assess the propagation of the shock. The second step is to assess to what extent the impacts are expected to be restricted to first-round and/or relative-price effects, or whether they are likely to generate more persistent second-round effects that may warrant a monetary policy response. As set out in Chapter 2, this will depend on a range of factors including the scale and persistence of the shock identified in step 1, the salience of affected prices, the nature of any fiscal response, the resilience threshold of the economy and the business cycle position when the shock hits. In the example in Figure 7.1, a shock to agriculture, and hence food prices, may be more likely to lead to second-round effects, given the salience of these prices for households. Forecasting second-round effects is challenging in practice. To inform their analysis, policymakers can draw on a range of inputs, including internal modelling and scenario analysis, case studies, academic and policy research, and other quantitative and qualitative analysis.

Step 3: Assess whether a monetary policy trade-off arises. Drawing on the analysis in step 1 and 2, the policymaker can assess whether a monetary policy trade-off is expected to arise. This judgement will be influenced by the factors set out in Table 2.3. For example, the central bank's mandate and remit is foundational for assessing the scale and materiality of any trade-off. Policymakers' preferences also matter – in particular, the relative weight placed on inflation and output stabilisation (the "lambda" parameter discussed in Chapter 2), and the weight placed on avoiding longer-term economic scarring from sustained periods of weak demand. The degree of uncertainty around the impact of the shock will also affect this judgement.

Step 4: Set monetary policy and communicate the decision. Drawing on this assessment, policymakers can determine the appropriate monetary policy response and the accompanying communications strategy. The key aspects of such a strategy are discussed in Chapter 6 and include acknowledging complexities and setting out the broad factors that will affect policy decisions. Clear communications can help anchor inflation expectations and build public understanding of the central bank's reaction function.

Step 5: Monitor and reassess. Following the decision, policymakers should monitor incoming data and stand ready to reassess their stance as new information on the shock's evolution becomes available. In particular, policymakers should assess how first-round inflationary effects are propagating through the economy, how inflation expectations are evolving and any longer-term structural consequences of the shock. External experts may be able to provide advice on whether similar repeated shocks are likely to occur again in the near future, potentially leading to persistent and/or compounding effects.

Conclusion

Climate change and the transition to net zero emissions are reshaping the macroeconomy, with important implications for the economy and monetary policy. As physical climate impacts intensify and the transition gathers pace, the implications for inflation and output are becoming more material for central banks.

Monetary policymakers should respond to climate-related shocks as they would to any other shock: by assessing the expected impacts on inflation and output over time. Climate-related shocks can potentially generate trade-offs for monetary policymakers between stabilising inflation and output, particularly when they manifest as negative supply shocks. Modelling and scenario analysis can help shed light on how impacts propagate and support policy judgements under uncertainty.

This report presents a framework to assess climate-related shocks. It brings together analytical insights, quantitative evidence and practical guidance to help central banks assess climate-related shocks, understand when trade-offs are likely to arise, and judge how those trade-offs should be managed within the context of their mandate, the state of the economy and the response of other policymakers.

Physical impacts, such as acute weather events and chronic shifts in climate patterns, can degrade productivity and disrupt supply chains, resulting in inflationary pressures and output losses. These shocks may be increasingly hard for central banks to look through as they become more frequent, severe and persistent, and as second-round effects become more material. Their macroeconomic consequences are likely to differ across countries depending on economic structure, resilience and fiscal capacity.

Transition impacts, arising from policies like carbon pricing and green subsidies, or changes in consumers' preferences, can also affect inflation and output through relative price changes, sectoral reallocation and changes in investment. The scale and persistence of these effects depend critically on the type, pace and credibility of governments' mitigation policies.

Climate change and the transition can also affect the monetary transmission mechanism, the natural rate of interest and the degree of uncertainty facing policymakers. Physical shocks and transition dynamics may alter transmission channels, while structural change, precautionary saving, investment needs and productivity effects may influence r*. Heightened uncertainty about shocks, their persistence and the structure of the economy make scenario analysis and robust analytical frameworks especially valuable.

Clear communications are essential for central banks as they respond to climate change and the transition. Clear communication can help explain the role of central banks in relation to climate change and the transition, set out how climate-related developments affect the outlook for inflation and activity, and clarify the factors shaping the monetary policy response. This is important for maintaining credibility, anchoring expectations and supporting public understanding in an environment of heightened uncertainty.

In summary, as climate change and the transition increasingly impact the macroeconomy, this will have important consequences for monetary policy. While there is considerable uncertainty about the scale and persistence of these effects, they are likely to amplify the challenges posed by a series of supply shocks in recent years. By deepening their analytical frameworks, making effective use of modelling and scenario analysis, and communicating clearly within the boundaries of their remits, central banks can help ensure that monetary policy remains credible, effective and resilient in a changing world.

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References

Aastveit, K. A., Natvik, G. J. and Sola, S. (2017)
Economic uncertainty and the influence of monetary policy, Journal of International Money and Finance, Volume 76, pp. 50-67.
https://doi.org/10.1016/j.jimonfin.2017.05.003

Abiry, R., Brandt, L. and Dotta, V. (2026)
Forthcoming, Bank of England.

Acemoglu, D., Aghion, P., Bursztyn, L. and Hemous, D. (2012)
The Environment and Directed Technical Change, American Economic Review, Vol. 102(1), pp. 131-166.
https://doi.org/10.1257/aer.102.1.131

Aghion, P., Hemous, D. and Kharroubi, E. (2014)
Cyclical fiscal policy, credit constraints, and industry growth. Journal of Monetary Economics. Vol 62, March, pp. 41-58
https://doi.org/10.1016/j.jmoneco.2013.12.003

Aghion, P., Bergeaud, A., De Ridder, M. and Reenen, J. V. (2024)
Lost in Transition: Financial Barriers to Green Growth. INSEAD Working Paper No. 2024/16/EPS.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4771433#

Akosah, N. K., Alagidede, P. and Schaling, E. (2020)
Interest rate and exchange rate volatility spillovers: Multiscale perspective of monetary policy transmission in Ghana. Journal of Central Banking Theory and Practice, 9(1), pp. 135-167. DOI: 10.2478/jcbtp-2020-0008.

Alberola, E. and Urrutia, C. (2020)
Does informality facilitate inflation stability?, Journal of Development Economics, Volume 146.
https://doi.org/10.1016/j.jdeveco.2020.102505

Allen, T., Dées, S., Caicedo Graciano, C. M., Clerc, L., de Gaye, A., Lisack, N., Pegoraro, F. and Rabaté, M. (2024)
An analytical framework for assessing climate transition risks: an application to France. Review of World Economics 162, pp. 183-239.
https://doi.org/10.1007/s10290-024-00540-w

Altavilla, C., Boucinha, M., Pagano, M. and Polo, A. (2024)
Climate risk bank lending and monetary policy, European Central Bank Working Papers No. 2969.
https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2969~0f4c56a156.en.pdf

Altunöz, U. (2025)
Do renewables reduce energy cost pass-through? Evidence from wind-solar penetration and PPI-to-CPI transmission in a multi-country panel. **International Journal of Social Sciences**, 9(41).
https://doi.org/10.52096/usbd.9.41.34

