Network for Greening the Financial System

Occasional paper

# Synthesis report on the greening of the financial system

## Insights for financial actors in advanced and emerging economies

November 2024

NGFS

Central Banks and Supervisors Network for Greening the Financial System

## About the NGFS

The Network for Greening the Financial System (NGFS), launched at the Paris One Planet Summit on 12 December 2017, is a group of central banks and supervisors, which on a voluntary basis is willing to share best practices and contribute to the development of environment and climate risk management in the financial sector, and to mobilise mainstream finance to support the transition toward a sustainable economy. The NGFS brings together 141 central banks and financial supervisors and 21 observers. Together, they span across five continents, operate in economies that account for more than 88% of global greenhouse gas emissions and are collectively responsible for the supervision of all global systemically important banks and more than 80% of the internationally active insurance groups. The NGFS is chaired by Ms Sabine Mauderer, First Deputy Governor of the Deutsche Bundesbank. The Secretariat, headed by Mr Yann Marin is provided by Banque de France.

## About this report and acknowledgements

This Synthesis report on the greening of the financial system is a collaborative effort of the Network of greening the financial system as well as its knowledge partners. As per all NGFS publications, this document is non-binding and does not necessarily represent the specific views of any member institution, nor of institutions and individuals having contributed to its drafting.

This document was prepared under the auspices of the NGFS Chair, Sabine Mauderer. The drafting of the document was coordinated and led by Dr Cristina Peñasco, Antoine Bakewell, Ludivine Berret and Dr Elsa Allman (NGFS Secretariat).

The preparation of the different sections of this document benefited from contributions by NGFS observers (International Monetary Fund, Organisation for Economic Co-operation and Development, World Bank) as well as NGFS knowledge partners (Climate Policy Initiative, World Wide Fund for Nature). The NGFS Secretariat is especially thankful to Deepali Gautam, Ananthakrishnan Prasad (International Monetary Fund), Jolien Noels and Raphaël Jachnik (Organisation for Economic Co-operation and Development), François Lesage and GianLeo (World Bank), Baysa Naran (Climate Policy Initiative) Siti Rizkiah, Maud Abdelli, and Adam Ng (World Wide Fund for Nature), with the support of Fabio Natalucci and Marina Moretti (International Monetary Fund), Mathilde Mesnard (Organisation for Economic Co-operation and Development), Jean Pesme and Saskia de Vries (World Bank), Barbara Buchner (Climate Policy Initiative).

The contributors are also thankful to Ravi Menon, former NGFS Chair, and Jean Boissinot, former NGFS Head of Secretariat for initiating this report.

The NGFS is also grateful to its other members and observers as well as other members of the Secretariat for providing comments and contributing materials to this document.

# Contents


Foreword 4

Glossary 6

Executive summary 7

Introduction 11

Context and Purpose 11

Importance of greening the financial system for contributing to the alignment of finance with climate goals 11

Structure of the Report 12

Section 1. Evidence on climate-related financial flows and transition-related investment needs 13

Key messages 13

A. Measuring financial flows and alignment for climate action 13

B. Tracking investments needs and current climate finance flows 14

Section 2. Scaling up green finance instruments 20

Key messages 20

A. The potential of green finance instruments 20

B. Current challenges with labelled green finance instruments 23

C. Unleashing the full potential of green finance for a net-zero transition of the global economy 24

Section 3. Fostering an enabling ecosystem through financial regulation, supervision and policy practices 26

Key messages 26

A. Enhanced market transparency can foster the alignment of financial flows 26

B. Integrating climate in supervisory frameworks and practices: recent progress and remaining gaps 29

C. Adapting monetary policy operations and macroeconomic modelling 32

Conclusion 34

A. Summary of key findings 34

B. Recommendations for further action in advancing the greening of the financial system 34

List of references 37

# Foreword

*Sabine Mauderer*
*Chair of the NGFS*

*At the Paris "One Planet Summit" in December 2017, the Network of Central Banks and Supervisors for Greening the Financial System was established to help strengthen the global response required to meet the goals of the Paris Agreement, and to enhance the financial system's role in managing risks and mobilising capital for green and low-carbon investments. Seven years later, as we approach the 29th UN Climate Change Conference (COP29), this report aims to take stock of the progress collectively made towards these objectives. Where do we stand on greening the financial system?*

*The urgency to address climate change has only intensified in recent years. The impacts of climate change and nature degradation are becoming increasingly apparent and disproportionately affect emerging markets and developing economies (EMDEs). If left unaddressed, climate and nature risks can turn into economic, financial and systemic risks. Limiting global warming to 1.5 °C above pre-industrial levels is economically far less costly than inaction, and requires comprehensive efforts across all sectors of the economy.*

*This report consolidates key publications and findings that help assess the progress on greening of the financial system and aligning the financial sector with global climate goals. It examines the readiness of financial institutions and the contribution of regulatory bodies, highlights gaps and challenges, and proposes actionable recommendations to advance towards a greener financial system.*

*Despite some progress, much work remains to align the financial system with climate goals. Financial flows are increasingly directed towards projects that support climate action, yet significant investment gaps persist, particularly in EMDEs and for adaptation and resilience investments. While green finance instruments have grown rapidly, there is still untapped potential for further expansion. Regulatory frameworks are evolving to incorporate climate risks, but the pace and scope of implementation vary widely.*

*These findings underscore the need for collective action. Within the financial sector, we can build on existing work to integrate climate risks into financial regulation and supervision, strengthen disclosure standards, invest in climate-related data, and enhance international policy coordination. However, these efforts by the NGFS should be supported by actions in the broader financial community and by policymakers.*

*We are truly thankful to NGFS observers (IMF, World Bank, OECD), knowledge partners (WWF, CPI) and members who contributed to this report. Drawing on this assessment, the NGFS will keep monitoring relevant progress by public and private actors. Above all, the NGFS will continue actively contributing towards greening the financial system by sharing practices and knowledge, and by enabling action by central banks and supervisors. In the global efforts to reach the goals of the Paris Agreement, every action counts.*

# Insights from NGFS knowledge partners

Barbara Buchner
Global Managing Director
Climate Policy Initiative

*Global climate finance needs to scale across all fronts – domestically, internationally, and across sectors – to reach our mutual climate goals. A much more ambitious and effective approach, with clear, collaborative roadmaps that guide finance to support the transformation to a sustainable future, can turn this challenge into a real business opportunity.*

Kirsten Schuijt
Director General
WWF International

*Over the past four years, we've seen steady progress in integrating climate concerns into financial systems regulatory frameworks. Yet, in some of the world's most influential economies, regulatory gaps remain stark. Nature is our climate's hidden ally, and we must confront these twin crises together. With tipping points fast approaching, inaction risks irreversible consequences for our economies, societies, and ecosystems. Time is not on our side – we must act decisively.*

# Glossary[1]

**Alignment:** Scaling up low-carbon investments and restricting the financing of high-emitting activities while actively supporting the transition of carbon-intensive industries to net zero.

**Climate finance:** In this report, climate finance refers to the allocation of funds at local, national, or international levels, sourced from public, private, and alternative channels, to finance activities aimed at mitigating and adapting to climate change impacts in the real economy. It can be understood as a subset of Green Finance.

**Green finance**: In this report, green finance encompasses all financial activities, including loans and investments, that contribute to climate change mitigation, adaptation, and resilience, as well as other environmental goals like biodiversity conservation. The primary focus of this report is on climate-related issues. Green finance is a subset of sustainable finance understood as the financial instruments whose goal is to reduce barriers in investments to foster sustainable development and SDGs beyond environmental concern, including economic and social considerations.

**Financial institutions:** Encompasses firms within the financial sector, such as banks, pension funds, insurance companies, asset management companies, brokerage firms, and investment dealers.

**Financial sector:** The financial sector encompasses all institutions, firms, and markets that provide financial services and products. These services typically involve the management of money, capital, and credit.

**Financial system:** The financial system is a broader term that includes not just the financial institutions, but also the rules, regulations, policies, markets, and frameworks that govern how financial transactions are conducted.

**Greening the financial system:** Refers to the engagement of financial actors in (a) directing investments and loans towards environmentally sustainable goals and (b) managing risks associated with climate change and environmental challenges.

**Greenwashing:** Describes the misleading practice of promoting financial products as environmentally friendly or climate-conscious when they do not effectively adhere to environmental or climate-related standards.

**Long-term strategies:** Outline a country's extended climate plans. As per the Paris Agreement (Article 4, paragraph 19), all parties are encouraged to formulate and communicate strategies that outline pathways to achieving long-term climate goals, including the global objective of reaching net-zero emissions by 2050.

**Nationally Determined Contributions (NDCs):** Serve as a key mechanism for implementing the Paris Agreement, representing each country's plan for national climate action, including targets, policies, and measures related to climate change.

**Physical risks:** Financial risks that arise from the direct physical impacts of climate change, including acute hazards like extreme weather events (e.g., cyclones or heatwaves) and chronic hazards such as long-term shifts in climate patterns, like gradual temperature increases.

**Transition risks:** Financial risks associated with the shift towards a low-carbon and more circular economy, driven by changes in environmental policy, technological advancements, or shifts in market sentiment.

**Transition related investment:** While not universal, in this report we define transition-related investment as the investment needed to bring existing economic activities in line with the goal of the Paris Agreement. Such investments support innovation and infrastructure development, among others, enabling current activities to eventually achieve climate neutrality. Transition-related investment mainly focuses on mitigation, but can also incorporate adaptation in certain cases, particularly when resilience is necessary for the long-term success of the low-carbon transition.

1 Definitions are adapted from World Bank (2021).

# Executive summary

**The global imperative to tackle climate change has never been more crucial. This report, prepared for the 29th Conference of the Parties (COP29), aims to synthesise critical data points, strategic insights and progress on the greening of the financial system and the alignment of the financial sector with global climate goals.** The NGFS was founded to help strengthen the global response to meet the objectives of the Paris Agreement by mobilising central banks, financial supervisors and international financial institutions towards the same goal of greening the financial system. Over the last seven years, the NGFS has highlighted that greening the financial system is not just driven by the need to manage climate-related risks to the financial system but also a strategic opportunity to ensure long-term economic resilience and stability.

**This report is a collective effort, building on knowledge and data from NGFS members, observers, and knowledge partners.** A number of initiatives have aimed to assess the state of climate finance. However, the uncoordinated nature of these assessments makes it difficult to provide a holistic and up to date view on the state of green finance. With this report, the NGFS aims to leverage its convening power to compile and synthesise the latest data and insights from the publications of the NGFS[2], the International Monetary Fund (IMF), the Organisation for Economic Cooperation and Development (OECD), the World Bank, as well as available evidence from the Climate Policy Initiative (CPI) and the World Wildlife Fund (WWF) as knowledge partners[3].

**To move towards a greener financial system – i.e., one that recognises that the economy is rooted in nature and effectively manages climate and environmental risks –, financial decision-making processes must integrate climate, nature or transition considerations.** A global collective effort is required, bringing together advanced economies (AEs) and emerging markets and developing economies (EMDEs) towards a common goal. This report aims to provide insights that cater to the specific needs and capacities of different countries, recognising their within group differences and challenges and that a one-size-fits-all approach is insufficient.

**While discussions on climate finance have often focused on "bridging the gap", this report underlines that efforts must go beyond the mobilisation of additional public and private funds.** To accompany this broader alignment of financial flows to take place at the required speed, regulatory and supervisory frameworks must fully consider the implications of climate change and the net-zero transition. More generally, climate and nature should be considered by an integrated approach as there are unavoidable feedback loops between them.

**This report assesses three key areas to provide an overview of the evolution of the financial system in its journey to reach the Paris objectives.** Each area constitutes one of the three foundations that are necessary to build a greener financial system: i) developing a common understanding of what climate goals mean for finance and the progress made on the provision of finance aligned with those goals; ii) scaling up the relevant market instruments and strategies, and iii) establishing regulatory and supervisory frameworks that foster and enable an ecosystem for an effective and just green transition.

## Evidence on climate-related financial flows and transition-related investment needs

**There is a significant climate finance gap. Global climate finance needs range between USD 5.9 and 12 trillion annually by 2030 (CPI, 2023).** Global climate finance flows nearly doubled from 2019/2020 to 2021/2022 reaching USD 1.3 trillion annual average[4] (CPI, 2023). Yet, current flows still fall far short of existing needs. In particular, adaptation finance remains insufficient to meet the growing needs in EMDEs.

2 See the most recent publications of the NGFS that have informed this report in different ways in the list of references.

3 The references in this report to data provided by knowledge partners are included as part of the evidence and do not represent endorsement by the NGFS or their members.

4 CPI figures provided in this report use a two-year annual average (e.g. annual average years 2021 and 2022). By taking annual averages, CPI is able to capture better the trend and smooth out year by year fluctuations. The figures provided by World Bank (mostly from World Bank (2024)) refer to 2022.

**Climate finance is heavily skewed toward advanced economies and China, with all EMDEs (excluding China) receiving only 14%, although they represent a quarter of global GDP (World Bank, 2024), and least developed countries (LDCs) receiving just 3% of total climate finance.** As EMDEs rely heavily on external finance compared to AEs, global commitments such as under the Copenhagen Accord play a key role in providing external climate public finance in these geographies.

**Despite the record of global climate finance mobilised in 2021/2022, significant sectoral imbalances remain.** Adaptation represented on average in 2021/2022 only 5% of the total climate finance provided. Also, energy and transport, the largest-emitting sectors, continue to attract the majority of mitigation finance, while agriculture and industry, despite their significant mitigation potential, remain severely underfunded. Energy and transport attract 44% and 29% of total mitigation flows respectively. In contrast, agriculture and industry received less than 4% of mitigation finance (CPI, 2023).

**Improving the quality and availability of climate finance data, as well as progressing towards standardised methodologies, is crucial for tracking progress towards climate goals.** There is no standardised approach to measuring climate finance alignment, with data gaps and methodological inconsistencies making it difficult to track progress accurately. Improved data collection and standardised transparency requirements are essential for improving data availability on climate-related risks in the market, for closing the investment gap and, ultimately, ensuring alignment with climate goals.

## Scaling up green finance instruments

**Green bonds, sustainability-linked bonds, and ESG funds have seen rapid growth, driven by strong investor demand and support from the public sector.** However, they still represent a small portion of the overall market, with green bonds making up 5.4% of the bond market and ESG funds at 6% of total investment funds.

**Banks in EMDEs play a crucial role but contribute minimally to climate finance.** Many EMDE banks allocate 5% or less of their lending to climate projects (World Bank, 2024), constrained by high borrowing costs and the difficulty in attracting private investment.

**Current labels for green finance instruments, like green bonds, are inconsistent and often lack strict standards, leading to concerns about greenwashing.** Stricter, standardised labels and clearer criteria are needed to ensure investments are truly aligned with climate goals.

**The green finance market has significant room for growth.** Improving information, developing stronger and standardised labels, and expanding taxonomies – especially in EMDEs – could help scale up green finance to support the global transition to net-zero emissions.

## Fostering an enabling ecosystem through financial regulation, supervision and policy practices

**Climate change is relevant to financial regulators and central banks from micro and macro prudential angles, a monetary policy perspective and in relation to their own operations. Enhanced transparency, robust disclosure standards, and integrated risk management of financial institutions are crucial for fostering a resilient financial ecosystem.** Enhanced market transparency can foster the alignment of financial flows, by allowing financial institutions to better identify and assess the financial climate risks associated with their investments and activities.

**Transition planning will be key to ensuring these efforts lead to more resilient and sustainable financial systems.** As internal processes that financial institutions and firms in general undertake to develop a strategy to align their core business with a specific climate outcomes, transition plans can help markets, but also supervisors, understand the climate-related risks an institution may be exposed to as a result of its strategy.