Anesti, N., Esady, V. and Naylor, M. (2025)
Food prices matter most: sensitive household inflation expectations, Bank of England Staff Working Paper No. 1125.
https://www.bankofengland.co.uk/working-paper/2025/food-prices-matter-most-sensitive-household-inflation-expectations

Angeli, M., Archer, C., Batten, S., Cesa-Bianchi, A., D'Aguanno, L., Haberis, A., Löber, T., Maxwell, S., Sajedi, R., Van der Merwe, M., Wanengkirtyo, B. and Young, C. (2022)
Climate Change: Possible Macroeconomic Implications. Bank of England Quarterly Bulletin 2022 Q4.
https://www.bankofengland.co.uk/quarterly-bulletin/2022/2022-q4/climate-change-possible-macroeconomic-implications

Annicchiarico, B., Di Dio, F. and Diluiso, F. (2024)
Climate actions, market beliefs, and monetary policy. Journal of Economic Behavior & Organization, Volume 218, February, pp. 176-208.
https://doi.org/10.1016/j.jebo.2023.12.003

Aoki, K. (2003)
On the optimal monetary policy response to noisy indicators. Journal of Monetary Economics Volume 50, Issue 3, April, pp. 501-523.
https://doi.org/10.1016/S0304-3932(03)00023-0

Arseneau, D. M., Drexler, A. and Osada, M. (2022)
Central Bank Communication about Climate Change. Finance and Economics Discussion Series 2022-031, Board of Governors of the Federal Reserve System.
https://www.federalreserve.gov/econres/feds/central-bank-communication-about-climate-change.htm

Baker, S. R., Bloom, N. and Davis, S. J. (2016)
Measuring Economic Policy Uncertainty. The Quarterly Journal of Economics, Volume 131, Issue 4, November 2016, pp. 1593-1636.
https://doi.org/10.1093/qje/qjw024

Ball, L. (2014)
Long-Term Damage from the Great Recession in OECD Countries. European Journal of Economics and Economic Policies: Intervention, Vol. 11, No. 2, pp. 149-160.

Banco de México (2025)
Monetary Policy Statement, November 6, 2025.
https://www.banxico.org.mx/publications-and-press/announcements-of-monetary-policy-decisions/%7B80D0AFF9-2BD6-F24D-889E-7DB5C462A13C%7D.pdf

Bandera, N., Barnes, L., Chavaz, M., Tenreyro, S. and von dem Berge, L. (2023)
Monetary policy in the face of supply shocks: the role of inflation expectations. Paper presented at the ECB Forum on Central Banking, Sintra.
https://www.ecb.europa.eu/press/conferences/ecbforum/shared/pdf/2023/Tenreyro_paper.pdf

Bank of Canada (2025)
Monetary Policy Report – April 2025.
https://www.bankofcanada.ca/wp-content/uploads/2025/04/mpr-2025-04-16.pdf

Bank of England (2025)
Financial Stability Report – December.
https://www.bankofengland.co.uk/financial-stability-report/2025/december-2025

Bank of Japan (2025)
Outlook for Economic Activity and Prices – April 2025.
https://www.boj.or.jp/en/mopo/outlook/index.htm

Bank of Uganda (2022)
Monetary policy statement – At a glance, August, 2022.
https://www.bou.or.ug/bouwebsite/bouwebsitecontent/MonetaryPolicy/Monetary-Policy-Statements-At-a-Glance/2022/Aug/MPS-at-a-glance.pdf

Barmes, D., Claeys, I., Dikau, S. and da Silva, L. A. P. (2024)
The case for adaptive inflation targeting: monetary policy in a hot and volatile world. London: Centre for Economic Transition Expertise (CETEx), London School of Economics and Political Science.

Bartocci, A., Cantelmo, A., Cova, P. and Pisani, M. (2026)
Macroeconomic Effects of the Green Transition in the Euro Area and Critical Mineral Bottlenecks (April 23). Bank of Italy Temi di Discussione (Working Paper) No. 1531.
https://ssrn.com/abstract=6672759

Batten, S. and Millard, S. (2026)
Productivity implications of the move to net zero. Bank of England Staff Working Paper No. 1,171.
https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2026/productivity-implications-of-the-move-to-net-zero.pdf

Battiston, S., Mandel, A., Monasterolo, I., Schütze, F. and Visentin, G. (2017)
A climate stress-test of the financial system. Nature Climate Change, 7(4), 283-288.
https://doi.org/10.1038/nclimate3255

Bauer, M., Offner, E. A. and Rudebusch, G. D. (2025)
Green stocks and monetary policy shocks: Evidence from Europe, European Economic Review, Volume 177.
https://doi.org/10.1016/j.euroecorev.2025.105044

Bell, S., Chavaz, M., Hofman, B., Rees, D. and Rottner, M. (2026)
Evolving approaches to monetary policy communication in the face of uncertainty: fan charts, scenarios and guidance. BIS Quarterly Review, 16 March.
https://www.bis.org/publ/qtrpdf/r_qt2603b.htm

Benchora, I., Leroy, A. and Raffestin, L. (2025)
Is monetary policy transmission green? Economic Modelling, Vol 144 (c).
https://doi.org/10.1016/j.econmod.2024.106992

Berg, G. and Schrader, J. (2012)
Access to credit, natural disasters, and relationship lending. Journal of financial intermediation, 21(4), pp. 549-568.
https://doi.org/10.1016/j.jfi.2012.05.003

Bernanke, B. S. (2024)
Forecasting for monetary policy making and communication at the Bank of England: a review.
https://www.bankofengland.co.uk/independent-evaluation-office/forecasting-for-monetary-policy-making-and-communication-at-the-bank-of-england-a-review

Bems, R., Caselli, F., Grigoli, F. and Gruss, B. (2021)
Expectations' anchoring and inflation persistence, Journal of International Economics, Volume 132.
https://doi.org/10.1016/j.jinteco.2021.103516

Bettarelli, L., Fuceri, D., Pisano, L. and Pizzuto, P. (2024)
Greenflation: Empirical Evidence using Macro, Regional and Sectoral Data. CEPR Discussion Paper 19643.
https://cepr.org/publications/dp19643

Bianchi, J. and Coulibaly, L. (2025)
The Optimal Monetary Policy Response to Tariffs, NBER Working Paper No. 33560.
https://doi.org/10.3386/w33560

BIS (2022)
Inflation: a look under the hood, Chapter II in BIS Annual Economic Report, June.
https://www.bis.org/publ/arpdf/ar2022e2.htm

Bistline, J., Mehrotra, N. and Wolfram, C. (2023)
Economic Implications of the Climate Provisions of the Inflation Reduction Act. Brookings Papers on Economic Activity, Spring.
https://www.brookings.edu/wp-content/uploads/2023/03/BPEA_Spring2023_Bistline-et-al_unembargoedUpdated.pdf

Black, S., Parry, I. and Zhunussova, K. (2022)
More Countries Are Pricing Carbon, but Emissions Are Still Too Cheap. International Monetary Fund, IMF Blog.
https://www.imf.org/en/blogs/articles/2022/07/21/blog-more-countries-are-pricing-carbon-but-emissions-are-still-too-cheap

Blinder, A. S. (1998)
Central Banking in Theory and Practice.
https://mitpress.mit.edu/9780262522601/central-banking-in-theory-and-practice/

Blinder, A. S. (2001)
Talking about Monetary Policy: The Virtues (and Vices?) of Central Bank Communication. Paper presented at the BIS Annual Conference, Lucerne, Switzerland.
https://www.bis.org/events/conf080626/blinder.pdf

Blinder, A. S., Ehrmann, M., Fratzscher, M., De Haan, J. and Jansen, D.-J. (2008)
Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence. Journal of Economic Literature, 46(4), pp. 910-945.
https://www.aeaweb.org/articles?id=10.1257/jel.46.4.910

Blinder, A. S., Ehrmann, M., De Haan, J. and Jansen, D.-J. (2024)
Central Bank Communication with the General Public: Promise or False Hope? Journal of Economic Literature, 62(2), pp. 425-457.
https://www.aeaweb.org/articles?id=10.1257/jel.20231683

Boehl, G., Budianto, F. and Takáts, E. (2024)
The macroeconomics of green transition, BIS Working Papers No. 1237.
https://www.bis.org/publ/work1237.htm

Brainard, W. C. (1967)
Uncertainty and the Effectiveness of Policy. American Economic Review 57(2). pp. 411-425.
https://www.jstor.org/stable/1821642

Breckenfelder, J., Maćkowiak, B., Marqués-Ibáñez, D., Olovsson, C., Popov, A., Porcellacchia, D. and Schepens, G. (2023)
The climate and the economy. European Central Bank Working Paper Series 2793.
https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2793~7969efec4f.en.pdf

Breeden, S. (2025)
Weathering the storm: stability in a changing climate. Remarks given at the Chapman-Barrigan lecture.
https://www.bankofengland.co.uk/speech/2025/july/sarah-breeden-speech-at-the-annual-chapman-barrigan-lecture-series

Brei, M., Mohan, P. and Strobl, E. (2019)
The impact of natural disasters on the banking sector: Evidence from hurricane strikes in the Caribbean. The Quarterly Review of Economics and Finance, 72(C), pp. 232-239.
https://doi.org/10.1016/j.qref.2018.12.004

Bylund, E. and Jonsson, M. (2020)
How Does Climate Change Affect the Long-Run Real Interest Rate? Sveriges Riksbank Economic Commentaries, No. 11.
https://www.riksbank.se/globalassets/media/rapporter/ekonomiska-kommentarer/engelska/2020/how-does-climate-change-affect-the-long-run-real-interest-rate.pdf

Cai, W. *et al.* (2021)
Changing El Niño-Southern Oscillation in a warming climate. Nature Reviews Earth and Environment, 2, pp. 628-644.
https://doi.org/10.1038/s43017-021-00199-z

Calcaterra, M., Consiglio, A., Martorana, V., Tavoni, M. and Zenios, S. A. (2025)
Sovereigns on thinning ice: Debt sustainability, climate impacts and adaptation. Working Paper No. 06/2025, Bruegel.
https://www.bruegel.org/working-paper/sovereigns-thinning-ice-debt-sustainability-climate-impacts-and-adaptation

Campiglio, E., Heise, F., Masi, D. and Schuermann, T. (2018)
Beyond carbon pricing: The role of banking regulation in the decarbonization of the economy. Climatic Change, 151(1), pp. 83-100.
https://doi.org/10.1016/j.ecolecon.2015.03.020

Campiglio, E., Deyris, J., Romelli, D. and Scalisi, G. (2025)
Warning words in a warming world: Central bank communication and climate change, European Economic Review, Volume 178.
https://doi.org/10.1016/j.euroecorev.2025.105101

Cantelmo, A. (2022)
Rare Disasters, the Natural Interest Rate and Monetary Policy. Oxford Bulletin of Economics and Statistics, Volume 84, pp. 473-496.
https://doi.org/10.1111/obes.12490

Cantelmo, A., Fatouros, N., Melina, G. and Papageorgiou, C. (2024)
Monetary Policy Under Natural Disaster Shocks. International Economic Review, Volume 65, Issue 3, August, pp. 1441-1497.
https://doi.org/10.1111/iere.12694

Cantelmo, A., Melina, G. and Papageorgiou, C. (2023)
Macroeconomic outcomes in disaster-prone countries. Journal of Development Economics, Volume 161, March.
https://doi.org/10.1016/j.jdeveco.2022.103037

Cantelmo, A., Lin, A. and Zanetti, F. (2026)
Natural disasters and central bank asset purchases. Unpublished paper.
google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiC6ZnYkbSUAxUqIxAIHf8tDQIQFnoECBoQAQ&url=hlps%3A%2F%2Fwww.aeaweb.org%2Fconference%2F2026%2Fprogram%2Fpowerpoint%2FEG9QE26e&usg=AOvVaw1QFidJBcz4EjDYwvoNC1L9&opi=89978449

Carney, M. (2015)
Breaking the tragedy of the horizon – climate change and financial stability. Speech given at Lloyd's of London, 29 September.
https://www.bankofengland.co.uk/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability

Carney, M. (2017)
Lambda. Speech given at London School of Economics, 16 January.
https://www.bankofengland.co.uk/-/media/boe/files/speech/2017/lambda.pdf

Carton, B., Evans, C., Muir, M. D. V. and Voigts, S. (2023)
Getting to know GMMET: The global macroeconomic model for the energy transition, IMF Working Paper No. 2023/269.
https://doi.org/10.5089/9798400262326.001

Casey, G., Fried, S. and Peterman, W. B. (2024)
Climate Policy and the Long-Run Interest Rate: Insights from a Simple Growth Model. FRBSF Working Paper 2024-37.
https://www.frbsf.org/research-and-insights/publications/working-papers/2024/12/climate-policy-and-the-long-run-interest-rate-insights-from-a-simple-growth-model/

Cavallo, A., Cruces, G., Perez-Truglia, R. (2017)
Inflation expectations, learning, and supermarket prices: Evidence from survey experiments. American Economic Journal: Macroeconomics, Volume 9, No. 3, July, pp. 1-35.
https://doi.org/10.1257/mac.20150147

Caviedes-Voullième, D. and Shepard, T. G. (2023)
Climate storylines as a way of bridging the gap between information and decision making in hydrological risk. PLOS Climate.
https://doi.org/10.1371/journal.pclm.0000270

Cesa-Bianchi, A., Harrison, R. and Sajedi, R. (2023)
Global R*. Bank of England Staff Working Paper No. 990.
https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2022/decomposing-the-drivers-of-global-r-star.pdf

Cevik, S. and Jalles, J. T. (2023)
Eye of the Storm: The Impact of Climate Shocks on Inflation and Growth. IMF Working Paper 23/87.
https://www.imf.org/en/-/media/files/publications/wp/2023/english/wpiea2023087-print-pdf.pdf

Ciccarelli, M., Kuik, F. and Hernández, C. M. (2024)
The asymmetric effects of temperature shocks on inflation in the largest euro area countries, European Economic Review, Volume 168.
https://doi.org/10.1016/j.euroecorev.2024.104805

Cieslak, A., Hansen, S., McMahon, M. and Xiao, S. (2023)
Policymakers' Uncertainty. NBER Working Papers 31849.
https://www.nber.org/papers/w31849

Chateau, J., Jaumotte, F. and Schwerhoff, G. (2022)
Climate Policy Options: A Comparison of Economic Performance. IMF WP 22/242.
https://www.imf.org/-/media/files/publications/wp/2022/english/wpiea2022242-print-pdf.pdf