**In line with the financial stability mandate of central banks and supervisors, regulatory frameworks are evolving to incorporate climate (and nature-) related risks into financial stability monitoring and micro-supervision. Yet, the pace and scope of implementation vary widely.** Areas for improvement include insurance supervision, data collection, and managing exposure to litigation risks through addressing gaps in supervisory practices.

**Central banks may incorporate climate-related considerations into their operational frameworks for two main reasons.** First, central banks ought to identify, assess and manage the financial risks that their own balance sheets are exposed to, including those stemming from climate change and climate policies. Second, some central banks have an explicit mandate to support the transition to a low-carbon economy in line with policies and climate targets of their governments.

**Central banks are seeking to integrate climate considerations into macroeconomic modelling.** Climate change and the green transition increasingly have macroeconomic impacts over time horizons relevant for monetary policy and are likely to pose difficult policy trade-offs. As such, understanding these effects and their monetary policy implications is becoming increasingly important for central banks.

## Recommendations for further action in advancing the greening of the financial system

Aligning the financial system with the Paris Agreement's objectives requires coordinated actions from policymakers, financial institutions and regulators, and other stakeholders. Building on the findings of this report and the conclusions of extensive work conducted by the NGFS over the years, the following recommendations highlight some key steps that public and private financial actors can take to support this transition.

**Recommendation 1. Strengthen international coordination within the financial system**

International coordination is essential to improve the financial system's capacity to manage risks and mobilise capital for green investments. Coordinating approaches between central banks and supervisors, governments, multilateral organisations, and financial institutions will foster an enabling environment for investment, improve access to finance and ensure that both AEs and EMDEs contribute to and benefit from climate action.

**Recommendation 2. Improve the quality and availability of climate-related data**

While imperfect data should not be an impediment for taking action, enhancing data collection processes of climate-related data is key to accurately measure the alignment of existing actions and policies with climate goals.

**Recommendation 3. Facilitate access to climate finance in EMDEs**

Addressing structural challenges faced by EMDEs and expanding financial support mechanisms such as blended finance and risk-sharing initiatives can help accelerate the transition.

**Recommendation 4. Enhance labels and standards**

Improving the standards and labels associated with green finance instruments will provide investors with information required to scale up these instruments.

**Recommendation 5. Strengthen climate risk integration in financial regulation and supervision**

As highlighted by multiple NGFS publications, the integration of climate and nature-related risks into supervisory and regulatory frameworks is essential for building a financial system that is resilient to environmental changes. This report underscores the importance of comprehensive regulations that promote transparency and accountability through standardised reporting practices.

**Recommendation 6. Integrating climate risks into macroeconomic policy**

Central banks will increasingly need to understand the macroeconomic impacts of climate change and the green transition. Policymakers can use the framework developed by the NGFS to help to better assess these impacts and their implications for monetary policy.

**Recommendation 7. Support the adoption of climate disclosure standards by financial and non-financial institutions**

The sustainability disclosure standard landscape has been evolving rapidly. Disclosure standards will need to be widely adopted to ensure environmental data availability and quality. Economic actors need to stay abreast of the latest developments, comply with evolving climate disclosure requirements, and can proactively adopt non-binding guidelines or recommendations.

**Recommendation 8. Advancing transition planning and transition plans within financial and non-financial institutions**

Transition plans should be prioritised as a key tool for ensuring a more resilient and sustainable financial system (G20, 2024). The NGFS has underlined in recent reports that, by outlining the strategy of how firms plan to align their core business with a specific strategic climate outcome, transition plans not only provide a roadmap for climate alignment but also allow supervisors to better assess the climate-related risks that institutions might face due to their strategies.

**Recommendation 9. Monitor progress and adapt to an ever-evolving environment**

Continuous monitoring and adaptation are crucial to ensuring that the financial system remains aligned with evolving climate goals. This report highlights the importance of tracking progress and adapting strategies based on emerging scientific insights and policy developments.

# Introduction

## Context and Purpose

**The global imperative to tackle climate change has never been more crucial.** Lowering greenhouse gas (GHG) emissions and the pursuit of climate-resilient development are key to address the growing costs of climate change. Recent analysis by the World Meteorological Organization found that there is a high likelihood the world will breach the 1.5°C temperature threshold by 2030 (WMO, 2023). This would exacerbate multiple climate hazards, posing numerous risks to people, ecosystems, and the economy. The financial sector plays a critical role in the transition to decarbonised economies, contributing to the realisation of the Paris Agreement's objectives by directing its operations and investments towards supporting the global shift to a decarbonised, climate-resilient economy.

**This report, prepared for the 29th Conference of the Parties to the Paris Agreement (COP29), aims to synthesise critical data points, strategic insights and progress on the greening of the financial system and the alignment of the financial sector with global climate goals.** By examining the readiness of financial institutions and regulatory bodies for a decarbonised future, this report provides an overview of the current status of the greening of the financial system, highlights gaps and challenges, and proposes actionable recommendations for different financial actors to progress towards a greener financial system.

**The report is a collective effort, building on knowledge and data from NGFS members, observers, and knowledge partners.** A number of initiatives have aimed to assess the state of climate finance adopting a plurality of approaches, be it by focusing on the global, regional, or local scale, or on the sources and destinations of climate finance. However, the dispersion of initiatives makes it difficult to provide a holistic and up to date view on the state of green finance. With this report, the NGFS aims to leverage its convening power to compile and synthesise the latest data and insights from the publications of the NGFS[5], the IMF, the OECD, the World Bank, as well as available evidence from the Climate Policy Initiative (CPI) and the World Wildlife Fund (WWF) as knowledge partners[6].

## Importance of greening the financial system for contributing to the alignment of finance with climate goals

**"Making financial flows consistent with low greenhouse gas (GHG) emissions and climate-resilient development" is one of the three core objectives of the Paris Agreement (UNFCCC, 2015)[7].** In 2017, the NGFS was founded to help strengthen the global response to meet these objectives by mobilising central banks, financial supervisors and international financial institutions towards the same goal of greening the financial system. Over the last seven years, the NGFS has highlighted that greening the financial system is not just driven by the need to manage climate-related risks to the financial system but also a strategic opportunity to ensure long-term economic resilience and stability.

**To move towards a greener financial system – i.e., one that recognises that the economy is rooted in nature and effectively manages climate and environmental risks –, financial decision-making processes must integrate climate, nature or transition considerations.** This task requires collaboration between policymakers, financial institutions, and regulators to both reduce exposure to climate risks and support the transition towards sustainable and resilient economies, in a just and equitable manner (NGFS, 2024a). Though banking authorities have an important role to play given the importance of the banking sector as a source of funding, neither prudential authorities nor central bank measures should interfere with institutional core mandates, neither can they substitute for necessary broader government interventions when tackling climate change, including carbon pricing, fiscal policies, and sectoral regulations.

5 See the most recent publications of the NGFS that have informed this report in different ways in the list of references.

6 The references in this report to data provided by knowledge partners are included as part of the evidence and do not represent endorsement by the NGFS or their members.

7 See Article (2.1(c)) – UNFCCC (2015).

**A global collective effort is required to reach the Paris Agreement objectives, bringing together AEs and EMDEs towards a common goal.** While both face unique challenges and opportunities in the transition to a net-zero economy, they must work together to achieve global climate objectives. This report aims to provide insights that cater to the specific needs and capacities of different countries, recognising their within group differences and challenges and that a one-size-fits-all approach is insufficient.

**While discussions on climate finance have often focused on "bridging the gap", this report underlines that efforts must go beyond the mobilisation of additional public and private funds.** Policymakers and financial institutions have a role to play in ensuring that funding is increasingly channelled from activities that are the most environmentally harmful and support their transition towards more just and sustainable business models[8].

**To accompany this broader alignment of financial flows to take place at the required speed, regulatory and supervisory frameworks must fully consider climate and nature as there are unavoidable feedback loops between them.** While the NGFS acknowledges the fundamental importance of addressing broader nature and biodiversity-related issues, these considerations are not included in sections 1 and 2 of this report due to its focus on climate finance. As the availability and quality of data on biodiversity finance improve, future efforts will aim to integrate these dimensions more fully into discussions on aligning financial flows with sustainability objectives.

## Structure of the Report

**This report assesses three key areas to provide an overview of the evolution of the financial system in its journey to reach the Paris objectives.** Each area constitutes one of the three foundations that are necessary to build a greener financial system: 1) developing a common understanding of what climate goals mean for finance and the progress made on the provision of finance aligned with those goals; 2) scaling up the relevant market instruments and strategies, and 3) establishing regulatory and supervisory frameworks that foster and enable an ecosystem for an effective and just green transition.

**Section 1. Evidence on climate-related financial flows and transition-related investment needs.**

This section examines the mechanisms for measuring and fostering alignment with pathways to a net-zero global economy, assessing climate-related financial flows and transition-related investments in both adaptation and mitigation. It identifies investment trends and gaps and highlights the critical role of both public and private finance in driving sustainable development both in AEs and EMDEs.

**Section 2. Scaling Up Green Finance Instruments**

This section explores the instruments and strategies that can be used to accelerate green finance. It discusses the role of green capital markets and direct financing in unleashing the potential of green finance.

**Section 3. Fostering an Enabling Ecosystem through Financial Regulation, Supervision and Policy Practices**

This section emphasises the role of financial regulation and supervision in creating an ecosystem that recognises climate-related and nature-related risks and supports the net-zero transition. Central banks and financial supervisors should incorporate climate risks into their frameworks through climate risk assessments, scenario analyses, and improved transparency. Strengthened regulatory frameworks are essential to managing these risks and aligning financial flows with global climate goals.

8 As said in NGFS scenario document NGFS (2021a).

# Section 1. Evidence on climate-related financial flows and transition-related investment needs

## Key messages

**There is a significant climate finance gap. Global climate finance needs are expected to range between USD 5.9 and 12 trillion annually by 2030 (CPI, 2023).** Global climate finance flows nearly doubled from 2019/2020 to 2021/2022 reaching USD 1.3 trillion annual average (CPI, 2023). Yet, current flows still fall far short of existing needs. In particular, adaptation finance remains insufficient to meet the growing needs in EMDEs[9].

**Climate finance is heavily skewed towards advanced economies and China, with EMDEs (excluding China) receiving only 14%, although they represent a quarter of global GDP (World Bank, 2024) and LDCs receiving just 3% of total climate finance.** As EMDEs rely heavily on external finance compared to AEs, global commitments such as under the Copenhagen Accord play a key role in providing external climate public finance to these geographies.

**Despite the record of global climate finance mobilised in 2021/2022, significant sectoral imbalances remain.** Adaptation represented on average in 2021/2022 only 5% of the total climate finance provided. Also, energy and transport, the largest-emitting sectors, continue to attract the majority of mitigation finance, while agriculture and industry, despite their significant mitigation potential, remain severely underfunded. Energy and transport attract 44% and 28% of total mitigation flows respectively. In contrast, agriculture and industry received less than 4% of mitigation finance (CPI, 2023).

**Improving the quality and availability of climate finance data, as well as progressing towards standardised methodologies, is crucial for tracking progress towards climate goals.** There is no standardised approach to measuring climate finance alignment, with data gaps and methodological inconsistencies making it difficult to track progress accurately. Improved data collection, standardisation, and transparency are essential to closing the investment gap and ensuring alignment with climate goals.

## A. Measuring financial flows and alignment for climate action

**Standardised, relevant and transparent methodologies are required to measure progress in greening the financial system.** Article 2.1c of the Paris Agreement calls for "making finance flows consistent with a pathway towards low greenhouse gas (GHG) emissions and climate-resilient development". Assessing progress towards Article 2.1c therefore requires being able to measure the evolution of climate finance as well as the broader alignment of finance flows with said pathway. This necessitates the use of robust and transparent methodologies (Noels and Jachnik, 2022), assessments anchored in Paris-aligned pathways (Noels *et al.* 2023), as well as metrics that assess real-economy actions and impacts (OECD, 2023a) beyond merely reflecting changes in financial portfolios.

**Despite clear progress, there is no standardised approach to measuring the alignment of financial flows with climate goals (CPI, 2021).** Existing climate-alignment assessments rely on complex methodologies, and different assumptions and choices lead to varied results (Noels and Jachnik, 2022). While different methodologies and metrics can complement one another, remaining data gaps and methodological uncertainties need to be addressed to improve the ability to perform comprehensive assessments of the climate alignment of finance.

**The available data on climate investments largely focuses on transaction-level information and global capital expenditure estimates[10].** These approaches

9 As mentioned in the introduction, CPI figures provided in this report use a two-year annual average (e.g. annual average years 2021 and 2022). By taking annual averages, CPI is able to capture better the trend and smooth out year by year fluctuations.

10 For example, assessments on transaction-level data are used by the OECD and CPI, while capital expenditures are used by the IEA.

highlight primary capital flows directed towards related investments in the real economy that advance the green transition. The emphasis on primary capital flows rather than on flows within the financial market allows for greater granularity in understanding sectoral and geographic financing trends, as well as the type of capital being deployed – such as debt, equity, or grants. However, significant data limitations remain with this approach, as transaction level data on private sector investments and public domestic expenditures related to transition finance remain sparse. These limitations are exacerbated by the various definitions of climate or transition finance and related methodologies (WB, IMF and OECD, 2023).

**Data on climate finance has so far mostly been available for mitigation finance, with information on adaptation finance lagging behind.** Data limitations hinder the assessment of adaptation finance, as the available information mostly concerns the international flows from AEs to EMDEs, as well as, to a lesser extent, finance provided by national development finance institutions. The context-specific nature of adaptation projects makes it difficult to standardise their classification under existing taxonomies, complicating efforts to identify and report on adaptation finance. Additionally, private sector investment in adaptation faces barriers such as uncertain revenue streams, limited information on physical climate risks, and long investment horizons, which leaves the public sector as the primary source of adaptation finance.

**Improving the quality and availability of climate finance data is crucial for identifying investment gaps, informing policy solutions and investment decisions, and tracking progress towards climate goals.** Strengthening the climate information architecture is therefore an important part of the climate and financial policy mix as investors rely on high-quality, reliable, and comparable data (IMF, 2023). To achieve this, governments are encouraged to establish a standardised and centralised approach to tracking climate finance data. Existing efforts, such as the G20 Data Gaps Initiative launched in 2019 to close the policy-relevant data gap, can support this process. Similarly, the NGFS in its pioneering work on *Bridging Data Gaps* had identified three building blocks to bridge data gaps under disclosures, taxonomies and alignment approaches, and metrics (NGFS, 2022a). The NGFS is also working on enhancing the accessibility of climate-related metrics through initiatives like the new Data Directory[11]. As a publicly available catalogue of available climate-related metrics and data sources based on specific stakeholder use cases, the Directory could help financial sector stakeholders to identify important and relevant climate-related data sources to meet their needs, facilitate access to data, and thus improve the broader dissemination of existing climate-related data.

## B. Tracking investments needs and current climate finance flows

**Tracking financial flows is essential for assessing the needs and current levels of climate finance, as well as ensuring their alignment with global climate goals.** Monitoring financial flows requires tracking their volume, sectoral distribution, and geographical allocation. Key sectors such as energy, transport, buildings, industry, and agriculture contribute heavily to, or are vulnerable to, climate change, and climate finance supports both mitigation and adaptation activities within these areas. Standardised approaches to climate finance tracking, such as those by the OECD and CPI, provide tools for assessing progress in scaling up climate finance, focusing on total volumes mobilised, geographic distribution, and sectoral allocation. These indicators provide a comprehensive understanding of where finance is flowing and how well it aligns with the global effort to combat climate change.