Chavleishvili, S. and Moench, E. (2025)
Natural disasters as macroeconomic tail risks. Journal of Econometrics, 247, 105914.
https://doi.org/10.1016/j.jeconom.2024.105914

Clarida, R., Galí, J. and Gertler, M. (1999)
The science of monetary policy: A New Keynesian perspective. Journal of Economic Literature, 37(4), pp. 1661-1707.
https://doi.org/10.1257/jel.37.4.1661

Coibion, O., Gorodnichenko, Y. and Kumar, S. (2018)
How Do Firms Form Their Expectations? New Survey Evidence. American Economic Review, 108 (9), pp. 2671-2713.
https://doi.org/10.1257/aer.20151299

Concordel, A., Ho, P. and Knittel, C. R. (2026)
The Differential Impacts of Critical Mineral Prices and Oil Prices on the Economy, NBER Working Paper 34847.
https://doi.org/10.3386/w34847

Costa, H. and Hooley, J. (2025)
The macroeconomic implications of extreme weather events. OECD Economics Department Working Papers No. 1837.
https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/08/the-macroeconomic-implications-of-extreme-weather-events_6d00a073/5e24a2d8-en.pdf

D'Acunto, F., Malmendier, U., Ospina, J. and Weber, M. (2021)
Exposure to Grocery Prices and Inflation Expectations. Journal of Political Economy 129:5, pp. 1615-1639.
https://doi.org/10.1086/713192

D'Acunto, F., Charalambakis, E., Georgarakos, D., Kenny, G., Meyer, J. and Weber, M. (2024)
Household inflation expectations: an overview of recent insights for monetary policy. ECB Discussion Paper Series, No. 24.
https://www.ecb.europa.eu/pub/pdf/scpdps/ecb.dp24~9b349a69b7.en.pdf

D'Arcangelo, F. M., Kruse, T., Pisu, M. and Tomasi, M. (2025)
The effect of climate policies on firm financing and investment through the banking channel, Journal of Environmental Management, Volume 387, July.
https://doi.org/10.1016/j.jenvman.2025.125866

Dafermos, Y., Nikolaidi, M. and Galanis, G. (2018)
Climate change, financial stability and monetary policy. Ecological Economics, 152, pp. 219-234.
https://doi.org/10.1016/j.ecolecon.2018.05.011

Dahlhaus, T., Duprey, T. and Johnston, C. (2025)
Estimating the impacts on GDP of natural disasters in Canada. Staff Analytical Note 20255. Bank of Canada.
https://doi.org/10.34989/san-2025-5

Damast, D., Kubitza, C. and Sørensen, J. A. (2025)
Homeowners Insurance and the Transmission of Monetary Policy, January 31.
http://dx.doi.org/10.2139/ssrn.5119139

De Bandt, O., Kuntz, L-C., Pankratz, N., Pegoraro, F., Solheim, H., Sutton, G., Takeyama, A. and Xia, F. D. (2025)
The effects of climate change-related risks on banks: A literature review. Journal of Economic Surveys, Volume 39, Issue 4, September.
https://doi.org/10.1111/joes.12665

Debelle, G. (2019)
Climate change and the economy. Reserve Bank of Australia.
https://www.rba.gov.au/speeches/2019/sp-dg-2019-03-12.html

Dees, S. (2026)
Feeding inflation: The non-linear spillovers of global food commodities. Oxford Bulletin of Economics and Statistics.
https://doi.org/10.1111/obes.70064

Dees, S. and Ozyurt-Miller, S. (2026)
Climate Economics and Finance. Cambridge: Cambridge University Press. ISBN 9781009628631.

De Fiore, F., Lombardi, M. and Rees, D. (2022)
Inflation indicators amid high uncertainty. BIS Bulletin No. 60.
https://www.bis.org/publ/bisbull60.htm

De Fiore, F., Lombardi, M. and Mangiante, G. (2025)
The Asymmetric and Heterogeneous Pass-Through of Input Prices to Firms' Expectations and Decisions. CEPR Discussion Paper No. 20835.
https://cepr.org/publications/dp20835

De Galhau, V. (2024)
Monetary Policy in Perspective (II): Three landmarks for a future of "Great Volatility".
https://www.banque-france.fr/system/files/2024-10/Monetary-Policy-in-Perspective-II.pdf

De Polis, A., Melosi, L. and Petrella, I. (2025)
The taming of the skew: asymmetric inflation risk and monetary policy. European Central Bank Working Paper Series No. 3028.
https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp3028~e58ecc9133.en.pdf

De Winne, J. and Peersman, G. (2021)
The adverse consequences of global harvest and weather disruptions on economic activity. Nature Climate Change, Vol. 11, pp. 665-672.
https://doi.org/10.1038/s41558-021-01102-w

Del Negro, M., Di Giovanni, J. and Dogra, K. (2023)
Is the green transition inflationary? Federal Reserve Bank of New York Staff Reports, No. 1053.
https://www.newyorkfed.org/research/staff_reports/sr1053

Dietrich, A. M. (2024)
Consumption categories, household attention, and inflation expectations: Implications for optimal monetary policy. Journal of Monetary Economics, Volume 147. October.
https://doi.org/10.1016/j.jmoneco.2024.103594

Dietrich, A. M., Mueller, G. M. and Leitenbacher, L. (2025)
Consumer Durables, Monetary Policy, and the Green Transition. Danmarks Nationalbank Working Paper No. 208.
https://www.nationalbanken.dk/en/news-and-knowledge/publications-and-speeches/working-paper/2025/consumer-durables-monetary-policy-and-the-green-transition

Dikau, S. and Volz, U. (2021)
Central bank mandates, sustainability objectives and the promotion of green finance. Ecological Economics, 184, 107022.
https://doi.org/10.1016/j.ecolecon.2021.107022

Diluiso, F., Annicchiarico, B., Kalkuhl, M. and Minx, J. C. (2021)
Climate actions and macro-financial stability: The role of central banks. *Journal of Environmental Economics and Management*, 110, 102548.
https://doi.org/10.1016/j.jeem.2021.102548

Dolphin, G. and Ferrucci, G. (2025)
The EU's CBAM: Implications for Member States and Trading Partners. IMF Working Paper 25/125, June.
https://www.imf.org/-/media/files/publications/wp/2025/english/wpiea2025125-print-pdf.pdf

Döttling, R. and Lam, A. (2025)
Monetary policy, carbon transition risk and firm valuation.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4582767

ECB (2021)
Climate change and monetary policy in the euro area. ECB Occasional Paper Series, No. 271/September.
https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op271~36775d43c8.en.pdf

ECB (2023)
Underlying inflation measures: an analytical guide for the euro area. ECB Economic Bulletin, Issue 5/2023.
https://www.ecb.europa.eu/press/economic-bulletin/focus/2023/html/ecb.ebbox202305_05~84e89bcb5d.en.html

ECB (2024)
Combined monetary policy decisions and statement. 18 July 2024.
https://www.ecb.europa.eu/press/press_conference/monetary-policy-statement/shared/pdf/ecb.ds240718~215969ab03.en.pdf

ECB (2025a)
The ECB's monetary policy strategy statement (2025).
https://www.ecb.europa.eu/mopo/strategy/strategy-review/ecb.strategyreview202506_strategy_statement.en.html