### B.1. Total climate finance mobilised

**The total volume of climate finance mobilised, including both domestic and international public and private sources, serves as a key metric for assessing the alignment of financial flows with global climate goals.** The mobilisation of climate finance refers to the process of generating and directing financial resources – both public and private – towards projects and activities that help mitigate climate change and adapt to its impacts, typically including both commitments and disbursements. Despite challenges in accurately estimating the finance needs for climate action, such estimates are useful to

11 NGFS Data Directory 2.0 developed in collaboration with the BIS Innovation Hub Singapore Centre, Banque de France, and the Monetary Authority of Singapore. Available at: http://ngfs.dev.masdkp.io/.

maintain the ambition and inform strategies to significantly scale up climate finance (Falduto *et al.* 2024).

**Current estimates suggest that between USD 5.9 trillion and 12 trillion annually will be required by 2030 to meet global climate mitigation and adaptation needs (CPI, 2023).** These estimates are based on an aggregation of available scenarios and models from different institutions to date, e.g. IEA, UNEP, IPCC, IRENA, BNEF or McKinsey among others. They act as an indicator of the level and order of magnitude of the investments required to reach the goal of the Paris Agreement and also the investments needs in different sectors e.g. AFOLU, energy, or adaptation among others[12]. With estimations at the country level in 42 economies, the World Bank Country Climate and Development Reports (CCDR) estimates annual climate-related investment needs for all low- and middle-income countries (excluding China) at USD 574 billion per year between now and 2030. While lower than other estimates, these investments still represent around 2.8% of GDP in these economies[13]. The International Energy Agency (IEA) reports for its Net Zero Emissions by 2050 scenario that the energy transition investment – with a mitigation component but without including broader adaptation needs – requires on its own more than USD 4 trillion annually by 2030 (IEA, 2023).

**Global climate finance has seen substantial growth yet still remains insufficient to meet climate targets.** Despite the economic disruptions caused by COVID-19, climate finance flows nearly doubled between 2019/2020 and 2021/2022, reaching an annual average of USD 1.3 trillion[14]. This increase was largely driven by mitigation finance, which grew from USD 439 billion in 2019/2020 to USD 1.17 trillion in 2021/2022. However, the gap between current finance flows and the estimated global climate finance needs remains considerable, underscoring the urgency of further scaling up investments to meet the USD 5.9 trillion annual requirement by 2030.

**Public and private sectors are both critical in mobilising climate finance, with near-equal contributions.** In 2021/2022, public actors committed an annual average of USD 638 billion, accounting for roughly half of the total global climate finance (Fig. 1). Development finance institutions, including national development banks and multilateral institutions, played a key role, channelling 53% of this public finance, highlighting their central position in driving climate investments. Private actors – including corporations, households, and commercial financial institutions – provided 49% of total climate finance, contributing USD 625 billion annually focussing predominantly on mitigation efforts. While private finance is substantial, advanced economies attracted a larger share (67%) compared to EMDEs (42%), reflecting an imbalance in financial flows across regions (See Fig. 1.1).

## B.2. Sectoral allocation of climate finance

**Sectoral allocation of climate finance remains heavily concentrated in energy, transport, and buildings, with significant disparities across sectors.** These three sectors represent the most visible efforts toward climate alignment, particularly in mitigation activities. Renewable energy projects alone account for a substantial portion of climate finance, emphasising the importance of the energy sector's transition to low-carbon sources. The UAE Consensus of 2023 further underscored this shift by calling for an equitable transition away from fossil fuels, aiming to reach net-zero emissions by 2050[15] (UNFCCC, 2023). Meeting this target will require annual investments in clean energy ranging between USD 2.2 and 2.8 trillion by the early 2030s (IEA/IFC, 2023) only in EMDEs, with approximately one-third of this directed toward low-emission power generation, primarily renewables, and another third focused on improving efficiency in end-use sectors such as cooling systems and electric mobility. Just as a matter of comparison, explicit and implicit fossil fuel subsidies reached globally in 2022 USD 7 trillion (CPI, 2023).

12 See the methodological note from CPI (2023).

13 See https://www.worldbank.org/en/news/feature/2024/05/01/what-you-need-to-know-about-ccdr-investment-estimates-and-the-role-of-the-private-sector for a more detailed explanation.

14 CPI's climate finance flows cover both public and private as well as international and domestic finance flows. The numbers represent narrower scope in the energy sector compared to IEA and excludes certain technologies such as plug in hybrid electric vehicles or grid investment. However, CPI numbers cover broader themes sectors including adaptation, agrifood systems, and waste that is not captured in IEA dataset. CPI figures provided in this report use a two-year annual average (e.g. annual average years 2021 and 2022). By taking annual averages, CPI is able to capture better the trend and smooth out year by year fluctuations.

15 The decision invites countries to "transition away from fossil fuels in energy systems, in a just, orderly and equitable manner, accelerating action in this critical decade, so as to achieve net zero by 2050 in keeping with the science".

**Energy and transport, the largest-emitting sectors, continue to attract the majority of mitigation finance, driven largely by private investment.** Together, these sectors account for 71.6% of global greenhouse gas (GHG) emissions (ClimateWatch, 2023)[16] and receive the lion's share of climate finance, with energy attracting 44% and transport 29% of total mitigation flows. Electric vehicles (EVs) have seen exponential growth, particularly in China, Western Europe, and the US, contributing to the rise in climate finance in these sectors. The IEA projects that global investment in clean energy technology and infrastructure will reach USD 2 trillion by 2024[17]. Emerging technologies, such as battery storage and hydrogen, are beginning to attract more private investment due to declining costs and policy support, but their scale remains far below potential (IEA, 2023a; IEA, 2023b).

**In contrast, agriculture and industry, despite their significant mitigation potential, remain severely underfunded.** Although agriculture (AFOLU) and industry are responsible for approximately 15.2% and 6.6% of global GHG emissions, respectively (ClimateWatch, 2023), they receive less than 4% of total mitigation and dual-benefit finance. According to the Intergovernmental Panel on Climate Change (IPCC), these sectors have a combined mitigation potential of almost 20 $GtCO_2$-eq by 2030 yet they remain underfunded (IPCC, 2022)[18].

**Adaptation finance has grown but remains insufficient to meet the growing needs, particularly in developing countries.** Adaptation finance more than doubled between 2018 and 2022, reaching a new high of USD 68 billion annual average in 2021/22 (CPI, 2024b). However, this increase has been from a low base, and there is still a large gap between current adaptation finance flows and estimated needs, particularly in developing countries where the annual climate adaptation financing needs are estimated to be USD 212 billion per year from 2024 to 2030 and USD 239 billion every year from 2031 to 2050. Even these figures may be a significant underestimate due to uncertain future climate impacts and the spiralling cost of inaction (CPI, 2024a), meaning that the global adaptation finance gap is likely to be even wider. At present, adaptation financing makes up merely 16% of climate finance directed to EMDEs excluding China, with the overwhelming majority (98%) supplied by public sources (World Bank, 2024). In terms of sectoral breakdown, in 2021/2022, the water and wastewater sector accounted for nearly half of tracked adaptation finance, receiving USD 35 billion, driven by capital-intensive projects like water treatment and desalination plants. Additionally, cross-sectoral adaptation efforts, including policy support and disaster risk management, received USD 3.8 billion and USD 6.9 billion, respectively. Despite its high vulnerability and adaptation potential, the Agriculture, Forestry, and Other Land Use (AFOLU) sector received only USD 7 billion in adaptation finance (CPI, 2024b).

## B.3. Geographical distribution of climate finance

**Recent growth in climate finance has been driven by clean energy investments in a limited number of geographies, underscoring the need for more balanced regional distribution.** Between 2019/2020 and 2021/2022, clean energy investments accounted for the bulk of increased climate finance, with China, the USA, Europe, Brazil, Japan, and India receiving 90% of the increased flows (CPI, 2023). While these trends demonstrate growing investments in key markets, they also highlight the disproportionate focus on a few regions, leaving many EMDEs underfunded. For example, between 2018 and 2022, AEs had a compound annual growth rate of 15%, China had 36%, LDCs averaged 20%, and EMDEs (ex. LDCs and China) only 12% (CPI, 2024b) (Figure 1.2). Climate finance in EMDEs has remained resilient, albeit heavily concentrated in a few major economies, highlighting the need for more targeted investments to address specific challenges in less funded regions (World Bank, 2024) (Box 1).

**The geographical distribution of climate finance remains heavily skewed towards advanced economies and China, with limited flows to EMDEs, particularly LDCs.** In 2021/2022, LDCs received just USD 34 billion – only 3% of global climate finance – despite being among the most

16 The energy sector contains emissions generated from fuel combustion, as well as fugitive emissions. The sector is broken down into electricity/heat, building, manufacturing/construction, transportation, other fuel combustion, and fugitive emissions.

17 Including in renewable energy, energy efficiency and end use, grids and storage, nuclear & other clean power and low emissions fuel.

18 As a benchmark, 20 $GtCO_2$-eq is roughly double the total annual emissions of the United States (around 6-7 $GtCO_2$-eq) and the EU (about 4 $GtCO_2$-eq) combined, showing the scale of impact this level of mitigation could achieve.

vulnerable to climate change[19]. EMDEs excluding China attracted 14% of global climate finance (USD 179 billion), while developed countries received approximately 44% of tracked flows[20]. This distribution reflects significant disparities between regions, with advanced economies and China benefiting from larger shares of climate finance due to their more developed financial markets and domestic financing capabilities among others.

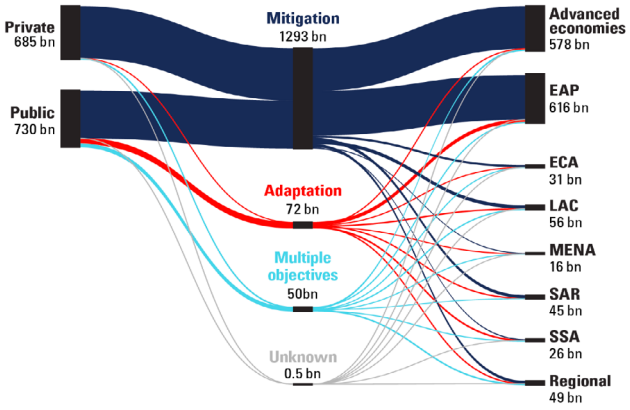
**The geographical origin of climate finance reveals significant disparities between advanced economies and EMDEs.** AEs and China rely on domestic sources for over 90% of their climate finance. In contrast, EMDEs (excluding China) generate less than half (46%) of their climate finance domestically, with the majority (54%) coming from public sources (World Bank, 2024). This reliance on external public funding, particularly for adaptation (provided by public actors in EMDEs), highlights the challenges EMDEs face in mobilising sufficient domestic capital for climate action.

**Global commitments to climate finance, notably under the Copenhagen Accord (UNFCCC, 2009), have played a key role in providing external public finance for EMDEs.** Under the Accord, developed countries pledged to mobilise USD 100 billion annually to support climate efforts in developing nations. According to the latest OECD data, this target was reached for the first time in 2022, with USD 115.9 billion provided and mobilised by developed countries (OECD, 2024). Efforts must now focus on maintaining this momentum by scaling up private finance mobilisation and increasing support for climate change adaptation (Box 2).

Figure 1 **Tracking climate finance flows**

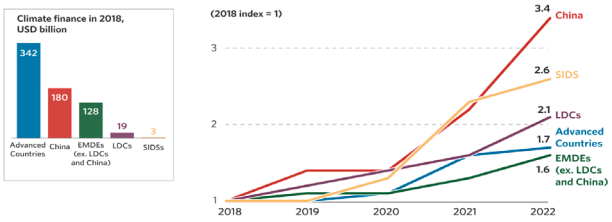
Figure 1.1 Climate Finance Flows

*Billions of US dollars 2022*




*Source: World Bank (2024). Finance and Prosperity 2024, World Bank staff calculation based on CPI (2023).*

Figure 1.2 Evolution of the geographical distribution of climate finance flows




*Source: CPI (2024b). Global Landscape of Climate Finance 2024. Note that unlike other figures in this report, Fig. 1.2. excludes both China and LDCs from EMDEs.*

19 See the Notre Dame Global Adaptation Initiative Vulnerability Index (https://gain.nd.edu/our-work/country-index/rankings/) for a ranking of the countries' vulnerability to climate change. The Vulnerability index measures a country's exposure, sensitivity and ability to adapt to the negative impact of climate change.

20 These estimations are provided by CPI (2023). Global Landscape of Climate Finance 2023.

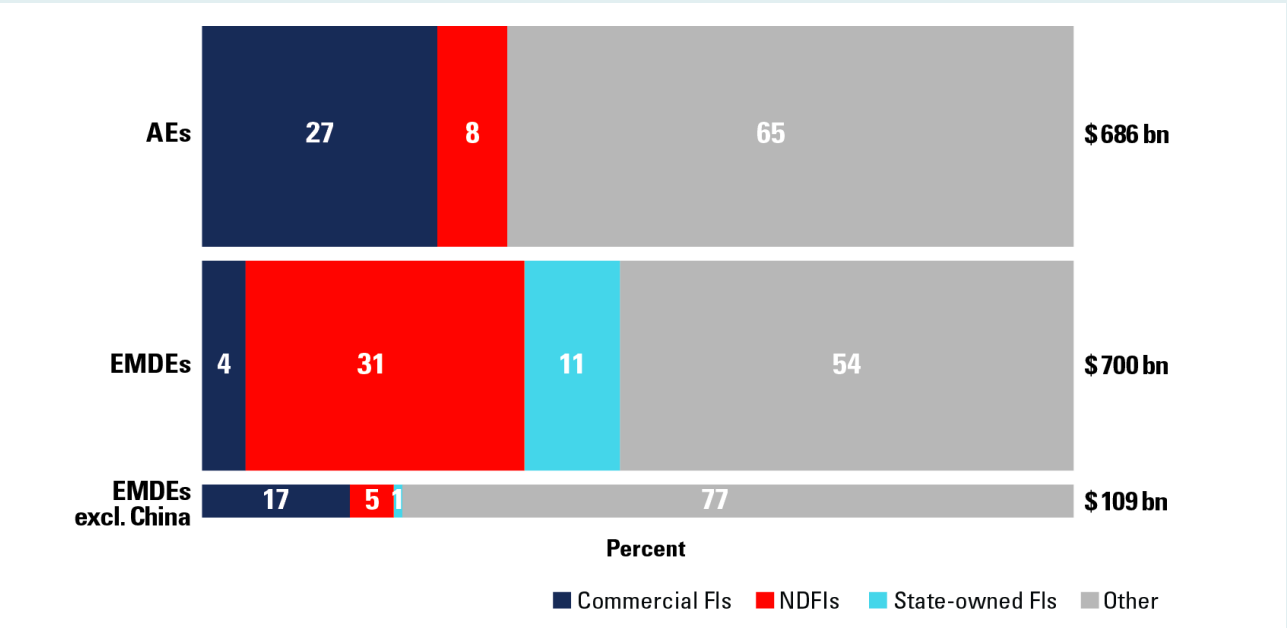
Box 1

## Promoting climate investments in emerging and developing economies

**Lack of awareness by investors, high transaction costs, and a variety of real and perceived risks hinder green finance investments in EMDEs.** Structural policies aimed at strengthening macroeconomic fundamentals, such as reforms to strengthen financial institutions, deepen domestic financial markets, or improve predictability of the legal and regulatory environment (e.g., the regulation of energy markets) can lower financing costs and attracting longer-term investments. Until these reforms take effect, blended finance and national development banks (NDBs), together with MDBs and other DFIs, can play a crucial role in improving the risk/return profile and facilitating capital flows to these economies (Anadon *et al.* 2022). Yet, solving these issues would require deep political commitment and reforms domestically. Although blended finance volumes fell to a ten-year low in 2022 due to political instability and inflation, it remains essential, with about USD 5 billion in climate-related transactions closed that year. Regional blended finance approaches can be very effective especially when channelling resources through national development finance institutions (NDFIs) with their established financing pipelines and distribution networks. NDFIs channel more than one third of climate finance in EMDEs, but their volume of financing is significantly reduced when excluding China (figure 3). Based on available data, a strategy could involve cooperation between MDBs and NDFIs. MDBs could expand the role of NDFIs by providing them with capital (through loans, equity and/or guarantees) so to increase their capacity to absorb more risk and extend more financing to real economy actors (NGFS, 2023a; Ahlgren *et al.* 2023).

**Supporting national development finance institutions (NDFIs) in absorbing risks is critical to facilitating investment flows to and within EMDEs.** High capital costs and limited domestic financial resources hinder climate investments, which are typically capital-intensive, such as renewable energy projects. NDFIs can mobilise domestic and international private finance for climate investment needs by using tools like de-risking instruments, blended finance, and credit enhancements. Additionally, increasing deployable resources for multilateral development banks (MDBs) and international climate funds, and supporting domestic capital market development, are crucial steps to mobilise private capital and address market barriers associated with green investments (See: Colombo and Cuda, 2023; Steffen and Schmidt, 2019; Anadon *et al.* 2022 among others).

Figure 2 **Type of Financial Institutions providing climate finance in 2022**




*Source: World Bank (2024). Finance and Prosperity 2024 World Bank staff calculation based CPI (2023).*

## Box 2

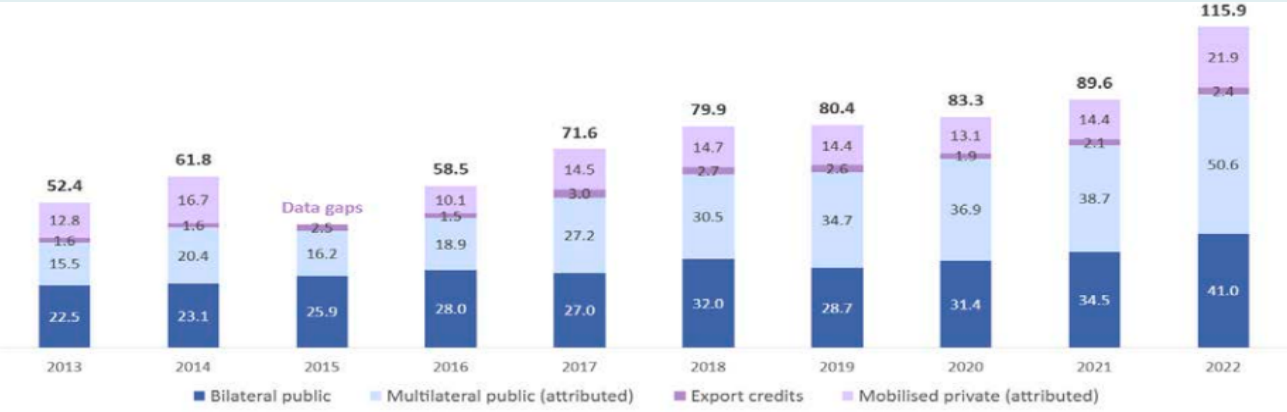
# Climate finance provided and mobilised by developed countries for climate action in developing countries (OECD report)

Under the UNFCCC, developed country Parties committed in 2009, to a collective goal of mobilising USD 100 billion per year by 2020 for climate action in developing countries, in the context of meaningful mitigation actions and transparency on implementation. The most recent OECD analysis shows that in 2022, developed countries provided and mobilised a total of USD 115.9 billion, thereby reaching the annual target of USD 100 billion for the first time (OECD, 2024). This collective goal needs to be achieved through to 2025. To support ambitious climate action in developing countries, international climate finance providers need to continue their efforts to address two long-standing issues: scaling up both the mobilisation of private finance as well as finance for climate change adaptation and resilience. More effective private sector mobilisation involves, among others, a more effective use of blended finance mechanisms, as well as increased training and capacity building to enhance project development, financial literacy, local capital markets and enabling conditions (OECD, 2023b).

For the post-2025 period, a New Collective Quantified Goal (NCQG) on climate finance is expected to be set based on the outcome of negotiations to be finalised during COP29 at the end of 2024. In contrast to the existing goal, the NCQG has the potential to be designed in a way that better reflects and incentivises the contributions to climate action from a broad range of sources, in line with the scale of investment needed to achieve the Paris Agreement's goals (Falduto *et al.* 2024). This could contribute to reconciling efforts to mobilise finance for climate action in developing and emerging economies, with voluntary and regulatory initiatives to green financial sectors in individual jurisdictions and internationally.

Figure 3 **Climate finance provided and mobilised in 2013-2022**

*USD billion*




*Note: The sum of components may not add up totals due to rounding. The gap in time series in 2015 for mobilised private finance results from the implementation of enhanced measurement methods. As a result, grand totals in 2016-22 and in 2013-14 are not directly comparable.*
*Source: Based on Biennial Reports to the UNFCCC, OECD DAC and Export Credit Group statistics, complementary reporting to the OECD.*

# Section 2. Scaling up green finance instruments

## Key messages

**Green bonds, sustainability-linked bonds, and ESG funds have seen rapid growth, driven by strong investor demand and support from the public sector.** However, they still represent a small portion of the overall market, with green bonds making up 5.4% of the bond market and ESG funds at 6% of total investment funds.

**Banks in EMDEs play a crucial role but contribute minimally to climate finance.** Many EMDE banks allocate 5% or less of their lending to climate projects (World Bank, 2024), constrained by high borrowing costs and the difficulty in attracting private investment.

**Current labels for green finance instruments, like green bonds, are inconsistent and often lack strict standards, leading to concerns about greenwashing.** Stricter, standardised labels and clearer criteria are needed to ensure investments are truly aligned with climate goals.

**The green finance market has significant room for growth.** Improving information, developing stronger and standardised labels, and expanding taxonomies – especially in EMDEs – could help scale up green finance to support the global transition to net-zero emissions.

## A. The potential of green finance instruments

**Both sustainable debt markets and ESG-type funds have enjoyed rapid market growth in the last decade (Figure 4)[21].** Supported by high investor demand for sustainable investments, even relatively new types of labelled instruments such as green, social, sustainability or sustainability-linked bonds, have very quickly grown to a significant size. However, volume growth in sustainable finance markets has receded in the most recent years due to both macro-economic conditions (higher rates, political volatility) as well as due to increased uncertainty on sustainability definitions, regulations and commitments from financial institutions and market authorities (Figure 4.1).

**As in conventional debt markets, the public sector has provided an important impetus to the development of sustainable debt markets.** In the early stages, supranational institutions, such as MDBs, have made a major contribution to kick-starting the market. Sovereign issuers have started to tap the sustainable bond market more recently, which has contributed to further market development (Chen *et al.*, 2024). Nevertheless, to date, private financial and corporate issuers have generally accounted for the majority of sustainable debt issuance (Figure 4.2). ESG-type funds, which largely hold equities, have grown at a similar pace to sustainable debt markets (Figure 4.4).

**Annual global issuance of sustainable bank loans has hovered around USD 400-500 billion in recent years, about half the size of the sustainable bond market (Figure 4.3)[22].** Banks are pivotal in advancing green finance, holding 80% of financial sector assets in EMDEs and 50% in advanced economies[23]. However, their climate finance contribution in EMDEs is limited with nearly 60% of EMDE banks allocating 5% or less of their lending to climate finance, and 28% providing no climate financing at all (Figure 5.4) (World Bank, 2024). In pursuit of their primary mandate of financial stability, central banks and regulators have a role to play to enhance the sector's capacity to finance climate action and build resilience, as investing in low-carbon activities can also reduce climate-related financial risks[24].

21 This chapter focusses on capital market-based green finance instruments (e.g., sustainable bonds, ESG funds), as well sustainable loans, and forms of green finance key for EMDEs including instruments for adaptation finance.

22 However, it must be noted that data coverage and reporting practices in several EMDE countries is significantly lower than the equivalent for bonds.

23 World Bank FinStats Database.

24 Indeed, as per the foundational text of The Network for Greening the Financial System (NGFS), the NGFS is a group of central banks and supervisors, which on a voluntary basis is willing to share best practices and contribute to the development of environment and climate risk management in the financial sector, and to mobilise mainstream finance to support the transition toward a sustainable economy.

Figure 4 **The global market for sustainable bonds, loans and ESG-type investment funds**

Figure 4.1 Global sustainable bond issuance by instrument

*Annual, billions of US dollars*

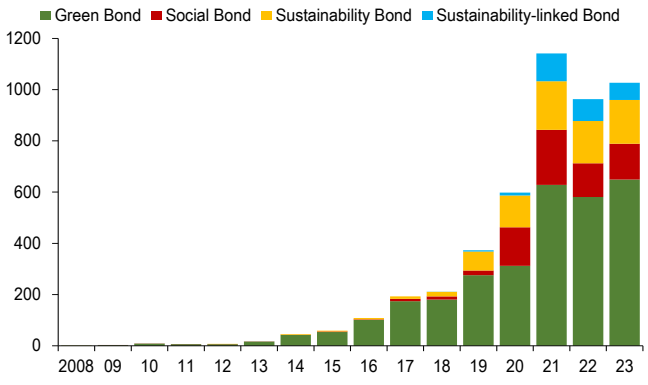



Figure 4.2 Global sustainable bond issuance by sector

*Quarterly, billions of US dollars*

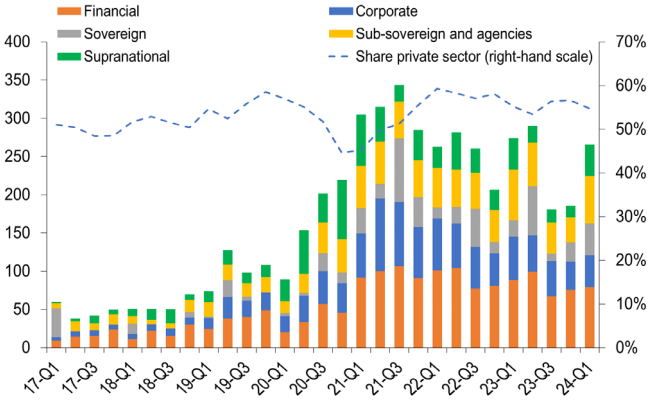



Figure 4.3 Global issuance of sustainable loans global

*Quarterly, billions of US dollars*

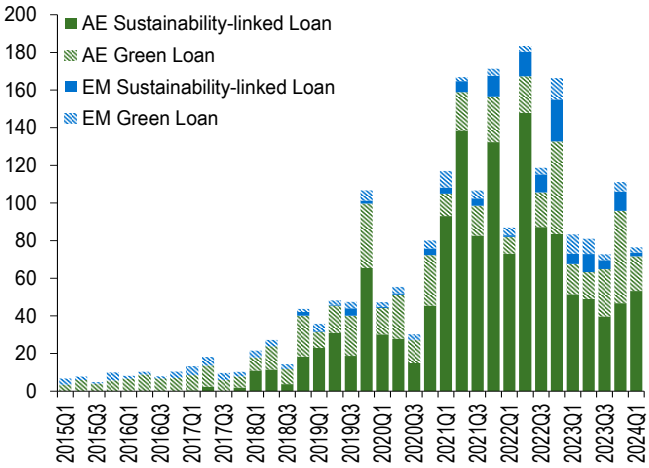
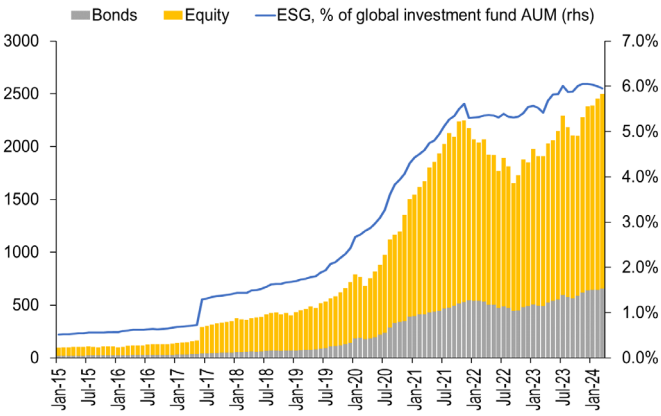



Figure 4.4 Assets under management (AUM) of ESG-type investment funds

*Billions of US dollars*




*Note: In panel 4.2, the share of corporate issuance is a 4-quarter moving average.*
*Sources: Refinitiv; Bloomberg L.P.; EPFR; WB authors' calculations.*

**Arguably, the potential for further growth of the market for green finance instruments is still large.** The market share of sustainable bonds in the total bond market in major jurisdictions remain relatively small – at about 5.4% in 2023 (Figure 6.2). ESG-type funds have a similarly small share in total investment funds – at around 6% in mid-2024 (Figure 4.4).

Furthermore, catastrophe (CAT) bonds, an instrument structured for insurance/ reinsurance companies to manage their risk from natural disasters like hurricanes, have also seen a revival since 2023, when its issuance surged to record high levels[25]. Notably, returns on CAT bonds have risen substantially since 2023, however this is believed to have been partially driven by incidentals like a period of relatively fewer catastrophes, and terms of certain bonds.

25 In 2023, USD 16.3 bn. were raised in CAT bonds globally, of which USD 350 mn were issued by supranationals. The total value of outstanding CAT bonds as of Sept 2024 is USD 49.4 bn.