ECB (2025b)
A strategic view on the economic and inflation environment in the euro area. ECB Occasional Paper Series 371.
https://www.ecb.europa.eu//pub/pdf/scpops/ecb.op371.en.pdf

Ehlers, T., Frost, J., Madeira, C., Shim, I. (2025)
Macroeconomic impact of weather disasters: a global and sectoral analysis, BIS Working Papers, No. 1292.
https://www.bis.org/publ/work1292.htm

Elekdag, S. A. and Tuuli, M. (2022)
Weather Shocks and Exchange Rate Flexibility. Review of International Economics, Volume 31, Issue 5, pp. 1793-1832.
https://doi.org/10.1111/roie.12692

English, B. (2025)
Comments on the Bank of England's Communications Changes in Response to the Bernanke Report, in Aikman, D. and R. Barwell (editors) The UK Monetary Policy Roundtable, National Institute of Economic and Social Research.
https://niesr.ac.uk/wp-content/uploads/2025/12/UK-Monetary-Policy-Roundtable-web-version.pdf?ver=NPpRtQ1URgMhCPK5mA81

Erlandsen, S. K., Garcia-Appendini, E. and Kolasa, T. (2026)
The ratchet effect of climate investments. Norges Bank Working Paper (forthcoming).

Espegren, C., Galaasen, S. M., Garcia-Appendini, E. and Mæhlum, M. (2026)
Weathering the storm? The effects of natural disasters on households under universal insurance." Norges Bank Working Paper 3/26.
https://www.norges-bank.no/en/news-events/publications/Working-Papers/2026/wp-32026/

Faccia, D., Parker, M. and Stracca, L. (2021)
Feeling the heat: extreme temperatures and price stability, ECB Working Paper Series No. 2626.
https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2626~e86e2be2b4.en.pdf

Faust, J. (2005)
Is applied monetary policy analysis hard?
https://crei.cat/wp-content/uploads/2016/08/faust.pdf

Feldkircher, M. and Teliha, V. (2024)
Speeches in the Green: The Political Discourse of Green Central Banking. Energy Economics, Volume 135, July.
https://doi.org/10.1016/j.eneco.2024.107646

Ferreira, T. R. T. and Shousha, S. (2023)
Determinants of global neutral interest rates. Journal of International Economics, Volume 145.
https://doi.org/10.1016/j.jinteco.2023.103833

Ficarra, M. and Mari, R. (2025)
Weathering the storm: Sectoral economic and inflationary effects of floods and the role of adaptation. Bank of England Staff Working Paper No. 1120.
https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2025/weathering-the-storm-sectoral-economic-and-inflationary-effects-of-floods-and-the-role-of-adaptation.pdf

Fornaro, L., Guerrieri, V. and Reichlin, L. (2025)
Monetary policy for the green transition. BIS Papers No. 161, September.
https://www.bis.org/publ/bppdf/bispap160.htm

Friedman, M. (1953)
Essays in Positive Economics, University of Chicago Press.

FSB (2025)
Assessment of Climate-related Vulnerabilities: Analytical framework and toolkit. Financial Stability Board. 16 January.
https://www.fsb.org/2025/01/assessment-of-climate-related-vulnerabilities-analytical-framework-and-toolkit/

Fuje, H., Yao, J., Choi, S. M. and Mighri, H. (2023)
Fiscal Impacts of Climate Disasters in Emerging Markets and Developing Economies, IMF Working Paper 23/261.
https://www.imf.org/en/publications/wp/issues/2023/12/15/fiscal-impacts-of-climate-disasters-in-emerging-markets-and-developing-economies-542408

Furceri, D., Loungani, P., Simon, J. and Wachter, S. M. (2016)
Global food prices and domestic inflation: some cross-country evidence. Oxford Economic Papers, 68(3), pp. 665-687.
https://doi.org/10.1093/oep/gpw016

Garcia-Macia, D., Lam, W. R. and Nguyen, A. D. M. (2024)
Public Debt Dynamics During the Climate Transition. IMF Working Papers No. 2024/071.
https://doi.org/10.5089/9798400270635.001

Gautier, E., Savignac, F. and Coibion, O. (2025)
Firms' Inflation and Wage Expectations during the Inflation Surge. NBER Working Paper 33799. DOI 10.3386/w33799.
https://doi.org/10.3386/w33799

Gavriilidis, K., Känzig, D. R., Raghavan, R. and Stock, J. H. (2026)
The Macroeconomic Effects of Climate Policy Uncertainty. NBER Working Paper 34762.
https://doi.org/10.3386/w34762

Ge, S., Johnson, S. and Tzur-Ilan, N. (2025)
Climate, Risk, Insurance Premiums, and the Effects on Mortgage and Credit Outcomes. Federal Reserve Bank of Dallas Working Paper 2505, January.
https://www.dallasfed.org/~/media/documents/research/papers/2025/wp2505.pdf

Georgarakos, D., Kenny, G., Meyer, J. and van Rooij, M. (2025)
How do rising temperatures affect inflation expectations? ECB Working Paper Series. No. 3132.
https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp3132~416696f737.en.pdf

Gilboa, I. and Schmeidler, D. (2009)
A Theory of Case-Based Decisions. Cambridge University Press.
https://www.cambridge.org/core/books/theory-of-case based-decisions/E3BC4760690AED47185F7D530FA8AAC5

Giuzio, M., Rousová, L., Kapadia, S., Kumar, H., Mazzotta, L., Parker, M. and Zafeiris, D. (2026)
Climate change, catastrophes, insurance and the macroeconomy. European Economic Review, Volume 182.
https://doi.org/10.1016/j.euroecorev.2025.105210

Granziera, E, Reiche, L., Maffei-Faccioli, N., Weber, M. and Fastbø, T. (2025)
Five Facts About Inflation Expectations: Evidence from Four Different Groups of Agents. Norges Bank Working Paper 7/25.
https://www.norges-bank.no/contentassets/1231996d7f744ba2a2e21924b56caa33/wp-7.pdf?v=27062025151620

Guerrieri, V., Lorenzoni, G., Straub, L. and Werning, I. (2022)
Macroeconomic Implications of COVID-19: Can Negative Supply Shocks Cause Demand Shortages? American Economic Review 112 (5), pp. 1437-74.
https://doi.org/10.1257/aer.20201063

Haberis, A., Harrison, R., Reinold, K. and Waldron, M. (2025)
Monetary policymaking under uncertainty. Bank of England Macro Technical Paper No. 5, October.
https://www.bankofengland.co.uk/-/media/boe/files/macro-technical-paper/2025/monetary-policymaking-under-uncertainty.pdf

Hallegatte, S., Jooste, C. and McIsaac, F. (2024)
Modeling the macroeconomic consequences of natural disasters: Capital stock, recovery dynamics, and monetary policy, Economic Modelling, 139, 106787.
https://doi.org/10.1016/j.econmod.2024.106787

Hansen, L. P. and Sargent, T. J. (2001)
Robust Control and Model Uncertainty. American Economic Review, Volume 91(2), pp. 60-66.
https://www.aeaweb.org/articles?id=10.1257/aer.91.2.60

Hansen, L. P. and Sargent, T. J. (2011)
Robustness. Princeton University Press.
https://press.princeton.edu/books/paperback/9780691170978/robustness?srsltid=AfmBOop0gW49J_9_T-gAkrshSuK7FKVbL4BcIUCcfe53W7Zxd9q-Txti