Figure 5 **Sustainable debt markets in EMDEs**

Figure 5.1 Total sustainable issuance by AE/EMDE

*Annual, Billion US Dollars*

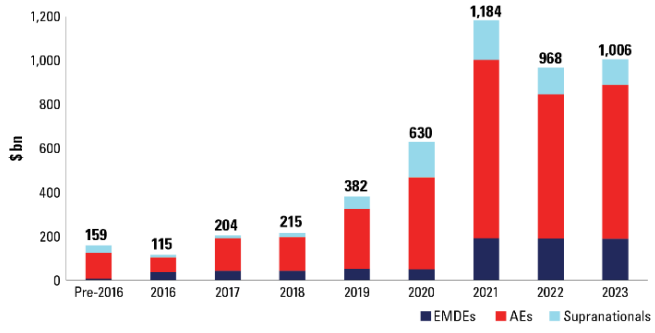



Figure 5.2 Cumulative sustainable bond issuance (since 2015) by country

*Cumulative gross issuance, billions of US*

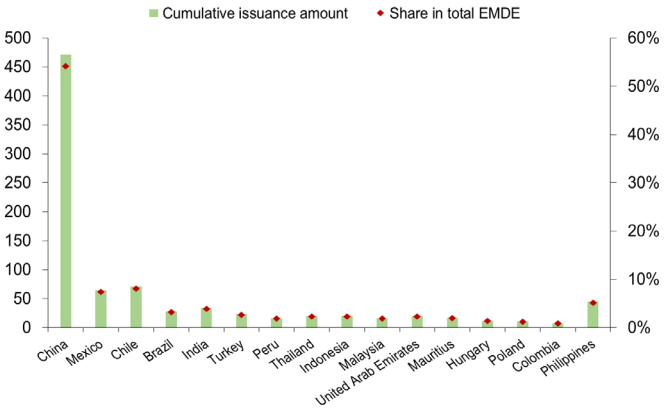



Figure 5.3 Breakdown of green loan and sustainability-linked loan issuance by EMDEs/AEs

*Percent of gross domestic product (GDP)*

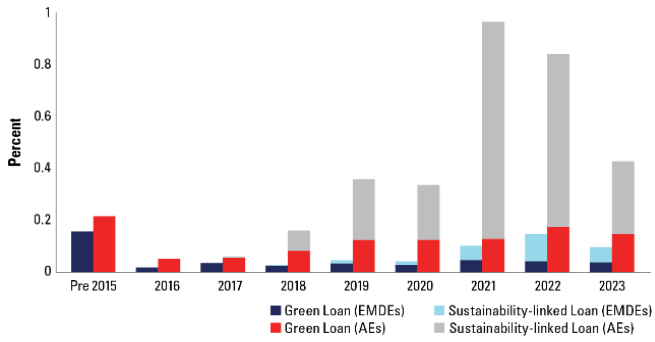
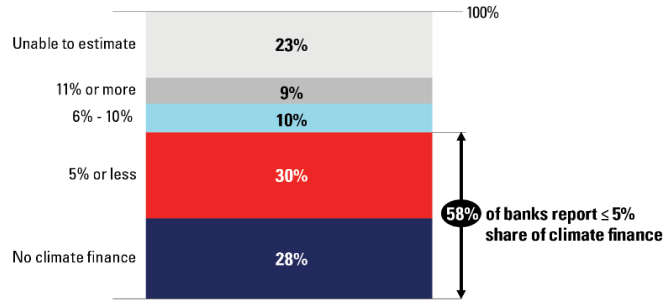



Figure 5.4 Share of climate finance in surveyed EMDE banks' lending portfolios

*Percent of total loans*




*The current environment of high interest rates poses significant challenges to financing the transition to a low-carbon economy. Elevated borrowing costs can hinder the availability and affordability of capital, particularly for long-term, capital-intensive green projects. This impact is most pronounced in EMDEs, where higher risk premiums exacerbate the difficulty of attracting private investment. As a result, the cost of climate finance rises, potentially slowing down the pace of the transition. Addressing these challenges will require innovative financial instruments, targeted subsidies, and enhanced risk-sharing mechanisms to ensure that the necessary capital flows are maintained despite the macroeconomic headwinds (World Bank, 2024).*
*Sources for figures 5.1 / 5.3 / 5.4. World Bank Finance and Prosperity 2024. Source for 5.2. Refinitiv, World Bank and IMF staff calculations.*

**Green finance instruments can help achieve long-term sustainability while maintaining competitive financial performance.** These instruments are designed to channel investments into projects that yield environmental benefits, thus aligning financial flows with sustainable development goals (SDGs) (Adisa *et al.*, 2024; Devi, 2023). The comparative analysis of returns from green instruments versus conventional investments has garnered significant attention in recent years. While some studies indicate that green bonds may carry a "greenium" – a slight premium due to investor demand and bond scarcity – this does not necessarily lead to diminished risk-adjusted returns (Zerbib, 2019). Others show identical pricing for green and non-green issues (Larcker and Watts, 2020). Research has supported this evidence not only at the level of municipal bonds but at the corporate level, showing that corporate green bonds generally offer returns comparable to conventional bonds while simultaneously enhancing the environmental reputation of the issuers (Flammer, 2021).

**While there may be concerns about potential trade-offs in returns** (Baker *et al.* 2018)**, green investments have the potential to contribute materially to climate risk mitigation.** Indeed, emerging evidence from the banking loan market indicates that green debt instruments have

been reporting lower rates of default when compared with conventional debt instruments (Moody's, 2020). In regards to ESG requirements, some studies (Pedersen *et al.* 2021) suggest that ESG investments might shift the efficiency frontier, implying a trade-off between financial returns and ESG goals. But some studies also suggest that integrating ESG factors into investment strategies can lead to better risk management and lower volatility, which can offset any minor sacrifices in returns (Giesen *et al.* 2019).

**Scaling up green finance will require a significant push in private capital mobilisation.** In regards to the private financial sector, climate policies and commitments of major banks and insurance companies are not yet aligned with net zero emission targets, curtailing the alignment of private financial flows with the climate transition (IMF, 2023). The apparent demand from investors for these instruments i.e. sustainable bonds, loans and ESG-type investment funds, presents an opportunity align finance flows with the Paris Agreement. Given limited fiscal budgets, a large share of climate investments – possibly 80% or more (IMF, 2023) – will have to come from private sources.

## B. Current challenges with labelled green finance instruments

**Current labels could be more effective in providing decision-useful and reliable information.** The purpose of labels for green finance instruments is to provide information about sustainability benefits to investors and other stakeholders. Yet, some labels are both lacking a focus on key issues such as climate alignment (e.g., net zero by 2050) or climate adaptation, and leave considerable room for greenwashing. Others including Climate Bond Initiative (CBI) labels for green bonds, are much stronger and do support climate alignment. Yet, they are far from being a market benchmark with most issuers opting for looser principles[26]. Investors looking to align their portfolios with climate goals such as net zero emissions by 2050 cannot do so without further due diligence with current labelled sustainable bonds. Specific categories of ESG funds do offer climate-alignment features, but there are no standardised labels. Similarly, there is a lack of investment products targeted at limiting climate-related risks (similar to funds targeting specific credit ratings).

Figure 6 **The voluntary nature of certification standards for green bonds and still small market share of sustainable bonds**

Figure 6.1 Global share of self-labelled green bonds not compliant with ICMA guidelines

*Percent of annual issuance*

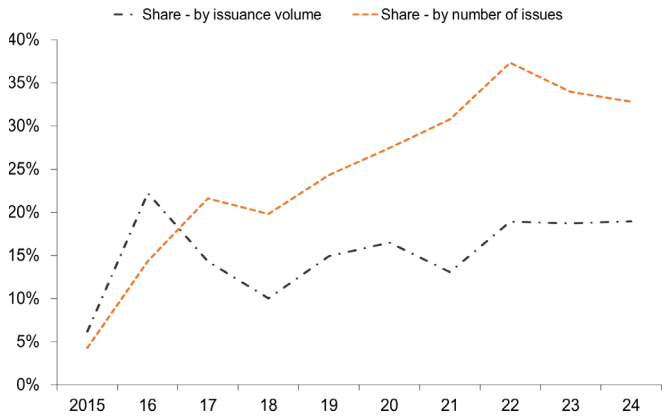
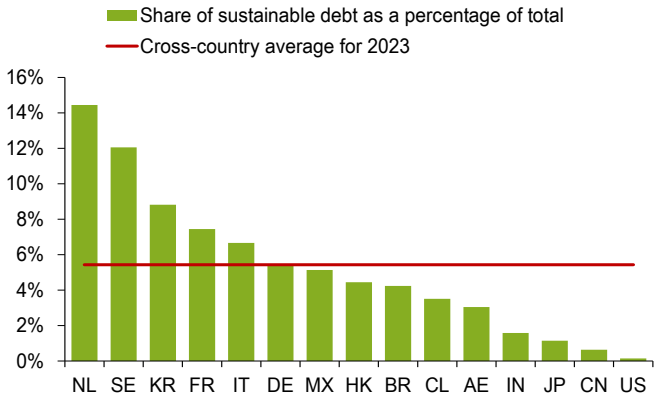



Figure 6.2 Share of sustainable debt in total bond issuance in major advanced and emerging markets

*Percentage share of annual issuance in 2023*



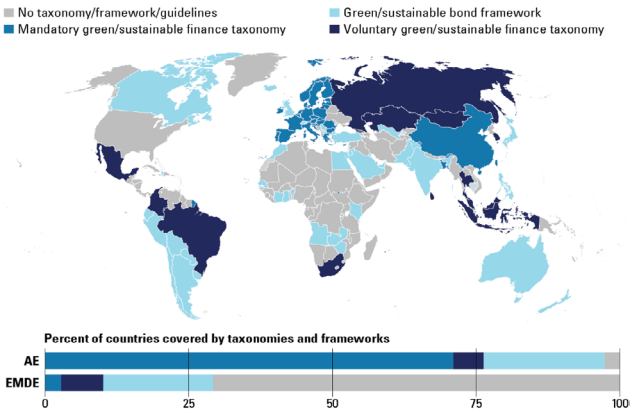

*Sources: Refinitiv; Bloomberg L.P.; EPFR; WB authors' calculations.*

26 Sustainability-linked bonds or loans can be aligned with given climate goals, if the SPT and KPIs are set accordingly. Instruments designed in this way are still rare and understanding the climate-alignment properties would require sophisticated additional analysis by investors. The EU climate-aligned and Paris-aligned benchmarks for investment funds are an example of climate-aligned instruments.

**Existing labelled "green" or "social" bonds promise to finance specific projects but current principles and standards are voluntary and do not necessarily ensure market integrity.** Currently, labelled bonds are expected to be in line with the principles developed by the International Capital Market Association (ICMA). These principles, however, leave a lot of room for interpretation regarding eligible projects and the content of require reporting and disclosures (Figure 6.1). Both the private sector (Climate Bonds Initiative) and the public sector (e.g., EU Green Bond Standards) have developed stricter requirements, but they remain voluntary. This has led to concerns about greenwashing and differing labelling. To the extent that jurisdictions and exchanges have introduced stricter standards and taxonomies, these often differ, complicating comparisons across markets internationally. ESG-type funds lack specific standards, with no equivalent to the ICMA principles. Recently, the EU and the UK introduced disclosure and labelling requirements for ESG funds, so that sustainable finance products offered to markets in these jurisdictions will have to align with the current relevant taxonomies. These efforts aim to enhance transparency and reliability in green finance.

**National sustainable taxonomies and financing frameworks could help to address the lack of awareness about green finance opportunities and high transaction costs in EMDEs.** While over 90% of advanced economies have an official sustainable finance taxonomy or framework, this coverage drops to less than one-third in EMDEs, especially in regions like Africa and Central Asia (Figure 7)[27] where green finance volumes remain very low. In these regions, investors lack pragmatic, immediate and reliable guidance on available sustainable finance opportunities, as well as contextualised definitions and eligibility requirements for what can be considered sustainable investments.

Figure 7 **Green and sustainable finance taxonomies**




*Sources: World Bank (2024). Finance and Prosperity 2024.*

## C. Unleashing the full potential of green finance for a net-zero transition of the global economy

**Enhancements in green finance instruments are needed to address current challenges and unleash their full potential.** Ensuring a stronger and more reliable information value of labelled green finance instruments, improving interoperability of taxonomies and standards, and better attending to the needs of EMDEs are key to promote green finance and thus for the climate transition[28].

**To promote longer-term growth in the green finance market and bolster alignment with climate goals, labelling of capital market instruments needs to be enhanced.** Only decision-relevant and reliable labels provide added-value. New labels, or more precise and improved requirements for existing ones, help signal investments aligned with climate goals (e.g., net zero), investment products that help to manage climate-related risks, as well as adaptation and biodiversity investments. Binding minimum standards for the certification of labels and the associated reporting requirements can better ensure the reliability of the information value of labels. Accreditation requirements with basic supervision for information data providers (e.g., second party opinions, ESG data providers) can help to ascertain the reliability of key sources of information.

27 Most taxonomies are voluntary instruments used by financial institutions and corporations to identify sustainable activities. Yet their use is now mandatory, especially for reporting and disclosure obligations in several countries. For example, in the case of the EU, Disclosure on the EU Taxonomy is only mandatory for companies that fall within the scope of the NFRD/CSRD.

28 More detailed policy recommendations can be found in IMF (2023) and in World Bank (2024).

**Development finance institutions (DFIs) that in 2021/2022 represented on their own almost 30% of the global climate finance flows (CPI, 2023) are pivotal in mobilising private capital and fostering public-private partnerships to meet financing needs.** A key task of DFIs is to help close the finance gap by offering both financial and technical support particularly crucial for large-scale infrastructure projects and sectoral transition plans. Multilateral funds, such as the Green Climate Fund (GCF), the Global Environment Facility (GEF), and the Climate Investment Funds (CIF) are instrumental in supporting projects that align with national climate priorities and provide funding for adaptation and mitigation initiatives. Multilateral development banks and other DFIs can play a catalytic role for climate finance, notably by helping scale up blended finance (NGFS, 2023a).

**Expanding geographical coverage of taxonomies and financing frameworks and ensuring the interoperability with global standards can help to set standards that are both appropriate for countries' circumstances and helpful for investors and other stakeholders.** Current taxonomies and sustainable disclosure requirements vary across markets, creating additional burdens for issuers and challenges for investors. To address this, there needs to be a focus on improving the interoperability of global standards for climate disclosures while considering proportionality, particularly for small and medium-sized enterprises (SMEs). Emphasising climate-alignment characteristics, such as net-zero, will ensure a certain level of comparability and reduce the complexity for global investors (World Bank, IMF and OECD, 2023).

**Institutional support plays a crucial role in closing the climate finance gap and unleashing the full potential of green finance by providing the necessary frameworks, tools, and resources for investors to make informed decisions that contribute to climate goals.** Among the key instruments available are Nationally Determined Contributions (NDCs), which serve as essential references for understanding the financing needs. NDCs outline each country's climate action plan, including targets for emissions reduction, adaptation strategies, and sectoral transitions. For their successful implementation, financial flows need to be assessed and directed towards projects that support these commitments.

# Section 3. Fostering an enabling ecosystem through financial regulation, supervision and policy practices

## Key messages

**Climate change is relevant to financial regulators and central banks from micro and macro prudential angles, a monetary policy perspective and in relation to their own operations. Enhanced transparency, robust disclosure standards, and integrated risk management of financial institutions are crucial for fostering a resilient financial ecosystem.** Enhanced market transparency can foster the alignment of financial flows, by allowing financial institutions to better identify and assess the financial climate risks associated with their investments and activities.

**Transition planning will be key to ensuring these efforts lead to more resilient and sustainable financial systems.** As internal processes that financial institutions and firms in general undertake to develop a strategy to align their core business with a specific climate outcomes, transition plans can help markets, but also supervisors, understand the climate-related risks an institution may be exposed to as a result of its strategy.

**In line with the financial stability mandate of central banks and supervisors, regulatory frameworks and prudential regulation are evolving to incorporate climate- and nature-related risks into financial stability monitoring and micro-supervision. Yet, the pace and scope of implementation vary widely.** Areas for improvement include insurance supervision, data collection, and managing exposure to litigation risks through addressing gaps in supervisory practices.

**Central banks may incorporate climate-related considerations into their operational frameworks for two main reasons.** First, central banks ought to identify, assess and manage the financial risks that their own balance sheets are exposed to, including those stemming from climate change and climate policies. Second, some central banks have an explicit mandate to support the transition to a low-carbon economy in line with policies and climate targets of their governments.

**Central banks are seeking to integrate climate considerations into macroeconomic modelling.** Climate change and the green transition increasingly have macroeconomic impacts over time horizons relevant for monetary policy and are likely to pose difficult policy trade-offs. As such, understanding these effects and their monetary policy implications is becoming increasingly important for central banks.

## A. Enhanced market transparency can foster the alignment of financial flows

### A.1. Transparency and disclosure: a condition to effective risk management

**Clear and transparent disclosure of climate-related risks in financial markets is essential to effective risk management in today's evolving landscape.** With significant progress in disclosure practices, financial institutions are better equipped to address climate-related risks and opportunities, driving a more sustainable and resilient global economy. In this respect, the Task Force on Climate-related Financial Disclosures (TCFD) – in force until October 2023 and taken over by the IFRS Foundations – and the Task force Nature-related Financial Disclosures (TNFD) have played major roles in developing a globally standardised framework on disclosures.