Hensel, J., Mangiante, G. and Moretti, L. (2024)
Carbon pricing and inflation expectations: Evidence from France. Journal of Monetary Economics, Volume 147, October.
https://doi.org/10.1016/j.jmoneco.2024.103593

IPCC (2021)
Climate Change 2021. The Physical Science Basis.
https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FrontMatter.pdf

IPCC (2023)
AR6 Synthesis Report. Intergovernmental Panel on Climate Change.
https://www.ipcc.ch/report/ar6/syr/

Jo, Y. J. and Klopack, B. (2025)
Fueling expectations: The causal impact of gas prices on Inflation Expectations, Journal of Monetary Economics, Volume 153.
https://doi.org/10.1016/j.jmoneco.2025.103797

Jonsson, M., Kamanzi, C., Kwizera, P. A. and Niyonsenga, J. C. (2025)
Adverse weather shocks and monetary policy in Rwanda South African Journal of Economics, 93, No. 4, pp. 387-404.
https://doi.org/10.1111/saje.70003

Jonsson, M. and Nilsson, C. (2025)
The impact of the green transition on the neutral interest rate. Sveriges Riksbank Staff Memo, June.
https://www.riksbank.se/globalassets/media/rapporter/staff-memo/engelska/2025/the-impact-of-the-green-transition-on-the-neutral-interest-rate.pdf

Juelsrud, R. E. and Larsen, V. H. (2023)
Macroeconomic uncertainty and bank lending. Economics Letters, Volume 225.
https://doi.org/10.1016/j.econlet.2023.111041

Kabundi, A. N., Mlachila, M. and Yao, J. (2022)
How Persistent are Climate-Related Price Shocks? Implications for Monetary Policy. IMF Working Paper 22/207.
https://www.imf.org/en/publications/wp/issues/2022/10/28/how-persistent-are-climate-related-price-shocks-implications-for-monetary-policy-525048

Kahn, M. E., Mohaddes, K., Ng, R. N., Pesaran, M. H., Raissi, M. and Yang, J. C. (2021)
Long-term macroeconomic effects of climate change: A cross-country analysis. Energy Economics, Volume 104, December.
https://doi.org/10.1016/j.eneco.2021.105624

Känzig, D., Konradt, M., Wang, L. and Zhang, D. (2025)
Green Business Cycles. NBER Working Paper No. 34041.
https://doi.org/10.3386/w34041

Karadi, P., Nakov, A., Nuño Barrau, G., Pasten, E. and Thaler, D. (2024)
Strike while the iron is hot: optimal monetary policy with a nonlinear Phillips curve. BIS Working Papers, No. 1203.
https://www.bis.org/publ/work1203.htm

Kaufman, L. (2026)
US Home Insurance Prices Set to Keep Rising With Severe Weather. Bloomberg news article. 18 March 2026.
https://www.bloomberg.com/news/articles/2026-03-18/us-home-insurance-prices-set-to-keep-rising-with-severe-weather?cmpid=BBD031826_GREENDAILY&utm_campaign=greendaily&utm_medium=email&utm_source=newsletter&utm_term=260318

Keen, M., Parry, I. and Roaf, J. (2021)
Border Carbon Adjustments: Rationale, Design and Impact. IMF Working Paper WP/21/239.
https://doi.org/10.5089/9781557752567.001

Keys, B. J. and Mulder, P. (2025)
Property Insurance and Disaster Risk: New Evidence from Mortgage Escrow Data, NBER Working Paper 32579.
https://www.nber.org/papers/w32579

Kirti, D. and Singh, A. V. (2025)
The Insurer Channel of Monetary Policy. IMF Working Paper No. 25/54.
https://doi.org/10.5089/9798229003667.001

Konradt, M. and Weder di Mauro, B. (2023)
Carbon Taxation and Greenflation: Evidence from Europe and Canada, Journal of the European Economic Association, Volume 21(1).
https://doi.org/10.1093/jeea/jvad020

Kotz, M., Kuik, F., Lis, E. and Nickel, C. (2023)
The impact of global warming on inflation: averages, seasonality and extremes. ECB Working Paper Series 2821.
https://ideas.repec.org/p/ecb/ecbwps/20232821.html

Kotz, M., Kuik, F., Lis, E. and Nickel, C. (2024)
Global warming and heat extremes to enhance inflationary pressures. Communications Earth and Environ, Volume 5, 116.
https://doi.org/10.1038/s43247-023-01173-x

Krogstrup, S. and Oman, W. (2019)
Macroeconomic and Financial Policies for Climate Change Mitigation: A Review of the Literature. IMF Working Papers 2019/185.
https://ideas.repec.org/p/imf/imfwpa/2019-185.html

Kyriakopoulou, D. (2020)
Central banks and climate change: Addressing climate risks to economies. Official Monetary and Financial Institutions Forum.
https://www.omfif.org/wp-content/uploads/2020/02/ESG.pdf

Lagarde, C. (2026)
Climate, nature and monetary policy. Introductory remarks given at the Climate, Nature and Monetary Policy Conference organized by the ECB, Frankfurt School and CETEX, 5 May.
https://www.ecb.europa.eu/press/key/date/2026/html/ecb.sp260505~936c9c11b5.en.html

Li, J. (2024)
Flooding, Inflation and International Spillover (preprint).
https://scispace.com/papers/flooding-inflation-and-international-spillover-2dipemulrv

Lombardelli, C. (2024)
Managing the present, shaping the future: Speech given at the Bank of England Watchers Conference.
https://www.bankofengland.co.uk/speech/2024/november/clare-lombardelli-speech-at-the-3rd-boe-watchers-conference

Lombardelli, C. (2025)
Central bank communications and uncertainty – remarks given at the Second Thomas Laubach Research Conference, Federal Reserve Board, 16 May.
https://www.bankofengland.co.uk/speech/2025/may/central-bank-communications-and-uncertainty-remarks-by-clare-lombardelli

Low Carbon Contracts Company (2026)
Scheme Dashboards.
https://www.lowcarboncontracts.uk/resources/scheme-dashboards/

Makhlouf, G. (2022)
Climate change: Avoiding the 'Do I Feel Lucky?' school of policymaking. Central Bank of Ireland.
https://www.centralbank.ie/news/article/speech-gabriel-makhlouf-chatham-house-waddesdon-club-of-financial-leaders-01-june-2022

Mangiante, G. (2026)
Carbon Pricing and Firms' Expectations: Evidence from Italy. IMF Economic Review.
https://doi.org/10.1057/s41308-026-00301-9

Mann, C. L. (2023)
Climate policy and monetary policy: interactions and implications. Speech given at the University of Oxford, 13 November.
www.bankofengland.co.uk/speech/2023/november/catherine-l-mann-university-of oxford-environmental-economics-seminar

Markowski, Ł. and Kotliński, K. (2023)
Renewables, energy mix and inflation in the European Union countries. Energies, Volume 16(23).
https://doi.org/10.3390/en16237808

McKibbin, W. J., Morris, A. C., Wilcoxen, P. J. and Panton, A. J. (2020)
Climate change and monetary policy: issues for policy design and modelling. Oxford Review of Economic Policy, Vol. 36(3), pp. 579-603.
https://doi.org/10.1093/oxrep/graa040

Mehrotra, N. R. (2025)
The Macroeconomics of Net Zero.
https://drive.google.com/file/d/1OTP-WMrKJ69GxoEFyHDqjR51aXC5mNde/view

Meisenzahl, R., Polacek, A., Ramnath, S. and Yudhishthu, Z. (2026)
Measuring the Impact of Property Insurance Premiums on the Mortgage Market. Federal Reserve Bank of Chicago, Working Papers, No. 2026-01. February.
https://www.chicagofed.org/publications/working-papers/2026/2026-01

Merrino, S. and Sibande, X. (2026)
From Climate Crisis to Cost Crisis: Inflation Dynamics in a Warming World. South African Reserve Bank, Working Paper Series (forthcoming).