**The development of extra-financial disclosure requirements is crucial to market transparency as they can play the role of an "environmental compass".** Among the first territories to have adopted mandatory ESG disclosures are the EU as a whole, India, Belgium, Australia, Denmark, China, France, Finland, Italy, South Africa, Singapore or Japan (Morrow, Yow and Lee, 2013; Morrow and Yow, 2014). For instance, the Securities and Exchange Board of India (SEBI) has made it mandatory for the top one thousand listed companies to publish annual reports containing 'Business Responsibility Reports' (BRR) describing the ESG initiatives they have undertaken. In Europe, the Corporate Sustainability Reporting

Directive (CSRD), which came into effect in January 2024 replacing the Non-Financial Reporting Directive (NFRD), requires all large companies in the EU, as well as listed companies, including SMEs, to report detailed information on their ESG impacts, including their exposure to climate-related risks, their sustainability performance, and how these factors are integrated into their business strategies. These new standards should enable financial institutions to better identify and assess the financial climate risks associated with their investments and activities.

**The standardisation of impact reporting and sustainability disclosures at the issuer level, supported by global baseline disclosure standards, ensures consistent, comparable, and reliable information for investors.** They also encourage more enlightened strategic management of capital flows and better financing of the transition. Global initiatives to introduce a harmonised and interoperable set of sustainability reporting standards that complement existing financial reporting standards, with due attention to proportionality, are key. The standardisation of sustainability reporting should cover a broad range of financial products and corporate disclosures, aimed at enhancing transparency and promoting sustainable economic activities across sectors.

**The International Sustainability Standards Board (ISSB) has played an important role in developing comprehensive sustainability reporting standards that will facilitate the standardisation of impact reporting and sustainability disclosures,** by providing information on how sustainability issues affect a company's financial performance[29]. As of 2024, over 20 jurisdictions have adopted or are in the process of adopting the ISSB standards for sustainability and climate-related disclosures[30]. These jurisdictions represent approximately 55% of global GDP and more than half of global greenhouse gas emissions. Notable adopters include major advanced and emerging economies such as Brazil and Japan, which are incorporating these standards into their regulatory frameworks. Countries like China, Bangladesh and Turkey have also taken steps toward mandatory implementation of ISSB standards for specific sectors, such as listed companies and financial institutions. Other countries, including Malaysia, India, Canada, Australia, Singapore, the Philippines, Japan, and South Korea, plan to follow suit.

**With regional norms being developed, standard setters aim to ensure that disclosure frameworks remain interoperable allowing for comparisons across jurisdictions.** For instance, while European jurisdictions will have to apply the CSRD and follow the European Sustainability Reporting Standards (ESRS), the ISSB and the European Commission, in collaboration with the European Financial Reporting Advisory Group (EFRAG), have worked together during the development of the ESRS and the ISSB Standards to achieve a high degree of alignment on climate-related reporting (EFRAG and IFRS, 2024).

29 The ISSB standards are based on the notion of single materiality, as opposed to double materiality, which focuses solely on sustainability topics that have a financially material impact on the firm. While this is essential for investment decisions, it may overlook or underemphasise non-financial impacts important for stakeholders beyond investors.

30 See https://www.ifrs.org/news-and-events/news/2024/05/jurisdictions-representing-over-half-the-global-economy-by-gdp-take-steps-towards-issb-standards/ and https://www.spglobal.com/esg/insights/where-does-the-world-stand-on-issb-adoption.

Box 3

### Central banks can lead by example by improving their sustainability reporting and disclosures

**Central banks have the potential to encourage enhanced market transparency by setting up or refining their own climate-related disclosures.** Central banks report on the measures they are taking to align their activities with global sustainability objectives, contributing to more transparent and accountable financial markets. The NGFS has notably published a guide, updated in 2024, which can help central banks set up or improve their climate-related disclosures (NGFS, 2024k). Central banks and supervisors could also publish their own transition plans, detailing their strategies and commitments toward achieving an emissions' reduction path in line with the Paris Agreement climate goals.

**Central banks can develop and report on sustainable and responsible investment (SRI) policies for their own investments.** Many central banks have put in place SRI policies for their non-monetary policy portfolios. For instance, the Eurosystem central banks disclose every year a report on climate-related financial disclosures, which includes the SRI policy. The NGFS has recently taken stock of existing SRI practices and provided insights on how to consider climate-related risks in both corporate and sovereign portfolios (NGFS, 2024h).

**Central banks can also disclose their work on greening their internal operations, just like financial or non-financial organisations.** This can encompass measuring the carbon and/or biodiversity footprint of central banks' day-to-day activities, and defining strategies to reduce it by working for instance on the energy efficiency of buildings, on limiting business travels by plane, on setting up recycling policies, or on defining responsible procurement policies or rules.

## A.2. Transition planning: a way towards aligning financial flows with the Paris Agreement

**Transition plans are a key tool for an orderly economy-wide transition and have received increasing global attention from investors, corporates, financial institutions and supervisors, governments and international organisations.** To understand the use of transition plans by supervisors, it is necessary to make a clear distinction between 'transition planning' and 'transition plans'. Transition planning can be understood as the internal process undertaken by a firm to develop a transition strategy to deliver climate targets and/or prepare a long-term strategic response to manage climate risks. Transition plans are a key product of the transition planning process, which are mainly used as an output for external audiences and represent the strategy of how firms plan to align their core business with a specific strategic climate outcome.

**Transition plans can help supervisors understand both the transition and physical risks an institution may be exposed to as a result of its strategy, risk appetite and corresponding risk management framework.** Given their role of external facing output, transition plans can inform micro-prudential authorities to develop a forward-looking view of whether its risk management framework is commensurate with the risks resulting from an institution's transition strategy. As regulations and guidelines on transition plans are being developed worldwide, it is necessary to ensure consistent international guidance for transition plans. Other challenges will need to be addressed, such as promoting economy-wide incentives to undertake transition planning and encouraging integration of physical risks and nature-related risks (NGFS, 2024b).

**To ensure a consistent development of transition plans, it is key to understand the broader context within which transition planning takes place for a financial institution.** For example, the connections between non-financial firms' and financial institutions' transition planning play a significant role as financial institutions rely on the data provided by their counterparties to develop their own transition plans. Another important dimension is the perspectives of EMDEs and the need to adapt transition planning to their unique needs and challenges, including varying objectives, constraints in the enabling environment and potential unintended consequences.

Lastly, the understanding of the key features of the credibility of transition plans from the micro-prudential perspective is needed. In its Transition plan package (2024b), the NGFS provided deep-dive analysis on these three topics.

## B. Integrating climate in supervisory frameworks and practices: recent progress and remaining gaps

### B.1. Steady progress has taken place in climate supervision

**The NGFS recognised the importance of climate-related financial risk since its inception and captured this in its 2019 report, emphasising the need for central banks and supervisors to consider climate change and transition dynamics in their core mandates** (monetary and financial stability). While acknowledging the diversity of its Members' mandates, the NGFS believes that recognising and addressing climate-related financial risks can contribute to aligning financial flows with the Paris Agreement's objectives. Central banks and supervisors can integrate these risks into financial stability monitoring and micro-supervision, supported by NGFS best practices and climate scenario analysis.

**Regulatory bodies are increasingly incorporating climate-related financial risks into their prudential frameworks.** This includes requiring banks, insurers and other financial institutions to assess and manage climate risks as part of their overall risk management processes (Campiglio *et al.* 2018). To name a few examples, the Prudential Regulation Authority (PRA) in the UK, for example, has issued supervisory statements that set out expectations for banks and insurers regarding the management of climate-related financial risks (PRA, 2019). Additionally the European Central Bank (ECB) and the Australian Prudential Regulation Authority (APRA), have begun monitoring and publishing the implementation progress of their sustainable financial regulations and expectations for regulated entities. In EMDEs, the South African Reserve Bank (SARB) has published a guidance on climate-related governance and risks practices for banks. The National Bank of Rwanda (BNR) and the Central Bank of Kenya (CBK) have done the same with guidelines on climate-related and environmental financial risks management for financial institutions and on climate-related risk management respectively. This integration of climate-related financial risks in the prudential frameworks allows supervisors to take more actions to ensure financial institutions correctly assess climate-related risks (e.g. thematic on-site inspections, requirements to ensure a better identification of material risks including climate-related risks etc.).

**There has been notable progress in climate supervision, with increasing efforts to incorporate climate risks into financial oversight.** The integration of climate risks into prudential frameworks and supervisory practices mark a pivotal step in enhancing the financial sector's resilience to climate risks. The NGFS guide for supervisors[31] outlines best practices for integrating environmental risks into micro-prudential supervision, including the need for detailed climate-related financial disclosures and robust risk management practices (NGFS, 2020). According to a stocktake on climate related financial risks conducted by the Bank for International Settlements (BIS), 6 out of 27 respondents had issued supervisory guidance on climate related financial risks while 5 out of 27 were in process by 2020[32] (BIS, 2020). Among best practices in incorporating climate-related and environmental risks into supervisory practices, the World Bank, in their report on ToolKits for Policymakers to Green the Financial System (World Bank, 2021), have highlighted initiatives by both EMDEs and AEs. These include the Banco Central do Brasil Sustainability Agenda or the Guidelines on Environmental & Social Risk Management (ESRM) for Banks and Financial Institutions in Bangladesh of the Bangladesh Bank; as well as the Guidance Notice on Dealing with Sustainability Risks of BaFin Germany or the Environmental Risk Management Guidelines for Financial Institutions of the Monetary Authority of Singapore.

**Pace and scope in the integration of those climate-related considerations have varied between countries also due to different capacities.** The approach to managing climate risks in EMDEs needs to consider these regions' unique capacities and the challenges they face. Banking authorities in EMDEs may need to adopt a proportional and sequenced strategy when deploying regulatory tools to manage climate risks, ensuring alignment with their financial stability mandate. Not all tools need to be implemented simultaneously; a phased approach allows

31 An update of the NGFS guide for supervisors will be published in 2025.

32 Qualitative information about progress can be found in the November 2023 BIS Newsletter here: https://www.bis.org/publ/bcbs_nl33.htm.

for gradual capacity building. Proportionality is particularly important when issuing climate-related guidance, although smaller institutions may still be highly exposed to climate risks and should not be overlooked. Additionally, regulators must balance these measures with the need to protect financial inclusion, ensuring that efforts to bolster stability do not unintentionally exclude vulnerable populations from financial services. This approach helps tailor climate risk management to the specific needs of each country, considering differences in supervisory capacity and risk levels (World Bank, 2024).

## B.2. Climate scenario analysis is becoming widespread

**For some supervisors, the development and application of climate scenario analysis have become essential, allowing for a more informed and forward-looking approach to managing climate-related risks.** This addition to the toolbox of financial supervisors addresses the fact that climate change exposes the financial sector to a radical uncertainty. Risk-based assessments are traditionally based on historical trends and extrapolation from observed data, but economic impacts from climate change are just starting to become evident and are expected to intensify over time. Transition policies are also subject to strong uncertainty, as they can take several forms (carbon tax, subsidies, environmental standards, etc.) and are highly dependent on the global geopolitical context as well as domestic decision making. A complete mapping and quantification of the possible developments is therefore impossible, calling for innovative forward-looking assessments.

**Scenario analysis and climate stress-tests are critical forward-looking tools for assessing the potential implications of climate change on economies and financial systems.** The NGFS has been working since 2018 toward the development of macro-financial climate scenarios to enable scenario based risk analysis of climate-change-related developments in the financial sector. Climate scenarios describe plausible futures (without attaching a probability to their occurrence) and consistently quantify the economic outcomes following each explored narrative. These scenarios can be used in stress-test exercises, so as to assess the robustness of financial companies under a range of transition pathways and/or temperature trajectories (Vermeulen *et al.* 2021). The NGFS scenarios have been improved and updated yearly, allowing for a better capture of the scope of risks and a reflection of the latest economic and climate policies developments[33].

**The use of scenario analysis is progressing across jurisdictions.** According to a joint survey conducted by the FSB and the NGFS in 2022, 67 climate scenario analysis exercises were either completed, in progress or being planned[34]. The European Central Bank (ECB), the Banque de France (BdF) and the Bank of England (BoE) are among the institutions that have conducted climate stress tests in advanced economies (Alogoskoufis *et al.*, 2021). In emerging economies, central banks and regulatory bodies have also performed climate stress tests including the Banco Central do Brasil (BCB), the Superintendencia Financiera de Colombia (SFC), the Central Bank of Kenya (CBK), the Bank Al-Maghrib (BAM) or the Reserve Bank of India (RBI) (UNEP, 2024).

**The NGFS Scenarios have played a key role in supporting financial authorities' climate scenario analysis exercises.** Several authorities have used or adapted the NGFS Scenarios and most at least include them as a point of reference (e.g. in terms of scenario narratives or alignment of key variables). NGFS scenarios provide a globally consistent tool, allowing for comparability across different exercises, but they often have to be complemented by users to get to the right level of modelling detail and/or to tailor scenarios for their particular needs.

## B.3. Gaps remain to fully address climate risks

**Despite recent progress in incorporating climate-related financial risks into financial supervision, significant areas for improvement remain** in fully addressing climate risks across various areas, including for example insurance supervision, data collection or litigation risks. Looking forward, integrating broader nature-related considerations into financial regulation and supervision will be key to ensure the resilience of the financial system (NGFS, 2023b; NGFS, 2024i) (See Box 3).

33 The NGFS Scenarios can be accessed through the following portal: https://www.ngfs.net/ngfs-scenarios-portal/. A fifth vintage will be made available in 2024.

34 For an overview of climate scenario analysis by Jurisdictions see FSB/NGFS (2022).

**Jurisdictions have made notable advances in banking and insurance supervision but there is room to strengthen financial supervision policies.** According to data from the SUSREG tool[35] developed by WWF[36], the progress on integrating climate risks into banking supervision has shown a steady progress in the past years. For instance, 44 out of 50 surveyed jurisdictions have issued supervisory expectations or guidance on climate issues. Financial supervisors have also advanced several climate supervision measures, such as conducting climate stress tests on banking portfolios (37/50), requiring banks to manage their portfolio-level exposure to climate risks (43/50), and publishing climate strategy and implementation in banks' annual reports (24/50). Similarly, climate insurance supervision progressed, although insurance supervision policies are still less robust than banking supervision policies. The WWF's SUSREG found that many guidelines are generic and designed to be applied across both sectors, which may not account for the unique challenges within the insurance industry. For the same indicators as those mentioned for banking supervision, fewer jurisdictions have issued supervisory expectations or guidance on climate for insurers (34/45), conduct climate stress test (21/45), require insurers to manage portfolio exposure against climate risks (21/45), and mandate climate strategy and implementation in annual reports (20/45). Additionally, in the most recent NGFS survey on climate scenarios, only 7% of respondents were insurance institutions, indicating a gap in engagement and sector-specific oversight.

**Effective climate integration into financial regulation requires robust data and methodologies.** Standardised datasets covering metrics such as financed emissions, portfolio carbon intensity, exposure to physical climate risks, and others would empower central banks with actionable insights for informed supervisory decisions. According to the UNEP Finance Initiative (UNEP, 2024), climate-related data quality and accessibility remains a significant challenge. More granular data is needed to improve climate scenario analysis as well as locational data of assets of clients. This includes standardised data collection, advanced risk assessment tools, and clear disclosure requirements. Prioritising the key drivers of climate change and nature loss, along with leveraging technological advancements in data collection, can enhance transparency and reporting (Kölbel *et al.* 2020). In this regard, the NGFS Directory (version 2.0) which is currently being developed will be a good example of how new data tools and analytics, and more generally digitalisation, can make data collection more transparent.

**Failure to address the existing gaps in supervisory practices increases the financial sector's exposure to climate and nature-related litigation risks (NGFS, 2024c).** If regulatory frameworks face difficulties to keep pace with the evolving demands of sustainability, financial institutions may face rising legal challenges. These risks, which often stem from accusations of greenwashing or inadequate management of climate risks, have already led to high-profile lawsuits. While supervisors are beginning to recognise these risks, micro-prudential approaches to assess and mitigate them remain underdeveloped. The recent NGFS reports on climate-related litigation highlight the growing urgency for stronger regulatory standards and enforcement (NGFS, 2023c). If left unaddressed, these gaps could undermine financial stability and expose institutions to further legal action, emphasising the need for more stringent disclosure and risk management practices. Through enhanced regulatory frameworks, supervisors can protect financial stability and ensure that institutions are not only compliant but are also actively contributing to climate mitigation and adaptation efforts (NGFS, 2023d).

35 The 2024 assessment marks the fourth edition of the SUSREG assessment since its inaugural publication in 2021. It covers 50 jurisdictions for central banking and banking regulation, and 45 jurisdictions for insurance regulation. See WWF (2024).

36 The WWF SUSREG tool provides valuable insights into global regulatory and supervisory climate policies, but its scoring does not reflect internationally agreed standards nor does it have the mandate to assess the compliance of countries' regulatory and supervisory frameworks with international standards.

Box 5

### Beyond climate, financial regulation and supervision should consider broader nature-related risks

**The NGFS has acknowledged that nature-related financial risks could have significant macroeconomic implications, and that failure to account for, mitigate, and adapt to these implications is a source of risks relevant for financial stability (NGFS, 2024i).** Numerous industries depend heavily on diverse ecosystems (Svartzman *et al.* 2021) for critical resources, genetic diversity, and essential ecosystem services. For example, the worldwide loss of pollinators (e.g. bees, butterflies, moths and insects) could reduce global agricultural output by USD 217 billion (Deutz *et al.* 2020). The degradation of nature can disrupt production processes, potentially undermining the creditworthiness of many sectors. Given these risks, central banks and financial supervisors should conduct thorough assessments of the economy's and financial system's vulnerability to such degradation, in order to inform the implementation of appropriate policies. However, conducting robust assessments of underlying nature risks is complex and fraught with considerable uncertainties, particularly in estimating potential financial impacts (NGFS, 2023b).

**While much of the focus in financial regulation and supervision has centred on climate-related issues, the climate-nature nexus should also be acknowledged.** Nature can play a significant role in mitigating human-generated carbon dioxide emissions, such as through carbon sinks and reducing physical climate risks. Moreover, climate change is a major driver of nature loss, and some climate mitigation policies and technologies can be detrimental to nature. In contrast, ecosystem restoration consistently supports climate change mitigation. However, it should also be recognised that biodiversity is not uniformly distributed worldwide. Many countries with the highest biodiversity are in the developing world, where financial supervision concerning broader environmental risks remains relatively weak.

**Without ambitious policies, the financial system will struggle to adapt to the challenges posed by a deteriorating planetary health.** The NGFS has provided a common language and guidance for central banks and supervisors on nature risks with its Conceptual Framework (NGFS, 2024i), while the BIS Principles for the effective management and supervision of climate-related financial risks serve as an essential reference point. Such efforts are essential for signalling the direction of sustainable investments, reducing risks associated with green initiatives, unlocking new economic opportunities, and ensuring financial stability and resilience (Gardes-Landolfini *et al.* 2024).

## C. Adapting monetary policy operations and macroeconomic modelling

### C.1. Progress in integrating climate consideration into central bank operations

**Central banks may incorporate climate-related considerations into their operational frameworks for two main reasons.** Integrating these considerations can help them to identify, assess, and manage the financial risks that their balance sheets are exposed to, particularly those arising from climate change and evolving climate policies. As highlighted by the NGFS reports on adapting central bank operations to a hotter world (NGFS, 2021b; NGFS, 2024d), central banks have various tools at their disposal to address these risks, including integrating climate risks into the implementation of monetary policy, though credit operations, collateral frameworks and asset purchase programs. In practice, this means central banks are developing methodologies to measure the carbon intensity and climate-related risks of assets held on their balance sheets, and adapting their operations to mitigate these exposures. Furthermore, some central banks have an explicit mandate to support the transition to a low-carbon economy, aligning their operations with national climate policies and targets. For example, they can actively shift their portfolios towards greener assets, both through direct investments and by adjusting collateral frameworks to incentivise greener financial products.

**Central banks have started incorporating climate-related considerations into their operational frameworks for both of these reasons.** Central banks in the Asia Pacific region such as the Bank of Japan, People's Bank of China, and Bank Negara Malaysia have introduced refinancing operations targeting green projects to support the shift towards a lower-carbon economy (BNM, 2024). Regarding collateral frameworks, the European Central Bank (ECB) has committed to restricting the use of assets issued by entities with a high carbon footprint as collateral. Similarly, the Hong Kong Monetary Authority plans to incorporate sustainability considerations into its evaluation of eligible collateral. The NGFS provides additional case studies in its 2024 report, including on Magyar Nemzeti Bank's credit operations and green collateral management, as well on the implementation of tilting asset purchases. When implementing such interventions, central banks may need to pay attention to avoid any potential unintended consequences for their financial stability objective.

**The SUSREG assessment observed that a growing number of central banks and supervisory bodies have started integrating climate in their governance and operations.** These include actions such as membership in the NGFS (48/50 of surveyed jurisdictions), having an internal organisation for sustainability (38/50), and conducting research and capacity building (45/50). However, in more advance areas, progress remains low e.g. integrating climate considerations into collateral frameworks (17/50), incorporating climate criteria into corporate asset purchase programs (13/50), establishing green Targeted Refinancing Operations (TRO) (5/50), phasing out environmentally harmful activities in central bank portfolios (10/50), and disclosing portfolios in line with relevant taxonomies (2/50). Nevertheless, progress is notable among several central banks on specific fronts. For instance, many institutions, including Banco do Brasil, Norges Bank, and the Bank of England, have integrated climate factors into their management of foreign exchange reserve portfolios (28/50). Additionally, many central banks have begun making a disclosure in alignment with the TCFD (23/50).

## C.2. Integrating climate considerations into macroeconomic modelling: the next frontier

**Climate change and the green transition are impacting the economic environment in which monetary policy-makers operate in pursuit of fulfilling their mandates.** The policies designed to facilitate the shift to a low-carbon economy are having significant effects on output, price volatility and inflation, as well as financial stability. These are already occurring and will likely continue to be relevant within the monetary policy horizon, despite government commitments often extending beyond it. The transition affects key economic actors, including households, firms, and investors, by altering supply and demand patterns, investment decisions, wages, and asset prices. These shifts will directly influence household incomes, savings behaviour, and overall economic activity, requiring a deeper understanding of how climate-related changes intersect with traditional macroeconomic dynamics (NGFS, 2024e).

**In order to better understand and anticipate the impacts of both climate change and the green transition on the economy, some central banks are seeking to integrate climate considerations into their macroeconomic modelling (NGFS, 2023e; NGFS, 2024f).** This includes the assessment of implications from acute and chronic physical hazards as well as implications related to policy changes and technological shifts likely to emerge with the transition to net zero. These elements can have varying impacts on inflation and economic output, and central banks must be able to distinguish between temporary and permanent effects as well as supply-side and demand-side shocks. Without integrating climate considerations into their models, central banks risk underestimating the full scope of these impacts and their potential implications for the macroeconomy and monetary policy.

**Central banks are seeking to integrate climate considerations into macroeconomic modelling.** Climate change and the green transition increasingly have macroeconomic impacts over time horizons relevant for monetary policy and are likely to pose difficult policy trade-offs. As such, understanding these effects and their monetary policy implications is becoming increasingly important for central banks. To address this, the NGFS provides guidance for central banks at different stages of climate-related modelling in order to integrate climate risks into macroeconomic analysis, helping central banks refine their strategies and tools for managing both physical and transition impacts (NGFS, 2024g). By improving their ability to forecast and manage the broader economic effects of climate change, central banks can better align their monetary policy strategy with the evolving economic landscape.

# Conclusion

## A. Summary of key findings

**The report highlights some progress in the development of climate finance and the greening of the financial system. However, the alignment of the financial system with climate goals remains a crucial objective for which further collective efforts are needed, amid persistent challenges.**

Financial flows are increasingly directed towards projects that support climate action, yet significant investment gaps remain, particularly in EMDEs and for adaptation and resilience investments. While AEs have made strides in mobilising climate finance, more efforts are needed to meet the global temperature target and to support developing countries. Also, while clear goals for mitigation efforts are generally well-established, setting equivalent goals for adaptation remains elusive and difficult to quantify. The complexity of measuring resilience and the diverse nature of climate impacts make defining concrete adaptation targets challenging, leaving this critical area of finance climate action underdeveloped and harder to track.

The use of green finance instruments has rapidly expanded, but there is untapped potential for further expansion. Challenges such as greenwashing, differing standards, and limited access to finance in EMDEs need to be addressed to fully harness the power of green finance.

Regulatory frameworks are evolving to incorporate climate risks, yet the pace and scope of implementation vary widely between countries. Additionally, climate scenario analysis and stress testing are becoming essential tools for central banks to assess the long-term economic and financial stability risks associated with climate change. These efforts ensure that monetary policy is more adaptive and robust, supporting the transition to a low-carbon economy while safeguarding financial stability. Central banks are positioning themselves as important actors in fostering climate-aligned financial flows and addressing the uncertainties posed by climate change. Enhanced transparency, robust disclosure standards, and integrated risk management are crucial for fostering a resilient financial ecosystem.

## B. Recommendations for further action in advancing the greening of the financial system

Aligning the financial system with the Paris Agreement's objectives requires coordinated actions from policymakers, financial institutions and regulators, and other stakeholders. Building on the findings of this report and the conclusions of extensive work conducted by the NGFS over the years[37], the following recommendations highlight some key steps that public and private financial actors can take to support this transition.

**Recommendation 1. Strengthen international coordination within the financial system**

**International coordination is essential to improve the financial system's capacity to manage risks and mobilise capital for green investments.** The NGFS is committed to knowledge and experience sharing among its members and other stakeholders, and stresses the importance for all relevant actors to work together freely and openly towards climate goals. Coordinating approaches between central banks and supervisors, governments, multilateral organisations, and financial institutions will foster an enabling environment for investment, improve access to finance and ensure that both AEs and EMDEs contribute to and benefit from climate action. In particular, central banks and supervisors can facilitate an enabling environment for the green transition.

**Recommendation 2. Improve the quality and availability of climate-related data**

**While imperfect data should not be an impediment for taking action, enhancing data collection processes of climate-related data is key to accurately measure the alignment of existing actions and policies with climate goals.** Data gaps and limitations, especially in areas such as GHG emissions, physical risk exposure, and transition risk factors, need to be addressed and reduced. Further work on sustainability data, including data on nature-related dependencies and impacts, is also needed

37 See the list of references for an overview of recent NGFS publications.

to understand the alignment with sustainability and biodiversity goals. Accurate, standardised data will allow institutions to make informed decisions about climate risks and opportunities linked to the transition to decarbonised economies, as well as broader sustainability goals. To this end, the NGFS can strengthen its ongoing work on bridging data gaps, for instance with the new NGFS Data Directory, which can help institutions identify relevant climate metrics and data sources to make environmentally sound investment decisions.

**Recommendation 3. Facilitate access to climate finance in EMDEs**

**Addressing structural challenges faced by EMDEs and expanding financial support mechanisms such as blended finance and risk-sharing initiatives can help accelerate the transition.**

The contribution from EMDEs is vital to achieving global climate goals but for an effective involvement of those economies, it is essential to strengthen foundational systems, e.g., by developing capital markets and building a robust climate information architecture.These regions often receive a smaller share of climate finance compared to AEs, which limits their ability to participate fully in the global transition. National development banks are key actors in mobilising private capital and fostering public-private partnerships by leveraging local expertise. Enhancing financial infrastructure and improving access to green finance will help EMDEs accelerate their transition efforts and contribute more significantly to global climate objectives. The NGFS, in its work on blended finance (NGFS, 2023a) and transition plans (NGFS, 2024a; NGFS, 2024b) has identified specific challenges faced by EMDEs that would need to be address to help mobilised climate finance for these countries. Central banks and financial supervisors can also contribute by offering capacity building opportunities.

**Recommendation 4. Enhance labels and standards**

**Improving the standards and labels associated with green finance instruments will provide investors with the information required to scale up these instruments.**

Current labelling practices often lack clarity and fail to provide investors with actionable information about climate alignment, leading to risks of greenwashing and reducing investor confidence. To address this, NGFS reports have stressed the need to establish robust standards and globally harmonised taxonomies[38]. By promoting interoperability and a comparable climate information architectures across jurisdictions, these measures will help ensure that investments truly contribute to climate goals. This, in turn, will enable investors to align their portfolios with sustainable practices more effectively, supporting the transition to a low-carbon economy.

**Recommendation 5. Strengthen climate risk integration in financial regulation and supervision**

**As highlighted by multiple NGFS publications, the integration of climate and nature-related risks into supervisory and regulatory frameworks is essential for building a financial system that is resilient to environmental changes.** This report underscores the importance of comprehensive regulations that promote transparency and accountability through standardised reporting practices. Supervisory and regulatory bodies should establish clear guidelines and expectations to create an environment that is conducive to sustainable investments and mitigates systemic risks. They can ensure that climate-related risks are properly integrated into governance and risk management frameworks, with a focus on the conduct of regular scenario analysis and stress testing (NGFS, 2020). These efforts are crucial to ensuring that the financial system remains robust in the face of climate and nature loss challenges and contribute positively to environmental sustainability.

**Recommendation 6. Integrating climate risks into macroeconomic policy**

**Central banks will increasingly need to understand the macroeconomic impacts of climate change and the green transition.** Policymakers can use the framework developed by the NGFS to help better assess these impacts and their implications for monetary policy (NGFS, 2024j).

38 Specifically, NGFS. (2022b), NGFS. (2024h) and NGFS (2024a).

**Recommendation 7. Support the adoption of climate disclosure standards by financial and non-financial institutions**

**The sustainability disclosure standard landscape has been evolving rapidly. Disclosure standards will need to be widely adopted to ensure environmental data availability and quality.** Economic actors need to stay abreast of the latest developments, comply with evolving climate disclosure requirements, and can proactively adopt non-binding guidelines or recommendations. They can support the adoption of appropriate and robust disclosure standards, together with harmonised and interoperable taxonomies to reduce risks of greenwashing. Following these disclosure requirements or voluntary frameworks also ensures that institutions are using the latest best practices for data collection and reporting, and that they are reporting in a consistent manner across countries. The NGFS can lead by example by publishing disclosure guidelines for central banks and supervisors (see NGFS, 2024k), and sharing best practices.

**Recommendation 8. Advancing transition planning and transition plans within financial and non-financial institutions**

**Transition plans should be prioritised as a key tool for ensuring a more resilient and sustainable financial system (G20, 2024).** The NGFS has underlined in recent reports that, by outlining the strategy of how firms plan to align their core business with a specific strategic climate outcome, transition plans not only provide a roadmap for climate alignment but also allow supervisors to better assess the climate-related risks that institutions might face due to their strategies. By implementing comprehensive transition plans, firms can proactively manage risks and support the broader financial system's adaptation to climate challenges.

**Recommendation 9. Monitor progress and adapt to an ever-evolving environment**

**Continuous monitoring and adaptation are crucial to ensuring that the financial system remains aligned with evolving climate goals.** This report highlights the importance of tracking progress and adapting strategies based on emerging scientific insights and policy developments. Relevant updates to regulatory frameworks and financial practices will ensure that the financial sector remains responsive to new challenges and opportunities. By maintaining a dynamic approach to climate finance, stakeholders can build resilience and drive innovation, supporting the transition to a decarbonised global economy.