Metcalf, G. E. and Stock, J. H. (2023)
The Macroeconomic Impact of Europe's Carbon Taxes, American Economic Journal: Macroeconomics, Vol. 15(3), pp. 265-286.
https://doi.org/10.1257/mac.20210052

Mian, A., Rao, K. and Sufi, A. (2013)
Household Balance Sheets, Consumption, and the Economic Slump. The Quarterly Journal of Economics, Volume 128, Issue 4, November, pp. 1687-1726.
https://doi.org/10.1093/qje/qjt020

Midthjell, N. (2017)
Household inflation expectations. In Ø. Røisland (ed.). Review of flexible inflation targeting (ReFIT). Norges Bank Occasional Papers No. 51.
https://www.norges-bank.no/contentassets/842a0eaa53cf4e7cb37411a880c0aa08/occasionalpapers_51.pdf?v=07122017152312

Millischer, L., Fu, C., Volz, U. and Beirne, J. (2024)
Do Renewables Shield Inflation from Fossil Fuel-Price Fluctuations? IMF Working Paper WP/24/111.
https://doi.org/10.5089/9798400277566.001

Moessner, R. (2025)
Effects of carbon pricing on inflation. Climate Policy, Volume 25(9), pp. 1508-1521.
https://doi.org/10.1080/14693062.2025.2467961

Monasterolo, I., Mazzocchetti, A. and Naumann-Woleske, K. (2025)
Output, inflation and monetary policy response to immediate climate risks, SUERF Policy Note, 382.
https://www.suerf.org/publications/suerf-policy-notes-and-briefs/output-inflation-and-monetary-policy-response-to-immediate-climate-risks/

Mongelli, F. P., Pointner, W. and van den End, J. W. (2023)
The Effects of Climate Change on the Natural Rate of Interest: A Critical Survey. WIRE Climate Change, Volume 15, Issue 2.
https://doi.org/10.1002/wcc.873

Mukherjee, K. and Ouattara, B. (2021)
Climate and monetary policy: do temperature shocks lead to inflationary pressures? Climatic Change 167, 32 (2021).
https://doi.org/10.1007/s10584-021-03149-2

Mundell, R. A. (1961)
A Theory of Optimum Currency Areas. The American Economic Review, Vol. 51., No. 4, Sep., pp. 657-665.
https://www.jstor.org/stable/1812792

Nagel, J. (2023)
Climate change and central banks – supporting the green transition by pursuing price stability. Bank for International Settlements.
https://www.bis.org/review/r230515d.htm

NGFS (2023)
NGFS Climate Scenarios Technical Documentation. November.
https://www.ngfs.net/system/files/import/ngfs/media/2024/01/16/ngfs_scenarios_technical_documentation_phase_iv_2023.pdf

NGFS (2024a)
Acute physical impacts from climate change and monetary policy. Network for Greening the Financial System, Technical document, August.
https://www.ngfs.net/en/publications-and-statistics/publications/acute-physical-impacts-climate-change-and-monetary-policy

NGFS (2024b)
The green transition and the macroeconomy: a monetary policy perspective. Network for Greening the Financial System, Technical document, October.
https://www.ngfs.net/en/publications-and-statistics/publications/green-transition-and-macroeconomy-monetary-policy-perspective

NGFS (2024c)
Adapting central bank operations to a hotter world: current progress and insights from practical examples. Network for Greening the Financial System, Technical document, July.
https://www.ngfs.net/en/publications-and-statistics/publications/adapting-central-bank-operations-hotter-world-current-progress-and-insights-practical-examples

NGFS (2025a)
NGFS Issues Declaration on the Economic Cost of Climate Inaction at COP30.
https://www.ngfs.net/en/press-release/ngfs-issues-declaration-economic-cost-climate-inaction-cop30

NGFS (2025b)
NGFS Short-term Climate Scenarios for central banks and supervisors.
https://www.ngfs.net/en/publications-and-statistics/publications/ngfs-short-term-climate-scenarios-central-banks-and-supervisors

NGFS (2026a)
Forthcoming.

NGFS (2026b)
NGFS Note on the economic and financial impacts of extreme weather events, May.
https://www.ngfs.net/en/publications-and-statistics/publications/ngfs-note-economic-and-financial-impacts-extreme-weather-events

NGFS (2026c)
Needs updated for GMMET report.

NGFS (2026d)
Greening Monetary Policy Operations: Exploring Additional Options. NGFS Technical Note, January.
https://www.ngfs.net/en/publications-and-statistics/publications/greening-monetary-policy-operations-exploring-additional-options?utm_source=copilot.com

Norges Bank (2024)
Norges Bank's monetary policy strategy statement.
https://www.norges-bank.no/en/topics/Monetary-policy/monetary-policy-strategy/

Norges Bank (2026)
Innspill til evalueringen av bestemmelsen om pengepolitikken. Norges Bank Memo 4/2026 [in Norwegian – English version is forthcoming.]
https://www.norges-bank.no/aktuelt/publikasjoner/Norges-Bank-Memo-/2026/nb-memo-4-bestemmelse-om-pengepolitikken/

Noy, I. (2009)
The macroeconomic consequences of disasters. Journal of Development Economics. Volume 88, Issue 2, March, pp. 221-231.
https://doi.org/10.1016/j.jdeveco.2008.02.005

Olovsson, C. and Vestin, D. (2025)
Greenflation? European Economic Review, Volume 184, April.
https://doi.org/10.1016/j.euroecorev.2025.105237

Orphanides, A. (2003)
Monetary policy evaluation with noisy information. Journal of Monetary Economics, Volume 50, Issue 3, pp. 605-631.
https://www.sciencedirect.com/science/article/pii/S0304393203000278

Orphanides, A. and Williams, J. C. (2003)
Robust Monetary Policy Rules with Unknown Natural Rates. Board of Governors of the Federal Reserve System Finance and Economic Discussion Series (FEDS), March.
https://www.federalreserve.gov/econres/feds/robust-monetary-policy-rules-with-unknown-natural-rates.htm

Orphanides, A. and Williams, J. C. (2008)
Learning, expectations formation, and the pitfalls of optimal control monetary policy. Journal of Monetary Economics, Volume 55, Supplement, October, pp. S80-S96.
https://doi.org/10.1016/j.jmoneco.2008.08.002

Ortiz-Bobea, A., Ault, T. R., Carrillo, C. M., Chambers, R. G. and Lobell, D. B. (2021)
Anthropogenic climate change has slowed global agricultural productivity growth. Nature Climate Change, Volume 11, pp. 306-312.
https://doi.org/10.1038/s41558-021-01000-1