# List of references


**Adisa, O., Ilogbosi, B.S., Obi, O.C., Awonuga, K.F., Asuzu, O.F. (2024)**
Green bonds in climate finance: a review of USA and African initiatives. International Journal of Science and Research Archive, 11(1), 2376-2383

**Ahlgren, V., Sabogal, L., Chin, N., Bagnera, E., Pinko, N. (2023)**
Enhancing MDB-NDB cooperation. Understanding climate finance flows and Paris Alignment. CPI, E3G. Available at: *https://www.e3g.org/wp-content/uploads/CPI-E3G-Report-Enhancing-MDB-NDB-cooperation.pdf*

**Alogoskoufis, S., Dunz, N., Emambakhsh, T., Hennig, T., Kaijser, M., Kouratzoglou, C., and Salleo, C. (2021)**
ECB's Economy-Wide Climate Stress Test. ECB Occasional Paper No. 2021/281, Available at SSRN: *https://ssrn.com/abstract=3929178* or *http://dx.doi.org/10.2139/ssrn.3929178*

**Anadon, L., Jones, A., Peñasco, C., *et al.* (2022)**
Ten Principles for Policymaking in the Energy Transition: Lessons from Experience. Report commissioned and jointly funded through UK Aid by the UK Government's Department for Business, Energy and Industrial Strategy (BEIS), and the Children's Investment Fund Foundation, through the project entitled 'Economics of Energy Innovation and System Transition' (EEIST). Access: *https://eeist.co.uk/eeist-reports/*

**Baker, M., Bergstresser, D., Serafeim, G., Wurgler, J. (2018)**
Financing the response to climate change: the pricing and ownership of US green bonds. NBER Working Paper Series. WP 25194. Available at: *http://www.nber.org/papers/w25194*

**BIS (2020)**
Climate-related financial risks: a survey on current initiatives. Available at: *https://www.bis.org/bcbs/publ/d502.pdf*

**BNM (2024)**
Annual Report 2023. Available at: *https://www.bnm.gov.my/documents/20124/12142010/ar2023_en_box8.pdf*

**Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G., & Tanaka, M. (2018)**
Climate change challenges for central banks and financial regulators. Nature Climate Change, 8(6), 462-468

**Cheng, G., Torsten, E., Packer, F., Xiao, Y. (2024)**
Sovereign Green Bonds: A Catalyst for Sustainable Debt Market Development?. IMF Working Papers 2024/120, International Monetary Fund. Available at: *https://ideas.repec.org/p/imf/imfwpa/2024-120.html*

**ClimateWatch (2023)**
Key Visualisations. Available at: *https://www.climatewatchdata.org/key-visualizations?visualization=3*

**Colombo, M., & Cuda, M. (2023)**
The Role of Public Development Banks & Institutions in the Implementation of the United Nations' Agenda 2030: A Survey in Europe (No. 179). Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

**CPI (2021)**
Private financial institutions commitments to Paris alignment. CPI – London UK. Available at: *https://www.climatepolicyinitiative.org/wp-content/uploads/2021/10/CPI_Private-FI-Commitments-Tracking-1.pdf*

**CPI (2023)**
*Global Landscape of Climate Finance 2023. CPI – London. UK*

**CPI (2024a)**
*The cost of inaction. CPI – London. UK*

**CPI (2024b)**
*Global Landscape of Climate Finance 2024. CPI – London. UK*

**Deutz, A., Heal, G. M., Niu, R., Swanson, E., Townshend, T., Zhu, L., Delmar, A., Meghji, A., Sethi, S. A., and Tobinde la Puente, J. (2020)**
Financing Nature: Closing the global biodiversity financing gap. The Paulson Institute, The Nature Conservancy, and the Cornell Atkinson Center for Sustainability. Available at: *https://www.paulsoninstitute.org/wp-content/uploads/2020/09/FINANCING-NATURE_Full-Report_Final-Version_091520.pdf*

**Devi, D. (2023)**
Green finance: a way towards sustainable India. Asian Journal of Management and Commerce, 4(2), 231-237.

**EFRAG and IFRS (2024)**
ESRS – ISSB Standards. Interoperability Guidance. Available at: *https://www.ifrs.org/content/dam/ifrs/supporting-implementation/issb-standards/esrs-issb-standards-interoperability-guidance.pdf*

**Falduto, C., J. Noels and R. Jachnik (2024)**
The New Collective Quantified Goal on climate finance: Options for reflecting the role of different sources, actors, and qualitative considerations. OECD/IEA Climate Change Expert Group Papers, No. 2024/02, OECD Publishing, Paris, *https://doi.org/10.1787/7b28309b-en*

**Flammer, C. (2021)**
Corporate green bonds. Journal of Financial Economics, 142(2): 499-516

**FSB/NGFS (2022)**
Climate Scenario Analysis by Jurisdictions Initial findings and lessons. Available at: *https://www.fsb.org/uploads/P151122.pdf*

**Gardes-Landolfini, Charlotte, William Oman, Jamie Fraser, Mariza Montes de Oca Leon, and Bella Yao. (2024)**
Embedded in Nature: Nature-Related Economic and Financial Risks and Policy Considerations. IMF Staff Climate Note 2024/002, International Monetary Fund, Washington, DC.

**Giese, G., Lee, L.-E., Melas, D., Nagy, Z., & Nishikawa, L. (2019)**
Foundations of ESG investing: How ESG affects equity valuation, risk, and performance. Journal of Portfolio Management, 45(5), 69-83.

**G20 (2024)**
G20 Sustainable Finance Working Group Presidency and Co-chairs Note on Agenda Priorities. Brazil. Available at : *https://g20sfwg.org/wp-content/uploads/2024/02/2024-G20-SFWG-NAP.pdf*

**IEA (2023a)**
Global Hydrogen Review 2023, IEA, Paris *https://www.iea.org/reports/global-hydrogen-review-2023*

**IEA (2023b)**
World Energy Investment 2023, IEA, Paris *https://www.iea.org/reports/world-energy-investment-2023*

**IEA (2023)**
Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach, IEA, Paris *https://www.iea.org/reports/net-zero-roadmap-a-global-pathway-to-keep-the-15-0c-goal-in-reach*

**IEA/IFC (2023)**
Scaling Up Private Finance for Clean Energy in Emerging and Developing Economies, OECD Publishing, Paris, *https://doi.org/10.1787/054f472d-en*

**IMF (2023)**
Global Financial Stability Report: Financial and Climate Policies for a High-Interest-Rate Era. Washington, DC, October or Sustainable Finance Alignment with a Focus on Climate Change Mitigation. Washington, DC: World Bank.

**IPCC (2022)**
Summary for Policymakers [P.R. Shukla, J. Skea, A. Reisinger, R. Slade, R. Fradera, M. Pathak, A. Al Khourdajie, M. Belkacemi, R. van Diemen, A. Hasija, G. Lisboa, S. Luz, J. Malley, D. McCollum, S. Some, P. Vyas, (eds.)]. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.001

**Kölbel, J. F., Heeb, F., Paetzold, F., & Busch, T. (2020)**
Can sustainable investing save the world? Reviewing the mechanisms of investor impact. Organization & Environment, 33(4), 554-574

**Larcker, D.F., Watts, E.M (2020)**
Where's the greenium? Journal of Accounting and Economics, 69 (2-3):101312

**Moody's (2020)**
Moody's Default and Recovery Rates for Project Finance Bank Loans, 1983-2018. Moody's 2020. Available at: *https://ma.moodys.com/rs/961-KCJ-308/images/Default%20Reports%20-%20Default-research-Global%20-%2017Aug20.pdf*

**Morrow, D., Yow, M. (2014)**
Measuring Sustainability Disclosure: Ranking the World's Stock Exchanges. Corporate Knights Capital. October 2014

**Morrow, D., Yow, M., Lee, B. (2013)**
Trends in Sustainability Disclosure: Benchmarking the World's Stock Exchanges. Corporate Knights Capital. October 2013

**NGFS (2020)**
*Guide for Supervisors Integrating climate-related and environmental risks into prudential supervision*

**NGFS (2021a)**
NGFS Climate Scenarios for central banks and supervisors. Available at: *ngfs_climate_scenarios_phase2_june2021.pdf*

**NGFS (2021b)**
*Adapting central bank operations to a hotter world: Reviewing some options*

**NGFS (2022)**
Final report on bridging data gaps. Available at: *https://www.ngfs.net/sites/default/files/medias/documents/final_report_on_bridging_data_gaps.pdf*

**NGFS (2022b)**
Enhancing market transparency in green and transition finance. Available at: *https://www.ngfs.net/sites/default/files/medias/documents/enhancing_market_transparency_in_green_and_transition_finance.pdf*

**NGFS (2023a)**
Scaling Up Blended Finance for Climate Mitigation and Adaptation in Emerging Market and Developing Economies (EMDEs). Available at: *https://www.ngfs.net/sites/default/files/medias/documents/scaling-up-blended-finance-for-climate-mitigation-and-adaptation-in-emdes.pdf*

**NGFS (2023b)**
Recommendations toward the development of scenarios for assessing nature-related economic and financial risks. Available at: *https://www.ngfs.net/en/ngfs-recommendations-toward-development-scenarios-december-2023*

**NGFS (2023c)**
*Climate-related litigation: recent trends and developments. Paris. Sept. 2023*

**NGFS (2023d)**
*Report on micro-prudential supervision of climate-related litigation risks. Paris. Sept. 2023*

**NGFS (2023e)**
*Monetary policy and climate change*

**NGFS (2024a)**
Tailoring transition plans: Considerations for EMDEs. Available at: *https://www.ngfs.net/sites/default/files/media/2024/04/17/ngfs_tailoring_transition_plans.pdf.pdf*

**NGFS (2024b)**
Transition Plan Package. Available at: *https://www.ngfs.net/en/liste-chronologique/ngfs-publications*

**NGFS (2024c)**
Nature-related litigation: emerging trends and lessons learned from climate-related litigation. Available at: *https://www.ngfs.net/sites/default/files/medias/documents/report-nature-related-litigation-emerging-trends-lessons-climate.pdf*

**NGFS (2024d)**
*Adapting central bank operations to a hotter world: current progress and insights from practical examples*

**NGFS (2024e)**
*The green transition and the macroeconomy: a monetary policy perspective*

**NGFS (2024f)**
*Acute physical impacts from climate change and monetary policy*

**NGFS (2024g)**
*Climate macroeconomic modelling handbook*

**NGFS (2024h)**
Sustainable and responsible investment in central banks' portfolio management – Practices and recommendations. Available at: *https://www.ngfs.net/sites/default/files/medias/documents/ngfs_sustainable_and_responsible_investment_in_central_banks_portfolio_management_–_practices_and_recommendations.pdf*

**NGFS (2024i)**
Nature-related Financial Risks: A Conceptual Framework to guide action by central banks and supervisors. *Nature-related Financial Risks: a Conceptual Framework to guide Action by Central Banks and Supervisors | NGFS*

**NGFS (2024j)**
*Climate change, the macroeconomy and monetary policy*

**NGFS (2024k)**
*Guide on climate-related disclosure for central banks – Second edition*

**Noels, J. and R. Jachnik (2022)**
Assessing the climate consistency of finance: Taking stock of methodologies and their links to climate mitigation policy objectives. *OECD Environment Working Papers*, No. 200, OECD Publishing, Paris, *https://doi.org/10.1787/d12005e7-en*

**Noels, J., Pouille, C., Jachnik, R., Rocha, M. (2023)**
Climate change mitigation scenarios for financial sector target setting and alignment assessment: A stocktake and analysis of their Paris-consistency, practicality and assumptions. *OECD Environment Working Papers*, No. 223, OECD Publishing, Paris, *https://doi.org/10.1787/bcd25b82-en*

**OECD (2023a)**
Assessing net-zero metrics for financial institutions. Supporting the monitoring of financial institutions' commitments. OECD, Paris. Available at: *https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/12/assessing-net-zero-metrics-for-financial-institutions_98b59756/dedcfe56-en.pdf*

**OECD (2024)**
*Climate Finance Provided and Mobilised by Developed Countries in 2013-2022*, Climate Finance and the USD 100 Billion Goal, OECD Publishing, Paris, *https://doi.org/10.1787/19150727-en*

**OECD (2023b)**
*Scaling Up the Mobilisation of Private Finance for Climate Action in Developing Countries: Challenges and Opportunities for International Providers*, Green Finance and Investment, OECD Publishing, Paris, *https://doi.org/10.1787/17a88681-en*

**Pedersen, L. H., Fitzgibbons, S., & Pomorski, L. (2021)**
Responsible investing: The ESG-efficient frontier. Journal of Financial Economics, 142(2): 572-597

**PRA (2019)**
*Enhancing banks' and insurers' approaches to managing the financial risks from climate change. Supervisory Statement | SS3/19. April 2019*

**Steffen, B., Schmidt, T.S. (2019)**
A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015. Nat Energy 4, 75-82

**Svartzman, R., Espagne, E., Julien, G., Paul, H. L., Mathilde, S., Allen, T. *et al.* (2021)**
A'Silent Spring'for the Financial System? Exploring Biodiversity-Related Financial Risks in France. Banque de France Working Paper No. 826, Available at SSRN: *https://ssrn.com/abstract=4028442 or http://dx.doi.org/10.2139/ssrn.4028442*

**UNFCCC (2009)**
*Copenhagen Accord. Dec 2009*

**UNFCCC (2015)**
*Paris Agreement. December 2015*

**UNFCCC (2023)**
*UAE Consensus. Dec. 2023*

**United Nations Environment Programme (2024)**
A Comprehensive Review of Global Supervisory Climate Stress Tests. Geneva. Available at: *https://www.unepfi.org/themes/climate-change/a-comprehensive-review-of-global-supervisory-climate-stress-tests/*

**Vermeulen, R., Schets, E., Lohuis, M., Kölbl, B., Jansen, D. J., & Heeringa, W. (2021)**
The heat is on: A framework for measuring financial stress under disruptive energy transition scenarios. Ecological Economics, 190, 107205

**WMO (2023)**
State of Global Climate, 2023. Geneva. Switzerland. Available at: *https://library.wmo.int/viewer/68835/download?file=1347_Global-statement-2023_en.pdf&type=pdf&navigator=1*

**World Bank (2024)**
Finance and Prosperity Report 2024, Washington DC. Available at: *https://www.worldbank.org/en/publication/finance-and-prosperity-2024*

**World Bank Group (2021)**
Toolkits for policymakers to green the financial system. Finance, Competitiveness, and Innovation Global Practice, World Bank Group. Available at: *https://documents1.worldbank.org/curated/en/374051622653965991/pdf/Toolkits-for-Policymakers-to-Green-the-Financial-System.pdf*

**World Bank Group, IMF and OECD (2023)**
Activating Alignment: Applying the G20 Principles for Sustainable Finance Alignment with a Focus on Climate Change Mitigation. Washington, DC: World Bank. Available at: *https://www.imf.org/external/np/g20/pdf/2023/091323.pdf*

**WWF (2024)**
2024 SUSREG Annual Report. An assessment of sustainable financial regulations and central bank activities. WWF. Switzerland. Available at: *wwfint.awsassets.panda.org/downloads/wwf_susreg-2024_full-report_1.pdf*

**Zerbib, O. D. (2019)**
The effect of pro-environmental preferences on bond prices: Evidence from green bonds. Journal of Banking & Finance, 98, 39-60. DOI: 10.1016/j.jbankfin.2018.10.012


BANQUE DE FRANCE
EUROSYSTÈME
NGFS
Secretariat