Owolabi, O., Oku, A. R., Alejo, A., Ogunbiyi, T. and Ubah, J. I. (2021)
Access to electricity, information and communication technology (ICT), and financial development: Evidence from West Africa. International Journal of Energy Economics and Policy, Volume 11, Issue 2, pp. 247-259.
https://doi.org/10.32479/ijeep.10344

Parker, M. (2018)
The Impact of Disasters on Inflation. Economics of Disasters and Climate Change, Volume 2, pp. 21-48.
https://doi.org/10.1007/s41885-017-0017-y

Parry, I. W. H., Black, S. and Vernon, N. (2021)
Still Not Getting Energy Prices Right: A Global and Country Update of Fossil Fuel Subsidies, IMF Working Paper No. 2021/236.
https://doi.org/10.5089/9781513595405.001

Patozi, A. (2023)
Green Transmission: Monetary Policy in the Age of ESG.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4327122

Patra, M. D., John, J. and George, A. T. (2024)
Are food prices spilling over? Reserve Bank of India Bulletin, August 19.
https://www.rbi.org.in/Scripts/BS_ViewBulletin.aspx?Id=22787

Patzelt, P. and Reis, R. (2024)
Estimating the rise in expected inflation from higher energy prices, CEPR Discussion Paper No. 18907.
https://cepr.org/publications/dp18907

Peersman, G. (2022)
International food commodity prices and missing (dis) inflation in the euro area. The Review of Economics and Statistics, Volume 104, Issue 1, pp. 85-100.
https://doi.org/10.1162/rest_a_00939

Poole, W. (1970)
Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model. The Quarterly Journal of Economics, Vol. 84, No. 2, May.
https://www.jstor.org/stable/1883009

Puyo, D. M., Panton, A. J., Sridhar, T., Stuermer, M., Ungerer, C. and Zhang, A. T. (2024)
Key Challenges Faced by Fossil Fuel Exporters during the Energy Transition. IMF Staff Climate Note No. 2024/001.
https://doi.org/10.5089/9798400270147.066

Rachel, L. and Summers, L. H. (2019)
On secular stagnation in the industrialized world. NBER Working Paper 26198.
https://doi.org/10.3386/w26198

Reis, R. (2026)
The Four R-stars: from Interest Rates to Inflation and Back, In Medium and Long-Run Trends. In Interest Rates: Causes and Implications for Monetary Policy, edited by S. Bauduco, M. García Schmidt, A. Mian, and L. Villacorta, Banco Central de Chile, Santiago, Chile, forthcoming.

Sahuc, J.-G., Smets, F. and Vermandel, G. (2024)
The New Keynesian Climate Model. SSRN Working Paper.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5035207

Schnabel, I. (2022)
Looking through higher energy prices? Monetary policy and the green transition. Remarks given at the American Finance Association 2022 Virtual Annual Meeting.
https://www.ecb.europa.eu/press/key/date/2022/html/ecb.sp220108~0425a24eb7.en.html

Seegolam, H. (2024)
Current economic conditions and outlook. Statement given at the post Monetary Policy Committee (MPC) press briefing, Port Louis, 3 April.
https://www.bis.org/review/r240403f.htm

Serebriakova, A., Polzin, F. and Sanders, M. (2026)
Monetary policy and energy installation: Implications for the European green transition. Energy Economics, Volume 155.
https://doi.org/10.1016/j.eneco.2026.109159

Solow, R. (1984)
Mr. Hicks and the Classics. Oxford Economic Papers, Volume 36, pp. 13-25.
https://econpapers.repec.org/article/oupoxecpp/v_3a36_3ay_3a1984_3ai_3a0_3ap_3a13-25.htm

Söderström, U. (2002)
Monetary Policy with Uncertain Parameters. Scandinavian Journal of Economics, Volume 104, Issue 1, pp. 125-145.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=355521

Spilimbergo, A., Symansky, S. and Schindler, M. (2009)
Fiscal multipliers. IMF Staff Position Note SPN/09/11.
https://www.imf.org/external/pubs/ft/spn/2009/spn0911.pdf

Svensson, L. E. O. and Woodford, M. (2004)
Indicator variables for optimal policy under asymmetric information. Journal of Economic Dynamics and Control, Volume 28, Issue 4, pp. 661-690.
https://doi.org/10.1016/S0165-1889(03)00039-3

Szoke, B., Xavier, I. and Vazquez-Grande, F. (2024)
Convenience Yield as a Driver of r*. FEDS Notes, September 03.
https://www.federalreserve.gov/econres/notes/feds-notes/convenience-yield-as-a-driver-of-r-20240903.html

Talbot, J. (2025)
The heat is on: Why monetary policy makers are increasingly focusing on the impact of climate risks. Speech given at the University of Oxford, 9 May.
https://www.bankofengland.co.uk/speech/2025/may/james-talbot-speech-at-university-of-oxford-on-climate

Thakoor, V. V. and Kara, E. (2023)
Monetary Policy Design with Recurrent Climate Shocks. IMF Working Papers 2023/243.
https://www.imf.org/en/Publications/WP/Issues/2023/11/24/Monetary-Policy-Design-with-Recurrent-Climate-Shocks-541778

The Riksbank (2025)
The Riksbank's Climate Report.
https://www.riksbank.se/en-gb/about-the-riksbank/the-tasks-of-the-riksbank/the-riksbanks-work-on-sustainability/climate-report/the-riksbanks-climate-report-2025/

Tobin, J. (1969)
A General Equilibrium Approach To Monetary Theory. Journal of Money, Credit and Banking, Vol. 1, No. 1, February, pp. 15-29.
https://doi.org/10.2307/1991374

Van den Bergh, J. C. J. M. and Botzen, W. W. J. (2024)
Assessing Criticisms of Carbon Pricing. International Review of Environmental and Resource Economics, Volume 18, Issue 3.
https://doi.org/10.1561/101.00000172

Weber, M. *et al.* (2025)
Tell Me Something I Don't Already Know: Learning in Low- and High-Inflation Settings. Econometrica, vol. 93, No. 1, Econometric Society, 2025, pp. 229-264.
https://doi.org/10.3982/ECTA22764

Wehrhöfer, N. (2023)
Energy prices and inflation expectations: Evidence from households and firms. Discussion Papers 28/2023, Deutsche Bundesbank.
https://ideas.repec.org/p/zbw/bubdps/279809.html

Woodford, M. (2003)
Interest and prices: Foundations of a theory of monetary policy. Princeton, NJ: Princeton University Press.

Woodford, M. (2005)
Central Bank Communication and Policy Effectiveness. NBER Working Paper No. 11898.
https://www.nber.org/papers/w11898

World Bank (2025)
State and Trends of Carbon Pricing 2025.
https://www.worldbank.org/en/publication/state-and-trends-of-carbon-pricing

Wunsch, P. (2024)
Beyond hawks and doves: trying to get it right in an uncertain world. Guest lecture at Frankfurt School of Finance and Management. 8 May.
https://www.nbb.be/en/nieuws-en-evenementen/nieuws/beyond-hawks-and-doves-trying-get-it-right-uncertain-world

Zappalà, G. (2024)
Propagation of extreme heat in agriculture across sectors and space. Paris School of Economics (unpublished report).
https://www.parisschoolofeconomics.eu/app/uploads/2024/10/ZAPPALA-Guglielmo-JMP.pdf

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